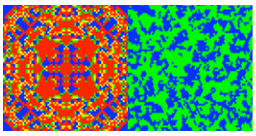
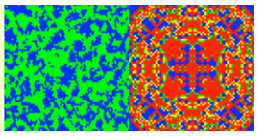


THE EVOLUTION OF COOPERATION



MSCI-463, The Evolution of Cooperation ***Fall 2014***
Department of Mathematics and Science, School of Liberal Arts and Sciences, Pratt Institute

Course Description:

When we describe what propels evolution, "competition" and "exploitation" are the processes that first come to mind. However, cooperation within and between organisms has also played a prominent role in the evolution of the earth's species. In this course, we will consider the various levels at which cooperation has emerged as the result of natural selection, starting with single-celled organisms and building up to human cultural systems. While the course has no prerequisites, the readings and assignments will be aimed at highly-motivated students; students will be expected to conduct significant independent inquiry.

Upon completion, this course is worth three (3) credits.

Meeting Time: Thursdays, 9:30 am to 12:20 pm, North Hall 107

Instructor:
Dr. Christopher Jensen
Associate Professor, Department of Math and Science
http://www.christopherxjjensen.com/
Office: ARC Lower Level, Room G-49
Email: cjensen@pratt.edu
Phone: 718-636-3572, x3572 from the BK campus

Office Hours: Mondays 11 am to 12:30 pm and 2:00 to 3:30 pm, *or by appointment*

Course Goals:

- To understand how cooperative interactions evolve within biological systems.
- To explore the various levels at which cooperation emerges in biological systems.
- To distinguish between altruistic and selfish behaviors.
- To become familiar with the various ways in which scientific researchers approach the problem of how cooperation evolves.
- To understand how cooperation functions in modern human society.

Learning Outcomes: Students who successfully complete *The Evolution of Cooperation* will be able to...

- Describe cooperation in the biological world, including the ecological conditions which foster this cooperation.
- Investigate evolutionary games to produce insights into how cooperation evolves.
- Discuss whether a particular behavior should be considered altruistic.
- Explain the various ways that natural selection can either produce or destroy cooperative structures and behaviors.
- Describe the levels of biological organization at which natural selection may operate.
- Apply your understanding of how cooperation evolves to the human species.

Assessment Criteria:
Below is a summary of how you will be graded in this course. All grades will be posted on the *LMS*, so please take advantage of the fact that you can always know how you are doing in the course.

Contribution to Grade	Category	Description
25%	*Homework*	You will be required to complete two kinds of homework in this class: reading response questions (**RRQ's**) and post-class questions (**PCQ's**). Both are posted and completed on the *LMS*. **RRQ's:** For each week's readings, I will post a series of RRQ's. These open-ended questions will help guide your reading and get you thinking about key issues that will be discussed in class. To receive credit, you must provide answers by 5:00 pm on the day before class. Unlike other assignments, late RRQ's will not be accepted. **PCQ's:** After each class I will post a series of short-form PCQ's. Unlike the RRQ's, PCQ's are not open-ended; if you emerge from class with a good understanding of the major ideas discussed, you should be able to complete the PCQ's in very little time. The *LMS* actually allows you to correct wrong answers on the PCQ's, although at the cost of some credit. You are free to use any resource *other than another person* to complete the RRQ's and PCQ's: your notes, books/articles, the internet, and other media are all allowed (see ***Open Information Policy and Honor Code*** below).
25%	*Classwork*	We'll be discussing course readings in light of our own particular concerns. I'll have questions for you; I will expect you to have questions for me. Come to class having read and thought about assigned readings, ready to actively engage in dialogue. To receive participation credit you need to be present in class; to receive full participation credit you need to be actively engaged in class discussions and work. Based on your participation during each regular class session, I will assign you a specific grade and make comments on the strengths and weaknesses of your contribution. You will also complete assignments in class. Some of these assignments will be done individually, others will require group cooperation. I will be grading your work on each assignment based on its clarity of thought, level of insight, and contribution to class dialogue.
10%	*Presentation*	During Week 02 of class, you will be given the chance to sign up to present a *key concept* at some point in the semester. Presentations take place in class throughout the semester, and you must present the *key concept* at the time that you signed up for. Your presentation will be graded based on how well you explain your *key concept* to your fellow students. See the *Key Concept Presentation Guidelines* (posted on the *LMS*) for more information.
10%	*Midterm Exam*	During Week 07 of class, a *Midterm Exam* will be taken in class on the *LMS*. This midterm will cover all material from Weeks 01 through 06. Please make sure to bring your Pratt I.D. to class on the day of your *Midterm Exam*, as we will be taking this exam in a Pratt computer lab. The midterm will be in an "open notes/ open book/open internet" format and will focus on broad concepts regarding how cooperation evolves rather than the regurgitation of biological facts.
30%	*Final Exam*	This course ends with a cumulative *Final Exam* that will be taken in class on the *LMS*. Please make sure to bring your Pratt I.D. to class on the day of your *Final Exam*, as we will be taking this exam in a Pratt computer lab. The final will be in an "open notes/open book/open internet" format and will focus on broad concepts regarding how cooperation evolves rather than the regurgitation of biological facts.

