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The Communication of Design to Non-Experts: An Investigation Into Effective Methods of Communicating Design Through Drawing Styles

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THE COMMUNICATION OF DESIGN TO NON-EXPERTS

AN INVESTIGATION INTO EFFECTIVE METHODS OF COMMUNICATING DESIGN THROUGH DRAWING STYLES

by

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Communication between designers and their client has always been an essential element in the design of buildings and interior spaces. This communication occurs in various different ways, but the key method of a designer communicating their space is through their drawings. Clients come from many different backgrounds and many may not have the training or experience that allows them to fully understand what they are seeing in the drawings being presented and as such can be considered non-experts. A majority of drawings are typically presented and developed in two-dimensions which can be confusing for non-experts to understand since they rarely experience a space in two-dimensions.

In establishing this research two main questions were developed to focus the study. Firstly, how do designers use drawings to communicate design intent and spatial elements? Secondly, how do non-experts interpret these drawings into perceiving a space that they can occupy? This research will assist designers with insight into how non-experts translate drawings in their minds to create a mental perception of a space. The research will also provide information on elements in drawings that communicate effectively in helping people perceive a space. Finally, the research will delve into if a

particular style of drawing, two-dimensional, three-dimensional or a combination of both, communicates with higher accuracy the elements of design that assist people in perceiving a space. Understanding how drawings can effectively communicate design to assist non-experts in perceiving space is a critical part of a designer's role.

DEDICATION

To Holly Rodwick, Kathryn Rivera and Jeanne Diehl-Shaffer of Seminole State College, whose constant words of encouragement and assistance with many different aspects of helping me through my thesis I could not have completed this.

To Jeff Haase: though our conversations at times are sporadic your drive, passion, endless energy and constant pushing of me to work hard and go after my goals has helped me achieve more than I can imagine.

To my family for their constant encouragement and assistance.

To my children Aiden and Aubrey who provide constant distraction, enjoyment and entertainment.

To my wife Tara whose extreme patience, understanding and love has helped me through everything and cannot be repaid.

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CHAPTER I: INTRODUCTION

Architects and designers have utilized drawings as the main method of communication for centuries to builders and clients. The styles of drawings have ranged from sketches through construction documents dependent on the need or purpose of the drawings. Due to the inherent nature of drawing where individuality determines how each person draws and "workers cannot be expected to interpret accurately the idiosyncratic jottings of thousands of architects, standard drawing conventions have grown up over the ages" (Gargus 1994). These standards in the profession means that some form of acceptance has been gained by a group of professionals and that others find their use as a way to communicate the necessary information to clients and contractors in an acceptable way.

The communication that occurs needs to follow a process of interpretation from the creator to the reviewer. The designer must represent their design into some form of drawing, the reviewer must then see and interpret the drawing, finally the reviewer must use their imagination to help develop a perception of what the drawing is trying to represent (Ching 1998). In some cases the drawing can be quite detailed and the reviewer does not have a far gap between the representation and what is trying to be communicated. During early design stages when sketches are very conceptual and less detailed the interpretation will be more open to the reviewer's and designer's imagination and the communication needed will be much more important due to the vagueness of the drawings.

Different styles of drawings will always be part of the design process and as such communicating information effectively will always be an important process for architects and designers. Despite the standardizing of drawings there still exists a difference between how each designer draws and depicts information to make their drawings unique from their competition. Information can also be displayed differently from drawing to drawing despite industry standards for creating notes and textual information. As technology and the profession advances along with client expectations the need for new ways to communicate becomes an important factor. The development of three dimensional views and renderings, video presentations and virtual walk-throughs are providing clients with new ways to see their space earlier on in the process. This also generates heightened expectations from the designers in that these types of offerings become a standard in the communication of the design. Communication all of this information to people who don't typically work with drawings, or non-experts, on a day-to-day basis is one of the most important skills that a designer can incorporate into their repertoire.

This research will contribute ways for designers to develop communication tools that will allow non-experts to become more invested in projects and understand drawings from a broad scope. The knowledge gained from this research will provide elements for designers to utilize that are found to be effective in communicating design intent and allowing non-experts to experience a space through various drawing techniques. Designers will need to utilize these tools to become teachers to the non-experts so each important element of the design is shown and explained clearly. To become teachers

themselves designers will need to learn new methods or relearn aspects of their current methods of communication and drawing techniques that allows for clearer communication. These communication tools will evolve as non-experts become savvy in their understanding but each project will interject a new group of non-experts that may have a different understanding than the previous group and a designer's ability to be fluid in their methods from understanding how these tools can be effective in their use will contribute to the overall success of a project.

CHAPTER II: LITERATURE REVIEW

IMPORTANCE OF QUESTION

In establishing this research two main questions were developed to focus the study. Firstly, how do designers use drawings to communicate design intent and spatial elements? Secondly, how do non-experts interpret these drawings into perceiving a space that they can occupy? This research is important because it will assist designers with insight into how non-professional people, or clients, translate drawings in their minds to create a mental perception of a space. The research will also provide information on elements in drawings that communicate effectively in helping people perceive a space. Finally, the research will delve into if a particular style of drawing, two-dimensional, three-dimensional or a combination of both, communicates with higher accuracy the elements of design that assist people in perceiving a space. Understanding how drawings can effectively communicate design to assist non-experts in perceiving space is a critical part of a designer's role.

PERCEPTION OF SPACE

As architects and designers one of the biggest issues we face is the ability to help our clients perceive a three dimensional space through two-dimension drawings. Perception is defined as 'awareness of the elements of environment through physical sensation' (Merriam-Webster 2015). This is one of the best ways to describe how people are able to understand a space as they move through it. The ability to perceive non-built space is not an innate ability for everyone but something that develops as people grow and their brains develop through experience. As their experiences expand their ability to perceive the surroundings can also develop further. Understanding how people develop their ability to perceive space will help designers find ways explain their drawings so that others can start to perceive a three dimensional space from a two dimensional drawing.

Architects and designers develop unique and sophisticated abilities to translate their two-dimensional drawings into a perceived three-dimensional space. Understanding how people develop their perception of space can help this transition, but also investigating how architects and designers are taught these skills through school and practice will also help. Through school and practice a process is developed in helping young designers understand how to interpret these drawings from two-dimension elements to three-dimension concepts and finally into constructed spaces and buildings. Developing a way to use this process to assist clients in understanding drawings and therefore gain a better knowledge and perception of their project will only develop a more cohesive project as all participants will have gained the ability to navigate drawings with more confidence.

When it comes to understanding how the brain is able to comprehend a space 'what you see, hear and feel at any given moment, the movements you made to get there and your memory of those movements... all contribute to your sense of position in the world. Your brain's different sensory and motor systems all work in concert to produce this sense' (Groh 2014). Perception of a space relies heavily on all senses and this is 'an easily observable stimulus-response relationship' (Kosalyn, Shephard and Thompson 2007). In the physical world it is easy to take cues from a subject and understand what people are seeing and reacting too. Applying this technique to how drawings are viewed is more difficult because non-experts will react differently to two-dimensional objects than three-dimension space.

It could be possible to use memories to recognize an existing space in drawing form as any person has developed associative memories of the space from their previous experiences in the space. These memories may not be readily available but constructed on demand as a situation arises and as a memory is pulled from the subconscious (Barkowsky 2007). These previous experiences have helped people to recognize using landmarks to navigate a space therefore they associate shape information with location information allowing the person to learn the layout of the building and their particular path they need to take (Kosalyn, Shephard and Thompson 2007). If working on a renovation or creating a space that utilizes elements from known shapes then it could be possible to develop drawings that become familiar to the non-expert and create these associative memories even though the space may be new.

