TOYS ARE US?

HOW BEHAVIOR-MIMICKING TECHNOLOGY IN TOY DESIGN IMPACTS THE PLAY EXPERIENCE OF CHILDREN WITH AUTISM SPECTRUM DISORDER

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Grace Daniels. Toys Are Us.

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This thesis explores the impact of technology-centered toy design on the quality of play, with a specific focus on those children with autism spectrum disorder (ASD). As technology becomes more deeply integrated into the lives of children, a trend has emerged in the toy industry of favoring technological designs and/or those with some aspect of behavior mimicry.[1] These toys, while appearing to smile, wave, speak, laugh, and cry just like that of a human, are coded to produce behaviors in response to the commands and actions of the child. In doing so, the natural socialization and play processes are manipulated. Play allows the opportunity for children to navigate their bodies and social spaces, develop language and motor skills, and learn creative problem-solving techniques. Technological toys, even those without behavior mimicry and life-like simulations, have been harshly criticized for their "constrain[ment of] the possibilities for cognitive development, interpersonal learning, and the quality of relationships that can be formed"[2]. Many of the critiques of high-tech toys – their limitations on imaginative play, their predictability in behavior and lack of deviation from encoded responses, and their singular functionality – have been developed from a neurotypical mindset with a concern for those children who develop along or adjacent to a predicted schema. Neurodivergent children and disabled children often stray from the expected developmental stages, therefore engaging in different play styles and requiring different play tools and support. Autistic children generally tend to prefer repetitive play activity and struggle to engage in coordinated play with peers, qualities which technological toys also exhibit and, in some ways, encourage. It is critical to keep the behavioral patterns of the toys, and the learning they may or may not promote, in mind as

[1] Home-Douglass, 2003.
[2] Kritt, 2001.

parents and educators attempt to meet the needs of their child with ASD. This thesis hopes to expand the understanding of these toys and encourage designers to approach toy design with a greater care for an equitable and inclusive user experience.

Keywords: *play, toy, Disability Studies, Autism Spectrum Disorders, electronic toys, behavior mimicry, technological toy*

Preface

The language surrounding disabilities has a long history of exclusionary and insulting word choice and continues to be wrought with controversy and debate. As Disabilities Studies has gained recognition and as the disabled community has a greater voice in society, there have been many conversations regarding the appropriate language to describe their experiences and needs. The author of this thesis recognizes that this is a continuing conversation and that there are many conflicting perspectives on the matter due to the vast range of experiences, values, and identities of those within the disabled community. The language used in this thesis is in line with ideas put forth by the autistic community, as per the Autistic Self Advocacy Network.[3] The author recognizes that semantic preferences are likely subject to change over time, and therefore hopes that the thesis is considered in relation to the contemporary climate as of the date of submission.

[3] Brown, n.d.

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Introduction: The Study of Toy-Play

So what is play, then?

It is seriousness and frivolity; reality and make-believe: rules and freedom.

Brian Sutton-Smith (qtd. Play Development in Children with Disabilities, 2017)

The subject of child's play has been at the center of conversation and controversy spanning disciplines since the time of Plato, and somehow still manages to evade universal understanding and definition.[1] Most people would define play through observation, a *you-know-it-when-you-see-it* type of judgment. Academia has had no better luck, as most accepted or working theories define play not by what it *is* but rather what it *is not*: "play does not involve work, it is not realistic, it is not serious, and it is not productive."[2] After centuries of research, philosophy, and various interdisciplinary approaches, some have even argued that the very nature of play as inherent to the human condition is what precludes its definition; play is an indefinable facet of the condition of human life and childhood.[3] While play is a universal truth and right of children across the globe, the way in which play is defined and performed varies widely and is heavily steeped in local and contemporary culture. Play allows the opportunity for children to navigate their bodies and social spaces, develop language and motor skills, and learn creative problem-solving techniques. In this way, the manner in which children play (or are encouraged to play by supervising adults) shapes their understanding of their bodies,

[1] Lynch, Moore, and Prellwitz. 2018.
[2] Ozanne and Ozanne. 2011.
[3] Bulgarelli, Besio, and Stancheva-Popkostadinova 2017; Sherratt and Peter 2002

their means of communication, and their interactions with their environment - thereby shaping their habits, values, and traditions.

Toys, as instruments of play facilitation, therefore also carry, reflect, and exhibit the social values of their respective culture. French poet and author Charles Baudelair defines the role of toys as an invitation to engage in play, and points out that "the existence of such an invitation depends not only on the intrinsic qualities of the object of play, but also its context and the identity of the player."[4] Baudelair, in recognizing the equal importance of form, context, and user identity, acknowledges the highly variable nature of toy-play and provides a critical framework for toy analysis. Levinovitz, in his work *Towards a Theory of Toys and Toy-Play*, supports Baudelair's theory and further argues that no toy can exist without the coalescence of all three critical components: "In order to have a toy, subject, object, and context must come together to create an object free from all forms of value aside from that of its own potential transformation into an object of play."[5] This thesis follows the structure proposed by Baudelair and Levinovitz and seeks to analyze toys in regard to their subject (autistic children), object (technological features), and context (free-play environments).

[4] Levinovitz, Alan. 2017.
[5] Ibid.

Chapter 1: The Autistic Play Experience

play as we know it is [...] a fortification against the disabilities of life

Brian Sutton Smith (qtd. Play Development in Children with Disabilities, 2017)

Understanding Autism

The diagnosis of Autism Spectrum Disorder (ASD) as per the DSM-5 is founded on the following two main criteria:

1. "Persistent deficits in social communication and social interaction across multiple contexts as manifested by the following: deficits in social-emotional reciprocity, deficits in nonverbal communicative behaviors used for social interaction, and deficits in developing, maintaining, and understanding relationships.
2. Restricted, repetitive patterns of behavior, interest, or activities as manifested by at least two of the following: stereotyped or repetitive motor movement, use of objects or speech; insistence on sameness; inflexible adherence to routines, or ritualized patterns of verbal or nonverbal behavior; highly restricted, fixated interest that are abnormal in intensity or focus; and hyper or hyporeactivity to sensory input or unusual interest in sensory aspects of the environment."[6]

While these criteria are foundational to the manifestation of ASD in an individual, it should be noted that the expression of autism is highly variable and specific to the individual. Just as any two people express their emotions, interests, and personalities differently from one another, so too are autistic behaviors expressed uniquely in each

[6] Bulgarelli, Besio, and Stancheva-Popkostadinova 2017, 84.

person. That many autistic individuals also receive diagnoses of coexisting conditions such as ADHD (30-80%) further confounds a blanket understanding of what ASD is and how it impacts the experiences and identities of autistic individuals.[7] Regardless of severity, expression, or comorbidities, the impacts of autism on a person's cognitive, sensory, motor, communicative, and social skills are universally recognized.[8] Recent research and advocacy efforts have revealed important truths about autism which have fundamentally shifted the way in which autistic behaviors and habits are understood and accommodated. As the characteristics and preferences of autistic children are analyzed as a target audience for the design of technological toys, it is critical to recognize the duality of autism as both a developmental disability and an identity in which many autistic individuals take pride. Therefore, this thesis frames the user experience of an autistic child's interaction with a technological toy within the context of joyful play, rather than that of a therapeutic and/or rehabilitative play-activity.

