

Exploring Emotional Attachments in Children's Toy Relationships: A Generative Co-Design Approach to Design for Sustainability

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Abstract: The existing production and consumption system is causing significant plastic waste in the toy market. Unfortunately, most toys are discarded within six months of purchase, often due to the limited opportunities for extending the lifespan of toys through repairing, reusing, or recycling. To address this issue, this study explores the potential of emotional durability as a strategy to promote sustainable consumption in the toy industry. Utilizing the Emotional Durability Design Nine Framework as a theoretical foundation, this study emphasizes creating long-lasting emotional connections between children and their toys through various dimensions such as narratives, identity, relationships, and evolvability. A mixed-method approach is employed to engage children aged 10 to 12 in reflecting on their emotional attachments to toys, starting with semi-structured interviews with five children to identify their favorite toys, which they have kept for an extended period, and the factors influencing their attachment. Following that, cultural probes in the form of an activity set are designed to explore the stories associated with these toys and tested with four children. Finally, the refined version of the activity set is conducted in the classroom environment with 30 children. Findings indicate that personal memories, the desire for personalization, and the ability to repair or modify toys significantly influence children's attachment and the longevity of their toys. By integrating emotional durability into toy design, the study highlights its potential to encourage sustainable consumption practices and reduce waste in the toy industry, which may also encourage children to see toys as valuable, long-term companions rather than disposable items.

Introduction

The linear consumption model, which dominates global production, involves using and discarding products. As a result of this model, toys, often produced from plastic material, are part of a fast-moving consumer goods market that promotes frequent replacement (UNEP 2014). Research indicates that the majority of toys end up in landfills within six months, significantly contributing to the accumulation of plastic waste (Qian et al., 2020; Clark, 2007). However, due to the complex and mixed use of materials in toys, it is rare to convert toy waste into raw materials for various purposes (Qian et al., 2020).

Circular economy principles focus on reducing waste and prolonging the lifespan of products through design interventions that enable repair, reuse, and recycling (Bocken et al., 2016). However, since the toy market is primarily concerned with low-cost disposable products, it is challenging to address these principles. As a

result, addressing this issue requires a shift from a linear consumption model to sustainable consumption, in which both producers and consumers can play a significant role in extending product life spans by establishing a strong person-product relationship (Mugge et. al, 2005; Kamptner,1991). This can be achieved by focusing on emotional durability, where consumers, especially children in this case. This approach would enable them to build long-term attachments with their toys while encouraging them to keep these products longer.

The Emotional Durability Design Nine Framework

The Emotional Durability Design Nine Framework proposed by Haines-Gadd et al. (2018), provides a comprehensive approach to designing products that foster long-lasting emotional connections with users. The framework comprises nine themes: *narratives*, *consciousness*, *identity*, *relationships*,

evolvability, materiality, integrity, imagination, and conversations. Each of these themes explores a different way in which a product can engage the user and create a meaningful experience that goes beyond its primary functional value. For instance, the *narrative* theme emphasizes the importance of a product's history and the stories it carries, while *identity* allows users to personalize and enhance their attachment. In toy design, these elements are critical because children often develop attachments to toys through storytelling, imaginative play, and personalization. By integrating features that allow children to connect emotionally with their toys, designers can help extend the life of these products, reducing the tendency for early disposal.

The Emotional Durability Design Nine Framework (Haines-Gadd et al., 2018) is particularly relevant in the context of toys, as it helps explain how specific design features can prolong a toy's lifespan by encouraging children to form deeper emotional bonds with them. It provided a critical theoretical foundation for this research, offering structured insights into the design and sustained emotional attachment to products over time. Within the context of the research, this framework was adopted by particularly focusing on the dimensions, such as *narratives, identity, relationships, and evolvability*, which was useful in guiding both the design of the activity set and the analysis of the data gathered from the participants involved in the research.

