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Reconnect: Designing to Touch

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Our everyday lives are surrounded by gadgets and digital devices that help us perform our daily chores with ease and efficiency. However, these digital devices can also separate us from what we should do ourselves. Although children who are exposed to high levels of technology might become attuned to the latest and the best gadgets, they might not learn to use their physical abilities. Another implication of a child’s overdependence on technology is that parental interactions such as encouragement, tutoring and reinforcement are provided by gadgets rather than living, breathing parents. Research done by Padma Ravichandran and Brandel France de Bravo, revealed the importance of child interaction with live people and games noting that “Very young children learn best by relating to real live people, but they also learn by moving and doing. Part of the problem with screen time is that young children who watch TV and DVDs or use computer games may be substituting these activities for free play.”
Reconnect
Designing to Touch
by
Dana Seros Rohani
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Abstract

Our everyday lives are surrounded by gadgets and digital devices that help us perform our daily chores with ease and efficiency. However, these digital devices can also separate us from what we should do ourselves. Although children who are exposed to high levels of technology might become attuned to the latest and the best gadgets, they might not learn to use their physical abilities. Another implication of a child’s overdependence on technology is that parental interactions such as encouragement, tutoring and reinforcement are provided by gadgets rather than living, breathing parents. Research done by Padma Ravichandran and Brandon France de Bravo, revealed the importance of child interaction with live people and games noting that “Very young children learn best by relating to real live people, but they also learn by moving and doing. Part of the problem with screen time is that young children who watch TV and DVDs or use computer games may be substituting these activities for free play.”

The aim of this project is to reduce the gap between young children and the tactile world by creating toys that are attractive for the children, but are low-tech and involve parental interaction. Thus, the primary goal that this thesis seeks to achieve is the stimulation of children toward tactile games, while the secondary goal is to allow and encourage parental involvement in the playtime of the child. The research is guided by the premise that children can absorb substantial knowledge through the tactile world and that such tactile centered play will broaden the horizon of their knowledge and experience.

Definition of terms

Definitions that will help to ease the reading and understanding of this topic include the following terms:

1. In Oxford Dictionaries the given definition of “Haptic” (adj) is as following:
   Relating to the sense of touch, in particular relating to the perception and manipulation of objects using the senses of touch and proprioception.

2. In Oxford Dictionaries the given definition of “Tactile” (adj) is as following:
   Of or connected with the sense of touch:
   “Vocal and visual signals become less important as tactile signals intensify”
   Perceptible by touch or apparently so; tangible:
   “She had a distinct, almost tactile memory of the girl fleeing”
   Designed to be perceived by touch:
   “Tactile exhibitions help blind people enjoy the magic of sculpture”

3. In Dorland’s Medical Dictionary for Health Consumers the given definition of ‘somatotopic’ is as follows:
   Related to particular areas of the body; describing organization of motor area of the brain, control of the movement of different parts of the body being centered in specific regions of the cortex.
Motherhood teaches a great deal about life. This thesis owes a major credit to an incident I experienced as the mother of preschool children. The incident opened my eyes to the relevance of technology as essential for my daughter and I, yet at the same time, it separated me from the learning activities and processes of my own child. It was a Friday afternoon when my family had gathered in the living room and among the chatter and laughter, I found my daughter insisting on having her socks to wear. Instead of wearing the socks on her feet, she pulled them over her hands making them into makeshift gloves and started touching my face with her hands. She would hold objects and shake the objects. The tactile world around her was exciting her and her joy captured the attention of the audience.

Lest I forget, my daughter is well aware of the technological gadgets around her. While I limit her exposure to no more than one hour of television and thirty minutes of mobile phone games per day, if she is not kept busy, she would ask for a technological gadget to keep her occupied. However her joy arising out of her interaction with the tactile world was inspiring. I wondered if other parents shared similar concerns of their children growing up having less interaction with the tactility in their surroundings as opposed to being consumed by digital devices around them. Hence I wished to break through the routine and monotony of toys that we see these days where little focus seems to be on the tactility of the toys and the interaction of parents with the children in playing with these toys.

In this regard, I held certain observations of different activities which would excite my daughter and make her discover new ideas about life and her surroundings. While I was stimulated towards this project through my personal observations, I was keen to enquire from other parents regarding their opinions. Thus I ran a qualitative survey that included a short questionnaire designed to examine the daily routine and activities of children in the target age range of 3.5 to 5.5 years. The information that I gathered as a result of this survey was instrumental in identifying those behaviors and attitudes that which seem common characterize the learning process for these children.

In my attempt to learn further about children and develop this project as a design solution to supplement and enhance learning of children, I observed a preschool gathering in the living room and among the chatter and laughter, I found my daughter insisting on having her socks to wear. Instead of wearing the socks on her feet, she pulled them over her hands making them into makeshift gloves and started touching my face with her hands. She would hold objects and shake the objects. The tactile world around her was exciting her and her joy captured the attention of the audience.

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class at a local Doha nursery. I noted the various objects and materials that are used to teach children about their environment. I then used those very objects and materials to design games and toys which would allow children in this age cohort to use and apply their sense of touch to differentiate between different objects and materials. My personal observations inform me that such interactions help children in this age range learn about shapes and numbers, and enable bonding with parents by including them in the play activities with their children. I chose to work with children of this age group since they are keen to touch and hold objects, feeling a multiplicity of textures, and learning to differentiate between toys and materials they find appealing and enjoyable to touch and play with, as well as identifying objects and materials they do not like.

Informed by research on children’s learning and development, I seek to create toys that re-establish a child’s learning as sensory and interactive, tactile and collaborative. It is the informed hope of this research that playing with such toys can enhance the bonding of children with the parents and excite a collective focus on learning through physical activity. More importantly, the low-tech and generalizable quality of these toys may serve to encourage the creativity of parents as they develop new ways of interacting with the toys and therefore new foci for learning. These items may be used in different setups to customize the learning activities pattern of the child. Multiple learning activities are necessary for children in this age range, and perhaps other ages too, because they interact with parents and learn to adopt their parents’ manners and habits. As they imitate their parents, children can develop strongly held habits of behavior. Thus, the low-tech interactive toys developed in this research can potentially allow parents to build and create alongside their children and help the children develop a wide variety of learning.

The inspirational sense among the five senses here was the sense of touch for children frequently put this sense to use to feel and hold an object. According to Derek Cabrera, the sense of touch helps children to ground abstract ideas in concrete experiences and in learning and retaining information.” Touch is a child’s earliest learning tool for gauging distances and depths, and it’s one of the best ways to store information in the brain.

I was inspired to question parents I knew, and others, and observe the children at a preschool to help me develop ideas that could help me in developing toys which would improve the tactility of the children. Ancillary to this goal shall be increased parental involvement through such physical and tactile toys thus I would be less isolated from my child’s learning. The problem is that toys are becoming increasingly technological and usable by only one person at a time rather than multiple players. The isolation caused by screen-based games breaks away from the traditions of family involvement and of building and moving different parts of the toy to make new designs and thereby gather more information and experience. The resulting product would have to be appreciative of the sensibilities of tech-savvy 21st century children and enable these children to learn new things and in new ways.

The preliminary results did not reveal anything astonishing but they did bring forth an awareness that I, as a mother, had already realized. Modern screen-based electronic toys and games are not the best choice for children these days because these toys separate today’s children from the tactility of the physical objects in their surroundings. Today’s preschool children seem to prefer the animated world engineered in games and applications, videos and cartoons, but these high-tech toys do not allow young brains to develop fully. Some researchers argue that such toys only stimulate one or two senses, thereby stunting the perspective of the
For instance, mobile games only use the sense of sight and touch-pads offer little in terms of activating the sense of touch.

The journalist, Geoffrey A. Fowler, wrote in The Wall Street Journal on October 2013:

New research from child advocacy group Common Sense Media has found that children’s use of tablets, smartphones and other portable gadgets with screens has exploded over the last two years, just as doctors warn too much screen time could be bad for kids.

The group’s biannual survey of American parents found an 89% increase in the number of zero to eight year olds who have used mobile devices — growing from 38% in 2011 to 72% in 2013. Even among kids under the age of two, some 38% have used a mobile device for media, compared to 10% two years ago (graph / previous page). Moreover, the amount of time all kids spend with the devices each day has tripled, from 5 minutes to 15 minutes.

Geoffrey Fowler quotes Jim Steyer, the Common Sense Media’s founder:

The devices are increasingly replacing TVs, storybooks, and even babysitters. Then Steyer says his organization recommends that parents set limits, though he appreciates that no screen time before age two isn’t practical for all families. “No question about it, the best brain development happens when you speak with kids and play blocks with them and cuddle – all the experiences where there is no intermediation by technology” he said.