Barriers to Play

The role of play in the development, education, and therapy of a disabled child has become the subject of interdisciplinary debate in which there are two dominant viewpoints: that play should be conducted and guided for an educational, therapeutic and/or rehabilitative goal or that free-play should be allowed to the fullest extent of the child's creative desires. Unfortunately the latter perspective lacks a recognizable basis of research and a supportive attitude amongst many educators and caretakers, therefore the

[7] Sandygulova et al., 2022.
[8] "About Autism", n.d.

play of disabled children remains to be seen "only as the means through which they can accomplish clinical and therapeutic goals . . . in other words, children are not engaged purely for the sake of play."[9] Further, the dominance of goal-oriented play-activities in the lives of disabled children has promoted a perspective through which "play for the sake of play is considered […] a waste of time."[10] While playful therapy programs and rehabilitation strategies are not to be dismissed in their usefulness, it is important to remember that these play-activities cannot and should not be seen as an absolute substitute for free, joyful, child-led play.[11] It should be noted here that play as an educational medium is not a concept unique to the field of occupational therapy or special education; educators such as Friedrich Fröbel and Maria Montessori very famously designed entire systems of education based on this concept. Where Fröbel's *kindergarten* and Montessori's method differ from the experiences of the disabled child, however, is that the play-activities performed during the school hours were aimed at reforming the way in which children *learnt*, not the way in which they *played*.[12] Bulgarelli, Besio, and Stancheva-Popkostadinova (2017) point out this difference, explaining that "when professionals have to deal with the more challenging behaviors and the lack of language of children with ASD, play is more likely to be viewed as a luxury only to be targeted when more basic deficiencies have been remedied."[13] Caillois, a twentieth-century French sociologist and author echoes this sentiment, stating that play "is a luxury activity [that]

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[9] Bulgarelli, Besio, and Stancheva-Popkostadinova 2017, 3.
[10] Ibid, 6.
[11] Ibid, 55
[12] Ibid, 36.
[13] Ibid, 142.

belongs to free men. Hungry people don't play".[14] What Caillois and many special education professionals neglect to consider and/or prioritize is the indispensability of play in the development of all children, not just those deemed 'privileged' or 'competent' enough.

Even when allowed the freedom for unadulterated play, disabled children oftentimes find that they still face barriers in their accessibility to or quality of play. These barriers come in the form of an inaccessible physical environment[15], a lack of recognition of a play object and/or situation, misunderstanding of the design of the play activity, and social isolation due to their own feelings or those of their peers.[16] Bulgarelli, Besio, and Stancheva-Popkostadinova (2017) pointedly note that, in addition to all of the above barriers, "one of the major barriers that exists is the attitude of professionals and others within the community towards disability."[17] In fact, parents of disabled children have described their frustration with this phenomena, with 81% reporting troubles accessing community play environments and 51% reporting intentional exclusion of their children on the part of the play providers/supervisors.[18] Self-isolation, therefore, becomes common practice out of fear of misuse of play equipment, causing disruption to the play sequence, or out of habit based on a history of exclusion by others. This social ostracism, while morally unacceptable and in direct opposition to the universal right of children to

[14] Ibid, 11.
[15]Ibid, 2.
[16] Ibid, 5.
[17] Ibid, 54.
[18] Ibid, 202.

play as established by Article 24 of the Universal Declaration of Human Rights, also strips the children of critical opportunities for personal and social development.[19]

For disabled children, and especially autistic children, play allows an exploration of sensory experiences, a space for practicing physical and social self-awareness, and an opportunity to gain a sense of control over themselves and their environment.[20] While autistic children may struggle to initiate group play experiences, their inclusion in such is a valuable experience for all play partners involved. The language used in the DSM criteria has great influence over the way in which autistic play is viewed, and terms such as 'inflexible', 'restricted', and 'stereotyped' "contribute to a sense that autistic people have limitations in imaginative and creative abilities."[21] However, as Snow (2015) clarifies "the neurodiversity perspective holds that autism and other neurological ways of being that differ from neurotypicality are not lesser ways of being."[22] In recognizing the inherent value of play for autistic children and the value which autistic children contribute to a play environment, parents, educators, and designers are then challenged to leverage their authority to work towards a more inclusive atmosphere. The inclusion of autistic children in play environments rests not on their ability to remediate their autistic behaviors, but rather on the ability of their collective support system to remediate the disabling factors which act as barriers to inclusion.[23] In part, this involves the acceptance and encouragement of their niche interests (often labeled as 'obsessions'). As Snow (2015) describes, if autistic children are "not allowed to engage their special interests in

[19] Sherratt and Peter 2002, 11.
[20] Ibid.
[21] Snow 2015, 7.
[22] Ibid, 10.
[23] Ibid, 9.

school, they in fact are leaving 'themselves at home'".[24] This extends to their play environments as well: current accessibility studies in the play of autistic children focus on adapted toys, social robotic tools, and toys used for the purpose of evaluation of impairments.[25] In other words, the current efforts for inclusive play design have a strong prescriptive nature in the types of interactions allowed during play. The qualities of play intrinsic to its value include the following: "the feeling of *freedom*, its association with *concentration* and *intensity* (rather than with laziness), as well as with *pleasure* and/or with *fun*; in addition the fact that play is always conducted in *serious* ways, driven by *curiosity* and *surprise*, *intrinsic motivation*, and finally, by *challenge*."[26] In stripping autistic children of autonomy over their play environment, the foremost qualities of play are compromised.

The way in which autistic individuals experience and interact with their environment is fundamentally different from that of their neurotypical peers, and the same applies to their styles of play. While any two autistic children may have drastically different preferences in terms of toys, games, play styles, or play environments, there are notable characteristics foundational to the autistic play experience. The act of coordinated social play requires a level of development in a child's cognitive, psychomotor, and relational skills - all of which are impacted in autistic children.[27] The ability to intake, process, and respond to multiple types of sensory information simultaneously is often lacking in autistic children, sometimes in the form of *sensory integration dysfunctions*,

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[24] Ibid, 13.
[25] Bulgarelli, Besio, and Stancheva-Popkostadinova 2017, 3.
[26] Ibid, 11-12.
[27] Bulgarelli, Besio, and Stancheva-Popkostadinova 2017, 137.

which can further impact their capacity to or preferences for social play.[28] For the vast majority of autistic children (estimated between 45-96%), these sensory processing difficulties greatly affect their participation in play.[29] Sensations such as light, noise, smell, and texture can become overwhelming and result in what is called *sensory defensiveness*, or an unexpectedly low tolerance for or response to such stimuli.[30] This sensory defensiveness is often misunderstood on the part of peers, educators, or parents as misbehavior, lack of interest, or limitations in play preference. As Naoki Higashida describes in his memoir, "for people with autism, the details jump straight out at us first of all, and then only gradually, detail by detail, does the whole image sort of float up into focus".[31] The autistic perspective is a vital aspect towards a better understanding of (and design for) their play experience, as it becomes clear that sensory defensiveness and feeling of emotional overwhelm in social environments are likely not due to their lack of interest in their playmates, but in the paralyzing inundation of sensory information that the children are doing their best to sort through.