Methodology

Sampling and Participants

In this study, children aged 10 and 12 were recruited based on their social, cognitive, and motor development. Ethical approval for this research was obtained from The Middle East Technical University (METU UEAM) Applied Ethics Research Center before participant recruitment. As stated in Piaget's Cognitive Developmental Theory, children around 10 to 12 years old are transitioning from the concrete operational stage (ages 7–11) to the formal operational stage (11+), enabling them to establish, express, and verbalize connections with their toys (Berk, 2006). Their capability for social bonding, analytical thinking, and physical involvement improved their engagement with toys in ways that promote emotional durability, making this group appropriate for investigating

how sustainable toy design may foster long-term relationships.

Stages of the Research

This research employed a mixed method, incorporating *generative design research* and *participatory co-design* approaches, to obtain comprehensive insights into children's behaviors and the underlying reasons for their preferences. This is achieved through the use of exploratory research techniques such as cultural probe kits (Hanington & Martin, 2012). Figure 1 illustrates the division of the field research into three stages.

Phases	Method	Aim of the Method
Preliminary Phase	Semi-Structured Interviews	Gaining an understanding of children's favorite toys and the type of toys they have been carrying with them for a long time.
Pilot Research	Cultural Probe	Learning more about the stories behind children's favorite toys and evaluating usability and how much they enjoy during completing the diaries.
Final Research	Cultural Probe (as a classroom activity)	Gaining an in-depth understanding of children's favorite toys and their emotional connections with their toys during completing the revised version of diaries.

Figure 1. Stages of Field Research.

Initially, *semi-structured interviews* were conducted with three girls and two boys aged between 10-11 to gain an understanding of children's favorite toys and the type of toys they have been carrying with them for a long time; secondly, *cultural probe* in the form of *activity set* was designed based on the Emotional Durability Design Nine Framework (Haines-Gadd et al., 2018) and the results of the semi-structured interviews, and then conducted with two girls aged 10 and 11 to learn more about the stories behind children's favorite toys and evaluating the usability and joyfulness of the cultural probe. Finally, as part of the primary research, the activity set was revised according to the findings of the pilot study and refined version was shared with 30 children, including 15 girls and 15 boys aged 10-12, recruited from both private and public schools to gain a comprehensive understanding of children's favorite toys, such as plush toys, educational toys, dolls, action figures, vehicles and sports toys, and their emotional connections with them, examining the reasons behind why they keep some toys while discarding others (see Table 1). During the main research, all sessions were held in the classroom environment (see Figure 2) as a classroom activity to facilitate a comfortable and familiar environment. Each

child was also encouraged to bring in their favorite toy to the activity sessions. Through these hands-on interactions, how they cared for their toys, which elements they felt most attached to, and what aspects of their toys they would modify if given the chance, were observed. This approach allowed for a deeper understanding of how emotional bonds are formed and maintained in the context of toy use.

Participant Number	Age	Toy Category	Age of the Toy
Pilot 1	10	Plush Toy	2
Pilot 2	11	Plush Toy	8
P1	12	Plush Toy	8
P2	12	Sports Toy	N/A
P3	11	Plush Toy	6
P4	11	Plush Toy	9
P5	11	Plush Toy	10
P6	11	Plush Toy	2
P7	11	Plush Toy	5
P8	11	Doll	6
P9	11	Plush Toy	10
P10	11	Action Figure	2
P11	11	Plush Toy	8
P12	11	Plush Toy	2
P13	11	Sports Toy	2
P14	10	Plush Toy	N/A
P15	11	Educational Toy	5
P16	11	Plush Toy	5
P17	11	Action Figure	9
P18	11	Sports Toy	N/A
P19	10	Action Figure	3
P20	10	Plush Toy	3
P21	11	Educational Toy	N/A
P22	12	Plush Toy	7
P23	11	Vehicle	3
P24	12	Doll	7
P25	11	Vehicle	2
P26	12	Vehicle	8
P27	12	Educational Toy	2
P28	12	Plush Toy	5
P29	12	Plush Toy	3
P30	12	Plush Toy	3

Table 1. The list of the participants based on their favorite toy categories and the length of time they have owned them.



