

PHYSICAL ENVIRONMENT AND CREATIVITY: COMPARING CHILDREN'S DRAWING BEHAVIOR AT HOME AND AT THE BOOKSTORE

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ABSTRACT:

We are interested in the role the physical environment plays in the development of children's creativity. To understand this relationship we asked children to draw and answer questions in two different environments. Children between 4-6 years of age draw what they think and not what they see. A drawing could reveal how children solve problems and how they feel about their environment. Based on our data analysis, environmental characteristics such as brightness of the space, colors of the walls, height of the furniture, visual exposure to more detailed paintings or objects are believed to influence children's problem solving and creative thinking ability.

Key words: Creativity in children, children's drawings, children –friendly environment, content analysis, vital point of interaction at home

1. INTRODUCTION

Young children spend most of their time at home. Although some spend a lot of their time at outside facilities such as daycare center, kindergarten, or school, most children still recognize home as their permanent space. They become attached to their home and feel safe and secure when they are at home. They attach meanings to their home and that becomes part of their culture (Super and Harkness, 1999). Children's experiences and images of early childhood are "the most deeply scored and enduring" (Dudek, 2000). Children develop interests at this environment, which helps them resolve inner conflicts, make sense of their existence, and develop self-regulation and self-concept (Cohen, 1999). Cohen states that "the passionate interests of young children can be thought of as the seeds of adult creativity." Creativity has been the subject of interest and study for the past 60 years. Still, creativity is mysterious! It is hard to do systematic analysis. This makes it hard to understand and explain why and how creativity happens and what elements it is related to (Fishkin, 1999). Furthermore, the variety of definitions of creativity among researchers makes it even more complicated to understand and study because there is no definitive meaning accepted by all. People define creativity as the ability to produce novel and original work within specific framework and limitations (Guignard, 2006). Creativity is commonly believed to be the source of human progress and advancement. Children are creative by nature. Social psychologists argue that creative people begin their creative production early in life. Resnick states that children are 'born with a natural impulse to explore and experiment, so we need to help them develop it further' (Chowns, 2003). What are the signs of creativity in children and how can we recognize it? Gelman and Gottfried (2006) believe that young children's ordinary thought and their made-up vocabulary, language or characters are the result of significant degree of creativity. Children who always pretend to do things have a more creative imagination.

The next question is, can we enhance creativity with environmental factors? Research showed that different factors such as formation of interests (Cohen, 1999), motivation (Fasko, 2006) and the culture one grows up within (Super and Harkness, 1999) can impact children's creativity. Can a stimulating physical environment enhance children's creativity? We believe that the physical environment that children grow up within strongly influences their problem solving and creative thinking abilities. Therefore, we are interested in studying how environmental surroundings impact children's creative behavior.

Increasingly, more children in the U.S. are growing up in large houses in the suburbs where they have a designated bedroom in an isolated part of the house. Although this place provides them with privacy, an important factor in formation of their social behavior, we observe that children rarely spend time in their own rooms. They prefer to be closer to the central location of interaction in the house where most activities of the family members take place. Usually, families have not prepared a children-friendly environment in the activity centered location of the house. Places such as the kitchen or the living room often become the vital points of interaction at most houses. As a result, children spend most of their time at such environments not designed for them. The need to be in the central location of the house could be a reason why many children spend a lot of time in front of TV or play electronic games in the living room. Although the importance of physical environment in nurturing children seems obvious and guidelines for the design of children's areas have been suggested, few studies explored the significance of the roles physical environments play on children's creativity. In this study, we are interested in investigating children's behavior and their ability in problem solving at their home and other environment to understand how physical environment affects their creative thinking. Also, we would like to know what elements in an environment might possibly have impacts on children's creativity. This could suggest how parents should arrange or integrate a small "children's place" that is closer to the central area of activity in the house. This will provide children with a chance to have a choice between having privacy (going to their rooms) or being closer to their parents in a more centrally-located place.

2. METHODOLOGY

Two sets of environments were chosen for the purpose of this study. The first location was the children's home. Home is the primary care giving environment and it has been the subject of interest for researchers. Physical environment is an element that contributes to the quality of care giving along with other elements such as parental response to children's needs, learning materials, modeling and variety of experiences (Bradley, 1999). Three characteristics of the space were controlled and kept consistent in all study settings. The locations chosen for observations were 1) centrally located, 2) had no daylight, and 3) no view to nature. The second chosen location for our study was the "children's area" at Barnes and Noble bookstore. It is a friendly environment specifically designed for children.

