

AC 2007-1158: TEACHING VISUAL DESIGN THINKING

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Teaching Visual Design Thinking:

Introduction

This paper presents a way to teach visual design thinking that is currently used to structure a foundation level University course entitled Visual Thinking. The Visual Thinking course is a core course for digital media, and product design based learning concentrations within the Engineering Technology Department at East Tennessee State University. Students who take this course typically have little to no formal art, design, or technology training.

In this design based learning course, students are introduced to visual art principles, a two to three dimensional design process, and digital media technology tools. The course is relevant to engineering educators in that it combines art, design, and technology education. The course incorporates lessons from historic predecessor courses including: Technical Illustration, Engineering Drawing, and Industrial Illustration. Even though computer aided design, drafting, and rendering programs have replaced the above career fields; it is important that students learn their fundamental traditional methods as they are essential towards empowering their visual design thinking skills. Therefore, to prepare students for today's entry level career opportunities, the course strategically integrates traditional artistic techniques and technical engineering graphics methods with modern day software tools and digital methods.

The course primarily seeks to provide students with: an applied understanding of visual design process stages, conceptualization, and computational visualization methods. The practical design process stages provide students with a structured way to visually learn and practice the art of design in a scientific or organized manner. The concept ideation and formation methods provide students with traditional visual mapping and concept sketching skills. The digital production methods provide students with computational tools and methods for developing ideas in 3D.

As the second in a series of papers describing ways to teach design (Wronecki, 2004) this paper outlines seven major design process stages and the corresponding visual thinking methods associated with each stage. In the course, these process stages and visual steps are used to structure and facilitate a semester long, student-directed, teacher-facilitated design project in which students are asked to design an innovative, inventive, or inspirational idea. Students are free to choose a project focus in their area of interest. Students in the Digital Media program tend to choose topics such as: character, product, and game design, and architectural, interior, and environmental visualization. Self motivation, individuation, and actualization are pedagogical drivers that dramatically improve the students' work ethic and academic performance.

Scope

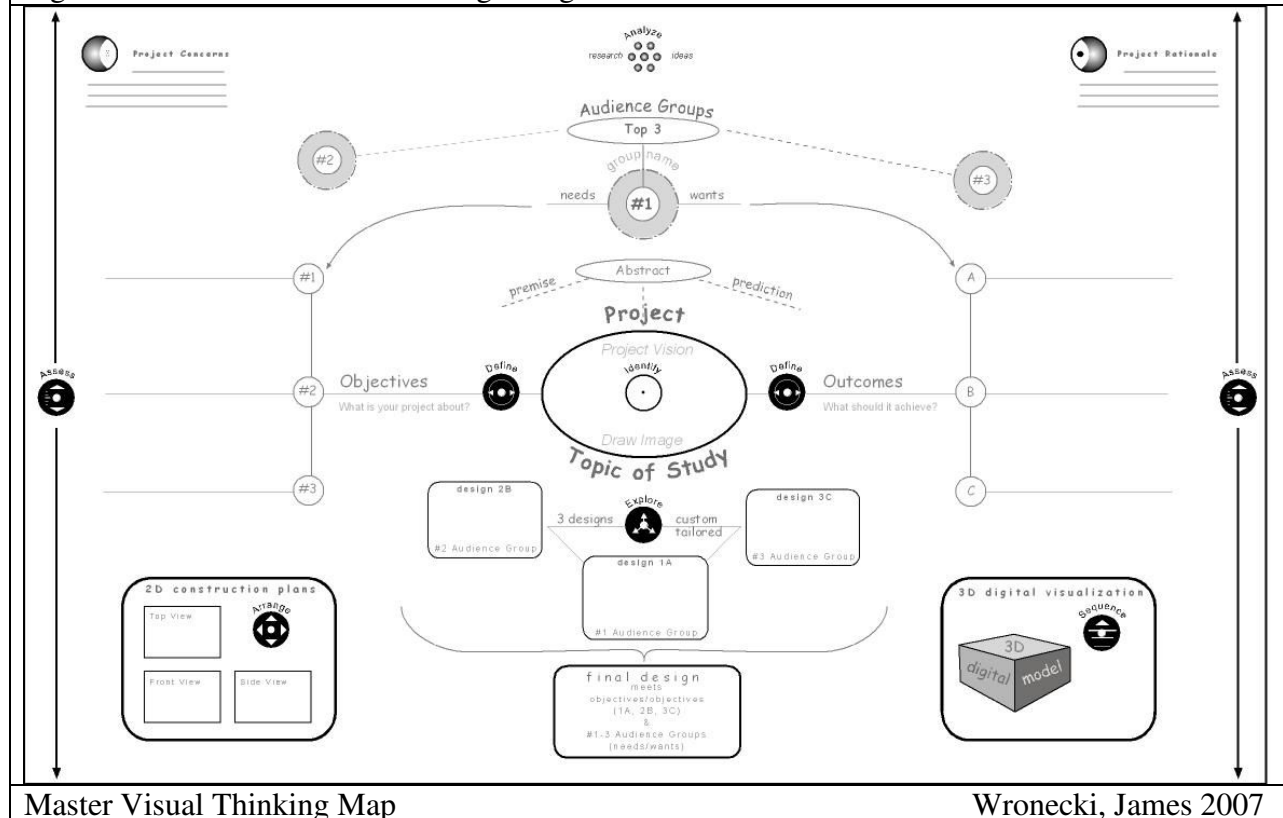
The scope of this paper is intended to provide an outline of a design process and to describe visual thinking methods contained within. Therefore, the main goal of this research paper is to simply communicate the author's approach towards teaching design. The results of this experimental research are by no means conclusive. Therefore, this paper neither substantiates nor validates the systematic methods contained within. However, some measure of assessing student performance when using the following methods can be ascertained by empirically peer reviewing examples of student design projects at the paper's presentation session.

