Color Theory/Electronic Color
A Multiple-Media Interdisciplinary Approach to the Study and Use of Color in Design

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PLACE WITHIN CURRICULUM

Color Theory/Electronic Color is a multiple-media interdisciplinary 3-credit introductory course in color theory and electronic color that meets once per week with an approximate enrollment of 15 students. There are no prerequisites and no advanced knowledge of computer graphics is assumed. This course, taught in the Imaging Laboratory Teaching Lab (within the School of Architecture), is an architectural elective for students pursuing a degree in architecture and a concentration elective for students pursuing a Bachelor of Science in Information Technology (BSIT) in either multimedia or graphics and design.

EDUCATIONAL GOALS

There are a variety of goals and expectations – the most important of which may be to make students acutely aware of the use of color in our environment as *both* consumers and creators (designers/specifiers) and be able to understand its use and impacts. Additional and important goals include: (1) Provide an exposure to traditional color theory and design composition for those students studying information technology who, by virtue of their programming and technical expertise, are going to be designing virtual worlds and cyber-architecture in the form of games, websites, location-based entertainment installations, and other visual artifacts (including advertising and theater and/or motion picture set design) with digital media. (2) Expose architecture students to basic color theory so that they can use color effectively in building design as well as in the presentation and simulation of proposed architectural projects. (3) Make all students aware of how color is used in the environment and the impacts its use has on people. (4) Provide students with the technical expertise to be able to analyze color schemes and understand the way different colors interact with one another. (5) Provide students with the knowledge of how computers and related equipment describe (e.g. RGB values, HTML representation, etc.) and mediate the use of color so that they can (a) better control the colors they use for display and design and (b) more effectively use their skills in the design of virtual worlds whose primary representation is digital. (6) Provide to all students straightforward training with current industry tools that are used in color composition or display (scanners, computers, and software for image processing, image compositing, bit-mapped/raster painting.) Additional color management software applications are also available. And finally, in a technological university that does not offer a generalized history of art course, (7) students are exposed to – and required to study – the use of color and composition in examples of fine art – especially painting.

TEACHING STRATEGIES

Physical Environment

A teaching laboratory (both the physical layout and specification of installed equipment) was established by the instructor of this course specifically for this and similar courses taught within the School of Architecture to enable students to work independently and/or collaboratively as necessary. Students work at computers located on the perimeter of the room. A large center table with an additional workstation and scanner is used for collective discussions and group work. A screen at one end is used for projected demonstrations, lectures, and instructional videos. Software is installed so that it is accessible only on the machines in the laboratory and groups are created within the local network so that only students registered for the course have access to the relevant software. The setup allows the instructor to give demonstrations and monitor students who are trying to use a particular software application or access an

instructional website without taking time out to walk behind rows of students to see what they are doing. (When students are set up in rows all facing front, the instructor must rely on (a) taking time out to walk behind students to see who needs help; (b) use monitoring software on an additional screen or workstation to see what students are doing – a time-consuming process; and/or (c) rely on teaching assistants to provide (frequently distracting) help while the instructor continues in the front of the classroom.) An added benefit of having all computer monitors viewable from a central location is that no student can use email or play games without the instructor noticing. The open space in the center also facilitates both impromptu and scheduled instructor-led group discussions that focus on the work of a particular student.

Class Activities

The class meets once per week for a three hour period in order to provide flexibility in type and length of individual assignments/tasks/activities. In general, there are a variety of activities scheduled for any specific class period, each of which may vary in time as needed. Rather than simply provide a lecture with individual assignments, there is an innovative combination of activities to promote learning and continue a high level of interest and focus as well as accommodate the various learning styles of the students. Typically, a class period may consist of an instructional and/or historical video, lecture, software demonstration, short student exercise of very limited scope, or work on a multi-week student exercise during which they can receive criticism and assistance from both the instructor and classmates. Demonstrations and class work rely on multiple media and interdisciplinary knowledge involving both design and non-design students in the same projects and subject matter. Classes always involve interaction between student and instructor as well as between students.