Therefore the "fixed, stereotyped patterns of behavior"[32] that autistic children are characterized for are likely a result of a comforting feeling of familiarity with the toy and/or play process. Higashida explains that "playing with familiar items is comforting because we already know what to do with them, so then, of course, people watching us assume, *Aha, so that's what he likes to do in his free time* . . . What I really want to do,

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[28] Ibid.
[29] Ibid, 138.
[30] Ibid.
[31] Higashida 2013, 59.
[32] Bulgarelli, Besio, and Stancheva-Popkostadinova 2017, 137.

however, is to get stuck in some difficult book or to debate some issue or other."[33] While this behavior can oftentime be read as "a lack of flexible imagination" and an "apparent need for order and ritual"[34], it would be wrong to assume that a tendency towards the familiar should act as a preventing force from allowing autistic children to use play as a means of exploration. Play is a universal agent through which children learn about the social and mechanical forces at work in the world. As autism often prevents spontaneous exploration of new sensations or procedures, the autistic child therefore requires a supportive environment and toolkit when engaging in play.

Supportive play environments manifest differently for each child as per their individual needs. However, the way in which autistic children seek support (or fail to do so), oftentimes presents challenges for educators and caretakers. While autistic children can show deep interest in creative, collaborative play environments, they oftentimes "have limited use of joint attention and other nonverbal skills, as well as marked spoken difficulties to ask for objects, request information, and share emotions, which make them unsustainable in social play."[35] It has been suggested, therefore, that a degree of simplicity in the play situation is best practice for the inclusion of autistic children as it allows them to acclimate to the environment and understand the rules independently without the added social stress of seeking external support.[36] Contrary to long-held beliefs in regards to neurodivergent and disabled play, the simplification of the play structure does not necessarily result in a degradation of the quality of the play at hand.

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[33] Higashida 2013, 86.
[34] Wolfberg 2009, 21.
[35] Bulgarelli, Besio, and Stancheva-Popkostadinova 2017, 141.
[36] Ibid, 195.

Many behaviors which are seen by neurotypical supervisors or peers as nuisances (such as constant string twirling, sand pouring, or banging of a doll)[37] may be considered a form of play and a means through which children explore phenomena such as tension, gravity, and sensory coordination. However, while recognizing that "children with ASD may engage in play that is personally meaningful, but not socially conform and well-accepted"[38], this is not to say that all play behaviors are high-quality. Autistic children can become wholly immersed in the task at hand, at the risk of all-consuming tunnel-vision and social isolation. Therefore, the quality of play must be considered with sensitivity to both the intention and impact of the child's actions. Trawick-Smith, et al. present a useful framework for determining the quality of play in which the following characteristics are analyzed: *thinking and learning behaviors, problem solving, curiosity, sustained interest, creative expression, symbolic transformations, and collaboration and communication.*[39] It is with these characteristics in mind that this thesis will engage in an analysis of the quality of play which technological toys provide for the autistic child.

[37] Ibid, 140.
[38] Ibid, 140.
[39] Trawick-Smith et al. 2014

Chapter 2: Design Analysis of Technological Toys

Toys become actors in the great drama of life, scaled down inside the camera obscura of the childish brain.

Charles Baudelaire, 1853 (qtd. Towards a Theory of Toys and Toy-Play, 2017)

Defining a Toy

Much like play itself, 'toy' is another concept which struggles to declare a concrete definition in the fields of design and philosophy. French poet and philosopher Charles Baudelaire "uses speech act theory to offer a definition of a toy - an invitation to play with its identity - and explores how the existence of such an invitation depends not only on the intrinsic qualities of the object of play, but also its context and the identity of the player."[40] Baudelaire's argument follows that for an object to adopt the role of a toy, the nature and context of the object (as well as the player) must be adaptable and dynamic, able to best suit the play style of whomever the player may be. "The existence of a true toy seems to depend on the freedom of the player in relation to the play-object…. A toy becomes something that falls apart so as to become something else. The cycle of constitution and dissolution is an integral motif, for the player must be willing to make and unmake an object in order for it to be a toy."[41] Unlike games, which have structure and rules under which the players must submit before engaging in play, toys are in their nature as ambiguous as play itself, and "the word toy is used

[40] Levinovitz, Alan. 2017.
[41] Ibid.

unsystematically to refer to a wide range of objects and associated play-activities." [42] As will be discussed in further detail later in this chapter, it is this universal application of the word *toy* that is a disservice to the quality of play of autistic children. The objects which are designed for and used within autistic play environments do not mimic the nature of flexibility and autonomy which define a toy, as per Baudelaire's philosophy.

Using Baudelaire as a logical foundation, Levinovitz questions the relationship between an object and its user experience, asking if "any object [can] become a toy when it becomes a part of 'goal-less' play?"[43] And further, "what kind of structure - goals, rules - are compatible with toys?" [44] Chris Crawford provides some clarification, defining an object as toy or not-toy on the basis of the following question: "Is there a defined goal associated with the use of this item?" [45] This thesis builds upon Crawford's argument, positing that if the above question is answered 'no', then that object has the potential to serve as a toy. However, if the above question is answered 'yes', then this thesis claims that the object is not just a not-toy, but rather has the potential to serve as a tool. Crawford elaborates on his defining criteria, explaining that "a player uses a toy in an unstructured fashion, without pursuing an explicit goal. This does not mean that the player's actions are arbitrary, for the player can still be engaged in exploratory play, determining in some fashion the behavior of the toy. The player's exploration may indeed show some structure, but this structure is not directed toward the satisfaction of any goal other than the determination of the behavior of a system."[46] This definition has been

[42] Levinovitz, Alan. 2017.
[43] Ibid.
[44] Ibid.
[45] Ibid.
[46] Ibid.

echoed in practice as well as philosophy, as Trawick, et al. "consider toys to be any concrete object that children can manipulate to carry out self-directed and meaningful play activities that are enjoyable for the process and not because they result in a product."[47] Roland Barthes, French essayist and philosopher, argues that under these definitions "many so-called toys … are actually adult tools in disguise" citing dolls as an example of the attempt to condition youth for adult responsibilities under the guise of a play-object.[48] Using the arguments of Levinovitz, Baudelaire, Crawford, and Barthes, this thesis argues that the defining difference between toy-objects and tool-objects is the degree to which the object behaves normatively. As a toy-object becomes entrenched in normative expectations of use, it loses the adaptability critical to its playful nature; "as when someone has seen dominoes used as dominoes so many times that the prospect of using them as soldiers is unthinkable."[49]