The thesis therefore seeks to address the issue of overt exposure of children to digital devices which adversely affects the children distancing them from the use of their senses, especially the sense of touch. A further consequence that is ancillary to this trend is the lack of parent-child bonding caused due to high-tech toys. Mobile devices and other gadgets supporting animated games and videos minimize the interaction of parents and children during play time. The toys that I have created in the process of addressing this problem are meant to be interactive and collaborative, less animated and more tactile.
The thesis focuses on development of toys that can potentially enhance the tactile experiences of children and thereby also enhance their sensory development of children ages 3.5 to 5.5 years. In addition, the toys developed in this project are designed to facilitate parental involvement and encourage the positive acts of mentorship that include guidance, role modeling and shared experience, all of which enhance parent-child bonding. Designs for these toys are identified through surveys, interviews of parents of preschoolers and personal observations of the preschoolers. However, this research does not focus upon those preschoolers who have special needs due to a disability or otherwise. It is possible some of the toys designed in this research may prove positive for children with certain disabilities, for example, visual impairment. However, particular focus on development of toys for children with specific disabilities is beyond the scope of this project. As mentioned above, this research also retains a tight focus on children within the preschool age group of 3.5 to 5.5 years. Children in other age groups are outside the parameters of this project.

The scope of this research also does not focus on such toys or games specifically designed to teach children and/or their parents about culture, religion or language. The research at this stage is limited to development of toys that are more universal and generic in nature. It is possible that other research will examine more specialized toys that replace numbers or colors on blocks with religious symbols or introducing elements of different cultures and languages to help develop multiple skills besides just reforming the tactility of the users, but that is outside the boundaries of this project.

A further delimitation of this study is that it does not extend to high levels of technology. The toys designed in this thesis are deliberately low-tech; they are aimed at developing learning through physical touch and manipulation. This research involves modern techniques to develop these toys but does not make technology an integral element of the toys. Attempts to incorporate more sophisticated technology into these toys is beyond the scope of this research.

Finally, although these toys are designed to be enjoyable and interesting for children, the toys are not intended for entertainment only. They are intended as tools to enhance the child’s development and parent-child bonding through enjoyable shared play.
Upon reading the work of Ferdinand Lewis and Rita Street, I was convinced that the sense of touch has an impact and power on people’s lives and memories. The importance of the sense of touch in developing the mind and memory of humans, and in particular children, drove me to choose this as the pivotal idea behind my thesis. A few different examples that I found interesting and relevant, illustrate some of the power of touch.

Firstly, Esther P Gardner, from New York University School of Medicine explains that the brain’s ability to interpret information is improved by the person’s experience in touch. She asserts that “The details of the somatotopic map characterize each individual and are determined largely by experience,” so the child’s brain has the ability to process information faster by the sense of touch and improve his or her understanding of objects. x

The importance of touch to brain development is seen in research conducted by educational theorist Charles H. Wolfgang, who found that simple toy building blocks are a much more important learning tool for children than most of us realize. Wolfgang conducted a 16-year longitudinal study on 37 preschool children as they played with blocks until they reached high school level. He correlated the sophistication of each student’s early block play with his or her test scores in middle and high school mathematics. Children who had played the most with blocks in preschool had significantly higher standardized math scores in seventh grade and high school than their peers did, x suggesting the important role the sense of touch plays in a child’s mental development.

Support for the significance of touch is found in the classic research of psychologist Harry Harlow, who conducted studies of the effects of isolation on infant monkeys. He separated monkeys at birth from their parents and siblings, keeping them in clean cages with adequate food. He then put two substitute mothers in the cages. One was a wire mother with a milk bottle and one was a wooden mother covered in terrycloth without a milk bottle. The infant monkeys clung desperately onto the terrycloth mothers for hours, ignoring the desire for food in exchange for the softness of the terry cloth. This demonstrates that the desire for touch is stronger than any other desire, and implies that mother-infant bonding is more dependent on affectionate touch than on the fact that the mother provides food to the infant. xii

In addition, the sense of touch can have medical implications. Aldrich and Shelly state that sense of touch (tactility) could be used to treat children whose tactile systems are hypersensitive and hyposensitive. The former prefer mess for instance playing in shaving foam, finger paint or messy foods, whereas the latter show an unusual fascination with textures such as hair and carpet. xiii While the toys that are designed in the process of this thesis do not take into account special needs of children, this example becomes important in understanding the importance of sense of touch for children and the way it characterizes their behavior. Aldrich and Shelly studied the brain of children with Sensory Integration Dysfunction (SID) whereby children are not able to process sensory information the same way as a typical brain does. In this regard, they provide a “sensory box” (figure 1) with materials and textures such as sandpaper and fur, encouraging the child to explore the contents of the box with his palms. xiv This is similar to a toy that is designed in this thesis to stimulate the sense of touch of the children by matching textures.

The target audience

The target audience for this research is preschoolers from the age of 3.5 to 5.5 years. It therefore became essential to understand how they think and act in order to develop toys that would be most effective in meeting the objectives of this project. Preschool is the time when children are separating from their caregivers.
for the first time and are developing bonds with the external world. Often this is characterized by increasing independence. This newfound independence allows the child to explore new tangents of his or her sensibilities. As a necessary consequence, toddlers often respond in the negative to commands by adults. This is not to be taken as defiance but as a display of gaining independence. In this thesis one of the important aspects of developing the toys is the improvement of a child’s capacity for independence through parental involvement. The toys that are being created were designed to allow children to learn about and explore their senses. As these toys would also allow parents to develop a stronger bond with the children whereby children would be less likely to respond negatively to their commands.

Children of this age are learning new ideas and achieving new milestones every day. Kyla Boyse, Consultant, Health Communication and Web Health Content Development at the University of Michigan Health System notes these developmental milestones as follows:

Language milestones
- Understands the concepts of “same” and “different”
- Has mastered some basic rules of grammar
- Speaks in sentences of five to six words
- Speaks clearly enough for strangers to understand
- Recalls part of a story
- Tells longer stories

Cognitive milestones
- Correctly names some colors
- Understands the concept of counting
- Can count ten or more objects
- Approaches problems from a single point of view
- Follows three-part commands
- Understands the concept of same/different
- Engages in fantasy play

Social and emotional milestones
- Interested in new experiences
- Cooperates with other children
- Increasingly inventive in fantasy play
- Negotiates solutions to conflicts
- More independent
- Views self as a whole person involving body, mind, and feelings

High-tech gadgets and games often tend to isolate children as has been mentioned earlier. The thesis does not seek to eliminate the use of digital devices from the daily life of the child as he needs to be informed about his surroundings. It is therefore argued that while eliminating digital devices might not be an option, it is possible to limit, monitor it, or channel it in a way that constructively contributes to the learning and honing of sensibilities during these developmental milestones (figure 2).

It is also noteworthy that during these developmental milestones, a child’s brain is processing diverse information and developing new motor skills. The research of Dietze and Kashin (2012), has confirmed that there are relationships between play experiences and brain cell development. During the first five to six years of life, play development and brain development have similar complimentary features (figure 2.1).
Brain development is complex and is influenced by both biology and environment and by a child’s experiences. For example, if young children are exposed to environments that are rich with experiences, safe, and predictable, “the child can grow to be self-regulating, thoughtful, and a productive member of family, community and society.” If a young child’s world lacks supportive relationships, is chaotic, bored, and lacks limited nutrition and stimulation, “the child is more likely to become impulsive, aggressive, inattentive, and have difficulties with relationships.” This reinforces the importance of children having access to appropriate environments.

Furthermore, if a child’s environment is one that encourages creativity, exploration, and wonderment, there are more opportunities for optimal brain development. To be creative, to explore, and to wonder are components best achieved through quality play experiences. Children who participate in consistent, enriched and stimulating play experiences are in a position where optimal development is being fostered. The Canadian Institute of Child Health indicates that there are four principles of brain development: first, environment shapes the brain’s wiring; second, the child experiences the outside world through the senses; third, the brain operates on use it or lose it principles; and fourth, early relationships are a source of development of emotional and social parts of the brain.

Conversely, an environment in which a child spends major amounts of time alone, focusing on screen-based activities, is not likely to help him develop optimally emotionally or socially. Hence, this is where a child’s connection to the physical world through touch is highly important.

As per Vygotsky’s argument about the effect of play on the child’s development:

- Play creates a zone of proximal development for many areas of intellectual development
- Play facilitates the separation of thought from actions and objects
- Play facilitates the development of self-regulation
- Play impacts motivation
- Play facilitates decentration.

For example, getting messy with mud isn’t just about fun as demonstrated in the article “The mud centre”, that tells the story of an early childhood programme in which playing with mud benefits a child (figure 2.2).

