Worcester Polytechnic Institute
Digital WPI

Interactive Qualifying Projects (All Years) | Interactive Qualifying Projects

September 2013

Animation Education With 2-D Modeling and 3-D Texturing

Congji Li
Worcester Polytechnic Institute

Edwin Nicholas McGlew
Worcester Polytechnic Institute

Malcolm Stuart Fano
Worcester Polytechnic Institute

Nicholas Barreto
Worcester Polytechnic Institute

Animation Education

With 2-D Modeling and 3-D Texturing

By

Nicholas Barreto

Li Congji

Malcolm Fano

Nicholas McGlew

Abstract

The process of educating the public about science is a difficult task when the numerous variables are taken into account. The task becomes even more difficult if the science in question is based around computers. The world of animation has become a science of its own that is now based solely around computers. This project focuses on the creation of two separate interpretations that will educate the public in the science of animation. These interpretations will use physical models to educate the public in two dimensional modeling as well as three dimensional texturing without the use of computers. The project's secondary focus is to create an evaluation plan for the interpretations so that they may be evaluated by interested organizations and adjusted to better suit their needs.

Introduction

Teaching is not any easy task with the numerous variables presented to someone attempting to teach. There are various learning styles to take into consideration when teaching. In addition, there is the issue of retention: how much one person can learn at a given time, how many times something needs to be repeated. In a classroom setting, there is one constant: you have a captive audience, one that is there to learn from you and is expected not to leave. However, in informal learning environments, such as that of a museum, the learning is self-driven. The guests are free to learn what they want, when they want, and for however long they want. The difficulty, therefore, becomes how we keep the attention of people in an informal learning environment long enough to impart the desired lesson. To understand how to do this, one must first understand how people learn. This can be broken down into three major categories: aural, visual, and kinesthetic. Some learn better by hearing, some by seeing, and some by doing. In addition to the ways one learns, we must take into account the time constraints for learning. How much can someone can learn in a given time directly corresponds to how long we can effectively teach for. We must then combine each of these aspects to create an interpretation that teaches the public the intended lesson.

Several learning models have been developed in order to better understand an individual's natural method of acquiring and processing new information. One such model is the Felder-Silverman Learning and Teaching Style Model. The elements of this model include the four learning style dimensions, the five questions that define learning style, and the five questions that define teaching style. The learning style dimensions are broken down into four components: sensing/intuitive, visual/verbal, active/reflective, and sequential/global. Both sets of questions delve into the subject of information. For a student, it is important to know what type of new information is preferred and through which sensory channel it is best perceived, as well as how it is organized, processed, and understood. Meanwhile, a teacher's main concerns with new information is what type should be emphasized, how it is presented, how it is organized, the way students use it, and the perspective the teacher has on it.

The aural aspect of these models is learning through listening. An auditory learner depends on their hearing and speaking in order to learn best. As a result, an auditory learner will show strengths in remembering conversations and oral instructions, and in classroom discussions. It is essential for the auditory learner to utilize their learning and repeating skills in order to sort through new information. When compared with visual and kinesthetic methods, aural learning is considered the most difficult. One may ask what can be so hard about putting our hearing and speaking abilities to use inside the classroom? These are two skills that are widely applied throughout everyday life. However, there are difficulties associated with auditory learning. The problems may begin to arise as early as the prenatal stage of life. This is when the development of the auditory system begins. As we age, parts of the ear and central auditory pathways continue to mature. However, there may be complications during these developmental stages. This can result in hearing loss or deafness. According to the National Institute on Deafness and Other Communication Disorders (NIDCD), 2 to 3 children out of 1,000 are born deaf or hard of hearing. Both of these cases make learning difficult. Since spoken word is still the primary communication channel, being able to hear speech is important and should not be taken for granted. This is because about 17 percent of American adults report some degree of hearing loss due to overexposure of loud sounds and noises. In addition to this, some adults lose their hearing altogether. The NIDCD states that there are about 4,000 new cases of sudden deafness reported each year in the United States.

Another factor playing into the difficulty of auditory learning is pitch. Pitch, as defined by the American National Standards Institute (ANSI), is the auditory attribute of sound according to which sounds can be ordered on a scale from low to high. It is an important aspect of auditory learning because pitch is the attribute that helps convey meaning in speech and helps determine inanimate sounds from animal sounds. The trouble with pitch is that it is not always easy to perceive. The physical properties of a sound and the precepts it generates are not always straightforward.

Teachers can work around these difficulties by understanding and respecting the student's unique background, skills, and knowledge. The teacher can further facilitate the educational experience by collaborating with a speech-language pathologist (SLP). By working together, the teacher and SLP can optimize the student's full potential.

Auditory learning remains as a learning style not commonly applied by students because of difficulties with hearing and pitch. However, it is still an integral part to various learning models. It is important that this learning/teaching style is further studied so that its benefits can be put to use within classrooms and other educational institutions.

Graphics is one of formal components of and creative addition to typical science exhibit component. To improve our exhibit, graphics would be involved and presented in their best shapes. Pictures, animations give instructions or explanations to help visitors understand the goal of their activity with relative ease and assurance of learning result. Graphics is extensively used in instructions, for example: a picture of the certain button highlights it from others; an illustration on desired result will better orient visitors about their progress. Graphis are designed to convey information efficiently.

There are four aspects associated with proper display of graphics. The first aspect is called adequate discriminability: variations in lines, intensities, or colors play an important role in perception, and they must be great enough to be easily noticed. A mark must be a certain minimal magnitude or it will not be seen1. The second aspect is, when stimuli must be discriminated from each other, the amount of change along the relevant dimension necessary to see the difference is a constant proportion of the value of the weaker stimulus2. More than one graphics together should all be in proper size to be recognized.

The third aspect is color: they are not ordered along a single dimension. The best way of thinking about the psychological similarity of colors is captured when they are arranged around a circle. Color should always be in conjunction with redundant values of intensity or saturation, which can be ordered quantitatively. Color should not be a confusion for viewers.

The fourth aspect is perceptual distortion: Everyone has seen visual illusions, but many people do not realize that the visual impressions we have of ordinary stimuli often are not veridical. Our perception of magnitude is the physical value raised to an exponent (times a scaling constant, which is known as Steven's Law). The value of the exponent varies for different stimulus dimensions3. To leave a correct impression in viewer's mind, several test runs should be conducted to verify the learning results.

A well designed exhibit should have graphics of proper size with titles or headings larger than text. Illustration should be psychologically familiar and reviewed by audiences. Short-term Memory and long-term memory could also give a hint of what should be noticed.

