Play taxonomies: A toy index for product design

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Abstract

This research delves into the diverse landscape of play categorizations, spanning historical foundations to contemporary perspectives, with a focus on its significance in toy design. Drawing insights from prominent scholars and classification frameworks, this study introduces an approach to be used during the toy design process and nurturing constructive design critique.

Beginning with Johan Huizinga's foundational dual classification of play, the groundwork is laid for comprehending the contest and representation forms of play. Jean Piaget's developmental viewpoint is explored next, underscoring the progressive nature of play categories and their pivotal role in children's cognitive and social development. Roger Caillois's taxonomy illuminates the spectrum of play types, uncovering the intricate interplay between human behavior and culture. Sara Smilansky's observations in child development further shed light on how play influences cognitive, social, and emotional growth.

A comprehensive toy product index emerges as a central outcome, offering a structured framework for evaluating and categorizing toy products, transcending traditional play value assessments. By encompassing attributes such as affect, miniaturization, assembly, simulation, craft, education, event-oriented toys, and collectibles, the index equips toy designers, educators, and users explore, compare, and critique products. The study details a methodical approach to data collection, categorization, database construction, and validation, while acknowledging inherent limitations and envisioning future refinements.

Ultimately, this study aims to bridge the gap between theoretical play classifications and their practical implications in design, to enhance the toy design process and foster a culture of informed design critique. By intertwining play categorizations with innovative design methodologies, this research aims to provide a deeper understanding of toys' significance in material culture. The toy product index emerges as a useful tool, promoting informed exploration, collaborative ideation, and innovative thinking within the realm of toy design.

Keywords: play categorizations, toy taxonomy, play attributes, affect, miniaturization, assembly, simulation, craft, education, event-oriented toys, collectibles, toy product index.

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1. Introduction

Play is an essential and multifaceted aspect of human behavior that transcends cultural boundaries, age groups, and cognitive development. Over the years, scholars and researchers from diverse fields have delved into the intricacies of play, seeking to unravel its complex nature and understand its profound implications for cognitive development, social dynamics, and emotional maturation.

This research embarks on a journey through the rich field of play categorizations, from foundational insights to contemporary perspectives, aiming to explore the multidimensional essence of play within the context of toy design. Drawing inspiration from influential scholars and classification frameworks, this study unveils a novel approach to enhancing the toy design process and fostering a culture of constructive design critique.

The exploration begins by revisiting the pioneering work of Johan Huizinga, whose seminal dual classification of play laid the groundwork for understanding the contest and representation forms of play. This historical foundation provides a springboard for delving into Jean Piaget's developmental perspective, which highlights the progressive nature of play categories and their significance in children's cognitive and social growth. Roger Caillois's taxonomy offers a panoramic view of diverse play types, unveiling the interplay between human behavior and culture. Additionally, Sara Smilansky's observations in child development provide valuable insights into the influence of play on cognitive, social, and emotional evolution.

Building upon these foundational classifications, this research introduces a comprehensive toy product index. Ultimately, this research aims to provide a new framework within the realm of toy design, shedding light on the intricate relationship between play

categories and innovative product creation. By bridging the gap between theoretical play classifications and practical design considerations, the study paves the way for a more informed, imaginative, and engaging approach to toy product development, enriching the toy design process and fostering a culture of design critique.This index serves as a structured framework for categorizing and analyzing toy products, offering a holistic approach that extends beyond traditional play value considerations. By incorporating attributes such as affect, miniaturization, assembly, simulation, craft, labor-training/education, event toys, and collectibles, the index provides a multidimensional lens through which toy designers, educators, and consumers can explore, compare, and critique toy products.

The methodology employed in the creation of the toy product index is outlined, detailing the systematic approach to data collection, categorization, database development, and validation. The study acknowledges limitations while envisioning future directions for refining the index and integrating emerging technologies.

2. Background

2.1 Taxonomies of play: From Huizinga's Dual Classification to Smilansky's Developmental Categories

Play, regarded as a complex and foundational element of human conduct, has attracted profound examination across diverse academic domains. Scholars and thinkers from various fields have probed the intricacies of play, aiming to deconstruct its multifaceted essence and shed light on its extensive implications for cognition, social dynamics, and emotional maturation. The study of play has been marked by distinct classification frameworks devised by researchers of a diverse set of disciplines.

This chapter presents an anthology of play categorizations, commencing with Johan Huizinga's seminal contribution and culminating in the perceptive insights of Sara Smilansky. The objective is to traverse the theoretical landscape mapped by these scholars, delving into their unique perspectives on the complexities of play.

The exploration begins in Section 2.1, which focuses on Johan Huizinga's pioneering dual classification of play, elaborated upon in his seminal work “Homo Ludens: A Study of the Play Element in Culture.” Huizinga's classification holds a pivotal position in the realm of play studies, furnishing a foundational framework that continues to shape scholarly discourse. In Section 2.1.1, Huizinga's categorization is elucidated, highlighting the contest for something and the representation of something as the central pillars of his schema.

Transitioning to Section 2.1.2, the spotlight shifts to Jean Piaget's developmental perspective on play in children. Piaget's investigation reveals a progression of play categories, each constituting a developmental milestone in cognitive and social growth. This section

examines Piaget's four play categories, tracing the evolutionary trajectory from rule-bound play to the realms of symbolic and constructive play.

Section 2.1.3 introduces Roger Caillois's classification framework, conceived by a polymath with a perceptive sociological vantage point. Caillois's taxonomy offers a reimagined panorama of play, delving into diverse motivations and modalities. Within this section, the focus is on Caillois's four play types – Agon, Alea, Mimicry, and Ilinx – which provide insights into the spectrum of human behaviors encompassed by play. Through Caillois's taxonomy, the profound interplay between play and the human psyche comes into view.

This part ends in Section 2.1.4, where Sara Smilansky's impactful contributions to the realm of child development and play are examined. Smilansky's categorization, based on careful observations, offers a lens to understand the intricate tapestry of children's play behaviors. The exploration traverses the realms of functional, constructive, symbolic, and rule-bound play, unraveling the influence of play on children's cognitive, social, and emotional evolution.

As these distinct chapters interweave within the broader narrative of play classification, a vivid tableau of human behavior and culture unfolds. Each scholar's perspective contributes a unique facet, offering a panoramic view of the diverse dimensions of play. A few more classification systems have been included but are presented in less detail. As it appears in this study of the different taxonomies, scholars have analyzed and designated play categories in various manners. In general, there exists a degree of consensus (Smilansky, 1968; Garon et al., 2002; Kudrowitz & Wallace, 2009; Bulgarelli & Bianquin, 2017) regarding four primary play types: challenge (such as contests, rule play, mastery, and competition); fantasy (including representation, symbolism, simulation, make-believe, and pretending); sensory (encompassing practices, sensorimotor activities, vertigo-inducing play, functional play, bodily interactions,

manipulative play, and object exploration); and creation (encompassing constructive activities, assembly, and creative endeavors). In two of the more detailed taxonomies (Hughes, 2002; Brown, 2009), an additional category labeled "social" play is included.

These four play categories are envisioned by Kudrowitz and Wallace as the corners of a tetrahedron, with the lines connecting them representing play that falls between two categories, and the surfaces representing play that combines three types. As shown in figure 2-1-a, this classification model, is referred to as the "Play Pyramid," and any toy or activity can be positioned within it (Kudrowitz & Wallace, 2009). In 2.00b Toy Product Design, the integration of these two tools has significantly enriched the learning experience and empowered students to think creatively and critically. Both the "play pyramid" and the "sliding scales of play" offer students a structured framework for conceptualizing, categorizing, and refining their toy product ideas while nurturing their creative thinking and design skills.

