AGENT-BASED SIMULATION MODELING
IN EVOLUTIONARY ANTHROPOLOGY

Course #: ANT 391L
Unique #: 31900

SAC 5.112
Wednesdays, 2:00 to 5:00 pm

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SAC Room 5.150

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Office Hours: Thursdays, 3:00 to 5:00 pm or by appointment

Website: Canvas (https://utexas.instructure.com/)

Check Canvas regularly for announcements, updated class information, readings, and supplementary materials

I. Course Description

The last two decades have seen the increasing use of individual or “agent-based” simulation modeling in the social sciences for examining how emergent aspects of human and nonhuman societies (such as dominance hierarchies, trade networks, coordinated behavior etc.) might arise from the iterated interactions of sets of individuals who each follow a limited set of behavioral rules.

In this course, we will explore the history and application of agent-based models to understanding current problems in evolutionary anthropology and other social sciences, including ranging behavior and use of space, coordination and cooperation, disease transmission, natural selection, and learning among others.

The course will also serve as a practical introduction to computer programming and scientific computing. As a central part of the course, students will develop and execute a software design project using NetLogo, an open-source high-level computer language designed for multi-agent simulation. In developing their models, students will also gain experience with integrating NetLogo with other open-source tools for scientific computing, including geographic information systems, databases, and statistical programming software.
II. Course Format

This course combines lecture, discussion (in which regular participation and comment is required of all enrollees and auditors), and hands-on programming exercises. You will be graded on your participation, individual programming assignments, and a final software design project that you will work on over the course of the semester and present to the group in the last couple of weeks of the class. Each week, I will typically give an introduction to the topic for the week, then we will spend the rest of the class period discussing assigned readings and working our way through code examples to learn the basics of computer programming in NetLogo and other softwares.

III. Prerequisites

This course assumes that students have had at least one semester of undergraduate statistics, statistical programming, computer science or the equivalent.

IV. Required Texts


• NetLogo 5.0.5 *User’s Manual*.

V. Other Useful But Optional Texts


VI. Reading Assignments

Most of our readings for the semester are either select chapters from the books listed above or are taken from the primary literature. Versions of all REQUIRED readings (apart from those from the primary textbook) will be posted as PDF files to the course Canvas site and listed on the syllabus so that you can download them for printing and reading.
For those with further interest in a topic, I will also often post additional, OPTIONAL readings for some weeks. Reading assignments and accompanying programming examples and problems should be completed before class. I strongly recommend that you carefully work through code examples included in the readings as you prepare for class.

VII. Learning Objectives

By the end of the class you should...

- Understand what distinguishes the 'agent-based simulation modeling' (ABSM) approach from other modeling approaches
- Describe the advantages and disadvantages of the ABSM approach
- Have familiarity with the use of ABSMs in modeling a variety of problems human and nonhuman behavioral biology and ecology
- Gain experience with fundamentals of computer programming
- Have a solid familiarity with reading and writing code in the modeling software NetLogo
- Be able to write or modify existing NetLogo code to address novel programming challenges
- Be familiar with other software tools for ABSM
- Develop a novel ABSM in NetLogo to explore a question or system of your choice
- Document your code and your model using the ODD framework
- Verify and test your model and use it to conduct a simulation study
- Analyze and present the results of your model runs in a formal paper and presentation to your peers

VIII. Grading and Assessment

Grading in this class is based on a variety of assignments, including regular homework and programming exercises, participation in class discussions, development and write-up of an independent ABSM project, and maintenance of a blog or wiki journal documenting the development of your programming skills and your project over the course of the semester. Each of these assignments will be discussed in more detail during class.

**Homeworks and Programming Exercises: 10 x 5% = 50%**

Homework and programming assignments are due 24 hours before the start of the class period after they are assigned.

**Participation: 10%**

Your attendance and your participation in class constitute a combined 10% of your final grade. Simply put, you MUST attend and contribute to this course in order to get a good grade. I expect you come to class with questions and comments about the days readings and to participate in class discussion. Attendance will be taken regularly during throughout the semester, so absences will be noted and penalized.

