



TECHNICAL UNIVERSITY OF CLUJ-NAPOCA

ACTA TECHNICA NAPOCENSIS

Series: Applied Mathematics, Mechanics, and Engineering
Vol. 68, Issue III, September, 2025

ERGONOMIC, AFFECTIVE AND EMOTIONAL DESIGN AS A PROJECT DESIGN APPROACH FOR THE EVOLUTIVE CHILDREN'S FURNITURE

Dorian ȘTEF, Nicoleta STELEA

Abstract: *The focus in product design is on the functionality and utility of the product. However, it is essential to consider what features must be implemented to promote a greater emotional attachment to the product. Thus, the general objective is to design a more suitable and durable children's furniture, specifically a chair that can accommodate a child's growth from 6 months to 7 years, allowing them to attach themselves because affection can be the most critical product feature. The development of the concept started from a study based on interviews to illustrate the feelings of children through the eyes of the parents towards the chair used, and the results showed that a design based on Tripp Trapp should be the starting point.*

Keywords: *Product Design, Ergonomics, Human Factors, Affective Design, Emotional Design, Children's Furniture.*

1. INTRODUCTION

Human Factors and ergonomic studies in product design often concentrate on function and usability. Besides considering body measurements and physical research, exploring people's emotional attachment to objects is essential for optimized design. According to Jordan (1998), understanding what characteristics can create a stronger emotional bond with an object is crucial [1]. When developing children's furniture, the focus is typically on safety, well-being, and environmental impact. However, there is less emphasis on exploring a child's emotional satisfaction when using such products [2].

This research aims to create furniture that is more suitable for children and has a longer product life cycle, contributing to sustainable development and being environmentally friendly. The aim is to design a seat that can accommodate a child's growth from 6 months to 7 years, providing physical and visual comfort at a reasonable cost and is not considered disposable. The extended product life cycle refers to the durability of the materials used, and the design tailored to a specific audience,

connection to children, and their emotional attachment. Developing an emotional connection with the product is crucial for creating a sustainable product, as pleasure results from using pleasing products, which fosters a bond between the product and the user [3]. In addition to the sensory experience, social and cultural contexts, which are subject to change, also impact enjoyment, making long-term attachment to a product challenging [4]. However, combining verbal and visual communication to convey meaning can bridge cultural differences [2],[5].

This paper has as its primary objective the development of a study based on the expression of feelings and expectations towards a specific piece of children's furniture, a new evolutive chair design based on the idea of the Tripp Trapp® chair that has been on the market for over 40 years, created by Norwegian designer Peter Opsvik and produced by the Stokke® company in Alesund [6] - the new product design is a seat suitable for children from birth to adulthood.

One of the designers' most widespread and representative prescriptive models is the systematic model by Pahl and Beitz [7]. This

model will be used to develop this research and is based on a sequential decomposition of the design process using the phase concept. Thus, this systematic development model will be used to construct the proposed new chair design [8]:

- Phase 1 - Clarify the task - which results in the initial description of the product, stated in the form of a list of functions and characteristics that the product must fulfil, with a system of constraints.
- Phase 2 – Conceptual Design - leads to a principal solution or a concept for the product;
- Phase 3 – Embodiment Design - leads to a first product solution based on the principal solution determined in the conceptual study phase;
- Phase 4 - Detailed Design - has as result the elaboration of all the documentation necessary to manufacture the product.

2. INTERVIEW SURVEY FOR CLARIFY THE TASK

The product design in this study is developed based on interviews with 60 parents aged 25-45 who have or had chairs of different shapes for their children. The purpose of these interviews is to gather information about:

- The chosen product and the characteristics considered during the decision-making process;
- The child's reaction, adaptation, identification, possessive behavior, and emotional attachment to the product;
- Daily use, security, and comfort of the product;
- Evaluation of the chair and intentions for its future use.