At the heart of the teaching methodology of the class is the "Play pyramid," the three-dimensional representation that serves as a conceptual map for students to position their toy concepts within a defined space. This space is characterized by four distinct dimensions of play: sensory, fantasy, construction, and challenge. In a classroom setting, students are guided to analyze and evaluate toy products by assessing how they align with each of these dimensions. By plotting the concepts on the play pyramid, students gain a comprehensive perspective on the strengths and potential areas for improvement of the designs. This structured approach not only enhances their ability to classify and communicate their ideas effectively but also fosters a deeper understanding of the multifaceted nature of play within the context of toy design. This applies both to existing toys but also when they brainstorm their novel product ideas.

Complementing the play pyramid is the “sliding scales of play,” a tool that offers descriptive modifiers to further illuminate the play aspects of a toy concept. As students engage with this tool, they are encouraged to explore the continuum of involvement, social interaction, level of restraint, mental/physical engagement, and gender considerations. Through manipulation of the sliding scales, students envision new dimensions and facets of toy designs, leading to the discovery of novel play experiences and the expansion of their creative horizons.

In the context of a toy product design class, these visual aids are integrated into various stages of the design process. As students brainstorm and ideate, the play pyramid provides a tangible framework to channel their creativity and align their concepts with well-defined dimensions of play. On the other hand, the sliding scales of play encourage students to analyze existing and novel toy ideas in depth, and in ways that are not always apparent without the use of such tools. By engaging with the play pyramid and the sliding scales of play, students are not only equipped with a comprehensive toolkit for effective toy design but are also empowered to critically assess and give constructive peer feedback.

In conclusion, the integration of the “play pyramid” and the “sliding scales of play” into the classroom environment of toy product design provides students with a structured and creative approach to ideation and refinement. These visual aids enhanced students' ability to conceptualize, classify, and manipulate toy product ideas while fostering critical thinking, innovation, and a deeper appreciation of the intricate world of play.

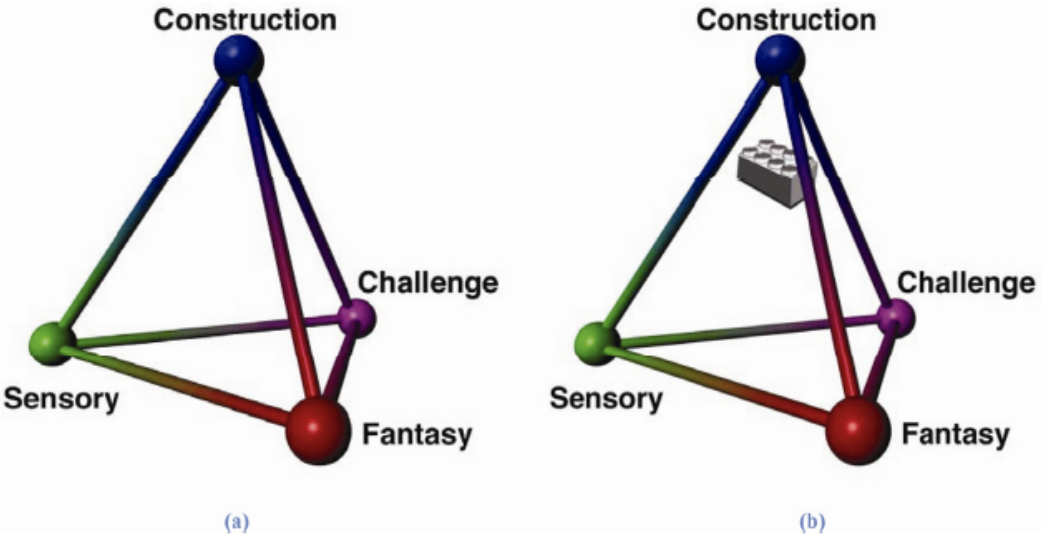


Fig 2-1-a The play pyramid classification (a) and the play pyramid with a suggested placement of Lego® (b) in Kudrowitz, B. M., & Wallace, D. R. (2009)

The play taxonomies that have been studied for this part of the paper illustrated in figure 2-1-b are the following:

Brown, Stuart. *Play: How It Shapes the Brain, Opens the Imagination, and Invigorates the Soul.* Avery, 2009.

Bulgarelli, D., & Bianquin, N. "Conceptual Review of Play." In *Play Development in Children with Disabilities*, edited by S. Besio, D. Bulgarelli, & V. Stancheva-Pop-kostadinova, De Gruyter Open Poland, 2017, pp. 58–70.

Caillois, Roger. Man, *Play and Games.* The Free Press, 1961.

Garon, D., Chiasson, R., & Filion, R. *Le Système ESAR: Guide d'Analyse, de Classification et d'Organisation d'une Collection de Jeux et Jouets.* Electre, 2002.

Goodson, B., & Bronson, M. *Which Toy for Which Child: A Consumer's Guide for Selecting Suitable Toys for Children: Ages Birth Through Five.* U.S. Consumer Product Safety Commission, 1997.

Hughes, Bob. "A Playworker's Taxonomy of Play Types." *PlayLink,* 2002.

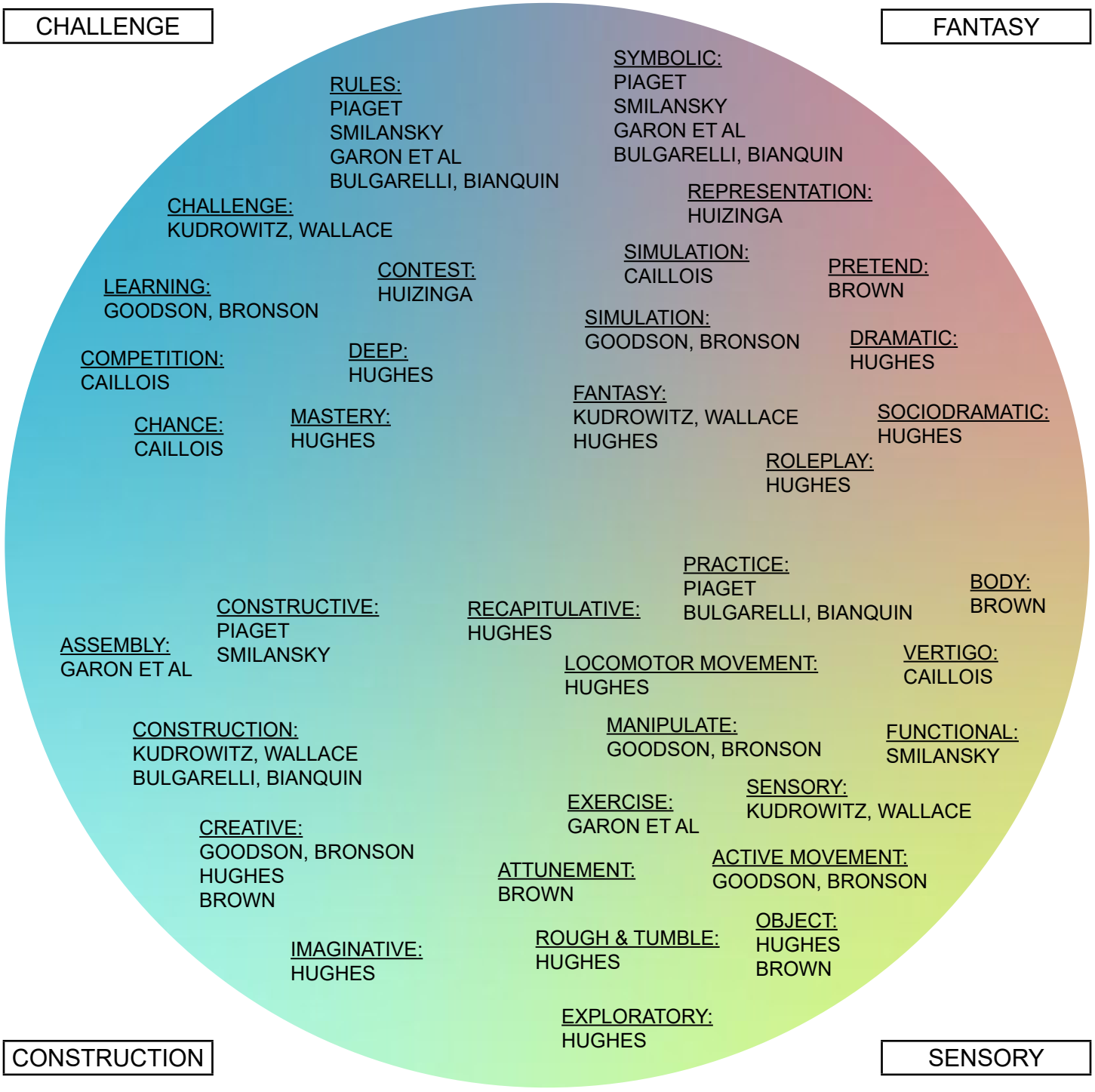
Huizinga, Johan. *Homo Ludens: A Study of the Play-Element in Culture.* Roy Publishers, 1950.