Figure 2. The cultural probe is utilized as a classroom activity.

Development of the Cultural Probe in the Form of Activity Set

A unique generative design research method, in the form of an activity set (Sanders et al., 2012), was developed to gather data from children about their emotional connections with their toys (Özkürkçü, 2024). Before designing the activity set as a generative method, a comprehensive literature review on the research methods such as Contextual inquiry (Druin, 1999), Mission from Mars (Dindler et al., 2005), and Kid Reporter (Bekker et al., 2003), was conducted to explore the relevant co-designing methods, tools, and techniques with children in a way that could be engaging for children. As a result, the activity set was designed to be engaging and interactive, allowing children to reflect on their favorite toys and explore why they are valuable for them. Initially, the concept of the activity set was inspired by the Mission from Mars approach (Dindler et al., 2005), in which children were encouraged to take off into space on a spacecraft called Memorium (see Figure 3). Within the context of class activity, 30 activity sets were shared with the children. The content of those was analyzed through thematic coding, with the theoretical framework guiding the structure of the analysis. This approach facilitated a systematic exploration of emotional durability by categorizing the data according to each dimension. The data analysis in this research included voice recordings and visual data from activity set sessions. The data was transcribed and analyzed using the Miro Board interface. Key parts were highlighted, and related themes were identified based on participants' responses. An Excel document was prepared to categorize participant information, including age, gender, toy

category, and features they love, dislike, or want to change. The data analysis aimed to improve the evaluation and interpretation of the verbal and visual information gathered.

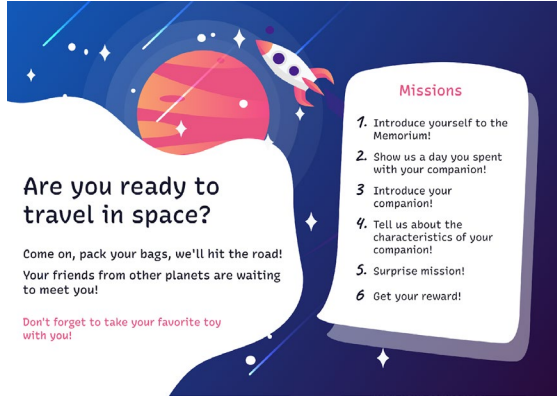


Figure 3. Introductory page of the cultural probe representing takeoff in space on Memorium.

To participate in the spacecraft and experience space travel between different planets, the children were required to complete specific tasks. These tasks included explaining the stories they had been together from the beginning, personalizing them according to their preferences, and expressing a desire to repair or modify them. The purpose of these activities was to uncover the emotional factors that underlie product attachment.

Before participating in the classroom activity, parents were required to complete the consent form, and the children were asked to bring their favorite toys. The first phase of the activity included an overview of the exercises, which included: i) an introduction to the spaceship; ii) a day with a preferred toy; iii) a general presentation of the preferred toy; iv) a features-focused introduction of the preferred toy; and v) a dream toy concept. Subsequently, children were asked for their verbal consent to participate in the study, and the tape recording began upon their approval.

As part of the “Mission on Mars: Introduce yourself to the Memorium!” activity, children were prompted to provide essential personal information, like their names, ages, interests, and hobbies. The objective of the activity was to familiarize the children with the activity and to gather information about them by allowing them to introduce themselves to the spacecraft. The design of the activity was intended to resemble progression through different levels, similar to progressing through stages in a board game,

rather than directly asking the set of questions in a list view (Figure 4).



Figure 4. “Mission on Mars: Introduce yourself to the Memorium!” activity.

