

An Interdisciplinary Course: “On Beauty: Perspective, Proportion, and Rationalism in Western Culture”

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Abstract

This paper describes the interdisciplinary seminar course “On Beauty: Perspective, Proportion, and Rationalism in Western Culture,” taught by the authors in Spring 2005 as part of the College Honors Program at the College of the Holy Cross. The instructors for this team-taught seminar included Alison Fleming, Sharon Frechette, and Sarah Luria, of the Departments of Visual Arts, Mathematics & Computer Science, and English respectively. This seminar considered the intersections between the fields of art, mathematics and literature. Through carefully selected readings, discussion, papers and presentations, students saw these fields woven together in deep and meaningful ways. Topics were selected around the central theme of “the quest for perfection” in the human form, works of art, the built environment and the natural landscape.

1. Introduction

In the interdisciplinary course described in this paper, mathematics, art, and literature were woven together, challenging students to explore the unity between what they may view as independent and disconnected fields. In studying the quest for perfection in the human form, works of art, the built environment and the natural landscape, we aimed to create meaningful connections and engage students from a variety of majors and interests, by touching upon their own experiences. With the chosen readings and assignments, we invited students to explore both the artistic and the scientific side of each topic, and of their own intellects.

2. Course Information

The students in this course were sophomores recently selected to participate in the College Honors Program. This program, part of the College's Center for Interdisciplinary Studies, admits approximately forty second-year students each year, following a rigorous selection process. These extremely talented students come from a wide variety of majors and are highly active participants in the College community. Students take a common seminar as their first course in the Honors Program, followed by a second seminar of their choosing as third-year students. In their final year, Honors Program students engage in ambitious independent projects, culminating in the senior honors thesis, including a presentation to the

College community as part of the annual Academic Conference at the end of the year.

The annual theme for the common second-year seminar is “On Human Nature.” This seminar is team-taught by three faculty members from disciplines representing the natural sciences, the social sciences, and the humanities and the arts. Each year, the faculty team chooses a specific seminar topic, and designs a unique course that integrates their areas of expertise. Our team consisted of a Renaissance art historian (Fleming), a number theorist (Frechette), and a specialist in 19th century American literature (Luria) centering on city planning and the landscape. We chose to interpret the theme “On Human Nature” through the study of the human quest for perfection and beauty among and across the topics of mathematics, art, architecture, and the landscape.

Our course format had three components: (1) Large group meetings included interactive presentations by the three faculty members. Topics for these meetings were chosen to blend together our strengths, significantly representing all three fields in a cohesive manner. All of us were present for each class meeting, and any number of us would contribute to the presentations, depending on the topic. (2) Small group meetings with our individual sections of 13-14 students included discussions of common readings. These sessions also included mathematical activities facilitated by the three faculty members. Throughout the semester, the number of small group sessions and large group meetings were comparable. (3) Occasionally, there were field trips and guest lectures by outside experts. These were met with great enthusiasm, and substantially enhanced the students’ usual classroom experience.

3. Course Curriculum

In the course introduction, we began with a discussion of the blurring of boundaries between the artistic world and the mathematical world, as depicted in Dan Brown's popular novel *The Da Vinci Code* [2]. This novel was chosen as our springboard due to its broad appeal to students, many of which had read it long before this semester. Discussing the various artworks appearing in the book allowed us to introduce Leonardo da Vinci, and to preview the topics of proportion and perspective, as they relate to Leonardo's Vitruvian Man, and Last Supper. Following this brief introduction, the course content consisted of five main units: (1) Proportion and Ratio, (2) Perspective, (3) Mapping and Measuring, (4) Urban Planning, and (5) The Modern Dimension.

In the first unit, students explored the importance of proportion in mathematics, art and the built environment. They debated the prevalence of the “Divine Proportion,” and studied proportion as applied to the artistic rendering of the human form—from the Spearbearer of Polykleitos in the 5th century BC to Michaelangelo’s 16th-century David—even re-enacting the measurements of Leonardo’s Vitruvian Man. They next considered the modular construction of Italian Renaissance churches, comparing this to Thomas Jefferson’s 19th-century plans for Monticello, the Virginia State Capitol, and the University of Virginia. The wide array of topics in this first unit was chosen to illustrate the universality of these connections between art/architecture and mathematics. The selection of topics and works in the other units had an equally broad base. In general, assigned readings ranged from short articles and primary source excerpts to novels and book-length studies. Readings from *Symmetry, Shape and Space* [3] served as a mathematical backbone during the course. In the second unit, we examined the development of linear perspective, from the standpoint of both mathematics and art. Students learned the technique of one-point perspective, created their own perspective drawings, and dissected the paintings of Renaissance masters. In particular, the works of artist/mathematician Piero della Francesca were studied closely.

The next two units of the course considered mapping and measuring, and urban planning. Students read excerpts of Thoreau’s *Walden*, [4] examined his land surveys, and made a field trip to nearby Concord,

Massachusetts. Following a guided visit to the Thoreau Archives at the Concord Public Library, students envisioned Thoreau's world by walking along a street that he designed, and then across the ice-covered Walden Pond and through the woods to where his cabin once stood. This field trip gave them the opportunity to consider not only the process of map-making, but also the ways in which land is developed and used. This unit closed with a guest lecturer who showed us mapping and measuring in the modern day, with a description of GIS (geographic information systems) and GPS (global positioning systems). Our speaker described applications of these systems as implemented by the City of Baltimore, giving students a taste of the versatility of current technology. The related unit on urban planning explored the designing and re-designing of cities, from 17th-century Rome to 19th-century Paris. The planning of Central Park and the 1892 World's Columbian Exposition in Chicago were also discussed. Their historical role as models for the Washington Mall then led us to a discussion of the Mall, as well as other "monumental spaces" throughout the world.