Kudrowitz, B. M., & Wallace, D. R. "The Play Pyramid: A Play Classification and Ideation Tool for Toy Design." *International Journal of Arts and Technology,* vol. 3, no. 1, 2009, pp. 36–56.

Piaget, Jean. *Play, Dreams and Imitation in Childhood.* Taylor & Francis, 1945.

Smilansky, Sara. *The Effects of Sociodramatic Play on Disadvantaged Preschool Children.* Wiley, 1968.

Fig. 2-1-b Chart of Play Taxonomies References



HUIZINGA 1950	PIAGET 1945	CAILLOIS 1961	SMILANSKY 1968	GARON ET AL 1982
GOODSON BRONSON 1997	HUGHES 2002	BROWN 2009	KUDROWITZ WALLACE 2009	BULGARELLI BIANQUIN 2017

2.1.1 Huizinga's Dual Classification of Play: Contest and Representation

Johan Huizinga proposed a seminal classification of play in his work “Homo Ludens: A Study of the Play Element in Culture.” Central to his framework are two pure forms of play: “a contest for something” and “a representation of something.” Huizinga's first pure form of play, “a contest for something,” centers on competitive activities with the aim of achieving a specific objective. Participants willingly submit themselves to the rules and boundaries of a contest, finding intrinsic value in the pursuit of victory or accomplishment. The contest form encompasses various activities, ranging from organized sports events and strategic board games to intellectual challenges and recreational activities with identifiable wins and losses. This structured form of play fosters, according to Huizinga, a sense of engagement, skill development, and social interaction, making it a fundamental aspect of human culture.

The second pure form, “a representation of something,” highlights play's imaginative and symbolic nature. In this mode, individuals immerse themselves in a separate realm of make-believe, where they can create or interact with fictional or abstract representations of reality. Role-playing, storytelling, artistic expression, and imaginative games exemplify this form of play. It serves as a conduit for creative expression, cognitive development, and exploration of alternative realities. Through representation, individuals can transcend the constraints of practicality, envision new possibilities, and convey profound insights into the human condition.

Huizinga's identification of these two pure forms of play is historically important in understanding the pervasive role of play in human society. By recognizing the contest form's competitive and rule-bound nature and the representation form's imaginative and symbolic

essence, scholars gained a deeper appreciation of how play is a foundational element in shaping cultural practices, social interactions, and individual identity.

Moreover, Huizinga's classification sheds light on the integration of play into various domains of human existence. The contest form, evident in organized sports and games, contributes to the development of teamwork, discipline, and the pursuit of excellence. Meanwhile, the representation form, present in artistic expressions and imaginative play, fosters creativity, empathy, and the exploration of diverse perspectives.

Following Huizinga's work, later classifications of play generally incorporate two additional broad categories: creation and construction, as well as sensory and sensorimotor experiences.

2.1.2 Exploring Piaget's Four Categories of Play: A Developmental Perspective on Children's Cognitive and Social Growth

Jean Piaget extensively studied the cognitive and developmental aspects of play in children, and his influential work has led to the identification of four categories of play. Piaget's categorization provides valuable insights into the progressive nature of play and its vital role in children's intellectual, emotional, and social growth.

The first category, “play with rules,” involves structured activities governed by explicit regulations and guidelines. Children engage in games with predefined rules, such as board games or organized sports, which foster their understanding of fairness, social norms, and the concept of cooperation. This type of play instills a sense of discipline and respect for rules, contributing to the development of self-regulation.

The second category, “symbolic play,” encompasses activities where children use objects, actions, or language to represent or stand for something else. Imaginative play, such as role-playing, pretending, or storytelling, falls under this category. Symbolic play facilitates the exploration of abstract thinking and emotional expression, enabling children to process and understand complex concepts in a creative manner.

The third category, “practice or sensorimotor play,” centers on repetitive actions and physical exploration of the environment. Infants and young children often engage in this type of play as they grasp and manipulate objects, enhancing their sensorimotor skills and coordination. Practice play forms the foundation for the development of more complex motor abilities and cognitive understanding of cause and effect.

Finally, the fourth category, “constructive play,” involves activities where children build and create using various materials like blocks, clay, or art supplies. This form of play fosters problem-solving abilities, spatial reasoning, and creativity, as children envision, plan, and execute their ideas through hands-on exploration and manipulation.

2.1.3 Roger Caillois's Taxonomy and its Reflections on Human Behavior and Culture

Roger Caillois, a French sociologist and philosopher, presented a comprehensive categorization of play in his influential work “Man, Play, and Games.” Caillois's taxonomy encompasses four fundamental types of play, each highlighting distinct characteristics and motivations inherent in human play behavior.

The first category, “Agon,” refers to competitive play, where individuals engage in activities governed by explicit rules with the primary aim of achieving victory. This form of play

fosters a spirit of rivalry and skill mastery, as participants vie for supremacy. Examples of Agon can be found in sports competitions, strategic board games, and other rule-bound contests.

The second category, “Alea,” involves games of chance and luck, where outcomes are uncertain and determined by random factors. Alea play entices individuals with the allure of risk and unpredictability, adding an element of excitement and suspense. Gambling activities, lottery games, and some forms of gambling fall under this classification.

“Mimicry,” the third category, encompasses play that involves role-playing, imitation, or make-believe. Participants in Mimicry play adopt different roles, personas, or identities, allowing them to explore and express various aspects of their psyche or the world around them. This form of play is evident in imaginative games, theatrical performances, and storytelling.

Finally, “Ilinx” refers to play that induces sensations of vertigo, dizziness, or altered states of consciousness. Participants seek moments of disorientation and disruption of the normal order, experiencing a temporary release from everyday constraints. Activities like spinning, roller coasters, and certain trance-inducing rituals exemplify Ilinx play.

Caillois's categorization of play provides a multidimensional framework for understanding the diverse manifestations of play in human culture. By identifying the intrinsic motivations and defining features of each play type, his work has contributed significantly to the study of play and its role in shaping human experiences and social dynamics.

2.1.4 Sara Smilansky's Four Categories of Play and Their Impact on Cognitive, Social, and Emotional Growth

Sara Smilansky, an influential developmental psychologist, made significant contributions to the study of play and its role in child development. In her work, she proposed a

categorization of play based on her observations of children's play behaviors and interactions. Smilansky's taxonomy identifies four play categories, each representing different aspects of children's cognitive, social, and emotional development.