During the “Mission on Jupiter: Show us a day you spent with your companion!” activity, the children were instructed to illustrate and articulate their interactions with their cherished toys, and also a sticker set was provided by the researcher to motivate them to complete the activity. This activity provided valuable insights into the significance of the toy in daily routines and activities, allowing the researcher to explore the “relationship” dimension, regarding “establishing a ritual or habit” as outlined in the Emotional Durability Design theoretical framework (Haines-Gadd, 2019; Haines-Gadd et al., 2018). For instance, Participant 1 drew a typical day with his cherished plush toy and highlighted the moments when his companion was present. As shown in Figure 5, he spends the entire day with his plush toy.

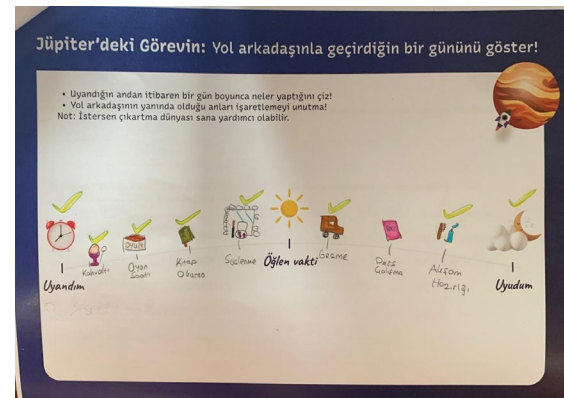


Figure 5. Participant 1's “Mission on Jupiter: Show us a day you spent with your companion!” activity.

In the “Mission on Saturn: Introduce your companion” activity, the children were asked to

provide details regarding their favored toy, encompassing its name, duration of ownership, reasons for selection, and the toy's significance in their lives, to collect general information about their favorite toys. In Figure 6, Participant 24 introduced her plush toy “Verda”, which she had owned for seven years. Verda with her curly hair, “containing everything” was seen as a source of confidence and capable of surviving in difficult conditions. In addition, reflecting on the *narrative* theme, where a toy's story and personal memories enhanced the emotional attachment, she explained the day they met each other as on the day her first tooth came out, the tooth fairy brought her a gift (meaning her mother).

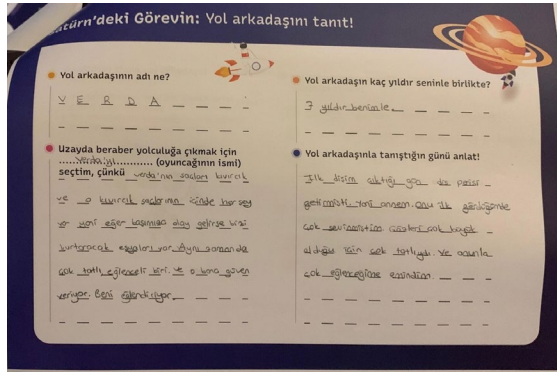


Figure 6. Participant 24's “Mission on Saturn: Introduce your companion!” activity.

The following content of the activity set will be the basis for the findings and insights regarding the main themes that emerged from the analysis. In the “Mission on Uranus: Tell us about the characteristics of your companion!” activity, children were instructed to provide details about their favorite toy and its characteristics, including both favorable and unfavorable aspects. They were also asked to demonstrate these features on the toy to facilitate a comprehensive understanding of their preferences. For instance, Participant 1 illustrated his cherished plush toy, marking his favorite characteristics with a green sticker and his disliked characteristics with a red sticker. Also, he explained the reasons for his favorites, including too cute, ideal size for portability, and also the disliked features, including unstableness and some scratches on his eyes (Figure 7). This aligned with the *relationship* theme, specifically, the subtheme of *fixing or maintaining the product*, since highlighting scratches indicated a desire to care for or fix the

toy, establishing an emotional connection through maintenance and care.