**ABM Project: 30%**

Early in the semester, after an introduction to agent-based modeling and the NetLogo software, you will choose a problem in human or nonhuman primate behavior, ecology, or population genetics around which you will develop an agent-based simulation model. Using
NetLogo, you will develop and test your model and present it and the results of testing, in the form of a scientific presentation and paper, during the final weeks of the class.

Digital Journal: 10%

IX. Other Logistical Information

Use of Canvas

For this class I will use Canvas — a Web-based course management system with password-protected access at https://utexas.instructure.com/ — to distribute course materials, to communicate with you, and to post assignments and grades. You may also be asked to use Canvas to submit some assignments.

Behavioral Expectations

Attendance

Inasmuch as students have voluntarily sought admission to the University, I expect you to attend all class meetings, including all lectures and all meetings of associated discussion sessions. Students may be excused for documented medical or personal emergency and will receive reasonable accommodation for the observance of religious holidays (see below). In these cases, they should contact me in advance or, in cases of emergency, as soon as is practicable. Students are responsible for making up any material or assignments they miss.

Classroom Decorum

Please remember that the classroom is a space for free and open inquiry and for the critical evaluation of ideas, and it should be free of personal prejudice. Every student has the right to learn as well as the responsibility not to deprive others of that right, and every student is accountable for his or her actions. Students and instructors alike have an obligation to all members of the class to create an educational atmosphere of mutual trust and respect in which differences of opinion can be subjected to deliberate and reasonable examination without animus. During classroom and online discussions and interactions with one another, please treat your fellow classmates with courtesy, civility and respect.

As a matter of courtesy to me and to your fellow students, I expect you arrive at class on time, prepared and ready to participate. Please do not schedule other engagements during this class time.

Students are reminded that cell phone use is forbidden in class. Please shut off all cellular telephones and pagers before class starts and refrain from checking messages and texts during class time. If this becomes an issue, students violating this rule will be asked to leave the class. Students should also refrain from eating in class. You are welcome to bring in water or another non-alcoholic beverage to drink during class.

Except in cases of emergency, I expect you to remain in the classroom for the duration of the lecture or section meeting. If you know that you will need to leave a particular class session early, please let me know beforehand. If it is necessary to leave or enter a room once class has begun, please do so quietly and with as little disruption as possible.
If you have trouble hearing or concentrating on the lecture or media presentation because of distractions around you, quietly ask those responsible for the distraction to stop. If the distraction continues, please let me know. Disruptive classroom behavior may be subject to disciplinary sanction.

Finally, please be aware that no audio or video recording of my lecture is permitted without prior, written approval, and I do not give assignments for extra credit, so please be sure to pay close attention to due dates of assignments.

**Completion of Assignments**

Students are expected to submit course work on time and to retain copies of their work until a final grade has been received for the course. Instructors are not obliged to accept late work and may assign a failing or reduced grade to such assignments.

Students who encounter sudden and incapacitating illness or other comparably grave circumstance beyond their control that prevents them from completing an examination or assignment in a course should see me immediately to discuss the situation. Under appropriate circumstances, the student may be granted a temporary mark of Incomplete. To receive an Incomplete, students must have completed all other requirements for the course, including satisfactory attendance, and there must be a strong likelihood they will pass the course when all work is completed.

**Religious Holy Days**

By University of Texas at Austin policy, you must notify me of your pending absence at least fourteen days prior to the date of observance of a religious holy day. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, I will give you an opportunity to complete the missed work within a reasonable time after the absence.

**Student Feedback**

During this course I will periodically be asking you to give me feedback on your learning in informal as well as formal ways, including through anonymous surveys about how my teaching strategies are influencing your learning. It is very important for me to know your reaction to the material we are covering in class and on graded materials and assessments, so I encourage you to respond to these surveys, ensuring that together we can create an effective environment for teaching and learning.

**Important Policies**

**Late assignments**

Assignments are due at the START of class on due date given. Assignments turned in after the start of class will be marked down 10% for each day or portion of a day that they are late.
Make-up assignments

Make-up assignments will not be permitted, except in the case of medical emergency (for which documentation from your physician’s office within 2 days of the due date is required) or for observance of religious holy days (in which case you must let me know two weeks in advance).