The first category, “Functional Play,” involves repetitive actions or movements where children explore and manipulate objects for their inherent sensory or physical properties. This form of play is common in infants and toddlers and lays the foundation for the development of fine and gross motor skills.

The second category, “Constructive Play,” centers on activities where children use materials to build or create objects, structures, or representations. Constructive play enhances problem-solving abilities, spatial reasoning, and creativity, allowing children to express their ideas through hands-on exploration.

The third category, “Symbolic Play,” encompasses imaginative and role-playing activities, wherein children use objects, actions, or language to represent or stand for something else. Symbolic play promotes cognitive flexibility, language development, and emotional expression, as children engage in make-believe scenarios and adopt different roles.

The fourth category, “Games with Rules,” involves structured play activities governed by explicit rules and social conventions. Participation in games with rules facilitates the understanding of fairness, cooperation, and the development of social skills, as children interact with peers in rule-bound contexts.

Smilansky's categorization of play provides valuable insights into the diverse aspects of children's play behavior and its pivotal role in their cognitive and socioemotional development.

2.2 Index

2.2.1 Definition of an index

An index is an instrument that helps organize information by providing a way to convert between the alphabetical or chronological order of its entries and the sequential order of some other medium. Sharing a parallel history with many systems of quantitative manipulation and scientific discoveries, it has been seen as a tool that eliminates individual discretion.[1] In the following pages I attempt a theorization of indexing as a technique, through three layers: *Indexing as a process*, *Indexing as a material activity*, and finally, *Indexing as a conceptual structure*. And although indexing is a form of non-sequential reading, these three layers follow a loose chronological order of the technique indexing. The goal is to explain the limitations and potentials from the perspective of using an index as a reference tool for product design. Of course, indexes have been present in many other disciplines, and to briefly illustrate an example of this mediation in another context, color standardization was achieved by the creation of an index:

In the nineteenth century, color scientists have been referencing natural elements as a standard to index colors, relying on nature for objectivity.[2] By the turn of the twentieth century, this method has proved to be confusing for consumers and sellers alike, because the explosion of commercially available goods required more rigorous color classification, as Robert Louis Stevenson noted his frustration with his attempt to accurately describe a shade of red in the Vailima letters.[3] It was not until 1905 that Albert Munsell proposed the beginning of an

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[1] For an instance of index's parallel history of double-entry bookkeeping see Sombart, Werner. "Medieval and Modern Commercial Enterprise," selections from Der moderne Kapitalismus (originally 1913), in *Enterprise and Secular Change*, ed. Jelle C. Riemersma and Frederic Chapin Lane (Homewood, IL: Richard Irwin, 1953), pp. 25-40.
[2] Werner, Abraham Gottlob, and Patrick Syme. *Werner's Nomenclature of Colours: By Patrick Syme*. William Blackwood, 1821, p.5.
[3] Stevenson, Robert Louis, and Sidney Colvin. *Vailima Letters*. Stone & Kimball, 1896, p.221.

autonomous color system that indexed colors not with referents in the natural world, but situated colors as coordinates in a three-dimensional atlas representing three variables: *Hue, Chroma, and Value*,[4] based on input from advancements in psychology and physiology of vision. This system was eventually developed into the Pantone color standard.

2.2.2 Indexing as a process

The professionalization of indexing emerged as a response to the abundance of books and information in the eighteenth and nineteenth centuries and the expansion of scientific research. However, indexing, as a form of non-sequential writing that constructs representations of an item in order to be retrieved, has predecessors that have a long history in the form of reference books for religious texts or for accounting methods for managerial purposes. All these techniques were intended to address the overload of information that emerged alongside other types of writing, for example, advice on effective reading and good note-taking, judgments and reviews of books to help in selecting them, bibliographies to identify already published books, and to potentially prevent the unnecessary publishing of new ones, and reference works that compiled the most valuable content from multiple books to save readers the effort of making their own selections.[5] Printing, and later computation, led to a new awareness of the need to manage information in and about books and also facilitated the development of new methods for doing so. These methods act as mediators in the transformation of data, into facts, and into evidence, and include, among others, questionnaires and lists, images and tables, and cutting and pasting from printed books.

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[4] Munsell, Albert Henry. *A Color Notation: A Measured Color System Based on the Three Qualities, Hue, Values and Chroma with Illustrative Models, Charts and a Course of Study Arranged for Teachers*. Geo. H. Ellis, 1905, p.12.

[5] For a complete history of these techniques see Blair, Ann. *Too Much to Know: Managing Scholarly Information before the Modern Age*. Yale University Press, 2011.

The history of indexing is marked by a few transitional moments. The two that are of particular significance for the purposes of this research are the switch from systematic to the mechanical arrangement of libraries in the late eighteenth century and the transition from analog to digital information storage and retrieval in the middle of the twentieth century. The transition from a systematic to a mechanical arrangement of books is important because it can be viewed as a switch from a method designed to produce an index for a very specific circumstance organization of information, i.e. one particular library to a mechanical system, in which the generalized proceeds any individual instance. Similarly, the shift to algorithmic methods also brought about the division of information into tree structures, with information organized into stacks. It is worth noting that the concept of organizing information into stacks is not a modern thing, as it has been used in various forms throughout history, including most remarkably Diderot's *Encyclopedie*. The diagrams in the *Encyclopedie* are not just simple lists or instructions. Stacking and linking different pieces of information played a significant role in allowing for the examination of novel ideas that may challenge traditional categories and expectations. This correlation created new ways of understanding by encouraging the examination of individual parts in different and unforeseen configurations, influenced by the user's perspective and knowledge, and allowing for the exploration of novel ideas that challenged conventional categorizations and assumptions.[6]

In *Systematic or Mechanical Arrangement? Revisiting a Debate in German Library Science, 1790-1914,* Catherine Minter discusses the required skills of an indexer during the transition from the systematic to the mechanical organization of libraries in nineteenth-century

[6] Bender, John, and Michael Marrinan. "Diagram." The Culture of Diagram. Stanford University Press, 2010, pp. 19–52.

Germany and how they relate to the concepts of classification, duplication of information, and interdisciplinarity.[7]

To give a brief definition and description of the process, systematic arrangement is a method of organizing the collections of a library based on the subject matter or content of the materials. The first step in a systematic arrangement is to assign a subject or set of subjects to each item in the collection. This is typically done by analyzing the content of the materials and identifying the main topics they cover. The next step is to choose a classification system to use for organizing the materials. Today, there are several different classification systems that are used in libraries, including the Dewey Decimal Classification, the Library of Congress Classification, and the Universal Decimal Classification. Once a classification system has been chosen, the next step is to assign a classification number or subject heading to each item in the collection based on its subject. These numbers or headings are typically based on the chosen classification system and are used to group materials together by subject. The final step in the process of systematic arrangement is to create the library's catalog, which is a list of all of the items in the collection, organized by subject. The catalog may be in the form of a physical card catalog or an online database, and it is used by users to locate and request materials from the library.

On the other hand, a mechanical arrangement of a library refers to the use of mechanical systems, such as shelving or storage units, to organize and store materials. In this type of arrangement, the materials are typically organized based on their physical characteristics, such as size or format, rather than their subject matter and the first step of this process is to assign a call number. The goal of the mechanical arrangement is to efficiently store and protect the materials, rather than to facilitate the access by subject. Specifically, the question of having duplicate

[7] Minter, Catherine. “Systematic or Mechanical Arrangement? Revisiting a Debate in German Library Science, 1790–1914.” *Libri* 67, no. 3 (2017).

information has been an interesting topic both conceptually and technically in these early dialogues regarding the limitations and potentials of each method.

