

# Research Toolkit for Family Speculative Play with Future Toys

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## ABSTRACT

In this paper, we aim to share guidelines that will help designers and researchers create meaningful, novel, and collaborative future games and toys for families. We bring together best practices from game design and the study of family communication so that family members can bond, collaborate, and ideate while having fun. We develop these learnings through a preliminary scan of existing family play-interaction guidelines and comparing them to indie as well as popular digital toys, apps, and games. We conclude with several reflective tools for measuring and assessing games and toys for family-centered play.

## Author Keywords

Family play, Smart Toys, Participatory Design

## INTRODUCTION

Today, we see more and more toys and physical play being replaced with mobile applications, digital games, and streaming services. While developmental psychologists and pediatricians recognize the importance of physical play in kids' development, we see that families spending less time engaging in collaborative play and widely adopting technologies in their homes that are not necessarily developmentally appropriate [49, 48].

As of February 2017, YouTube Kids counted over 8 million active users, with over 30 billion views made in the app. 81% of US parents with kids under the age of 11 say they allow their child to watch YouTube, with 34% saying their child regularly watches content on YouTube [40]. At the same time, an estimated 3.25 billion digital voice assistants are being used in devices around the world. Forecasts suggest that by 2023, the number of digital voice assistants will reach around eight billion units [39].

Research on families' interactions with smart toys and new technologies is a growing area with implications for speculative play design [30, 16, 36]. As devices become more human-like in form or function, humans tend to attribute more social and moral characteristics to them [25]. These findings

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raise the question of parental engagement and interventions in children's interaction with connected toys and intelligent agents [16, 49], and it also raises the opportunity to involve families in future smart toys and games design [28, 50, 8]. In this context, we wonder what the future of play for families looks like and how can we best support researchers and designers to engage with families in order to create future toys and games. We contribute a new toolkit for families to co-design speculative play and present three examples of future toys that were assessed by this toolkit. We aim to advance research on the family's conceptualization and interaction with future technologies through play in various social, economic, and cultural settings [44, 1, 16, 34]. These initial explorations aim to engage a broader conversation around ways to design inclusive play artifacts and experiences for and with a diverse group of families.

## RELATED WORK

In order to inform our analysis of existing and future play scenarios we look at research on playing and speculative design, studies on socio-cultural values for family-tech toys and games and existing methodologies for play co-design with families.

## Playing and Futuring

Games and toys often enable creative exploration, relationship-building, meaning-making and fun to emerge when players learn and master the rules and context of play. [27]. Formal games provide structured interactions among players through a democratizing space of a "magic circle", a term used by ludic scholar John Huizinga [23], to denote a "third space" that is created outside of everyday life's power structures. Play is also a powerful lever for inter-generational relationship-building [10]. Positive social-emotional learning outcomes are drawn from joint media engagement studies. For example, in Electric Race: an inter-generational gaming experience for promoting literacy, parents and children earn more points when they play the game together, as adults actively share prompts that boost the learning outcomes [42]. When adults and children play together, adults can improve their digital and media literacy skills, while children are more likely to improve their cognitive, social, and emotional development skills [46].

A common strategy for considering the future, involves mapping probable, possible, and preferred futures [29]. Designers from the "games for good" communities and public engagement practitioners have created games where players can practice civic skills like democratic participation, citizen science, and cross-cultural learning as well as engage

in critical speculation and futuring. For example, the game @Stake game enhances civic creativity as players ideate solutions to solve public problems by playing different community roles [21]. Architects, urban planners, and community organizations have used games like this to facilitate participatory design and scenario planning [5].

Game and toy designers must articulate their values when designing for futuring and consider inequities, such as who gets to design for the future, whose futures are included in players' imaginations, etc. For example, the NGO Coding Rights developed The Oracle for Transfeminist Technologies to envision and support technologies designed by and for the most marginalized groups. Though there are many game examples that encourage critical reflection and futuring, we did not find games or toys in this vein designed specifically for families. While game design often relies on structures like rules and turn-taking, there are also opportunities to playful engage families in more emergent and passive ways. For example, when family-centered HCI research first appeared in the CHI and IDC literature, researchers encouraged the use of cultural probes [24] [33], which proved to be not only generative, fun, and engaging but also productive for co-design outputs. Designers have the opportunity to apply guidelines from game design, child learning, and speculative design practices to create playful and future-oriented activities for families.