Design Process

A seven stage design process organizes design projects and structures this paper. The stages in the process can be remembered using the acronym –IDEAS A+ (Wronecki, 1999). The symbols and letters in –IDEAS A+ stand for the stages in the author’s design process which are: –analyze, Identify, Design, Explore, Arrange, Sequence, Assess, and Synergize + (Wronecki, 2004). In academic practice the process is linear and it theoretically can be approached iteratively as one can jump forward or iterate back to a previous stage. However, to be efficient and comprehensive, it is important to complete the task in each stage before moving forward. Students however, often tend to want to skip various steps and jump ahead to a final solution.

The visual design thinking project is broken down into seven biweekly stages, cited above, depicted in figure 1, and described in detail below, that the students must follow and visually execute in order to move towards realizing a visual solution. Points are allocated to all of the design stage deliverables, based on the number of hours students are expected to spend working on each task. By measuring, monitoring, and mentoring student design processes, they learn to see how important their visual thinking design process is as it directly influences their final solution. Before presenting the following visual thinking design process, it is important to note that: all of the design stage associated artistic techniques, and technical methods are both demonstrated in lecture by the instructor and practiced by students as in class tutorials called lab exercises. Detailed explanation and demonstration of these lab based techniques are not included in the scope of this paper. Both the author’s and various student example images of these visual methods are out of the scope of the written paper and are to be shown at the visual presentation.

Figure 1: -Ideas A+ Visual Thinking Design Process



Master Visual Thinking Map

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Stage 0: Analyze

In Stage 0, students analyze the various concentration areas and choose a topic of study. This pre-design stage begins with research. Students record their thinking by creating a one page Mind Map of their verbal notes and visual images (Buzan, 1994). The oval in the center of mind maps focuses their thinking on a central topic of study. A neatly printed topic of study and loose gesture drawing with at least three colors, which can be abstract, stimulates the critical/analytic left thinking side of the brain and creative/synthetic right doing side of the brain. Next, students are asked to research verbal and visual references to provide information, visual inspiration and artistic direction. Since the project must be an inventive, innovative, or inspirational idea, both critical thinking and creative problem solving skills are engaged. Brainstorming techniques such as free and forced association are used, to help students' generate many possible project ideas. Finally, students are asked to write two short paragraphs, one describes their Reasons Why they would like to pursue the project; the other describes the Concerns identified in their research.



Stage 1: Identify

In Stage 1, students *identify* and commit to a main goal or project vision. Here, the instructor serves as a project manager and mentor to help students focus on an appropriate task. At this point, the students may either have a vague idea or clear vision of what they want their final project solution to be. To express this, students are asked to create a vision page by printing a working title for their project and traditionally illustrating their idea. They also can add related concept details, research notes, and website URL's to the page as needed.

The students are also asked to write a project abstract composed of three parts: the main premise or problem, general description of the project, followed by its purpose or prediction of what benefit it will bring. In Stage 1, the scope of the project is left undefined, to allow it to be widened or narrowed as needed.