Children express their creativity, enhance their fine motor skills, and practice literacy, science, and math skills while using the mud centre. The mud is an art medium that children mold and decorate in unique, creative ways. The creations become the centre of children’s play.
Play is not just about recreation or a way to pass time; it has sizable advantages for young minds. This was reinstated through my meeting with Katie Salen, a professor of design and technology at Parsons the New School for Design working in games and learning. She is also the Executive Director of a non-profit organization called the Institute of Play, which works on building new learning environments for children. She believes that games and play are important parts of human learning and development as they teach experiences and social practices such as collaboration, teambuilding and problem solving. She also believes that games work in a way that good teachers work.xxiv Informed by this input, I attempted to make toys that contribute to the teaching and learning of children.

This thesis is not aimed at proving that technology, advanced gadgets and devices are necessarily averse to positive impact on the society. Similarly, it is not aimed at suggesting that digital devices could not have any positive effect on the development of the children’s mind and sensibilities. Rather, this thesis is based upon the premise that low-tech toys and games could be instrumental in allowing the child to fully process the information and better develop skills in conjunction with high-tech game. The sensory abilities of a child could best be stimulated through games which are less dependent on computer generated graphics and are more tactile.

Technology

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While technology has aided the learning process, it has taken away or at least limited exposure to such activities which would require the child to use his sensory abilities and motor skills.

Warren Buckleitner, editor of Children’s Technology Review, says it makes sense to introduce a child to digital media at 2.5 years of age, although some children are not ready until they are older. When it comes to basic math, writing and reading comprehension, studies show that children can enhance these skills through quality computer games (figure 3).xxv

Despite the benefits computers can contribute to teaching and learning, there are other issues to consider. For example, BabyCenter.com* conducted a survey on moms and their smart phones, and they found that out of 3,000 moms, almost half reported letting children younger than three play with their smartphone mostly as a distraction. Nearly a quarter of the applications on their phones were for their children. There are so many software applications designed specifically for toddlers and preschoolers that Apple’s iTunes Store for this demographic is the fastest-growing category of educational games.

Moreover, habits that are formed at a very young age tend to play an instrumental role in the personality building of a child. Children tend to form their social be-

*Babycenter.com is a respected and well-recognized website that is hosted in public media. It provides the most complete and accurate pregnancy and parenting information on the web. The company consists of doctors and other professionals, all highly respected experts, selected to provide a depth and range of experience in their field.
havior around the exposure they have been provided. This means that if children have been exposed to meeting new people, listening to stories, making friends at a nursery or engaging themselves in play-dates, they would develop strong social skills. Many experts agree that children five years and younger learn best by handling tangible, concrete materials – like blocks (figure 3.2) – rather than by manipulating abstract images on a computer screen.

Adults’ (parents/caregivers) participation and involvement

Playing and learning in early childhood education, written by Beverlie Dietze and Diane Kashin, and by the HighScope* Institute, explains that involvement with children allows for a multitude of opportunities of learning (figure 4).

These authors suggest three levels of adult participation in child’s play experiences: parallel play, co-playing, and play tutoring. The first two levels demonstrate the positive impact of an adult’s role and the opportunity to be a role model for children. I discounted the third level from this thesis, as it involves aggressive play-change in a child’s behavior resulting in the adults’ interference and shifting the play into a new direction. Here are the first two levels in detail:

- **Parallel play** is described as adults playing beside the child, not with the child. The adult may use similar materials as the child. Adults exhibit this type of involvement when they wish to role-model positive play behaviors, without intervening in the child’s play episode with words or active involvement.

- **Co-playing** is used to describe play episodes that include a child or group of children and an adult. The children control the play, thus determining the role that the adult will have. Co-playing provides the adult with an opportunity to role-model particular skills and behaviors, and introduces the children to new language and problem-solving techniques.

Adults should consider carefully when and how they become involved in children’s play. The more the adults become involved, the more intrusive and domineering the adults can become in the play. However, there should be well-balanced parental involvement in the child’s play. The products designed in this thesis afford parents the opportunity to play with children and set the pattern for play; these toys also allow children to take the lead, which increases their confidence level and the development of the child’s social behavior. As Thomas G. Power said “When parents play with infants and young children, the complexity of children’s behavior increases substantially, both in the length of the social interactions, and in the developmental level of children’s social behavior”.

Moreover, HighScope suggests that toddlers communicate what they know with their parents or caregivers by initiating contact with them, expressing their feelings and discoveries to receptive and responsive caregivers by stringing together sounds, gestures, and words in a way that makes sense to them. Toddlers also learn within the context of trusting relationships. Thus the caregiver should take interest in the child’s play, take part in the child’s action and exploration, and give the child their full attention so as to respond readily to the child’s signals. Additionally, they should talk with the child, tell them what will happen next, encourage their problem solving, and read to them.

In light of the above, it is imperative for children, especially preschoolers, to stimulate...
their sense of touch—a sense that has been proven to play a pivotal role in brain development of children. As mentioned earlier in Esther P Gardner’s article, a child’s brain development is hugely assisted through interactive games and this helps them achieve developmental milestones at an accelerated pace. Hence, parents should take note of the activities of children and allow them to develop their skills and senses. Parental involvement is instrumental for a child’s nurturing and development.

Existing toys

The research discussed above has shown that multi-sensory toys, building toys and tactile puzzles are ideal for developing the senses of sight and touch in a child. The “Feely box” or “sensory box” (figure 1 / p19) is a type of toy or device that and a majority of researchers use it to do research on the sense of touch to record and collect data on toddlers. This toy helps focus the child’s thinking on the sense of touch. The “feely box” is a box with a hole in it that allows a child to insert a hand and feel an object inside without seeing it. It can also be a small pillowcase allowing the object inside to be felt through the cloth. 

Texture Squares

This game creates awareness of the sense of touch. Children (3 and above) "build tactile awareness and vocabulary skills as they interact with these 20 texture squares [10 different pairs] in a variety of hands-on activities. Each textured pillow or patch is approximately 2” to 3”, which fits perfectly in small hands and in the handy cloth drawstring bag. Includes fun activities that “touch” on matching, vocabulary, communication, and tactile discrimination skills. Textures include bumpy, furry, fuzzy, nubby, ribbed, rough, scratchy, slippery, smooth and soft.” (figure 5)

Tactile Discs

"These tactile discs challenge the sense of touch on both hands and feet. Each large disc has a different tactile design that can be found in the same pattern and color on a small disc that a child can hold. The discs offer numerous possibilities for play ranging from simply sensing and matching the tactile designs, to blindfold games based on memory and recognition.”

This game could be a great assistance for children with visual impairment. This game in particular gives more opportunity to the parent to set a pattern for the child that can be made difficult incrementally for the child to learn more and stimulate the sense of touch and coordination between the senses in the hand and the foot. (figure 6)
Interactive tactile game strengthens tactile perception, concentration and cooperation, and promotes healthy, positive touch. Consists of 2 wooden bars, each holding 9 pieces of different textures. (figure 7)

Glove-Ball-Velcro
For learning how to develop hand-eye coordination. (figure 8)

Touch and Match Pair Game
This game is a way to help build tactile awareness and matching skills. The idea of the game is to match the block to the correct hole on the board using the color or the texture or both. It is to improve tactile awareness, vocabulary, communication and tactile discrimination skills. (figure 9)

Tactile Turn ‘N Match
This game strengthens tactile perception, concentration and cooperation, and promotes positive, non-aggressive touch with the Tactile Turn ‘N Match puzzle game. (figure 10)

Counting and measuring with lego
"Numbered LEGO blocks to play some fun math games with children are great for recognizing numbers, counting, ordering and measuring in a hands-on, kinesthetic and most importantly, playful way... Children learn mathematical concepts from sorting and matching, to patterning, counting and measuring." (figure 11)
Shape Sorting Clock

"Shape Sorting Clock Preschool Learning Toy is an educational play that includes color-coded minute and hour hands that spin around with a simple push. Playing with this quality wooden shape sorter, kids can match the colors, sort the shapes, and solve the puzzle as they manipulate the color blocks and turn the hands, building cognitive and motor skills all the while. This toy encourages parent-and-child play, helping children begin to master early-learning concepts as they gain familiarity with the form of a clock and concepts of time." \(\text{xxxvii}\) (figure 12)

Tangram

"This toy consists of seven flat wooden shapes, called tans, which are put together to form shapes. The objective of the puzzle is to form a specific shape (given only an outline or silhouette) using all seven pieces, which may not overlap." \(\text{xxxviii}\) It stimulates and exercises the child’s right and left parts of the brain. (figure 13)