Short-term memory has a notoriously limited capacity, which is a bottleneck in processing4. This property will make it difficult to read a visual display if too much material is present. Perceptual grouping, how visual information is organized into "perceptual units" in short-term memory, limits the maximum information visitors should be provided. In fact, the article from Ericsson suggests that the short-term memory has a capacity of around 3 to 4 digits (color, size, name could each be one digit). Marks that are near to each other, that line up along a smooth function, that are similar in shape, orientation, color, texture and so on, that are symmetrical will tend to be seen as single group. These terms are called proximity, good continuity, similarity and symmetry5.

On the other hand, long-term Memory suffers for ambiguity: Parts of displays can be ambiguous either because labels are missing or are ambiguous or because the perceptual input corresponds to two or more patterns the reader has seen before. We also often draw inferences after recognizing the pattern in a display; sometimes the inferences are unwarranted. For example: a steep line suggests that a quantity is rapidly increasing-even if the number tells a different story.
A good visual display will have less than 4 digits of perceptual units, which will correspond to a type of pattern familiar to the viewer. New types of displays should tap into knowledge users have gathered from previous experience. The font, size, space, and relative size are important design consideration. The selection of graph, illustration would be another aspect to be looked at. In addition, 2D shapes and their 3D creations should not familiar with audiences.

Kinesthetic learning is the mode of learning during which people physically interact with something in order to better understand a concept. As with the two other main facets of multimodal learning, visual and aural, it is important to include some degree of kinesthetic interaction when explaining a concept in order to appeal to those who learn better by doing rather than by just seeing or being told. Unlike the other facets of multimodal learning, kinesthetic learning utilizes multiple sensory functions (touch, smell, taste) and involves movement. An advantage to kinesthetic teaching styles is that it appeals to both information perception and information processing. Unlike both visual and audial styles of teaching, which incite information perception as the learner is being told or shown a concept, when something is taught kinesthetically, the learner must both understand the concept at hand and also implement it with their hands. The purpose of kinesthetic learning is to understand through action, so the learner will gain some degree of new insight upon performing the concept compared to that which they had previous to the physical activity.

Informal learning environments such as museums play an important, niche role in that it allows visitors to learn at their own pace and focus only on what they are interested in. This type of self-guided learning opportunity is unique to informal learning environments because the information, represented as exhibits or interpretations, are designed to present the information in an engaging way. For many people - particularly children - who are learning something new, learning is a natural process that occurs when they are given opportunities for engagement, interaction, and discovery. In creating several interactive museum exhibits at which visitors at a museum would interact with a museum representative, we wanted to facilitate the learning of complex computer animation concepts by employing techniques that fall under the categories of visual, aural, and kinesthetic learning.

For children, play (an aspect of kinesthetic learning) is a large and important part of their development. Everyone learns through experience, but as children have had fewer experiences than adults, they are less likely to have previous experiences that are applicable to a situation or concept that is being taught. ‘Play’ is how children can experience, explore, and discover new things for themselves. Types of teaching that involve visual and aural tactics frequently expect the learner to interpret what is being taught and apply things they have experienced and know to the ideas being taught. With kinesthetic methods of teaching, those experiences and connections between motion and understanding are being made as the learner explores and discovers for him- or herself.

Kinesthetic teaching approaches have been found successful in communicating, teaching, and promoting understanding of many complex topics. In the Toys Are Us: Presenting Mathematical Concepts in CS1/CS2 study in 2000, it was found that kinesthetic activities were effective at teaching children concepts of computer science. Many other scientific concepts have been effectively taught using a physical activity to promote understanding. Such topics can be of any difficulty, so long as a kinesthetic approach is applicable and designed appropriately. There has been success with many topics: Ptolemaic vs. Copernican models for the solar system, nanoscale viral phenomena, glycolysis and the Krebs cycle, and mitosis, to name a few. Applying kinesthetic teaching methods to such topics was so successful because it helped the learners create their own associations between the concepts being taught and a physical representation of the subject matter.

When attempting to teach the public informally about new topics the concept of time becomes very important in many aspects. With the creation of a lesson plan, be it 5 minutes or 5 hours, the concept of learning with relation to time must be taken into account. The amounts of new topics that can be taught in a given period as well as the retention rate for a specific interval are vitally important. When in a museum setting the interactions are less like a lecture and more of a demonstration that requires the participation of the people being educated. That is why timing of questions and the time allowed for people to answer a question is important. Time is also important in the concept of repetition. How many times a particular idea is presented in a given period is just as crucial for retention as any aspect of teaching. With the creation of an interpretation for a museum the concept of time versus learning capacity must be taken into account for all types of people.

The time required to spend on a particular subject is particularly difficult to judge. When in a nontraditional learning environment the ability to judge is even more difficult. According to a study conducted by Wayne C. Fredrick and Herbert J. Walberg (1) that compares the retention rate of children of varying learning speeds, the slowest 10% of a population requires anywhere from 5 to 6 times as much time to learn a particular idea than the 10% percent. When presented with their information one might draw the conclusion that as long as the extra time is spent on each topic the whole group will learn it. Further in their studies Fredrick and Walberg (1) noticed a trend seen in economics, the idea of diminishing returns. In their studies the fastest 10% did not learn the subject that much better. Through the results of test scores through their experiment they determined a logarithmic line for learning ability. This meant the learning rate of the top 10% greatly reduced when that extra time is spent. Because of this logarithmic curve the idea of spending that much extra time would be more detrimental to the group than it would help. So determining the amount of time spent must be somewhere between the fastest and slowest learners, somewhere in the 2-3 times range of the fastest learners. The amount of time required for the fastest learners to sufficiently learn a subject is heavily dependent on the subject and the learning ability of the target group.

The most important factor when creating a museum interpretation is the timing of questions as well as the allowed response time. The timing of questioning depends greatly on the type of interpretation. Some interpretations require more explanation to get a basic understanding. Questions must always be placed before and after liking concepts. In Jos Eslgeest's paper The Right Question at the Right Time he discusses the use of questions in learning. The point of a question is to develop an idea in the mind of another then create a different scenario and link the two with another focused question. This allows the person learning to create the link rather than being told the link. If the person learning creates the link themselves they remember the link more easily. This also makes the person feel accomplished at their discovery making them want to continue learning. The other key part to timing questions is allowing the person enough time to think about and determine an answer. One issue observed at the museum is the short time allowed for someone to think of an answer. If the person is given sufficient time a person can make the necessary connect to come up with a proper answer. The issue then becomes how much time someone allows for an answer. This is critically important because too short of a time and the person will not think about the problem enough and we revert back to being told the solution. Too long and the person begins to feel stupid and shuts down. In a study by Lloyd Peterson and Margaret Jean Peterson, they study school aged children and their response time required to determine correct answers. The average time required to determine a correct answer if know is 2.38 seconds depending on the nature of the question. The time required vs. the frequency of corrected answers followed a negative exponential curve. At around 9 seconds the frequency was at about 20% and decreased to about 3% at 18 second. The time required for a 50% correct answer rate is about 6 seconds. So if the questioner allows the person between 6-9 seconds before offering help the person will be allowed sufficient time to create the correct connections. After about 9 seconds the person has an 80% chance of either guessing or making wrong connections. The timing of questions as well answers is critically important to the success of a learning situation.