Beyond formalized games, ludic- or playful, design can be incorporated into a wide-range of interactions for tool-use, entertainment, art, information seeking, communication, and toys themselves especially for domestic technologies. Design researchers have found many benefits from open-ended, playful explorations of domestic technologies such as aesthetic appreciation, invigorated curiosity, and increased social engagement [20]. It is also important to note that the field of social impact games is fragmented in its definition of social impact itself [41]. While many "social good" games are set in the future or enact a future-oriented simulation, there are few examples that invite families to co-design futures

### Socio-Cultural Values for Family-Tech Toys and Games

As we embark on this journey, we recognize the importance of an inclusive family tech-toys and games designed for multi-cultural and multi-lingual families from different socio-economical backgrounds. This approach requires that we avoid WEIRD populations [22] both in the group of people we work with but also in our team of researchers. Thus, we recognize that as Medin and Bang describe [31], the answers to our research questions will be impacted by "who is asking." In our co-design research, our unit of measure is the practice of how families engage with AI technologies in their daily lives [38]. We situate this practice in the constellation of socio-cultural practices that families have developed [35]. Our work builds on prior work on multi-cultural families technology literacy and joint-media engagement [2, 32].

As we discuss designing for family interactions, we want to highlight that it is essential to accommodate the diversity of family structures. More often than not, the contemporary family in the United States does not resemble the nuclear family. As HCI researchers have noted, our designs must take

into account family configurations that include divorced, same-sex, dealing with death, work-related periodic separation, and reunion, military, single-parent household [26].

### Co-design with Families

Parents help scaffold their children's behavior when interacting with robots or interactive devices together [7, 19]. We observe the same behavior when families interact with VUIs(Voice User Interfaces), and parents help children repair various communication breakdowns with the conversational agents [3].

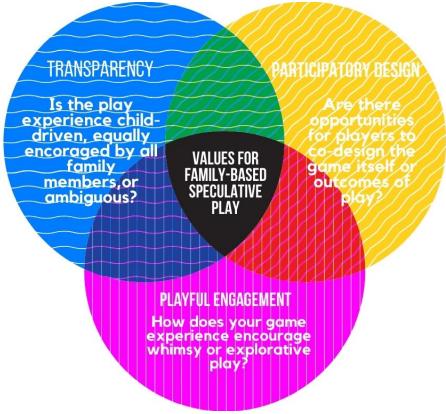
Prior work examining children's use of media, proposed an updated framework for parental mediation that includes participatory learning in which both children and parents interact and learn together through digital media [9]. Our current study explores the field of family speculative play by examining families' understanding and perceptions of various technologies and science concepts presented to them in the form of digital games they can play with, and modify. Building on parental mediation and JME frameworks [42, 43, 51], we aim to analyze and support future games and toys co-design with families.

### GUIDING VALUES FOR FAMILY CO-DESIGN

We consider that access to knowledge, when done right, can have equalizing force in society and help address some of our most pressing issues when it comes to increasing inequalities, discrimination, and power abuse. Our goal is to allow families to discover how some of the most intriguing discoveries in science and technologies could be tamed or re-purposed.

By Incorporating the value of transparency, designers can be explicit about the power dynamics of play: whether the game or experience is child-driven, designed for reciprocal levels of engagement, or intentionally open for interpretation.

We prioritize three values for designers to consider incorporating into game-play. The first value, transparency, requires a reckoning with the power dynamics reproduced in play. Children's sense of agency, efficacy, and emotional connection can greatly vary in child-driven play versus more balanced play dynamics. We encourage designers to intentionally reflect or explicitly share whether their games are child-driven, adult-driven, or include more balanced family play dynamics. Next, we propose a focus on participatory design as a guiding value. This democratic value is well-aligned with the emancipatory ethos of critical design and socially-responsive design. Various participatory design studies with children have demonstrated the affordances of this method to level out power dynamics between diverse stakeholders to foster more constructive dialogues [6], [47]. Finally, we note a value of designing with playfulness, such as through whimsical game elements or encouraging explorative and open-ended play. Recent studies have shown that a playful approach to co-design activities and games enables greater genuine participation. The value of playfulness complements the value of participatory design as it has shown to be in service of children's roles as co-designers [18], co-researchers [12], and even process designers [37]



**Figure 1.** Values for Family Centered Speculative Play

In our prior workshop on co-design at IDC'20 participants underlined the importance of considering children as experts of their lived experiences when designing futurist technologies for them. In our current inquiry we investigate how that positioning translates when putting families at the center of the speculative future play design.