To understand the effects of the environment on children's problem solving and creative thinking ability, we conducted a series of different experiments. First, children were asked to learn and play a game called "Zingo," a game similar to "Bingo." Zingo uses different shapes and animals on the cards as shown in Figure 1. We were interested to know how fast the children can learn a new game and how well they can play it. Then they were asked to perform a drawing task using two circles that were previously drawn on a piece of paper. As there is no standard test for creativity (it is not an IQ test), we designed our own drawing test. Drawing is a problem-solving activity embedded with artistic development and feelings. Children's drawings are often used in psychology to assess child personality, intellectual development, communication skills, emotional adjustment, and to diagnose learning disabilities. This test was designed to help us understand how children approach and solve a problem, and assess how they feel about the specific environment they were in when performing the tasks. Finally, they were asked to comment about the environment and answer questions such as how comfortable the space was, how much they liked it, and even how they would redesign it and why!



Figure. 1: Zingo game.

All children were videotaped when they were playing the game and when they were making the drawings. We performed content analysis of the videotapes to understand how children performed these tasks. We were especially interested in finding out how the children responded to their environment through their body language. Children's problem solving ability was analyzed based on two factors. One was the speed they learned to play a new game and how well they carried it on. Their drawings were analyzed to see how and in what ways they solved the given problems and how well they expressed themselves. This assessment was performed based on the colors and the concepts they used in their drawings.

To understand the drawings and find relationships between children's drawings and creativity, and the impacts of the environment on children, we asked three questions:

1. What are the characters and meanings in children's drawings?
2. What are the characteristics of children's creativity?
3. What are the known attributes of physical environments designed for children?

3. EXPERIMENTAL SETTING

The first phase of the experiment took place at the children's home, the familiar environment they spend most of their time in. The second phase was conducted at the children's area in the Barnes and Noble bookstore. Parents of the children were present when the researcher interacted with the children during all tasks. Below, we briefly describe each experiment session and present these children's drawings.

3.1. SUBJECT 1: SAM¹ (MALE, 4 YRS. OLD, BILINGUAL)

Sam is the first child of the family with a younger brother. He, his brother and his parents live in a 2 bedroom apartment in Atlanta. The observation session with Sam started by playing Zingo at the dinning table. The dinning table is located adjacent to the living room that has an open kitchen. Sam learned Zingo as soon as the game was explained to him. He played well and missed only a few cards during three rounds of the game. During the time the game was introduced, Sam rested his knees on the chair to increase his height and to get closer to the game on the table. He was probably trying to have more control over the game. He kept this pose while he was learning the instructions. When he became more comfortable with the game, he sat back on the chair and took a more relaxed and comfortable position.

After the game, the observer asked Sam to use the pre-drawn circles to make a drawing. He listened quietly for the instructions without interrupting the researcher. Figures 2 and 3 show the four year old Sam's drawings. It is evident that the drawings are just pure scribbling (Franz, 2007). Although drawing was not the right test for Sam, this boy exhibited very interesting

¹ Psuedo names are used in the paper to protect the privacy of the children.

behavior. He would not answer to the observer's request to explain how he felt or in what position he was most comfortable in that environment at home. However, Sam's body language clearly indicated his feeling about the environment. For example, when he sat on his knees on the chair to appear taller in height, it was obvious that the height of the chair and table were not appropriate for him. He adjusted himself so he can see the game cards on the table.