The timing involved in a museums interpretation is vitally important but most of the values require variables that change drastically depending on many factors. Most of these factors have to be either determined on site or through extensive testing.

As one can see there are many variables in the world of teaching and many of those come down to individual situations that must be judge at that time. For the variables that are not so situational dependent we must determine values for the interpretations that will be created. For this a construction of a prototype and the testing of these variables will allow for a generalized outline for how to teach someone a new subject in a museum setting. This information is vitally important in the creation of the Interpretations that are being devolved here. The Use of multimodal learning was used in great depth for the development of both the interpretation as well as the evaluation that is to be used by other institutions.

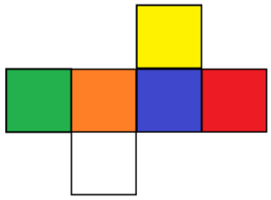
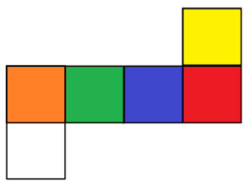
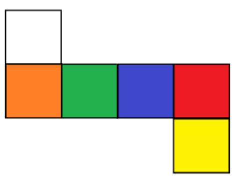
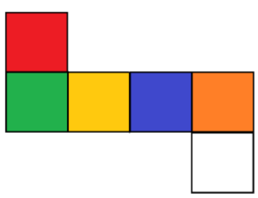
Materials and Methods

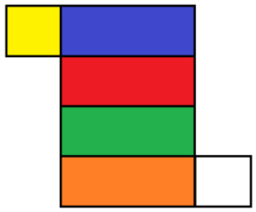
The interpretations being developed are to be used to teach an audience about the creation of three dimensional objects in a way that an animation studio would create them. To do this two interpretations are being used. One interpretation was developed to show how a texture is applied to a three dimensional object by way of a two dimensional wrap. The second interpretation shows how three dimensional objects are created by a combination of multiple shapes. This was accomplished by using two dimensional shapes to create more complex two dimensional shapes.

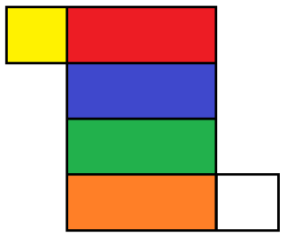
Texturing

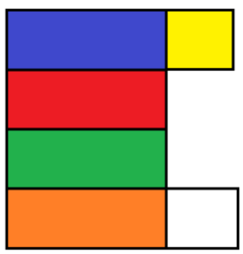
The texturing interpretation was developed to take advantage of all three of the learning modes. The Interpretation uses blocks of various shapes with different colors on all sides to aid in the interpretation. The blocks where chosen for their simplicity in texture as well as their ability to be easily manipulated. This will allow users that are visual learners to see the different patterns easily as well as allow the kinesthetic learners to touch the objects and manipulate them. To show how a texture is created a 2 dimensional layout of each shape with bend locations was created to allow the users to attempt to recreate the three dimensional object with the correct color pattern. The interpreter will serve as an aid asking questions of the users to help them along in the creation of the three dimensional texture. When completed the user can wrap the created texture around the supplied shape to see if the color pattern matches the original. The user can then attempt to recreate other shapes such as a cubic triangle or a cylinder. After the user has attempted a few of the supplied objects the user will be given a quick test. The test is used to provide the host organization with data that reflects the interpretations effectiveness in conveying the concept to the demographic that the host organization caters to. The Exam was developed using pre-determined images the correlate to a three dimensional object that will be given to the user. This allows users to touch and examine the three dimensional object in an attempt to have them find the correct answer. The test varies both color patterns as well as possible pattern configurations to accurately assess the user's knowledge level. This information can then be used by the host organization to determine if the interpretation is suitable. The three dimensional objects used can be seen in figure 1. The two dimensional texture patterns can be seen in figures 2, 3, and 4.

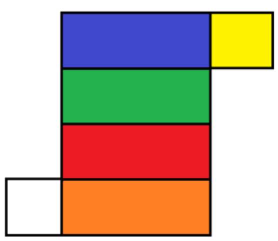
Texturing Evaluation

1. Which of the following 2-D Textures could be used to texture the supplied cube.
   a.
   
   b.
   
   c.
   
   d.
   
   e. All of the above

2. Which of the following textures matches the supplied cubic rectangle
   a. 

   b. 

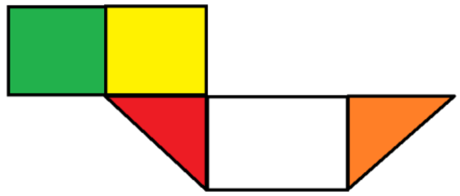
   c. 

   d. 

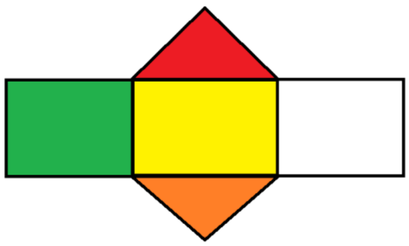
   e. All of the above

3. Which of the following textures matches the supplied cubic triangle

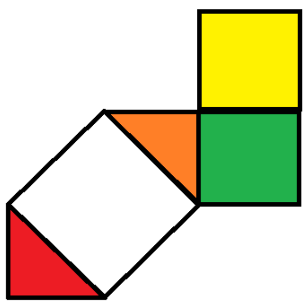
a.



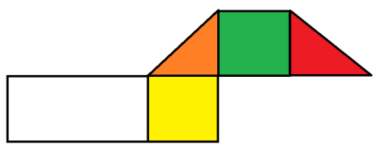
b.



c.



d.



e. All of the above

The answers to the exam are 1. A 2.A 3.C

2-D Modeling

We used magnetic boards and flexible magnet stickers for viewers to play with because magnetic boards are easy to carry around: wherever the demonstration may take place, a person could hold the board on his or her hands and be able to stand or sit wherever is ideal. This would make the teaching flexible and easy to conduct. We used magnetic board because the material is durable under long time of bending, being placed at many places on the board. The magnets and boards attract each other so that the picture viewers are interacting with would have a solid fixture and that makes it easier for them to experience with their design which is predictably of many alterations before finishing.