## DESIGNING FOR FAMILIES PLAYING TOGETHER

### CRITICAL PLAY FOR FAMILIES

Critical play scholar Mary Flanigan defines critical play as the "means to create or occupy play environments and activities that represent one or more questions about aspects of human life," and "is characterized by a careful examination of social, cultural, political, or even personal themes that function as alternatives to popular play spaces". This type of play for families has potential to promote resiliency in the face of intersecting global catastrophes, including pandemics, climate change, and the impacts of systemic racism. As more family members work or learn remotely during the COVID-19 pandemic, games can create a temporary "third space" [4] for families to experiment with expression, learning, and bonding amidst trying times. While in our research, we could not find examples of critical play geared toward children and youth, the indie game community offers inspiration from many games that invite critical social commentary, such as Dog Eat Dog (produced in 2012, a game about colonialism and its consequences) and Molleindustria's Phone Story (produced in 2011, a game about the production of smartphones). While these games primarily target adults, we propose applying the values and framework in this paper to adapt critical games for family-centered play. We recommend that toy, game, and playful interactions designers assess prototypes and products based on several relational and user experience dimensions, as well as opportunities for reflection (since reflection is a critical part of speculative design).

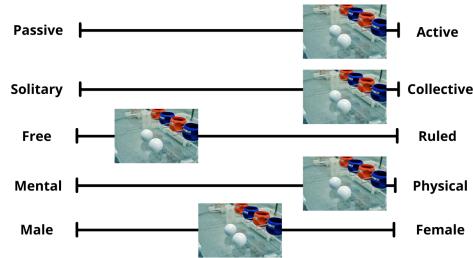
Implementing these scales and guidelines can support a wide range of meaningful engagement, fun, and literacy of more advanced concepts such as machine learning and algorithms. The scales in Figures 3, 6, and 9 invite users to assess how holistic their designs are for family engagement. In order to illustrate how designers or families might use our research toolkit, we



**Figure 2.** Demo prototype "Ballbit" toy



**Figure 3.** Kids play-testing "Ballbit" toy together



**Figure 4.** Scale of play for "Ballbit" toy

Design Principles	Definitions	Ballbit	Humming Box	Shake it off
<b>Mutual Engagement</b>	Equally engage in the activity	**	**	**
<b>Co-Creation</b>	Use toys and games to create experiences that are good & meaningful	*	*	*
<b>Boundary Crossing</b>	Interactions are informed by past individual experiences & interests		**	**
<b>Collaborative Inquiry</b>	Collaborate via conversations to understand the game/toy	**	*	**
<b>Intention to Develop</b>	Develop awareness of their interest of AI	*	*	
<b>Focus on Content</b>	Focus on the content and play & minimize technical considerations	*	**	*

\*\*featured \*partially featured

Table 1. Custom Toys Family Play Interaction Analysis based on guidelines adapted from Takeuchi et al. \cite{takeuchi2011new}

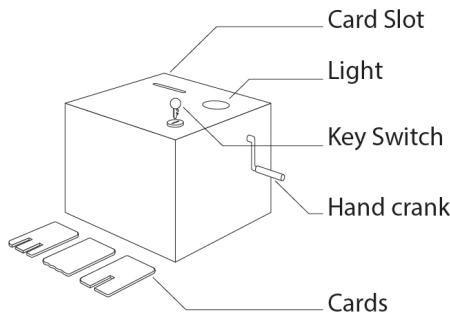


Figure 5. Components and key interactions with the Humming Box Toy

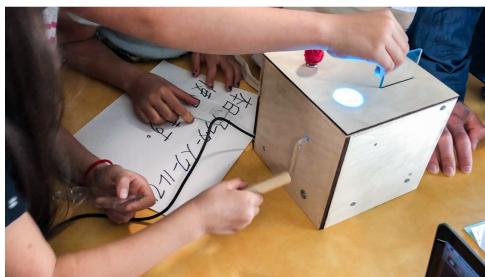


Figure 6. Children interacting with the Humming Box Toy Final Prototype

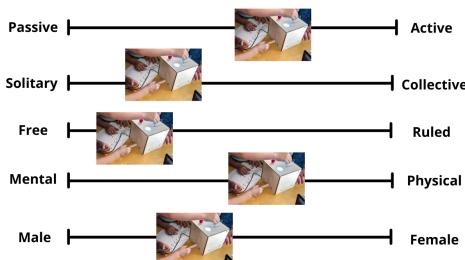


Figure 7. Scale of play for the Humming Box Toy [8]

placed three bespoke games on the spectrums of player passivity vs. action, solitary playing vs. collective playing, free-form vs. rule-heavy mechanics, mental vs. physical formats, and male vs. female themes. The bespoke toys include: Humming Box (a multimodal musical creation toy), Ballbit (an interactive maze where children collaborate to solve challenges), and Shake It Off (a movement-based game to change virtual scenery).