This array of toys in the market helped me realize what products were already available to children and what responses were expected from the children who play with these toys. I was able to gauge the popularity of these toys despite powerful competition from more technologically sophisticated gadgets for children. A few of the toys have a significant overlap in stimulating certain sensibilities of the child. The knowledge of these toys has helped me in developing my own designs, which most importantly would ensure challenging the sense of touch and ensuring parental involvement in a balanced manner.
As a parent, my increasing concern was that my daughter was overly involved with technological gadgets. Thus, I conducted a preliminary survey with ten parents who had preschoolers aged 3.5 - 5.5 years. My findings reinforced this concern; however, this data was insufficient for my project. I next developed a questionnaire survey that I distributed to 140 individuals with preschoolers at my workplace, but only 15 parents responded. The survey responses demonstrated that the use of sense of touch was a concern among parents. While all children were in the habit of using touchpads, their sense of touch would not respond to different textures or shapes. A disconcerting fact discovered through my survey was that it was not just the children who would demand to play with a technological gadget if they were not occupied, but parents were also in the habit of getting free time by allowing the child to play by himself with an iPad or tablet. I also considered information available on the website for toddlers and preschoolers, www.babycenter.com. There were data from surveys and other forms of information available on this website which proved instrumental in providing a background to my research. This information was not specific to my inquiry as the lifestyle and environment were different; however, the information was instrumental in allowing me to gain deeper insight into my theme. I was not, however, content with the results of the questionnaires alone. To study the behavior and closely observe activities of preschoolers, I visited a nursery school myself. Observations at the nursery made it evident that children are attracted to objects such as blocks that have different shapes and sizes and challenge their senses. In sum, I utilized four methods of data collection in this project. These include the initial survey, a deeper-level survey, secondary data available at the babycenter website, and personal observations at a local nursery. The starting point for data collection was the initial survey that I conducted to acquire first hand responses of the parents based on their experience, opinion, attitude and perception (Appendix I). This was done to establish if other parents were concerned about the use of digital devices during the early learning phase of their child. Were there parents who would not allow the use of digital devices at all and would they only allow the child to play with traditional and tactile toys? Were there parents who were not concerned with learning and rather only focused on acquainting the child with the latest technologies? This survey was also to enquire if children were balanced between being visual and tactile. The questionnaire was designed to enquire about the activities of the children and what excited them more to show whether the children were inclined towards visual technology or tactility. My target population were families living in Qatar, both locals and expatriates. Qatar is a very small country, with strong family and cultural orientation. Thus, parents tend to spend time with their children more than might be the case in other countries where the pace of life is extremely swift. The weather for most part of the year is hot and humid, so outdoor activities are rather limited. As a result most of the activities are indoors which can often limit the options of form many forms of play.

To begin with, I had to shortlist the families whom I would approach for my interviews. I chose to interview ten families to start with; three Qatari families, one Bahraini family and six expatriate families. Each family had a child of the age relevant to the survey. Moreover, I had also kept in mind to keep my survey gender balanced, thus, there were five girls and five boys in my survey (Graph 2).

The preliminary survey revealed that six of the ten (60%) of the children were interested in iPads and iPhones, but just less than one half (48%) of the ten children...
ask for these technological gadgets when they were bored. Two out of ten children watched TV when bored and four out of ten played outside when they had free time. Eight of the ten parents (80%) agreed that their children were very much interested in technological gadgets. A 35-year old mother described the intensity of her child’s interest in the visual world as, “She won’t stop watching cartoons on the YouTube until the battery is dead”.

The survey (Graph 3) also indicated that 50% of the parents were of the view that their child was more inclined towards visual technology such as screen-based games and digital devices. While 40% said that their children were both involved in physical games as well screen-based games, thereby being both tactile and visual. Only 10% considered their children be tactile only. However, when enquired as to whether they want their child to be more tactile or not, 60% (six of the ten) parents showed eagerness for their child to be more tactile. They said they were concerned that over use of digital devices was affecting the growth of their children. They wanted their children to increase contact with the outdoors and thereby augment their learning of their physical environment. The other four parents said they did not mind whether their child was tactile or visual.

BabyCenter carried out a similar survey which gathered 14,858 responses in relation to the use of computers for three-year olds. Approximately 76% people stated that it was correct at the age of 3 to introduce the child to a computer, whereas the other 24% disagreed. Through my survey, I checked at what age technological screen-based games were first introduced to the children and discovered that 60% had done this before they were even two years old. This was surprising to me because a majority of the parents showed deep concern on the lack of tactile activity in the life of their child. Around eight out of ten parents were more involved in outdoor activities or played with low-tech toys both indoors or outdoors during their adolescence unlike their children who were more inclined towards screen-based games and digital devices. It should not be forgotten that the influx of technology in the recent past has changed the demographics of child play.

One of the parents, who was worried about her child’s interest in screen-based games at his age, said the following:

I know digital devices will be a major part of their lives, but I am sad about the way it mediates relationships and prevents people from developing the relationships and life skills, which we believe are so important. As they get older we will probably allow some computer games so they are not totally left out of the world of their friends, but we are holding out as long as we can.

The above survey was conducted to draw upon the ideas and concerns of the parents of children in the target class. These would have been instrumental in supporting the thesis and the idea of developing low-tech toys in order to encourage children to become more tactile than visual. However, the results have been divergent and have failed to identify the real choices of the parents, nor do the survey results show an inclination towards screen-based games or tactile toys. The project is not designed to replace screen-based games or digital devices with tactile toys but to provide according to the concerns of parents for children to enhance their learning and augment their skills. This survey however proved futile in this respect.
The information gathered through the initial survey was not enough to resolve the design issue that might arise from constraints upon developing tactility of pre-school children as a result of excessive involvement with screen-based games or digital devices. I designed a second, more extensive survey to dig deeper and collect more precise information for my research. I distributed the survey questionnaire to 60 families, however, only 15 families responded within the established timeline of the survey (Appendix II and III).

When it comes to a child’s preference in spending his time on playing random digital games or educational games; 60% (9 of the parents) responded that their children spent more hours on random games such as Angry Birds, Turbo Fast, and so on, rather than educational games.

Forty percent of the children spent 6 to 10 hours on digital devices, while 46.6% spent 1 to 5 hours playing outdoors. The number of children who played with digital devices or outdoor activities is almost equal, but the hours spent on digital devices are higher. On the other hand, around 66.6% of children do spend over 10 hours on non-digital games like puzzles, and Play-Doh.

It was surprising that 60% of the preschool children in the sample group owned iPads and had access to the internet at all times without parental control. Whereas, 53% of these children showed negative behavior when they played on digital devices. Parents defined the child’s negative behavior as aggressive, ignorant, stressed, hyper, absent-minded, agitated and immersed. In so far as the negative and positive impact of digital devices is concerned, 26.6% parents thought digital devices have a negative impact on the child while 44.6% thought otherwise, while the remaining thought there were both negative and positive impacts. One of the parents expressed his concern about children being exposed to digital devices by saying:

It is important for children to grow up enjoying exercise and being outdoors. In my opinion, it is important that children understand how to use digital devices, but after a certain age. Very young children’s brains are under tremendous growth and require stimulation from different inputs, “zoning out” to iPads or TV limits the thinking and activity in the brain and creates children with underdeveloped thinking capabilities with health problems due to lack of exercise. Obviously there are many studies out there that will tell you exactly the same. I can confirm it from a parent’s standpoint as I spend a lot of time with my children and see the reaction first hand.

As my design problem was not specific to just Qatar, and design solutions could have impact around the world, I wished to incorporate information from other nations. I also wanted to include information that was not specific to a particular ethnicity, religion, or a social or economic background. Thus, I consulted babycenter.com to seek out more information. On the website, there are a series of questions which were set out in the public forum for discussion.

A specific survey of particular importance to my research was based on the different styles of learning. Some children are visual learners, which means they learn by viewing things alone, or at least better, than by feeling them or hearing them. Data regarding them is specifically important to the thesis. Others might have a stronger sense of hearing and could differentiate between different products based on the sounds that they create. These are referred to as auditory learners. Thirdly, there could be those who would feel each object and differentiate between...
them who could be called physical learners. This categorization of children cannot be affixed permanently for the change in surroundings shall lead to a change in learning habits. Out of 15,749 viewers, 41% responded that their child is primarily a visual learner, 25% responded that their child is an auditory learner and 34% replied that their child is a physical learner (Graph 4). Based on the given percentages, the majority of children are visual learners.

In another survey, the time children spent in outdoor play such as swings and playgrounds was questioned. The results showed that out of 4,480 viewers, 42% spent less than an hour in such activities while 5% spent more than 4 hours however between 1–2 hours and 2–4 hours were spent by 36% and 17%, respectively (Graph 5).