The design must incorporate characteristics that foster an emotional connection with the child, strong enough to grow with them through habitual and daily use. Parents typically choose a chair shape without allowing the child to try the product. It's essential to understand the basis of their choices and if they are satisfied. The interview questions are as follows:

A. About the chair

1. Do you have one or more child seats?

2. What is the brand, model, and colour of the seat?

3. Was the seat purchased brand new or second-hand?

4. What were the specific characteristics that influenced your decision to purchase this seat?

5. Did the seat require any special maintenance?

6. Can you describe any technical or other issues identified with the seat?

7. How would you describe its performance in terms of durability and efficiency?

B. Children adaptation

1. At what age did the child receive the chair?

2. Did the child test the seat before purchase?

3. What was the child's first reaction?

4. How was the adaptation to the chair?

5. Were there any incidents, instability, or abuse from the child related to the chair?

6. Does the child consider the chair as his own?

7. Has the child formed an emotional bond with the chair?

8. Does the child get upset when someone tries to sit on the chair?

9. Has the child tried to personalize the chair with designs or stickers?

C. Utilization of the chair

1. What type of activities is the chair used for?

2. How long does the child sit during the activities?

3. Is it necessary to install any security systems?

4. At what age does the child sit alone?

5. Does the child sit on the chair willingly or does he need to be forced?

6. Is the child comfortable while sitting or does he complain?

7. Does the child fall asleep in the chair?

8. How often is the chair cleaned?

D. Conclusions

1. The chair type that you used; would you recommend it?

2. If it is an evolutionary seat (that follows the child's growth), would you intend to keep it?

3. Would you use an evolutionary chair?

4. Can you provide any other feedback or suggestions for improving the chair design?

The interview results are summarized into four categories:

1. Information about the parents' choice and method of obtaining the chair identified issues, as well as efficiency assessment.
2. Children's emotional response to the product.
3. How children use the product.
4. Parental satisfaction and future intentions regarding the product.

Based on the questionnaire results, we found that the children's seats can be categorized into two types - those that can grow with the child until adulthood and those that cannot. The Stokke Tripp Trapp design represents 51.5% of the sample, the Chicco Polly design represents 35%, and the IKEA Antelope design represents the remaining 13.5%. Most purchases are new, and the factors influencing the choice vary. Parents opting for the Tripp Trapp chairs are more focused on durability, timeless design, quality, brand, safety, ecology, and sustainability, seeking a long-lasting product (Fig. 1). Chair owners with a design based on Polly value quality, brand, ergonomics, comfort, decoration, and availability. The design is evolutionary and suitable for children up to 36 months old. On the other hand, owners of seats based on the Antelope design prioritize price and security. An easy-to-clean chair is considered necessary for both designs. Despite some identified issues, parents are delighted with the efficiency of these chairs.

The next category expresses the parents' perspective on their child's reactions to the chair. It indicates that the child does not try the chair before it is purchased, so the parents' decision is based solely on their own experience, without considering the possible reaction of the child. Identifying the chair and the parents' own experience appear to strongly influence the choice of each chair model in the study, but the children's reactions and adaptation are generally positive. However, there is a significant difference in emotional connections between

chairs. According to their parents' observations, only approximative 20% of children with chairs based on the Polly design felt an emotional connection to the chair.



Fig. 1. Children's Chairs

A. Tripp Trapp by Stokke [6], B. Polly by Chicco.
Antelope by IKEA

In comparison, all children with chairs based on the Tripp Trapp design showed attachment to the product, and one-third could personalize it with stickers. Only a third of the children were likely able to personalize the chair because some parents did not express much satisfaction with allowing their children to decorate the chair - some stated that they did not allow it.

The final category to consider is the outcomes of the product's actual use by the child, which reflects the time spent in the chair and the activities carried out during that time. Most children don't need to be coerced into sitting and being comfortable. At times, they become so relaxed that they fall asleep, especially children using seats based on the Polly design.