In the systematic approach of the nineteenth century, the librarian's "spatial memory" is the embodiment of their expertise and proficiency. Part of their job was to frequently move books around in order to achieve an ideal arrangement.[8] Similarly, the manifestation of subjectivity in the index, and more generally, subjectivity in information and data, make the mediation of the indexer, visible. The implication is that this subjectivity is an expert subjectivity, embodied in a certain person. It is not the nature of vagueness that indexing and information management is trying to limit using controlled vocabularies, e.g. through the translation of visual information into textual or numeric information.[9] The indexers describe concepts and their words are already formatted into an indexical mentality, therefore their work is about the transubstantiation of subjectivity in different ways situated in a historical moment.

There is a degree of anticipating subjectivity embedded in the creation of an index. To balance ambiguity, an indexer must consider where people would look for information and project how others would think of search terms. In this process, the agency and expertise of a librarian or indexer intertwine with that of a historian. Arriving at something given, the data, seems to predispose a kind of passivity or complaisance with the biases that an index created by another professional, carries, which are often imperceptible unless the entire indexing process is revealed. This raises an ethical question: how much should a professional defer to indexers and the systems they provide, and where does a designer's affinity lie in this process, given the proliferation of indexing systems?

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[8] *ibid*, p. 196

[9] For the process of indexing an image see Stewart, Brian. "Pictures into Words." *The Indexer: The International Journal of Indexing* 33, no. 1 (2015)

In order to prevent an indexer's fluency in their register from becoming a fact in the designer's register, a way to think about indexing is in terms of the tiers of data, facts, and evidence.[10] Indexers have access to data -and the presumption that they are bringing, and their work is to translate this material into facts and evidence. There is an embodied practice involved in this process: indexers look for the best representation of a particular category in order to make evidence. The technique of indexing is the translation of things into a different modality so that they are considered evidence, they are given authority and meaning, ascribed by a certain value by being chosen to be in the collection of a library and given a set of metadata. For example, a visual material like a photograph contains information and an indexer classifies this information into categories of data or evidence. Something has to be the most representative of one category of things in order to be indexed. This reduction to the most representative or the most exemplary of a category is necessary to manage the sheer amount of material and create a structure of data retrieval. The "best" of a category is evidentiary, and thus it is given a shape, identity, and meaning by a person interacting with it.

Evidence, both in an indexer's and designer's practice is about making something meaningful from data, which do not have meaning, or facts, which exist. An indexer also mediates how a designer or a user encounters other, liminal objects of study, such as something that is always data and can never become evidence because it is fragile and can never be seen, or has a call number but is lost.

[10] For the relationship between the triad data-fact-evidence see Daniel Rosenberg, "Data Before the Fact," in Raw Data Is an Oxymoron, ed. Lisa Gitelman (Cambridge, MA: The MIT Press, 2013), 15-40.

2.2.3 Indexing as a material activity

The genealogy of the card catalog as a storage technology includes several technology transfers between the discourse of the library and that of efficient management in accounting. The universal use of card catalogs in libraries and offices from the period between World War I and II demonstrates how the concept was adopted for use in office management.[11] The card catalog allows for the storage, processing, and transferring of data, similar to other data storage systems. However, it is unique in that the information is stored on separate, uniform, and mobile carriers that can be arranged and organized according to a specific system. This flexibility makes the card catalog a type of machine, which allowed for its translation into the computational era. The process of rearranging the elements of a card catalog, such as moving a card to a different location and adjusting the positions of other cards accordingly, can be thought of as a chained mechanism.

At the turn of the nineteenth to the twentieth century, libraries were restructured with larger storage receptacles, storage towers that could fit as many books as possible into a discrete space. Similarly, they were bomb-proof indicating the library as the apparatus of bureaucracy, related to other types of government, and instantiations of authority in general. The way data management techniques were instantiated in architecture and storage receptacles more broadly reveals that indexing, as a physical operation, entails the challenge of designing something for an increasingly expanding body of knowledge that also cannot be circumscribed. In *The Larkin's technologies of trust* Zeynep Çelik Alexander states that "the Larkin Company's most valuable asset was neither soap nor other merchandise manufactured and sold, but its inventory of names and addresses annotated with indications of trustworthiness —what we would today call its

[11] For the dissemination of American indexing techniques to European business communities and national libraries see Krajewski, Markus. "Transatlantic Technology Transfer." *Paper Machines: About Cards & Catalogs, 1548-1929.* MIT Press, 2011, pp. 107-22.

customer database."[12] And indeed this technology was also present in the company's architecture. The Larkin Administration Building was notable for the flexibility of its "addressability," a term used in information science to refer to the organization and accessibility of information. In this context, the "address" refers to the location of the information in space, such as a file in a cabinet or on a computer, and the "index" is a way to find the address, like a directory for a filing cabinet or folders on a computer and the capability of the building to allow information to be stored and retrieved based on its content rather than its location by its quick adaptation to the flow of paperwork.[13]

Indexing, as a technique, is cumulative. This attribute is ascribed to the technique because of its material embodiment, but it spans through its conceptual structure too. New indexing systems do not replace older systems -they modify them, increase them and decrease them- but they do not completely erase them. In the transition from the systematic to the mechanical arrangement of libraries, certain aspects of the systematic approach were not eliminated. The desire for comprehensiveness, and the idea of subcategorization, are some of the vestigial patterns that can be traced in the majority of the subsequent systems. Consequently, these vestiges create presumptions in the indexing systems that determine other types of work. For example, the prefabricated alphabetical ordering automatisms assume that alphabetic languages are the languages of science and become the key apriori of information retrieval.

Finally, the segregation of indexical systems themselves is another attribute that is bound to the physical operation of the technique and disposes to certain visibilities. Indexing requires that material is already segmented. In organizing a library or an archive, the nature of the index produces the sense that the researcher must be looking for a piece of specific information, not

[12] Çelik Alexander, Zeynep. "The Larkin's Technologies of Trust." Journal of the Society of Architectural Historians, vol. 77, no. 3, 2018, p. 301.
[13] Ibid, p. 308.

"just looking," with the librarian or the archivist, as an agent, acting out the nature of the index, allowing access to parts of the material based on different priorities like security, sensitivity, staffing, etc. This segmented access to information inscribes blindspots in the work of a researcher. The digital libraries and archives, less constrained by segmentation, have other types of dispositions linked to lower transparency and knowability of the process of indexing and infrastructure of data.

2.2.4 Indexing as a conceptual structure

In *Files: Law and Media Technology*, Cornelia Visman, argues that the ability to add to and circulate files gives them certain characteristics that make them seem "up-to-date, live, ever-changing, acting, and inexhaustible." In other words, the constant flow of information being added to and circulated through the files makes them seem alive and constantly changing, as if they have their own agency or presence. She suggests that this gives files a certain "ontological quality," an existence or being of their own.[14] Even if files have a certain ontological quality, it is ascribed to them through the collision of different mediators, including an institution, an archivist, an index card, etc. Indexes are not lists of repositories of facts, the circulation of the different holdings of a library or an archive is dependent on the act of collecting, sorting, and storing material, which through this process, and the presuppositions that it entails, are given the status of "indexed information." This blurs the relationship between data, fact, and evidence because the same system that puts information forward as data, is the system that gives them an evidentiary cast in the sense that there is an indexer making the decision of collecting, sorting, and storing them. In this context, the transition from systematic to mechanical can be seen as a

[14] Vismann, Cornelia. "Law's Writing Lessons," in Files: Law and Media Technology. Stanford: Stanford University Press, 2008, p. 10.

transition from a more evidentiary bias to a more data bias, collecting, and managing data which, through indexing, survive and reproduce themselves allowing for certain visibilities in the historical work.