Additionally, out of the 19,192 viewers, 66% introduced their child to a computer when younger than the age 3; 23% introduced their child to a computer when between the ages 3 and 4; while 3% introduced their child to a computer when between the ages 5 and 6. Only 1% of parents introduced their child to a computer when between the ages 7 and 8, and 7% had yet to introduce their child to a computer (Graph 6).

Looking at these percentages, it can be concluded that the children of more than half those polled, know how to use computers before reaching the age of three.

Data compiled through questionnaires and reading through websites can be informative, but when the topic involves human activities there are additional ways to supplement the data. I chose to augment these findings with personal observations of the target group of children as they went about their daily activities at a nursery. I went to the Creative Child Nursery School and observed children between the ages of 3.5 to 4.5 years. The nursery’s main focus is to instill in children an appreciation of their senses. Children here are exposed to healthy eating habits, educational videos, music and songs, natural materials and crafts. All the multisensory manufactured toys have been removed from the class to promote creativity through the objects, materials and tools. I chose to observe them here because the whole purpose of a nursery is to enhance learning and keep children occupied. Children are constantly involved in individual and group activities and are exposed to both digital devices and physical activities. Seeing their responses to the different methods of learning and different games proved enlightening in my research. I closely observed the children, their behavior, their caretakers and the methods they adopted to keep the children occupied. I also observed the environment and interaction of students with each other and their caretakers. I secured permission from the parents to observe, photograph and video the children and to use the children’s photographs and videos in my research. These observations spanned four days, and I focused on how chil-
Children interacted with each other, in teams; how they collaborated; solved problems; played; what materials and tools they used; and the language and words they used to describe, or express themselves to the teacher (figures 14 – 14.4).

Figure 14
Observation: Preschool classroom available materials for student use

Figure 14.1 (Left)
Observation: A preschooler making a spider from Play-Doh and other available materials

Figure 14.2 (Right)
Observation: A preschooler using a stick to print on a Play-Doh

Figure 14.3 (Left)
Observation: A preschooler playing puzzle – problem solving

Figure 14.4 (Right)
Observation: A preschooler creating a game from surrounding items in the classroom
For one of the days, I designed an activity with the teacher wherein I chose different materials and selected a group of students allowing them to self-play. This was to observe their response to the different materials and how they interacted with the materials without any assistance from the teacher. An observation was made on their creativity in problem solving and the language that they would employ amongst each other (figure 14.5).

The different materials chosen were pasta, blue sticky, rocks, bottles, sticks, spoons, empty paper cylinders, plastic jars and cotton balls. It was ensured that these materials were child friendly. The children were then allowed to interact with the materials and play in any manner they wanted. As the children became more involved, I asked questions such as what they were making and how the different materials felt and how would they describe them. They described blue sticky as soft, mushy and sticky, while pasta was described as hard and so were rocks. Cotton was described as fluffy besides being soft.

One of the most useful observations I had was when one of the children stuffed the plastic jar with the blue sticky and couldn’t take it out (figure 14.6), and so his friends started taking turns, finding solutions by using different tools. This indicated to me that problem-solving skills were being used very strongly. Also, I noticed that as these children developed new ideas, they did so using nothing but clever ingenuity (figure 14.7).

What I realized during my visit was that children are constantly in the mode of challenging themselves, solving problems, and coordinating with each other. Caretakers also played a significant role in enhancing the child’s vocabulary and directed them in the right direction by allowing them to find solutions rather simply giving them the solutions. This experience was instrumental for the design process as I knew what materials attracted children the most, and what activities they would be involved in when left alone in the presence of peculiar objects and materials. It also highlighted that interaction, by parents or caretakers, is essential to stimulate the child to interact with the material and to use his senses and analytical skills.
level in order to make the toys attractive. I, therefore, developed toys which provided for visual and physical learning. Ancillary to this development, the toys would also allow for increased parental involvement in the playtime of the child.

In order to design this toy, I created a reusable mold of geometric form from blocks of wood (square, rectangular, triangular). I nailed them to a wooden board and drilled holes in the tray itself. I used a polystyrene plastic (thickness 0.03 inch) through the vacuum machine to create the mold (figures 15.1 - 15.3). The holes in the board helped the vacuum machine to suck the polystyrene plastic and shape it around the geometrical forms. A releasing agent (Vaseline) was used and brushed over the wooden forms to release the polystyrene plastic easily from the wooden forms.

The materials I used to create the forms were wood, paper, glue, clay, plaster, wax, salt, sugar, concrete, clear castable epoxy, rubber glass silicon compound, etc. (figure 15.4). During construction, I realized that each block had a different weight, temperature and feel to it, but in different media. Each block had a different density, thus

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**Intro**

The research indicated that a majority of children at the preschool age were more inclined toward the use of digital devices and screen-based games rather than physical activity. Literature shows that this holds the tendency to adversely affecting the growth and development of a child. While the use of technology serves the need of modernity and efficiency in learning, it does not allow the brain of a child to develop in the same way when playing with building blocks and solving puzzles. The results of the survey and the questionnaire revealed that parents themselves were to be partially blamed for the increase in attraction of children towards digital devices as they either introduced the children to it at a very young age, or they would allow the children to be occupied with digital devices, while the parents performed their daily chores.

As a result, my design thesis revolves around the need for toys and interactive games that allow children to develop their sensory abilities, and in particular, the sense of touch. Such toys would allow the children to explore a variety of materials and a range of shapes and sizes. This may seem like a move backwards towards analog toys used for learning, however, this is not the case. The highly-advanced gadgets, digital devices and screen-based games do not engage the child physically enough to make him or her tactile. Since children are more attracted to screen-based games and digital devices, the toys have to involve some level of technology, albeit at a lower
stacking them in different levels and heights was tricky, as the sturdiness and balance of the blocks had to be maintained.

The challenge with this was the level of brittleness of these blocks:
- The sugar block was sturdy, but very sticky and fragile.
- The salt block was sturdy, but fragile.
- The concrete block was fragile.
- The rubber glass silicon block worked very well, but as it fell from a 3rd block level, it was torn.

These toys were used to investigate shapes and numbers. The blocks were of different shapes and textures which would allow the child to use his sense of touch to play and differentiate between the different textures. The exploration of these materials led me to start 3 other projects (Project 2, 3 and 4). Project 1 only provided limited opportunity to explore the tactility of the child. I went on to design other toys which would prove helpful in other aspects besides shapes and numbers.

Project 2 (Learning and texture):
Count my angles
My inspiration for this prototype were the two toys, “the imagination tree” (figure 11 /p31) and the “tangram” (figure 13 / p33). “The imagination tree” enhances the recognition of numbers, counting and basic mathematical concepts. The “tangram” helps children to develop spatial skills and boost their mathematical performance. With that in consideration, I decided to design a toy that would address how to enhance a child’s sense of touch through learning count and basic mathematics.

By moving away from the well-recognized geometric forms like squares, triangles and rectangles, new shapes were designed that would help children recognize numbers through the number of angles in a shape. Through the exploration of different materials and textures in “project 1”, I moved on to building these different shapes (the size of a child’s palm) from different textures and materials that were best suited to children. Materials used were: white foam, soft foam, acrylics, soft felt and sticky balls (figure 16).

The shapes had incremental angles, i.e. number 0 had no angles, number 1 had 1 angle, number 2 had 2 angles, number 3 had 3 angles and so on and so forth. I designed shapes that focused on counting angles in order to know their number, while materials addressed the ability to identify texture (figures 16.1 and 16.2).

The final shapes were laser cut and painted. The materials used were: acrylic...
sheets, linoleum sheets, rough sponge and mat board to support the sponge (figures 16.3 - 16.6).

The acrylic sheets were hard and bumpy while the linoleum sheets were smooth and flexible. The rough sponge was rough, itchy and soft. A box was designed and made to collect the shapes that would allow a child's hand to be inserted to guess and pull out the object of choice. All the edges of the box were sanded and rounded to ensure child safety (figure 16.7).

It is highly encouraged that with such a toy, parental involvement be ensured to assist the child in familiarizing oneself with the shapes and their different textures. This would also increase the child's vocabulary and allow the parent to come up with new shapes and materials that could help the child learn further. However, parents need to ensure that the child be allowed the lead in the game, rather than be told to do everything, as this is a collaborative task of parents and children (figure 16.8).

The toy’s instructions are as follows:

1. The child needs to get familiar with the game pieces. He should be allowed to visually see and physically feel the shapes. Through touching, he is building memory subconsciously (figure 16.9).

   Put the pieces in a bag or a box with a hole in it, and ask the child to put his hand in it and look for a specific number with a specific texture. Example:
- Find me the number three that is rough in texture.
or I want a bumpy number five

What a child does is, use his memory and sense of touch to recall and look for these numbers and textures (figure 16.10).