Where the quality of toys suffers on the basis of prescriptive behavioral norms, tools gain only benefit. The experience of working with a tool oftentimes becomes "blind, unreflective, and automatic. The tools disappear; we work, and the outcome is predictable."[50] Tools almost require this passivity and lack of attention to their object, as the user's attention is oftentimes required on the task at hand through which the tool is a medium of completion. While it can be argued that "tools are always the same… they get old… [and] they encourage [only] one type of usage", this is not to say that the role that tools play is less valuable.[51] Rather, the value in the tool is determined by the outcome of

[47] Trawick-Smith et al. 2014
[48] Levinovitz, Alan. 2017.
[49] Ibid.
[50] Lewis and Eagen. 2012.
[51] Ibid.

the work product, whereas the value in the toy is explicitly determined by the lack of outcome of a work product. These classifications of objects by use, intention, and outcome rather than form, material, and physical presence allows for the opportunity of objects to exist within, without, and fluidly along the toy-tool spectrum. Tools can even be made into toys, when "a new use has been found, such as a drum made out of a cooking pot and a spatula." [52] Conversely, toys can very easily behave as tools when their only interactions are 'as directed' or seeking to accomplish some goal outside of spontaneous and undirected play. Farmer, 2005 describes this inversion through a metaphor of LEGO blocks (a toy cited time for its incredible adaptability and success in promoting explorative play): "Rather than use their brightly colored blocks to create Gaudi-like works of art, they painstakingly build replicas of the Death Star." [53] In exploring the role of technological toys in the play environments of autistic children, this phenomenon of intentional limitation of an object's playful potential to accomplish some task or gauge some metric is unfortunately widespread and works to redefine many 'toys' as mere tools. This thesis argues that, while tools are absolutely necessary and critical to learning and success in many environments, the manipulation of toy-objects into tools creates a void in the play environment which requires the presence of toys to maintain a standard of play quality.

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[52] Lewis and Eagen. 2012.
[53] Ibid.

Toy Evaluation Criteria

Even within the definition of a toy as outlined above, there is still notable diversity amongst the objects. So does one determine which toys are best suited for their child? Currently, "media and societal influence may be a persuasive factor in parental thinking and purchasing . . . [favoring] electronic toys and devices with explicit educative intents." [54] Walter Benjamin warns parents against this trend, insisting that "the more appealing toys are, in the ordinary sense of the term, the further they are from genuine playthings." [55]

The following criteria is used by the researchers in the TIMPANI study as they evaluated the interactions of preschool-age children with play-objects:

1. "Does a child using the toy demonstrate thinking and learning behaviors, such as exploring objects, displaying facial expressions of deep concentration, and commenting on new concepts or discoveries?
2. Does the child engage in problem solving with the toy, such as trying to overcome challenging obstacles and completing difficult tasks?
3. Does the child show curiosity when playing with the toy, such as asking questions about its properties and uses or showing facial expressions of puzzlement or fascination?
4. Does the child show sustained interest, such as persisting in play with the toy with minimal distraction?

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[54] Wong, et al, 165-166. 2008.
[55] Levinovitz, Alan. 2017.

5. Does the child engage in creative expression, such as using the toy in a novel way or conveying unique ideas?
6. Does the child enact symbolic transformations, such as using the toy to represent something completely different and engaging in pretend play?
7. Does the child collaborate and communicate with peers when playing with the toy?
8. Can the child use the toy independently without expressions of frustration or the need for adult assistance?"[56]

Researchers at the University of Buffalo, through their 'Let's Play!' projects, have compiled their evaluation guidelines for toys. The read as follows,

1. "The toy must be appealing: The design should communicate all necessary information effectively and appeals to children's sensory abilities.
2. It should be clear how to play with the toy: A simple design with well-defined access areas that offer consistent responses makes a toy easy to use, regardless of the children's experiences.
3. The toy is adjustable for a range of users: For example, children can use the toy in a variety of positions (sitting, standing, playing on the floor, etc.) or the output is varied and adjustable. Furthermore, the toy appeals to children at varying ages, developmental levels and abilities.

[56] Trawick-Smith et al. 2014

4. The toy supports the child's development: Toys should encourage imagination and social play, stimulate physical or mental activity, and promote the discovery of new ways to play."[57]

Universal design principles, which have been developed specifically with inclusive play in mind, require toy designers to consider the following:

1. Equitable Use
2. Flexibility in Use
3. Simple and Intuitive Use
4. Perceptible Information
5. Tolerance for Error
6. Low Physical Effort
7. Size and Space for Approach and Use[58]

When designing toys that integrate technology, specifically sophisticated technology such as behavior mimicry, it is crucial that the objects are durable and adequately protect the delicate electronic infrastructure within. [59] For this reason, technological toys (but ideally all toys) require an early involvement of children's play in the design process to determine the successes and failures of the form and concept. [60] Early involvement of children in the design process also allows for the opportunity to

[57] Hinske, Langheinrich, and Lampe, 79. 2008.
[58] Lynch, Moore, and Prellwitz. 2018.
[59] Hinske, Langheinrich, and Lampe, 80. 2008.
[60] Ibid, 80.

analyze the object in relation to safety criteria. This is especially crucial when designing a product for disabled children and autistic children, as their sensory and motor skills may differ from their neurotypical peers. As a toy's safety is often graded based on the expected sensory, motor, and cognitive development of a child according to age, special attention must be given to those toys designed for children whose development does not align with a predicted schema.[61] "The evaluation process of physical toy design scheme is … an uncertain reasoning process with the characteristics of imprecision, fuzziness, and subjectivity"[62], and while there are resources available to aid parents and educators of autistic children on the suitability of their toys, the ultimate evaluation is entirely dependent on the interests, skills, and preferences of the individual child. Further, the evaluation of a toy as suitable extends to include, to some degree, the evaluation of the play environment itself; "the conditions of access to play materials inside the play areas and the toys' arrangement should also be taken into account, as well as the roles concretely played by adults when supporting children with disabilities as they use toys and games."[63]

Integration of Technology in Toy Design

Given the definition and criteria for a successful toy as outlined above, it should come as no surprise that the integration of technology into children's toy design has been wrought with controversy and contention. Many felt as though the introduction of

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[61] Bulgarelli, Besio, and Stancheva-Popkostadinova, 182. 2017.
[62] Shilin Wu. 2022.
[63] Bulgarelli, Besio, and Stancheva-Popkostadinova, 181. 2017.

technology to young children in a play environment held the potential for earlier or more efficient education, greater comfortability around proper use of technology, and/or an enhanced play experience.[64] Panelists from leading technological toy development companies such as Mattel, LEGO, and Zowie Intertainment opine on the subject, saying that "Smart toys combine the best of two worlds - traditional toys and the power of computers and electronic chips. Experts predict that almost every toy will be powered by interactive technology in the very near future." [65] However, regardless of popularity and shifting consumer trends, the question remains of "how can toy makers integrate technology in a way that truly delivers enhanced play value for the child?" [66]