By definition, indexing embodies the desire to quickly access information and the parallel need to divide the contents of some aggregation of material into discrete, easily accessible units of knowledge. Throughout the history of indexing, there were attempts to create universal indexing projects, either in analog, or digital form. Susan Artandi's Book *Indexing by Computer* in 1963 and Harold Borko's *Experiments in Book Indexing by Computer* in 1970 stem from the same idea of creating a comprehensive key to all knowledge.[15] Artandi's method focused on identifying which keywords were present in a document, while Borko's method focused on eliminating common "function" words from a document. Artandi's approach used inclusion to analyze documents -given a list of potential keywords, while Borko's approach used exclusion -given a dictionary of "function" words.[16] The contemporary embodiment of these projects is the concept of a pandiscplinary index, as a corollary of the functions of search engines. A pandisciplinary index presumes a global transdisciplinarity and transmodality that is projected as not discriminating. However, given that different disciplines have different methods of organization, classification, and indexing, this pandisciplinarity is translated into a greater or lesser affinity for certain disciplines. Similarly, the fundamental switches and substantiality of different media make them incommensurable at some level, in the sense that an archive of visual

[15] Artandi, Susan. "Automatic Book Indexing by Computer." *American Documentation*, vol. 15, no. 4, 1964, pp. 250–257., and Borko, Harold. "Experiments in Book Indexing by Computer." *Information Storage and Retrieval*, vol. 6, no. 1, 1970.
[16] For the history of book indexes in the digital era see Duncan, Dennis. "Ludmilla and Lotaria." in *Index, a History of the: A Bookish Adventure from Medieval Manuscripts to the Digital Age*, W W Norton, New York, NY, 2022, pp. 230–260.

materials is not commensurable to an archive of textual material, which is not commensurable to an archive of numerical information.

Indexing, as a technique is used in a wide range of operations, and thus, encountering an object of study through an index has commonalities with different activities that share the same structure. From a methodological perspective, “doing product research” is not segregated from other activities, and because these activities are parallel, designers have already created affinities a long time before doing research.

The goal of this part of the research, through the three sections of indexing as a process, as a material activity, and as a conceptual structure, was to illuminate some of the limitations and potentials of product research that are tied to the proliferation of indexing systems in libraries, archives, and textual information in general.

3. Methods

In the realm of toy design, the creation of a comprehensive index holds significant potential for enhancing the accessibility and understanding of a diverse array of toy products. And although there are very robust taxonomies of play and play value, the goal of this paper is to explore the possibility of an index for toy products and the value this could have in the toy design process. The following methodology outlines a systematic approach used to create an index that not only categorizes and organizes toys but also empowers users, including children parents, educators, and most importantly toy designers, to engage in meaningful exploration of toys and have a language informed by design critique to talk about their designs and give feedback to their peers in a constructive way.

Step 1: Defining Purpose and Scope

As stated in the introduction, the central objective of this study is to develop a comprehensive toy product index that not only aids in efficient toy categorization but also cultivates a structured language for design critique, fostering meaningful exploration and productive feedback among toy designers and students.

The primary objective of the index, includes providing designers, educators, and students with a valuable resource for toy research, facilitating comparative analysis, and assessing educational value. The scope of the index is extensive, covering a diverse range of attributes that influence the design, usage, and impact of toys. These attributes encompass age appropriateness, play categories, educational benefits, safety considerations, and, other specific criteria of the predefined categorization framework.

The categorization framework forms an integral part of the index's scope, aiming to offer a structured system that enhances the clarity and precision of toy description, evaluation, and feedback. This stage lays the foundation for a comprehensive and meaningful tool that equipes designers and students with the required toolkit to engage in informed discussions about toy designs.

Through this stage, the methodology sets the stage for subsequent steps that will systematically transform the defined purpose and scope into a tangible and functional toy product index. This transformation will enable the index to serve as an effective tool for both facilitating design exploration and nurturing a culture of constructive design critique within the realm of toy product development and education.

Step 2: Data Collection and Compilation

The second phase of the methodology involves the systematic collection and compilation of data from a variety of sources. These sources are selected to ensure a well-rounded and representative dataset, enabling the creation of an inclusive and informative toy product index. One of the primary sources of data is the extensive descriptions commonly associated with popular toys available on online purchasing platforms for toys. These descriptions provide valuable insights into the attributes, features, and play characteristics of each toy, forming a foundational component of the index's data pool.

Toy manufacturers, known for their expertise and in-depth knowledge of their products, contribute critical details about each toy, including manufacturer details, product names, recommended age ranges, play categories, materials used in production, distinct features, and

relevant safety certifications. Industry reports contribute valuable market insights, trends, and emerging themes that further enrich the dataset.

A key aspect of this phase is the alignment of the collected data with the predefined categorization framework. The attributes and characteristics of each toy are carefully examined to ensure that they correspond to the established categories, such as Affect, Miniaturization, Assembly, Simulation, Craft, Labor-training/Education, Event toys, and Collectibles. This alignment ensures that the collected data can be effectively categorized and organized within the index, enabling users to explore and compare toys based on their specific attributes and attributes.

Step 3: Creating a Categorization Framework

A hierarchical framework is devised to systematically categorize the collected toy products. This framework consists of dimensions like play categories, age ranges, themes, and the specific categories of Affect, Miniaturization, Assembly, Simulation, Craft, Labor-Training/Education, Event Toys, and Collectibles. Each toy is assigned to appropriate categories based on its attributes, ensuring efficient navigation and easy retrieval.

Step 4: Identifying and Tagging Attributes

Key attributes and descriptors are identified to provide essential information about each toy product. These attributes encompass play types, skill development, social interactions, cognitive benefits, safety features, and specific characteristics corresponding to the established categorization. Each toy is tagged with relevant keywords, creating an in-depth vocabulary for each toy based on specific criteria, but also diverse enough to cover different contexts.

Step 5: Developing a Database and Indexing Tools

A structured Excel spreadsheet is established as the database to effectively manage and organize the collected toy product data. The spreadsheet is equipped with indexing tools and multiple sheets specifically tailored to accommodate the predefined categorization framework.

Step 6: Testing and Validation

So far the index has been tested during an extensive period of two months by two undergraduate students who were simultaneously pursuing a design process of a novel toy. Feedback is collected to identify any usability issues and areas for improvement, including the effectiveness of the categorization system.

Step 7: Updates and Maintenance

A structured process is established for ongoing updates and maintenance of the index. New toy products, emerging trends, and safety regulations are regularly integrated to ensure the index remains current and relevant, while also considering potential refinements to the categorization framework.

Step 8: Documentation and User Guidelines

User documentation and guidelines are prepared to assist users in effectively using the index. Clear instructions are provided on navigation, search, filtering, and interpretation of information, including guidance on utilizing the established categorization for toy exploration.

Short description of the categories:

Affect:

Affect play category focuses on engaging players' emotions, creating an immersive and enjoyable experience. It elicits feelings of joy, excitement, surprise, or empathy. Toy designers incorporate elements that evoke emotions, such as colorful visuals, fun sounds, and unexpected interactions. Toys in this category aim to create a strong emotional connection, making playtime more delightful and memorable.

Miniaturization:

Description: Miniaturization play involves toys that replicate real-life objects or scenarios on a smaller scale. It offers a unique perspective and encourages exploration of the miniature world. Designers create detailed and realistic miniature versions of everyday objects, animals, or environments. This category sparks curiosity and encourages imaginative storytelling within a scaled-down setting.

Assembly:

Assembly play revolves around constructing or building components to create a whole. It encourages hands-on creativity, problem-solving, and spatial awareness. Toy designers develop kits or sets that require assembling various parts. These toys foster fine motor skills and cognitive development as children follow instructions and manipulate pieces to construct something new.

Simulation:

Simulation play enables children to mimic real-world situations, activities, or roles. It allows them to explore different scenarios and engage in imaginative role-play.

Designers craft toys that simulate real-life experiences, such as play kitchens, doctor kits, or vehicle sets. These toys promote imaginative play, social interaction, and the development of life skills.