Shape and size play an important role in helping and assisting viewers understating and performance in our interpretation and evaluation. In order for audiences to easily recognize and interpret shapes within their reach, and quickly identify the solution to our requirement, we designed our simple shapes to be circles, triangles, squares, quadrilaterals of different sizes. These are the shapes that audiences would encounter every day and have impression and no difficulty in interpreting what the shape is and could potentially do.

To make the shape easily interpreted, we used white magnetic board and shapes which were made out of flexible magnetic cards as building blocks for complex shapes. The shapes of magnets are simple and regular: the circular ones has uniform arc, the blocks have parallel sides. These shapes are the fundamental shapes that have already imprinted in viewers' mind that are readily available and retrievable from their memory. The building blocks are designed as familiar to the general public as possible so that it takes minimum of effort for the viewers to search for components and thus could let them concentrate on the task thoroughly. We also purchased different colored foam for each shape so that the user would better perceive the goal through their imagination.

The idea behind the components is that simple model creates complex model and our ultimate goal is to help viewers learn the material as fast as they could and be able to apply the idea to reinvent new shapes. With the help of design of basic components, the viewers practice their understanding with little distraction. In this way, we minimize the effect other factor has on the clarity of evaluation and better generate conclusion on whether the components delivers the message.

The interpretation and evaluation part of our experiment involves using complex shapes for the viewers to first learn how to make the complex shape and be able to come up with their own understanding and idea of how to create complex shapes on their own. We designed both of our interpretation and evaluation to be as realistic as possible. Viewers would recognize what they are seeing right away and by doing this, minimizes the effect of obscurity in their interpretation of what is disseminated. We also designed and modified the picture to the point where regular shapes available to them on the board would match up with what is shown to a very good scale. The viewers would not have such a time of looking for a small piece that is of nowhere and have to use a larger piece instead. In a word, the viewers would find it easy to assemble the complex shape with readily available simple shapes if they have grasped the idea of what is behind our experiment. And by designing this way, we have lowered the influence of other factors that might curb their performance but solely looking at their interpretation skill. The outlines used for the exam can be found in figure 5 and the piece that the user may use is listed below. The shapes the user is asked to make for the interpretation are found in figure 6.

Person

- 1 large rectangle (square)
- 6 small rectangles (square)
- 4 short, thin rectangles
- 2 small circles
- 1 large circle
- 2 small, thin triangles

- 2 medium triangles
- 2 medium trapezoids
- 1 small trapezoid (mouth)

Castle

- 4 large rectangles
- 1 large, thin triangle
- 1 long, thin rectangle
- 1 large triangle
- 2 medium triangles
- 5 large squares
- 6 small squares
- 2 quarter circles

Car

- 1 quarter circle
- 2 small circles
- 1 large rectangle
- 2 small squares
- 2 small rectangles
- 1 small triangle

Bird

- 1 medium circle
- 1 small circle (eye)
- 1 large rectangle
- 1 small, arched triangle (beak)
- 1 large trapezoid
- 1 large triangle

Tree

- 1 small rectangle
- 1 small triangle
- 1 medium triangle
- 1 large triangle

Results

The objective of the project was to create an interpretation with an evaluation plan in place so individual organizations can evaluate the effectiveness for their target audience. All demographics are different, so some interpretations may vary in effectiveness the interpretations were developed to be evaluated by other groups to better suit their situations.

Texturing

The objects for the texturing were the best choice because they had simple color patterns that can be viewed by the user and copied with relative ease. The shapes having sides of a solid color make it so the user's ability to draw wouldn't not affect the ability to learn the concept. By having uniquely colored sides the possibility of accidentally creating the desired texture becomes very low. The supplied 2 dimensional texture has bend lines that directly correlate to the object. This allows the user to visualize the object more effectively and provides boundaries for the color patterns. By providing a texture template the user can focus on the way the texture lines up as oppose to determining what the shape of the texture would look like. By providing bend lines the user is able to bend the texture around the base shape to see if all of the colors match up correctly. The test was created to effectively showcase a user's knowledge in the subject of texturing. The test does this best by providing shapes that the user can use and supplying a list of possible textures that match it. Each question varies both the pattern shape as well as the color orientation to prevent knowledge gaps for occurring. Each question will contain an all of the above answer to prevent random guessing. When the interpretation is being conducted the interpreter will supply the user with the three dimensional shapes and explain that each colored surface may be represented with a two dimensional flat patter. The interpreter will ask show the user a demonstration using the shapes and the supplied texture pattern. From there the interpreter will have the user attempt to model other three dimensional textures in two dimensions. The interpreter will attempt to help the user by asking pointed questions that attempt to get the user to observe patterns that they normally wouldn't see. After the user has completed a few of the patterns the interpreter will supply the evaluation. The evaluation will be given and the user will have no helpful input from the interpreter so that the data may be gathered in an accurate fashion.

2-D Modeling

In order for audiences to easily recognize and interpret shapes within their reach, and quickly identify the solution to our requirement, we designed our simple shapes to be circles, triangles, squares, quadrilaterals of different sizes.

The audiences are supposed to use several simple shapes to make a complex shape from our instruction page. The goal is to impart the knowledge how computer modelers commonly and efficiently build complex objects with relative simpler ones. Users learn by interacting with shapes, trying out different ways of achieving the goal, and getting familiar with the technique.

We used white magnetic board and shapes which were made out of flexible magnetic cards as building blocks for complex shapes. The shapes of magnets are simple and regular: the circular ones have uniform arc, the blocks have parallel sides. These shapes are the fundamental shapes that have already imprinted in viewers' minds which are readily available and retrievable from their memories. The building blocks are designed as familiar to the general public as possible so that it takes minimum of effort for the viewers to search for components and thus could let them concentrate on the task thoroughly. We also purchased different colored pieces of foam for each shape so that the user would better perceive the goal through their imagination.

The idea behind the components is that simple model creates complex model and our ultimate goal is to help viewers learn the material as fast as they could and be able to apply the idea to reinvent new shapes. With the help of designs of basic components, viewers practice their understanding with little distraction. In this way, we minimize the effect other factors have on the clarity of evaluation and could better generate conclusion on whether the components deliver the message.

The material presented would challenge their interpretation of what the demonstration conveys. Being provided with interpretation examples that demonstrate how simple shapes fit into the frame of a larger, more complex shape effectively would lead to replicable behavior or mindset that other complex shapes could be made with simpler shapes. This process suggests viewers that simpler shapes could universally create complex shapes.

To achieve the goal, we designed our project to be two parts. First one is the interpretation. Viewers are to be given sample shapes and be illustrated about how to create different shapes with magnetic pieces of triangles, circles, and rectangles. Second part is the evaluation. In this section, some required shapes are to be made with the sample pieces. The evaluation comes to decide if the interpretation has successfully conveyed the idea by evaluating how well would the viewer's finish the requirement.