The creation of new spaces requires the perceiver to take mental leaps and use previous experiences to help inform the brain of what they are seeing in two-dimension form. These leaps can be extremely difficult for non-experts as they may have no frame of reference to rely upon to help establish recognizable shapes in their mind. Architects and designers should try to harness the information that is already in the brain to help people start to make sense of each piece of information presented and in the end will allow them to develop a perception of the space. Architects and designers help facilitate new relations, features and entities with the use of visual representations, whether through sketching or other methods during early design processes (Barkowsky 2007).

COMMUNICATING THE DESIGN

Of all of the senses, vision, contributes the most to the brain's ability to assembly of a sense of space. Vision allows us to perceive shapes and their arrangement and placement around a space (Groh 2014). To interpret drawings the user must take the information presented in two-dimensions and convert that into a three-dimensional concept in their mind. This is the opposite process that the brain takes when looking at a space and understanding distance when the eye takes a three-dimensional world and makes a two-dimensional projection for the brain to interpret. The brain is able to interpret the distance of objects in the world because of the user's eyes and the slight differences between an object's location on each eye (Groh 2014). Knowing that the eyes and brain interpret three-dimensional spaces into two-dimensional images shows a correlation that there is an innate understanding of two-dimensions and it is up to

architects and designers to find ways to communicate their drawings in ways for non-experts to understand.

The importance of drawings in architecture and design throughout history cannot be disputed. Whether it is drawings that communicate the design to a client for a project to get commissioned or drawings that are issued to the contractor so the project can be constructed, drawings have an integral role in the profession. The main issue comes with how architects and designers can communicate with clients and allow them to perceive the space. The ability to present to a client through a variety of methods including drawings, images words and possibly digital components allows a full range of possibilities. Explaining a concept using a variety of methods will increase overall comprehension (Mas, et al. 2013). Architects and designers need to take on an extra role as a teacher so that they can take the clients on a journey to understand their space. While not teaching a class, it is important for architects and designers to find ways to connect the client with the progressions of the building process, the building materials and its spatial situation in relation to a site or to a building (Mas, et al. 2013).

In addition to teaching clients about the process of design we need to also analyze how the drawings are being presented and how non-experts can gain information from those two-dimensions to create that three-dimensional space in their mind. 'Well designed displays of visual information ensure we don't miss anything important by careful arrangement and manipulation. A wide variety of techniques are used to make meaning clear. Detail is put just where it is important, shapes can be changed or removed, colors and textures enhanced or suppressed' (Santella 2005). To help non-experts read

drawings elements can have emphasis placed on them such as edges. ‘Edges are what distinguish one object from the next. So, emphasizing an edge can provide a clue to where one thing ends and another begins' (Groh 2014). This type of manipulation of drawings will provide information to all viewers about how the space is laid out and what the space looks like.

Architects and designers 'have developed specialized skills for making inferences about the 3-dimensional nature of the building plans which are 2-dimensional' (Gobert 1999). As non-experts become more familiar with their building, plans and other drawings they too start to become experts on their particular project, but they will still need assistance with the interpretation of drawings and inferring spatial information from two-dimensional drawings. One element that may be overwhelming to non-experts as they review drawings is that all of the information is presented simultaneously, where in a written narrative or verbal description the information is more structured and possibly easier to follow (Gobert 1999). It is possible that if a process is developed that breaks the conveyance of information to a non-expert and it is compartmentalized into smaller segments that it may allow the brain to better process the drawings and information being presented.

Understanding how these non-experts are able to process two-dimensional information from drawings into a perceived three-dimensional space is an important factor in how drawings are developed and presented. As an example knowing that the brain recognizes contrast, edges or other types of manipulation to represent shapes is one step to take to in communicating drawings. As architects and designers we take for

granted that we have worked with drawings and have the ability translate two-dimensional drawings into three-dimensional spaces through our education and experience. Architects and designers need to assist non-experts that do not have the experience in performing this type of translation so that the project becomes successful and is understood by all people on a fundamental level. This could mean that architects and designers need to become more like teachers at the beginning of projects so that everyone has a base knowledge of what they are reviewing and can take the basic steps to start perceiving the building into three-dimensions.

CHAPTER III: RESEARCH

GENERAL METHODOLOGY

This study will utilize a quasi-experimental research method to obtain data. The first part of the experiment will utilize students' work as part of a cooperative exercise with a studio class where the students will develop the drawings to be reviewed by the non-experts. As part of the exercise these drawings will be part of the students' graded work and for the research the students will take part in an optional survey that will look for their opinion on difficulties with their particular method of and what may be effective ways to communicate the design to non-experts.

The students will be divided into two main groups using a random selection process. Each student will select from a group of cards that are pre-marked with either 'A' or 'B'. These two groups will be the core of our experiment and will develop their own style of work based on their group. Group 'A' will be the group that creates two-

dimension drawings only during this experiment. Group ‘B’ will create only three-dimensional drawings. Dependent on class size a small group of students may be sub-selected to be part of a third group that creates the project in a combination form using both two-dimensions and three-dimensions and deciding which style works best to communicate their design for each particular view they create.

Group 'A' will create all two-dimensional drawings for plans, elevations and sections. Perspectives or isometrics cannot be used for Group 'A' drawings. Group ‘B’ drawings will not be able to use conventional plans, elevations or sections. All drawings will need to be conveyed in three-dimensions in some form of perspective or isometric. Both groups can add any type of embellishment to a drawing (shadows, shading, color, line weights, etc.) to their drawings to help the client understand their space. Notes may also be added to the drawings. Concept photographs or images from other sources can be used but only as a small portion of the overall presentation.

Students from Group A and Group B can work together to develop the concept design and if using software that allows them to share information and create both two-dimensional and three-dimensional drawings. This would also provide a chance for a reviewer to view drawings for the same space in two-dimensions and then three-dimensions and provide a better understanding of which style allows the reviewer to perceive the space more effectively. The class project will be structured so that the students can perform the work in the allotted time frame of two to four weeks, dependent on the instructor’s coursework, to develop the project and then an additional two to three

weeks to perform the surveys. Survey results will then be collected and data will be compiled and tabulated.

The second part of this research invited the public population of the Heathrow Campus of Seminole State College: students, staff and faculty participated in reviewing the drawings developed by the students from the studio course. These participants took part in a survey to gather information and thoughts about what elements were effective in communicating the design in the drawings. The focus of the survey was to collect information on what non-experts see as effective or ineffective elements in communicating the space to the reviewer. The results also benefit from participants who took part in the review and survey process that have experience with drawings and are not considered non-experts. Their experience provides additional insights and gauges the non-experts responses to what a 'trained eye' feels is effective or ineffective communication to see if there are common threads. The survey process will occur over the period of a single day and will be available to all people that wish to participate.

CASE STUDY: SEMINOLE STATE COLLEGE OF FLORIDA

Interior Design students that were enrolled as part of the Spring 2016 semester Studio IV: Advanced Commercial Design were asked to take part in the creation of drawings for review by non-experts as well as participate in an optional survey as part of this research. This particular studio class had twenty-seven students enrolled. The students had been grouped into nine groups of three for their semester long project where they would collaborate on a three-story building, with each student focusing on a particular floor but the overall concept being harmonious between each of the student's

work. A general program had been prepared by the instructor prior to the assignment and rooms of approximate equal size were selected on each floor for the students to focus on for this particular exercise. The first floor focused on the entry lobby, reception and mail room area, the second floor focused on a training room and the third floor had a daycare room as its focal room.

The students were asked to develop a concept set of drawings for a potential client showcasing a plan, reflected ceiling plan, two to three elevations for the two-dimensional drawings (Figure 3.0.1 & Figure 3.0.2). The students in the three-dimensional group were asked to develop a three-dimensional plan and reflected ceiling plan and two to three perspectives showing the best views that communicated the most information possible about the space to the clients (Figure 3.0.3 & Figure 3.0.4). The drawings for the three-dimensional group were to be a perspective, isometric or axonometric style view. Each space had casework contained within that was specific to the type of space that could be described and detailed and shown in these views. Students were also encouraged to add as much information that described materials or critical dimensions that would help a contractor give an initial price estimate to the client. A small portion of the drawing was allowed to have a concept statement or imagery for materials, furniture or other concepts that did not get translated into the drawings.