Unfortunately, children seated in Polly or Antelope-designed seats tend to end up in adult seats, which are clearly unsuitable for them due to the incomplete attachment of their own seats. That happens when they are 2-3 years old. It is well-documented that adult chairs are not suitable for small children, and using inappropriate furniture can lead to muscle and bone disorders in the future.

Table 1

		Survey response.		
		Tripp Trapp	Polly	Antelope
Design model		51.5%	35%	13.5%
Purchase	1st hand	70%	90%	100%
	2nd hand	30%	10%	
Valued feature		Durable – evolutive Form - simplicity Personal experience Friend's recommendation Prestige brand Color range Easy to clean Safety – stability Versatility Quality Material-ecology	Ergonomic - comfort Friend's recommendation Availability Prestige brand Quality Easy to clean Decoration/Color Safety – stability	Low Price Security Easy to clean
Age during use		6 months - 7 years	6-36 months	6-30 months
Try before by		0%	0%	0%
Adaptation	Very good	10%	30%	
	Good	50%	40%	77%
	Average	40%	20%	23%
	Bad		10%	
Emotional bonding		95%	22%	66%
Identify the chair as their own		100%	90%	100%
Customized the chair		35%	No	No
Activities		Meals Games/ puzzles Drawing/ painting	Meals Games	Meals Games
Comfort		100%	80%	100%
Time spends		15 min. -1 hour	20 min. -1 hour	30 min. -1 hour
Satisfaction/recommend		100%	90%	100%
Keep the chair		Yes	No	No

3. TRIPP TRAPP® CHAIR

One of Peter Opsvik's first projects as an independent designer was the Tripp Trapp® chair, launched in 1972 by the Norwegian company Stokke® [2]. The primary necessity from which Opsvik started to develop his design was not finding a unique chair on the market that would allow his 2-year-old child to be included in family mealtimes [9]. Thus, he developed an evolutive chair that can easily follow a child's

growing anthropometry by changing the different component elements of the chair [2].

Opsvik conducted extensive research based on his theories of human posture [10]. His views on the human need for movement and constant dimensional variation are reflected in his various chair designs. His dedication to studying evolution and human interaction makes human factors central to his design process. By observing and researching human nature, he sought to understand human beings at their core, with particular interest in the sitting position. Opsvik also explored the evolution of our bodies

and the constant need for movement. He believes that well-adapted furniture is essential, considering it to be a sort of third skin, with clothing as the second skin and architecture as the fourth [2], [9-10].

Opsvik's research focuses not only on following human growth and development but also on the belief that the key to comfort lies in developing products that support human posture in different positions, allowing them to change position. Opsvik stated that "the best posture is always the next one," suggesting that there is no ideal posture to adhere to as presented in anthropometry and ergonomics literature. He believed any so-called perfect posture would become uncomfortable after a while, emphasizing that variety is positive and monotony is negative [2]. Opsvik also highlighted the harmful effects of sedentary situations on people's physical and mental health [2]. The chair features a clean and simple design with a diagonal line structure, is made of solid wood, and is available in several colors. Its contemporary look and minimalist, functional design have established it as a timeless classic over the years.

4. CHILD'S EMOTIONAL

Considering human factors and ergonomics as a fundamental element in the design process, we can look to Jastrzebowski (1799-1882) as a pioneer in this field. He contributed to a new way to optimize products and systems. The primary objective of HFE (Human Factors and Ergonomics) is to understand the interactions between humans and everything around us and, based on such knowledge, optimize human well-being and overall system performance [12]. According to HFES (Human Factors and Ergonomics Society), the function of ergonomics in product design is to develop functional, usable, safe, valuable and attractive products, applying the methods and principles of human factors, consumer research, and industrial design to ensure product success in the market [2].