Considering these dimensions throughout the game and toy design and development process can promote a well-rounded approach to intergenerational learning and social engagement. Future toys and games can be evaluated for quality and family-fit along these dimensions while noting possible emergent tensions such as unbalanced gender dynamics. The principles ranging in Table 1 (mutual engagement, co-creation, boundary-crossing, collaborative inquiry, intention to develop, and focusing on content instead of control) build on the influential work on families' joint-media engagement [42]. We assessed the bespoke toys again based on these guidelines, noting which of them were partially or fully implemented (See Table 1).

Relational recommended guidelines include: mutual engagement (where family members build off each other's participation), co-creation (collaborative creativity), and collaborative inquiry (understanding a game or playful interaction together). Guidelines related to explicit intentions include: boundary crossing (such as sharing personal stories), focusing on content rather than physical and technical constraints, and engaging with the intention to develop self-awareness of that of other's needs and/or interests. We are motivated to review how family interaction design guidelines are being applied in current game and play designs in order to create a more standardized tool for family play designers. First we conduct a preliminary review of several guidelines for family interaction design and synthesized their findings (Table 1).

With these best practices in mind, we reviewed the top twenty apps in the Apple Store geared toward family play, as well as the top-selling and games and electronic toys sold in Amazon (Table 2). We found that some of the most popular digital apps and games for families are re-makes and re-releases of popular games such as Monopoly, Family Feud, Uno, Charades, etc.

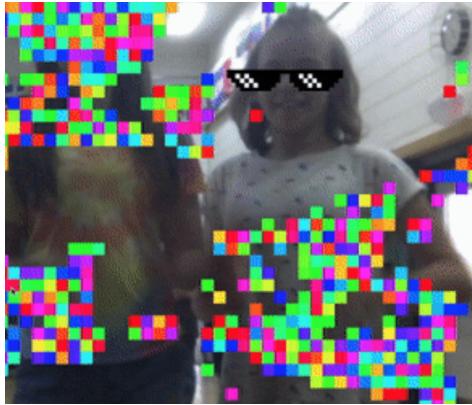


Figure 8. Demo screen "Shake It Off" game



Figure 9. Kids play-testing "Shake It Off" game together



Figure 10. Scale of play for "Shake It Off" game

Other popular digital games include supplements to tools like voice assistants- such as themed trivia games, puzzles, and board game adaptations. While we searched for games that have been directly marketed as fun for the "whole family", we are also aware that anecdotally, many games have been adapted by families to be played together (such as augmented reality games such as Pokemon Go or all-ages pictionary and charades style games such as the Jackbox suite). In reviewing these games, we assessed which of the relational recommended guidelines were met. Most games included the principles of "mutual engagement" and "collaborative inquiry", however few games included co-creation, boundary-crossing, and intention to develop.

To address future-oriented play design, researchers can include elements of future-oriented ideation, reflection, and creative collaboration toward preferred futures- such as with in-game mechanics or with reflection moments throughout a game or toy experience.

## AUTHOR'S POSITIONALITY

### **Stefania: Curious Mind**

In presenting these initial ideas and future vision for my research with multi-cultural families, position myself primarily as a Romanian, Eastern-European activist for better and more inclusive technology education. Before deciding to embark on a Ph.D. Journey, I worked for more than eight years on hands-on STEAM education in different communities around the world as part of the organization I created called HacKIDemia. I learned seven languages and lived studies and worked in more than ten countries until the age of 33 years old. This international experience allowed me to gain a glocal view when it comes to community engagement and pedagogical approach. In the past three years, I lead multiple co-design sessions with families focused on AI literacy [16, 17, 15] and created Cognimates, one of the first platforms for AI education, which is free and open-source [14, 13].

### **Rebecca: Family Futurist**

I am collaborating on this toolkit, as a first-generation American whose family immigrated from the former Soviet Union. Growing up in San Francisco instilled in me the appreciation of diversity and curiosity for creative experimentation while witnessing inequities that can come with technological innovation. I worked in an applied research lab on civic media and technology, where our design research team created experiential learning opportunities such as hackathons, games, and co-design workshops. My projects included game-based learning, public engagement research, and postpartum healthcare innovation [11]. These experiences motivated my pursuit of graduate school, where I situate my research at the intersections of family well-being, technology, and participatory design. Specifically, I am interested in developing theories and methods that enable a deeper understanding of family life, their caregiving needs, and the role of technology so that families may grow healthy and resilient, together.