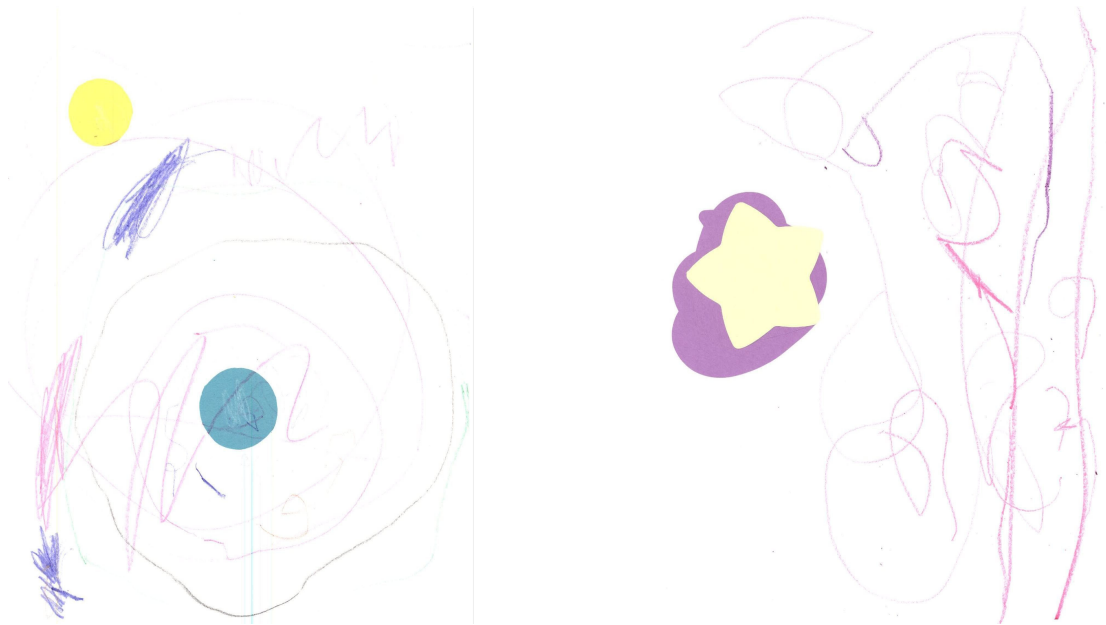


Figure 2 and 3: Sam's drawings.

Later, the researcher sat with him on the floor to observe if he behaves differently. It was very obvious that he became more comfortable at the situation. He became friendlier toward the observer and started having more interactions with the observer on the floor. He knew the shapes well and when asked to name the shapes, he brought the proper object to the experiment although he was not asked to do so.

Due to the fact that drawing was not the right test for a four-year-old and we could not understand much from his scribbling, we did not continue the experiment with Sam at Barnes and Noble bookstore. However, the session with him at his home revealed interesting results that would be discussed later in the paper.

3.2. SUBJECT 2: ASHLEY, (FEMALE, 6 YRS. OLD, FIRST GRADE, BILINGUAL)

Ashley is the first child of the family and lives in a six bedroom two story house in the suburb of Atlanta with her parents and her 3 year old bother. She has her own room upstairs but spends more than 90% of the time she is home downstairs and in the living room which is adjacent to the kitchen (she is at school from 8:00 AM to 2:45 PM). The session with her took place in the evening at the breakfast area that is next to the dinning room (shown in Fig. 4). The walls are light green and calming. The window blinds were shut at the time of observation. The area was bright. The main lighting at the breakfast table came from the ceiling light. In general, the environment was open and bright, but not a children-friendly environment. This breakfast area between the kitchen and the living room is designed for adults. Ashley spends most of her time in the living room. The only child-friendly furniture in the living room are one low table and two small chairs.



Figure 4: The home environment the experiment took place at.

3.2.1. FIRST PHASE: ASHLEY AT HOME

Ashley was first given the instructions to play Zingo and she immediately learned and started playing. She missed only two cards during three rounds of game. She was very energetic and excited about the game. She enjoyed being competitive.

Next, the observer asked her to make a drawing using the two circles previously drawn on a piece of paper. The circle on the top was yellow and the other one place about the middle of the page was green. She immediately started drawing and made a sun out of the yellow dot and a red

flower with the green one. She added a blue sky, white clouds, green ground and a pink and purple butterfly. Her drawing is shown in Fig. 5 below (unfortunately some colors are not very clear in the picture).



Figure 5: Ashley's first drawing using two pre-drawn circles. The circle on the top was yellow and the other was green.

Psychology research on children's drawings indicates that different colors may represent different feelings in children especially if used repeatedly and extensively (Franz, 2007). For example black can be a sign of depression or feeling hopeless or restricted; red shows intense anger; blue and green resemble calm colors, and yellow and orange illustrate cheerfulness (Franz, 2007). The colors Ashley used in her drawing are blue, green, red, yellow, and purple respectively in terms of the amount of the color used. Her drawing is in general calm and peaceful, but the objects she drew are not very creative and according to her previous drawings a blue sky, green ground, flowers and butterflies are subjects of her interest and she usually does these if there is no subject and it is just free drawing. To see if she draws something different, the night after the first session, the observer repeated the drawing experiment and asked Ashley to use two circles and draw something. This time a yellow circle was previously drawn at the bottom of the page

and a pink one on the top. Ashley first complained and said: “this is not right. Yellow should be on the top.” She immediately figured out what to do and turned the page upside down and made the drawing shown in Fig. 6. This shows that as soon as she saw the yellow dot, she associated that with the sun and knew what she wanted to do without thinking about another subject. She made the same drawing as the night before, but this time she used darker markers and as a result her drawing is clearer.