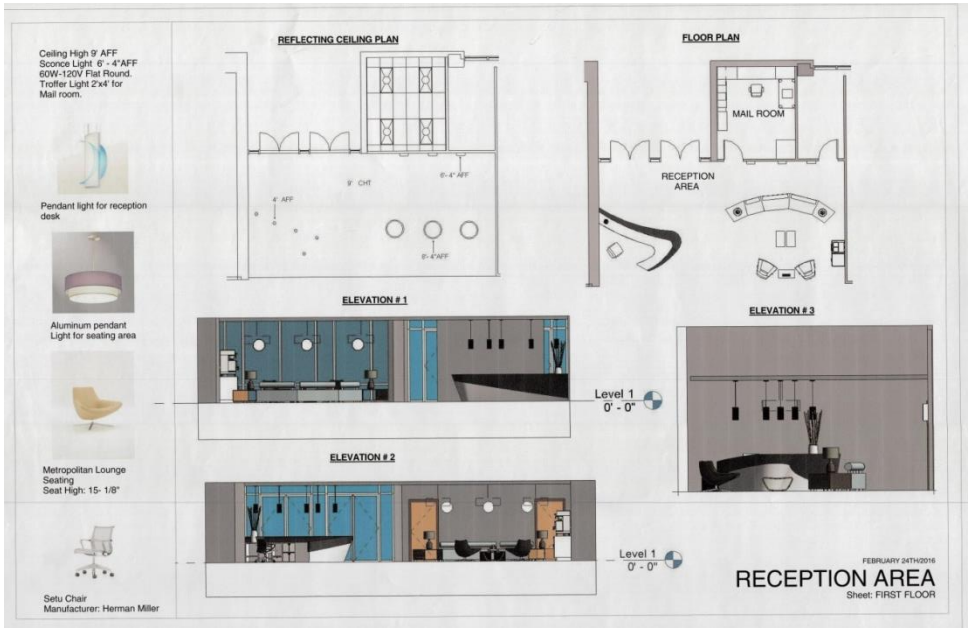

Figure 3.0.1 – Example of Two Dimensional Drawing, Drawing Scan, March 2016. (Student Work – Unidentified)

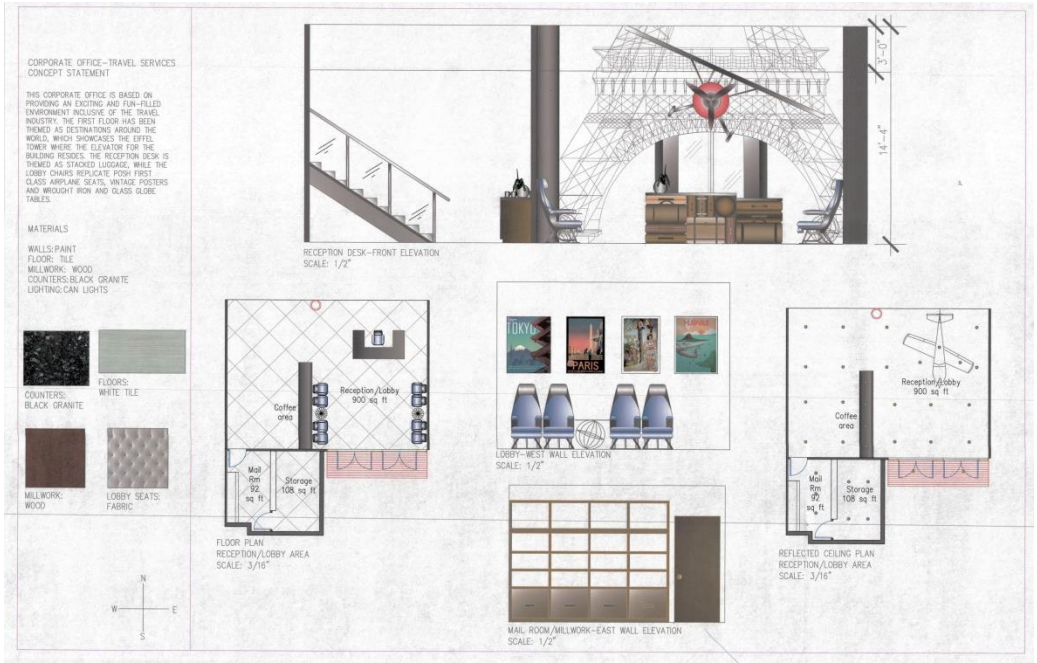

Figure 3.0.2 – Example of Two Dimensional Drawing, Drawing Scan, March 2016. (Student Work – Unidentified)

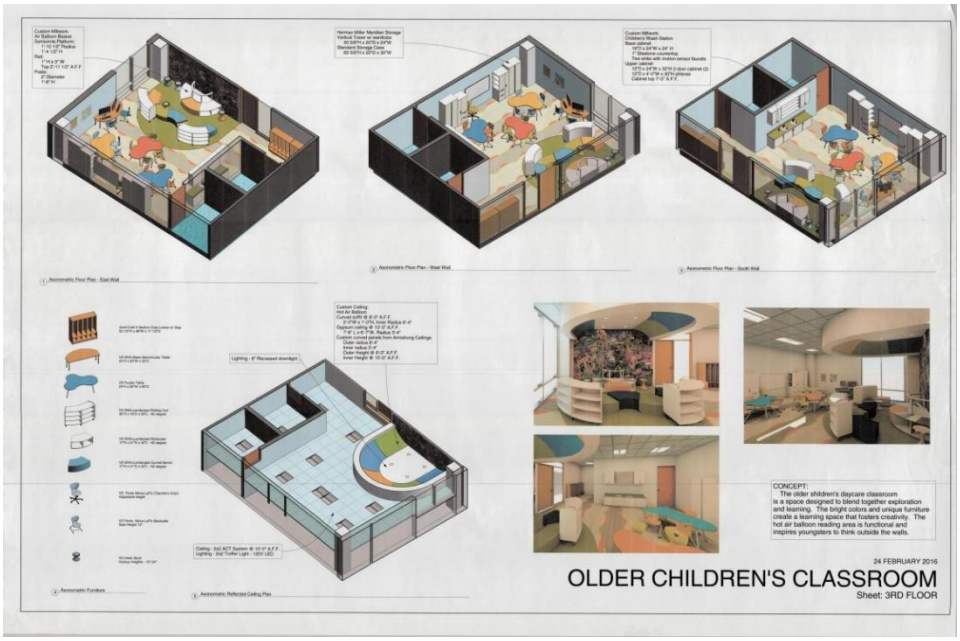

Figure 3.0.3 – Example of Three Dimensional Drawing, Drawing Scan, March 2016. (Student Work – Unidentified)