Under no circumstances will personalized extra-credit work be offered to any student

Open Information Policy and Honor Code:

You will never be required to memorize anything in this class: we maintain an "open information" environment, so you may use your notes, books/articles, the internet, and other media to complete homework, in-class assignments, and exams.

HOWEVER: Unless specifically stated otherwise, all work in this class is to be completed on your own. You may not and should not obtain help from any other person to complete any of your work: this includes all homework, all exams, and individual assignments. You should also not share any of your individual work with other students. "Studying together", discussing material outside of class, and any other processing of the course materials prior to completing coursework is allowed and encouraged, but you need to do your own work. Students are asked to sign an oath to uphold and honor this code at the beginning of the semester, and are expected to take this commitment seriously even when violating the code would likely escape detection. Any violations of this policy will be considered cheating and reported as appropriate (see ***Classroom Civility and Academic Honesty*** below).

Lateness and Absence:

Of Students: I expect you to arrive to class on time. Lateness and absence can adversely affect your participation grade.

Of Assignments: Late reading response questions (RRQ's) and post-class questions (PCQ's) are not accepted. You must make your presentation on the day you signed up for.

Excuses: There are very few legitimate reasons to miss all or part of a class session or for submitting assignments after the stated deadlines. In order for an absence or lateness to be excused, you must provide formal documentation stating which classes/deadlines were affected and explaining the reason behind the absence; all documentation will be subject to strict verification. Valid excuses include family emergencies and chronic personal health issues. The following reasons do not excuse lateness or absence: oversleeping, excessive work load in other classes, inability to use the *Learning Management System*, or "forgetting".

Readings:

There is no required textbook for this course. You will be assigned a series of reading materials from popular science periodicals, books, and the scientific literature posted on the *LMS* (see ***Weekly Units*** below). The main book sources for readings in this course are:

Corning, Peter (2011). The Fair Society: The Science of Human Nature and the Pursuit of Social Justice. The University of Chicago Press. (ISBN: 978-0-226-00435-8)*

Dawkins, Richard (1989). The Selfish Gene. Oxford University Press. (ISBN: 0-19-286092-5)*

Henrich, Natalie & Joseph Henrich (2007). Why humans cooperate: a cultural and evolutionary explanation. Oxford University Press. (ISBN: 978-0-195-30068-0)*

Hölldobler, Bert & Edward O. Wilson (2009). The Superorganism: The Beauty, Elegance, and Strangeness of Insect Societies. W.W. Norton Company. (ISBN: 978-0-393-06704-0)*

Ridley, Matt (1996). The Origin of Virtue. Penguin Books. (ISBN: 0-670-87449-3)

Ryan, Frank (2002). Darwin's Blind Spot. Houghton Mifflin Company. (ISBN: 0-618-11812-8)

Weiss, Kenneth M. & Anne V. Buchanan (2009). The Mermaid's Tale: Four Billion Years of Cooperation in the Making of Living Things. Harvard University Press. (ISBN: 978-0-674-03193-7)*

Williams, George C. (1996). Plan and Purpose in Nature. Phoenix (London). (ISBN: 0-75380-042-X)*

You are encouraged to save paper by viewing all readings electronically (as opposed to printing them out); books with asterisks (*) are on reserve in the Pratt Brooklyn library.

Learning Management System (LMS):

During the course of the semester, we will make extensive use of Pratt's *Learning Management System* (*LMS*). I recommend that you use the *Firefox* browser to access the *LMS* via this page: http://lms.pratt.edu/ (I discourage you from using the *my.pratt.edu* entrance point, as it is not always working). Use your ONEKEY username and password to log in. I expect you to check the *LMS* several times a week for announcements, reading assignments, and updates to your class grade (note that you can also set the *LMS* to send you email messages every time our class page is updated). I will be using the *LMS* to send email announcements throughout the semester, so please make sure that you check the email address listed under your *LMS* profile regularly. "I forgot to check my Pratt email" is an invalid excuse.