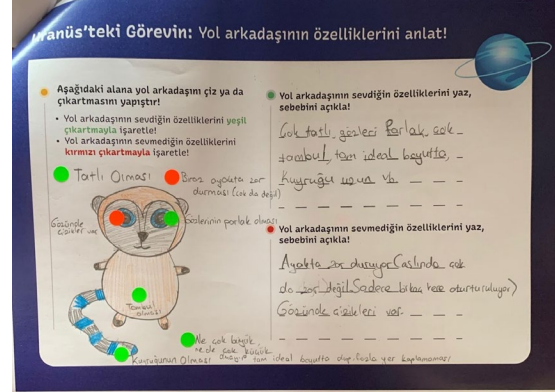


Figure 7. Participant 1's “Mission on Uranus: Tell us about the characteristics of your companion!” activity.

On the other hand, related to the relationship theme, Participant 23 preferred to repair his favorite vehicle by detaching the broken parts and replacing those with new ones (Figure 8) in order not to lose his cherished item.

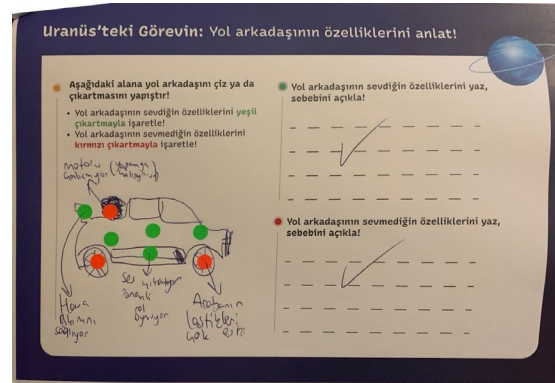


Figure 8. Participant 23's “Mission on Uranus: Tell us about the characteristics of your companion!” activity and repairing his cherished vehicle.

During the “Mission on Neptun: Time for change!” activity, children were prompted to express their concepts of a dream toy, including any preferred modifications or alterations, as well as the reasons and methods for implementing these changes. This enabled both the researcher and the children to investigate their preferences and concepts for their dream toys, also linked with the *identity*, *relationship*, and *evolvability* themes as outlined in the Emotional Durability Design theoretical framework (Haines-Gadd, 2019; Haines-Gadd et al., 2018). For instance, Participant 24 expressed a desire to personalize the doll's appearance, aligning with the *identity* theme. She indicated that she wanted to change Verda's "simple and boring" clothes for something more stylish, as well as change her hair color, to improve her fashion sense. To connect Verda's look with her own style, Participant 24 drew a "before and after" change on the activity sheet (Figure 9), demonstrating how personalization promoted personal connections via shared identity.

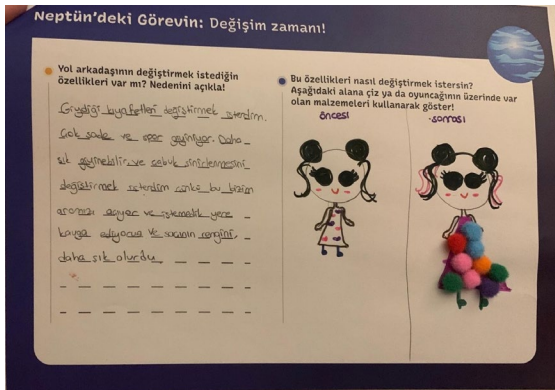


Figure 9. Participant 24's “Mission on Neptun: Time for change!” activity.

On the other hand, Participant 8 expressed a desire to personalize her cherished doll (Figure 10) by adding a scarf that matches her outfit and giving it magical abilities: “I wish it had a wand and could do magic.” This was also in line with the *identity* theme, as she highlighted tailoring the doll with some distinct characteristics that represented her creative desires.