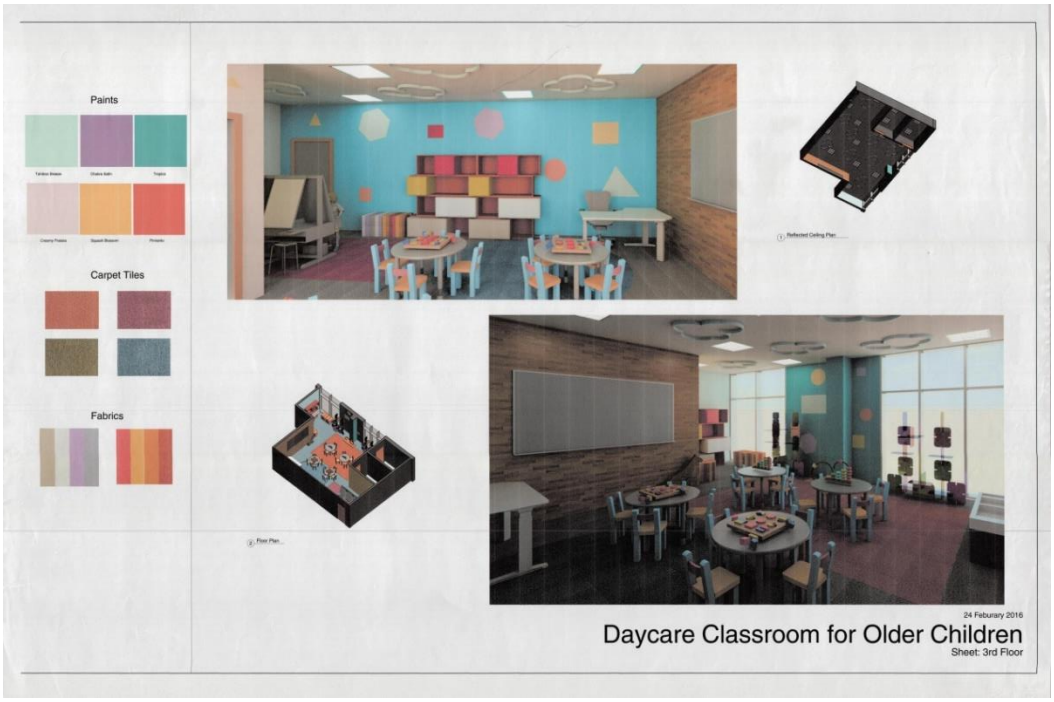

Figure 3.0.4 – Example of Two Dimensional Drawing, Drawing Scan, March 2016. (Student Work – Unidentified)

CHAPTER IV: CONCLUSION

LIMITATIONS

There were a variety of factors that could be seen as limitations to this research. These limitations could also be seen as providing a range of possibility to focus future work and give greater insight as starting points from which to initiate new studies. The communication of design is something that has always been open to interpretation both from a designer's point of view as well as the reviewer's, hence the research to investigate the type of elements found in the two styles of drawings used that assist in creating clear communication.

One of the largest limitations for the participant reviews that took place at Seminole State was the large number of projects that were available for review. Overall there were about eighteen to twenty different projects; each project was one of three techniques: two-dimensional, three-dimensional or a combination of both with different information presented in different ways. The communication of each of these differences was to help show that so many varieties can occur in drawings and that we were looking for elements that may have helped in the communication of the space from any of these, but the large number of drawings may have been overwhelming to the reviewers. Reducing the number of drawings to a more manageable number would allow the participants to focus on the drawings and if the space was communicated so that they could perceive the design. To reduce the number of drawings we would need to select particular drawings that we felt best represented the intent of communicating a design to a reviewer thus possibly eliminating a drawing that might have a unique quality because

it did not meet a need for multiple elements. For this review we wanted to present all possible opportunities to the reviewers by presenting all of the drawings. This would also possibly eliminate a drawing that would help the reviewer perceive the space due to the information presented.

A secondary limitation was that there were a variety of spaces presented to the reviewers. The students at Seminole State were assigned spaces on three different levels each with different program requirements. This part of the student's assignment worked for their overall assignment but could have added confusion to reviewers since each space was presented in different presentation styles, unique designs and working with differing spaces. While each of the spaces were unique enough that the reviewers seemed to be able to follow the drawings and each space represented the process of having different types of spaces with a large number of drawings introduced possible confusion into the study.

The study could also have been limited by the overall skill level of the students in the use of the software, documentation and their ability to work under pressure in the time provided to develop the project. While the students performed well developing the space and tasks to develop the drawings necessary for the study, being sophomores/juniors in the program may mean they have not had the experience or education in certain areas to understand what is needed for particular tasks or the students may not have had exposure or use of certain software programs to create the necessary drawings would have a major limitation on the study. To assist in mitigating this limitation the students were allowed to select the software they used to develop their

particular technique. In addition the students were provided descriptions of different styles and techniques that may help them develop their own method of communicating to their client. Examples were not shown to students so not to taint or sway the students into believing that one method is more effective than another.

A final limitation that was faced is that Seminole State College is a non-traditional college in that most students work during the day and take courses in the evenings. This limits the amount of student reviewers who were not part of the studio class that might be able to participate in the survey, but the facility is open all day and staff and faculty work throughout the day and were able to participate. Unbeknownst to the faculty I was coordinating with, a majority of other building staff was unavailable due to training sessions or meetings. Despite the above factors I was still able to get a small population but decent variety of participants with varied backgrounds, ages and experience levels to participate in the survey.

DATA COLLECTION & REVIEW

Collection of the participant reviews occurred over an eight hour period during a normal work/class day at Seminole State College at their Heathrow campus in Florida. During the previous week flyers had been placed throughout the facility and local staff spread word to staff and faculty of the research study. Twenty-five participants took part in the survey over the eight hour period and during slow periods additional recruiting would occur by walking around the commons area of the facility. The participants individually reviewed each of the different drawing techniques: two-dimensional, three-dimensional and group comparison. The participants were not focused on a single

technique, but asked to review the two different techniques and then compare the two drawing techniques. The drawings were arranged along tables grouped together based on their particular technique and organized in the same flow as the survey. Each different technique had approximately five or six different drawings for the participants to review (Figure 4.0.1 & Figure 4.0.2). As noted in the limitations section Seminole State College is typically a non-traditional school and that limited the amount of people that were recruited for the study.

Figure 4.0.1 – Project Survey Room Setup, Jerry Hiler Photograph, March 2016.

Figure 4.0.2 – Project Survey Room Setup, Jerry Hiler Photograph, March 2016.

The survey form (Appendix A) utilized a mixture of a Likert scale and open ended question to not lead the reviewers into responses that they might not have selected on their own. The use of open ended questions does make analysis of data more difficult in that the data needs to be reviewed more closely and coded to find recurring themes and information. The Likert scale questions asked the reviewers to gauge the effectiveness of the particular style and how the reviewer felt the information was communicated in this particular style. The open ended questions then asked the reviewers to offer their opinion of effective items in that particular style or what sort of information they felt was missing that would help them understand and perceive the space more effectively.

The survey was broken into four sections to help maintain a flow of information. The first section of the survey was a general information section used to help sort and

categorize the participants. This section gathered information on the reviewer's age range, experience with interior or architectural plans and current occupation. The second section collected information for the two dimensional portion of the review. This is where the participants reviewed the two dimensional drawings and provided feedback on the effectiveness or ineffectiveness of the student's methods of communication through their drawings. The third section reviewed the three dimension drawings and followed the same format of the two dimensional review. The final section of the survey asked the reviewers to compare the effectiveness of the two dimensional drawings versus the three dimensional drawings and in their opinion state which was the more effective of the two styles. This section also asked the reviewers to state if there were elements not in either section that might have been helpful or if a narrative or design description from the designer might be helpful. The participants were not restricted to follow the arrangement of drawings on the tables, but in observing them and how the room was set up most did follow the general flow. A number of participants did return back and review previous drawings and asked questions so that they could communicate clearly on their surveys.

The data was sorted and organized in two different methods. The first method was to review each of the statements by the reviewers and sort them by like statements and themes into categories. Each survey participant was sorted by their age range and their experience with interior and architectural drawings. For reviewing the drawings, both two dimensional and three dimensional, the sections were organized with items were seen as successful and what items were deemed to cause difficulties in communicating the design (Table 1.1 & Table 1.2). The last section reviewed the preferences of the

reviewer on which style they felt was more effective in communicating the design and if there was a particular style they would prefer to see if they had to review drawings and try to perceive a space. In this last section reviewers also gave some reasons as to why they felt the particular style they chose was more effective and if they had any suggestions to other improvements (Table 1.3 & Table 1.4).

