Pattern Play:
The Creative Arts & Mathematics

FALL 2014  MWF 1:30-3:20pm

Instructors: Erik Stern (estern@weber.edu) & Julian Chan (julianchan@weber.edu)
Office: (Stern) Browning Center 213 B, (Chan) Building 4 513A
Credits: 6  Rooms: SG 71 & 72

This course satisfies two Weber State University requirements:

• Honors CA 2020: Exploring Primary Texts in the Creative Arts (3 credits)
• MATH QL 1030 Contemporary Mathematics

The mathematician does not study pure mathematics because it is useful; he studies it because he delights in it and he delights in it because it is beautiful. – J.H. Poincaré

PREREQUISITES
• Math 1010 grade of C or better or an ACT score of at least a 23 or a placement test
• Interest in writing
• Interest in creativity and the creative arts. Willingness to share written, oral and creative work with teachers and class, to move and use the body, to work with materials and music

REQUIRED MATERIALS & PROCEDURES:
1) Journal and notes
2) Comfortable clothing on moving days
3) Text: Math Dance with Dr. Schaffer and Mr. Stern by Schaffer, Stern, and Kim.
   Selected texts and articles on e-reserve
4) Regular access to CANVAS for assignments, discussions and course updates
5) Assignments handed hardcopy. No exceptions
6) Attendance (four total absences before grade is lowered), timely handing in of papers and attendance on test days
7) Willingness to create and discuss creative projects in a respectful manner
8) Other texts that will be excerpted:
   The Creative Habit: Learn It and Use It for Life by Twyla Tharp and Mark Reiter
   The Heart of Mathematics – An invitation to effective thinking by Edward B. Burger and
   Michael Starbird
   The Creative Process – Reflections on Invention in the Arts and Sciences, edited by
   Brewster Ghiselin
   A Mathematician’s Lament – How School Cheats Us Out of Our Most Fascinating and
   Imaginative Art Form by Paul Lockhart

   Dance first. Think later. It’s the natural order. –Samuel Beckett

Why This Class?
   Take a few moments and picture a person Creating, Manipulating, Defining and Expressing
   Pattern.

   What did you see? You may have imagined someone making a model of the double helix of
   human genes, or throwing clay on a potter’s wheel. Pattern underlies everything we do, see and study:
   chemistry & pottery, traffic & card tricks, the Hustle & knitting the heel of a sock. Recent studies
   show people are not naturally good at finding randomness. But we’re very good at pattern, and when
   we think of classic human ways to do pattern, Mathematics and Dance are among the most
   fundamental.

   In this course, we will embody and analyze pattern and look at the underlying structures of
   pattern. We will apply old concepts to new ones. In mathematics and science one tries to quantify the
   physical world using a model or set of assumptions, and in dance and art one can use a particular style
   to guide them. In all these disciplines, we observe what happens when we change one aspect of the
   model or the work of art. We learn by looking at the result and responding to what we see. We play.

   We will explore the connections between mathematics and dance, visual art and music. The
   spatial, timing and experiential aspects of these art forms allow us to explore areas in mathematics
   such as geometry, symmetries, counting principles and more. But there is an underlying theme of this
   course that goes beyond mathematics and the arts, and belongs to the larger whole of how we learn:
   moving as thinking, and thinking as moving.

   Although the two courses will be graded and the Learning Outcomes evaluated, in practice the
   course will involve integrating the two areas as often as possible.

   Obviously is the most dangerous word in mathematics. - E.T. Bell
COURSE OBJECTIVES

We will . . .

- Create projects through choreography, with some work in visual art and music (see "Creative Arts Foundation Principles and Learning Outcomes" below)
- Look carefully at the patterns to be found in these creative projects and related mathematical concepts
- Learn about specific mathematics concepts (see "Mathematical Topics Addressed" below)
- Develop the ability to discuss, analyze and reflect on these above processes

**Grading**

<table>
<thead>
<tr>
<th>Attendance and In-Class Work</th>
<th>Required</th>
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<tbody>
<tr>
<td>Journal (one entry per class)</td>
<td>10%</td>
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<tr>
<td>Papers</td>
<td>15%</td>
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<tr>
<td>Creative Arts Projects</td>
<td>15% (not graded on performance ability)</td>
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<tr>
<td>Exams</td>
<td>20%</td>
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<tr>
<td>Project/Signature Assignment</td>
<td>20%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>20%</td>
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NOTE: To receive credit for both courses, a student must receive at least a C- in both classes, and the average of the grades in the two classes must be at least a C.

A signature assignment addresses the overall idea of the course and can take many forms: written, oral presentation, performance and other. These assignments serve many assessment aspects: course Learning Outcomes, and Honors outcomes such as communication skills, critical thinking, open-minded inquiry and awareness of diverse points of view. Signature Assignment topics are designed by students in conjunction with faculty, and must have faculty approval. They will be presented at the end of the semester, and can be done individually or in pairs.

The journal will be a record of your response to each class session. Keep it simple; briefly answer three questions:

1) What did I get out of the session?
2) What did I learn about math and creative arts?
3) What questions do I have?