Next, a user centering design process is initiated. To do this, students prioritize their top three intended audience groups. During the time allocated for this stage, students are required to seek out and interview a person from each group. Often they choose to interview friends, parents, younger/older siblings etc. Students start their audience survey interviews by showing their Stage 1, Vision Page and explaining their project idea. They then use a colored hat questionnaire that they have devised, based on De Bono's six colored thinking hats (De Bono, 1985). This survey data provides neutral objective information (white), emotional feelings (red), somber, serious, cautious views that points out weakness (black), positive optimistic opinions (yellow), alternative creative ideas and options (green), and a higher level managerial perspective (blue). Next, students ask each audience to state any left brain critical needs (things the idea needs to work) or any right brain creative wants (things they'd like to see). They record keywords from their interviewees and later create a prioritized list of needs and wants for each of their target audience groups. This user-centering design approach teaches students how to consider the needs and wants of others in their designs. At the end of the stage, the preliminary vision of their project needs to change to accommodate the different perspectives of their audiences.



Stage 2: Define

In Stage 2, students define the top three main *objectives* for their project and their corresponding target *outcomes*. Often this is accomplished by restating the #1 Need or Want identified by the three audience groups as either an objective or outcome, and then discerning its counterpart. If the project is unclear, then students can write a more general, higher level, 1st draft and iterate back to write in specific details when they have a more clear idea of what their project is about (it's objectives) and what it should achieve (it's outcomes). In this stage, students decide what the project will contain, and what the main parts and parameters of the project will be. Finally, the limits and boundaries of the project are set to position content in or out of the project scope. This stage is primarily verbal and tends to include rather abstract visual concepts. As a result, this stage often needs to be revisited and readdressed over and over again. This method of writing, editing, and rewriting however, is beneficial as it teaches students how to iteratively work towards a clear, concise project statement.



Stage 3: Explore

In Stage 3, students explore ways to *connect* their audience data to their project vision. They do this by visually thinking through sets of visual ideas and by *drawing* concept sketches. Stage three starts as students create small thumbnail sized sketches, called thumbnails of various visual concepts and specific detail views. As a visual brainstorming method, thumbnails enable designers to generate a variety of visual concepts quickly. It is quick and easy to draw something small and in doing so capture the essence of an idea in addition to its specific facts, form, and/or function. To give this method a user centering design approach, students are asked to create six unique, custom-tailored, thumbnails for each audience group. Students do this by first reviewing their audience surveys from stage one. Next, they visually translate their prioritized list of verbalized audience groups needs and wants into visual concepts and design elements. The audience survey data provides concrete verbal and visual content that drives critical thinking and stimulates creative action. As a result, the students' design process again shifts from being individualized or self centered to being customized or user centering as the target users needs/wants have to remain central in the young designer's minds. By teaching students to design for multiple target audience perspectives, students learn to see things in different ways. Students are given a week for the thumbnail method. After which they present their project and process stages, ending with their thumbnails, to get feedback from their peers and professor.

After the critique, students design their top three concepts to create three various solution options. These alternative ideas are drawn again in a larger, more formal, sketch compositional style called a rough comp. Students are asked to create three custom tailored comps, one for each of their top three audience groups. After a week, the three rough comps are critiqued. A final design is then identified or conceptualized by either choosing the best one, by integrating visual elements from all three designs, or by creating a new inspired and informed concept. The final design is visualized, illustrated, and then presented as a final composition illustration, known in industry as a final comp sketch, to conclude this stage.



Stage 4: Arrange

In Stage 4, students formally arrange their ideas by *positioning* and *placing* the visual elements of their final comp into concrete two dimensional construction plans. These plans are created by drawing traditional orthographic drawings (top, front, side views) of their project. In addition to these views, students draw perspective sketches of various angled views to illustrate and communicate their concept in three dimensions. Examples of these perspective sketches include: drawings of characters in action, called character sheets, typical eye level interior perspectives, and 30 °/60 ° and 45 ° perspective product views. Both the orthographic drawings and perspective sketches are value shaded and color rendered to give the drawings depth, detail, and visual interest. These construction plans sketches are typically drawn traditionally at first, scanned in the computer, and then digitally rendered using pen based input devices and raster based artistic software such as: Art Rage, Gimp, and or Photoshop. Both orthographic and perspective drawing techniques are demonstrated by the instructor and practiced by students in lab exercises.



Stage 5: Sequence

In Stage 5, students execute a sequence of production steps to *produce* their final project. The specific implementation steps in this stage can and should vary based on the type of course and nature of the design discipline being taught. As the top two student groups of the presented visual thinking class are in digital media and product visualization, the following steps are relevant to these disciplines. The sequential production steps in this course and stage include: storyboarding, 3D modeling, and 3D texturing. Corresponding to characteristics of this stage students' visually think through and illustrate a time based sequence that describes the story, experience or use of their project. These storyboards describe the personality or story of a character, the navigational experience of an interior space, or the usability or functional use of a product. By situating their project in a user centering, scenario based context, students learn to further think through, design and refine their project vision. After storyboarding, students create three dimensional computer graphics of their project using art based CAD modeling software tools such as 3D Studio Max or Alias Maya.

