JONA

JOINING TRIANGLES AND SQUARES WITH HAIR TIES

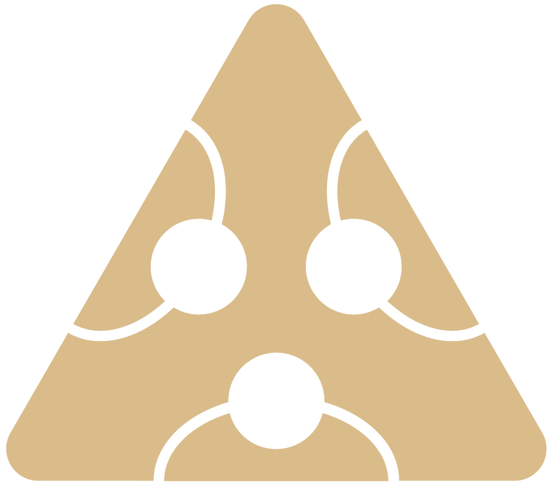
A CONSTRUCTIONAL PLAYTHING DESIGNED TO SUPPORT DEVELOPMENTAL PLAY

LUNDS UNIVERSITET

Degree Project for Master of Fine Arts in Design
Lund University
School of Industrial Design

2026

TOBIT JOSHUA KIRSCH



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Degree Project for Master of Fine Arts in Design
Main Field of Study: Industrial Design
Lund University, School of Industrial Design

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ABSTRACT

This master's thesis explores the design of a construction toy that supports developmental play for children aged seven to ten years. The project is motivated by the observation that increasing digitalization and highly stimulating environments are changing the way children play, potentially reducing opportunities for tactile, open-ended, and self-directed play experiences that contribute to healthy development.

The project was grounded in research from a case study at an elementary school, developmental psychology, pedagogy, and toy design. Theoretical perspectives on play and learning, combined with the analysis of existing construction toys, were used to identify values of developmental toys, including open-endedness, exploration, creativity, flexibility, and simplicity. A market analysis revealed that while these qualities are common in toys for younger children, they are less prominent in products designed for older age groups.

Based on these findings, JONA was developed, a modular construction toy consisting of triangular and square elements made from beech wood, connected with hair ties. The toy encourages children to build and create their own structures through experimentation and free play, while supporting creativity, spatial understanding and fine motor skills. The design process involved iterative prototyping, material exploration, and the development of a custom joining mechanism that balances flexibility and stability.

The concept was evaluated through a user workshop with elementary school children, where observations provided valuable insights into usability, engagement, and creative potential. The results showed that children quickly understood the system, enjoyed building with it, and created a wide range of imaginative constructions both individually and in groups.

The outcome of this thesis is a construction toy that combines open-ended play with educational value and demonstrates how industrial design can foster child development through meaningful, hands-on play experiences.

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„Play is not an end in itself, but the means by which the child learns... Objects, properly chosen, allow the child to touch, manipulate, and thereby develop concentration, coordination, and understanding."

Maria Montessori (The Montessori Method, 1912)

MOTIVATION

Children nowadays are growing up in a world that changes rapidly and an environment that is shaped by the digitalisation, constant stimulation, and an increasing presence of screens. These developments offer new opportunities for learning and entertainment, but they also change how children play, explore, and develop skills that shape their character.

Elementary school teachers started to observe challenges in areas like fine motor skills, attention span and creativity. These challenges can be associated with the decline of analogue, haptic and free play experiences. The exposure to a highly stimulating and often predefined form of interaction and entertainment can reduce opportunities for self-directed, explorative learning.

Play is fundamental for children. It is an intrinsic mechanism through which children explore and understand their environment, learn and construct knowledge. The design of playthings therefore has a significant responsibility in shaping these processes. However, contemporary toys and digital media often prioritise instant engagement, predefined interaction and continuous stimulation. This limits children in actively acquire knowledge through trial, error and open-ended interaction.

At the same time, developmental processes that need slowness, repetition, and the culture of making mistakes are increasingly underrepresented in the everyday experiences of children. This is very critical when considering the importance of spatial reasoning, mathematical thinking, and soft skills such as creativity, motivation and self-regulation.
In a society that requires human beings to navigate a complex world, think independently, and adapt to constant change, these competences are growing in importance. This highlights the potential of design, to actively support child development by creating more meaningful play experiences that encourage curiosity, patience and active engagement.

The toy industry's focus on products that capture attention quickly and provide immediate feedback, is effective when it comes to engaging users and buyers in the short term. But it may not support the long-term developmental needs. That motivates to create a project that positions itself in contrast to these tendencies by focusing on the extended developmental value of play and by grounding the design in psychological and pedagogical research.

The aim of this project is to design an object that supports positive child development by framing play as a form of learning. The proposed outcome tries to encourage explorative interaction and strengthen key soft skills, including creativity, attention, and fine motor skills. By reintroducing tactile, constructive, and open-ended play experiences, the project seeks to contribute to a more balanced and development-oriented approach within the field of toy design.

BACKGROUND

THEORETICAL CONTEXT

This project is grounded in established theories from developmental psychology and pedagogy that understand play as a central mechanism of learning and development. The work of Jean Piaget describes learning as an active process in which children construct knowledge through interaction with their environment. Similarly, Lev Vygotsky emphasises the social and contextual nature of learning, highlighting the importance of interaction, support, and the surrounding environment. In addition, the project draws on the play theory of Gordon Burghardt, who defines play as a voluntary, intrinsically motivated activity that is essential across species.

Pedagogically the project is based on reform-oriented educational approaches. Maria Montessori emphasises the importance of self-directed, hands-on learning and carefully designed materials that support independent exploration. Rudolf Steiner highlights the role of imagination, creativity, and holistic development through sensory and artistic experiences. More recently, Hartmut Rosa introduces the concept of resonance, emphasising meaningful relationships with the environment and the value of slowness over constant acceleration.

Although some of these theories were developed in earlier contexts, they provide a relevant foundation for addressing contemporary challenges related to digitalisation and changing childhood environments.

Additionally, the project is informed by a study at a German elementary school that examines the context of pre-school and after-school care. The study investigates existing toy availability and identifies needs from teachers and caregivers.

STATE OF RESEARCH

Recent research indicates shifts in children's developmental conditions, particularly in relation to increasing exposure to digital media and decreasing opportunities for physical and explorative play. Studies suggest a decline in analogue, haptic, and object-based play experiences, which can be associated with challenges in areas such as fine motor skills, attention, and creative engagement (Cimino et al. 2025; Dhar et al. 2026).

Previous studies on toys and early childhood education highlight the role of physical and sensory-rich environments, material quality and accessibility (Woodroffe & Willat, 1976). Similarly, research such as the Timpani Toy Study highlights the impact of toy design on the duration and quality of children's play, showing that simple, non-realistic and open-ended toys have positive influence on child development (Trawick-Smith et al. 2015).

This body of research shows the importance of embodied and explorative learning processes. Physical interaction with materials, open-ended play, and opportunities for trial-and-error support cognitive development, creativity, and problem-solving abilities. Collectively, this research forms the foundation for the project, which aims to translate these principles into the design of an object that supports holistic child development.

MARKET AND USER CONTEXT

The project is situated within the Western European toy market, where private households represent the primary context of use. The intended users are children between the ages of 7 and 10, while the primary buyers are adults, such as parents or family members. This distinction between user and purchaser introduces differing expectations and requirements, which must be considered in the design process.

The contemporary toy market offers a wide range of products with varying levels of educational and developmental value. While there are open-ended, non-realistic toys made from natural materials for children in the ages of 0-6, the toys are changing in their design for older children. A noticeable trend is the emphasis on products that capture attention quickly and provide immediate predefined interaction. These characteristics may be effective in attracting buyers and engaging children in the short term, but they do not necessarily align with long-term developmental needs. Despite increasing awareness of the developmental importance of open-ended and sensory play, relatively few products for children aged 7–10 translate these principles into contemporary toy design.

KEY CONCEPTS AND DEFINITION

Toy:
A designed object intended to facilitate play, interaction, and learning experiences.

Child Development:
A holistic process that includes cognitive, motor, emotional, and social growth.

Soft Skills:
Non-technical competencies such as creativity, attention, self-regulation, and problem-solving, which are essential for navigating complex environments.

RESEARCH

CASE STUDY

PSYCHOLOGICAL THEORY

PEDAGOGICAL THEORY

TOY RESEARCH

MARKET ANALYSIS

CASE STUDY

Prior to the start of the thesis project, a case study and visual research were conducted at a German elementary school. The study examined the context of preschool and after-school care, with a particular focus on how toys and play materials influence the quality of the care environment and children's engagement within it. The research consisted of a questionnaire distributed to teachers and care staff, as well as a visual analysis of the existing facilities, materials, and spatial organisation.

The findings of this preliminary study served as an initial foundation for the thesis project, supporting the identification of needs, challenges, and opportunities within the selected context. The case study provided insights into the current conditions of care environments and informed the initial direction of the project.

The study indicated a limited availability of objects specifically intended to support the development of soft skills such as creativity, self-regulation, and problem-solving. Many of the available toys appeared to prioritise short-term entertainment value over open-ended or development-oriented interaction.

Teachers and care staff emphasised robustness, simplicity, safety, and flexibility as essential characteristics for objects used within care environments.

Another recurring theme was the desire for a stronger integration of crafts and craftsmanship-based activities within the daily care program, particularly as a means of encouraging creativity, material understanding, and hands-on engagement.

The visual research further indicated that most materials in the available toys are plastics and artificial materials.

In addition, the organisation, storage, and presentation of materials appeared to play a significant role in accessibility, usability, and children's independent interaction with the available objects and play environments.

EXCERPT OF STUDY FINDINGS

ATTRIBUTES FOR TOYS

PURPOSE

- promote creativity
- promote movement
- promote social interaction
- balance to school life
- play everyday situations
- cognitive challenging
- fit in children`s way of thinking
- not too competitive

CHARACTERISTICS

- stability
- robust
- many variations possible
- not fragile
- children can`t get hurt
- not too many small parts

MOTIVATION OF USE

- easy to use
- challenging
- age appropriate
- possible to play together
- not much explanation needed
- not too complicated
- usable alone and in groups
- no long team games
- not too school like
- no complicated rules

NEEDS AND WISHES

EDU TOYS

- Wooden Toys
- Educational material
- Motoric objects for indoors

CRAFTS

- Craft activities
- Guided craft activities
- Craft supplies

NATURAL MATERIALS

- Natural materials (sand, water)
- Sandbox
- Quiet musical instruments

After this study, it became clear at an early stage that a meaningful and well-informed project within the field of toy design required broader and more in-depth research than an analysis of the current market situation alone. While observations of existing products and care environments provide important insights, they are often shaped by external factors such as economic constraints, availability, and commercial trends.
To develop a good understanding of children's developmental needs, it was necessary to address the fundamental principles of child development and learning. For this reason, the initial research focused on theories in psychology and pedagogy, establishing a theoretical foundation that informs and supports the design process. This approach aimed to create a stronger conceptual basis for the project and ensure that the resulting design decisions were grounded in developmental and educational perspectives rather than solely in market-driven considerations.

PSYCHOLOGICAL THEORY

JEAN PIAGET (1896 - 1980)

Jean Piaget was a Swiss psychologist, and the pioneer of child developmental psychology. He developed the theory of Cognitive Development of children. He saw childhood as a creative phase with different stages of exploring the world and oneself (Deutschlandfunk, 2021).

Piaget divides child development in different stages:

- Sensorimotor Stage (Birth-2)
- Preoperational Stage (2-7)
- Concrete Operational Stage (7-11)
- Formal Operational Stage (12+)

Piaget stated that play is not just pastime, it is the **reflection of cognitive development** and shows the perception and understanding of the world that surrounds children. Exploration and experiences that are made through play are translated into the thought processes and therefor are a part of **growing and developing**.

An important characteristic of play for the child's development is that in it the **reality is adjusted to the thought process** and not the other way around. Play has no goal it is the inner organisation of thoughts.

MY TRANSLATION FOR TOYS

- Toys are materials to **explore the world**
- Toys should have a **big scope of action** so the thoughts of children can be fit in them
- Toys have to fit into the **developmental stages** for children as the cognitive structure is different

FURTHER READING

Play, Dreams and Imitation in Childhood (1962), J. Piaget

LEV VYGOTSKY (1896 - 1934)

Lev Vygotsky was a soviet psychologist, working with psychology, linguistics and education. His work influences education, mainly in the areas of play and collaborative learning. His focus is the cultural impact on child development (Celinska, 2023).

Lev Vygotskys theories on play and its importance for child development are slightly different to Jean Piaget, but the fundamental statements are similar.

For him play is as well a leading activity **for children to learn and develop**. But in difference to Piaget, Vygotsky states that play is not just the use of already acquired cognitive skills, but the **driving force to acquire new ones**. So, play is the possibility to take the next step and challenge the own development.

Vygotsky calls it the Zone of Proximal Development (ZDP), as an in between stage of the things children can do all alone and where they need help from their peers or adults to reach the next developmental stage.

His focus is that play is a tool for children to **learn self-regulation and impulse control** as there are roles and rules that give certain limitations.

MY TRANSLATION FOR TOYS

- Toys can mediate cultural meanings and support children's connection to their **social surrounding**
- Toys should open the space for **imagination**, as this is the main **motor of learning**
- Toys can support **self-regulation and control**
- Toys can give the possibility to **develop more** than the child is already capable to do

FURTHER READING

Play and its role in the mental development of the child (1967), L. Vygotsky

GORDON M. BURGHARDT (*1941)

Gordon Burghardt is a professor in the psychology department at the University of Tennessee. His work is an examination of play in different species. He is exploring the evolution of play from a biological perspective (nifplay, 2026).

Play is described by Burghardt as a **naturally evolved behaviour** that is in both humans and animals and is not only attributable to culture. Behaviour can be classified as play when it is not fully functional, is intrinsically motivated, differs from serious behaviour, is repeated with variation, and is in a low-stress situation.

Object play represents one category of play and involves the **manipulation and exploration of objects**, allowing animals to investigate the properties through repeated but variable try.

Burghardt suggests that play may contribute to the development of **motor skills and behavioural flexibility** and may have implications for **problem-solving skills and social interactions**.

MY TRANSLATION FOR TOYS

- Toys should be easy to **manipulate**
- **Different variations** give different reactions
- Toys should give the possibility to try **different behaviour**

FURTHER READING

The Genesis of Animal Play: Testing the Limits (2005), G.M. Burghardt

PERSONAL REFLECTION

The research on psychological theories of children, child development and the role of play is the foundation for understanding how children develop. It helps identify their needs, the ways to support the development and the various influencing factors involved. In the process of designing for children, it is essential to ground decisions in a research base.

The theories of Piaget and Vygotsky are broad and sometimes abstract, but they provide a valuable framework for filtering essential aspects that can be translated into the objects that surround children.

In general, it is a learning that each child is unique and develops individually, so it is difficult to generalize. However, these theories suggest that development follows a rough structure, reflected in milestones such as language, memory and self-awareness.

Children learn through exploration and experience, both of which strongly influence their development. Exploration and experiences occur through several activities, and play is one of them. Play is a form of learning and development and therefor plays a central role in child development.

Through play children test and explore the reality, in terms of behaviour, social interaction and physical skills. Objects that encourage play, such as toys, can have a positive impact, especially when they offer possibilities of exploration and testing a variety of behaviours. In this way, they support learning and development.

Moreover, children need fantasy and imagination to understand the world and process their experiences. Providing space for imagination, fosters creativity and a deeper understanding of self.

Burghardt suggests that play is a natural behaviour that is intrinsically and is not following rules of functionality. Important aspects of play are repetition and variation.

PEDAGOGICAL THEORY

MARIA MONTESSORI (1870 - 1952)

Maria Montessori was an educator who developed the Montessori method of education, where the child is the focus point. She designed child-centred learning environments that promote independence, hands-on learning, and self-directed activity. Her work had a major influence on early childhood education worldwide (Montessori Deutschland, 2026).

Montessori has developed pedagogical concepts, that are still very relevant for schools and kindergartens. Her ideas are touching the way how children learn and develop.

In the theory the **child is the focus point**, and the idea is that the learning process is not following external principles. Her idea is that children **need to do things by themselves to learn**. She sees children as the master builder of their own development. In her pedagogy the role of adults is more on the outside and her key points can be stated in:

- Help me to do it by myself
- Help me to think it by myself
- Help us to do it by ourselves

She says that development is **making mistakes** and grow with them and learn through play and individual activities.

Her theories are looking into schools and the system of educational institutions, but the perspective on learning and development can be translated into private homes as well. In the pedagogy of Montessori, she developed many materials that help and support the learning process.

MY TRANSLATION FOR TOYS

- Toys should be made from **high quality** materials to give the child play value
- Learning is **multi sensoric**, haptic and grabbing are a big part of understanding
- Toys should be suitable for **different stages in age**
- Toys are isolated activities that resemble parts of reality
- Toys offer **intrinsic control of mistakes**
- Concentration offers development, so the toys should **not offer distractions**

FURTHER READING

Die Entdeckung des Kindes (2015), M. Montessori, H. Ludwig

RUDOLF STEINER (1861 - 1925)

Rudolf Steiner was a philosopher who founded anthroposophy, a spiritual philosophy that influenced education, agriculture, and medicine. He developed the Waldorf education system, which emphasizes creativity, imagination, and holistic child development. His educational approach focuses on integrating intellectual, artistic, and practical learning (dw, 2025)

Steiner developed the Waldorf pedagogy and states that child development is in a rhythm of seven years. The stages are focusing on different areas.

- 0-7 y/o is the stage of **imitation**
- 7-14 y/o is the stage of the **outside world** and aesthetic understanding, pictures and stories are important in that stage

He says that learning is done through **senses, doing and experience**. Fantasy is the main motor for child development. For children the focus is not cognitive learning but sensoric and **bodily experiences**. Based on psychological theories on play is that cognitive learning is done through play. So, Steiners theory is not just focusing on play but as well on learning.

Play in the pedagogy of Steiner is the way to process experiences, build creativity and social interactions and are tools to crater the building and creation competences of children.

MY TRANSLATION FOR TOYS

- **Openness** to create fantasy
- **Natural materials** address more senses than artificial materials
- **Reduction** is better than overstimulation
- **Non-realistic** objects open the possibility of fantasy

FURTHER READING

https://www.waldorfshop.eu/blog/paedagogik/das-zweite-jahrsiebt-die-welt-ist-schoen
https://www.waldorfschule.de

HARTMUT ROSA (*1941)

Hartmut Rosa is a sociologist known for his theory of social acceleration and the concept of resonance. He argues that modern societies are characterized by increasing speed in technological and social processes, which can lead to alienation. He proposes “resonance” as a form of meaningful, responsive relationship between individuals and the world (dfg, 2023).

Rosa developed from his social studies the concept of resonance pedagogy.

He states that learning and education can develop when children are in a relation between themselves and a person or their environment. Resonance needs **answers and feedback** to create a relationship between human and world. His pedagogy says learning is not wisdom, but the **active experience of connectedness**.