I try to make the assignments, announcements, and other documents I post on the *LMS* as universally-readable as possible. The only proprietary program you will need to have loaded onto your computer is *Acrobat Reader*, which can be downloaded here: http://www.adobe.com/products/acrobat/readstep2.html. I strongly recommend that you use *Acrobat Reader*, rather than another program, to read all of the PDF's provided in this class.

***Important*:** If you experience any problems with the *LMS*, you should:

1. Report the problem to the ***Service Desk*** and receive a "ticket number" by one of four means:
   a. visiting their office in the basement of the ARC Building; or
   b. calling (718) 636-3765; or
   c. emailing services@pratt.edu; or
   d. using the "Computers & Technology Services" section of the "Get Help With" tab of my.pratt.edu.
2. Receive an email from the ***Service Desk*** assigning your problem a "ticket number".
3. Forward this email from the ***Service Desk*** to me.

In order for me to verify claims of *LMS* outages, you must contact the ***Service Desk*** *when the LMS problem occurs*, not hours or days later.

Classroom Civility and Academic Honesty:

I expect you to maintain the civility and integrity of our course in and out of the classroom. In class, this means arriving on time, turning off cell phones and refraining from sending text messages, maintaining focus on class discussion, respecting the right of others to speak, and leaving the classroom in good condition (among other things). Out of class, this means properly citing all work that is not your own (in other words, not plagiarizing).

Plagiarism means presenting, as one's own, the words, the work, information, or the opinions of someone else. It is dishonest, since the plagiarist offers, as his/her own, for credit, the language, or information, or thought for which he/she deserves no credit. Types of plagiarism include: (1) The use of any material from any source other than yourself in a paper or project without proper attribution. This includes material from the Internet, books, papers or projects by other students, and the media; (2) The extensive use of the ideas of others in your work without proper attribution; and (3) Turning in work done by another person, downloaded from the web, purchased from any agency or supplier, as one's own. Plagiarism occurs when one uses the exact language of someone else without putting the quoted material in quotation marks and giving its source. The method for documenting sources and references is established by a number of standards: please choose one of these standards (such as the *MLA Handbook for Writers of Research Papers* or the *Chicago Manual of Style*) and use it consistently. Plagiarized assignments receive no credit, and all cases of plagiarism will be referred to the Registrar. For more information on avoiding plagiarism, please see: http://www.christopherxjjensen.com/teaching/for-students/#no-plagiarism.

Any disruptive, disrespectful, or dishonest behavior will be promptly reported to the appropriate campus authority. Students must adhere to all Institute-wide policies which include policies on attendance, academic integrity, plagiarism, computer, and network use. Please see http://www.pratt.edu/student_life/student_affairs/student_policies/ (click on *Online Student Handbook*) for policies and procedures for handling academic conduct issues.

Rights of Students with Disabilities:

If you have a physical or learning disability, ADD/ADHD, chronic disease, or physical condition that we should know about, please contact Disability Services at 718-636-3711 to discuss your needs and how we can best serve you. In order to receive classroom accommodations and other services, you must have documentation of your disability on file in the Disability Services office. Your records will be kept completely confidential. For more information, please see the Pratt webpage for Disability Services (http://www.pratt.edu/student_life/student_services/disability_resource_center/for_students/services/).

Weekly Units:

Week	Date	Major Topic(s)	Key Questions	Readings	Events & Assignments
01	Aug. 28th	**Introduction to evolution and game theory**	1. How do evolutionary processes work? What constraints are there on evolution? 2. What is game theory? 3. How is game theory used to understand evolutionary processes?	‣ *Plan and Purpose in Nature* "Adaptationist Storytelling" [Ch 1] ‣ *Plan and Purpose in Nature* "Functional Design and Natural Selection" [Ch 2] ‣ *Evolutionary Games Infographic Project* "Prisoner's Dilemma Interactive Guide"	➡ *Syllabus* distributed ➡ *LMS Warm-up Assignments* discussed ➡ **Reading Response Questions & Follow-Up Questions** due @ 5 pm EST 5 days after your class section meets
02	Sept. 4th	**Cooperation in evolutionary games**	1. How has game theory contributed to our understanding of how cooperation evolves? 2. How can experiments in game theory be used to understand how cooperation evolves?	‣ *Scientific American* "The Economics of Fair Play" ‣ *Scientific American* "The Traveler's Dilemma" ‣ *Nature* "Winners don't punish" ‣ *BMC Evolutionary Biology* "Reciprocal cooperation between unrelated rats..."	➡ **Reading Response Questions** due @ 5 pm EST on the day before your class section meets ➡ Class visits a computer lab: remember to bring your Pratt ID!! ➡ *Key Concept Presentation* guidelines distributed ➡ **LMS Warm-up Assignments** due Sunday, September 7th @ 11:59 pm EST ➡ **Follow-Up Questions** due @ 11:59 pm EST 5 days after your class section meets
03	Sept. 11th	**Evolution and the morality of nature**	1. What is altruism? 2. Can organisms interact in a harmonious manner? 3. Does nature have a moral code?	‣ *Plan and Purpose in Nature* "Philosophical Implications" [p. 211-218] ‣ *The Origin of Virtue* "Ecology as Religion" [Ch 11] ‣ *Darwin's Blind Spot* "From Anarchy to Cooperation" [Ch 3] ‣ *Talk of the Nation*, Interview with Frans de Waal	➡ **Sign up** for a *Key Concept Presentation* slot by Monday, September 8th @ 11:59 pm EST ➡ **Reading Response Questions** due @ 5 pm EST on the day before your class section meets ➡ Class visits a computer lab: remember to bring your Pratt ID!! ➡ **Follow-Up Questions** due @ 11:59 pm EST 5 days after your class section meets

Week	Date	Major Topic(s)	Key Questions	Readings	Events & Assignments
04	Sept. 18th	**Selfish genes, cooperative genomes, and multicellular organisms**	1. What is "Selfish Gene Theory"? What evidence supports this theory? 2. What allows the genome to "cooperate"? 3. How did multicellular organisms evolve?	‣ *The Selfish Gene* "Why are people?" [Ch 1] ‣ *The Selfish Gene* "The replicators" [Ch 2] ‣ *The Selfish Gene* "Immortal coils" [Ch 3] ‣ *The Mermaid's Tale* "The Cooperative Genome" [Ch 11] ‣ *The Scientist* "The Cheatin' Amoeba"	➡ **Reading Response Questions** due @ 5 pm EST on the day before your class section meets ➡ Class visits a computer lab: remember to bring your Pratt ID!! ➡ *Key Concept Presentations* begin ➡ **Follow-Up Questions** due @ 11:59 pm EST 5 days after your class section meets
05	Sept. 25th	**Inclusive Fitness**	1. What is inclusive fitness and how might it lead to kin selection? 2. How is kin selection related to altruistic behavior? 3. Does kin selection explain most forms of intra-species cooperation?	‣ *Animal Behavior* "Hamilton's legacy: kinship, cooperation and social tolerance in mammalian groups" ‣ *Philosophical Transactions of the Royal Society Biological Sciences* "Helping in cooperatively breeding long-tailed tits: a test of Hamilton's rule"	➡ **Reading Response Questions** due @ 5 pm EST on the day before your class section meets ➡ **Follow-Up Questions** due @ 11:59 pm EST 5 days after your class section meets
06	Oct. 2nd	**Sociality and group living**	1. Why do organisms live together? 2. What are some of the challenges of social living? 3. When does social living involve cooperation? 4. What adaptations can maintain cooperation amongst members of a social group?	‣ *Trends in Ecology & Evolution* "The Evolution of Social Behavior in Microorganisms" ‣ *National Geographic* "In the Whirl" ‣ *The New York Times* "African Wild Dogs, True Best Friends" ‣ *Scientific American* "Divided We Fall: Cooperation among Lions" ‣ *Nature "*Group living and hungry lions" ‣ *Nature "*Group formation stabilizes predator–prey dynamics"	➡ **Reading Response Questions** due @ 5 pm EST on the day before your class section meets ➡ Last hour of class used for *Midterm Exam Review* ➡ **Follow-Up Questions** due @ 11:59 pm EST 5 days after your class section meets
07	Oct. 9th	**Midterm Exam** taken <u>in class</u> on the *LMS*.			➡ Class visits a computer lab: remember to bring your Pratt ID!!