Karwowski suggested that affective ergonomics could be considered a part of the Human Factors field [12]. It was also termed

Hedonomics [13], focusing on the study of pleasure in interacting with a product and its tasks. This concept influenced the design proposed in this research. From a psychological perspective, Theodor Lipps' early theories (1851-1914) about empathy or aesthetic sympathy led to forming an emotional connection with an object, projecting oneself onto it. This aesthetic experience is a non-cognitive process described as "objectified self-pleasure" [2]. Possessing material goods allows individuals to incorporate different meanings, stories, and memories into them [13]. Recognizing the emotional connection with various objects is crucial for developing sustainable products. According to Chapman, "waste" results from broken (emotional) relationships [14]. Peter Opsvik, the creator of Tripp Trapp®, believes that objects should age gracefully, accumulate and express life stories over the years [15] and become a part of our lives (Fig. 2).

The proposed product design focuses on young children and presents specific problems that must be considered. According to Piaget (1896-1980), children between 2-7 years old are in a pre-operational stage of cognitive development. During this stage, children learn representational skills, become more competent in various areas such as communication, and become increasingly independent.

However, they cannot see reality from the perspective of others and may not understand the consequences of their behavior [16]. Significant differences can be observed between 3-year-olds and 4-5-year-olds, with the latter demonstrating the development of capacities such as the recognition of primary colors, significant language development, a shift in focus from adults to other children, and increased physical and emotional autonomy. Shyness and fear give way to curiosity at this stage (Fig. 3).



Fig. 2. Evolution of Tripp Trapp Chair by Stokke [6].

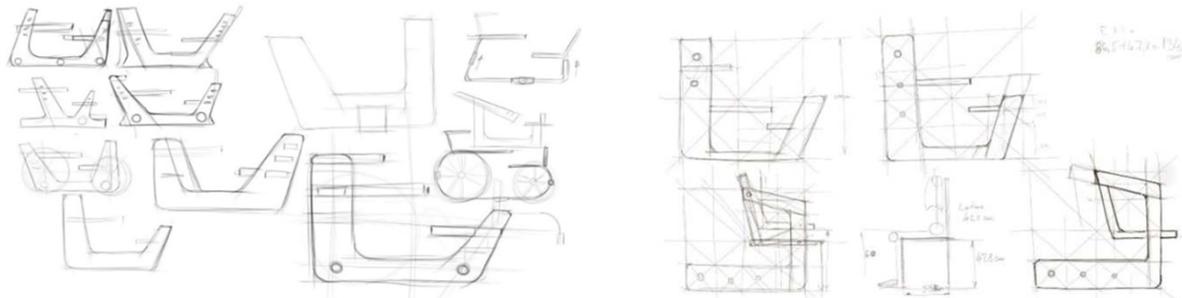


Fig. 3. Idee sketches – Conceptual Design.

5. THE PROJECT DESIGN PROCESS FOR CHILDREN CHAIR PRODUCT

5.1 Phase 1 - Clarify the task

One conclusion drawn from the survey is that parents who bought chairs based on the Tripp Trapp design prioritized durability, choosing a simple, classic design with sustainability in mind. In contrast, for the other two types of seats, the primary consideration for purchase was visual comfort. Security, safety, easy cleaning, brand prestige, and quality are common features across all chair types.

Human nature, particularly the nature of children, is prone to change, and their high sensitivity and subjectivity make it challenging to draw objective conclusions after an interview. However, using Ergonomics and Human Factors studies as important tools for developing an evolutive chair design model. A product can be created that meets a wide range of needs and has an emotional impact, creating a positive interaction for the child.

In terms of appearance, there is no ideal formula, as the designs of the chairs analyzed differ significantly. However, an evolutive chair design that combines durability (up to 7 years or more), ergonomic comfort, and flexibility in use could be the optimal choice for an emotionally sustainable product.

5.2 Phase 2 – Conceptual Design

After clarifying the tasks, we noticed that the chairs with a design based on the Tripp Trapp shape designed by Peter Opsvik are a point of reference. The design is considered classic and

is preferred by parents in more than half of the cases. Based on these observations and the tasks recognized during the task clarification phase, we began a set of idea sketches that would lead to conceptual design development.