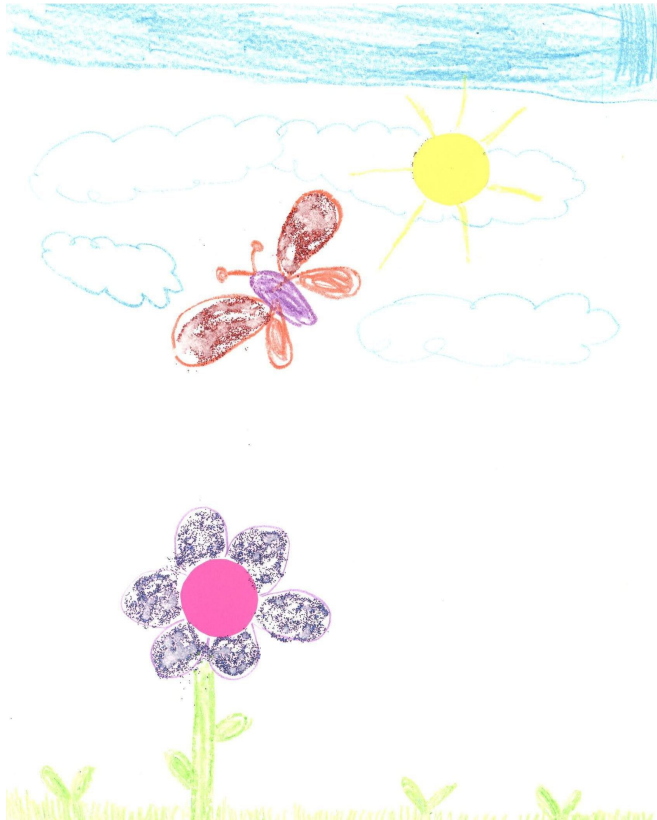


Figure 6: Ashley's second drawing using two circles.

The observer asked Ashley whether she would repeat the same pattern if she was asked to make another drawing using two circles. She said she was not sure. We then asked what else she could draw using a circle to make her think about other objects. She said she could do a ball or the head of a person. In general, she preferred to stay simple and clear. Her drawings were not complex, but bright and happy. She was a very happy, talkative, smart and sharp girl. These characteristics did not seem to have much to do with the creativity; at least they were not much evident Ashley's drawings.

After the first drawing, the observer took Ashley to the living area and sat with her on the floor and asked if she prefers sitting on the floor. Her reply was: “sometimes I am more comfortable sitting on the floor.” We asked: “How about lighting? Do you prefer the lights on and very bright or dimmer?” She replied strongly that she does not like it dark or the night time; “it is boring and dark and I have to sleep.” She did not have much idea about the furniture. We asked her what color she would have picked for the walls if she had the choice. She replied with excitement: “I would color the walls black with pink and purple stars!” We asked her why she did not spend time at her own room and she answered that she did not like to be alone. She said: “Cameron (her brother) bothers me sometime here (downstairs), but still I prefer to be here.”

The last task was to ask Ashley to draw anything she liked. She seemed excited and suggested that free drawings were more fun! Of course she felt limited when she was given two circles to use and did not like to have a framework to work within. She drew an Egyptian mummy shown in Fig.7. She did not use any color and just sketched it using a black pencil. According to her mother, the Egyptian mummy was the subject of her last week drawing class and she had done it again and again later on!



Figure 7: Ashley's free drawing. An Egyptian mummy.

We learned a little bit about Ashley, but we did not know whether the patterns of her drawings would change if the elements of the environment changed. The next step was to take her to the children's area in the Barnes and Noble.

3.2.2. SECOND PHASE: ASHLEY AT BARNES AND NOBLE

The Barnes and Nobles' children's area is an environment specifically designed for children. The one we chose had no windows and exposure to day lighting and nature since we were trying to keep these elements controlled in the experiments. The space was very bright, cozy and friendly. The furniture were all low and appropriate for the height and physical comfort of the children. Figure 8 shows some pictures taken at Barnes and Noble's children's area. The furniture and the paintings on the walls give children visual exposure to more shapes and figures. In this environment children could sit on the floor or on the low chairs. During the story-telling time it appeared that most children preferred to sit on the floor.



Figure 8: Pictures from Barnes and Noble's Children's area showing children during story-telling time (left) and during coloring and drawing time (right),

We attended the story-telling time presented on by Miss Mary. Her story was about the life of a little caterpillar and then she gave children some pictures to color and also some problems to solve. These problems required knowledge of alphabets, lower-case and upper-case letters and recognizing the size of different types of caterpillars. Ashley performed all these tasks very well and did not have any mistake. This was not part of the plan, but since it was a good problem-solving practice, the observer decided to observe and record. Then, Ashley was asked to make a drawing using two pre-sketched circles on a piece of paper. This time the pre-drawn circles were green and pink and the observer specifically asked Ashley if she could draw something different. She seemed like she wanted to solve the problem with the easiest and fastest way. She said that she knows copying is not good and she will make some changes. Fig.9 shows the drawing she

made. She still drew flowers. When she was asked to talk about her drawing she said: "These are flowers floating on the ocean next to the beach." According to her the yellow dotted spot on the top is the beach and the flowers are spread over the ocean. Again her drawing was very colorful and she used very bright and happy colors. Blue, yellow (light orange), and red are respectively the colors she used according to the amount of each color used in the drawing. Later, Ashley was asked to talk about the environment at Barnes and Noble. She said she liked the atmosphere, the low chairs were comfortable and it was fun.