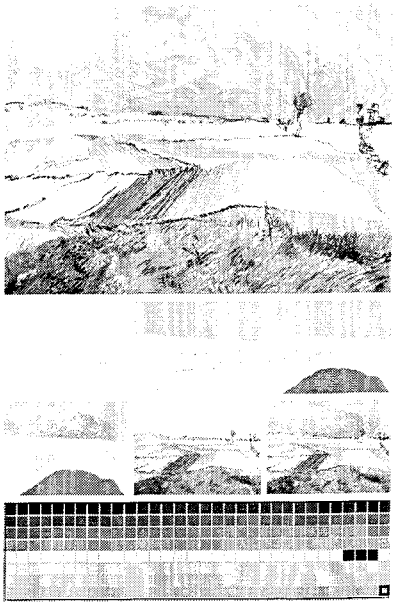
Subjects

A variety of topics are covered and include: the way the eye sees and color vision (including causes/impacts of color deficient vision); color in painting (with specific attention paid to the works of Cezanne, Titian, Monet, Miro, and Mondrian); color wheels and "primary" colors (additive and subtractive); color schemes (monochromatic, analogous, complementary, split complimentary, triadic, etc.) and Itten's "Color Star"; interaction of color (including study of Albers' examples and the assignment of exercises based on his work that include exploration of the Bezold Effect, visual vibration in compositions of complementary colors, visual mixing of colors, etc.); human response to color (including study of Birren and Mahnke's works); color representation in print and photography; file types for displaying color with computers (raster vs. vector, compressed vs. uncompressed, types of compressed files, etc.); color in a digital world: history of computer graphics and electronic color, color models (CIE, CIE L*a*b, Munsell, Maxwell, NCS, Newton, Lambert, Goethe, Gerritsen), colorimetry, gamut, monitors/display, color separation, pattern control, printing, scanning, color correction and manipulation in image processing software (photorealistic, enhanced reality, and artistic composition), digital cameras (how they work as well as how they are used – including their options and limitations); and color in the environment (architecture, advertising, entertainment, web).

Projects and Assessment

There are six separate projects/tasks (excluding assigned and recommended reading) and assessment is proportional to the amount of time spent on each project. The tasks are designed to require students to learn basic color theory, to understand and be able to create a variety of color schemes for different purposes, to be capable of analyzing color as used in architecture and allied arts, and learn a variety of software applications on a need-to-know basis in order to complete the different color studies. The tasks and their relative values are as follows:

- *Participation (5%)*: An evaluation of course participation includes both discussions in class (reflecting, in part, an understanding of the readings) and cooperative work with colleagues.
- *Watercolor Color Wheel and Value Study (7%)*: Students are asked to create a color wheel and value study in watercolor by mixing three colors. They are also taught to scan and required to turn in digital files in multiple formats that are used later when learning about the impacts of various compression algorithms on the ability to faithfully render and display images and used for a study of printer types, output media, and so on.
- *Painting Study and Documentation (25%)*: As a means to learn about color through the study of fine art/painting, and as a way to become proficient with bit-mapped raster paint software, students are given a painting project requiring the creation of a painting facsimile (*without scanning*) and an analysis of the use of color in the painting. Results of the painting facsimiles and analyses are presented in class and graded together.
- *Color Interaction (20%)*: Following lectures, discussion, and readings; exercises requiring both digital and traditional (cut paper) media are assigned to allow an exploration of traditional, Albers-based color studies.
- *Quiz/Exam (10%)*: One three-hour, session-long quiz is given at about the two-thirds point in the class – upon completion of all general color theory material – during which students are shown a series of slides from various media (advertising, painting, printmaking, textile design, clothing, traditional publications, web pages, screen captures from games and videos, etc.) and are asked to briefly describe the color schemes and evaluate their effectiveness. During this class period students are also shown a movie in



Facsimile of Van Gogh's The Plain of Auvers *by T. Hood*

which color plays a significant role and then are given approximately twenty minutes to write about the use of color.

- *Research Project (25%)*: Students are asked to study and present the origin and use of a particular color in environmental design (physical and virtual) or the use of color by a particular designer. This project forces the Information Technology students and the young/inexperienced design students to focus in detail on one color or designer and then expose their colleagues to their findings. The fifteen minute presentations take place during one class period and time is budgeted for discussion after each project.
- *Color Palettes (8%)*: Students are asked to study patterns from other sources (drawing/fine art, ceramic, textiles, etc.) and apply the palette extracted from the original painting study to the line art to create an effective composition.

The projects are evaluated on execution/skill of the software application as well as the aesthetic quality and effectiveness of the final composition (including, but not limited to, the way in which issues of focal point, balance, and color interaction were addressed). Students keep possession of original watercolors and prints to be able to compensate for and calibrate their own monitors/workstation to be used for presentation of their work in other courses and also as an aid to predict color shift when they digitize and print with inkjet and color laser on a variety of papers (bond, coated, glossy, film, etc.). The evaluation of project-based work is consistent with evaluation and assessment of design studio work and is based on both concept and execution.

IMPACT ON PRACTICE

The ways in which this class has the potential to change practice are simultaneously both modest and monumental. They are modest in that proficiency with the tools and subject matter provide skills and knowledge that would contribute to architects designing better buildings and communicating proposed projects more accurately to avoid unexpected surprises and understand the difference between that which is previsualized and that which will be built. The goals are monumental in that anything that produces better architecture and gives both designer and client a better understanding of what will be built prior to its construction is significant and can, ultimately, have a powerful effect on both the practice of architecture (including architect-provided related services like graphic design) and our built environment. Furthermore, the inclusion of students from a technical, non-design discipline expands the visual literacy of society – and gives all of the participating students a visceral appreciation for the creative process.