Currently, there has been a dominant trend in the design of smart toys of "adding technology to existing popular toys. For example, adding a voice chip to a teddy bear to create a talking/singing bear. It can be argued that this approach creates toys that leave less to the child's imagination than their low-tech original in that this tends to automate play." [67] In fact, this phenomenon is one of the main arguments that parents, educators, and fellow designers have against technological toys - that technology's benefits of automation and optimization have no place in a child's play environment. Play is characterized by the autonomy of the player, the unpredictability and ephemerality of the play style, and the flexibility of the play to grow and adapt as the player sees fit. As it currently exists, technological interventions in toy design seem to work in direct opposition to all of these. Philosophers, authors, and parents have commented on this,

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[64] Schleinzer. 2014.
[65] D'Hooge et al, 247. 2000.
[66] Ibid, 247.
[67] Ibid, 247-8.

saying that "When play is merely an imitation of a pre-supplied script, it is not toy-play"[68], and "an outcome known in advance, with no possibility of error or surprise, clearly leading to an inescapable result, is incompatible with the nature of play." [69] Studies have found that, contrary to many of the potential advantages promised by the introduction of technology into toy design, "poorly designed interaction technology in electronic toys can actually detract from the benefits that would otherwise be provided by traditional devices and media."[70]

The possibility of smart toys doing more harm than good in a child's development continues to be explored by researchers across the globe[71], however their impact on the child is irrefutable. Compared with their low-tech or no-tech competition - blocks, for example, which allow children freedom to play as they choose and still explore lessons of gravity, proportion, physical manipulation of their environment, planning and personal expressivity[72]- toys which rely on technology to initiate play often create a formulaic play environment which closely mimics the function and limitation of the technological features. Further, many of the features of technological toys - speaking, dancing, singing, walking, etc. - provide little to nothing in regards to promoting social play and strengthening interpersonal relationships between the players. [73] The toys are often aimed more at entertainment rather than engagement; they treat the player as a mere observer of the predetermined behavior of the toy. This inversion of the relationship between player

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[68] Levinovitz, Alan. 2017.
[69] Orellana et al. 2014.
[70] Wong, et al, 168. 2008.
[71] Rosen, Christine. 2007.
[72] Kritt, David. 2001.
[73] Ibid.

and toy repositions the toy as the dominant force in the play environment - stripping the player of the autonomy to self-determine their play.[74] Author David Kritt goes as far as to say that, when playing with such toys "children's thoughts, feelings, and actions are guided in certain directions rather than others." [75] The threat which many argue technology poses on the ability for children to freely think, play, and learn has created "an endangered species"[76] out of children's play. When considering the possible impacts of technological toys on the integrity of a child's development- promoting limited social interaction skills, communicative abilities and expectations, predictable and repetitive behavior, etc[77]- in conjunction with many of the barriers which autistic children face, the importance of further research into this field is not to be understated.

Behavior mimicry, or the ability of the technology to exhibit animate (often human-like) qualities and behaviors such as talking, walking, smiling, laughing, etc., introduces an entirely distinct set of design challenges and user interface experiences. Kritt elaborates on this topic, saying that

> "Interactive dolls, robots, and virtual pets, especially in their self-announced guise as quasi-biological, sentient beings, occupy an indeterminate status as neither living nor completely inanimate. . . The dual nature of high-tech toys, as both machine and animate being, invites confusion, especially for young children."[78]

While the idea of using technology as a vehicle through which a child's toys can be 'brought to life' may seem to signal incredible advances in human achievement, the reality very much so falls short of this. The intelligence displayed in behavior mimicry

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[74] Rosen, Christine. 2007.
[75] Kritt, David. 2001.
[76] Ibid.
[77] Ibid.
[78] Ibid.

toys, such as disembodied voices, interactive capabilities, appearance of free will, and language recognition software[79], works only to further entrench the player into a role of passivity as the technology begins to limit or override the child's own play capacities. As toys become capable of realizing the wildest fantasies of the adult toy designers, marketers, and consumers, the necessity for children to flex their own ability for imagination diminishes. Susan Swanson, of Excelligence Learning Corporation, worries that "electronic toys don't encourage dramatic play . . . And what is going to happen to these kids who are used to having a quick electronic fix and who think things happen at the push of a button?" [80] In the case of toys which exhibit behavior mimicry, emotion and reactions are converted to an *If A, then B* logical statement. Rather than promoting social play which allows the opportunities for children to navigate conflict, personal emotions, environmental interruptions, and peer reactions, these toys reduce the innumerable complexities of the navigation of emotions in a play environment to predetermined visual, audible, and physical manipulations of the object. "In play with these toys, emotion is reduced to relevant variables and contingencies. This functional emphasis in relationships assumes prominence, and emotive aspects of human activities and relationships are treated as disruptive influences external to the primary purpose of the activity." [81]

While some still contend the authenticity and intensity of this issue,[82] designers have recognized this issue and are pushing for change within the industry. A

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[79] Kritt, David. 2001.
[80] Rosen, Christine. 2007.
[81] Kritt, David. 2001.
[82] Best. 1998.

"technology-inspired" approach[83] has been called for, which places technology as the means through which natural play patterns are achieved rather than the catalyst for the determination of such patterns. [84] As the market currently stands, the majority of the products available which claim to be 'high-tech toys' would be more accurately classified as a tool object, under the definitions established earlier in this chapter on the basis of the limitations of free play and goal-orientation. This is not to say that the nature of technology is incompatible with the nature of play, just that the current manifestations of its integration are antithetical to the key features of play. Innovations often have growing pains as they are developed and disseminated, and there has been interdisciplinary work done already to establish pain points for analysis and correction. The following are guidelines developed to guide designers in an artful and intentional integration of technology - especially that with anthropomorphic qualities - into an appropriate and successfully designed toy object:

1. "Provide added value through technology: Enhancing traditional toys with technology should not be a goal in itself, but should offer clear benefits. Wren and Reynolds suggest adding 'as little as possible, but as much as necessary.'
2. Technology should stay in the background: The augmentation should not lead children to focus on the added features only. Technology should not let children neglect the traditional play and limit their own imagination.

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[83] Hinske, Langheinrich, and Lampe, 80. 2008.
[84] D'Hooge et al, 248. 2000.

3. Design for implicit interactions: To prevent a distraction from the toy itself, the integrated technology should be unobtrusive, or even completely invisible, allowing children to focus on playing with the toy instead of using the toy's novel interfaces.
4. Strive for robustness in the presence of failures: The toy environment should still be functional if the technology fails or is switched off; i.e., the technology should not become critical to the play experience and render the environment useless if it is malfunctioning or turned off"[85]

Toy Objects Designed for Autism

Toy-like objects which exhibit behavior mimicry capabilities have recently been introduced into the occupational and rehabilitative therapies for autistic youth, appropriately named Robot-Assisted Autism Therapy (RAAT) devices. Researchers Sandyguolva et al. utilized this approach in their analysis of the efficacy of design choices, explaining RAAT as "a growing area that traces social aspects of human-robot interaction (HRI) through therapeutic and educational interventions for children with Autism Spectrum Disorder (ASD). RAAT can serve as a complementary therapy for children with ASD with the aim to improve social and communication skills by making use of the robots that are capable of interacting with humans in a social way."[86] These devices, while demonstrating much success in their therapeutic abilities, are designed and applauded for their toy-like characteristics. As discussed previously in this chapter, the

[85]Hinske, Langheinrich, and Lampe, 80. 2008.
[86] Kozima, Nakagawa, and Yasuda, 43. 2007.

very nature of RAAT devices as being technologically driven (and therefore ludically limited) and intended for the accomplishment or measurement of specific behaviors precludes them from classifying as a toy. Where these objects succeed in their inclusive design is on the basis of their design being intentional towards the needs and specifications of their audience, autistic children. The failure, however, is that these RAAT devices are not toys, but are the closest available equivalent on the market. Therefore, the following analysis of the design and application of the RAAT devices recognizes that while these objects are distinctly not toys they are the closest current equivalent for inclusively designed play objects for autistic youth.