Figure 9: Ashley's drawing at Barnes and Noble's children's area.

A quick comparison between Ashley's three drawings revealed that the one at Barnes and Noble was different. Although she turned circles into flowers again, she thought of a different scenery, not a common scene. The idea of flowers floating on the ocean may come from an experience she had before, but she said that was her imagination and she had not seen it before. So, the environment might have stimulated her to think of different things and to create work that was

more novel. Which elements in the space really influenced her? How can we identify elements that had positive impact on her? In the story of the little caterpillar, there was no ocean or beach. Is it possible that the story reminded her of something? How can we know if the influence came from physical or psychological elements? Could it be that the researcher asked her to think differently? These are the questions we will try to answer later.

3.3. SUBJECT 3: HEIDI, (FEMALE, 5 YRS. OLD, PRESCHOOL, BILINGUAL)

Heidi is the only child and lives in a four bedroom, two story house in Atlanta suburb with her parents. Like Ashley, she has her own room upstairs but does not spend much time in her room according to her mother. She goes to school from 8:00 AM to 2:45 PM and likes to spend a lot of time in front of TV. The experiment with her took place at the breakfast area that is next to the kitchen and has a lot of open windows as shown in the picture below. In these rooms, the walls were plain white, blinds were open at the time, but it was at night without any day lighting. The main lighting at the breakfast table came from the ceiling. In general, the environment was plain and cold and not children-friendly.



Figure 10: The home environment the experiment with Heidi took place at.

3.3.1. FIRST PHASE: HEIDI AT HOME

Heidi was first given the instructions to play Zingo and she immediately learned and started playing. She missed about eight cards during three rounds of game. In these three rounds she did not show much interest in the game and did not have much confidence. Ashley was present there. It seemed Heidi's only motivation to play was the presence and excitement of Ashley.

The researcher then asked Heidi to make a drawing using the two circles previously drawn on a piece of paper. The circle on the top was yellow and the other one about the middle of the page was green. Ashley also received a piece of paper to draw; Heidi started by looking at Ashley's drawing. Ashley was drawing her flower and Heidi started by turning the green circle into a flower as well. But, her pattern changed after the flower and she continued drawing without copying Ashley. Her drawing is shown in Fig. 11 below.



Figure 11: Heidi's first drawing at home.

Heidi turned the yellow dot into the moon and colored the sky black to indicate night time. She said the blue stars are snow and the building is Mellow Mushroom (a restaurant). She drew one happy girl on the roof and another one behind the window and mentioned that she was the one behind the window. The dominant color in Heidi's drawing is black, which is not a good sign in children's drawings and can be a sign of depression or feeling hopeless or restricted (Franz, 2007). But, it is possible that she drew night time because that was what she could see through the window. On the other hand, researchers believe that drawing develops through distinct stages and from ages 4-7, children draw what they know and not what they see (Franz, 2007).

Whichever it is, it is different unusual among children to draw black sky. Snow is another element in her drawing that makes it interesting; Heidi lives in Atlanta and has not seen much snow. All these factors indicate that Heidi has good imagination and she can think of things that seemed to be unique and different at her age.

Next, the observer asked Heidi to sit on the floor with her in the living room and asked which position she was more comfortable at. Heidi replied she liked sitting on the floor. She said she did not like night time because nights are dark. She preferred brightness and did not like to be alone. She did not know what type of furniture she liked or what color she liked for the walls.

The last thing Heidi did was performing a free drawing. Heidi used only a black pen for this exercise. She might have done this since Ashley started drawing her Egyptian mummy using a black pen. Fig. 12 below shows the free drawing by Heidi. She said this is “Marco Brown”. “Marco Brown” is not a known character like Cinderella and it is Heidi’s imaginary character; a character that she invented. According to Gelman (2006), “young children’s ordinary thoughts entail a considerable degree of creativity.”



Figure 12: Heidi’s free drawing at home. She said this is “Marco Brown.” Marco Brown looks like a smiling girl with long hair wearing a dress, having wings and a heart shape balloon above her head.

3.3.2. SECOND PHASE: HEIDI AT BARNES AND NOBLE

Heidi also attended the same story-telling time and listened to the story of the little caterpillar². She did not show much interest in playing with other kids and claimed that she did not know how to do the problem solving activities. The observer explained to her and she took her time to solve them. She was obviously not as excited and competitive as Ashley and did not actually care if she finished an activity first or last.