A person who is willing to participate in our experiment would be shown a piece of paper with pictures of sample complex shapes. There will be detailed steps for them to work on building the complex shape of a person, tree, bird, and a castle. They would be provided with shapes like triangles, circles, and squares of different sizes and colors. The end results of interpretation would be to make those complex shapes with the Then the viewer would be given another set of shapes to work on. This time there are no instructions and the viewer is to assemble the required complex shape with magnetic board and pieces. An evaluation would be given at the end asking about how they feel about their performance and what they have learned from the process.

The evaluation part would consist of questions on both general and specific aspects whereas the motivation behind the questions is to see what the viewers have learned from the interpretation and what they thing this experiment is trying to show. We would formulate the question in an explorative manner. First part of the question would be on how much time did they spend on each part of the interpretation, how well and confident did they feel about working on the question. Then we would switch gear to asking about what they feel the test is trying to show them and what they have learned from the activity.

The interpretation and evaluation would show the viewer how complex shapes are modeled with simpler ones. The evaluation would focus on how they performed and what they have learned. If the self-reflection matches what we are trying to show the viewers, then the viewers have acquired what we want to show. The method works on his or her case. If majority of viewers successfully reaches the desired outcome then our test would be shown to be effective to most of the people. And this would justify the effort from methodology that the shape, color, we designed have minimized the side effects and that the difficulty level we have set for which complex shape to use in evaluation is appropriate for the majority of population.

Discussion

The projects aim was not to create results in the form of data but rather create a process for which other organizations can collect data for their individual demographic. As a result neither exam was administered to actual participants, but rather encompassing exams with direction for how they would be administered was created. These exams may be used by other organizations to judge if the interpretation would be useful for their demographic. If their results are of an unacceptable nature the organizations can use the results to adjust the interpretations to better suit their needs. The basic building blocks for these interpretations have been developed.

The interpretation would be to tailor the questions and incorporate more questionnaire technique. The questions should not help the viewers figure out what the answer should be without really understanding. Another technique in psychology research is to plant sanity question among the real questions so that it measures the credibility of the overall answer. Improving the questions would help us better evaluate viewers' performances.

The interpretations can be used as a standalone unit or adjusted and modified for better results. As the research into learning shows all people learn differently and this interpretation allows for flexibility so that all may be able to gain the benefits intended by the presentation. For most organizations the base interpretation will suffice seeing how it was designed for children and non-technical people in mind. This would allow the organization to achieve the goal of teaching the public about the science behind the animated movies that they see. The hope is that the users will gain an interest in the subject and explore the subject matter more in depth either at the organization or own their own. If the results obtained show that the interpretations were not successful the organizations can either simplify the provided projects to accommodate a lesser inform guest or more depth in the objects being created or texture can be created to help allow users with more background knowledge from gaining from these interpretations.

References

- Hawk, Thomas F., and Amit J. Shah. *Using Learning Style Instruments to Enhance Student Learning*. 1st ed. Vol. 5. N.p.: n.p., n.d. Print.

- Schnupp, Jan, Israel Nelken, and Andrew King. *Auditory Neuroscience: Making Sense of Sound*. Cambridge, MA: MIT, 2011. *Http://lib.myilibrary.com.ezproxy.wpi.edu/Open.aspx?id=302010*. Web. 1 July 2013.

- "The Dunn and Dunn Learning Styles Model." *Ilsa-learning-styles.com*. N.p., n.d. Web. 24 June 2013.

- "The Felder-Silverman Learning and Teaching Styles Model." *Icels-educators-for-learning.ca*. N.p., 2013. Web. 26 June 2013.

- "What Is My Learning Style - Auditory Learner." *What Is My Learning Style - Auditory Learner*. N.p., 2012. Web. 27 June 2013.

- Smith SL. Letter size and legibility. Human factors 1979;21(b):661-670.
- Schiffman HR. Sensation and perception. New York: John Wiley, 1982.
- Stevens, S. S. "Perceptual magnitude and its measurement." *Handbook of perception* 2 (1974): 361-389.
- Ericsson, K. Anders, William G. Chase, and Steve Faloon. "Acquisition of a memory skill." *Science* 208.4448 (1980): 1181-1182.
- KOSSLYN, STEPHEN M. "The psychology of visual displays." *Investigative Radiology* 24.5 (1989): 417-418.

- Begel, Andrew. "Kinesthetic Learning in the Classroom." Vol. 362004. 183. Print.
- Breckler, J. "Student Responses to a Hands-on Kinesthetic Lecture Activity for Learning About the Oxygen Carrying Capacity of Blood." Advances in physiology education 35.1 (2011): 39-47. Print.
- Felder, R. M. "Learning and Teaching Styles in Engineering Education." Engineering education 78.7 (1988): 674. Print.
- Harris, J. A. "The Topography of Tactile Learning in Humans." The Journal of neuroscience 21.3 (2001): 1056. Print.
- Hauptman, Hanoch. "The Synergetic Effect of Learning Styles on the Interaction between Virtual Environments and the Enhancement of Spatial Thinking." Computers and education 57.3 (2011): 2106-17. Print.
- Henderson, Tara Zollinger. "Integration of Play, Learning, and Experience: What Museums Afford Young Visitors." Early childhood education journal 35.3 (2007): 245-51. Print.
- Murphy, R. J. "Student Learning Preferences and Teaching Implications." Journal of dental education 68.8 (2004): 859. Print.
- Richards, Ted. "Using Kinesthetic Activities to Teach Ptolemaic and Copernican Retrograde Motion." Science & education 21.6 (2012): 899-910. Print.
- Weisberg, Shelley Kruger. "Moving Museum Experiences." Journal of museum education 36.2 (2011): 199-208. Print.
- "In Principle, in Practice: Perspectives on a Decade of Museum Learning Research (1994–2004)." Science education (Salem, Mass.) 88.s1 (2004): S1-S3. Print.