To create the digital models students scan, and import and use their orthographic views as reference image planes into CAD software. The computer graphic models are created using low polygon modeling tools and techniques. The complete polygonal models are then UV mapped as part of the texture mapping process. The texture maps are rendered using traditional illustration techniques and digital tools. Next, a three point scene lighting technique is used to illuminate the object using a: main direct key light, a shadow brightening fill light, and a set of profile defining and background illuminating rim lights. Rendering the scene creates an artistic digital image of their project idea. All of these traditional storyboarding, and digital visualization production methods are again covered in class using the lecture and lab exercise format.



Stage 6: Assess

In Stage 6 students, present and *critique* their work and the work of their peers. It is important to state here, that at the end of the preceding design stages, all work is informally critiqued and reviewed by all of the students and the instructor. These “end of stage” critiques enables students to see what their peers are doing and helps to ensure that required stage deliverables are completed by their assigned deadline. Based on the feedback from these critiques, students are required to rework, revise, and improve their work. The critique in Stage 6 however, is a main critique in which faculty members from the program are asked to attend. The faculty expertise in various learning concentrations helps students to discern further ways to improve their work.

In this main critique, the faculty measure how well the students have: identified appropriate project visions and target audience group needs, defined and met their top 3 objectives and target outcomes, explored various concepts and custom tailored designs for each of their audience groups, designed appropriate 2D construction plans, and implemented basic 3D visualization production methods. In addition, students are asked to provide a fair and honest self assessment as to how well they think they have met these required stage deliverables. Also during the critique, students are required to ensure that they co-select three main items to correct, improve, or modify. These final changes are to be completed as a final exam during finals week. This approach enables students to meet and to be motivated and mentored by their peers and future professors. Also this critique mandates final examination changes that often result in portfolio quality work. More importantly it teaches students to continually strive to improve their work.



Stage 7: Synergize

In Stage 7, students synergize or put all of the parts of their design process stages and project pieces together to form one integrated solution. To do this, students compile their work from all seven stages and create a concise, comprehensive project report. The report includes all of verbal and visual steps and solutions completed for each design stage. The report serves as a presentation format for the final examination presentation. For the final review, students prepare an oral, verbal, and visual presentation of their design process and present the final changes for their design project. As the third and final project presentation, students gain confidence and experience in public speaking, visual presentation and critique skills. These oral and visual presentation opportunities provide students with ample time and opportunity to improve. Also since students are given final feedback before the final critique, they have the opportunity to be more successful by making final changes and improvements to enhance their final deliverables.

○ Stage 8: Visual Design Thinking

Upon successfully completing the course, students are thought to have both the theoretical knowledge and practice experience to practically apply: the design process, the visual thinking steps, and basic production methods covered in this course. After completing one round of the design process students may be able to operate on a higher level of design awareness. With the knowledge and experience acquired in this course; students may be able to more consciously use the design process to manage more complex challenges. As an emerging design thinker armed with design process, visual thinking methods, and relevant production techniques, students are thought to be both better prepared and able to apply these design practices in future courses.

This repeating design cycle is expressed in the symbol for Stage 8. As a new challenge is embraced, the cycle of design begins again and the 8 turns on its side to form infinity loop ∞ . This symbolizes, that with practice students can improve the visual design thinking skills learned in this class. Upon graduation students hopefully move closer to actualizing a greater awareness and sense of self as they learn to consciously live in and productively contribute to their worlds.

Conclusions

This paper presents a design process and corresponding visual design thinking methods and production techniques. Both the design stages and visual methods can be used to successfully design almost any kind of challenge. The approach is user centered, as the needs of target audiences are incorporated into student ideas. The specific digital media based production steps discussed in Stage 5 can be modified to accommodate many art, design, or technology based learning program objectives. Through experience the author deems it important to have a Stage 5, production component to the class that directly corresponds to the students major. A balanced thinking and doing approach enables students to “make the connections” by practically seeing how visual planning stages directly lead to the actual production of a final concrete deliverable. In doing so, students learn to see the relevance of the visual thinking and planning stages to their discipline. By practically employing the same design process and visual thinking methods presented in this paper in advanced classes, students continue to learn to both consciously and naturally design with these methods while also learning real world production skills.

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