Then, the observer asked her to use the two pre-drawn circles and make a drawing. Fig. 13 shows Heidi's drawing at Barnes and Noble.

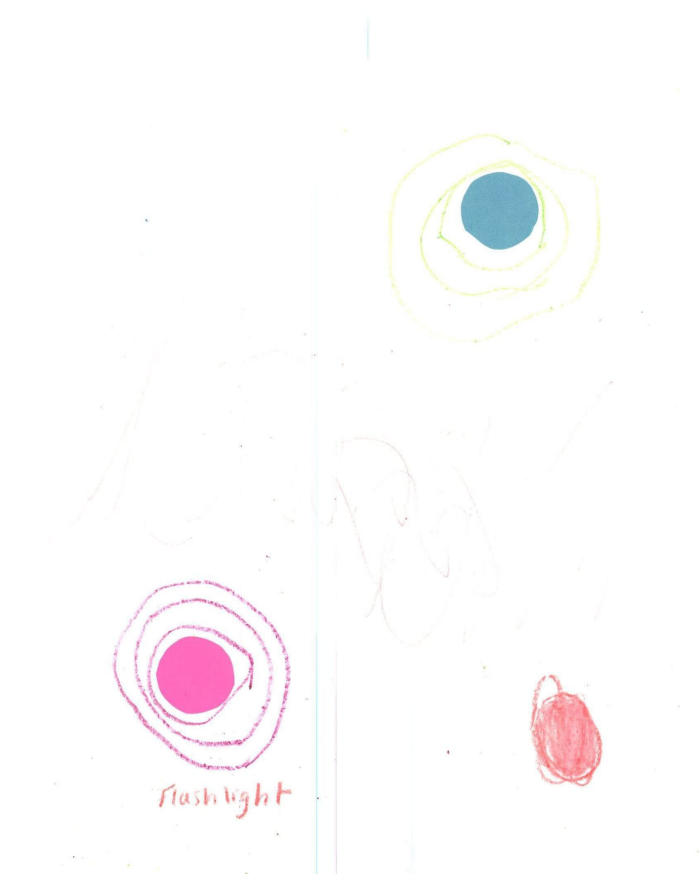


Figure 13: Heidi's drawing at Barnes and Noble. She said she drew flashlights.

² We had run the first phase of experiment at children's home environment first and then the observer took both Heidi and Ashley to the Barnes and Noble. Every activity and any condition Ashley was exposed to during this phase of experiment, Heidi also experienced.

Heidi drew three green circles around the green dot and three pink circles around the pink dot (the red circle on the right side is not part of her drawing; she was just trying out a marker)! The researcher first assumed Heidi was bored and did not want to draw, but Heidi said she was done and when we asked what she has drawn, she confidently said “flashlights!” Drawing an object such as flashlights was special and different by itself and showing it with very simple lines was even more fascinating.

Afterward, Heidi was asked to make a free drawing. Her drawing is shown in Fig. 14. She drew a rainbow, a plum tree, a woodpecker and its nest, flowers, Ashley and herself! Again, she chose interesting subjects to draw. She used any dominant color but used orange, yellow, purple, brown, green, and blue. There was no dominant color in her drawing this time. In general, her drawing was happy, remarkable and meaningful.



Figure 14: Heidi's free drawing at Barnes and Noble.

Finally, the observer asked if she liked the environment and she approved by moving her head up and down. She said she liked sitting at the low tables and chairs and the brightness of the space. She also said she liked the paintings on the walls and the books around. She thought having more cartoon characters and animal paintings around is like having more friends.

4. Further Analysis

A more detailed comparison and analysis of each child's behavior revealed how environment might impact children's creativity abilities and also what elements in a space could play a role in enhancing creativity in children. The content analysis of the videotapes took into account two main factors:

1. The space characteristics in terms of size (small, medium, large), openness(closed or open), lighting (bright, dim, dark), colors (plain, busy, warm, cool, cold), furniture (material and height), exposure to more detailed visual objects or paintings (limited, some, a lot), and overall atmosphere (cozy, uncomfortable, not cozy). As mentioned in section 2, methodology, in all cases, we tried to pick an area at home that is the vital point of interaction in the house in which family members spent most of their time at. All experiments, except the one at Barnes and Noble³ were run at night time and there was no exposure to daylight or to nature.
2. The drawing characteristics in terms of size (full page, half page or small area), colors (bright, dark), intensity and amount of colors (heavy, light), and objects and things drawn (plants, animals, people, buildings, and etc.).

4.1. SPACE CHARACTERISTICS

A summary of space characteristics of each child's home environment and Barnes and Noble is shown in Table 1. These are the characteristics observed during the sessions. In all cases the researcher and the children had the opportunity to sit on the floor.

³ Although the experiment at Barnes and Noble was run during day time, there was no window.