Review of grades

Please review all grades assignments immediately after they are returned. If you feel an error has been made in how you were graded or if there is anything you do not understand about why you received a particular grade, you must come to office hours or come see me in an individual appointment to bring that to my attention within one week of the assignment being returned. Email is not an acceptable venue for requesting a review of your grade.

X. Tentative Course Schedule

Below is a TENTATIVE schedule of lecture topics, which represents my current plans and objectives. As we go through the semester, those plans are LIKELY to change somewhat to enhance the class learning opportunity. Such changes are not unusual and should be expected.

Any changes, revisions, or updates to the course schedule will be posted in a timely fashion on the course Canvas site and/or noted in class. PDF files of the readings for each class, apart from those from the primary text, will also be posted on the course Canvas site, and you should check the site regularly for announcements and to be prepared for class.

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<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>15-Jan</td>
<td>Introduction to Agent-Based Simulation Modeling</td>
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<td>2</td>
<td>22-Jan</td>
<td>Beginning Programming with NetLogo</td>
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<td>3</td>
<td>29-Jan</td>
<td>Epistemology of the ABSM Approach and Further Steps with NetLogo</td>
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<td>4</td>
<td>5-Feb</td>
<td>Emergence and Complexity</td>
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<td>5</td>
<td>12-Feb</td>
<td>Foraging and Diet</td>
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<td>6</td>
<td>19-Feb</td>
<td>Movement, Search, and Range Use</td>
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<td>7</td>
<td>26-Feb</td>
<td>Model Verification and Testing</td>
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<td>8</td>
<td>5-Mar</td>
<td>Social Interactions - Competition and Dominance</td>
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<td>12-Mar</td>
<td>SPRING BREAK</td>
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<td>9</td>
<td>19-Mar</td>
<td>Social Interactions - Cooperation and Collective Action</td>
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<td>10</td>
<td>26-Mar</td>
<td>Learning and Adaptation</td>
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<td>11</td>
<td>2-Apr</td>
<td>Integrating NetLogo with Databases and R</td>
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<td>12</td>
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<td>AAPA MEETINGS - NO CLASS</td>
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<td>16-Apr</td>
<td>Integrating NetLogo with GIS</td>
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<td>14</td>
<td>23-Apr</td>
<td>Model Presentations</td>
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<tr>
<td>15</td>
<td>30-Apr</td>
<td>Model Presentations</td>
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XI. Academic Integrity

*The University of Texas Honor Code*

The core values of The University of Texas at Austin are learning, discovery, freedom, leadership, individual opportunity, and responsibility. Each member of the university is expected to uphold these values through integrity, honesty, trust, fairness, and respect toward peers and community.

As a student at The University of Texas, you are expected to maintain the highest integrity in your academic work and to adhere to and abide by the University of Texas Honor Code all times. All work you submit in this course for academic credit must be entirely your own work; you are permitted to collaborate with another student on a graded assignment without the express permission of the instructor.

You are encouraged to study with your fellow students and to discuss information and concepts covered in lecture and the sections with one another. You may also give "consulting" help to or receive "consulting" help from your classmates. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else, in the form of an email, an email attachment file, a diskette, or a hard copy. Should copying occur, both the student who copied work from another student and the student who gave material to be copied will both automatically receive a zero for the assignment.

During examinations, you must do your own work. Talking or discussion is not permitted during examinations, nor may you compare papers, copy from others, or collaborate in any way. Any collaborative behavior during examinations will result in failure of the exam, and may lead to failure of the course and additional University disciplinary action. During exams, you also may not use notes or other sources to answer exam questions without the instructor’s permission.

Plagiarism consists of presenting ideas and words without acknowledging their source. Whether intentional or inadvertent, plagiarism is another serious offense against academic integrity and will also result in failure on an assignment and possibly failure if the course and additional University disciplinary action. Any of the following acts constitutes a crime of plagiarism:

- Using a phrase, sentence, or passage from another person’s work without quotation marks and attribution of the source.
- Paraphrasing words or ideas from another’s work without attribution.
- Reporting as your own research or knowledge any data or facts gathered or reported by another person.
- Submitting in your own name papers or reports completed by another.
- Submitting your own original work toward requirements in more than one class without the prior permission of the instructors.

Plagiarism and other cases of academic fraud are matters of fact, not intention. It is therefore crucial that you be diligent in assuring the integrity of your work by:
• Using quotation marks to set off words not your own.
• Using proper forms of citation and attribution for source materials.
• Doing your own original work in each class, without collaboration, unless otherwise instructed.
• Not using published sources, the work of others, or material from the web without attribution.
• Asking your professor or preceptor if you have questions about an assignment or the use of sources.

Additional violations of academic integrity include the following:
• Giving your work to another student to submit as his or her own.
• Secreting or destroying library or reference materials.
• Submitting as your own work a paper or results of research that you have purchased from a commercial firm or another person.

Particular emphasis is placed on the use of papers and other materials to be found on the internet, whether purchased or freely available. Be aware that in addition to having access to the same search engines as students, faculty also have at their disposal a number of special websites devoted to detecting plagiarism from the web.

Penalty for violation of The University of Texas Honor Code and for all of the violations of academic integrity discussed above can also be extended to include failure of the course and University disciplinary action.

XII. Other University Notices and Policies

Use of Email for Official Correspondence to Students

All students should become familiar with the University's official e-mail student notification policy. It is the student's responsibility to keep the University informed as to changes in his or her e-mail address. Students are expected to check e-mail on a frequent and regular basis in order to stay current with University-related communications, recognizing that certain communications may be time-critical. It is recommended that e-mail be checked daily, but at a minimum, twice per week. The complete text of this policy and instructions for updating your e-mail address are available at http://www.utexas.edu/its/help/utmail/1564.

Documented Disability Statement

Any student with a documented disability who requires academic accommodations should contact Services for Students with Disabilities (SSD) at (512) 471-6259 (voice) or 1-866-329-3986 (video phone) or via the internet at http://www.utexas.edu/diversity/ddce/ssd. Faculty are not required to provide accommodations without an official accommodation letter from SSD.
• Please notify me as quickly as possible if the material being presented in class is not accessible (e.g., instructional videos need captioning, course packets are not readable for proper alternative text conversion, etc.).
• Please notify me as early in the semester as possible if disability-related accommodations for field trips are required. Advanced notice will permit the arrangement of accommodations on the given day (e.g., transportation, site accessibility, etc.).
• Contact Services for Students with Disabilities at 471-6259 (voice) or 1-866-329-3986 (video phone) or reference SSD’s website for more disability-related information: 

Behavior Concerns Advice Line (BCAL)

If you are worried about someone (e.g., a fellow student) who is acting differently, you may use the Behavior Concerns Advice Line to discuss by phone your concerns about another individual’s behavior. This service is provided through a partnership among the Office of the Dean of Students, the Counseling and Mental Health Center (CMHC), the Employee Assistance Program (EAP), and The University of Texas Police Department (UTPD). Call 512-232-5050 or visit http://www.utexas.edu/safety/bcal.

Q Drop Policy

The State of Texas has enacted a law that limits the number of course drops for academic reasons to six (6). As stated in Senate Bill 1231:

“Beginning with the fall 2007 academic term, an institution of higher education may not permit an undergraduate student a total of more than six dropped courses, including any course a transfer student has dropped at another institution of higher education, unless the student shows good cause for dropping more than that number.”

Emergency Evacuation Policy

Occupants of buildings on the UT Austin campus are required to evacuate and assemble outside when a fire alarm is activated or an announcement is made. Please be aware of the following policies regarding evacuation:

• Familiarize yourself with all exit doors of the classroom and the building. Remember that the nearest exit door may not be the one you used when you entered the building.
• If you require assistance to evacuate, inform me in writing during the first week of class.
• In the event of an evacuation, follow my instructions or those of class instructors.
• Do not re-enter a building unless you are given instructions by the Austin Fire Department, the UT Austin Police Department, or the Fire Prevention Services office.