MY TRANSLATION FOR TOYS

- **stimulation and feedback** through the senses
- Toys are a **medium for dialogue** for children
- Toys are building a relationship through **building and manipulation**
- Toys open the possibility for **cooperation**
- Children should bring their **own ideas** in

FURTHER READING

Resonanzpädagogik (2016), H. Rosa, W. Endres
https://www.rpi-loccum.de/material/pelikan/pel3_21/3_21_Hanusa

PERSONAL REFLECTION

In addition to psychological research focusing on children’s developmental processes, pedagogy addresses how children learn. There are numerous pedagogical theories and systems. This research focuses on the principles and literature of reform pedagogy, particularly of Maria Montessori and Rudolf Steiner, as well as the concept of resonance pedagogy developed by Hartmut Rosa.

These theories address learning not only as the acquisition of knowledge, but more importantly as a process of growth and the development of a diverse set of skills. This perspective makes them relevant and interesting for the project.

Children are at the centre of the pedagogical process and act as the driving force of their own learning. They approach situations and challenges differently from adults, which makes it essential to allow them to find their own ways of engaging with the world. Children should not be understood as incomplete adults, but as individuals with own ways of thinking and acting. A culture that allows mistakes supports learning and development, as trial-and-error is a fundamental way in which children explore and understand their environment.

Toys exist in a relationship with the child, making their quality and affordances highly important. They shape the child’s responses and interactions and can support development when they function as a kind of canvas for the child’s thoughts and imagination. This relationship should not be one-sided, as is often the case with purely entertainment-oriented tools, but both-sided. Children engage with toys, and toys, in turn, invite and guide interaction.

Concentration is important for both learning and play, and toys should therefore foster focus. Reduction, abstraction, and simplicity help to minimize distractions and enable deeper engagement. At the same time, this simplicity creates openness, allowing children to decide independently how they want to use and interpret a toy.

TOY RESEARCH

THE TIMPANI TOY STUDY

The TIMPANI Toy Study (where TIMPANI stands for Toys that Inspire Mindful Play and Nurture Imagination) is a decade-long empirical research project (2010 – 2019) that was conducted by the Center for Early Childhood Education at Eastern Connecticut State University. It examined how different toys influence young children's play in natural preschool settings by observing and video-coding children using a variety of toys. Researchers assessed toys based on how they supported

- Thinking and Learning
- Creativity and Imagination
- Social Interaction
- Verbalization

Across the ten-year project, the study found that certain types of toys consistently support higher-quality play:

1. SIMPLE, OPEN-ENDED TOYS

Toys without bells, lights, or fixed scripts encouraged deeper engagement and imagination because children had to decide how to use them themselves. Open-ended toys helped sustain attention and allowed multiple imaginative uses, leading to richer play and language use.

2. NON-REALISTIC TOYS WITH MULTIPLE PARTS

Toys that didn't look exactly like real objects prompted children to invent their own ideas, talk through scenarios, solve problems, and negotiate with peers.

3. CONSTRUCTION TOYS

Toys such as hardwood blocks, building bricks, TinkerToys, magnetic tiles, and other buildable sets were consistently among the highest performing, because children could create many different structures and cooperatively build together.

4. REPLICA PLAY TOYS

Small animals, people, vehicles, or similar figures encourage symbolic, make-believe play. Children used these to create scenes and narratives, often engaging in extended pretend play with rich social interaction and verbalization.

FURTHER READING

https://www.easternct.edu/center-for-early-childhood-education/timpani/index.html

PLAY MATERIALS AND TOYS IN THE EDUCATION OF YOUNG CHILDREN
BY S.E. WOODROFFE & B.J. WILLAT

Woodroffe and Willatt argue that the educational value of toys lies not in their build-in features but in how they foster active engagement and exploration. The authors emphasize that young children learn through direct manipulation of materials, constructing understanding through sensory, motor, and cognitive interaction. Toys function as tools that support developmental processes rather than as carriers of predetermined knowledge.

A key implication for design is the importance of **developmental appropriateness**. Materials should align with children's cognitive and motor abilities while offering an appropriate level of challenge. Overly prescriptive or single-outcome toys may limit imaginative engagement, whereas open-ended materials support problem-solving, symbolic thinking, and creativity. The authors also highlight that simple and everyday materials can be as educationally valuable as specialized "educational" toys when they allow multiple uses and interpretations.

For the design of toys, the article suggests that the following characteristics should be prioritized:

1. **Open-ended** interaction over fixed outcomes

2. **Sensory and manipulable** qualities that invite exploration

3. **Flexibility** to support multiple developmental stages

4. Opportunities for **imaginative and symbolic** use

Overall, Woodroffe and Willatt position toys not as teaching devices, but as catalysts for experimental learning, placing responsibility on design to create affordances that encourage active, self-directed play.

PERSONAL REFLECTION

In addition to theoretical research, the project is informed by studies focusing specifically on toys. A central source is the TIMPANI Toy Study, which provides a comprehensive overview of different categories of toys and their characteristics.

Although the variety of toys on the market is big and forms of play continue to evolve over time, certain aspects can be generalized and used to inform the design process of new toys. One of the most significant of these is open-endness. In line with psychological and pedagogical theories, toy studies suggest that open-ended toys foster imagination, sustain attention, and support the development of problem-solving skills, symbolic thinking, and creativity. The absence of instructions or predefined outcomes allows children to engage in multiple ways, encouraging exploration and self-directed learning.

Age appropriateness is essential for a toy to be meaningful and supportive. It should correspond to the developmental stage of the child it is intended for. Understanding children's abilities and skill sets is crucial to create engagement without causing frustration or overstimulation. At the same time, challenges play an important role in development. A toy should ideally be positioned at the boundary between what a child can already do and what they have not yet mastered. This balance promotes growth by encouraging children to extend their capabilities.

Non-realistic toys create space for symbolic play, allowing children to project their own ideas, experiences, and interpretations onto the object. This fosters imagination and supports the development of abstract thinking. In contrast, highly predetermined toys may capture attention immediately, but often fail to sustain engagement over time and offer limited opportunities for deeper learning.

Construction toys combine open-endness, abstraction, and material quality, making them a particularly valuable category of toys. They provide diverse opportunities for exploration and creation, supporting a wide range of developmental processes.

MARKET ANALYSIS

The toy market is highly saturated, making it difficult to get a comprehensive overview. This project therefor focuses specifically on construction toys, as this is the intended area of design. In line with the research, age groups play an important role in the development and evaluation of toys. So, the market analysis is structured into four categories: 2–3 years, 3–5 years, 5–7 years, and 7+ years.

Based on the research and personal reflections, a set of evaluation criteria has been developed to assess how different toys support development and how they are structured. This framework enables a more systematic understanding of the types of toys available within each age group and the design principles they follow.

Through this analysis, it becomes possible to identify patterns, as well as potential gaps and misalignments within the current toy market. These insights serve as a foundation for informing the design process and positioning new toys more effectively.

DUPLO
Building Blocks

AGE 2-3

Open-Endness

Motoric Skills

Challenging

Natural Materials

Feedback

Manipulative

Exploration

GOKI
Stacking Blocks

Open-Endness

Motoric Skills

Challenging

Natural Materials

Feedback

Manipulative

Exploration

IKEA
Building Blocks

Open-Endness

Motoric Skills

Challenging

Natural Materials

Feedback

Manipulative

Exploration

GRIMMS
Rainbow

Open-Endness

Motoric Skills

Challenging

Natural Materials

Feedback

Manipulative

Exploration

KAPLA
Building Blocks

AGE 3-5

Open-Endness

Motoric Skills

Challenging

Natural Materials

Feedback

Manipulative

Exploration

BRIO
Builder Set

Open-Endness

Motoric Skills

Challenging

Natural Materials

Feedback

Manipulative

Exploration

EICHHORN
Builder Set

Open-Endness

Motoric Skills

Challenging

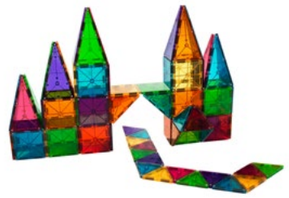
Natural Materials

Feedback

Manipulative

Exploration

MAGNA-TILES
Building Sheets



Open-Endness

Motoric Skills

Challenging

Natural Materials

Feedback

Manipulative

Exploration

AGE 5-7

HABA
Building Game

Open-Endness

Motoric Skills

Challenging

Natural Materials

Feedback

Manipulative

Exploration

BRIO
Build a Car

Open-Endness

Motoric Skills

Challenging

Natural Materials

Feedback

Manipulative

Exploration

EICHHORN
Build a Crane

Open-Endness

Motoric Skills

Challenging

Natural Materials

Feedback

Manipulative

Exploration

HABA
Marble Run

Open-Endness

Motoric Skills

Challenging

Natural Materials

Feedback

Manipulative

Exploration

AGE 7+

MOONTOY
Building Set

Open-Endness

Motoric Skills

Challenging

Natural Materials

Feedback

Manipulative

Exploration

QUERCETTI
Tech-Building

Open-Endness

Motoric Skills

Challenging

Natural Materials

Feedback

Manipulative

Exploration

FISCHER
Marble Run

Open-Endness

Motoric Skills

Challenging

Natural Materials

Feedback

Manipulative

Exploration

LEGO
Building Set

Open-Endness

Motoric Skills

Challenging

Natural Materials

Feedback

Manipulative

Exploration

CONCLUSION

2-3 y/o	**Open-Endness**	**Natural Materials**	Exploration
	Motoric Skills	Feedback	
	Challenging	**Manipulative**	
3-5 y/o	**Open-Endness**	Natural Materials	**Exploration**
	Motoric Skills	Feedback	
	Challenging	Manipulative	
5-7 y/o	Open-Endness	Natural Materials	**Exploration**
	Motoric Skills	**Feedback**	
	Challenging	Manipulative	
7+ y/o	Open-Endness	Natural Materials	Exploration
	Motoric Skills	**Feedback**	
	Challenging	Manipulative	

The market analysis informed the concept development in several ways. Aligning these findings with the conducted research provides the foundation for a grounded and relevant design proposal.

In the youngest age group (0–3 years), there is a strong focus on child development and the impact of toys on learning. Materials are carefully selected, often favouring natural qualities. Construction toys in this category tend to be simple, open-ended, and non-realistic.

For children aged 3 to 5, toys continue to emphasise open-endness and exploration. However, the sets become larger and more complex. Material choices shift towards plastics and more artificial finishes, while affordances become increasingly realistic. Visual qualities are often polished and highly stimulating.

This trend continues for children aged 5 to 7. Play becomes more predetermined, with sets designed to recreate specific structures. Open-endness and process-oriented building are less prominent, and free play is reduced.

In the oldest age group, the focus shifts further towards challenge and final outcomes. Materials are predominantly artificial, and the visual language aims for realism. Developmental aspects of play become fewer, making room for feature-rich and highly stimulating products.

Overall, the analysis indicates that the market for developmental play is well saturated for younger children. However, for older children (7+), these qualities are significantly diminished. Key aspects such as open-endness, simplicity, material quality, and exploration become less present.

This reveals a gap at an age where play behaviour is undergoing significant change and digital media is becoming increasingly influential in children’s lives.

ANALYSIS

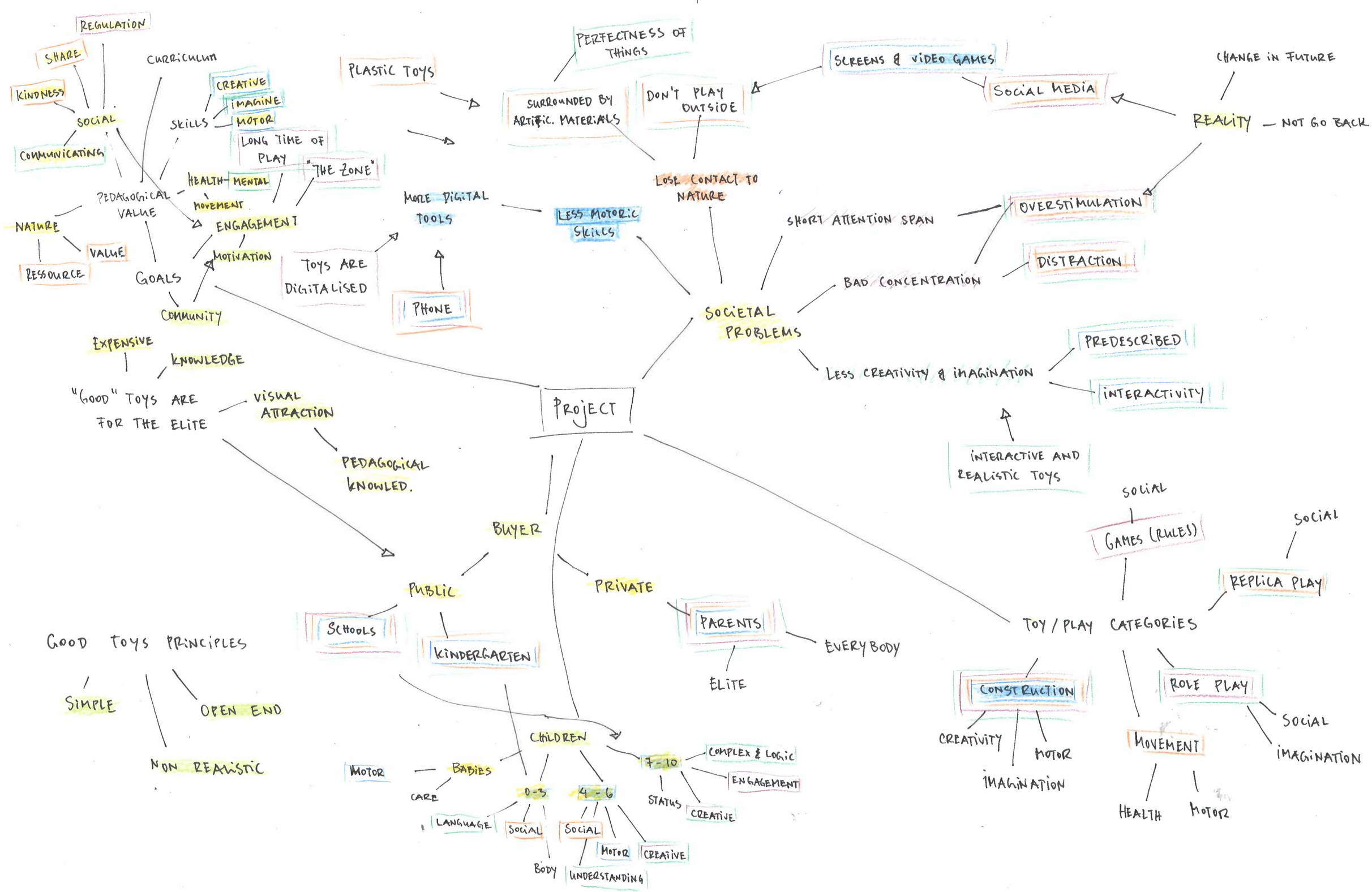
PROJECT FRAMEWORK

TARGET GROUP

CONSTRUCTIONAL PLAYTHING

VALUES

PROJECT FRAMEWORK



TARGET GROUP

When it comes to designing objects for children, there is always an intersection of two user groups. The parents and the children, and they are equally important. Parents are the buyers and facilitators of the toy and children the end user.

PARENTS (BUYER)

The project is focusing on parents in the Western-European market, that put emphasis on sustainability, product longevity, and educational value. Parents increasingly seek toys that align with ecological values, consists of natural materials and designs that avoid unnecessary plastics. Aiming for parents that preference pedagogically meaningful products that contribute to a child's development rather than passive consumption.

CHILDREN (USER)

The age group for children is 7-10 years old.

Designing toys needs careful alignment with the intended age group, as children develop quickly in early years, especially around the transition into school at about age six. At this stage, children start to shift from a self-centred perspective to a **wider awareness of their surrounding** (peers, family, environment), integrating these influences into their play and understanding of the world.

Cognitively, they move from single perspective thinking to understanding **multiple aspects** at the same time, enabling pattern recognition, generalization, and the formation of self-esteem and value systems.

Physically, this period is marked by significant advances in motor skills, alongside an increasing awareness of their bodily capabilities. Combined with improved language and memory, children start to engage in more **complex, challenging, and exploratory activities**.

CONSTRUCTIONAL PLAYTHING

There are many toys in the world, some are designed to play with, some are designed to entertain, and some are designed to sell. Toys can be categorized in many different ways, and each category is focusing on different aspects of play and promoting those. The most common categories are

- Construction Toys
- Replica Toys (Pretend Play)
- Arts and Craft Toys
- Logic toys
- Active Play Toys
- Board Games
- Sensoric Toys
- Digital Toys

This project is focusing on construction toys, because they can combine open-ended play with a high value for child development. Construction systems invite children to actively shape their play experience, supporting creativity, problem-solving, and independent thinking. For the age group of 7-10, this is very relevant, as they are developing more advanced spatial reasoning skills and the ability to understand the relation of parts and wholes.

Construction is helping children to engage in iterative learning processes that encourage experimentation and resilience. Construction toys naturally integrate both cognitive and physical development, as they require planning, structure, and fine motor skills. At the same time, they offer different levels of complexity, making them adaptable to individual developmental stages.

From a pedagogical perspective, construction toys align with educational approaches that emphasize learning through doing and self-directed exploration. They provide a platform for both individual and team-play, promoting not only individual creativity but also communication and social skills when used in group settings.

In addition, construction toys are well suited to principles of sustainability and longevity. Their modularity encourages long-term use, repairability, and the possibility of expansion, reducing the need for frequent replacement. With the right choice of material, they contribute to a more responsible product lifecycle in the toy industry.

For those reasons the category of construction toys is perfectly suited as a framework for the design of a pedagogicially valuable toy.

VALUES

Assessing whether a toy is “good” or “bad” is very complex, especially as each child has individual needs, preferences, and ways of learning. This project is grounded in detailed and wide-ranging research on values that support and promote child development, with the aim of fostering self-awareness, autonomy, soft skills, and social skills.

Encouraging creativity, logical thinking, and the development of motor skills equips children with the ability to actively and positively shape the society they are part of. This perspective represents one possible approach, it does not claim to be definitive or universal. It is informed by the designer’s experiences, reflections, and thoughts regarding the future of children and society.

By grounding the design process in scientific research, the project establishes relevance and connects its outcomes to existing knowledge in child development and pedagogy.

The project is guided by a set of values drawn from research, analysis, and observation. These values serve as measuring criteria throughout the design process, informing decisions of whether the intention of creating a “good” toy is being met.