	Size	Lighting	Colors	Furniture	Visual things	Overall atmosphere
SAM's home	Small and limited	Bright	Plain but not cold (white walls)	Wood table and standard height	Limited	Small and cozy.
ASHLEY's home	Large and open	Bright but not intense	Plain and cool (light green walls)	Glass table and standard height	Some but not childish	Open and cozy.
HEIDI's home	Medium but limited	Dim but not dark	Plain and cold (cream walls)	Glass table and standard height	Limited	Close and not very warm.
Barnes and Noble's children's area	Large, but surrounded with books	Very bright	Warm colors along with paintings	Wood tables and chairs, low height	A lot, surrounded with visual things	Warm, happy and cozy

Table 1: Space characteristics of different environments.

As it was mentioned before, we did not perform the experiment with Sam at Barnes and Noble. However, the experiment with him at home still revealed an interesting result about space. He obviously was more comfortable sitting on the floor. He started communicating with the observer. It was hard to understand him since he was bilingual, but he did not give up and tried to make a closer relationship with the researcher.

In the case of Ashley and Heidi, they both claimed that they liked their home environment. They mentioned that they liked to have more toys around. But they did not like to go all the way upstairs to play with their toys. When the observer asked them why they do not spend time at their rooms they said that they do not like to be alone! They both preferred brightness and said that sometimes they liked sitting on the floor; but, they did not know why. They both did not comment much about the furniture and the colors.

4.2. CHILDREN'S DRAWING CHARACTERISTICS

Here, we present the results of the analysis of children's drawings at home and Barnes and Noble. These results are summarized in tables 2 and 3⁴.

⁴ There was not much we could conclude from Sam's scribbling; as a result his drawings were not analyzed in this section. He did not draw any meaningful object and the colors he used were random.

	Size	Colors	Intensity and amount of colors	Objects
ASHLEY's drawing	Full page	Bright (blue, green, red, yellow)	None (all colors were used on the same level)	Nature (sky, butterfly, and plants)
HEIDI's drawing	Full page	Dark colors on the top (black). Bright colors at the bottom!	Very intense black (the most used)	Nature (night time sky, snow, and plants) house, and people

Table 2: Drawing characteristics of each child at home environment.

	Size	Colors	Intensity and amount of colors	Objects
ASHLEY's drawing	Full page (all colored. No white space)	Very bright (blue, green, red, yellow)	A lot of blue. Very intense colors	Nature (ocean and beach) and flowers
HEIDI's drawing⁵	Full page	Different bright colors (green, red and yellow were used mostly)	Even distribution of colors	Nature (rainbow, plum tree, plants) and people

Table 2: Drawing characteristics of each child at Barnes and Noble.

Comparing these two tables shows that children performed differently at home environment and at Barnes and Noble bookstore. There might be different psychological reasons for that. It could also be the influence of the physical environment. The colors, complexity and novelty of the objects drawn by Heidi and Ashley at Barnes and Noble are higher. Although Heidi's drawing at home was creative, she had used a lot of black. Remarkably, in her first drawing at Barnes and Noble (the flash lights), she solved the problem of making an object with the circles in the fastest and simplest way. She just drew basic circles around the pre-drawn circles and made flashlights!

5. DISCUSSION

Physical environments are not just architectural structures. We attach meaning to our surrounding and that becomes part of our culture. Our empirical studies showed that change in performance and creativity of children can occur in different environments. According to the children

⁵ Her second drawing shown in Fig. 14 was chosen for the purpose of analysis.

interviewed in this study, they like to be in bright spaces. They do not like to be alone and they like to have more toys around. It seems their creativity performance is higher when furniture and colors are designed according to their needs. That is what we refer to as a more children friendly environment.

Children, especially at the US suburb houses do not have such area close to the central point of interaction at home. They have their private rooms, but they do not spend a lot of time there. They grow up in environments that are designed for adults. Having a children friendly environment closer to the focal point of interaction at home could give the children the opportunity to establish better relationship with their surrounding. Since they make friends with their dolls, toys and other objects, having the proper physical environment might help reducing the negative impacts of other factors around. This gives them the chance to interact more with their environment, to explore more and think more, which all can help enhancing their creative thinking ability.

Some elements of the physical environment that might play a role in enhancing children's creativity could be: 1) brightness of the space, 2) less use of cool colors and more warm colors (McCoy, 2002), 3) visual exposure to more children-friendly objects that are composed of basic shapes, 4) the use of low height furniture or no furniture (sitting on the floor), and 5) an environment that increases the sense of security and protection.

For future work we would like to test the impact of other elements and factors in the physical environment. These elements are: 1) the view and exposure to natural environment, 2) the use of natural materials, 3) exposure to day lighting, and 4) the use of other basic shapes such as triangles or squares for problem solving exercise.