The RAAT devices analyzed by Sandygulova et al. include Keepon (pictured in Figure 1) and Infanoid (pictured in Figure 2). These two objects present themselves in sharp contrast to one another visually and mechanically. Keepon is handheld, malleable, and colored bright yellow. Infanoid, on the other hand, is much larger - over five times the size of Keepon - and defined by its intensely mechanical appearance. The internal mechanical components which frame Infanoid's many movement features are exposed, creating an uncomfortable dichotomy between the anthropomorphic features and movements patterns and the highly mechanized and inhuman appearance. Keepon's interaction with the player is in the form of head and body movements to mimic attention and emotions. Keepon does not attempt to directly interact with the player in the form of physical touch, nor would this be possible due to the lack of appendages in the design. Infanoid, conversely, was designed with arm, hand, and finger structures included. Therefore, regardless of the active behavior, the form of Infanoid connotes a more direct

engagement strategy. This, combined with the distorted anthropomorphic appearance, creates a degree of intimidation in the engagement experience.

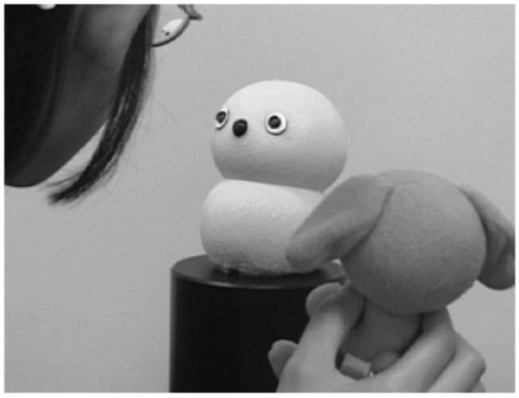

Figure 1: Keepon

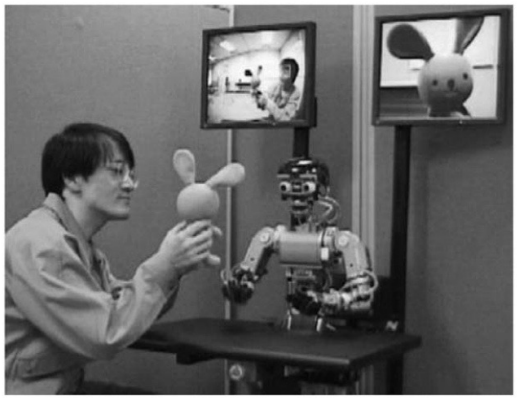

Figure 2: Infanoid

Images sourced from Kozima, Nakagawa, and Yasuda. 2007.

The researchers cite Keepon's appearance as a possible source of its success in application, saying that the "minimal expressiveness helped the children understand socially meaningful information, which then activated their intact motivation to share interests and feelings with others."[87] The study goes as far as to recommend the simple appearance and movement strategy for future RAAT iterations, claiming that the device's form contributed to its ability to "facilitate social interaction … in autistic children."[88] Much of Keepon's visual approachability derives from its simple, semi-anthropomorphic yet not humanoid appearance. The inclusion of eyes allows for the movements of the head to be read as attention and emotion, which invite "the spontaneous exchange of mental states in autistic children."[89] While autistic children are often overwhelmed by eye contact and prefer to avert their gaze in their interactions with others, Keepon has been

[87] Kozima, Nakagawa, and Yasuda, 43. 2007.
[88] Ibid.
[89] Ibid.

shown to help facilitate comfortable gaze between child and robot. [90] Further, Keepon has been used in therapies addressing issues with joint attention - the shared acknowledgement of an object, event, person, etc. between two individuals. Joint attention is a crucial aspect of social interactions and facilitates trust and relationship between two individuals; Keepon's expressions promoted the engagement of joint attention in autistic children, demonstrating that the assumption of joint attention incapability within autism is false and requires further research.[91] Within this study, parents of the autistic youth interacting with Keepon were surprised by the device's ability to promote "positive proto-social behaviors, such as touching, vocalizing at, and smiling at the robot, which were generally rare in their everyday life."[92]

Infanoid, on the other hand, had different results when presented to the autistic youth (aged 2- to 4-years old) in the study. The physical form of the robot seemed to incite "strong embarrassment and anxiety about Infanoid at first sight."[93] Compared to the form and function of Keepon, Infanoid contains much more visual and mechanical complexity. The various components (i.e., hands, fingers, eyes, eyebrows) were cited as a strong point of interest for the children as they engaged with the robot; "Each of the moving parts induces qualitatively different meanings in the children, who then need effortful integration of the separated meanings into a holistic recognition of a social agent."[94] As Higashida describes his experience with autism in *Chapter 1: The Autistic Play Experience*, the many individual moving parts of the robot, rather than the device as

[90] Ibid.
[91] Kozima, Nakagawa, and Yasuda, 43. 2007.
[92] Ibid.
[93] Ibid.
[94] Ibid.

a whole, likely dominated the attention of the children. Much like Keepon, Infanoid's facial and body movements were designed to promote active listening and attention, emotion recognition and navigation, and joint attention skills to the autistic child. The researchers note that, while the emotive behavior of the RAAT devices encouraged progress in the above skills, attempts to further the perception of free will of the robots may be counter-productive: "This information flood would so overwhelm the children that they would hardly grasp the gestaltic meaning."[95] This should be noted by future researchers, engineers, and toy designers. That the inclusion of more sophisticated technology does not always work to serve the experience of the user is a concept which is often at odds with much of the consumer marketing of technological products. Further, the successes and failures of Keepon, Infanoid, and other RAAT devices should be understood within the context of the individual with which they are engaging. Any generalization of the efficacy of these devices for their therapeutic potential across individuals may prove to be inaccurate[96], as distinct differences in the child's preferences, interests, comorbidities, and presentation of autism are key determinants in the therapeutic strategy best suited for them.