OPEN-ENDNESS

EXPLORATION

SPACE FOR IMAGINATION AND CREATIVITY

SELF-REGULATION

MOTIVATIONAL

DEVELOPMENTALLY SUPPORTIVE

STIMULATION & FEEDBACK

QUALITY OF MATERIAL

MULTI-SENSORIC

MANIPULATION & VARIATION

NON-REALISTIC & SIMPLE

SOCIAL & COOPERATION

IDEATION 01

STRING AND STICK

INTERSECTING SURFACES

MOVEMENT PLAYTHING

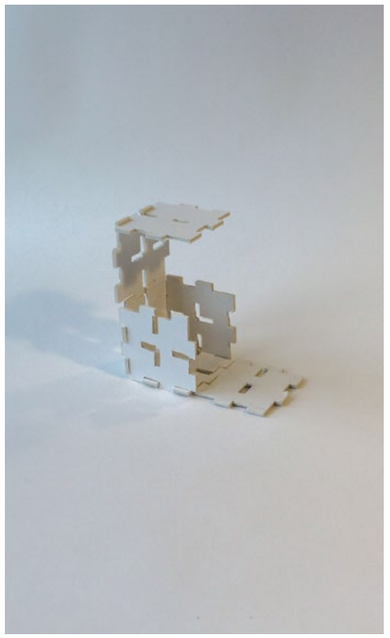
FURNITURE BUILDING KIT

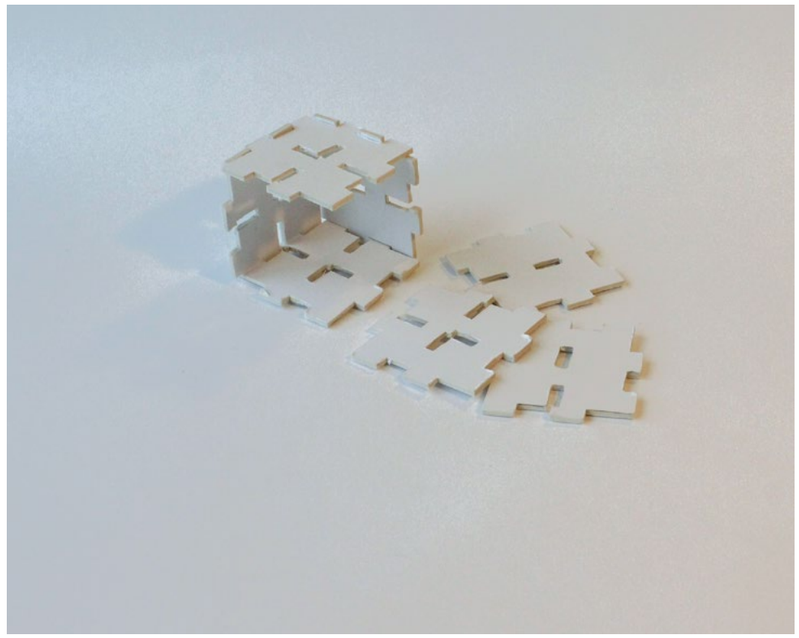
TETRA-OCTA BUILDING BLOCKS

ANALYSIS

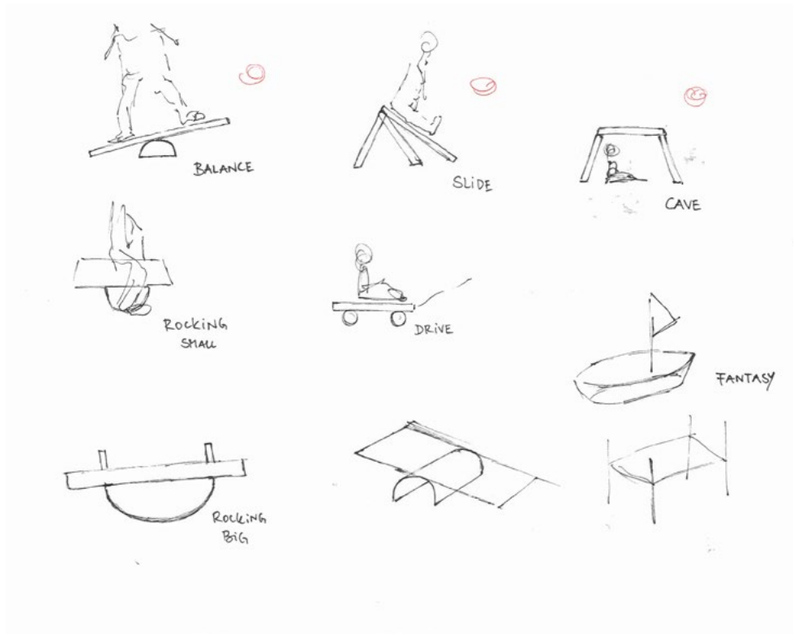
STRING AND STICK

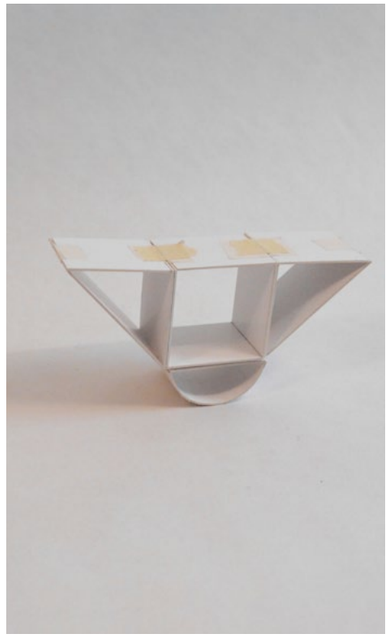
INTERSECTING SURFACES



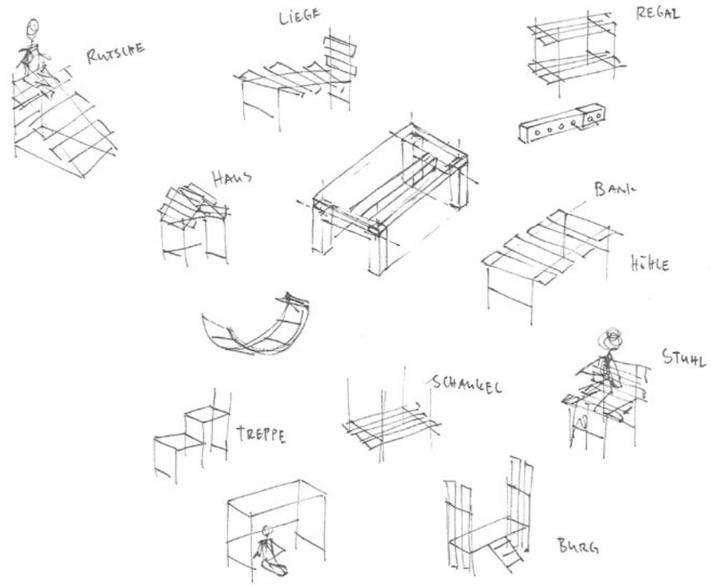


MOVEMENT PLAYTHING

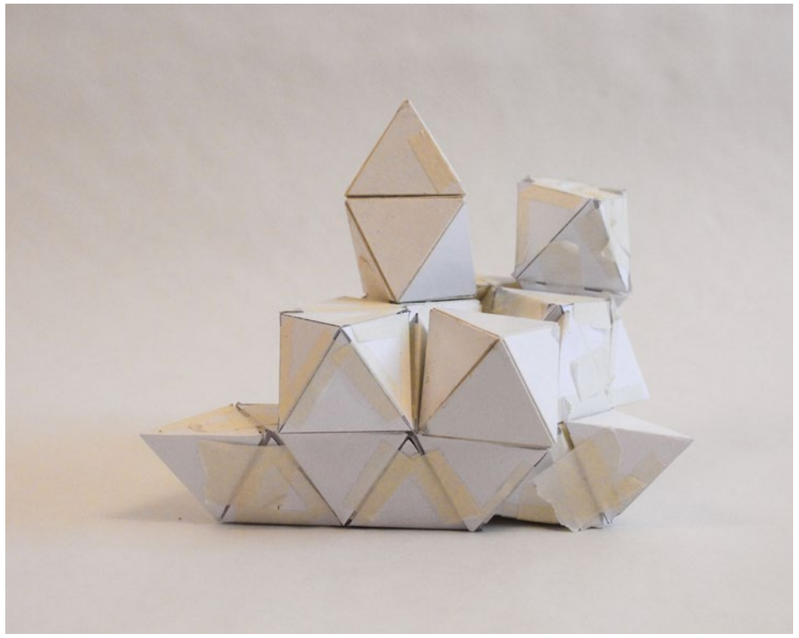


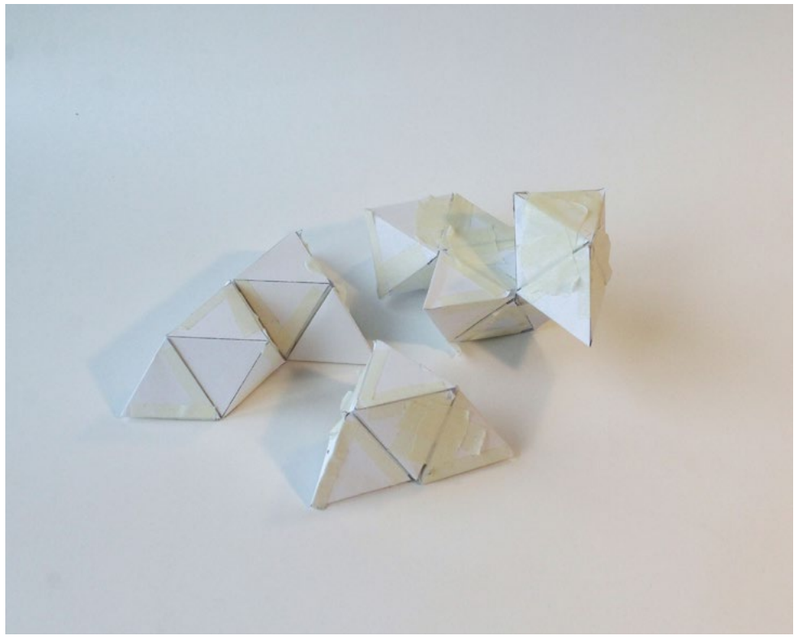


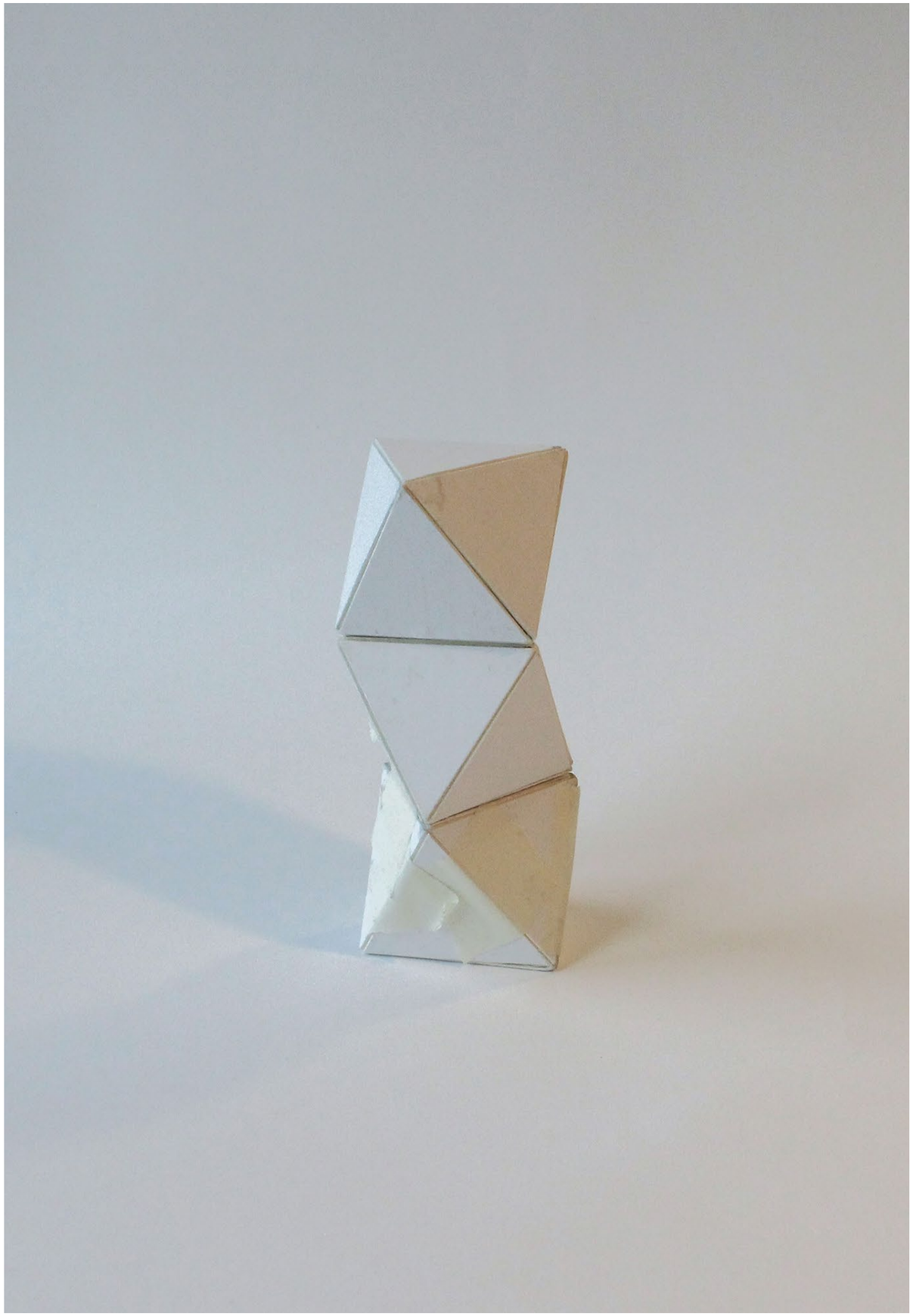
FURNITURE BUILDING KIT



TETRA-OCTA BUILDING BLOCKS







ANALYSIS OF IDEATION 01

In the first phase of ideation it is important to find identify a clear entry point into the project that includes the research findings. While these findings provide a valuable framework for evaluating ideas and guiding decision-making, the initial step is to develop a concept that addresses a relevant need and is a strong foundation for further development.

Throughout the process, many paper models are build to gain a direct, tangible understanding of an object or an emerging idea. This exploration revealed a general distinction: whether the focus should be the building process itself, or the outcome and how children ultimately play with it.

Two main directions are emerging from this exploration. The first focusing on developing more complex joining systems, where the act of connecting modules becomes a learning experience for children. The second direction explores the creation of a construction kit designed for play, emphasizing movement, creativity, and the development of craft skills.

Among these ideas, the most potential is identified in the principle of tetra-octa building blocks. This system is based on a three-dimensional tessellation with tetrahedra and octahedra. These blocks allow to create unusual and new structures. As all elements consist of equilateral triangles, everything fits together. The triangle as a fundamental geometric form, is both simple and variable, making it very suitable for a construction toy to create new spatial outcomes.

LEARNING BY DOING

BASIC GEOMETRIC SHAPES

EASY JOINERY COMPLEX BUILDING

EXPERIENCE OF STABILITY

WHAT NEEDS TO BE POSSIBLE?