Week	Date	Major Topic(s)	Key Questions	Readings	Events & Assignments
08	Oct. 16th	**Symbiosis and mutualism**	1. What makes mutualism different from other forms of cooperation? 2. What allows the evolution from parasite to mutualist? 3. How does natural selection maintain mutualisms?	‣ *Darwin's Blind Spot* "The other force of evolution" [Ch 2] ‣ *Darwin's Blind Spot* "Symbiosis comes of age" [Ch 9] ‣ *Darwin's Blind Spot* "The wonder of symbiosis" [Ch 10] ‣ *Scientific American* "The Ultimate Social Network"	➡ **Reading Response Questions** due @ 5 pm EST on the day before your class section meets ➡ **Follow-Up Questions** due @ 11:59 pm EST 5 days after your class section meets
09	Oct. 23rd	**Superorganisms**	1. Why do some organisms live in cooperative colonies? 2. Can natural selection act on these colonies?	‣ *The Superorganism* "The construction of a superorganism" [Ch 1] ‣ *The Superorganism* "Genetic social evolution" [Ch 2] ‣ *Science* "Ancestral monogamy shows kin selection is the key to the evolution of eusociality"	➡ **Reading Response Questions** due @ 5 pm EST on the day before your class section meets ➡ Class visits a computer lab: remember to bring your Pratt ID!! ➡ **Follow-Up Questions** due @ 11:59 pm EST 5 days after your class section meets
10	Oct. 30th	**Multilevel selection theory**	1. How do we extend simple models of evolution to explain the evolution of cooperative behaviors? 2. Under what conditions does selection operate on more than one level?	‣ *The Quarterly Review of Biology* "Rethinking the theoretical foundation of sociobiology" ‣ *The World* "Seeking the roots of kindness" ‣ *PLoS One* "Multilevel selection and Neighborhood Effects..."	➡ **Reading Response Questions** due @ 5 pm EST on the day before your class section meets ➡ **Follow-Up Questions** due @ 11:59 pm EST 5 days after your class section meets
11	Nov. 6th	**Human altruism**	1. In what ways do humans act towards the common good? 2. Should we label this behavior as altruistic? 3. What mechanisms foster cooperation in human groups?	‣ *Nature* "The nature of human altruism" ‣ *Nature* "Share and share alike" ‣ *Nature* "Egalitarianism in Young Children" ‣ *NPR All Things Considered* "Do We Choose Our Friends Because They Share Our Genes?" ‣ *Proceedings of the National Academy of Sciences* "Friendship and natural selection"	➡ **Reading Response Questions** due @ 5 pm EST on the day before your class section meets ➡ **Follow-Up Questions** due @ 11:59 pm EST 5 days after your class section meets

Week	Date	Major Topic(s)	Key Questions	Readings	Events & Assignments
12	Nov. 13th	**Human culture and cooperative behavior**	1. How do genes & culture interact to produce behavior? 2. In what ways has human culture allowed for the evolution of cooperative behaviors?	‣ *The Origin of Virtue* "The Division of Labor" [Ch 2] ‣ *Why Humans Cooperate* "Dual Inheritance Theory" [p. 7-11] ‣ *Why Humans Cooperate* "Culturally evolved social norms lead to context-specific cooperation" [Ch 8] ‣ *Evolutionary Anthropology* "Human Evolution and Human History: A Complete Theory"	➡ **Reading Response Questions** due @ 5 pm EST on the day before your class section meets ➡ **Follow-Up Questions** due @ 11:59 pm EST 5 days after your class section meets
13	Nov. 20th	**Contemporary social dilemmas**	1. Why is understanding how cooperation evolves important in modern-day society? 2. What are some of the challenges to modern cooperative efforts?	‣ *Why Humans Cooperate* "Cooperative dilemmas in the world today" ‣ *Scientific American* "No country is an island" ‣ *NPR Planet Money* "Give Me the Money or I'll Shoot the Trees" ‣ *National Geographic* "Rain Forest for Sale" ‣ *The Guardian* "Yasuni: Ecuador abandons plan to stave off Amazon drilling"	➡ **Reading Response Questions** due @ 5 pm EST on the day before your class section meets ➡ **Follow-Up Questions** due @ 11:59 pm EST 5 days after your class section meets
	Nov. 27th	*Thanksgiving Break, No Class*			
14	Dec. 4th	**The future of cooperation**	1. What social dilemmas present challenges to maintaining future cooperative civilizations? 2. How can an understanding of how cooperation evolves lead to a better future?	‣ *Scientific American* "The ethics of climate change" ‣ *Harvard Business Review* "The Unselfish Gene" ‣ *Scientific American* "Don't talk, reproduce"	➡ **Reading Response Questions** due @ 5 pm EST on the day before your class section meets ➡ Course Evaluations ➡ Last hour of class used for *Final Exam Review* ➡ **Follow-Up Questions** due @ 11:59 pm EST 5 days after your class section meets
	Dec. 11th	*Studio Days, No Class*			
15	Dec. 18th	**Final Exam** taken <u>in class</u> on the *LMS*.			➡ Class visits a computer lab: remember to bring your Pratt ID!!