This is also introducing a very simple mathematical concept of addition to the child. To find numbers 6 to 10, the child should find two shapes that adds to that number, for example:

$4 + 2 = 6$

So the child would look for 2 shapes (one with 4 angles and one with 2 angles) that if you sum them together, it will result in number 6.

Another way of playing this game is to keep the pieces out on the table and look for a specific number by identifying its texture and color. This method may be specifically useful for the younger group of ages 3.5 to 4.5 years old and especially in the beginning when the child is not fully familiar with the objects and textures.

Tip: Parents can find many materials and textures available in their home to cut into shapes and add it to the collection. Parents are reminded to keep child safety in mind when making any such objects at home.

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Project 3 (Materials and textures): FeelyPop

This specific project was created in a two-week workshop with the designer Ali Ganjavian, the founder of Studio Banana, a Madrid-based interdisciplinary design company. The workshop was to create one photo that is self-explanatory and represents my thesis. With some initial brainstorming, I attempted to combine the words I had determined were key to my research: texture, preschooler, touch and fun. I based my design on lollipops and candies for two reasons. First, these are treats children understand and enjoy, and second, children often associate these treats with their family members, especially parents, because it is the parents who typically provide these treats for children. I decided to create a lollipop that held a texture pop instead of a candy pop (figure 17).

As the project was exciting and involved a rich opportunity to replace candy, I named it “FeelyPop”.

In this project, pops of various textures, weights, colors and shapes were created to enable parents to creatively enhance the learning of the child (figure 17.1).
As a fun toy, a FeelyPop could also serve as a good replacement of candies as a reward for a child.

When one of the prototyped FeelyPops was given to my daughter, she smelled it, then touched it with her hand and rubbed it on her cheek. She expressed her sense of touch by stating, “This is soft” (figure 17.2).

As a parent, I interacted with her by asking her questions to further analyze and examine the FeelyPop; what is its shape like? What is the color of the pop? This particular project would allow the child to use his sense of touch while stimulating the senses of sight, smell and with specifically designed Feelypops, taste as well. While lollipops are a traditional means of rewarding a child, the attraction serves more purpose than sugar intake. This toy teaches children about color, weight and textures and would allow the parent to interact by deciding when to give a FeelyPop as a reward.

**Project 4 (Materials): Material kit box**

I continued exploring materials and textures by creating different geometrical shapes and forms (figure 18).

Some shapes were hard, some flexible and some soft. The intention was to build a kit of different materials children could use to build imaginative abstract objects. This was similar to the “tangram” idea. Instead of using glue to connect the pieces, different connecting methods were added and tested: magnets, Velcro, buttons, straw, strings, etc. (figure 18.1).

The child has to figure out how to connect each form to the other, to figure out what material or texture to use, and what hardness level works best to build his abstract form. With this toy, a child discovers the feel of particular textures in connection with one another, is demonstrating problem-solving skills through building objects, and learning new vocabulary through conversation with the parent helper during the play activity. This is slightly complex play activity with the potential to activate the child’s imagination in many ways.

While the idea was attractive, the prototype was too complicated and not unique enough to continue and be developed further. I discarded the idea and moved on. I also learned that companies such as “Early Learning Center” already sell ready-made material kits for children to make animals and objects.
Building on learning outcomes from the first four projects, a fifth project focuses on a combination of texture exploration (Project 1), haptic learning (Project 2) and parental involvement (Project 3). Inspiration was drawn from “Tactile Discs” (figure 6 / p29).

I used the circular “disc” to allow the child to interact with them and use his memory to recognize similar textures. I analyzed what children liked to interact with and learn about (figure 19). The top three choices amongst children in the study were: animals, colors and nature.

I created a board with circular cutouts. Once the circular “lid” was lifted, players would see a word engraved on the bottom of each circle. The engraved words included “bird,” “rough,” “teddy bear,” and others (figures 19.1 - 19.3).

The objective of this game is for parents to read the words inside these circles and assist the child in finding suitable textures to place inside the circular depression. Upon discovering the initial prototype was not satisfactory because it did not seem to hold children’s attention, I added ad-
ditional layers to the project, including: mood board, animal board, etc. (figure 19.4).

These new layers enable the child to change the surface of the board and create new challenges with the same concept. The challenge with this idea was to find proper animal examples that would lead children to discover the right texture in relation to each animal; however, this was not an exciting toy for children in the study so I had to re-think its design.

After further ideation I decided to replace words inside circles with words on reading cards to facilitate a card game process rather than a board game process. The cards have two versions: one for parents, with sentences or short stories to be read to the child; and one for children, with printed images to be read to the parent. In this case, both parent and child can participate and play. Answers will be placed in a numeral sequence (figure 19.5).

A button was added to each circular cut (figures 19.6 and 19.7).

When the button is pushed, two things happen:

1. The speaker asks the child a question or gives him a word
2. The related circle lights up with an LED light indicating the active circle

The issue found in this toy was that it could only be played with once or twice, before the commands for each circle finished and the child gets bored. In addition to that, by adding the Arduino system, parental involvement was limited and to edit...
or add commands to the system was challenging. The attempts in this project led me to create two more projects (projects 6 and 7).

Project 6 (Texture): Where is the Chameleon?

Although the 5th project did not work as hoped, I knew that children like animals and this instinctive attraction to animals is a powerful theme I wanted to work with in this study. As I was speaking to my Graphic Design friend, Tarek ElDebsi about the projects, he told me about the chameleon (figure 20) and explained that this reptile changes its color and pattern to camouflage with its environment. I found the chameleon interesting and inspiring, and decided it would make an interesting foundation for another interactive game design. An interactive game related to the chameleon could provide younger children with knowledge about an animal they have had little, if any, experience with. I decided to keep the game simple and practical.

The game design features a few cut-outs of the chameleon featuring different colors and patterns, and sticky, high-resolution images of different environments such as grass, stone, desert, forest, and so on (figures 20.1 – 20.3).

The idea of the game is to place the environment images on an A4 board and ask the child to guess where the chameleon is (to guess its environment). Based on that, the child with the help of the parent can approach it in two ways:
1. To go outdoors and look for the suitable material or texture and glue it to the board (recommended)
2. Or else to color the board in similar colors as the chameleon

For example: If the chameleon has a grass image on it, then the child will go outdoors, look for grass and glue it to the board around the chameleon creating its environment.

Another version of this toy is to reverse it. So, have changeable high-resolution images of different environments on the A4 board and have the child camouflage the empty, plain chameleon cut-outs to its environment by either coloring or finding suitable texture from nature and glue on it [figure 20.4].

In this exercise, children will be enhancing their knowledge, strengthening their vocabulary, honing their sense of touch by being exposed to different textures and collaborating with parents to analyze the environment, and going outdoors and find a suitable matching texture. Parents can also add more environmental options to this game, by using the basic tools available at home.

Project 7 (Learning and texture): Tell me a story!

Two elements were taken from project 5 to continue and generate a new project focusing on haptic learning and perception. Based on the questionnaire distributed to the families for my research, storytelling was one of the elements that retained the children’s attention for approximately 8 to 15 minutes.

Story telling is a powerful mechanism for enabling children to use and their imagination. The story telling experience can be extended through adding ways for the child to incorporate more active imagination and expression. This would allow the child to be creative and come up with new elements in a story that she has created every time she re-opens the book or create a new story each time. This would also be important as children aged 3.5 to 4.5 could create short sentences.

To create this project I began by looking for images that children would be familiar with and would know at least some words to describe the image [figure 21].

I considered how to add tactility and texture to these images. Using the laser cutter, etching of the objects were placed on one side of the tile, and a cut out texture was placed on the other side of the tile. For example, the image of a house [figure 21.1] and the image of a girl with a pony tail [figure 21.2]: the pony tail was cut out and a hair texture was added to it, making the image into a textured puzzle where the child has to look for the matching piece and add it to complete the image.

Figure 20.4
Project 6: Preschooler camouflaging and adapting the Chameleon to its surrounding environment (desert)

Figure 21
Project 7: Chose the image “House” as a familiar image and easy to describe for a pre-schooler
When I showed the original image of the girl to my daughter, she exclaimed, "It’s a girl!" When I showed her the etched image of the girl with the hair-piece, the addition of a texture, the level of excitement increased and she said that it was a girl with white hair.

As a prototype, I used a foam board to cut and etch (figure 21.3). I repeated the process on a wood board and then created the final tiles (figures 21.4 and 21.5).

The objective was to ask the child to choose three to five tiles of images and allow him to use his imagination, perception and memory to create a story. In order to keep a record of it, it is optional for the parent and the child to record the child’s story by using an iPhone or iPad. Every time images change, the stories would differ. Parental involvement is highly encouraged, as new vocabularies could be taught to the child and also questions could be asked as the child is telling the story, to help him expand the story further.