BASIC SHAPE BUT COMPLEX STRUCTURES

FURNITURE OR OBJECT

SIZE

EXPERIENCE FROM MODULE TO BODY

JOINERY

OUTCOME VS. PROCESS

GEOMETRY LAYS FRAMEWORK

EVERYTHING FITS TOGETHER

IDEATION 02

VOLUMES

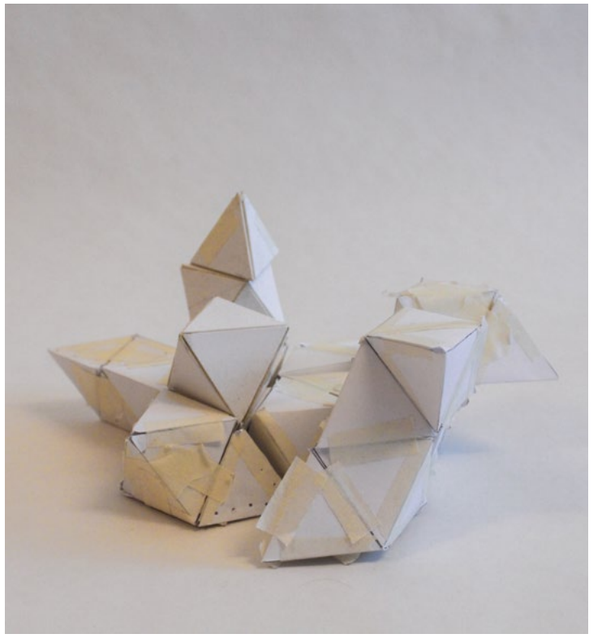
EDGES

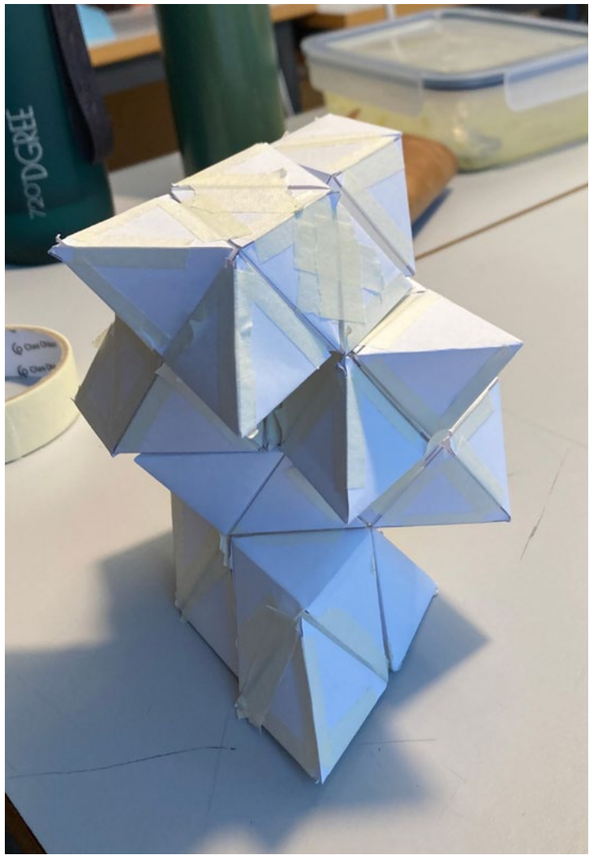
SURFACES

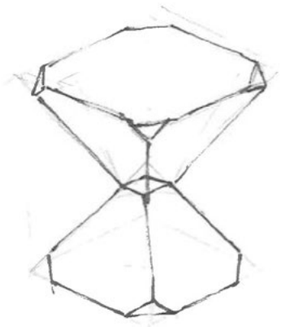
JOINERY

ANALYSIS

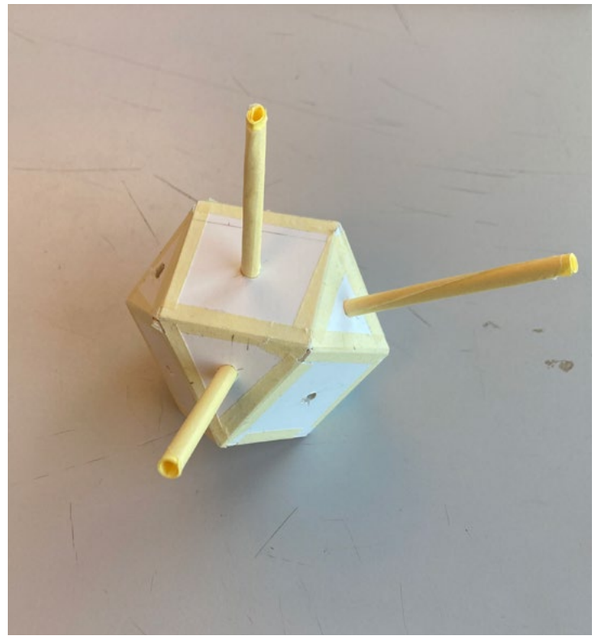
VOLUMES

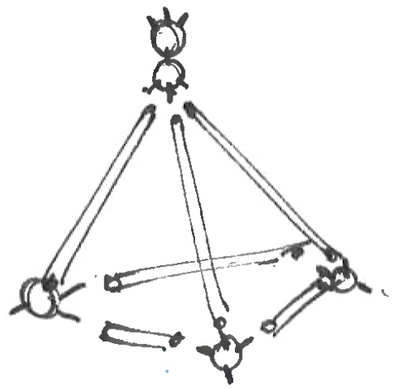


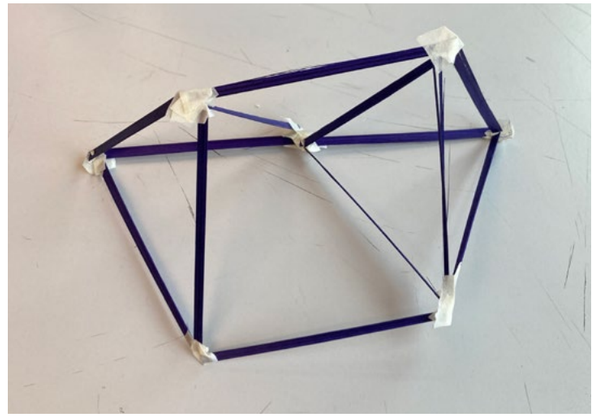


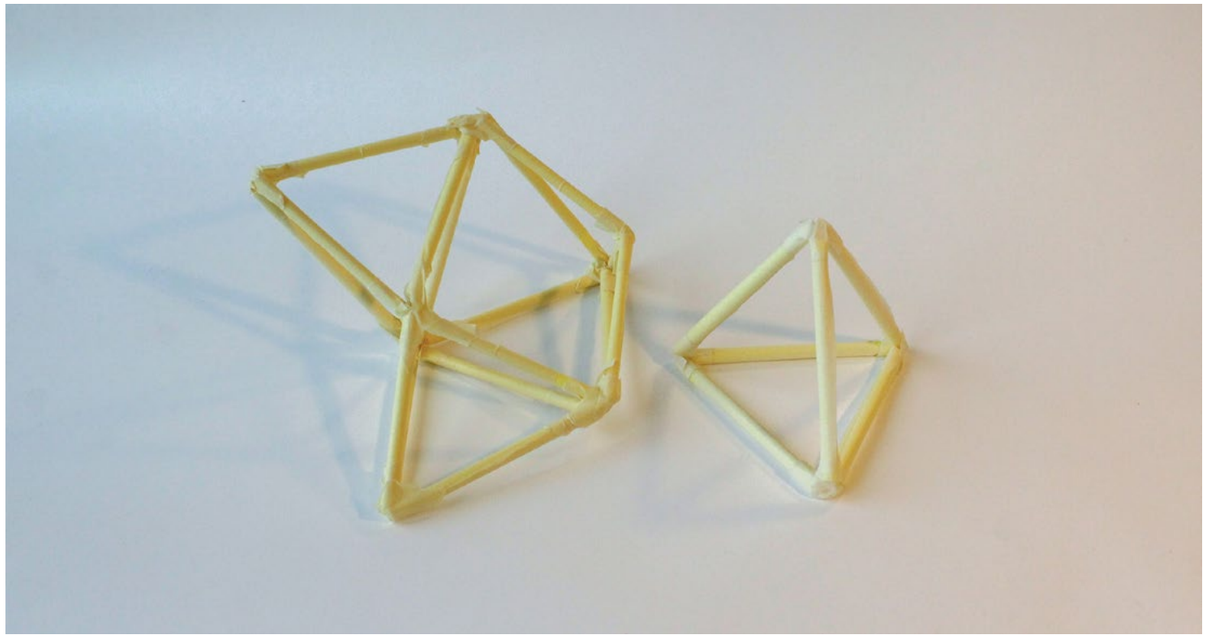


EDGES

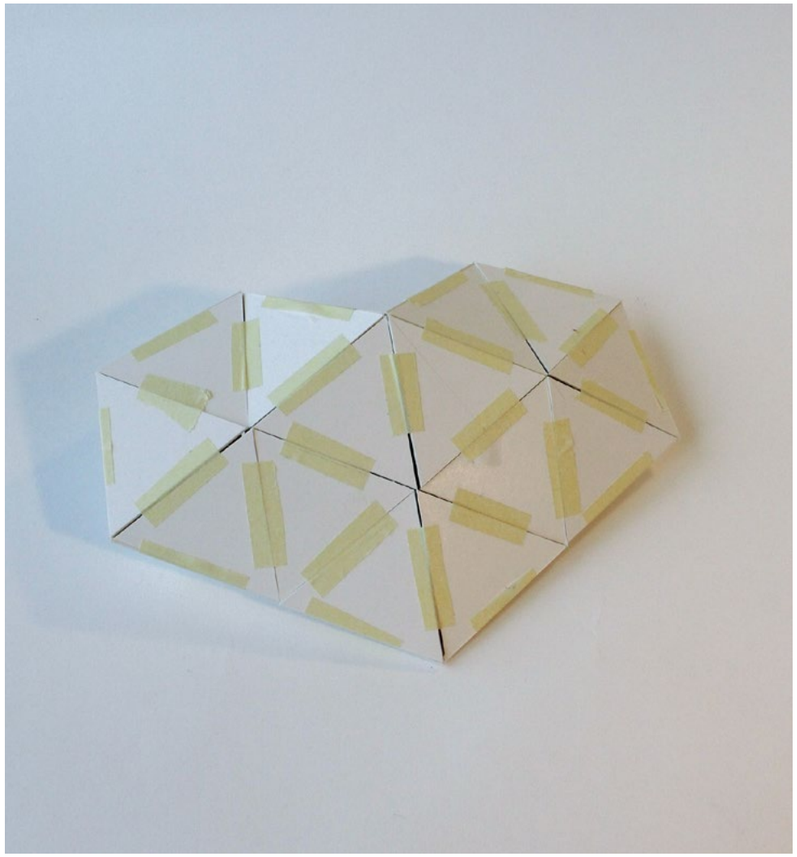


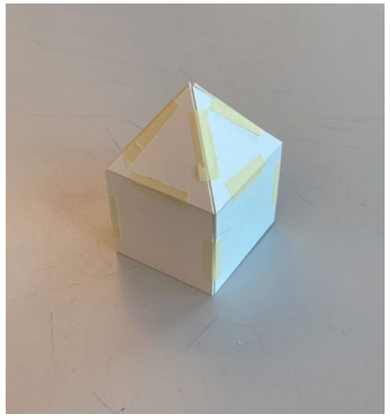


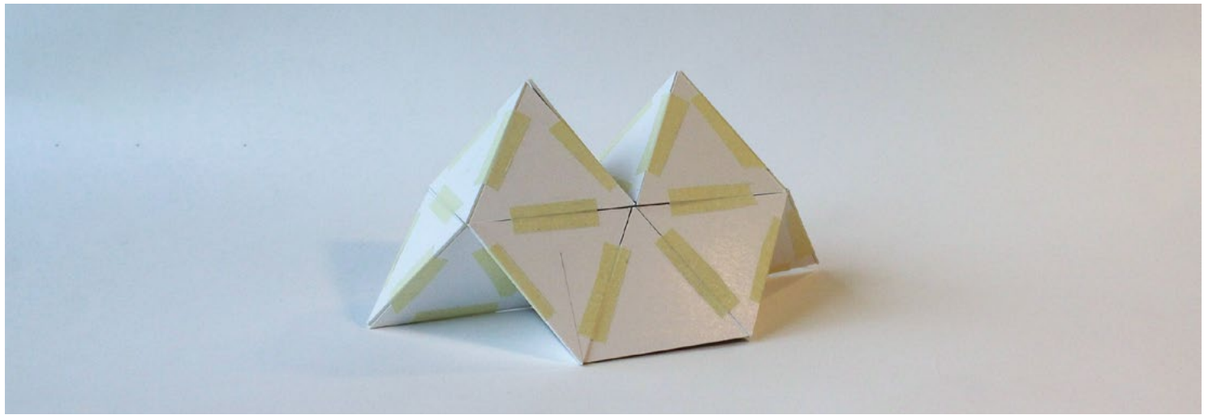




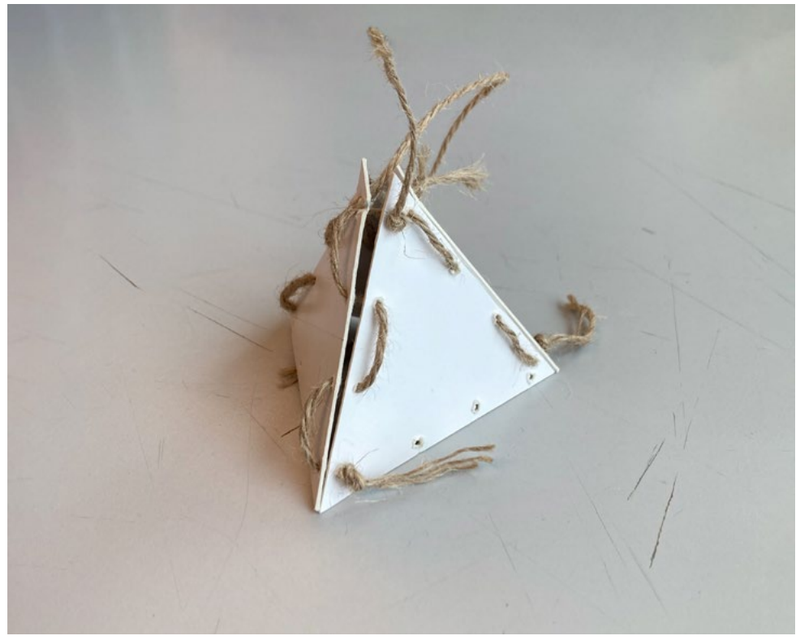
SURFACES

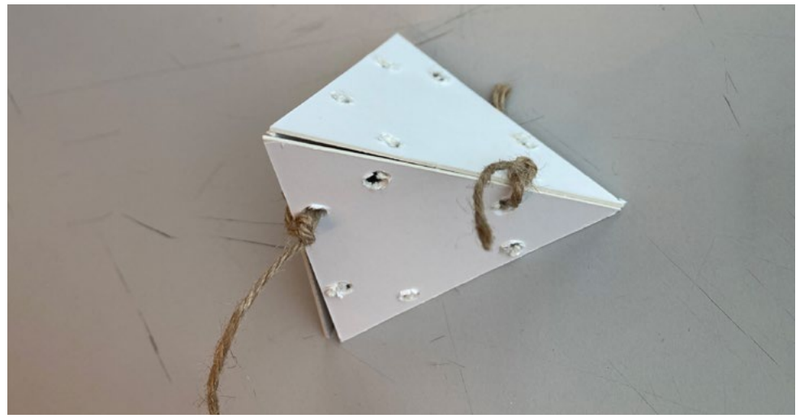


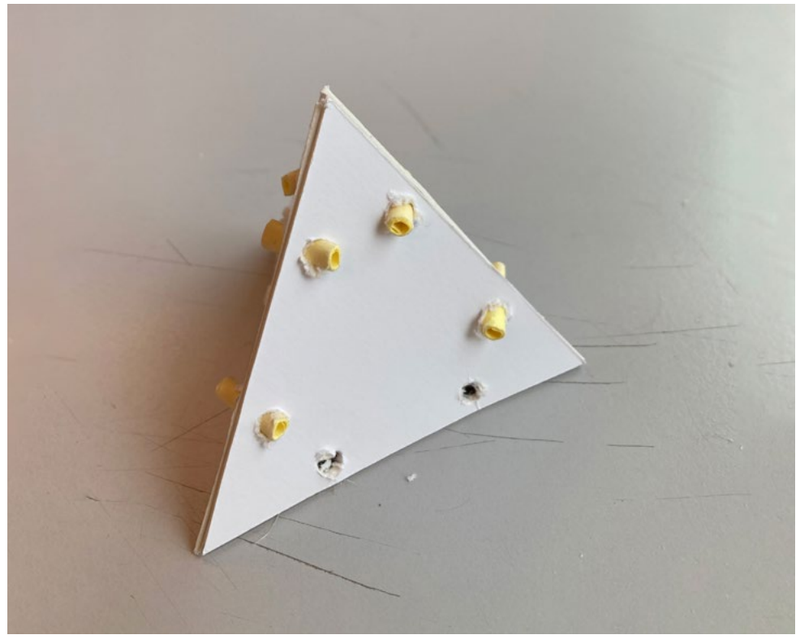




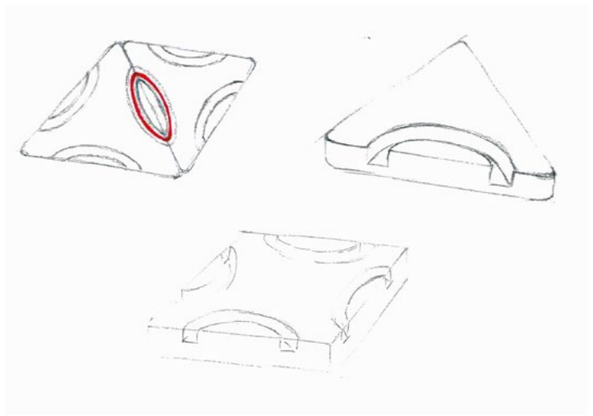
SEWING/PLUG

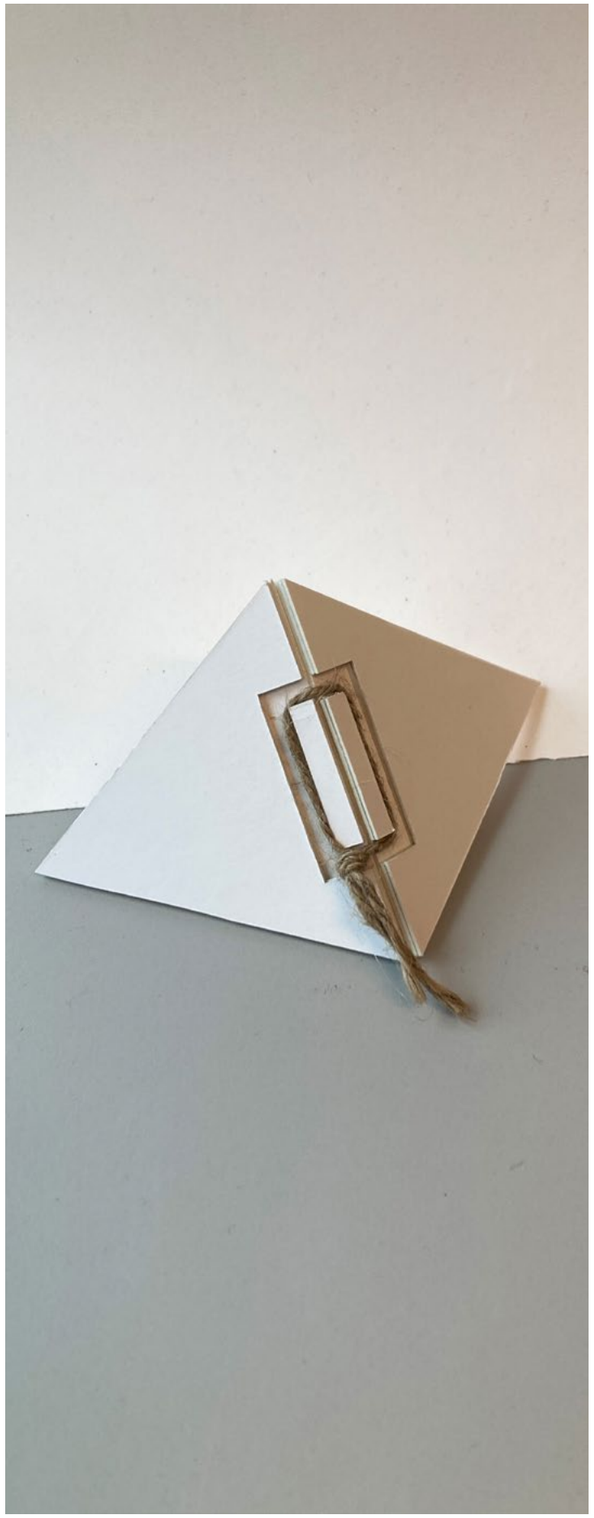




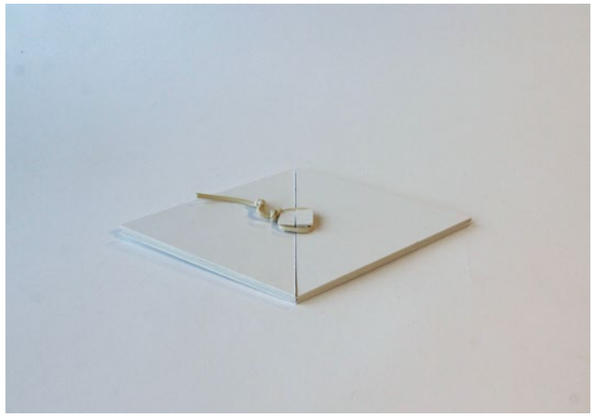


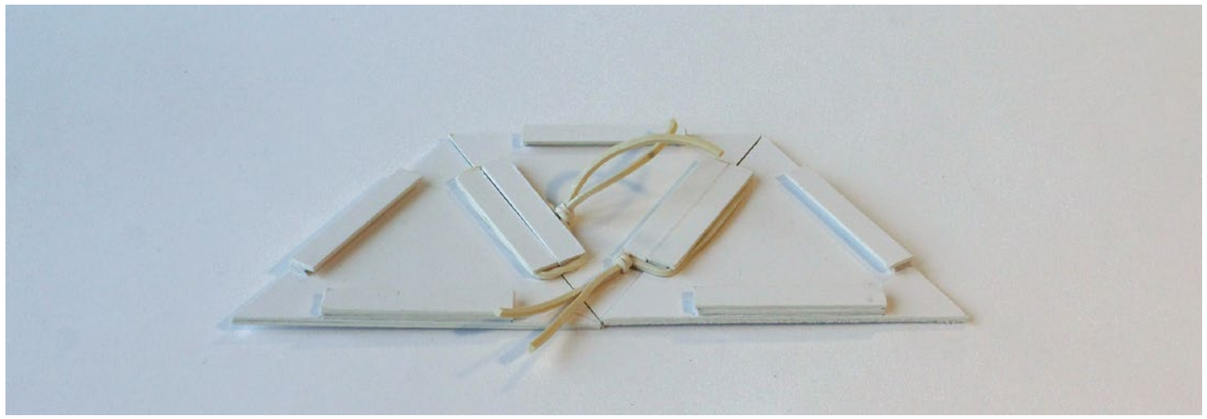
GROOVE





HOOK





ANALYSIS OF IDEATION 02

The second phase of ideation focuses on the further development of the tetra–octa tessellation, utilizing the geometric principle of equilateral triangles to create spatial outcomes. Within this framework, three approaches are explored: using the geometry as volumes (tetrahedra and octahedra), as edge-based structures, and as surface-based components.