The second method of sorting the data also reviewed each of the statements by the reviewers but looked for positive or negative statements in the review in lieu of sorting statements by a particular theme (Table 1.5). This style of analysis allows for more effective sorting and analysis of information to see which particular style has more positive feedback throughout the process. The comparison section is more difficult to sort in positive or negative fashion but the data was sorted so that if there were comments noting a particular style then that was marked. This second style of sorting data was used to assist with analysis of the data through convergent validity. This type of analysis focuses on the type of questions asked and their wording, meaning that if a positive question is asked that positive feedback is expected and if a negative question is asked then negative feedback is expected.

DATA ANALYSIS

Analyzing the first section of data (Table 1.1) allows us to note that a variety of age ranges were represented throughout the entire study. This is important as it allows a good range of perspective from various age demographics who interpret information differently based on their life experiences. One of the main focuses of this study is that

we are looking to find effective ways to communicate with non-experts unfamiliar with interior and architectural drawings and the profession, so the population as shown in the table and chart below leans heavily toward the less experienced group. However, it is important to include people with varying degrees of experience in the survey so that their insight and knowledge can be captured and included in the information (**Error! Reference source not found.**). Sixty percent of the reviewers surveyed had less than one year experience working with architectural drawings which shows a vast majority of the population has little experience with the profession of architecture and is the key audience the study is looking to understand. An additional sixteen percent of the population had less than four years' experience with drawings and the profession which adds more people to the group that could be considered non-experts since they have minimal experience with drawings. This second group of people may be young professionals or students starting to learn the profession or people that have general knowledge of interior design and drawings from various sources.

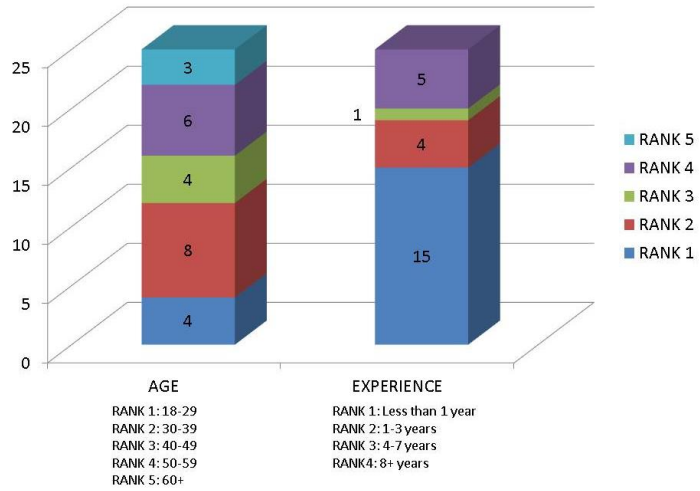

Figure 4.0.3 – Age & Experience Rankings of Survey Participants

Reviewing the two dimensional data one of the most surprising pieces of information that presented itself initially is that more than seventy-five percent of the survey participants had some perception of the space and were able to understand the information presented on the drawings to an extent that they felt was with little difficulty (Figure 4.0.4). In reviewing the open ended questions of the survey a majority of the participants had felt that the two dimensional drawings allowed them to see the layout of the space with the furniture plans or finish plans. The reviewers also felt that the notes and dimensions on the two dimensional drawings helped provide additional information that gave a sense of scale and allowed them to better understand that particular space. In addition to seeing the general layout and seeing information notes and dimensions the reviewers felt that seeing the materials on the drawings, either placed on the plans, elevations and/or seeing material swatches placed on the drawings to create a color palette helped them understand the space. Some reviewers also felt that seeing the elevations assisted in communicating the design and helped them perceive the space.

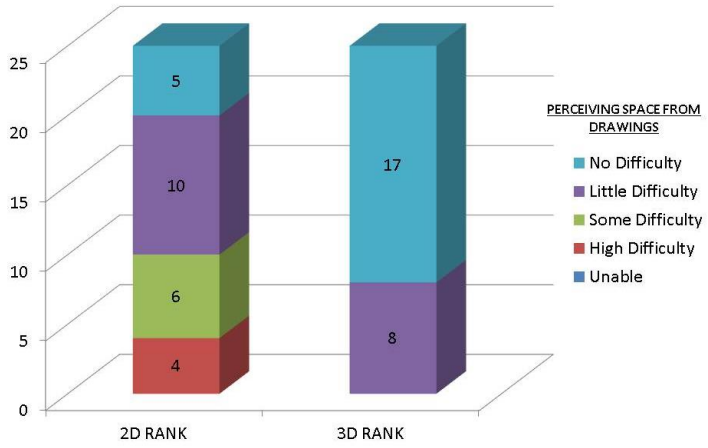

Figure 4.0.4 – 2D/3D Ranking of Survey Results; Perceiving the Space from the Drawings

With every success there are usually difficulties that must be overcome to have created projects and effective communication. The reviewers had some difficulties in understanding the two-dimension drawings and the most common difficulty noted was a general lack of information perceived from the drawings. This lack of information ranged from line work being too simple to lack of color making the drawings difficult to understand. These are in a way a contradiction to how some of the same reviewers also felt that the notes, dimensions and other elements provided good information. Reviewers also felt that the two-dimensional drawings lacked visual information and depth that would allow them to really start to perceive the space more effectively. The reviewers also felt that it was difficult to know exactly where each elevation was located in the drawings as most were not noted on the drawings with some form of marker to show location and direction of view.

The review of the three-dimensional drawings yielded expected results where the reviewers felt they could mostly perceive the space or fully perceive the space (Figure 4.0.4 – 2D/3D Ranking of Survey Results; Perceiving the Space from the Drawings. The reviewers felt that the main success of the three-dimensional drawings was that they felt immersed in the space as they could see form, depth and perspective of the space. The application of materials and lighting also assisted the reviewers in their ability to perceive the space from the drawings. The creation of a three-dimensional view in a drawing allows reviewers to see the space from a person's point of view, thus giving the illusion of the reviewer being able to experience the space first hand.

While the reviewers had little difficulty in perceiving the space as depicted by the designer they did note some items that would be helpful in communicating the design more effectively. The reviewers felt that some of the ceiling information was hard to read and decipher from the views that were provided. Reviewers also thought that the drawings could have more dimensions to help understand scale and sizes, which is highly uncommon for three-dimensional drawings. Finally, some of the angles selected for the views were seen as difficult or poor for showing information. Overall these were minor and few comments in comparison to the amount of difficulties the reviewers noted on the two dimensional drawings.

Comparing the two sets of drawings the reviewers unanimously selected the three-dimensional drawings as being the most successful in providing the best ability to help reviewers perceive a space. Overall the main reasoning stated was that the reviewers felt that the three-dimensional drawings best shows the concept. The three-dimensional drawing also shows the materials in a way that is more representational to what a person would experience in the space than what two-dimensional drawings could represent. Reviewers felt that the three-dimensional drawings could use more notes and dimensions to help provide more information. When asked if the reviewers would prefer to have drawings in two-dimensions, three-dimensions or a combination of the two styles, they overwhelmingly stated that a combination of the two styles would provide the best overall information (Figure 4.0.5). A majority of the reviewers also felt that a narrative or brief presentation provided by the designer describing the design intent would assist in the overall communication of the design.