The information obtained from clarifying the tasks is transformed during the conceptual design phase to create a conceptual solution. The goal is to design an evolutive, ergonomic, and flexible chair while also evoking an emotional impact and positive interaction with the child. We aim to introduce the Human Factor, especially empathy and aesthetic sympathy, to establish an emotional connection with the chair. Recognizing this emotional connection is crucial for developing a sustainable and durable product. To create an emotional connection with potential users, we plan to implement a series of stories and the option to decorate the product.

5.3 Phase 3 – Embodiment Design

The conceptual solution chosen to be transformed into a constructive design solution tries to cover all the tasks expressed in the task clarification phase.

Therefore, in addition to the previously mentioned tasks, such as ensuring ergonomic positioning, comfort, and adaptability as the child grows, to enhance the emotional impact, we have chosen to increase the design's flexibility by incorporating the option to transform the chair into a worktable. Even in this form, the product can still be used as the child grows through different ages (Fig. 4, Fig. 5).

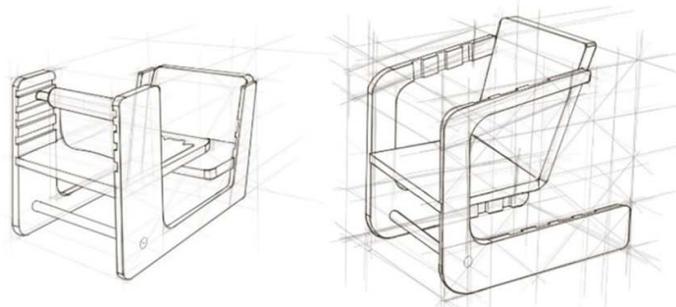


Fig. 4. Rendering of the product – Detailed Design.



Fig. 5. Rendering of the product – Detailed Design.

To enhance the emotional impact on the user, we can introduce options for decorating the product, engaging in various activities such as drawing or painting, or even transforming it into different toy forms.

5.4 Phase 4 - Detailed Design

During this phase, the detailed solution takes the constructive solution as input data and involves modelling all the stages required for manufacturing the product and manufacturing management. In this phase, the necessary technical documentation is developed, including the file for launching the designed product, the plan, and the instructions for the client to assemble the product.

6. CONCLUSIONS

Regarding the shape of this product, there is no one-size-fits-all formula. Opinions on the shape can vary depending on the customer's preferences. In this case, the parent is the one making the purchase. Their previous experiences play a crucial role in their decision-making process, so the design proposed in this

work aims to use a classic shape that already has a significant presence in the market.

The main objective of developing and analyzing the proposed questionnaire was to recognize as many needs as possible. That led to the observation that, generally, when purchasing a children's seat, factors such as simplicity, sustainability, visual comfort (colored decoration), security, safety, ease of cleaning, and the quality of the materials used are considered. Few parents emphasize the emotional and empathic aspects, particularly the attachment children develop to the objects they encounter. If a child cannot identify with an object, they may not be able to bond with it and form an emotional attachment [17].

Regarding ergonomics, Opsvik's theory that "the best posture is always the next" must be considered when it comes to children. Therefore, in the proposed design, careful attention was given to this element to ensure the child had enough room to move without being restricted.

As a result, in the development of the proposed design, in addition to the previously mentioned requirements, emphasis was also placed on the ergonomic design and Human

Factor, the desire for the seat to be evolutive, and the flexibility in use. Still, the most important thing is increasing the child's ability to attach to this object and his emotional response, by considering the sustainability aspects, too [18].