Experimentation across all three approaches shows their general potential for product development. However, when considering the intended age group of children between 7 and 10 years, important distinctions become apparent. Volumes prove to be too simplistic in their interaction, while edge-based systems introduce a level of complexity that exceeds the children's capabilities. In contrast, the use of **triangular surfaces as building modules offers a good balance**, enabling the construction of complex forms through relatively simple components, and thus aligning with the needs of the target group.

The next step focuses on developing an appropriate joinery system for a surface-based construction kit. Open-ended play requires a high degree of manipulability and the possibility of multiple outcomes. A key requirement, therefore, is flexibility in the angles at which triangular surfaces can be connected. This consideration leads to the use of **string or cord as a joining material**, allowing for flexible connections.

A central aspect of the project is the exploration of methods for securely attaching the cord to the triangular elements while maintaining simplicity in assembly and disassembly. A wide range of solutions are explored through model making. Creating **a groove in the triangle that holds the elastic band** shows a high potential, by fulfilling all needs. The outcome of this process is the detailed design of a joinery system based on elastic bands and triangular surfaces, enabling constructions that are both stable and flexible.

DESIGN 01

JOINERY

SIZES

HAIR TIE

HAIR TIE

GRIP HOLE

MATERIAL

MDF GROOVE

Building on the initial concept of a groove-and-band system, triangular modules are created from MDF. Each triangle has a simple, linear groove with a width of 5 mm. As a connecting element, a children's hair tie is used. The groove dimensions are designed to fit the hair tie while applying slight tension to ensure a functional connection.

This system is successful in terms of visual appearance and general handling. However, several limitations become evident during testing. Most notably, the hair ties are not fixed securely within the grooves and tend to fall out too easily, which complicates the building process and reduces usability.

Further steps therefore focus on refining the groove geometry to improve the hold of the hair tie. In addition, the initial prototype reveals a second issue: the hair tie is difficult to grab when attempting to disassemble a connection. Addressing both secure fixation and removal is a central aspect in the next design iterations.

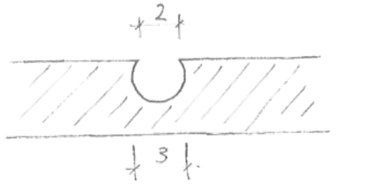
INTEGRATED BANDS

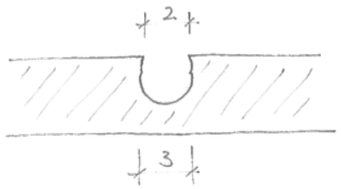
The second iteration in the development process aims to eliminate loose components by integrating the elastic band directly into the geometry of the module. To achieve this, a revised joinery system is developed that uses the groove principle while incorporating shorter elastic bands, which are fixed to the sides of each triangular element. Each side has both a groove and an attached elastic band, resulting in a system composed of a single, unified component. This significantly simplifies the assembly process.

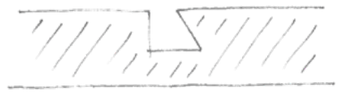
However, this approach introduces several disadvantages. Elastic bands that loosen or wear out cannot be easily replaced, reducing the longevity and maintainability of the system. In addition, the motoric action of placing and tensioning the hair tie within the groove, an important part of the learning experience, gets lost.

From a visual perspective, the system appears less precise and more irregular, making it harder to intuitively understand the construction logic. This reduced clarity negatively affects both usability and the overall perception of the building process.

EXACT JOINERY SYSTEM







The decision is made to further pursue the version based on a groove and a separate hair tie. This direction is chosen due to replaceability of the hair ties, the learning scope for children and the visual appearance.

Key challenges that need to be solved in the joinery design to make the product suitable for children's play are:

- The fixation of the hair tie within the groove must be intuitive and easy for children
- The hair tie needs to be held securely in the groove, so it doesn't fall out with movement to enable construction play
- The joinery must be easy to disassemble individually
- The system must be manufacturable in solid wood using a CNC machine

The development of an appropriate joinery solution involves an extensive process of trial-and-error. The final design is milled using the CNC in separate components. A key challenge in the process is to find the right milling tool to achieve a groove that holds the hair tie and can be manufactured efficiently. The small dimensions of the groove limit the search for applicable tools, as tools in that size tend to be fragile.

The initial approach uses a lollipop mill that cuts out a circular groove. However, this geometry doesn't provide enough retention for the hair tie.

A second iteration uses a dovetail mill that creates an angled groove. While this version improved secure hold of the hair tie, the achievable angle and tool constraints prevent a perfect solution. As well the groove needs to be wider, because of the tooling on the market.

The final solution separates the geometry into two components: the main triangular element and an additional plug that forms the opposing side of the groove. These parts are milled individually and then are assembled.

The outcome of this process is a joinery system that fulfils all the defined requirements and can be produced in solid wood. For a large-scale production, the development of a custom milling tool would be good, as it would eliminate the need for assembling separate components and thereby increase manufacturing efficiency. Within the scope of this degree project, however, the two-part milling approach represents the most feasible and effective solution.

ANGLED 5MM

ROUNDED 2MM

ANGLED 2MM

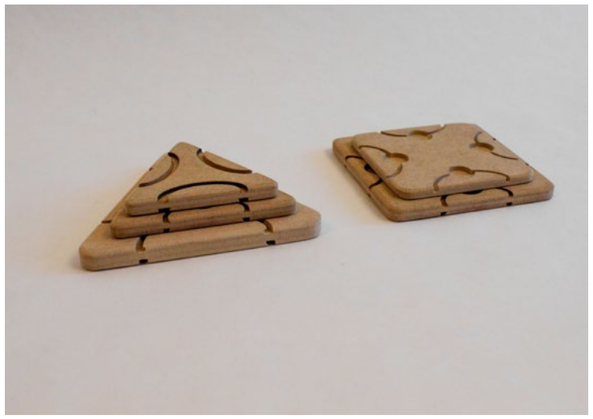
UNDERCUT 2MM

UNDERCUT ROUNDED 2MM

SIZES

Simultaneously with the development of the joinery system, the dimensions of the modules are defined. The size of the joinery and its manufacturability directly influence the overall scale of the elements. While a larger groove and the use of bigger hair ties simplify production, they also result in components that are too large to be comfortably handled by children.

The initial design is based on a side length of 80 mm. A second version with a side length of 110 mm is then developed, that provides a more stable and visually balanced appearance. This larger format is suitable for children's use while also ensuring that the hair ties are held securely within the joinery.



In parallel, the thickness of the elements is determined in proportion to their side length. This requires consideration of whether the joinery is on one or both sides of the triangles. The design objective is to minimize thickness while maintaining functionality and producibility.

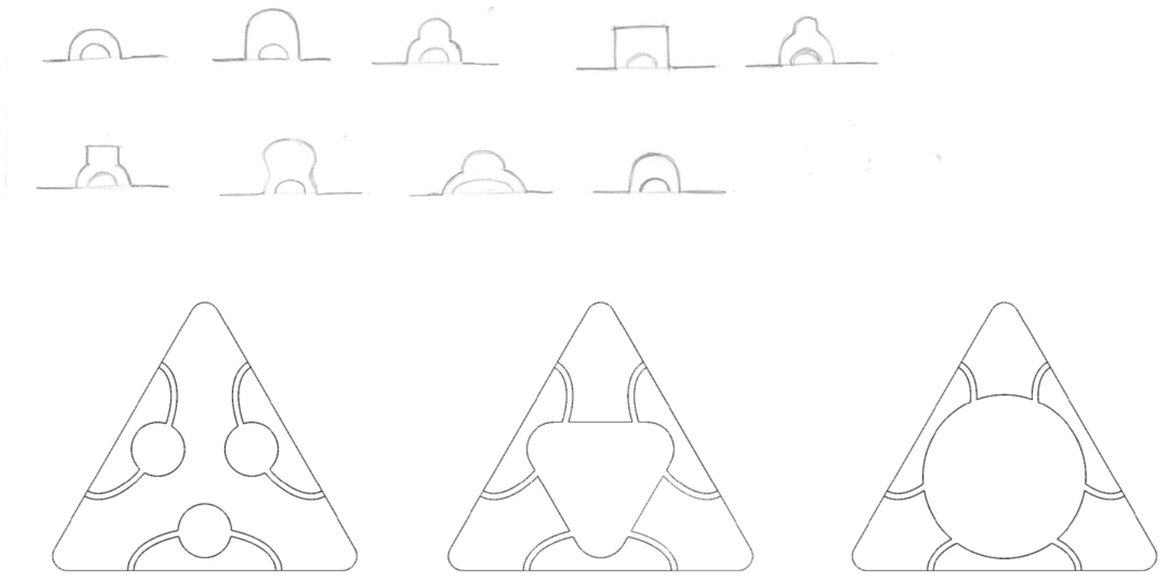
The final outcome is a triangular module with a side length of 110 mm and a thickness of 10 mm. These proportions are producible, compatible with the hair ties and good to handle by children's hands.

HAIR TIES

Using hair ties as elastic bands proves to be the most suitable solution. As a ready-made product, they are available in a wide range of sizes and colors, which is beneficial for the design process. Hair ties are durable, widely available, and designed for everyday use by children, making them well suited for the intended application.

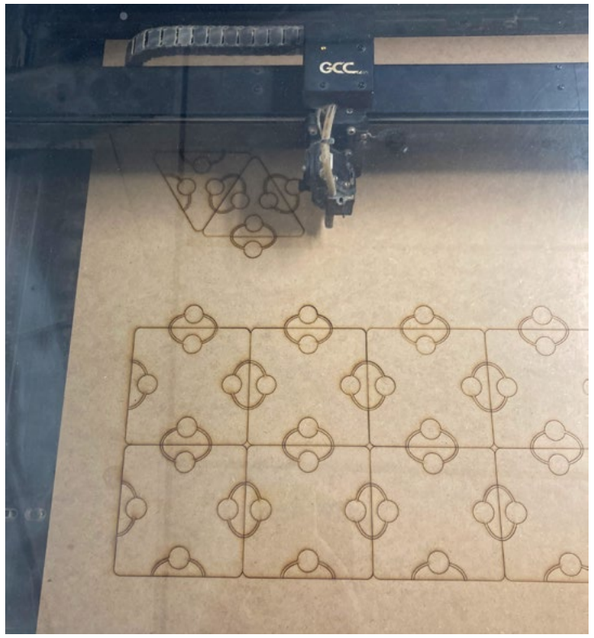
The size that fits best is a hair tie with a diameter of 25 mm and a thickness of 2 mm. They provide a simple and cost-effective solution for the joinery, which has positive implications for manufacturing, usability, and the overall production cost of the toy.

GRIP HOLE

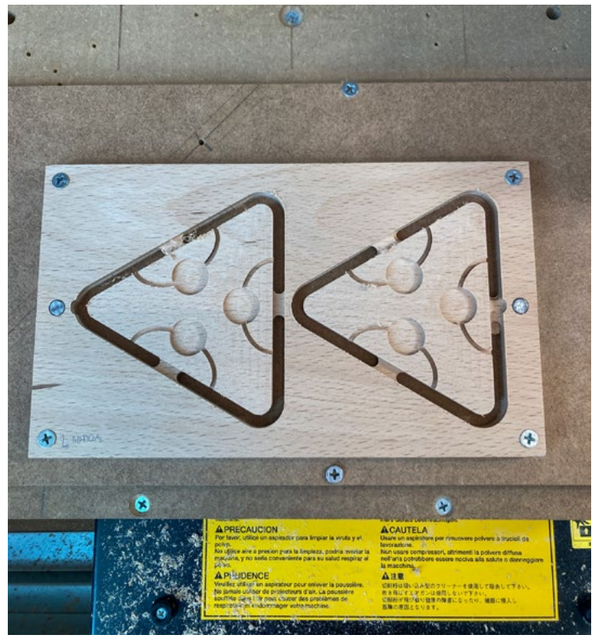


After the first mock-ups, it shows that a grip hole is necessary to remove the hair tie without disrupting the existing structure. A grip hole is therefore developed to enable this function while maintaining the integrity of the assembled form. As the visual appearance strongly influences the overall perception of the object, the design of this feature is important.

Simple circular shapes prove most effective as grip holes. They offer a clean yet playful look and do not visually compete with the square and triangular shapes. The size is defined to fit both children's and adults' fingers, ensuring good handling across users. Careful consideration is given to the proportion and placement of the holes, as these factors significantly affect the overall attractiveness of the toy. The final design consists of circular openings with a diameter of 18 mm, intersecting central with the groove.



MOCK UPS CNC



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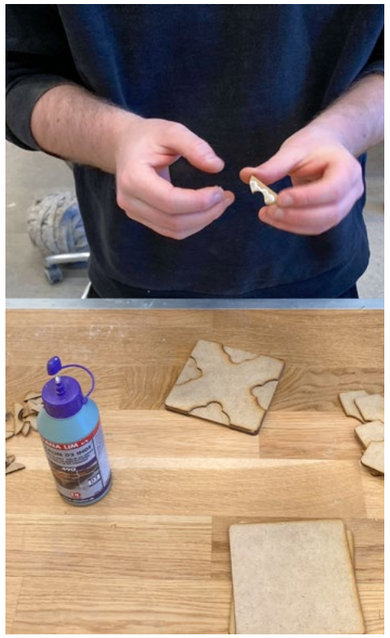
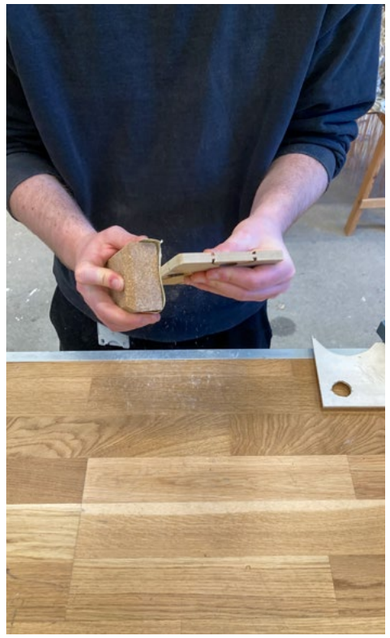
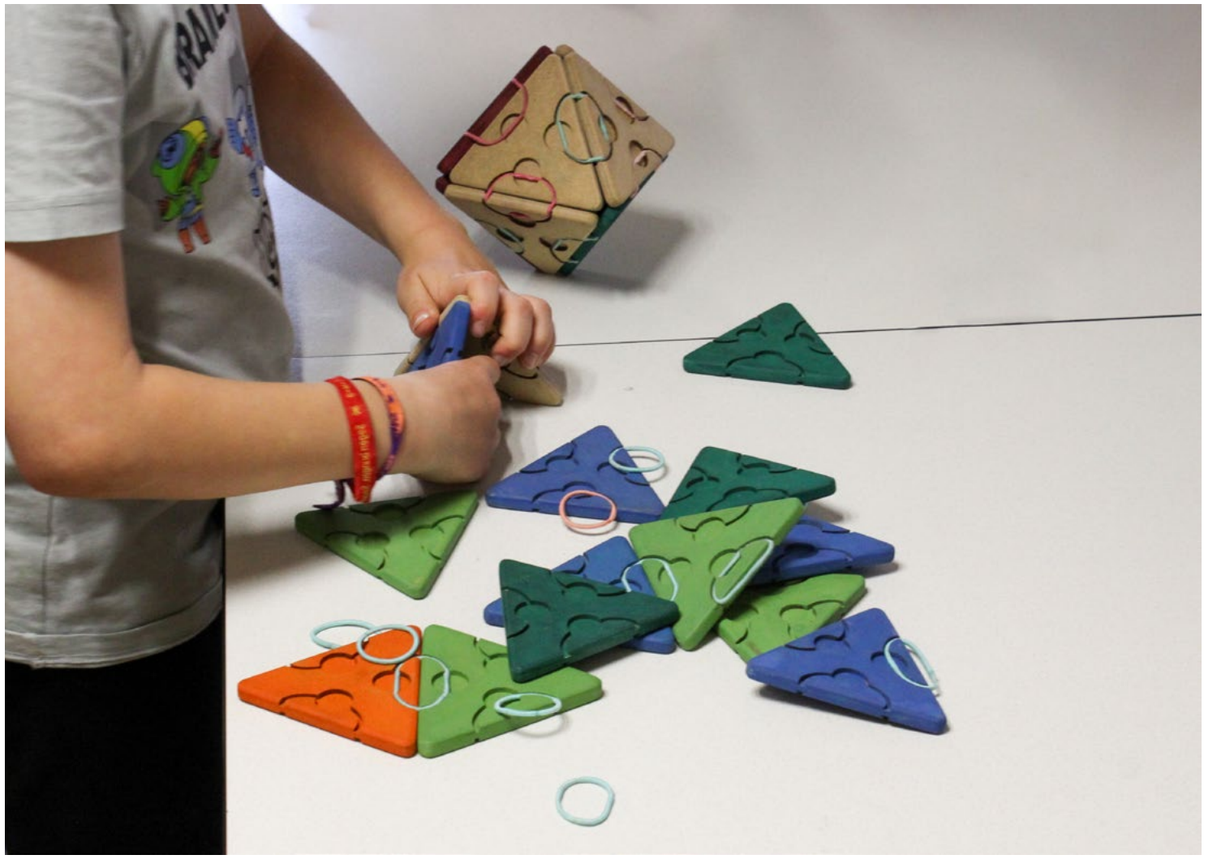
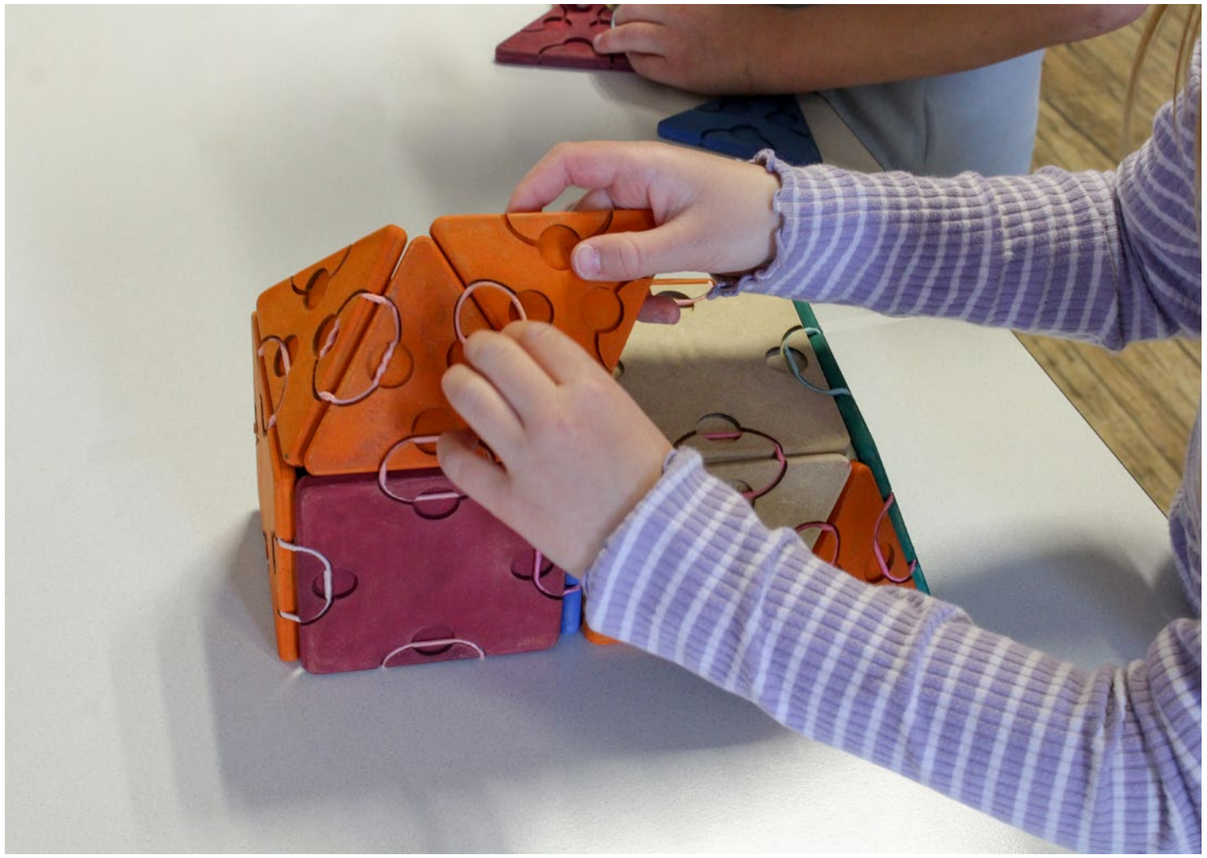