Type of gameplay	Game or Toy Name	Co-viewing Guidelines
Boardgame	Watch Ya Mouth	Mutual Engagement, Collaborative Inquiry
Boardgame	STEM Family Battle	Mutual Engagement, Collaborative Inquiry, Intention to Develop
Boardgame	Kids Against Maturity	Mutual Engagement, Focus on Content
Boardgame	Flarts (Floor Dart Game)	Mutual Engagement, Focus on Content
Boardgame	Hedbanz	Mutual Engagement, Collaborative Inquiry, Focus on Content
Boardgame	Twister	Mutual Engagement, Collaborative Inquiry
Boardgame	Family Feud	Mutual Engagement, Collaborative Inquiry, Intention to Develop
Smart toy	Shifu Plugo Count	Individual play, Intention to Develop
Smart toy	Vector Robot by Anki	Individual play, Intention to Develop
Smart toy	WowWee Toy Robot	Individual play, Intention to Develop
Smart toy	Osmo - Genius Kit For Ipad	Individual play, Intention to Develop
Smart toy	Drone toy	Individual play, Intention to Develop
Smart toy	Yoego Robot	Individual play, Intention to Develop
Family Coding	Tangiplay: Code N Play	Mutual Engagement, Co-Creation, Collaborative Inquiry, Intention to Develop
Family Coding	ThinkFun Hacker Game	Mutual Engagement, Collaborative Inquiry, Intention to Develop
Digital to analog	Minecraft Uno	Mutual Engagement, Content Not Control
Digital to analog	The Science Game: Alexa Skills	Mutual Engagement, Collaborative Inquiry, Intention to Develop, Focus on Content,
Digital to analog	Ticket to Ride: with Alexa	Mutual Engagement, Collaborative Inquiry
Digital to analog	When in Rome Trivia: with Alexa	Mutual Engagement, Collaborative Inquiry, Intention to Develop
Digital to analog	St. Noire Cinematic with Alexa	Mutual Engagement
Digital to analog	Monopoly: with Alexa	Mutual Engagement, Collaborative Inquiry
App	Charades	Mutual Engagement, Co-creation, Focus on Content
App	Monopoly	Mutual Engagement, Collaborative Inquiry
App	Draw Something	Mutual Engagement, Co-creation, Focus on Content
App	Worms 3	Mutual Engagement, Collaborative Inquiry
App	Family Feud	Mutual Engagement, Collaborative Inquiry, Intention to Develop
App	Catan	Mutual Engagement, Collaborative Inquiry
App	Bejeweled	Mutual Engagement, Collaborative Inquiry, Focus on Content
App	Quiz Up	Mutual Engagement, Collaborative Inquiry, Intention to Develop
App	Scrabble	Mutual Engagement, Co-Creation
App	Uno	Mutual Engagement, Content Not Control
Subscription Box	Awesome Pack	Mutual Engagement, Intention to Develop
Subscription Box	The Salty Owl Studio	Mutual Engagement, Co-Creation
Subscription Box	Slime	Individual play
Subscription Box	We Craft Box	Mutual Engagement, Collaborative Inquiry, Co-Creation
Subscription Box	Wonder Co	Individual play
Subscription Box	Brick Loot	Individual play
Game	QQFarm	Mutual Engagement, Collaborative Inquiry, Focus on Content
Game	Save Amaze Princess	Mutual Engagement, Collaborative Inquiry, Focus on Content
Game	Xtreme Gardener	Mutual Engagement, Collaborative Inquiry, Focus on Content
Video Game	Find It	Mutual Engagement, Collaborative Inquiry
Game	Toy Generations	Mutual Engagement, Collaborative Inquiry
Video Game	Farmer's Animals	Mutual Engagement, Collaborative Inquiry
Gesture game	Virtual Soccer	Mutual Engagement
Game	Blast from the Past	Mutual Engagement, Collaborative Inquiry, Intention to Develop
Augmented Reality	Curball	Mutual Engagement, Collaborative Inquiry, Content Not Control
Mixed Reality	Virtual Box	Mutual Engagement, Collaborative Inquiry, Content Not Control

Table 2. Summary of commercial games and toys analysis

## CONCLUSION

As technology becomes increasingly integrated into daily life, design researchers can design for play that is "together together", rather than perpetuate the anxiety of being "alone together" where people are co-located but socially isolated on devices [45]. With increasing trends in smart, STEM-based, and mixed reality toys, there are tremendous opportunities to orient toy and game design for family engagement, rather than individual play. While these play potentials are on the horizon, we encourage designers to keep their values at the center of play development in an ever-evolving digital landscape where the novelty of new technology can put privacy at risk. This toolkit aims toWith our toolkit we aim to support future-oriented toys and games co-design and reflection for families.

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