The final unit of the course examined the concept of dimension, beginning with E.A. Abbott's celebrated *Flatland*, [1] an adventurous excursion into worlds of other dimensions. Students grappled with the problem of understanding the fourth dimension, just as A. Square had struggled to understand Spaceland. This was followed by a look at the art of M.C. Escher and the Cubist and Futurist artists of the early 20th century, as related to the fourth dimension and non-Euclidean geometries, topics that dominated intellectual circles of the time. We discussed the intriguing question of determining the intent of the artist in regard to his use of mathematical ideas. This unit concluded with a short consideration of the Post-Modernist world; students read two short stories by Jorge Luis Borges and looked at architecture, including Frank Gehry's just-completed Stata Center on the MIT campus in Boston.

4. Assessment

The course included three factors for assessing student participation and learning. First, students received a grade for contribution to small group discussions. Student participation in these discussions was high, facilitated in part by the small size of the class sections. We expected them all to complete the daily readings and contribute substantially to the discussion on a regular basis, and the students consistently met or exceeded our expectations. Each faculty member was responsible for assessing the participation grade for students in her individual class section. Second, students completed four paper/project assignments during the course of the semester. Each assignment was designed and graded by a single member of the faculty team, although close consultation with the other members ensured consistency and fairness of grading. Finally, students completed an individual final project in the form of a poster, which was presented at a poster session during the College's annual Academic Conference in late April. These projects were graded jointly by all three faculty members.

More specifically, the first paper asked students to further explore the unity of science and art by researching an individual who could be termed a "Renaissance Man" (or Woman). Their creativity with this assignment got the semester off to an exciting start! Students wrote on such diverse figures as James Cameron, Santiago Calatrava, Piero della Francesca, and George Balanchine, to name a few. Students who chose an artist (or musician, architect, etc.) were asked to focus on the person's scientific or mathematical side, while students who chose a mathematician or scientist focused on discussing the person's artistic side. The second assignment, given during the unit on Perspective, asked students to envision themselves as 15th-century artists charged with writing a pamphlet on the newly invented science of linear perspective. Their goal was to convince their fellow artists to embrace the use of this "modern" technique in their works. This assignment required a visit to the Worcester Art Museum, giving students a first-hand look at works painted before and after the development of linear perspective.

The third assignment asked students to select a favorite spot on campus, and then survey and interpret it,

as Henry David Thoreau did at Walden Pond. This project, which was composed of both a written paper and drawings of the site, allowed students to apply what they had learned in the units on Mapping & Measuring and Urban Planning. The fourth paper, assigned during the final unit on The Modern Dimension, prompted students to envision life in E.A. Abbott's *Flatland*. They proposed inventive explanations for the nature of movement, architecture, writing, and the arts, aspects of life that A. Square merely hinted at in the book. In general, the papers/projects were intended to allow for a wide range of writing styles and interests. Students were encouraged to be creative, inventive, even daring in their approach to these assignments.

In the final course project, students envisioned possible ways to expand the course. They each proposed one additional unit, complete with a general theme, subtopics comprising 4-5 class meetings, images and bibliography. A written paper was due during the final exam period, while students were also responsible for creating a poster—outlining their key information and providing a visual description of a space to contain their ideas—exhibited at the college-wide Academic Conference at the close of the semester.

5. Instructors' Reflections

The commonality of topics on a daily basis required us to instruct each other on the readings and activities coming from the other two fields. This sharing of ideas was one of the most exciting and rewarding aspects of teaching this course! We recaptured the excitement of being students and learning things for the first time, as we shared explanations and discussed the readings. Each of us was challenged on a daily basis to think beyond the boundaries of our own expertise. We had the opportunity to see our subjects through different lenses, gaining valuable perspective to carry over to our individual work. Designing and implementing a course such as this may be a daunting task, yet ultimately it offered a rich and unique experience.

Throughout the course, we aimed to introduce students to new disciplines and encouraged them to find pathways threading between these disciplines. We also presented them with an opportunity to view their own disciplines in new and unexpected ways. Students with artistic inclinations were challenged to think about the scientific contributions to their fields, just as science students were challenged to think about the importance of inventiveness, vision, and artistry in the discovery of science. The students' response to these challenges showed great creativity, flexibility and enthusiasm. Some found themselves drawn to further pursue a field of study they had not envisioned before. This is one of the true advantages of a curriculum such as the College Honors Program, and a wonderful benefit of this course.

References

- [1] E. A. Abbott, *Flatland: A Romance of Many Dimensions*, Princeton, NJ: Princeton UP, 1991.
- [2] D. Brown, *The Da Vinci Code*, New York, NY: DoubleDay, 2003.
- [3] L. C. Kinsey, T. Moore, *Symmetry, Shape and Space*, Emeryville, CA: Key College Press, 2001.
- [4] H. D. Thoreau, *Walden*, Norton Anthology of American Literature. Shorter Fourth Edition. New York: W.W. Norton, 1995. 788-829.