PROOF OF CONCEPT

WORKSHOP WITH 33 KIDS



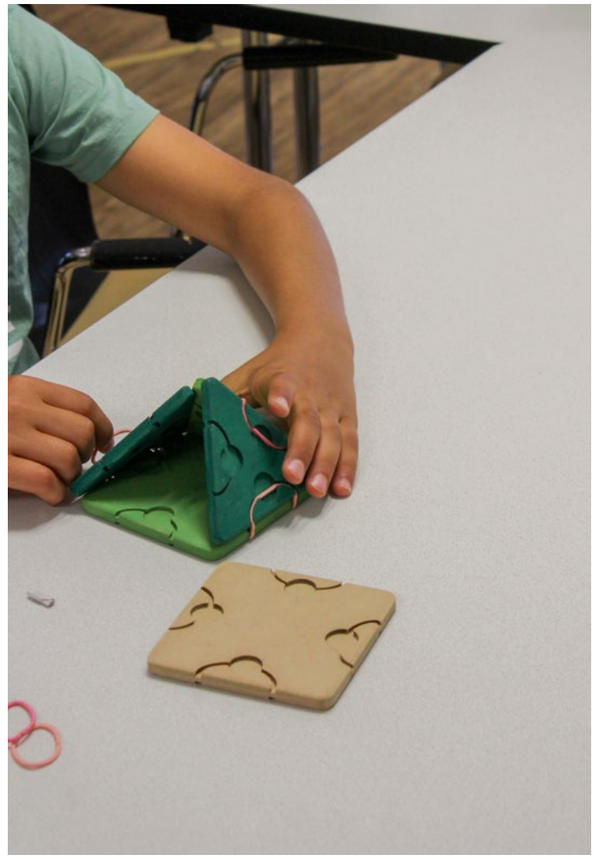


In the process of designing a toy intended to be used by children, user testing is essential. Children often interact with objects in ways that are different from adult expectations, making direct observation an important part of the design process.

I had the opportunity to conduct such testing during a three-day class trip with two third-grade classes (33 children) from a German elementary school. I joined the group as an accompanying person to assist with supervision and to organize a user-testing workshop. Within this setting, I introduced the toy on the morning of the second day and invited the children to explore it freely.

The goal of this testing was to observe how the toy is received and used in practice. I focused on how the children approached building, what kinds of structures they created, and whether they were able to handle the system intuitively. I also paid attention to how they used color, if they experienced enjoyment or frustration, how they perceived the level of difficulty, and how many elements are necessary to support open-ended play.

After briefly introducing the project and explaining the toy, I stepped back to observe, allowing the children to engage with the material on their own terms while I followed their interactions and conversations.



I provided a large table with 60 pieces as the main play area. Following the initial group introduction, I left the materials accessible in a group room throughout the trip, enabling the children to return to them during their free time. I remained present for most of the time, but in the background. Over the course of two days, there was almost always a group of three to six children actively engaged in play, sometimes individually and sometimes collaboratively.

At a certain point, I joined the activity and began to build my own structures, placing them on the table. This allowed me to observe whether the children would use these forms as inspiration or guidance for their own constructions.

QUOTES FROM CHILDREN

"I think it's cool that there aren't any instructions."

"What else could we build on top of that?"

"Wow, that's huge!"

"I think it's best when you can build on something that's already been created."

"We could even build an entire city!"

"I wish that I had that at home."

"That's the coolest, complicated toy I've ever played with."

"With magnets, it's just about putting things together; with this toy, it's more about building."

REFLECTION

INITIAL INTERACTION AND RECEPTION

During the testing I really noticed how naturally the children started to play with the system. They immediately combined playing and building, and it felt like there was no real separation between the two. Most of them began by building two-dimensional structures, joining modules flat on the table, before slowly discovering that the pieces could also become three-dimensional objects. This shift did not come from explanation on my side, but happened entirely through their own exploration, which I found very interesting to observe. Three-dimensional building felt more like a process of discovery, while two-dimensional arrangements allowed for more immediate creativity. Both approaches were clearly valuable and enjoyable for the children.

JOINERY AND HANDLING

The joinery felt intuitive for them, which was good to see. The affordances of the hair ties and grooves seemed to work as intended, and the size and handling of the pieces fit well. Still, joining elements was not always easy at the beginning, especially in three-dimensional constructions. There was a clear learning curve, and I could see them trying different strategies until something worked. Sometimes they asked me for help, but often they solved problems together. I quickly noticed that collaboration almost emerged naturally whenever something became challenging.

MOTIVATION AND FRUSTRATION

What stood out to me was that frustration was surprisingly low. Even when something did not work immediately, it rarely stopped them. In many cases, it actually increased their motivation to figure it out.
Small structures were built quickly and confidently, while larger constructions were more challenging but still actively attempted. The understanding of how things could work was clearly present, even if execution sometimes required time and repetition.

COLOR, DETAILS AND IMAGINATION

Color was mostly used for sorting rather than for storytelling or representation. This is also helpful from a design perspective, as it allows more freedom in defining color systems for different sets.
I also provided small plugs that fit into the grip holes, and these were used very intensively by the children. They quickly turned them into “eyes” or character elements, which helped transform abstract shapes into creatures or figures. This added a strong imaginative layer and made the system feel more alive.

COMPLEXITY

I noticed that having different levels of difficulty was very important. Two-dimensional assembly and the square elements in particular acted as an easy entry point, helping the children quickly understand the logic of the system. From there, they were able to move into more complex spatial constructions.
It felt like the system offered a clear way in without blocking progression, while still leaving enough openness for exploration and discovery.

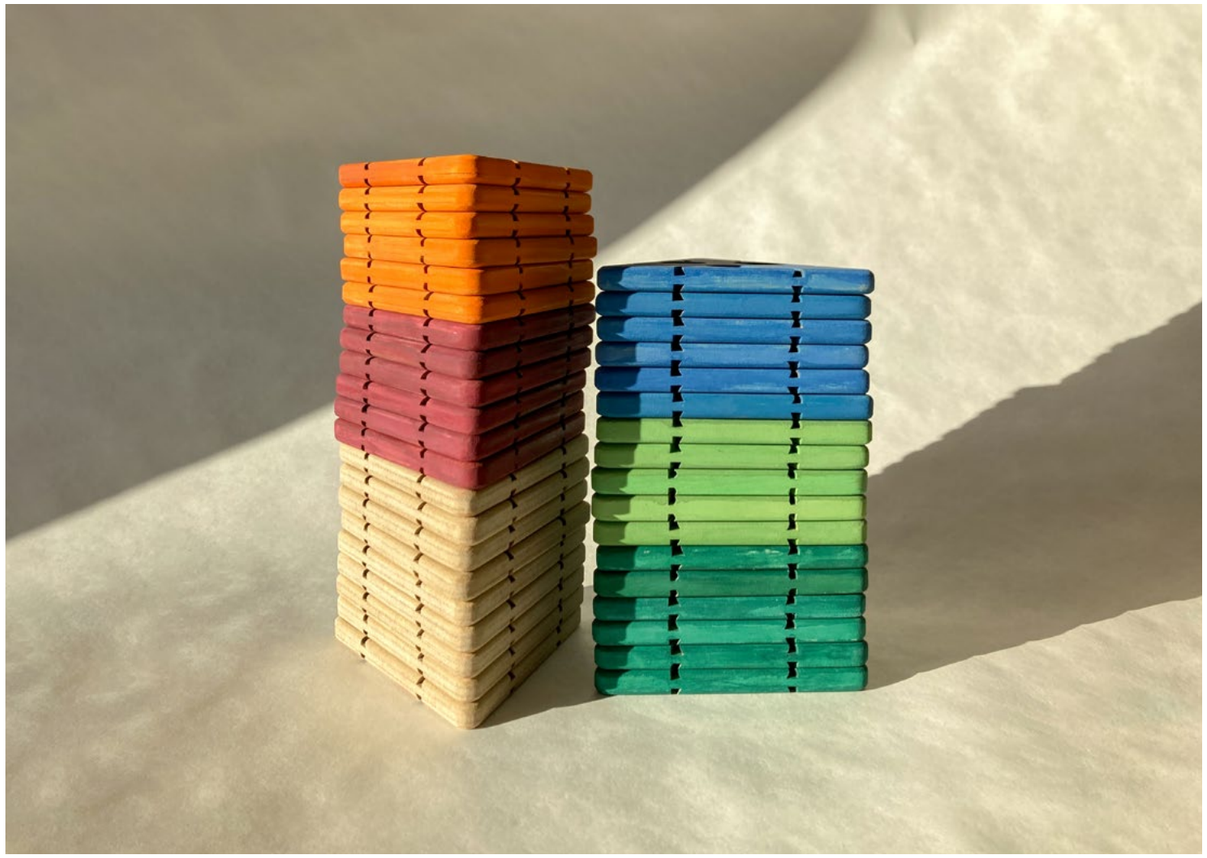
COLLABORATION

Overall, I had the feeling that the children understood the system mainly through doing rather than explanation. The feedback from the toy was immediate, which seemed to support engagement and reduce frustration. Even when something failed, the result was visible straight away, and they simply tried again.
I also found it important how much they built together. The process was not purely individual. They constantly observed each other, copied ideas, modified them, and helped when someone needed support holding or connecting elements.

CREATIVITY AND GUIDANCE

At a certain point I also started building myself and placed my own structures on the table. I noticed that the children sometimes used these as inspiration, reinterpreted them, or built further on them in their own way. There was never a point where they didn’t know what to do anymore, but for the imagination of bigger and more complex buildings, the help of a visual guidance was needed and appreciated.

Overall, it felt like a very open and active process where the children were constantly testing, adjusting, and discovering what the system could do. For me, this also confirmed that the research and detailed development process behind the system was meaningful and that the final outcome works well in a real context of use.



DESIGN 02

PRODUCTION

COLOR

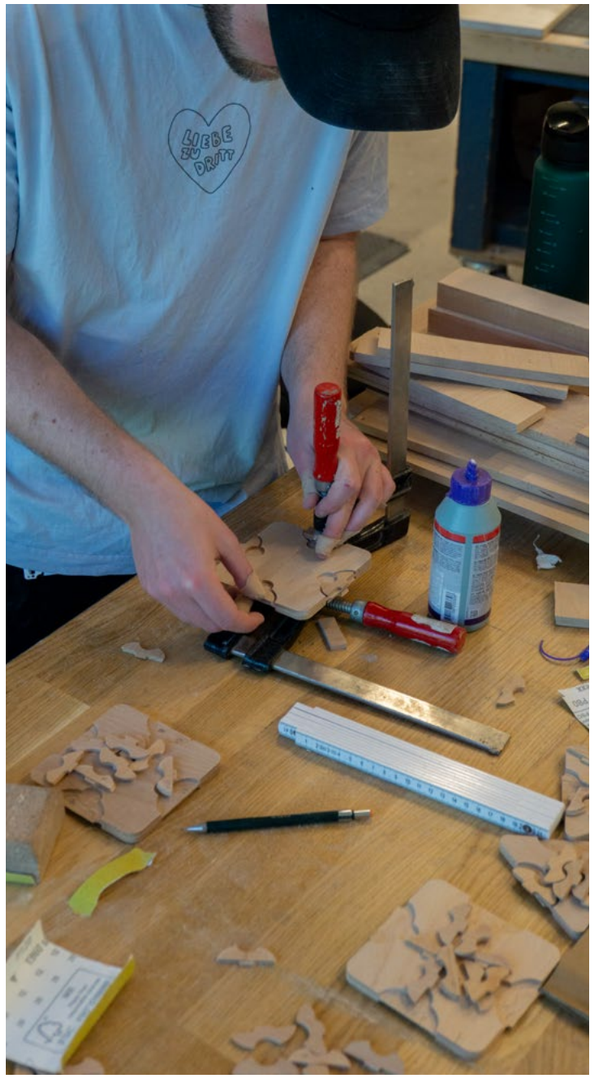
CREATIVITY STARTER

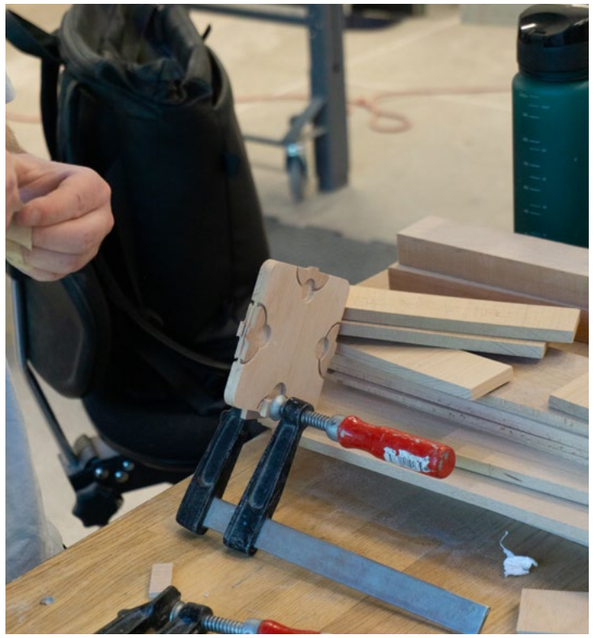
SET AND PACKAGING

PRODUCTION

Taking all the learnings from the workshop and the proof of concept into consideration, small adjustments are implemented, such as refining the final dimensions of the groove and the chamfer along the edges. Beech wood is chosen as the material due to its durability and hardness. It fulfills all the requirements for toy production while also being a natural material, which is an important aspect of the material selection process.

Using the CNC, the production process is relatively straightforward. However, the large number of pieces makes it both challenging and time-consuming. The main bodies are milled with a small step that allows the plugs with the undercut to be positioned accurately. The plugs are milled in a way that aligns the grain direction after gluing, creating the appearance of a single solid piece. After milling, all components are sanded and glued together. Once assembled, the pieces are sanded again before the final chamfer is added along the edges.



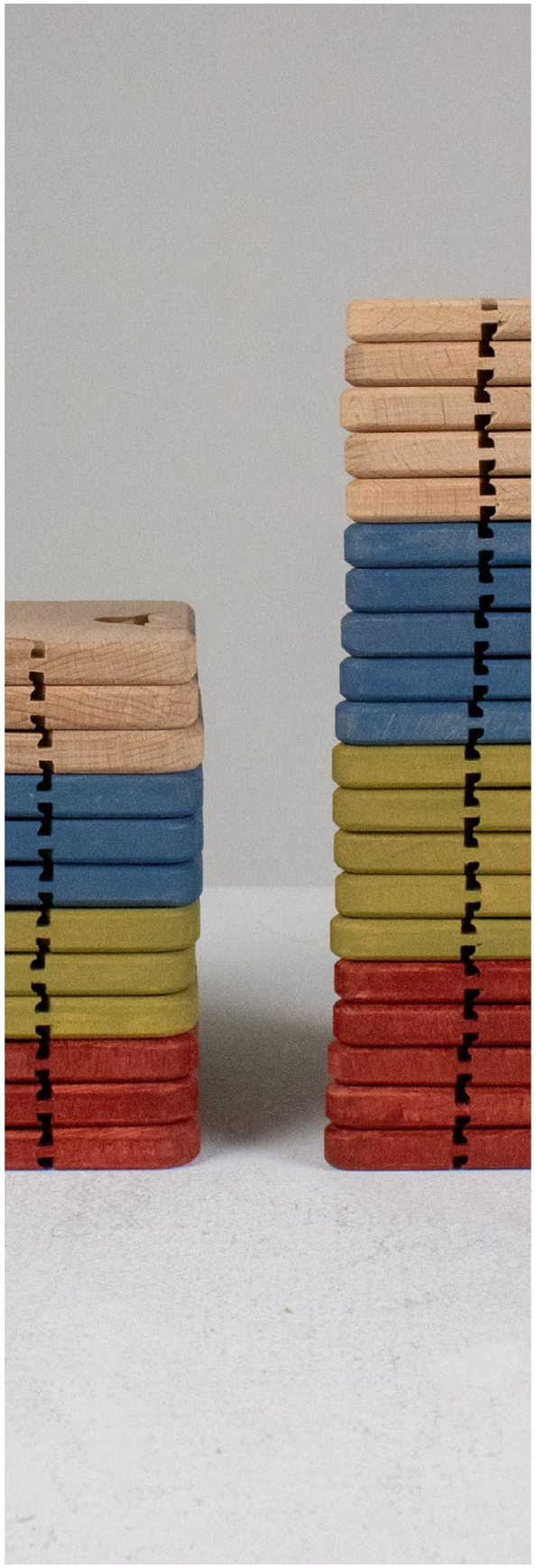


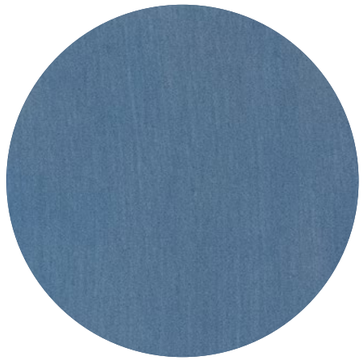
COLOR

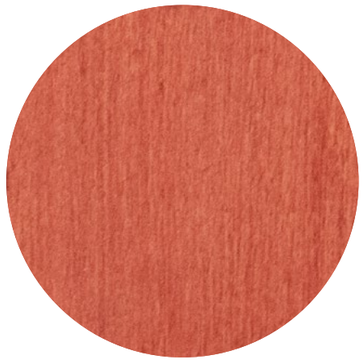
For the color scheme of the toy, several aspects are taken into consideration. The attractiveness for children and the visual appeal for parents need to be carefully balanced. The colors should encourage children to play and explore different ways of using the toy. As representation and storytelling prove to be less important during the user testing, three primary colors, green, red, and blue, are chosen for the basic set.

To achieve a high visual quality that also appeals to parents, the colors are slightly toned down and follow a more neutral palette that works well as a cohesive set. At the same time, they remain colorful and playful. The three colors are evenly distributed across the pieces, while the natural wood surface is retained as a fourth color.