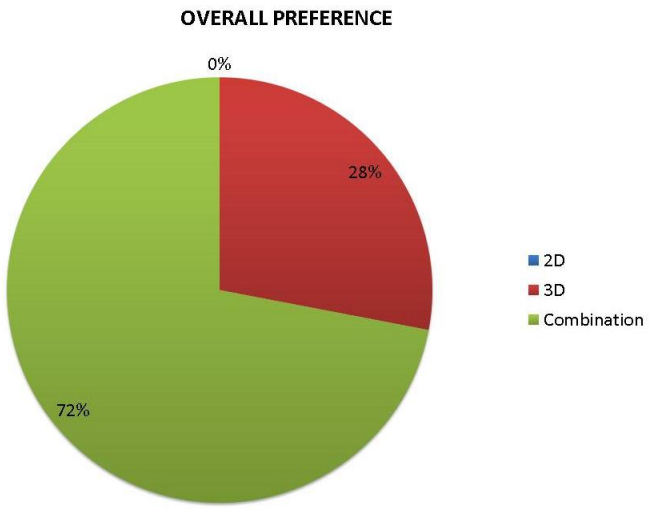

Figure 4.0.5 – Overall Preference of Styles

Analyzing the positive and negative feedback reviewed the responses to the questions and the expected type of answer to the question asked based on convergent validity. Within each drawing technique review the first question asked expected a positive answer and the second question expected a negative response. For the comparison review the first question expects a positive response but the second question asks a more complicated question and the responses are expected to be more complicated which could lead to either a positive, negative or combination response. Also for this analysis we reviewed the participants' rankings for each style and their final selection for the preferred method and how all of those compared.

The data shows reviewing the two-dimensional questions that ninety-five percent of the participants gave a positive response (Figure 4.0.6) to the question highlighting that this style does offer good possibilities for helping people perceive the space. The second question asked for difficulties with the two-dimensional type of presentation and

nearly ninety-five percent of the respondents gave insights as to how this style also faces difficulties in providing adequate information for some to perceive a space. Reviewing the same questions for the three-dimensional data shows that nearly ninety-five percent of the respondents felt that the three-dimensional style is a successful style for perceiving the space. The second question in regards to the three-dimensional technique having difficulties as a way to present information returned an eighty-three percent of people returning a negative response stating what issues if any they had with this particular technique. Part of the response to the second question for the three-dimensional technique has a significant portion of people that did not respond to the question. This non-response could lead to questions of whether the participants did not find anything difficult or could they not summarize what they found difficult from perceiving the space.

Reviewing the comparison questions the first question asked for reasons that the participant selected the particular style they felt was the most successful. This question produced a seventy-nine percent positive response from the participants showing that they were looking for positive reasons for the response in lieu of why they did not select the other style. The second question asked for input on how the style the participants they did not select could be improved. This question looks for a little more in depth information and can elicit a little more complicated answer as shown by the responses received. Forty percent of the respondents provided a negative response, twenty percent provided a combination of both positive and negative responses and forty percent provided an answer with positive wording. We then compared how each of the participants ranked each style in comparison to each other. One participant, or four

percent, ranked two-dimensional higher than three-dimensional. Twenty-four percent of the participants ranked both two-dimensional styles and three-dimensional styles at the same level of comprehension. Seventy-two percent of the participants ranked the three-dimensional style higher than the two-dimensional style for perceiving the space from the drawings (Figure 4.0.7). These results can be a little misleading since all users unanimously selected the three-dimensional style as the more successful style when comparing the two styles. This introduces a question into why did the participants rank the results the same or why did the one participant rank two-dimensional higher but then select three-dimensional as more successful.

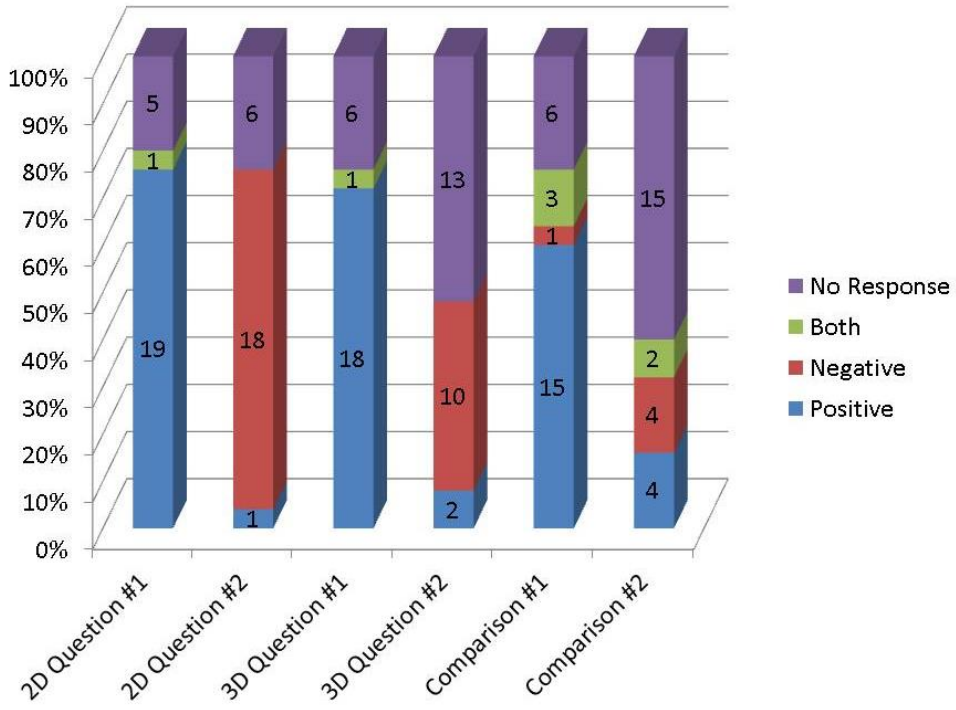

Figure 4.0.6 – Question Analysis Utilizing Convergent Validity

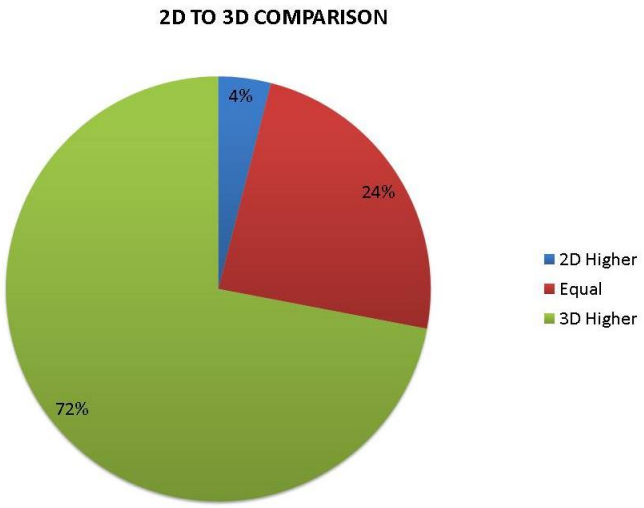

Figure 4.0.7 – Participant Ranking Comparisons

CONCLUSION

As was assumed from the beginning the data showed that the reviewers preferred the three-dimensional drawings over the two-dimension drawings for being able to perceive and understand the space. The survey did provide a unique bit of information in that a majority of the reviewers felt that the two-dimensional drawings were effective to an extent and that the reviewers were able to partially perceive the space from the information provided in the drawings. This means that two-dimensional drawings can still be effective in delivering information, but it will be limited to particular types of information and people who are able to glean information from this style of drawings. To further emphasize this point the survey also showed that a majority of the reviewers felt that a combination of two-dimensional and three-dimensional drawings would provide the best amount of information to all parties that review the drawings (Figure 4.**0**.**5**). This

response shows that no matter who reviews the drawings they should be able to take information they need from the project.