I decided to take it a step further and make it more interesting by adding a few components pieces, like sound tracks. After consulting with colleagues and further ideation I decided to add a digital element to the idea instead of keeping it all analog. I explored the Radio Frequency Identification (RFID) system (figure 21.6).

Each tile had a unique RFID tag attached to it. When the child would scan the tile over the RFID reader, it produces a sound related to the image on the tile. This option added audio to the story, if the child wished.

The devices added were:
• 12LA RFID reader
• 125kHz RFID tags
• Arduino board
• Wave shield
• SD memory card for storing the sound tracks
• Speaker
In order to make the digital part work in the toy, I used Arduino in conjunction with an RFID system in order to emit sound tracks as the tags were scanned (figures 21.7 and 21.8).

Having the code figured out to read the RFID tags was a challenge. For the RFID reader, a box was created to contain and preserve the electrical component of the device. Only parents will have access to it by unscrewing the top to change the 9V battery. The box is engraved with prints indicating the location of the reader for the child to scan on the right location.

At first, a tray was designed, where 5 chosen images would be placed and the reader would be attached to it (figure 21.9).

I also created a storage space for both the image tiles and the puzzle pieces to be stored safely to avoid losing them. In the initial design, the tray was too long and heavy for parents so I had to modify the tray. Figure 21.10
shows the preliminary ideas about the storage and the reader box and figure 21.11 shows the final design. The final images were etched and cut on a round-edged square made from a 3mm MDF wood (figure 21.12). Figures 12.13 - 21.15 show the process and the end result of creating the final designed toy.
Conclusion

The child of today is surrounded by a range of highly technological toys and games. From televisions to computers to mobile devices and gaming consoles, children are acquainted with complex technologies that require intense focus and in so doing, separate children from the physical environment around them. Today, developmental milestones children should reach throughout childhood are either hurried or are assisted by digital devices which, by their very nature, require the use of some of the player’s natural senses but not all. One consequence of the type of play is that the senses not used are not allowed to develop as quickly and fully and they could if the child played with other types of toys and games.

The process of this thesis involved a detailed study into the behavior patterns of children of the age of preschool, as well as the choices and preferences of parents with respect to the development of their children. Data for the study were collected through a range of surveys, questionnaires, and personal observation. Analyses of these data revealed that many parents of preschool children in Qatar are concerned their children are becoming less tactile due to reliance upon high-tech games and toys. While parents do not want their children to be addicted to these gadgets, they could not avoid allowing their children to have access to these gadgets since these technologies are a part of our everyday living and therefore, children need to learn how to use them. The design solution to this problem is premised on the argument that children can also learn to enjoy playing with low-tech toys and games while playing with these toys and games, can utilize senses they do not use with the electronic gadgets. By enabling use of these senses, the low-tech toys and games enable children to develop these senses to an extent the electronic toys and games do not allow. The designs explored herein stimulate the child's sense of touch and in so doing, enhance learning and development. It was evident through these explorations and experimentations that the addition of texture had a positive effect on the child. This created a new layer of interaction and a learning point for important developmental milestones for the child (see page 15 “noted milestones by Kyla Boyse”), because the sense of touch increases learning by experience.

In addition to enabling sensory development for the users – the children – these designs also facilitate high levels of interactive parent/child play. Parents are inspired by the designs and can extend the play experience by choosing additional materials and introducing other shapes to develop new patterns of play for the child. This expanding interactivity will also facilitate the child’s progression to reach age appropriate development milestones and improve social skills and collaboration. Parental interaction also contributes to the child’s development through language and body gestures. Through these interactions, parents are able to contribute to their children’s experience by acting as mentors when they teach their children how to behave while playing, how to interact with others and with their physical environment, and how to analyze and collaborate in solving a problem. In this way, parents served as role models for their children to emulate.

The toys are designed to be universal and generic in nature, with no emphasis upon culture, race or religion; however, future directions of design could emphasize such themes. For example, blocks could display images of religious symbols instead of numbers or alphabets. The toys are also designed to be unisex but future design research could examine and analyze components that result in a gender-specific appeal and application. Moreover, future development of these toys may also target children of higher ages. Yet other future research and development could investigate toy ideas for enhancing sensory development amongst children with impairments or disabilities.

Children achieve different milestones of development through interaction, learning and play. This thesis sought design solutions to enhance use and development of the sense of touch as a catalyst for developmental learning using tactility. The toys created within this study seek to enhance the sense of touch, motor skills and interactive learning abilities of children without resorting to high-tech games and expensive technology. As one Piaget Acolyte, Massachusetts Institute of Technology professor Seymour Papert, put it, “Better learning will not come from finding better ways for the teacher to instruct, but from giving the learner better opportunities to construct.”xiii

Children achieve different milestones of development through interaction, learning and play. This thesis sought design solutions to enhance use and development of the sense of touch as a catalyst for developmental learning using tactility. The toys created within this study seek to enhance the sense of touch, motor skills and interactive learning abilities of children without resorting to high-tech games and expensive technology. As one Piaget Acolyte, Massachusetts Institute of Technology professor Seymour Papert, put it, “Better learning will not come from finding better ways for the teacher to instruct, but from giving the learner better opportunities to construct.”xiii
Thesis Abstract

Exhibition layout

Toy #1 description

Toy #2 description

Toy #1

FreebyPoup

The FreebyPoup is inspired by a child’s love of balls, 

pop. It is self-explanatory, playful and educational with 
potential involvement. It enhances the child’s sense of 
space and strengthens their vocabulary to articulate and comment 
shapes, colors and textures. The “pop” may be used 
reward good behavior, replacing the sugar shock with a 
learning opportunity.

Toy #2

Where is the Chameleon?

The Chameleon is one of the few lizards classifications that 
change its color and pattern to match its surrounding 
environment. With parental cooperation, the child learns 
the Chameleons’ environment, looks for the matching leaf 
and material from her own garden or backyard and eases 
Chameleon to match the background image. This simple 
skills adds to the child’s knowledge, strengthens their vocabulary, 
encourages their sense of touch.

RECONNECT: Designing to Touch

We live in a fast-paced world where communication and 
touch are somewhat less frequent, but increasingly 
important. We use technology to enhance our interaction with 
parents and friends. Children bear mobile phones in their 
pockets, playing games while waiting for the bus, and parents 
and friends can be connected in instant messages.

The RECONNECT project presents a new perspective on 
how mobiles in our lives are shaping the way we interact 
with each other. The design of a new generation of 
technology and mobiles needs to reflect this constant 
interaction and new ways of communicating with each 
other.

Toy #1

Toy #2

Exhibition layout
Toy #3 description

Count my angles

This toy focuses on the child’s memory and sense of touch. It consists of 5 different shapes made from 5 different materials and textures. Each of these shapes represents a number by counting its angles. With gradual involvement and cooperation, the child recognizes numbers, counting and learning in a kinesthetic and psycho-motor ways. They will also learn how mathematical concepts from sorting and matching, to counting and adding.

Toy #4 description

Tell me a story!

This toy combines a child’s imagination, self-expression, and vocabulary to build stories. The toy asks the child to choose these 5 free tiles of images, find the matching puzzle piece, and allow them to use their imagination, perception and memory to create a story. In order to keep a record of it, it is optional for the parent and the child to record the child’s story in their diary or with. Every time images change, the story differs. Parental involvement is highly encouraged, as new vocabularies could be taught to the child and other questions could be asked as the child is telling the story, to help him expand the story further.
An adult interacting with a child – Exploring the Feely-Pops

Interacting with the designed toys

Solving problem by matching pieces and creating a story

Interacting with the designed toys
A child matching a Chameleon to its environment (Grass)

Two children interacting and creating a story

Three children interacting with the designed toy

A mother interacting with her daughter – Exploring the toy “Tell me a story!”

Parents and their children figuring out how to interact with the toy
Giveaway FeelyPops for guests and children to take home and explore.

Guests interacting.

Guests watching instruction video on how to play with exhibited toys.

Giveaway FeelyPops for guests and children to take home and explore.

Guests interacting.

Children watching instruction video on how to play with exhibited toys.
A mother and few children watching instruction video on how to play with exhibited toys

Guests watching instruction video on how to play with exhibited toys

Thank you for interacting with my mummy’s toys!!!
Appendix I

Survey questions:

1. How would you describe your child when it comes to interacting with toys? (Does he like playing with his toys, prefer going out, or prefer playing with real objects, such as frying pans, spoons, coins, etc.)?