To complement the warm and neutral color palette, the hair ties are selected in bright red and blue to highlight the joinery. The colors are applied using water-based wood stains, allowing the wood grain to remain visible while ensuring the toy remains safe for children. The use of non-toxic finishes is the most important aspect of the color selection, supporting safe play while preserving the natural characteristics of the wood.







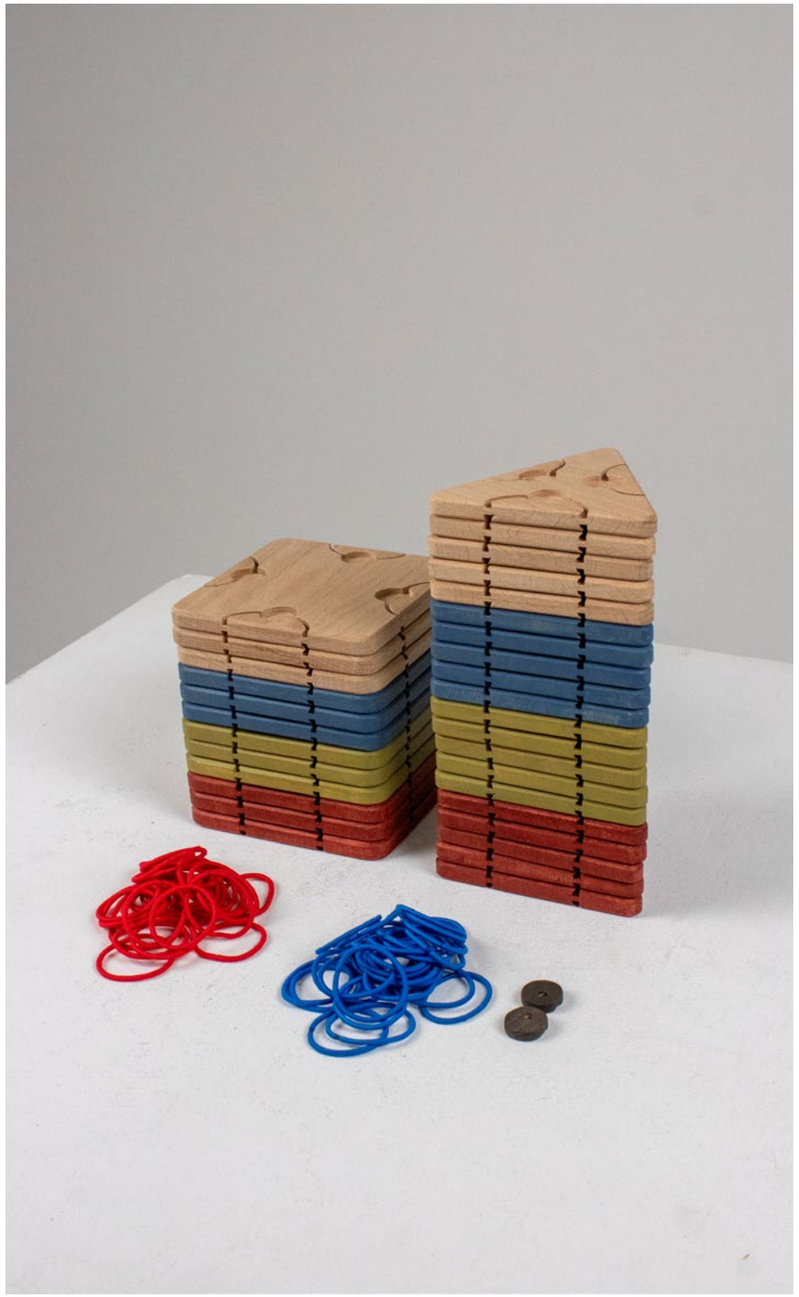
CREATIVITY STARTER

Another important learning from the workshop with the children is that having a visual guideline is very helpful for sparking their creativity.

It is important that this is not presented as a manual with clear step-by-step instructions on how to build specific objects. Instead, it should serve as visual inspiration that encourages children while still giving them the freedom to play and explore on their own.

Based on this insight, the decision is made to include a booklet with images of possible objects to build, ranging from simple structures to larger and more complex constructions. The booklet contains no written instructions, only visual references. This approach provides inspiration and a starting point while still allowing children to discover and explore the possibilities of the toy independently.

SET AND PACKAGING



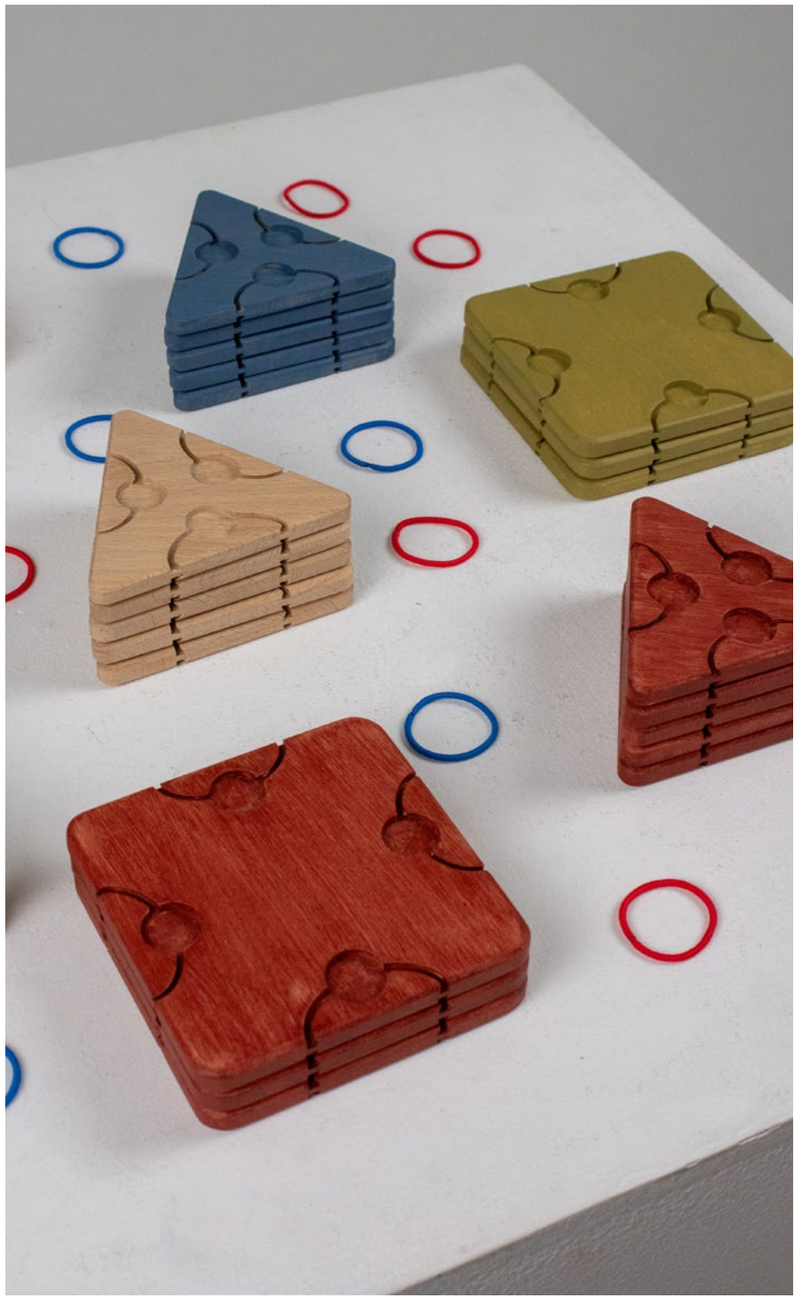
The basic set includes 20 triangles, 12 squares, and 50 hair ties. This quantity enables children to play freely and build many different objects, creatures, and structures, while still remaining manageable in size and affordable in pricing for a single set.

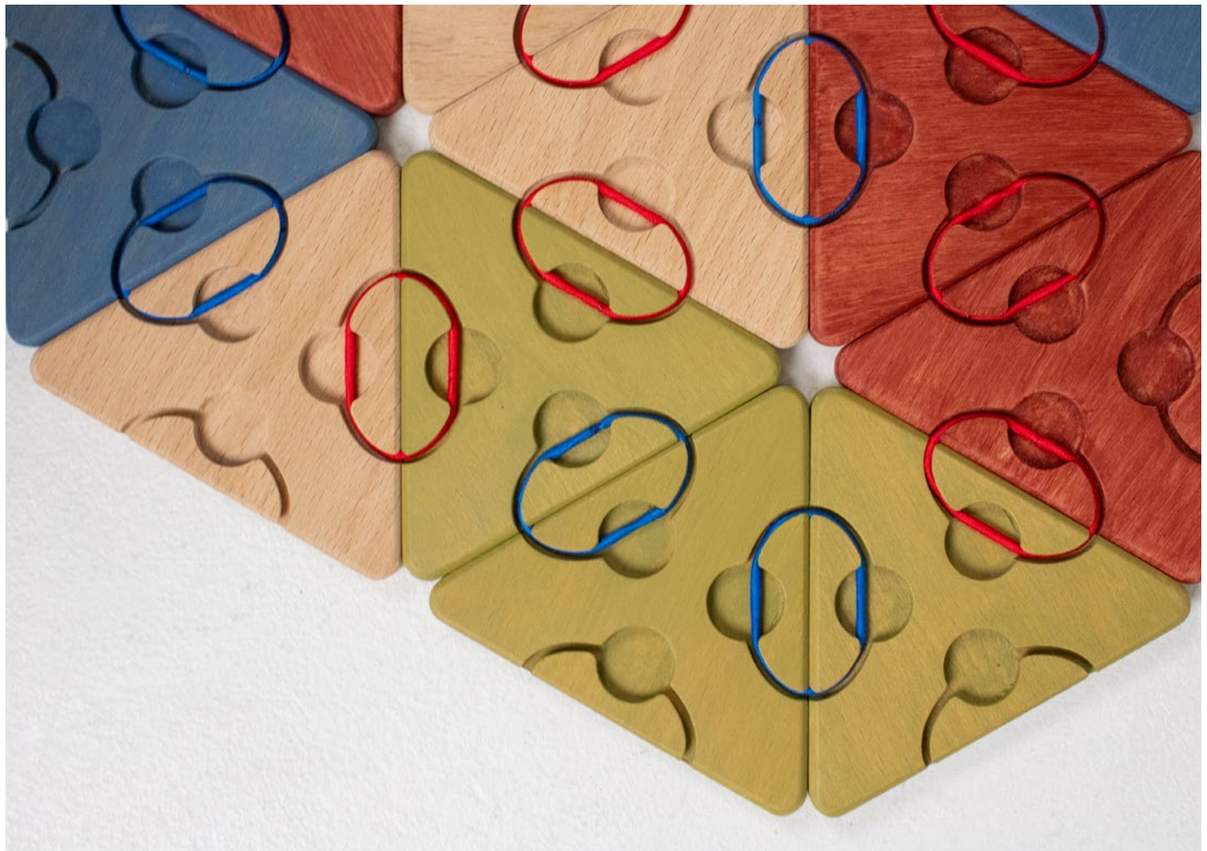
The set also includes two round plugs that fit into the grip holes and can be used as eyes to bring creatures to life. This is a direct learning from the user testing, as children are particularly attracted to these elements.
For the packaging, a cardboard box is designed for both shipping and display in shops, making the handling simple and efficient. The graphics follow an abstract design language that reflects the playfulness and the main characteristics of the toy.

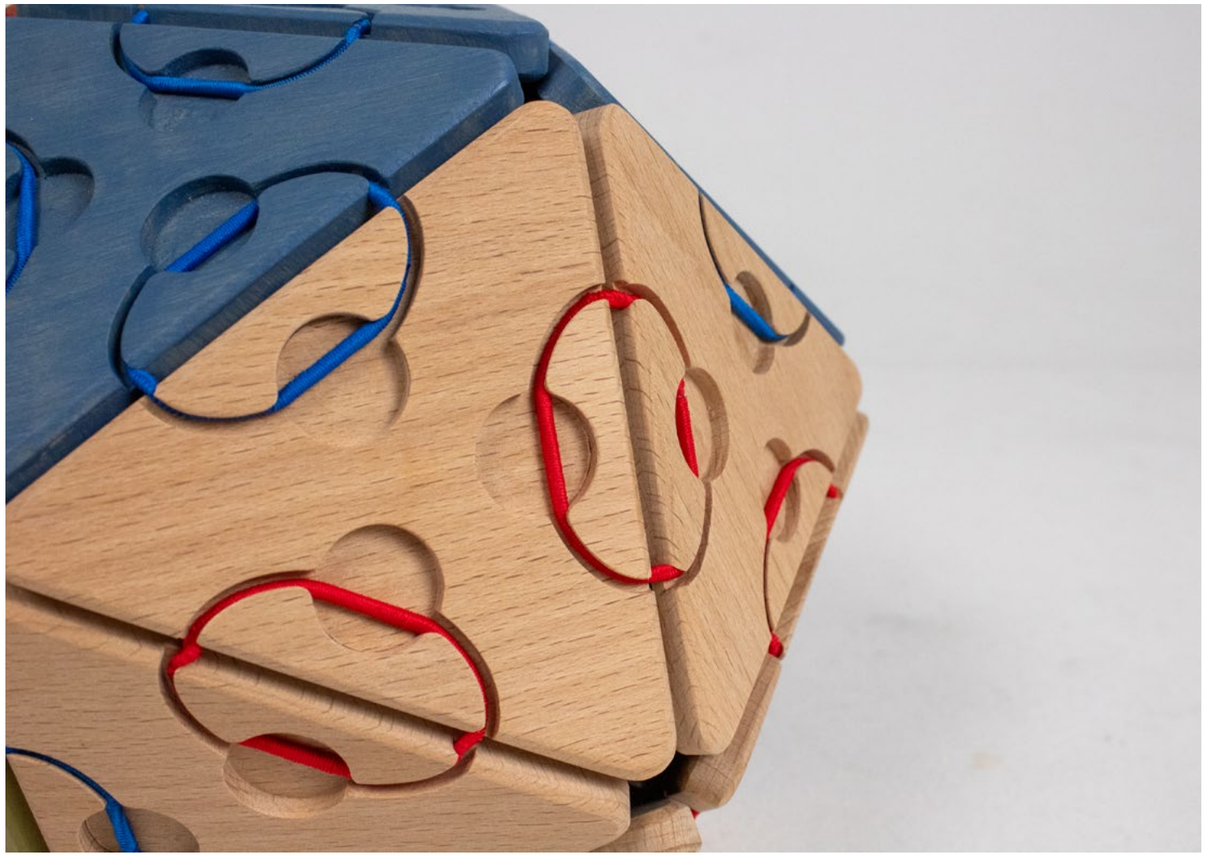
For storage at home, a linen bag is included. A larger bag is used to store the wooden shapes, while a smaller one is designed for the hair ties and plugs, preventing the smaller parts from getting lost.