The results from numerous studies involving various RAAT devices have encouraged excitement and further research into the possible therapeutic avenues which the field of human-computer interaction (HCI) holds. Design critiques of the form and function of these devices (i.e., scale, materiality, complexity of movement) are applicable to the design of behavior mimicking technological toys. Iskanderani and Ramírez, in their

[95]Kozima, Nakagawa, and Yasuda, 43. 2007.
[96] Sandygulova et al. 2022

study of the relationship of toy design and emotional regulation, found that the primary mechanism through which many toys (as well as RAAT devices) "use facial expressions as a sole source of emotion identification."[97] The inclusion of further emotive indicators in the design of behavior mimicking toy products would serve to benefit all children as they develop their social skills, regardless of a diagnosis of autism. It should be noted that these RAAT devices were designed with the direct interest of "reduc[ing] the child's spontaneity and self-expression in … play."[98] While this limitation of autonomy may not have been the expressed intention of technological toy designers, it is important to note the similarities between the two products. As both products fail to meet the criteria for a toy, and as their applicability as tools in therapeutic strategies depends largely on the individual child in question, there is a void in the market for products which support the technological feature of behavior mimicry and which are still capable of true ludic interaction. Toy designers would benefit from further study of the successes and failures of both technological toy objects and RAAT devices as they work towards a product capable of supporting free play for autistic children.

[97] Iskanderani and Ramírez. 2021.
[98] Giannopulu, 2013.

Chapter 3: TOOL/TOY: A Classification of Play Objects

The designed exhibition which serves to supplement and expand the research presented in Chapters 1 and 2 includes a board game and visual essay. The board game, titled TOOL/TOY: A Classification of Play Objects, is intended for use by one or more persons and benefits from use by a diversity of age, ability, and profession demographics. The visual essay mimics the form of board game instructions and, paired with the board game, results in the possibility of multi-level experience within the exhibition by the user. The following subsections will dive into the design intent of this exhibition, an analysis of formal characteristics of the various involved components, the intended user experience when engaging with the exhibition, key takeaways, and areas for further research or improvement upon this thesis.

Design Intent

TOOL/TOY: A Classification of Play Objects was conceptualized and designed with the intent of creating a playful experience that can be engaged with by a wide audience and understood on a variety of levels dependent upon the user's curiosity, capacity for understanding, and experience level with the process of selecting age-appropriate objects for promoting a child's play. Further, TOOL/TOY hopes to highlight the distinct differences, similarities, and ambiguities between a toy object and a tool object (see Chapter 2: Design Analysis of Technological Toys for more details). By calling direct attention to these objects and placing them on an axis comparing playfulness and usefulness, the user is able to recall their personal experiences with these

or similar objects and reflect on the quality and type of interaction. This exhibition does not seek to provide answers to the natural questions that may arise as one engages with it, but rather finds higher value in the process of prompting curiosity and reflection. Many of the questions that may arise as a user engages with the exhibition are the very questions that have arisen throughout my research process, and which remain either unanswered or unanswerable. The importance lies within the very fact of these questions being posed to a wide audience, expanding this thesis to include all who participate as contributors to the research. The feedback that each person produces may take on a variety of forms or opinions, but this diversity is expected as individual experiences, personalities, and biases heavily inform one's experience with an object and/or exhibit.

The intended sequence of interaction with the exhibit begins with an initial interaction with the game board, followed up by independent reflection, and if desired, further exploration via the coordinated visual essay. The game board includes explicit instructions located within which details how one should interact to achieve the most productive experience. The instructions read as follows:

HOW TO PLAY:

1. Pick up a card and read the object description.
2. Find the corresponding tile, leaving it face down.
3. Based on the description, decide for yourself if the tile references a playful object or a useful object.
4. Leaving the tile face down, place the tile within the grid where you believe it to be most appropriate.

5. The bottom of the tile has magnets and should snap into place with the magnets on the lid face.

6. Once all tiles are located within the grid, flip the lid to close the game box.

7. Review the location of tiles on the front face. Reflect on the distribution of objects in the grid.

TAKEAWAYS:

Is there anything surprising about the distribution?

What was the decision-making process like for you?

What does this distribution say about the use of everyday objects?

How might your understanding of the relationship between form and use of objects have changed?

Do you have a child for whom you provide toys?

Where might their toys fit into this grid? (Scale adjusted for visual impact)

Exhibition Form

The form of the game board was chosen intentionally to allow for a playful user interaction with an audience spanning ages, so that the demographics which most often use toy objects (children) and tool objects (adults) can participate equally. The scale of the game board was designed with this in mind, with large tiles and the integration of magnets so that small hands or hands with limited dexterity can comfortably participate. Further, the font size, typefaces, and images were selected for ease of legibility. The

objects selected to be featured on the tiles were done mindfully with the intention of unanimous relatability regardless of present user. All objects present on the tiles were selected on the basis of their widespread popularity, assuming that the users would have some previous experiential knowledge of each object. The square shape of the tiles and the strict adherence to uniformity in the grid promotes an idea of anonymity and interchangeability amongst the various tiles, so that as one user's placement of tiles may differ from another user's there is no obvious differentiation until the final reveal of object distribution when the top face of the game board is in the closed position. In terms of the object description cards, the bright colors were chosen for their immediate visual impact and ability to quickly draw the user's attention. As with the game board, all font sizes and typefaces were selected for ease of legibility. The descriptions include a variety of sensory and experiential information, allowing for users of diverse experience levels to engage on some level with each description without revealing enough information to introduce personal bias into the decision-making process of tile placement within the grid. The language used on the description cards is not intended to be completely transparent as to the nature of the referenced object. This lack of transparency serves two purposes: first, to conceal the identity of the objects and prevent preconceived biases or experiences to impact the determination of playfulness and utility; second, to mimic the dissonance between the marketing of a product and the reality of the actual object experience. By using the form of a game board to introduce the concepts and questions that this thesis has explored, the very exhibition is called into question as to its object classification. Is the exhibition a toy, as it mimics a game board and it is intended to be used in a playful manner by a variety of users? Or is the exhibition a tool, as it seeks to

expand the user's understanding of toy design and impart upon the user the information explored in this thesis? The form of the exhibition, therefore, exists within the spectrum of playful and useful and further emphasizes that the two classifications are not mutually exclusive however equally important.

User Experience

The primary mechanism through which the exhibition functions to deliver information and prompt reflection is the intentional concealment (and later reveal) of information as the user makes their selection determinations. By revealing information at different points in the game experience, the exhibition attempts to control the amount of information present at any given time and therefore assumes that different users will consume varying amounts of information based on their personal interests and degree of engagement. It is expected that children, with their natural curiosity and limited attention spans, will not adhere to the HOW TO PLAY instructions nor explore the information in the visual essay. Children might pluck out all the tiles, flip them all over, use the cards as a guessing game, explore the magnetism of the tiles, etc. In this way, their experience with the object would align more closely with exploratory play – classifying the exhibition as a toy. Conversely, adults may feel more inclined to follow the step-by-step instructions, seek follow-up information in the visual essay, and treat the overall experience as one of learning rather than playing. This experience would align more closely with the classification of the exhibition as a tool for education and personal reflection. Similar to the phenomenon in which toys are marketed to different age demographics with different strategies, this exhibition relies on the same object (game

board) to speak to different age demographics differently and impart age-appropriate experiences. Further, the game board can be utilized by either one individual, many individuals sequentially, or many individuals working together as a group with each of these participation levels likely resulting in a different distribution of object tiles within the grid. The quality of the experience is not reliant upon the number of participants and can be enjoyed regardless of group participation – a key feature of a well-design toy (as described in Chapter 2: Design Analysis of Technological Toys).