7. REFERENCES

- [1] Jordan, P.W., *Designing Pleasurable Products*. London: Taylor & Francis, 2000.
- [2] Salvador, C., Vicente, J., Matins, J.P., *Ergonomics in Children's Furniture – Emotional Attachment*, Proceedings of the 5th International Conference on Applied Human Factors and Ergonomics AHFE 2014, Kraków, Poland 19-23 July 2014.
- [3] Borjesson, K., *Affective Sustainability. Is this what timelessness really means? in: Undisciplined!* Design Research Society Conference 2008. Sheffield, UK, 16-19 July 2008.
- [4] Jordan, P.W., *Human factors for pleasure in product use*. Applied Ergonomics, Volume 29, No. 1, pp. 25-33, 1998.
- [5] Pöppel, E., *A Toolbox for Thinking – an essay*. Cognitive Semiotics, Fall 2007, pp. 8-24, 2007.
- [6] Stokke®(2013), *Growing together™ – Tripp Tripp® concept*. Stokke®'s Website: <http://www.stokke.com/en-pt/highchairs/tripptrapp/tripp-trapp-concept.aspx>
- [7] Opsvik, P., *Sitting Philosophy*. Peter Opsvik's, <http://www.opsvik.no/reflections/sitting-philosophy>
- [8] Pahl, G. ş.a., *Engineering Design - A Systematic Approach*, 3rd edition. Springer, 2007.
- [9] Stef, D., *Dezvoltarea produsului in contextul fabricii digitale*, PhD thesis Editura Politehnica, Timișoara, 2012.
- [10] Opsvik, P., *Rethinking Sitting*, New York: W.W. Norton, 2009.
- [11] Ryan, N., Norwegian Design: *The Work of Furniture Designer Peter Opsvik*. The National College of Art and Design's Website: <http://archive.is/OeSA>, 2000.
- [12] Karwowski, W., *The discipline of Human Factors and Ergonomics*. in: Handbook of Human Factors and Ergonomics. Salvendy, Gavriel (Ed.). Hoboken, NJ: Wiley, 2012.
- [13] Helander, M.G., *Hedonomics – Affective Human Factors Design*. in: Proceedings of the Human Factors and Ergonomics Society Annual Meeting. Volume 46, No. 12, 2002.
- [14] Chapman, J., *Emotionally Durable Design – Objects, Experiences & Empathy*. London: Earthscan, 2005.
- [15] Piaget, J., *The Child's conception of the world*. London: Routledge, 1929.
- [16] Lueder, R., Rice, V., *Ergonomics for Children – designing products and spaces for toddlers to teens*. Taylor and Francis, 2008.
- [17] Mugge, R., *Product Attachment*. PhD thesis. Delft University of Technology, 2007
- [18] Sirbu, R. M., Popescu, A. D., Borca, C., Draghici, A., *A study on Romania sustainable development*. Procedia Technology, 19, 416-423, 2015.

Propunere de design ergonomic, afectiv si emoțional pentru mobilier evolutiv pentru copii

Accentul în designul de produs se pune în general pe funcționalitate și utilitate, cu toate că, este important să se caute noi caracteristici ce ar trebui implementate, pentru genera un atașament emoțional cât mai mare față de acesta. Este mult mai important în designul și dezvoltarea unui nou produs ca acesta să fie cât mai tentant pentru client. Astfel, obiectivul general este de a concepe un corp de mobilier (un scaun) pentru copii mult mai potrivit și durabil, care să poată urmări creșterea copilului de la 6 luni până la 7 ani și de care aceștia să se atașeze, deoarece afecțiune poate fi considerată cea mai importantă caracteristică a unui astfel de produs. Dezvoltarea conceptului, a pornit de la un studiu bazat pe interviuri pentru a ilustra sentimentele copiilor prin ochii părinților, față de formatele de scaune folosite, concluzia acestui studiu a condus la dezvoltarea noului design de scaun evolutiv baza pe formatul Tripp Trapp.

Dorian ȘTEF, PhD., Lecturer, Politehnica University Timisoara, Mechanical Faculty, Material and Manufacturing Engineering Department, Bd. Mihai Viteazu No. 1, Timisoara, Romania, dorian.stef@upt.ro

Nicoleta STELEA, PhD Student, Transilvania University of Brasov, Faculty of Technological Engineering and Industrial Management, Department of Engineering and Industrial Management, 1 Universitatii str., Brasov, Romania, nicoleta.stelea@unitbv.ro