Craft:

Craft play involves creative and artistic activities where children use materials to make unique creations. It encourages self-expression, fine motor skills, and imaginative thinking. Toy designers develop craft kits that provide materials and instructions for artistic projects, like painting, sculpting, or jewelry-making. These toys foster creativity, allowing children to explore their artistic talents.

Labor-Training/Education:

Labor-training/education play focuses on toys that simulate work or educational activities. It helps children learn practical skills and gain knowledge through interactive play. Designers create educational toys that teach concepts like counting, reading, or scientific principles. These toys engage children in hands-on learning, making education enjoyable and effective.

Event Toys:

Event toys are designed for group play during gatherings, parties, or special occasions. They encourage social interaction, cooperation, and friendly competition. Toy designers craft games

that can be enjoyed by multiple players, promoting shared experiences and building social bonds. These toys enhance social skills.

Collectibles:

Collectibles are toys that come in a series, encouraging children to collect and trade different items. They spark enthusiasm, organization, and negotiation skills. Designers create collectible lines with unique characters or elements. These toys nurture children's desire to complete sets, and collaboration with friends.

4. Results

4.1 Examples of index entries

Example #1

Toy Name: Hungry Hungry Hippos

Manufacturer: Hasbro

Age Range: 4 years and up

Play Categories: Simulation, Event Toys

Materials: Plastic

Features: Rapid hippos' mouth-opening mechanism, colorful marbles

Safety Certifications: ASTM F963, CPSC Safety Standard

Categories:

Simulation: Simulates a playful feeding frenzy among hippos.

Event Toys: Suitable for family game nights and playdates.

Cognitive benefits based on company advertisement:

Develops hand-eye coordination and dexterity.

Fosters social interaction and friendly competition.

Safety Considerations: Rounded edges and non-toxic materials ensure safe play.

Description on the company website:

You'll have a chompin' good time with Hungry Hippo and his pals! Be ready to join in the feeding frenzy when you release all the marbles onto the game base, because all the hippos will be chomping and your hippo will need to move fast! If he chomps the golden marble, you win! Classic HUNGRY HUNGRY HIPPOS game has 4 hippo heads and bodies plus marbles for them to chomp! 20 marbles! One golden marble! Cleanup is a snap with the marble and hippo storage! Game base comes with 4 hippo heads, 4 hippo bodies, 4 marble launchers and guides, 20 plastic marbles, label sheet and instructions.

The original late-'70s and '80s television advertisements for the game:
If you wanna win the game you've gotta take good aim
And get the most marbles with your hippo
Playin' Hungry Hungry Hippos
Hungry Hungry Hippos

The advertisements from the 1990s showcased a sequence of vibrant cartoon hippos dancing and singing, "Hungry Hungry Hip-pos!" to the beat:
"It's a race, it's a chase, hurry up and feed their face!
Who will win? No one knows! Feed the hungry hip-ip-pos!
Hungry hungry hippos! (open up and there it goes!)"

Play Scenario 1:

"Picture a room filled with happy shouts and colorful marbles rolling around. Four friends are sitting around a bright game board with hippos on it. They're having a blast! When the game

starts, they press buttons to make their hippos open and close their mouths, trying to catch marbles. Everyone is really excited and laughing a lot. They're in a hurry to catch the most marbles! Whenever a hippo catches a marble, they all cheer and clap."

Play Scenario 2:

"Imagine two brothers and their friends gathered around a cool game. It's called Hungry Hungry Hippos. They're all ready to play and having so much fun. When the game starts, the marbles start rolling around, and the hippos start munching them up. The boys are leaning in close, laughing, and trying to catch as many marbles as they can. They're not just playing against each other; they're also cheering for each other. Sometimes they talk about how to catch more marbles and win. This game is bringing them all together and making them laugh and smile."

Example #2

Toy Name: Etch A Sketch

Manufacturer: Spin Master

Age Range: 3 years and up

Play Categories: Simulation, Miniaturization, Craft

Materials: Plastic, Aluminum Powder, Glass

Features: Dual knobs for drawing, shake to erase, lightweight and portable design

Safety Certifications: ASTM F963, CPSC Safety Standard

Categories:

Simulation: Simulates drawing and creativity on a unique screen.

Miniaturization: Miniaturized version of a drawing board for creative play.

Craft: Allows children to create intricate designs and images.

Cognitive benefits based on company advertisement:

Develops fine motor skills and hand-eye coordination.

Enhances creativity and imagination through drawing.

Safety Considerations: Rounded corners and non-toxic materials ensure safe play.

Description on the company website:

It’s the one and only Etch A Sketch, the classic drawing toy that’s been challenging artists with its magic and mystery since 1960! Use the knobs to create anything your imagination dreams up, then give it a shake, shake, shake to erase and start all over again.

Play Scenario 1:

Imagine a child sitting at a table, engrossed in drawing on their Etch A Sketch. With a few twists of the knobs, they create wavy lines and loops, experimenting with different patterns. Their focus is intense as they carefully control the knobs to bring their imagination to life on the screen. When they're satisfied with their creation, they give the toy a quick shake, and the screen becomes blank, ready for a new artistic adventure.

Play Scenario 2:

Visualize a group of friends gathered on a sunny afternoon, each taking turns with the Etch A Sketch. They share excited smiles as they try to draw various shapes and objects, laughing when their creations turn out different from what they initially intended. The toy sparks friendly competition, with everyone attempting to draw the most elaborate and imaginative designs. As they pass the Etch A Sketch around, they showcase their artistic skills and enjoy the thrill of creative expression.

Example #3

Toy Name: Play-Doh

Manufacturer: Hasbro

Age Range: 2 years and up

Play Categories: Simulation, Craft, Miniaturization

Materials: Non-toxic Modeling Compound (Wheat-based), Plastic Accessories

*Fe*atures: Colorful and malleable modeling compound, various shaping tools

Safety Certifications: ASTM D4236, CPSC Safety Standard

Categories:

Simulation: Simulates hands-on sculpting and creative play.

Craft: Offers a medium for artistic expression through modeling and shaping.

Miniaturization: Miniaturized containers of modeling compound.

Cognitive benefits based on company advertisement:

Enhances fine motor skills and hand strength.

Promotes imaginative and open-ended play.

Encourages sensory exploration and tactile learning.

Safety Considerations: Non-toxic and conforms to safety standards for children's products.

Description on the company website:

Start or stock up your Play-Doh stash with this 8-pack of non-toxic modeling compound in 8 cheerful Rainbow colors! This set comes with 8 2-ounce cans of compound in red, orange, yellow, green, pink, blue, purple and white. From building their own rainbow to mixing their own colors, kids ages 2 and up can pop these Play-Doh cans open and make almost any creation they can imagine. It makes a great starter pack for Play-Doh playtime or to add some extra colors to your Play-Doh toys at home (sold separately). Teachers can also use these fun colors of the rainbow for classroom activities! The airtight containers keep the Play-Doh compound nice and squishy to use again and again. Play-Doh 8-pack Rainbow modeling compound will brighten up playtime for kids ages 2 and up who love to craft and create with arts and crafts toys like modeling clay! Hasbro, Play-Doh and all related terms are trademarks of Hasbro.

Play Scenario 1:

Picture a child at a table, enthusiastically pressing, rolling, and shaping Play-Doh into different forms. They use their fingers to create a smiling sun, squishy animals, and colorful flowers. The soft texture of the Play-Doh is perfect for their little hands as they experiment with combining colors and textures to bring their ideas to life. Their face lights up with excitement as they proudly display their Play-Doh masterpiece.