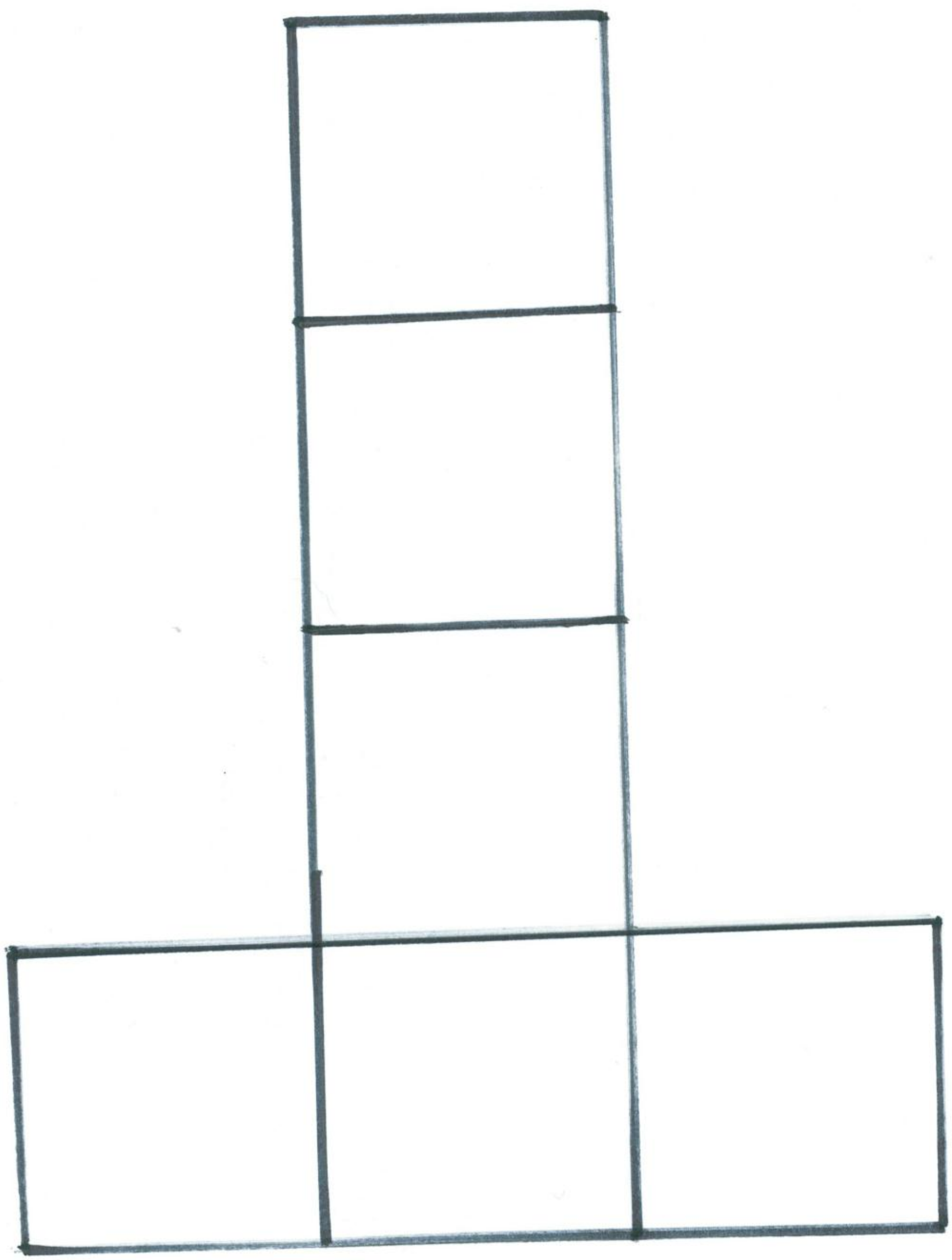
- Fredrick, Wayne C., and Herbert J. Walberg. "Learning as a Function of Time." journal of Educational Research 73.Mar.-Apr.,1980 (1980). Print.
- Peterson, Lloyd. "Short-Term Retention of Individual Verbal Items." Journal of experimental psychology 58.3 (1959): 193-98. Print.

Figures

Figure 1

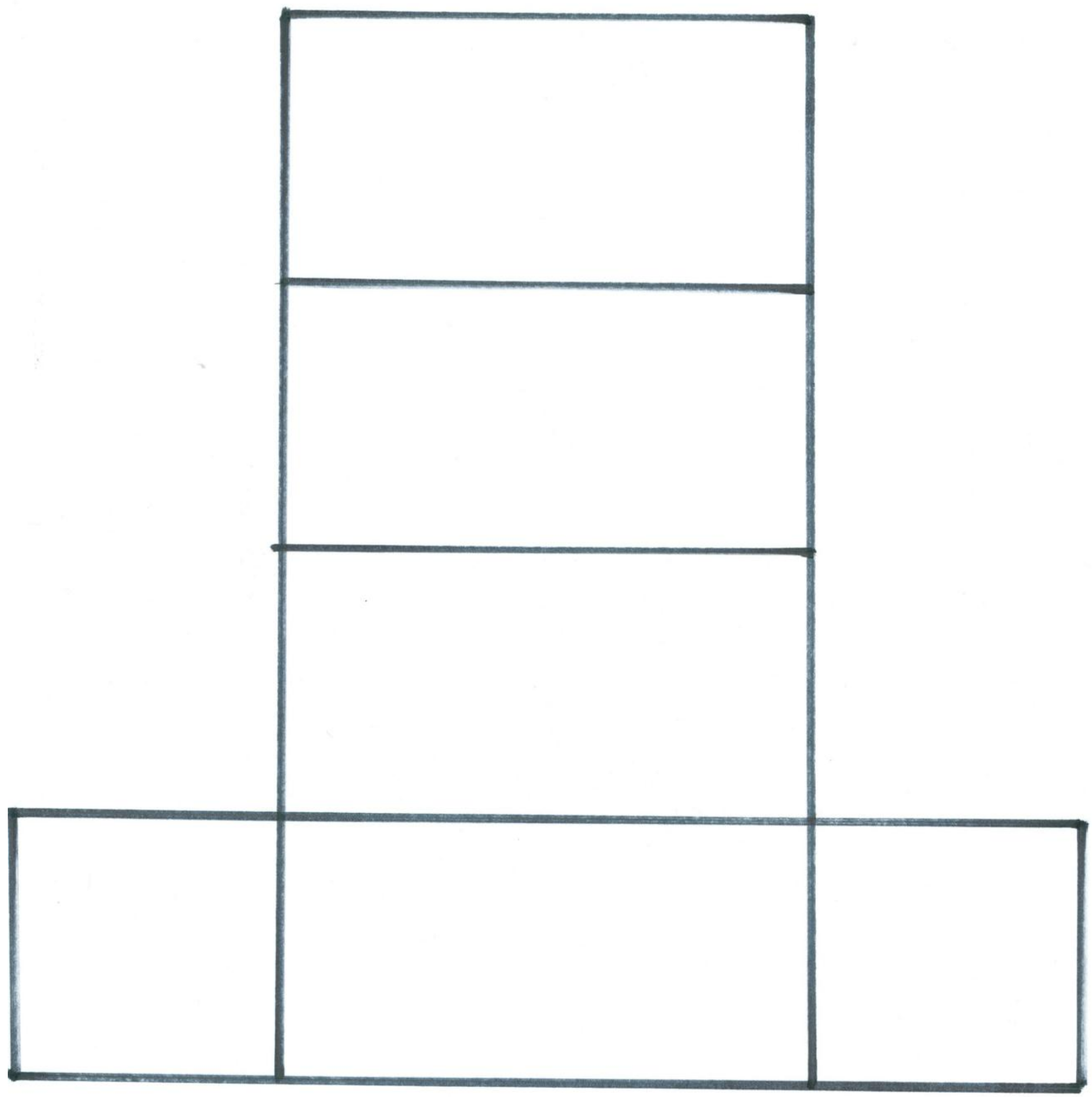
The 3 dimensional shapes that are used for the demonstration and the interpretation. Similar shapes with differing color patterns are used in the evaluation

Figure 2



Cubic texture outline that is supplied to the user in an attempt to recreate the 3 dimensional texture. The pattern can be folded over the supplied shapes to test if the pattern drawn is correct.