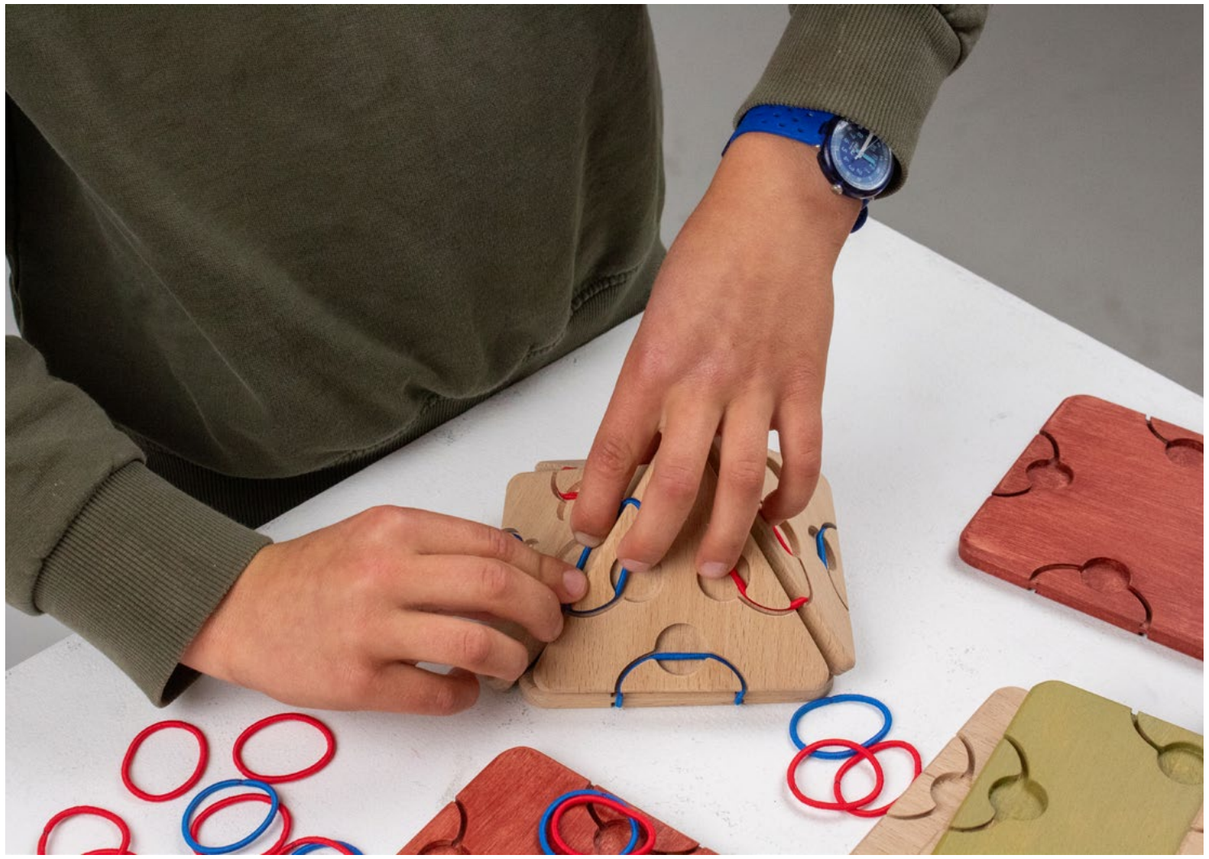
JOTA

JOINING TRIANGLES AND SQUARES WITH HAIR TIES





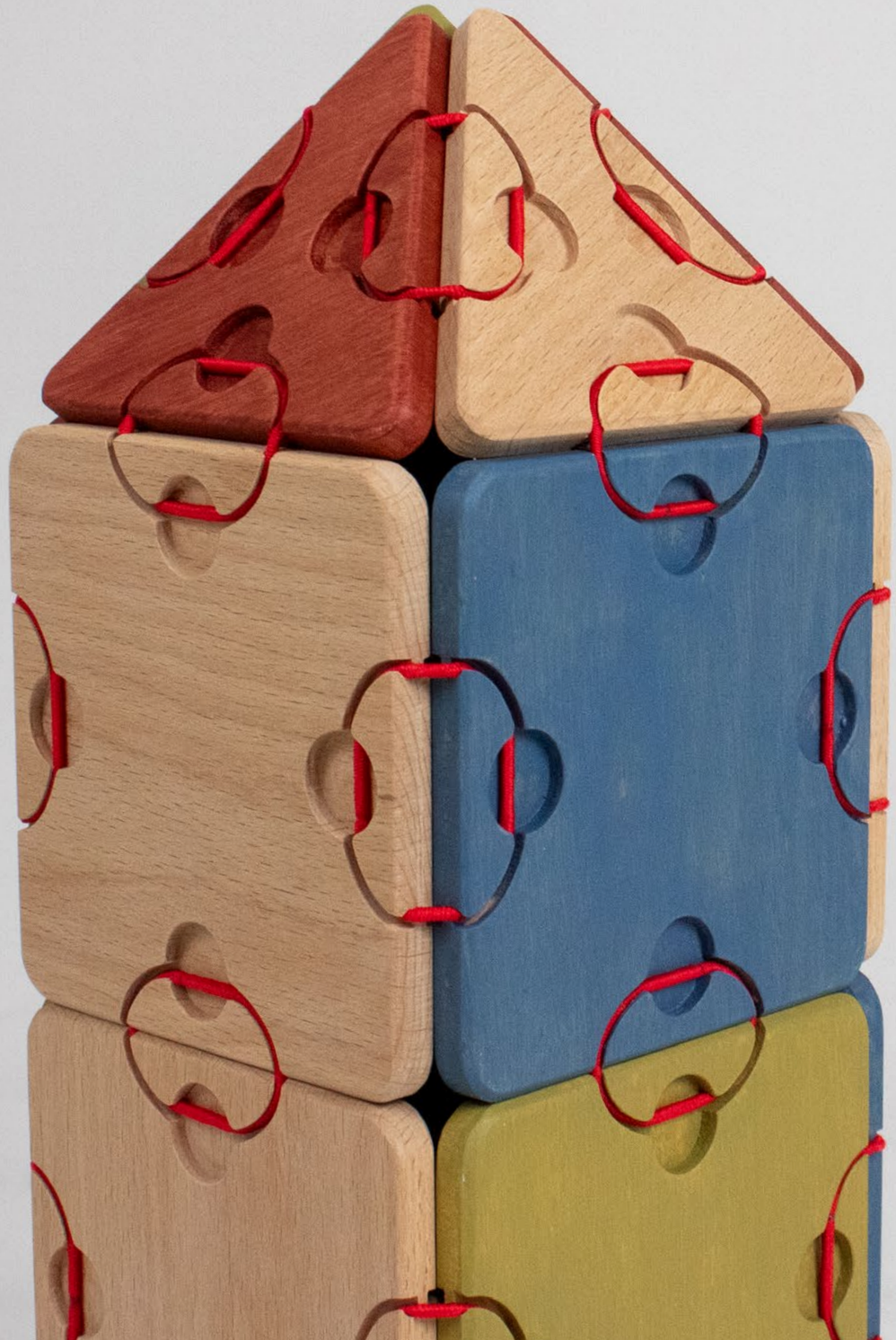


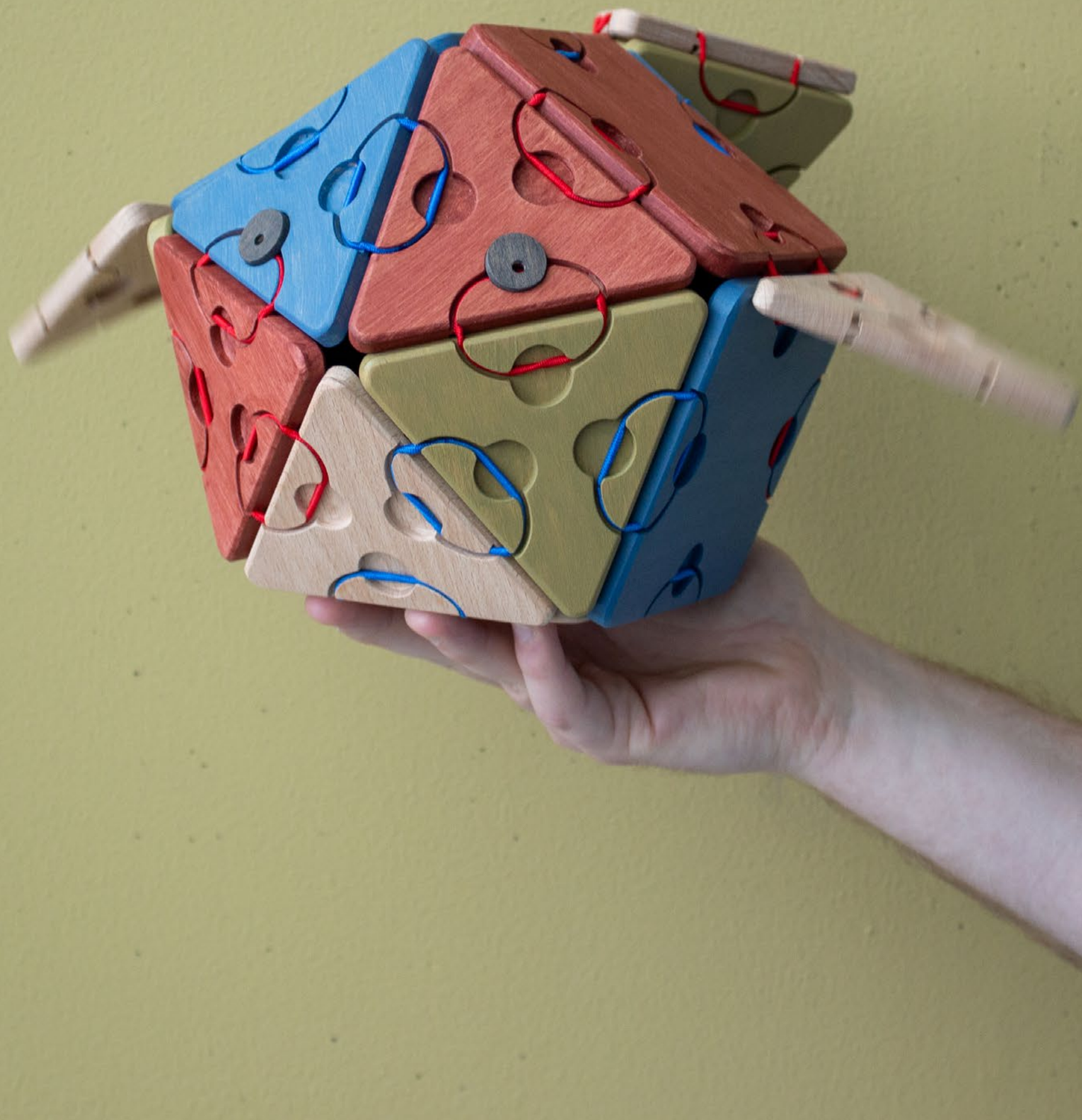


JONA is a construction toy designed to support developmental play through tactile, open-ended interaction. It invites children to build freely using a joinery system of hair ties to connect colorful triangles and squares made from beech wood. The simplicity of the system opens up a wide range of possibilities and leave room for children's imagination.

Designed for children aged 7–10, the system encourages creativity, fine motor skills and spatial understanding. From abstract geometric structures to recognizable objects, and further into creatures and animals, JONA opens up a fantasy world made of triangles and squares for children to explore.

The project is grounded in research on psychology, pedagogy, and toy design, focusing on the value of analogue and explorative play in an increasingly digitalized childhood. By combining a simple joining principle with a high degree of creative freedom, JONA creates playful learning experiences that continuously evolve through experimentation and imagination.





REFLECTION

Throughout my studies, many of the projects I developed unexpectedly appealed to children. Although this was never an intentional objective, children often responded positively to my work. For this master thesis, I decided to design for children from the beginning with intend.

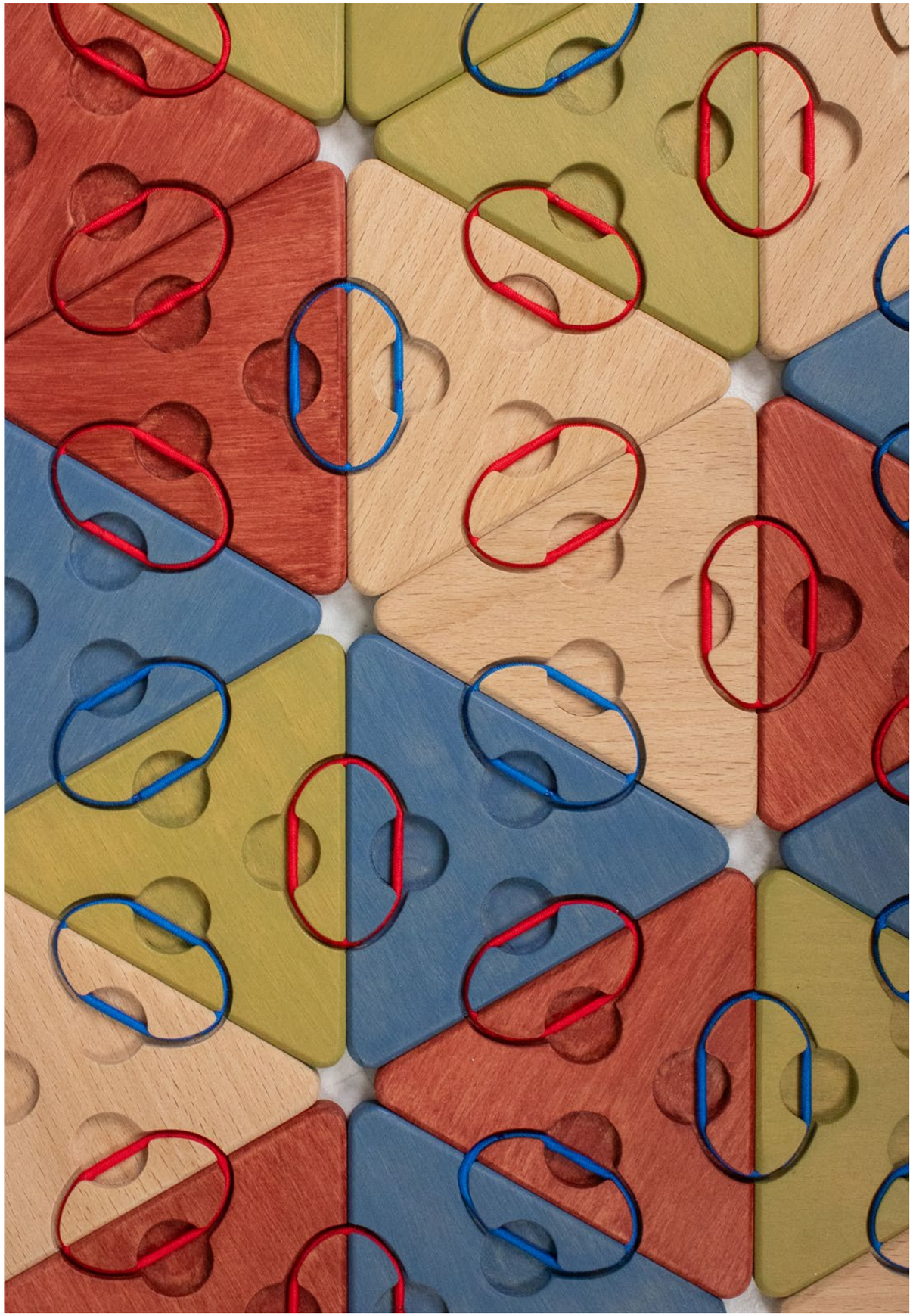
This decision presented several challenges. I had few experience working with children and was not an expert in pedagogy. I do not have children myself, nor am I regularly surrounded by them, which made it difficult to fully understand the needs, behaviours, and perspectives. Furthermore, designing a toy was a completely new area for me, as my previous projects had focused on other design typologies. Exploring these unfamiliar fields simultaneously made it challenging to develop an outcome that felt meaningful, relevant, and well-informed.

One of the greatest difficulties throughout the project was gaining access to children for research and testing purposes. Understanding the needs and preferences of specific age groups required direct interaction.Traditional research methods such as interviews and surveys are less effective than they would with adult participants. Consequently, finding reliable and authentic ways to gather insights from children became a significant challenge.

Despite these challenges, designing for children proved to be both rewarding and enjoyable. Adopting a child-centred perspective encouraged a more playful and imaginative approach to the design process. The integration of play throughout the project not only informed the development of the concept but also influenced my own way of thinking and creating. One of the most rewarding moments was conducting the workshop with children and observing them interact with JONA. Seeing them engage with the toy, explore its possibilities, and genuinely enjoy the experience was highly motivating and confirmed the value of the project.

While further development is needed, particularly regarding manufacturing optimisation and validation of the target age group, I believe that JONA has strong potential as a marketable toy. The system offers opportunities for future expansion and development in multiple directions, allowing it to grow beyond its current form.

Overall, I am very satisfied with the outcome of this project. It has challenged me to work with an unfamiliar user group, develop new methods of research and testing, and explore a different scale and category of design. Most importantly, it has demonstrated the potential of JONA as a playful and engaging product with opportunities for continued development in the future.



USE OF AI

I acknowledge the use of AI-based programmes for this project. The softwares I used are ChatGPT and DeepL.
I used them to review and refine grammar and spelling of texts, as well as making alternative formulations of texts, that I have written.

REFERENCES - PICTURES

1
https://www.deutschlandfunk.de/vor-125-jahren-geboren-jean-piaget-der-vater-der-100.html (access April 10, 2026)

2
https://www.firstdiscoverers.co.uk/lev-vygotsky-child-development-theories/lev-vygotsky/ (access April 10, 2026)

3
https://eeb.utk.edu/people/gordon-burghardt/ (access April 10, 2026)

4
https://www.montessori-hofheim.de/zentrum/dr-maria-montessori (access April 10, 2026)

5
https://www.anthroposophische-gesellschaft.de/rudolf-steiner (access April 10, 2026)

6
https://www.dfg.de/de/gefoerderte-projekte/preistraeger-innen/leibniz-preis/2023/rosa (access April 10, 2026)

7
https://www.kaufland.de/product/484755066/ (access April 21, 2026)

8
https://goki.eu/de/stapelschloesschen/item-1-58350-2000-2.html (access April 21, 2026)

9
https://www.ikea.com/se/sv/p/underhalla-byggtraeklossar-40-delar-flerfaergad-00506684/ (access April 21, 2026)

10
https://www.grimms.eu/products/regenbogen (access April 21, 2026)

11
https://www.kapla.com/de/200er-schachtel_p37.html (access April 21, 2026)

12
https://www.ravensburger.de/de-DE/brio/produkte/konstruktionsspielzeug/builder-box-135-teile-63458700 (access April 21, 2026)

13
https://www.eichhorn-toys.de/eichhorn_de/kategorien/konstruktionsspielzeug/holzbausaetze/eichhorn-constructor-erweiterungs-set-111-100039009-de.html (access April 21, 2026)

14
https://magnatiles.com/products/magna-tiles-classic-100-piece-set (access April 21, 2026)

15
https://www.haba-play.com/de-de/p/kreativbausteine-logikbaumeister--1306313#variationId=1306313001 (access April 21, 2026)

16
https://www.ravensburger.de/de-DE/brio/produkte/konstruktionsspielzeug/volvo-muldenkipper-63459900 (access April 21, 2026)

17
https://www.eichhorn-toys.de/eichhorn_de/kategorien/konstruktionsspielzeug/holzbausaetze/eichhorn-constructor-kran-100039097-de.html (access April 21, 2026)

18
https://www.haba-play.com/de-de/p/kullerbue-spielbahn-bahnhof--1306745#variationId=1306745001 (access April 21, 2026)

19
http://www.ilovemoontoy.com/pd.jsp?id=67&fromMid=5#pfc= (access April 21, 2026)

20
https://www.quercettistore.com/products/georello-tech?_pos=1&_sid=c71a8b877&_ss=r (access April 21, 2026)

21
https://www.fischertechnik.de/de-de/produkte/spielzeug/kugelbahnen/536620-dynamic-s-gruen (access April 21, 2026)

22
https://www.lego.com/de-de/product/at-rt-attack-75444 (access April 21, 2026)

REFERENCES - TEXT

1
Montessori, M. (1912). The Montessori Method: Scientific pedagogy as applied to child education in “The Children’s Houses”

2
Cimino, S., Maremmani, A.G.I, & Cerniglia, L. (2025). Discontinuation of Classic Toy Play vs. Digital Play Among 8–10-Year-Old Children: A Systematic Scoping Review. Societies, vol. 15, no. 12, p.354, https://doi.org/10.3390/soc15120354

3
Dhar, D., Mukhopadhyay, D., Paul, D.K., Mandal, A.K. (2026). Effect of Screen Time on the Development of Fine Motor, Language, and Social Skills in Children Aged 1 to 6 Years. Cureus, vol. 18, no. 1, doi: 10.7759/cureus.101325

4
Woodroffe, S.E., Willat, B.J. (1976). Play mataids and toys in the education of young children. Australian Paediatric Journal, vol. 12, no. 1, pp.1-5, https://doi.org/10.1111/j.1440-1754.1976.tb02826.x

5
Trawick-Smith, J., Wolff, J., Koschel, M., & Vallarelli, J. (2015). The effects of toys on the play quality of preschool children: Influence of gender, ethnicity, and socioeconomic status. Early Childhood Education Journal, vol. 43, pp.249–256, DOI:10.1007/s10643-014-0644-7

6
https://www.deutschlandfunk.de/vor-125-jahren-geboren-jean-piaget-der-vater-der-100.html (access Februaryl 10, 2026)

7
Piaget, J. (1962). Play, Dreams and Imitation in Childhood

8
Celinska, A. 2023. An introduction to Lev Vygotsky, www.thevoiceofearlychildhood.com/introduction-lev-vygotsky/ (access February 10, 2026)

9
Vygotsky, L. (1967). Play and its role in the mental development of the child

10
https://nifplay.org/profile/burghardt/ (access February 12, 2026)

11
Burghardt, G.M. (2005). The Genesis of Animal Play: Testing the Limits

12
https://www.montessori-deutschland.de/ueber-montessori/maria-montessori/ (access February 12, 2026)

13
Montessori, M.,& Ludwig, H. (2015). Die Entdeckung des Kindes

14
https://www.dw.com/de/esoteriker-oder-reformer-wer-war-waldorf-gründer-rudolf-steiner/a-72028723 (access February 16, 2026)

15
https://www.waldorfshop.eu/blog/paedagogik/das-zweite-jahrsiebt-die-welt-ist-schoen (access February 18, 2026)

16
https://www.waldorfschule.de (access February 18, 2026)

17
https://www.dfg.de/de/gefoerderte-projekte/preistraeger-innen/leibniz-preis/2023/rosa (access April 18, 2026)

18
Rosa, H.,& Endres, W. (2016). Resonanzpädagogik

19
https://www.rpi-loccum.de/material/pelikan/pel3_21/3_21_Hanusa (access April 18, 2026)

20
https://www.easternct.edu/center-for-early-childhood-education/timpani/index.html (access March 5, 2026)

JOINA

JOINING TRIANGLES AND SQUARES WITH HAIR TIES

A CONSTRUCTIONAL PLAYTHING DESIGNED TO SUPPORT DEVELOPMENTAL PLAY

Degree Project for Master of Fine Arts in Design
Main Field of Study: Industrial Design
Lund University, School of Industrial Design

Project Supervisor: Therese Eklund
Assistant Supervisor: Riccardo Centazzo

Examiner: Andreas Hopf

2026

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