Play Scenario 2:

Imagine a group of friends gathered around a Play-Doh playset. They take turns using the shaping tools to create mini sculptures and play characters. Laughter fills the air as they share ideas, swap modeling compound, and collaborate on creating a vibrant Play-Doh world. The kids

use their imagination to craft everything from pretend food to imaginative creatures, sparking endless storytelling and creative fun.

Example #4

Toy Name: Simon Says

Manufacturer: Hasbro

Age Range: 7 years and up

Play Categories: Event Toys, Affect

Materials: Plastic, Electronic Components

Features: Electronic game unit with colorful buttons and lights, challenging memory and reflex gameplay

Safety Certifications: ASTM F963, CPSC Safety Standard

Categories:

Event Toys: Ideal for group play and interactive entertainment at parties and gatherings.

Affect: Engages players' emotions and reactions through gameplay instructions.

Cognitive benefits based on company advertisement:

Enhances memory and concentration skills.

Promotes quick thinking and cognitive processing.

Fosters social interaction, teamwork, and healthy competition.

Safety Considerations: Durable and safe construction adhering to industry standards for electronic toys.

Description on the company website:

Get ready to watch, remember, repeat! The Simon game is the exciting electronic game of lights and sounds in which players must repeat random sequences of lights by pressing the colored pads in the correct order. It's fast-paced play, with lights and sounds that can challenge you. Experience the fun as you repeat the patterns and advance to higher levels. Keep track of your score as you challenge friends or try to beat your own high score. Includes Simon game unit and instructions.

Play Scenario 1:

Imagine a group of friends gathered in a circle, taking turns playing Simon Says. The game unit lights up, and players focus intently as they follow the pattern of lights and sounds. Laughter erupts as the commands get faster, and players try their best to keep up. There's friendly banter and cheers as players successfully mimic the sequence or share in good-natured chuckles when someone misses a step. Simon Says brings everyone together for a lively and engaging gaming experience.

Play Scenario 2:

Picture a family game night where parents and children gather around to play Simon Says. The room is filled with excitement and anticipation as each player takes their turn. The game challenges players of all ages to concentrate, react quickly, and remember the sequence. The game fosters a sense of camaraderie and shared enjoyment as players cheer each other on to victory.

Toy Name	
Manufacturer	
Age Range	
Play Categories	Affect Miniaturization Assembly Simulation Craft Labor-Training/Education Event Toys Collectibles
Materials	Plastic Wood Metal Fabric Rubber Paper Electronic Components
Features	Sound Effects Lights Movement Interactivity Customization Augmented Reality App Integration
Safety Certifications:	ASTM F963 CPSC Safety Standard EN 71 (European Toy Safety Standard) ISO 8124 (International Toy Safety Standard) CE Marking JPMA Certification
Cognitive benefits based on company advertisement	Enhances Fine Motor Skills Encourages Problem Solving Fosters Creativity and Imagination Supports Language Development Promotes Spatial Awareness Develops Logical Thinking Improves Memory and Concentration
Safety Considerations:	Rounded Edges for Safety Non-Toxic Materials Choking Hazard Warning for Small Parts Age-Appropriate Design Secure Battery Compartments Durable Construction

Description on the company website	
Play Scenario	

5. Discussion

5.1 Findings

During the testing phase of the toy product index, valuable insights were gathered from two undergraduate students engaged in the design process of a novel toy. While the sample size and the index entries were limited, the results provide preliminary evidence of the index's potential use in the field of toy design and education.

Empowering Informed Decisions:

The index's comprehensive attributes help students make informed decisions. By evaluating play categories, age appropriateness, and educational benefits, students grasp the potential impact of their design choices, resulting in purposeful and targeted concepts.

Structured Design Critique:

The index fosters structured design critique by providing a common language for discussing concepts, strengths, and areas for improvement. This framework enhances peer collaboration and contributes to refining toy designs.

Encouraging Novel Play Experiences:

Exploration within the index's play categories inspires innovative play experiences. By combining attributes and design elements, students uncover unique and engaging toy concepts, pushing the boundaries of conventional design.

Iterative Design Process:

The index facilitates iterative design refinement. Students revisit ideas, adapt attributes, and explore new play categories, evolving concepts based on continuous evaluation and alignment with design goals.

Collaborative Learning:

The index creates a collaborative environment where students exchange insights, ideas, and feedback based on shared play categories. This approach promotes a level playing field for students of varying expertise.

In conclusion, the index encourages students to consider the multidimensional nature of play. By evaluating toys based on play categories and educational benefits, students enrich the design process and elevate the quality of toy concepts.

5.2 Study Limitations and Future Work

While the toy product index presents a promising approach to enhancing the toy design process and facilitating informed design critique, several limitations should be acknowledged:

Data Representativeness:

The effectiveness of the index heavily relies on the accuracy and comprehensiveness of collected data. The index's value is contingent upon the availability and accuracy of information provided by toy manufacturers and other sources. Incomplete or inaccurate data may limit the index's ability to provide a comprehensive and accurate representation of the toy landscape.

Subjectivity of Attributes:

The categorization of toys and assignment of attributes involve an element of subjectivity. Different individuals may interpret and assign attributes differently, leading to potential inconsistencies in categorization.Standardize categorization based on predefined criteria is required, but some degree of subjectivity may persist.

Static Framework:

The current version of the index operates within a static framework. As the toy industry evolves and new trends emerge, the index may need regular updates to remain relevant and up-to-date. Failure to incorporate emerging play categories or design trends could limit the index's capacity to reflect the dynamic nature of the toy market.

User Familiarity:

The usability and effectiveness of the index are influenced by users' familiarity with the categorization framework and attributes. Providing user documentation and guidelines is the first step, and users may require time to become proficient in navigating and utilizing the index.

Limited Validation Pool:

The index's testing and validation were conducted with a limited number of undergraduate students engaged in the toy design process. The sample size and context may not fully capture the diverse needs and perspectives of toy designers, educators, and other potential users. Further validation with a broader range of users would provide a more comprehensive understanding of the index's impact.

Future Work:

Testing and validation:

Firstly, the proposed framework will be tested and validated in order to be further used in the design and design critique process.

Dynamic Database:

Future iterations of the index will integrate a dynamic database that allows for real-time updates.

User-Generated Content:

Enabling users to contribute toy entries, and additional attributes could enhance the index's richness and accuracy. User-generated content, mostly in the form of play scenaria descriptions, will provide a more diverse and comprehensive perspective on toy products, encouraging community engagement and knowledge sharing.

Cross-Cultural Considerations:

Future work could explore the adaptation of the index to accommodate cross-cultural variations in play preferences, design aesthetics, and educational contexts.

6. Conclusion

In the realm of toy design, the fusion of play categorizations with innovative product development methodologies offers a comprehensive approach to design and design research. This research encompasses a range of play taxonomies, from historical classifications to contemporary perspectives, highlighting the role of play in cognitive, social, and emotional development. The goal is to enhance our understanding of the significance of toy products in human behavior and culture and to provide insights for reimagining the design process.

At the core of this study is the creation of a new tool—the toy product index—a manifestation of structured exploration and informed critique. This index goes beyond traditional assessments of play value, incorporating attributes that capture various dimensions of play and design. By combining affect, miniaturization, assembly, simulation, craft, education, event-oriented toys, and collectibles, it helps designers, educators, and consumers to engage more deeply with toy products.

Developed through the described methodology, the index is purpose-driven, curated through data collection, and organized into a database. Testing and ongoing updates will ensure its relevance and usefulness, supporting an environment for toy design exploration and refinement.

However, this study has several limitations. The index's scope, may need adjustments with the emergence of new play dimensions. Also, there hasn’t been an attempt yet to quantify

the ways that it has been used. By exploring the interplay between play categories and design attributes, the goal of this index index is to encourage collaborative ideation, interdisciplinary innovation, and the cultivation of a design critique culture.

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