Figure 3



Cubic Rectangular texture outline used to mimic the patter on the supplied 3 dimensional shape. The pattern can be folded over the supplied shaped to show if the drawn pattern is correct.

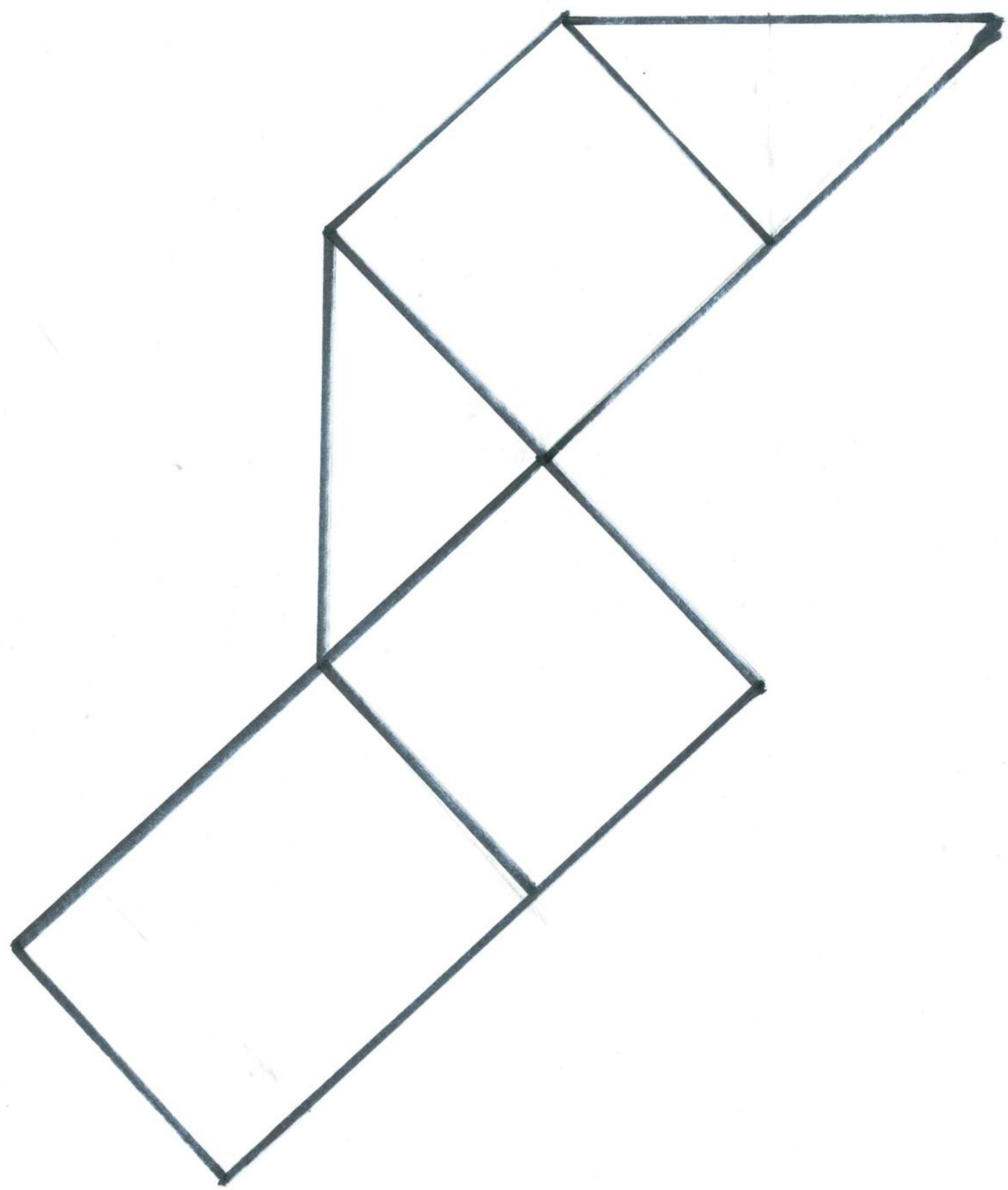


Figure 4

Triangular cubic texture outline that is supplied to the user so they can attempt to recreate the color pattern of the supplied 3 dimensional shape. The pattern is to scale allowing it to be folded over the supplied shape to show if the drawn pattern is correct