User Takeaways

As stated previously, the intention of the exhibition is not to claim to present answers to the questions that may arise during user participation, but rather to prompt reflection on a variety of issues that have arisen in the research process for this thesis. The intended points of reflection are as follows:

1. Dissonance between actual object experience and advertised experience:

   The language used in the object descriptions is intentionally vague and relies upon the varied interpretation of objects within each individual user. This allows for each user to reflect upon the language used in relation to each object and determine for themselves the accuracy and honesty of each description, calling into question the accuracy and honesty of the language used in the promotion of a new toy.

   Does the language always provide a complete or incomplete description of the experience using the object? If incomplete, which aspects of the experience

are missing? Are there objects whose descriptions are more incomplete than others? If so, are there certain characteristics or traits that are more likely to be omitted?

2. Dissonance between expectations and reality in the classification of objects:

By including some object tiles that reference object explicitly defined as tools (i.e., scissors, hammer, etc.) and toys (i.e., teddy bear, doll, etc.), there is the possibility that these objects may be classified in direct conflict with the user's preconceived notions of the object's purpose. The experience that each person has with an object is subject to their individual preferences, interests, background knowledge, ability, etc., and this subjectivity of object experience confounds any strict definition of a toy or a tool. The possibility that objects may be placed in direct conflict with the user's prior knowledge introduces this concept and prompts further reflection on their own experiences.

Which toys are classified as useful? Which tools are classified as playful? Which objects are classified as both? How was the information on the cards used to make each of these determinations?

3. Critical characteristics and qualities of play:

By sorting a variety of objects according to their playfulness, the exhibit calls into question the characteristics of play that would determine an object as appropriate for a play environment. *Chapter 1: The Autistic Play Experience*

explores the qualities of play that best serve the child and *Chapter 2: Design Analysis of Technological Toys* explores the characteristics of objects which make them appropriate for play environments.

Is it possible to play with the objects classified as playful? How might one's age or ability level impact their ability to play with these objects?

4. Consumer habits and choices relating to purchasing toys:

The decision to purchase toys, or one toy rather than another, is driven by a variety of information and values specific to the individual. However, there are key trends (outlines in *Chapter 2: Design Analysis of Technological Toys*) which may indicate that not all objects purchased as toys serve a playful role in the child's development. The introduction of technology oftentimes confounds the roles of toy, resulting in an arsenal of objects that may be serving opposite or alternative roles. Both toys and tools are absolutely necessary in providing a child with a well-rounded developmental experience, and while these roles are not mutually exclusive they are also not substitutional. A child that engages with only toys will be lacking, much like a child that engages with only tools. A diverse range of objects and uses is necessary, and this balance must be taken into careful consideration in product design, marketing, and user experience.

Where would one's own toys be placed in the distribution of playful v. useful? If the user is responsible for the development of a child, where would their toys be placed in this distribution?

Areas for Further Research

This exhibition is limited in public exposure due to the private nature of the Honors Thesis Oral Defense, and therefore would benefit unilaterally from widespread exposure and user feedback. The form of the game board was designed with accessibility in mind, however accessibility takes on a variety of forms dependent upon the specific individual user. A wealth of user feedback would benefit the exhibition by providing information regarding the successes and failures of the attempt to meet accessible design standards. Further, user feedback regarding the object choices, object description card language, scale of components, etc. would all help inform a future prototype which may achieve the design intent more precisely.

Further research into product design for children, disabled children, and autistic children is necessary. As explored in *Chapter 2: Design Analysis of Technological Toys*, many of the products currently in the toy market for autistic children function more accurately as tools. While these tools are impressive in their therapeutic and educative results, they cannot serve as substitutes for toys. The question of appropriate toy design for inclusive play requires the joint attention of occupational therapists, product designers, and (most importantly) autistic children. Furthermore, there is much work to be done in educating parents, caretakers, and educators of autistic children of the importance of unadulterated play and which objects can best support this goal. Education- or skill-oriented play is vital in every child's development, autistic children included, however should not be the only available play environment. This thesis hopes to prompt further research and reflection by all parties involved in a child's development to explore the range of play objects and environments that best suit the needs of the child.

Conclusion

Given play's centrality in child development, the choice and use of playthings becomes significant.

Joel Best, 1998.

Background Research

Increased research attention and shifting social norms have allowed for a greater understanding of the autistic experience, notably in breaking down vast generalizations in regards to autistic individuals' social and intellectual capacities. As autism has gained greater recognition and respect, autistic individuals have expressed pride in their diagnosis and autistic identity. Unfortunately, as with most disabled children, autistic children are still commonly deprived of free play environments and instead provided with therapeutic and/or rehabilitative play environments. This strategy, while also depriving autistic children of a critical outlet for self expression, frames autism as a preventing force precluding their ability to play. While goal-oriented play activities are an effective methodology for skill-building, they cannot and should not be used in replacement of free play opportunities. Autistic children are equally deserving and capable of high-quality ludic expression, and the objects and environments which they have access to must support this endeavor.

The mislabeling of products as toys contributes to this void of play opportunities. The objects which are designed with technological features, specifically the capacity for behavior mimicry, are not done so with the key tenets of free play in mind: flexibility and autonomy of the player and the distinct lack of a goal-orientation. As technological toy

objects often have physical limitations (due to the fragile nature of the embedded technology) and experiential limitations (due to the degree to which behavior is precoded by the product designers), they can oftentimes serve to degrade the quality of the play experience. RAAT devices may have shown great success in therapeutic settings, however there is still much work to be done in creating an accessible alternative for free play environments. This thesis encourages toy designers, educators, and parents of autistic children to review the included criteria for evaluating the success of an object as a toy, so as to provide the best possible environment and object selection to support ludic expression. Design is a deeply interdisciplinary profession, and this thesis urges designers to closely analyze RAAT devices as a precedent for their own iterations of technological toys. Recognizing the successes and failures of existing products, keeping in mind their specific context and audience, will only benefit future iterations or innovations of behavior mimicking toys.

TOOL/TOY: A Classification of Play Objects

The exhibition designed in conjunction with the presentation of this thesis includes a game board and visual essay, intended to prompt in the audience similar inquiries and emotions as that which occurred during the research process of this thesis. The form of the exhibition is intended to evoke an air of playfulness through the game board, yet still highlight research and call to action regarding inclusive design through the visual essay. As a person moves throughout the exhibit and interacts with both the game board and the visual essay, they should reflect on their own experiences with and expectations of objects. Further, the exhibit hopes to prompt further inquiry on the critical

characteristics of play and reflect upon how their product purchasing habits may or may not support play. As the thesis attempts to illuminate the issue of accessibility in technological toy design as it relates to autistic children, the exhibition hopes to make the broader themes of play quality and consumer habits relatable to the average audience.

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