

**MA 111
Spring 2010**

Paper 1 Guidelines

In the first portion of our class, we have been exploring mathematical and cultural ideas of symmetry in three different ways: learning the mathematics of group theory, reading Gardner's *The New Ambidextrous Universe* and other of his essays, and examining other examples of symmetry in art, biology, and music. You are to write a paper which **synthesizes** these approaches to symmetry and which **explores** the value of a mathematical approach to symmetry.

Subject Matter

Your paper should be centered on one or more objects, ideas, or pieces of art which demonstrate complex forms of symmetry. If you use more than one object, idea, or piece of art the objects should be related to each other in some natural way. For example, you could use three different paintings by the same artist or 3 different jellyfish.

Your goal should be to synthesize the different aspects of the course by focusing on particular objects. This means that you should rely heavily on Gardner's book. You may use other sources, but this is not a research paper, *per se*. One other resource which may be helpful the book *Symmetry* (especially the non-mathematical parts) by Hermann Weyl which is on reserve in the Olin Science Library.

Structure

Your paper will consist of a short introduction to the object you will be studying, a section performing a mathematical analysis of the symmetries (or near symmetries) of the object, and then a reflection on the value of mathematics for an appreciation of the object.

In the mathematical portion of the paper, you should relate the symmetries of the object to the symmetry groups we have studied in class and discuss how the consideration of different aspects of the object affects the symmetry. Examples of questions you might address include:

- What types of rotational, bilateral, or translational symmetries are there?
- Are there other types of symmetries? For example, does scaling leave the object unchanged?
- In what ways do the symmetries you've identified fail to be perfect symmetries?
- What features make the object asymmetrical?
- How does taking color or pattern into account change the symmetry group of the object?
- What is an estimate for how many symmetries the object has?

In the reflective portion of the paper, you may wish to address whether or not the mathematical analysis made you notice attributes of the object that you would have missed otherwise. You should also discuss the aesthetic effects of the symmetries you have found. In the reflective section is where you should draw on Gardner's discussion of

bilateral symmetry for comparison or contrast. Your guiding question should be: is a mathematical understanding of symmetry helpful for understanding the object?

In order to have enough content you should carefully choose your object of study. An object with too few symmetries or whose symmetries are completely obvious may not provide a substantial enough basis for your paper.

Technical Requirements

- 1) The paper should be 4 - 6 pages in length, not including any figures or pictures.
- 2) It should be typed in 12 pt font with 1 ½ in. line spacing and reasonable margins. You may hand write any mathematical symbols or figures.
- 3) You **must** cite all sources, including sources for images.
- 4) You should include a picture of the object, a thorough description, or a link to a picture (or recording) of the object so that I can compare your analysis with my own analysis.
- 5) This is neither a research paper nor a personal essay, although you may (and perhaps should) express opinions.
- 6) The writing style should be formal, without being stilted, and should be free from serious grammatical and typographical errors.
- 7) This paper should reflect **your** understanding of the material we have covered; significant similarity between your paper and another's will be cause for concern and may be considered academic dishonesty.

The paper is due in class on **Friday, March 19**, although you may submit it earlier by email to sataylor@colby.edu . I prefer PDF format for papers. If you turn in a rough draft of your paper by **Monday, March 15**, I will give you feedback in advance of the due date. **Jessica Acosta** is the writing fellow assigned to this class. She is available to help you with the organization and writing of your paper. She can be reached at jtacosta@colby.edu .