We tend to think more effectively with spatial imagery on a larger scale. It's as if our brains take larger things more seriously and can devote more resources to them. — William Thurston
Mathematics Topics Covered (and related art activity or chapter)
Generally, each new mathematics section will be introduced by a creative activity. These topics satisfy Mathematics 1030 requirements

1. Polygons and Polyhedra
2. Transformational Geometry
3. Proportional Reasoning
4. Graphing
5. Functional Relationships
6. Permutations and Combinations
7. Counting
8. Golden Ratio and Fibonacci numbers
9. Fractals
10. Probability theory
11. Probability distributions
12. Conditional probabilities
13. Topics in Statistics
14. Pythagorean theorem - history, proof, and application
15. Exponential & Logarithmic Functions
16. Personal Finances
17. Group Theory
18. Study of Symmetries
19. Number systems and their history
20. Logic
21. Binary System

A lot of people insisted on a wall between modern dance and ballet. I'm beginning to think that walls are very unhealthy things. - Twyla Tharp

Mathematics 1030 learning Outcomes

1) Interpret mathematical models such as formulas, graphs, tables, schematics and draw inferences from them
2) Represent mathematical information symbolically, visually, numerically, and verbally.
3) Use arithmetical, algebraic, geometric, and statistical method to solve problems.
4) Estimate and check answers to mathematical problems in order to determine reasonableness, identify alternatives and select optimal results.
5) Recognize that mathematics and statistical methods have limits.
6) Understand basic concepts describing time-varying systems, and how prediction follows from the formulation of basic laws of change, both analytically and numerically.

Dance and mathematics share many essential concerns: 1) they both deal with pattern recognition and manipulation, 2) they both involve defining a problem and seeking a solution, 3) they both begin with concrete problems and progress to abstract ideas, 4) they both involve aesthetics and are integrally connected to cultural values and biases, and 5) they both can make you sweat. - Schaffer and Stern
Creative Arts and Humanities General Education

Exploring Primary Texts is a 2000 level series of Honors courses that emphasizes primary texts, interdisciplinary thinking, open-ended questions and new ways of looking at things. The primary texts in this case of HNRS CA 2020 absolutely fit the bill of "being original or seminal," but represent a different take on the academic definition; these "texts" will come from studies that students create in Pattern Play under the guidance of the teacher. There will also be "texts" (dance, visual art and music examples from history) that represent the intersection of mathematics and the arts. As support texts, students will read and hear from people who have thought deeply about the arts and examine in what ways the arts might be considered one of the pillars of humanity. These support texts and lectures will be both assigned and researched by students.

Creative Arts General Education Foundational Principles

1) We believe the arts and humanities play a fundamental role as tools for the analysis, interpretation, creation, and expression of human ideals, challenges, and desires across cultures.

2) Perspectives from the arts and humanities apply to other academic disciplines and to society at large.

3) We value open inquiry into complex problems, and the ability to reflect on, analyze, and appreciate diverse viewpoints and schools of thought.

Although the broad foundational principles outlined above are explored in both Creative Arts and Humanities courses, important distinctions of emphasis characterize these two branches of knowledge. The specific learning outcomes for the Creative Arts are as follows.

Creative Arts General Education Student Learning Outcomes

7) Students will create works of art and/or increase their understanding of creative processes in writing, visual arts, interactive entertainment, or performing arts.

8) Students will demonstrate knowledge of key themes, concepts, issues, terminology and ethical standards employed in creative arts disciplines. They will use this knowledge to analyze works of art from various traditions, time periods, and cultures.

Honors Program Learning Outcomes

- Examine one's own perspective in the light of differing values or points of view
- An integrative approach to education, connecting disciplines and ideas
- Developing oral, written and other forms of communication
STUDENT RESPONSIBILITIES
Students who choose to complete *Pattern Play: Mathematics and the Creative Arts* must be responsible members of the class. Ideally, we should all help one another learn; *at the very least, no one student may impede the learning another*. If necessary, we reserve the right to address issues related to these requirements privately with a student, and, if that student is not able to properly meet the requirements, ask the student to drop the class. Feel free to make an appointment with me or see me after class if you have any questions.

Any student requiring accommodations or services due to a disability must contact Services for Students with Disabilities (SSD) in room 181 of the Student Services Center. SSD can also arrange to provide course materials (including this syllabus) in an alternative format if necessary. You must make your request for accommodation no later than the beginning of the second week of classes.

Academic integrity is required as per the Student Code. Weber State University Student Code: The Student Code is spelled out in the Student Policy and Procedure Manual (SPPM). Students have specific rights in the classroom as detailed in Article III of the code. The code also specifies proscribed conduct (Article IV Section D) that involves cheating on tests, plagiarism, and/or collusion, as well as fraud, theft, etc. Students should read the Code carefully and know they are responsible for the content. Students will receive sanctions for violating one or more of these proscriptions.

In the event of a situation causing the closure of campus, please check your wildcat e-mail for instructions about this course.

Grading Scale:

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<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A</td>
<td>93-100</td>
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<tr>
<td>A-</td>
<td>90-92</td>
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<tr>
<td>B+</td>
<td>87-89</td>
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<td>B</td>
<td>82-86</td>
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<tr>
<td>B-</td>
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<td>C+</td>
<td>76-78</td>
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<td>C</td>
<td>71-75</td>
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<td>C-</td>
<td>68-70</td>
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<td>D+</td>
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Late work will either not be accepted or will result in reduced points. Homework will be due on the date listed on CANVAS.

IMPORTANT DATES
Last day of class
Signature Assignment presentations
Final Exam/Discussion
Holidays (NO CLASS)

Every dance is a kind of fever chart, a graph of the heart. — Martha Graham