2. How would you describe your child when he is interacting with any kind of technology (TV, Wii, PS3, i-phone, etc.)?

3. What is his favorite toy (it could be technological)?

4. What does your child ask for when he is bored?

5. Is your child more tactile (likes to use his hands and senses) or more visual (likes to watch and hear things more or listen to music)?

6. How worried or happy are you about your child’s being more tactile and/or visual?

7. Does he play and eat? Or sit, eat and then play?

8. If he plays and eats, what does he play with while eating?

9. If you are trying to complete a task and your child is in your way (very naughty and noisy), what would you give to keep him quiet?

10. If your child plays with any kind of technology, how many hours would he spend with it?

11. What did you used to do when you were a child? How would you spend your spare times?

12. At what age did you introduce your child to digital devices?

13. Are you happy that your child is using more technology or are you happy that your child is not into technology?

14. Any comments or additions?
Appendix II

Research Questionnaire on preschoolers and technology

Researcher: Dana Rohani – MFA student at VCUQ
Targeted age: 3.5 years old to 5.5 years old

Survey Date:

Your name:     Child name:     Child age:     Gender:

Please answer the below questions [only if you have siblings or/and son/daughter aged 3.5 to 5.5] by carefully circling the best suitable answer. You can ask the child some of these questions if required.

I appreciate your help in the research. No names will be mentioned in final result.

1. How many hours does your child watch television or DVDs each week?
   a. 1 – 10 hours
   b. 10 – 19 hours
   c. 20 hours or more

2. Does your child have access to Internet at home?
   a. Yes
   b. No

3. What type of digital (phone) games does your child play?

4. How many hours each week does your child play digital games, e.g. I-pad, I-pod, phone...etc.?
   a. Never
   b. 1 – 5 hours
   c. 6 – 10 hours
   d. 10 hours or more

5. Does your child have his/her own mobile phone?
   a. Yes
   b. No

6. Does your child have his/her own I-Pad?
   a. Yes
   b. No

7. Do you supervise the time your child is on the digital device (computer, phone, I-Pad...etc.)?
   a. Yes
   b. No

8. How many hours per week do you sit and play with your child?
   a. Never
   b. 1 – 5 hours
   c. 6 – 10 hours
   d. 10 hours or more

9. How many hours per week does your child play physical, interactive games (non digital) – e.g. storytelling, pretending, puzzles, Play-Doh, building blocks...etc.?
   a. Never
   b. 1 – 5 hours
   c. 6 – 10 hours
   d. 10 hours or more

10. How many hours per week does your child play outdoors (e.g. cycling, football, running, hide and seek...etc.)?
    a. Never
    b. 1 – 5 hours
    c. 6 – 10 hours
    d. 10 hours or more
11. Please select: which of the two following options does your child focus on more and can spend over 15 minutes without getting bored?
   a. Digital games [e.g. I-Pad, phones... etc.]
   b. Non-digital games [pretending, puzzles, Play-Doh, building blocks... etc.]

* Please state why you think they stay focused on your chosen option?

12. Story telling: How many minutes can your child stay focused if you are reading to them a story?
   a. Never
   b. 1 to 7 minutes
   c. 8 to 15 minutes
   d. 20 minutes or more

13. Please circle what your child does as part of their daily bedtime routine (you can circle more than 1):
   a. Bath/Shower
   b. Reading/read to
   c. Watching TV
   d. Listen to music
   e. Playing digital games
   f. Others

14. Please circle what your child does as part of their daily morning routine (you can circle more than 1):
   a. Bath/Shower
   b. Reading/read to
   c. Watching TV
   d. Listen to music
   e. Playing digital games
   f. Others

15. Does your child show any change in behavior when they play on the computer? Please give an example...

16. Does their mood change according to the success of the game they are playing? Please give an example...

17. Do you think that your child’s exposure to digital devices like I-pads, phones... etc. is affecting them negatively or positively? Please explain why...

18. Do you feel you are more distant from your child than you were with your parents when you were at his/her age? Please explain why...

19. Please add any comment:

Thank you for your help. If you have any questions or you would like to receive a copy of the results, please e-mail me on dsrohani@vcu.edu

Note: this questionnaire is to help me in building my thesis and to obtain the findings I need to support it.
Appendix III

Survey questions:

Questionnaire on Preschoolers and Technology
Topline Data – 15 families

1. How many hours does your child watch television or DVDs each week?
   a. 1 – 10 hours  11
   b. 10 – 19 hours  4
   c. 20 hours or more 0

2. Does your child have access to Internet at home?
   a. Yes   10
   b. No   5

3. What type of digital (phone) games does your child play?
   a. None   3
   b. Digital Games (iPad, iPhone, Computer, Websites) 9
   c. Educational Games 3

4. How many hours each week does your child play digital games, e.g. I-pad, I-pod, phone...etc.?
   a. Never   1
   b. 1 – 5 hours  8
   c. 6 – 10 hours  6
   d. 10 hours or more 0

5. Does your child have his/her own mobile phone?
   a. Yes   1
   b. No   14

6. Does your child have his/her own I-Pad?
   a. Yes   9
   b. No   6

7. Do you supervise the time your child is on the digital device (computer, phone, I-Pad...etc.)?
   a. Yes   13
   b. No   2

8. How many hours per week do you sit and play with your child?
   a. Never   0
   b. 1 – 5 hours  4
   c. 6 – 10 hours  6
   d. 10 hours or more 5

9. How many hours per week does your child play physical, interactive games (non digital) – e.g. storytelling, pretending, puzzles, Play-Doh, building blocks...etc.?
   a. Never   0
   b. 1 – 5 hours  3
   c. 6 – 10 hours  2
   d. 10 hours or more 10

10. How many hours per week does your child play outdoors (e.g. cycling, football, running, hide and seek...etc.)?
    a. Never   1
    b. 1 – 5 hours  7
    c. 6 – 10 hours  3
    d. 10 hours or more 4

11. Please select: which of the two following options does your child focus on more and can spend over 15 minutes without getting bored?
    a. Digital games 4 (e.g. I-Pad, phones...etc.)
    b. Non-digital games 7 (Pretending, puzzles, Play-Doh, building blocks...etc.)
    c. Both 4
12. Story telling: How many minutes can your child stay focused if you are reading to them a story?
   a. Never 0
   b. 1 to 7 minutes 2
   c. 8 to 15 minutes 8
   d. 20 minutes or more 5

13. Please circle what your child does as part of their daily bedtime routine (more than 1 answer was selected per child)
   a. Bath/Shower 11
   b. Reading/read to 9
   c. Watching TV 2
   d. Listen to music 2
   e. Playing digital games
   f. Others:
      i. Reading prayers 4
      ii. Drawing and Coloring 1
      iii. Singing Songs 1

14. Please circle what your child does as part of their daily morning routine (more than 1 answer was selected per child)
   a. Bath/Shower 7
   b. Reading/read to 3
   c. Watching TV 5
   d. Listen to music 2
   e. Playing digital games
   f. Others
      i. Praying 3
      ii. Playing Outside 1
      iii. Breakfast up dress up 1

15. Does your child show any change in behavior when they play on the computer?
   a. No Change 6
   b. Excited 1
   c. Negative Behavior 8
      (Aggressive, ignore, stress, hyper, absent minded, agitated, immersed)

16. Does their mood change according to the success of the game they are playing?
   a. No Change 12
   b. Yes 3

17. Do you think that your child’s exposure to digital devices like I-pads, phones...etc. is affecting them negatively or positively?
   a. Negative 4
   b. Positive 7
   c. Both 4

18. Do you feel you are more distant from your child than you were with your parents when you were at his/her age?
   a. Yes 5
   b. No 10
Bibliography


“GENERAL DISCUSSION.” *Monographs Of The Society For Research In Child Development* 34, no. 6 (September 1969): 33-37.

Green, Laura. Personal interview. December 6, 2012


Horton, Jason. Questionnaire. March 2, 2014


Bibliography

http://www.babycenter.com/0_a-parents-guide-to-computer-games_64180.bc(accessed 23.10.12)


All figures are cited except the ones taken personally by myself, which are not mentioned below.

Figure 1: “Feely Box Game”. activitiestoshare.co.uk, http://www.activitiestoshare.co.uk/p/194/feely-box-game (Accessed March 20, 2014).


Figure 5: “Learning Resources Teachable Touchables”. amazon.co.uk, http://www.amazon.co.uk/Learning-Resources-3049-Teachable-Touchables/dp/B000KTC7G [Accessed April 14, 2015].


Ibid.

Ibid., 65.


Lourdes Mangune. Personal interview. 25.11.2012

Laura Green. Personal interview. 06.12.2012

Jason Horton. Questionnaire. 02.03.2014

Look, Listen and Feel, 22-25.
Dana Seros Rohani, BFA In Interior Design, Virginia Commonwealth University
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