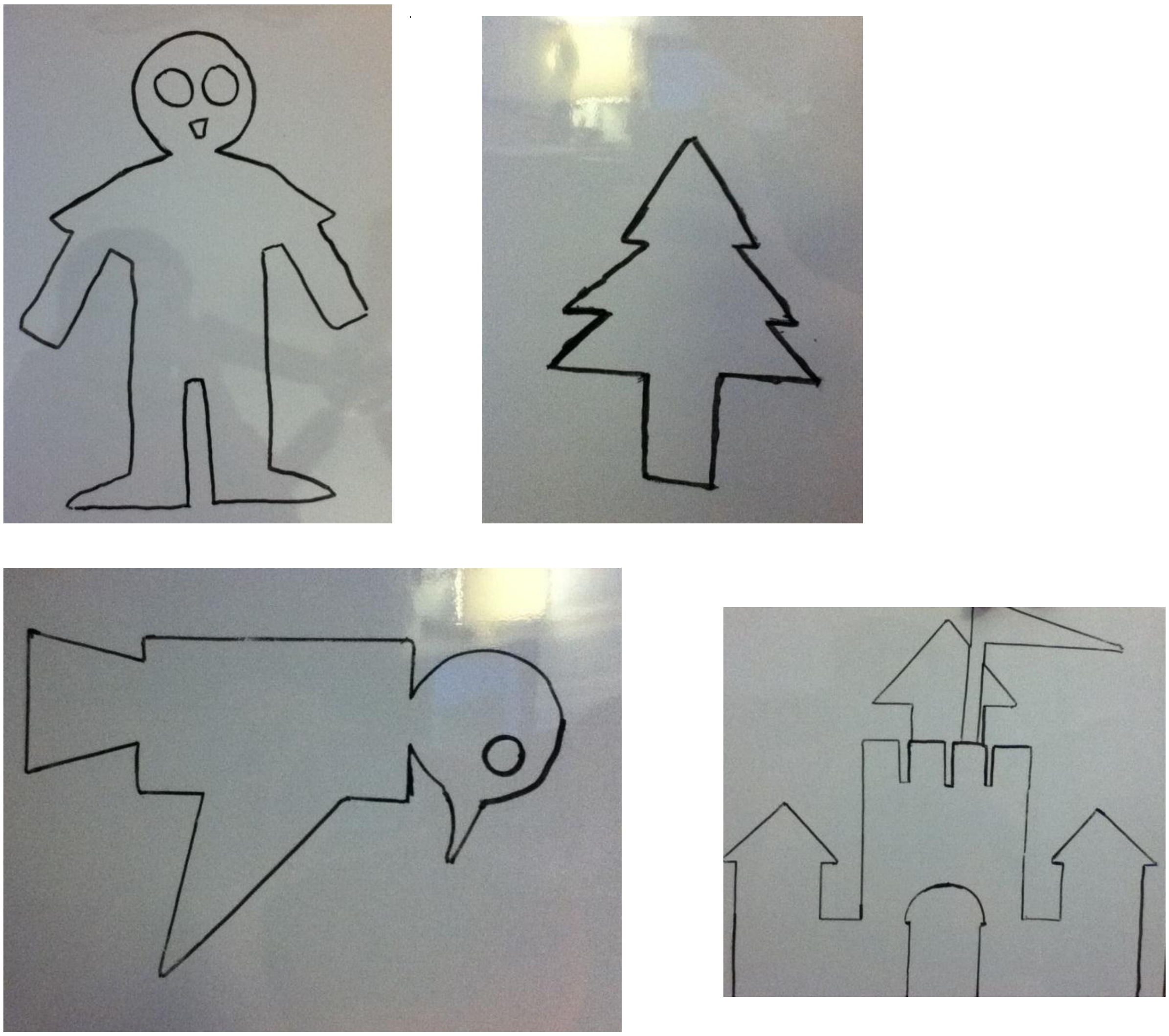


Figure 5

2-D Modeling exam shapes. The user will be provided with a list of shapes that can be used and the outline of the desired pattern. The user will then attempt to recreate the complex shape shown.

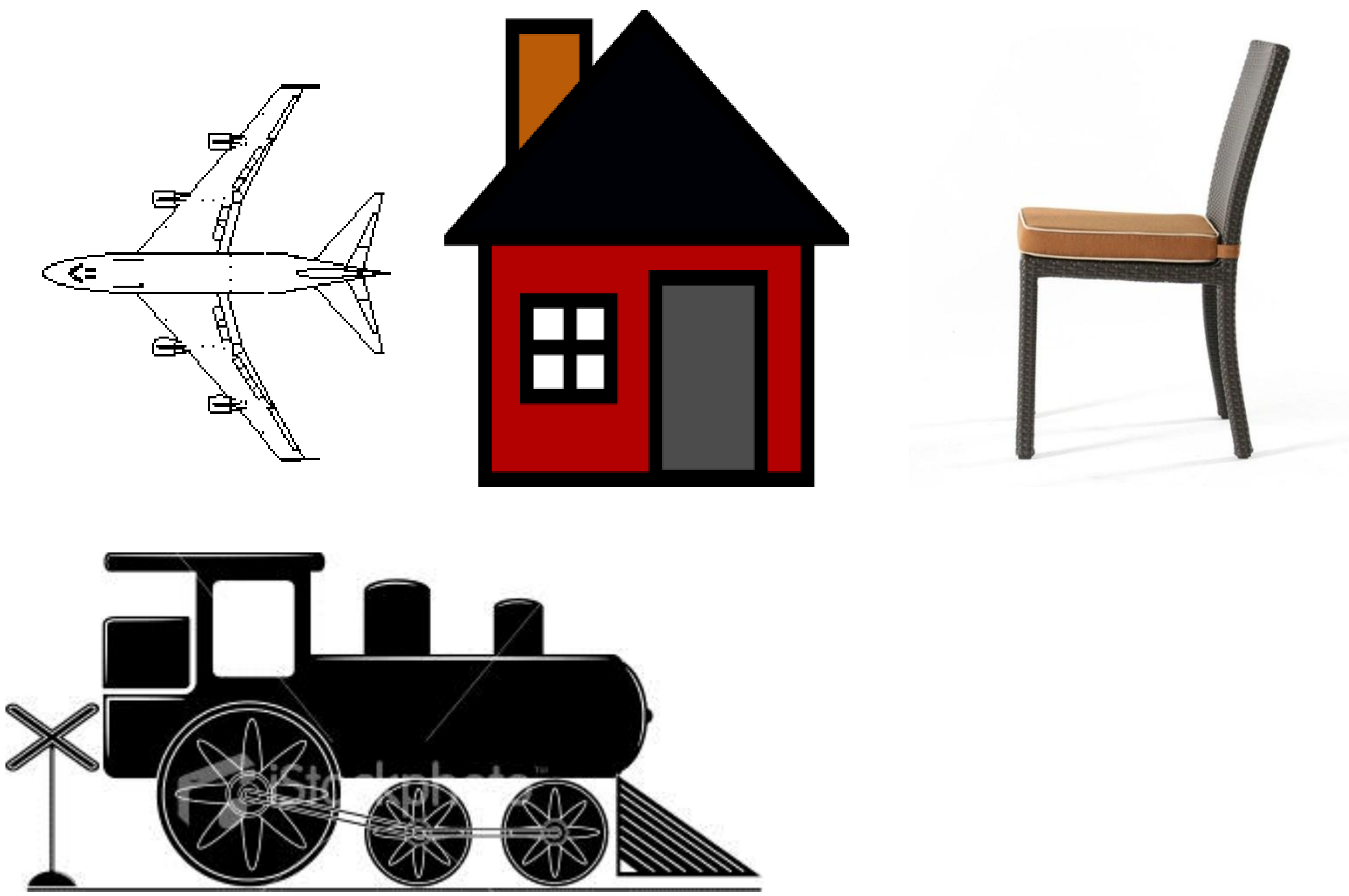


Figure 6

2-D Modeling shapes for interpretation. The user will attempt to recreate each of the above basic shapes from a supplied stockpile of simplistic shapes.