The survey also gave us more insight into other methods of communication to people reviewing the drawings and what type of information assists those people in their understanding. The data showed that from the two-dimensional drawings that the addition of notes and dimensions allow for understanding of scale and size as well as more information in regards to specific elements shown on the drawings. The two-dimensional drawings also provided good spatial information showing the layout. The simple top down look of a plan allows reviewers to see a general layout and see spacing of objects where a perspective can be skewed or distorted at times. The three-dimensional drawings provided the ability to see the space from an eye-level or from an aerial view giving the reviewer an overall idea of the size of the space with heights in addition to widths and depths. Both techniques benefitted the reviewers by adding representations of materials to give the feel of how finishes might appear in the space.

Within the survey the reviewers also provided suggestions to help with communication techniques that they did not see within both styles of drawings or new presentation styles that might be effective. Overall the reviewers mentioned that more notes and dimensions on both styles would give more clarification to design intent and project information. The reviewers also felt that in both two-dimensional elevations and the perspectives provided in the three-dimensional drawings that human scale would be helpful in providing a sense of scale within the space. One of the other notable suggestions is to provide a physical model for review in addition to drawings. One

reviewer noted that with the advances of '3D' printing technology that creation of a simple physical model for review may be beneficial for some people so that they can possibly move items around in a model and get a more hands on feeling and less looking at drawings. Physical models can present their own issues so the presenter would need to weigh the benefits versus the detractors of creating such a piece. This presentation was focused on paper drawings however another suggestion mentioned showing a virtual walkthrough which would depending on the software used could be accomplished. Similar to a physical model this different style of presentation present its own issues and dependent on the type of virtual walkthrough required or desired may need unique expertise and software to develop.

Overall this study demonstrated that three-dimensional drawings will provide the best possible opportunity for non-experts to understand and perceive a space by providing the best representation showing the width, depth and height of a space through a perspective or axonometric style view. Two-dimensional drawings are still an acceptable form but can cause confusion or unclear intent if not properly noted, dimensioned or utilized for a proper audience. The suggestion of using a combination of both two and three-dimensional drawings appeared to appeal to a majority of the reviewers as this would allow the largest cross-section of potential people review and understand the information presented. The drawings are only a subset of what is to be presented though and the designers need to be effective in displaying notes, dimensions, materials, graphics and other information so that it can be easily understood by the potential reviewers.

FUTURE WORK

There is plenty of potential for future work on this topic as there is a range of information that can be explored in different ways. In exploring some of the limitations future researchers could decide to focus on one space or one design in lieu of how this experiment utilized a variety of spaces and designs to review. Utilizing one design or space to focus the research will allow the reviewers to have a clearer idea of the difference between the two techniques of drawings as they will be comparing the same space in two unique techniques of drawings. This type of study would allow reviewers to focus on the difference in techniques and information presented rather than seeing a variety of different spaces each with a different design which might lead to confusion as to what they are supposed to be reviewing.

Future work could also be done incorporating feedback provided by the survey results. Incorporating this feedback into the drawings and then instituting another survey would allow researchers to test to see if the adding the additional components truly were helpful or if the made little to no difference in how reviewers perceived the drawings. This could be a critical point for two-dimensional drawings to continue to test their validity for non-experts since these are the most common way for designers to develop drawings past a concept design stage. A key factor here though would be that the original survey was anonymous and it would be difficult to survey the original respondents to see if they feel the addition of their feedback to the drawings improved the overall presentation or made little to no difference. This may not be a necessary step for

new research only one that would allow comparison of initial survey responses to secondary responses.

A different take on this study could also look into using different forms for the same style of drawings. For instance a two-dimensional drawing could be presented in color with images showing material patterns or it could be shown in gray shaded tones to be more representational with pictures to one side showing where the materials will be placed. The same two-dimension drawing could use thicker line work to denote depth or utilize shade and shadows to do the same. These kinds of subtle differences may have an important impact on how the reviewers perceive the space and if the information is well received. Subtle variations to drawings could provide the reviewers visual cues to take the mental steps needed in order to perceive the space. Designers may decide to develop a virtual walkthrough that allows the reviewer to experience the space almost first hand. The style here is important to determine as it will play an important factor in how the reviewer feels in the space as it will seem more realistic than any of the other forms discussed to this point. There is any number of possibilities for future work based on the communication of design to people that can be derived from this research.

CLOSING

As architects and designers we take in the world around us and immerse ourselves in the environment to see as much as we can. We learn from spaces so that we can use what we can incorporate what we have learned into better spaces for those non-experts that come to experience our spaces. In our industry there are plenty of signature names that are recognized as great designers. In most cases however we work in teams to

develop unique and breathtaking structures and spaces that people wonder how did that ever get built or in our instance how did that get communicated to the non-experts?

As a designer I am constantly amazed that structures like Frank Gehry's Walt Disney Concert Hall (Figure 4.0.8) or Zaha Hadid's Heydar Aliyev Cultural Center (Figure 4.0.9) are able to be built with such fanciful shapes and unique materials. Something so unique will present challenges that experts will have problems understanding, so how do non-experts begin to understand such complex shapes and designs. Sketches and renderings start to present the base shape and general look and feel of the space and structure. Developing the plans and details and communicating the flow of the people through the space, around the building and how people are to interact with the facility to non-experts presents an array of challenges on a normal project, but for a space or building with an architectural vocabulary all its own will require its own set of communication tools to help the non-experts feel as if they are being part of the process.

Technology is allowing major leaps and bounds for our communication tools to become more accepted and accessible to a variety of people all over the world. With the ability to created three-dimensional views, renderings and even animations or virtual walk-throughs the computer models that just a few years ago were only for high priced firms are available for use for even small projects. This accessibility allows more non-experts to see and understand drawings and spaces for a variety of settings and project types. Some of this technology also allows designers to make changes to designs that can be seen in real time which opens up a brand new tool for design communication to non-experts. Imagine discussing materials for a particular space with a client and they cannot

make up their mind between a wood floor or porcelain tile floor. In a simplistic sense a designer could make a change for the material in the model and have it update in the rendering as the client watches. Technology can take a group of non-experts on a virtual walk-through of the new hospital and allow them to experience their new space using virtual goggles or a computer screen.

In all of this it is important that we as designers do not lose sight of who the non-experts are. The non-experts we will think of mostly as our clients or people that may have a vested interest in the project but may not be directly be our clients. In most cases this will be true, but there are many other non-experts when it comes to our particular drawings. Our partners in the design profession are experts of their own nature but even they may have trouble at times interpreting our drawings and what our intent is just from the drawings themselves. Not only do we work with engineers, but we also work with our contractor partners who employee people who may or may not be an expert in interpreting drawings. I was reminded of this recently while visiting a construction site and discussing some details with a drywall superintendent. After our discussion about the details and showing him the idea in our quick three-dimension sketch he asked us to make sure to include the sketch when we issued the documents for the change so that his workers would also understand what we wanted. He said that we explained it clearly to him and he understood the details of what we were looking for but that for his crew who may or may not be the same people every day, having the three-dimension sketch would be beneficial. This example goes to show that the non-experts range just beyond the immediate people that we discuss our drawings with and the information we are trying to

communicate needs to be clearly defined and delineated so that everyone can be successful in understanding their role.

Figure 4.0.8 – Frank Gehry's Walt Disney Concert Hall, Carol M. Highsmith Photograph, April 2005; https://commons.wikimedia.org/wiki/File:Image-Disney_Concert_Hall_by_Carol_Highsmith_edit.jpg

Figure 4.0.9 – Zaha Hadid's Heydar Aliyev Cultural Center, N/A Photograph, July 2012; https://en.wikipedia.org/wiki/File:Heydar_Aliyev_Cultural_Center.jpg

Table 1.1 – Two Dimensional Response Organization.