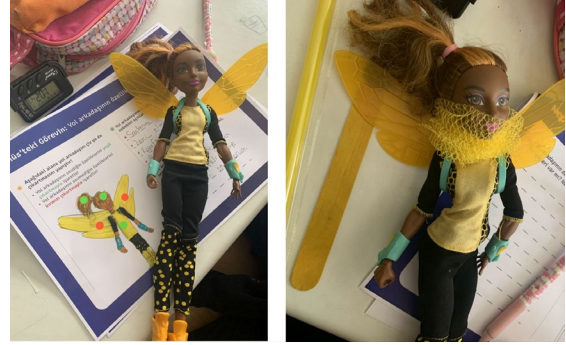


Figure 10. Participant 8's “Mission on Neptun: Time for change!” activity.

Participant 22's desire for her plush toy Snoopy to have stronger, more durable limbs highlighted the *evolvability* theme, which emphasized the adaptability of products to meet evolving user demands over time. When she wished to put extra stuffing in Snoopy's arms for comfort, she demonstrated how toys might be modified to enhance functioning as preferences change (Figure 11).

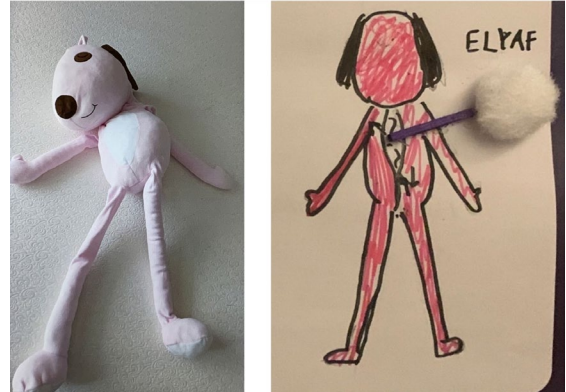


Figure 11. Participant 22's desire to evolve her plush toy.

Another example linked to the *evolvability* theme was given by Participant 19, who described his action figure as a cherished toy because it could transform across various play scenarios, such as changing from a whale to a robot, which evolved to match children's changing preferences and developmental needs over time (Figure 12).



Figure 12. Participant 19's "Mission on Neptun: Time for change!" activity.

Conclusion

This study demonstrated the potential of emotional durability as a strategy for promoting sustainable consumption in the toy industry. The study encouraged children to engage in activities that reflect their emotional attachments to toys by integrating the Emotional Durability Design Nine Framework (Haines-Gadd et al., 2018) as the theoretical basis for developing the activity set. The activity set included tasks such as storytelling about the

toy's origin, personalizing or repairing the toy itself or the drawing of the toy, and imagining how they might evolve or modify their toys. The findings revealed that certain emotional dimensions were more prominent in promoting toy longevity. Children often attach emotional value to toys linked to personal memories, such as gifts from family members or toys associated with special life events, highlighting *narratives* as a key factor. *Identity* was also significant, as children expressed a strong desire to personalize their toys, which deepened their attachment to their belongings. On the other hand, the *relationship* was another key dimension influencing their connection, as several participants mentioned that they repair or want to repair broken toys. Additionally, *evolvability*, the ability of toys to change and adapt over time, was found to be crucial in maintaining long-term engagement, as children valued toys that could grow with their interests. While implementing the activity set as a classroom activity for generative co-design sessions provided valuable insights into children's relationships with their toys and supported its effectiveness in fostering interest and motivation, several limitations emerged. Initially, some children did not bring their toys to the classroom due to fear of damage. Contrary to expectations, few children had personalized or repaired their toys, aiming instead to preserve them. For these limitations, the toolkit can be developed further with additional 2D and 3D components and accessories to help children reflect on changes that they would like to make or simply build their dream toy that may also reflect or integrate those features for personalization, repair, and upgrade. Future research could encourage children to bring toys they wish to modify or create their dream toys, offering additional perspectives on attachment and personalization by implementing warm-up activities. In addition to these future research suggestions, it would also be valuable to explore the role of parents in toy purchasing decisions, as these can significantly influence the connection children form with their toys. Finally, longer study durations and multiple sessions including the whole lifespan of toys (design, production, use, and post-use) could also provide a deeper understanding of building emotional connections for actively involving children in the design process.

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