REFERENCES:

- Boden, M. (1995). Creativity and Unpredictability, in *Constructions of the Mind: Artificial Intelligence and the Humanities*, Vol. 4, issue 2, (eds) by Stefano Franchi and Güven Güzeldere
- Bradley, R. H. (1999). The Home Environment. In S. L. Friedman & T. D. Wachs (Eds.), *Measuring Environment Across Life Span: Emerging Methods and Concepts* (pp. 31-58). Washington, DC: American Psychological Association.
- Chowns, J. (2003). Toy Story. Fairfax Digital. Retrieved February 15, 2007, from <http://www.smh.com.au/articles/2003/11/21/1069027320836.html?from=storyrhs>

- Cohen, L. M., & Gelbrich, J. A. (1999). Early Childhood Interests: Seeds of Adult Creativity. In A. S. Fishkin, B. Cramond & P. Olszewski-Kubilius (Eds.), *Investing Creativity in Youth* (pp.147-177). New Jersey: Hampton Press.
- Dudek, M. (2000). *Kindergarten Architecture: Space for the imagination* (2 ed.). New York: Spon Press.
- Evans, G. W. (1999). Measurement of Physical Environment as Stressor. In S. L. Friedman & T. D. Wachs (Eds.), *Measuring Environment Across Life Span: Emerging Methods and Concepts* (pp. 249-277). Washington, DC: American Psychological Association.
- Fasko, D. (2006). Creative Thinking and Reasoning. In J. C. Kaufman & J. Baer (Eds.), *Creativity and Reason in Cognitive Development* (pp. 159-176). New York: Cambridge University Press.
- Fishkin, A. S. (1999). Issues in Studying Creativity in Youth. In A. S. Fishkin, B. Cramond & P. Olszewski-Kubilius (Eds.), *Investing Creativity in Youth* (pp.3-26). New Jersey: Hampton Press.
- Fishkin, A. S., Cramond, B., & Olszewski-Kubilius, P. (Eds.). (1999). *Investigating Creativity in Youth: Research and Methods*. Cresskill, NJ: Hampton Press.
- Franz, J. (2007). Drawings. *Encyclopedia of Children's Health*. eNotes.com. Retrieved February 15, 2007, from <http://health.enotes.com/childrens-health-encyclopedia>
- Friedman, S. L., & Amadeo, J.-A. (1999). The Child-Care Environment: Conceptualizations, Assessments, and Issues. In S. L. Friedman & T. D. Wachs (Eds.), *Measuring Environment Across Life Span: Emerging Methods and Concepts* (pp. 127-165). Washington, DC: American Psychological Association.
- Gardner, H (1994). The Creator's Patterns, in MA Boden (ed) *Dimensions of Creativity*, MIT Press, 143-158
- Gelman, S. A., & Gottfried, G. M. (2006). Creativity in Young Children's thought. In J. C. Kaufman & J. Baer (Eds.), *Creativity and Reason in Cognitive Development* (pp. 221-243). New York: Cambridge University Press.
- Goldschmidt, G. (1991). The dialectics of sketching, *Creativity Research Journal*, Vol. 4, Nov. 2, pp. 123-143
- Guignard, J.-H., & Lubart, T. (2006). Is it Reasonable to be Creative? In J. C. Kaufman & J. Baer (Eds.), *Creativity and Reason in Cognitive Development* (pp. 269-281). New York: Cambridge University Press.
- McCoy, J., & Evans, G. (2002). The Potential Role of the Physical Environment in Fostering Creativity. *The Creativity Research Journal*, Vol. 14, Nos. 3 & 4, 409-426.
- Rogers, K. B. (1999). Is Creativity Quantitatively Measurable? A paradigm for Creativity Research. In A. S. Fishkin, B. Cramond & P. Olszewski-Kubilius (Eds.), *Investing Creativity in Youth* (pp.217-237). New Jersey: Hampton Press.
- Runco, M. A. (2006). Reasoning and Personal Creativity. In J. C. Kaufman & J. Baer (Eds.), *Creativity and Reason in Cognitive Development* (pp. 99-116). New York: Cambridge University Press.
- Super, C. M., & Harkness, S. (1999). The Environment as Culture in Developmental Research. In S. L. Friedman & T. D. Wachs (Eds.), *Measuring Environment Across Life Span: Emerging Methods and Concepts* (pp. 279-323). Washington, DC: American Psychological Association.
- Vander, A.H. (1945). Formal Criteria for the Analysis of Children's Drawings. *Psychoanal Q.*, 14:426-427. Retrieved February 15, 2007, from <http://www.pep-web.org/document.php?id=paq.014.0426b>