AGE	EXP	2D RANK	SUCCESS	SEE LAYOUT/ SPACING	NOTES/DIMS	COLORS/ MATERIALS	ELEVATIONS	DIFFICULTIES	LACK OF DEPTH	LACK OF INFO	LACK OF VISUAL ELEMENTS	LOCATION MARKERS
2	4	4		2SA	2SB				2DA		2DC	
2	2	3		2SA						2DB	2DC	
3	1	4										
3	1	4										
2	1	2		2SA					2DA			2DD
4	4	4		2SA					2DA			
1	1	5		2SA	2SB		2SD					
1	1	5		2SA						2DB		
4	4	4					2SD					
4	2	3		2SA			2SD					
2	1	2			2SB					2DB	2DC	
5	1	3			2SB	2SC	2SD			2DB	2DC	
1	1	3					2SD			2DB		
2	2	5			2SB					2DB		
2	3	4			2SB	2SC	2SD			2DB	2DC	2DD
5	1	3										
4	1	5										
4	1	2			2SB				2DA		2DC	
2	1	5		2SA			2SD			2DB		2DD
4	4	4		2SA	2SB					2DB		
3	4	4							2DA		2DC	
1	2	4		2SA	2SB	2SC				2DB	2DC	
5	1	4										
2	1	2				2SC						2DD
3	1	3		2SA					2DA			

Table 1.2 - . Three Dimensional Response Organization.

3D RANK	SUCCESS	SEE THE FORM OF SPACE	DEPTH	MATERIALS	DIFFICULTIES	RCP INFO	POOR ANGLED VIEWS	LACK OF DIMENSIONS	BETTER LIGHTING/ RESOLUTION
5		3SA						3DC	
4		3SA						3DC	3DD
5									
5									
4		3SA							
5		3SA							
5		3SA							
5									
5		3SA				3DA			
5									
4		3SA		3SC					
5		3SA	3SB						
4		3SA					3DB		
4		3SA							
5				3SC				3DC	
4									
5									
5		3SA				3DA			
5									
4		3SA		3SC			3SB		
5		3SA		3SC					
5		3SA				3DA			
4									
5		3SA							
5		3SA							

Table 1.3 - Group Comparison Response Organization

GROUP COMPARISON									
	2D/3D	REASONS	3D SHOWS CONCEPT	MATERIALS	DETAIL	IMPROVEMENTS	MORE NOTES/INFO	PREFERENCE	NARRATIVE
	2		GRA					3	M
	2		GRA					3	Y
	2							2	M
	2		GRA					3	M
	2							3	Y
	2		GRA					3	Y
	2		GRA					3	M
	2			GRB	GRC		GIA	3	Y
	2		GRA				GIA	3	Y
	2							2	M
	2		GRA					3	M
	2		GRA	GRB				3	N
	2		GRA	GRB				2	Y
	2							3	Y
	2						GIA	3	Y
	2							2	Y
	2		GRA					2	M
	2							3	M
	2							3	Y
	2		GRA	GRB				3	Y
	2		GRA					3	Y
	2		GRA	GRB				3	Y
	2							2	N
	2		GRA				GIA	2	Y
	2		GRA					3	Y

Table 1.4 - Additional Responses

ADDIRIONAL INFORMATION							
OTHER	PAIR COMMON VIEWS	PHYSICAL MODEL / 3D PRINTED MODEL	VIRTUAL WALK-THROUGH	PEOPLE FOR SCALE IN VIEWS	COMBO PROVIDES MOST OVERALL INFO		
		OB					
					OE		
				OD			
			OC				
				OD			
					OE		
					OE		
			OC				
					OE		
					OE		
	OA				OE		
					OE		

Table 1.5 - Positive & Negative Responses to Questions

AGE	EXP		2D RANK				3D RANK				GROUP								
			S	Q1	Q2		S	Q1	Q2		S1	Q1	Q2	S2	S3	Q3			
2	4		4	pos	neg		5	pos	neg			3D	pos	pos	combo	M			
2	2		3	both	neg		4	pos	neg			3D	pos	both	combo	Y	pos		
3	1		4				5					3D			3D	M			
3	1		4				5					3D	pos		combo	M	pos		
2	1		2		neg		4	pos				3D			combo	Y			
4	4		4	pos	neg		5	pos				3D	pos		combo	Y	pos		
1	1		5	pos	pos		5	pos				3D	pos	pos	combo	M	pos		
1	1		5	pos			5	pos				3D	pos		combo	Y	both		
4	4		4	pos			5	pos	neg			3D	neg	neg	combo	Y	pos		
4	2		3	pos	neg		5	pos				3D			3D	M			
2	1		2	pos	neg		4	pos				3D	both		combo	M			
5	1		3	pos	neg		5	pos				3D	pos		combo	N			
1	1		3	pos	neg		4	pos	neg			3D	pos	neg	3D	Y	pos		
2	2		5	pos	neg		4	pos	neg			3D	pos	neg	combo	Y			
2	3		4	pos	neg		5	pos	neg			3D	pos	neg	combo	Y	both		
5	1		3				4					3D			3D	Y			
4	1		5	pos			5					3D	pos		3D	M			
4	1		2	pos	neg		5	pos	neg			3D	pos		combo	M	pos		
2	1		5	pos	neg		5		neg			3D			combo	Y	both		
4	4		4	pos	neg		4	pos	neg			3D	pos	both	combo	Y	pos		
3	4		4		neg		5	pos				3D	both		combo	Y			
1	2		4	pos	neg		5	pos	neg			3D	pos		combo	Y	pos		
5	1		4	pos	neg		4					3D			3D	N			
2	1		2	pos	neg		5	both	pos			3D	both	pos	3D	Y			
3	1		3	pos	neg		5	pos	pos			3D	pos	pos	combo	Y			

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APPENDIX A – Participant Survey

GENERAL INFO

Current Occupation: _____

Age Group: ☐ 18-29 ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐ 60+

Are you familiar with Architecture & Interior Design? ☐ Yes ☐ No

Previous experience with Architectural Drawings:
☐ Less than 1 year ☐ 1-3 years ☐ 4-7 years ☐ 8+ years

2D DRAWINGS

On a scale of 1 to 5, after reviewing the project were you able to perceive the space based on the style of drawings?

☐ 1 (I was unable to perceive the space)
☐ 2 (I had difficulty perceiving how the space would appear once constructed)
☐ 3 (I only had some perception of how the space would be constructed)
☐ 4 (I was mostly able to perceive how the space will appear once constructed)
☐ 5 (I was able to perceive how the space will appear once constructed)

Were there particular elements of the drawings that helped make it easier to perceive the space?

___

Please list:

Were there particular elements of the drawings that made it difficult to perceive the space?

___

Please list:

APPENDIX A cont. – Participant Survey

3D DRAWINGS

On a scale of 1 to 5, after reviewing the project were you able to perceive the space based on the style of drawings?

- ☐ 1 (I was unable to perceive the space)
- ☐ 2 (I had difficulty perceiving how the space would appear once constructed)
- ☐ 3 (I only had some perception of how the space would be constructed)
- ☐ 4 (I was mostly able to perceive how the space will appear once constructed)
- ☐ 5 (I was able to perceive how the space will appear once constructed)

Were there particular elements of the drawings that helped make it easier to perceive the space?

___

Please list:

Were there particular elements of the drawings that made it difficult to perceive the space?

___

Please list:

GROUP COMPARISON

In comparing the 2D project vs the 3D project which was more successful in helping you perceive the overall space?

☐ 2D Project ☐ 3D Project

What are a few of the reasons that you selected your above answer?

Please list:

APPENDIX A cont. – Participant Survey

Were there elements from the Project you did not select that were not in your selection that would have helped that presentation?

___

Please list:

Do you feel that one particular method is the best way for people to understand and perceive a space as they look at drawings or would a combination of the two methods offer the best overall solution?

☐ 2D Project ☐ 3D Project ☐ Combination

Would a brief narrative or verbal presentation by the designer assist in either presentation?

☐ Yes ☐ No ☐ Maybe

What other suggestions do you have that would make these presentations help the reviewer understand and perceive the space as it is intended?

Please list: