

GGG 470 (Special Topics): Spatial Agent Based Modeling of Disease Spread (3 credits)

**Syllabus is subject to change

Fall 2022

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Instructor: Taylor Anderson

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Course type: In-person

Meeting hours: Wednesday 4:30-7:10p (EXPL 2312)

Office hours: Thursday 3:30-4:30p (Blackboard Collaborate and EXPL 2405)

Course website: Blackboard

Final Exam: None

Safe Return to Campus Notice

All students taking courses with a face-to-face component are required to take Safe Return to Campus Training prior to visiting campus. The Safe Return to Campus Training is currently available in Blackboard. More instructions can be found [here](#). Students are required to follow the university's public health and safety precautions and procedures outlined on the university Safe Return to Campus [webpage](#). Similarly, all students in face to face and hybrid courses are encouraged to complete the Mason COVID Health Check daily, seven days a week. The COVID Health Check system uses a color code system and students will receive either a Green, Yellow, or Red email response. Only students who receive a "green" notification are permitted to attend courses with a face-to-face component. If you suspect that you are sick or have been directed to self-isolate, please quarantine or get testing. Faculty are allowed to ask you to show them that you have received a Green email and are thereby permitted to be in class.

Course Description

Models are critical to explain and predict the spread of diseases in and between human and ecological systems. Furthermore, these models can be used to better understand and predict health outcomes and prescribe the most optimal policy actions that mitigate negative impacts. This course offers a combination of theory, techniques, and practical considerations related to spatial agent-based models of infectious diseases. Topics include foundations in epidemiology, agent-based models, complexity, synthetic populations, health behaviors, mobility and movement, model evaluation, and application of models. Although we briefly touch on a range of

different modeling approaches and infectious disease applications, our focus is on the agent-based approach in the context of infectious human diseases. Students will develop hands on experience in developing a spatially explicit model of diseases.

Prior Experience

Prior experience with programming languages or simulation platforms and software is not required. Prior experience with geographic information systems and/or spatial data will be helpful.

Blackboard Login Instructions

Access to [MyMason](#) and GMU email are required to participate successfully in this course. Please make sure to update your computer and prepare yourself to begin using the online format BEFORE the first day of class. Check [the IT Support Center](#) website. Navigate to [the Student Support page](#) for help and information about Blackboard. In the menu bar to the left you will find all the tools you need to become familiar with for this course. Take time to learn each. Make sure you run a system check a few days before class. Become familiar with the attributes of Blackboard and online learning.

Readings

Some recommended texts:

1. Railsback, Steven F., and Volker Grimm (2012). *Agent-Based and Individual-Based Modeling: a Practical Introduction*. Princeton University Press.
2. Vynnycky, E., & White, R. (2010). *An introduction to infectious disease modelling*. OUP Oxford.
3. Crooks, A., Malleon, N., Manley, E., & Heppenstall, A. (2018). *Agent-based modelling and geographical information systems: a practical primer*. Sage.

Course Learning Outcomes

Upon completion of this course, students will be able to:

1. Describe foundational concepts in epidemiology
2. Identify advantages, assumptions, and key limitations in different disease modeling approaches
3. List key spatial drivers of disease spread
4. Describe a spatially explicit model of disease spread
5. Consider the potential insights disease models offer decision and policy makers

Technology Requirements

Hardware: You will need access to a Windows or Macintosh computer with at least 2 GB of RAM and access to a fast and reliable broadband internet connection (e.g., cable, DSL). A larger screen is recommended for better visibility of course material. You will need speakers or headphones to hear recorded content and a headset with a microphone is recommended for the best experience. For the amount of Hard Disk Space required taking a distance education course, consider and allow for:

1. the storage amount needed to install any additional software and
2. space to store work that you will do for the course.

If you consider the purchase of a new computer, please go to [Patriot Tech](#) to see recommendations.

Software: Many courses use Blackboard as the learning management system. You will need a browser and operating system that are listed compatible or certified with the Blackboard version available on the [myMason Portal](#). See [supported browsers and operating systems](#). Log in to [myMason](#) to access your registered courses. Some courses may use other learning management systems. Check the syllabus or contact the instructor for details. Online courses typically use [Acrobat Reader](#), [Flash](#), [Java](#), and [Windows Media Player](#), [QuickTime](#) and/or [Real Media Player](#). Your computer should be capable of running current versions of those applications. Also, make sure your computer is protected from viruses by downloading the latest version of Symantec Endpoint Protection/Anti-Virus software for free [here](#).

Students owning Macs or Linux should be aware that some courses may use software that only runs on Windows. You can set up a Mac computer with Boot Camp or virtualization software so Windows will also run on it. Watch [this video](#) about using Windows on a Mac. Computers running Linux can also be configured with virtualization software or configured to dual boot with Windows.

Note: If you are using an employer-provided computer or corporate office for class attendance, please verify with your systems administrators that you will be able to install the necessary applications and that system or corporate firewalls do not block access to any sites or media types.

Course-specific Hardware/Software: This course uses a range of open-source software including NetLogo and proprietary software like ArcGIS Pro.

Course Schedule **Full details can be found on Blackboard and is subject to change. Note that the weeks are organized from Wednesday (class) to Tuesday (journal prompt due).

WEEK (W-Tu)		MEETING (Wednesday @4:30-7:10)	Topic	Journal Prompt (JP) (following Tuesday @11:59pm)	Paper Presentation Response (following Tuesday @11:59pm)	Project
1	Aug 24-30	Aug 24	Introduction to Infectious Disease Spread	JP1		
2	Aug 31-Sept 6	Aug 31	Introduction to Compartmental Modeling	JP2		
3	Sept 7-13	Sept 7	Complexity	JP3		
4	Sept 14-20	Sept 14	Agent-Based Modeling I	JP4		
5	Sept 21-27	Sept 21	Agent-Based Modeling II	JP5		Group formation required (if applicable) by September 21
6	Sept 28-Oct 4	Sept 28	Synthetically Generated Populations	JP6	Population composition (x2)	
7	Oct 5-11	Oct 5	Mobility and Movement			Proposal Due October 11 @11:59pm
8	Oct 12-18	Oct 12	Disease Transmission and Staging	JP7	Mobility and movement (x2)	
9	Oct 19-25	Oct 19	Networks	JP8	Contact or social networks (x2)	

WEEK (W-Tu)		MEETING (Wednesday @4:30-7:10)	Topic	Journal Prompt (JP) (following Tuesday @11:59pm)	Paper Presentation Response (following Tuesday @11:59pm)	Project
10	Oct 26-1	Oct 26	Health Behavior	JP9	Health behavior (x2)	
11	Nov 2-8	Nov 2	Model Evaluation	JP10	Policy interventions (x2)	
12	Nov 9-15	Nov 9	Project Work		Student Choice (x2)	
13	Nov 16-22	Nov 16	Applications and Future		Student Choice (x2)	
14	Nov 23-29 Thanksgiving Break					
15	Nov 30-Dec 6	Nov 30	Project Presentations			Project Presentations Due Nov. 30 @ 2pm (In Class) ODD protocol due Dec. 6 @11:50pm

Assignments Description

DELIVERABLE	% OF FINAL GRADE
Journal Prompts	50
Paper Presentation Responses	10
Project	40

Journal Prompts

Throughout the course of the semester, you will complete responses to 10 journal prompts (each worth 5% of your final grade). Think of each response as a progress update on both your understanding of the conceptual material and your progress on model

development. You will receive the prompt at the beginning of the week (on Wednesday) and are encouraged to reflect on it throughout the week. Your responses to each journal prompt are due at the end of each week (the following Tuesday).

Presentation Discussions

Graduate students in the course will be creating and posting presentations to examine the use of ABM to explore the role of one of the following on disease dynamics: population composition, mobility and movement, contact or social networks, health behavior, policy interventions, or other. Each week, you will watch the recorded presentations and respond to their presentation with questions and comments.

Project

You will have the opportunity to either find and modify an existing ABM or develop your own ABM of disease spread (either individually or in a group of undergraduate students). The project component is composed of a project proposal, a presentation, and a complete ODD protocol.

Course Policies

Late Assignments:

One Extension Policy: Any student may propose a reasonable deadline extension for any course deliverable, subject to my approval, once during the semester. Students must justify in writing why they need this extension and provide a plan for how they will complete the work prior to the submission deadline.

One Revision Policy: Any student may revise and resubmit one major project deliverable within two weeks, after it is graded, either for a new grade or for up to a 15% increase on their prior grade provided the revisions are significant (not just error corrections).

Late Assignment Deduction Policy: Any late deliverable will earn a flat 10% grade deduction as long as the deliverable is completed within 7 days of the deadline. If it is not completed within 7 days of the deadline, the student will receive a 0.

Instructor-Student Communication: I will respond to your emails within 48 hours. If I will be away from email for more than one day, I will post an announcement in the Blackboard course folder. Before sending an email, please check the following (available on your Blackboard course menu) unless the email is of a personal nature:

1. Syllabus
2. Ask the Instructor Blackboard Discussion

3. On-demand Blackboard videos on how to use Blackboard features, and Technical Requirements.

Feel free to respond to other students in the Ask Professor forum if you know the answer.

Campus Closure: If the campus closes or class is canceled due to weather or other concern, students should check Blackboard for announcements.

Grading Scale

GRADE	PERCENTAGE
A+	> 99
A	93 – 98.9
A-	90 – 92.9
B+	87 – 89.9
B	83 – 86.9
B-	76 – 82.9
C	70 – 75.9
D	60 – 69.9
F	0 – 59.9

University Policies and Resources

- a. Academic Honesty: You are expected to be familiar with and abide by the University’s Honor Code. The Code can be found [here](#). It is your responsibility to see me if you have questions about these policies. George Mason University has an honor code that states the following:
To promote a stronger sense of mutual responsibility, respect, trust, and fairness among all members of the George Mason University community and with the desire for greater academic and personal achievement, we, the student members of the University Community have set forth this:
- b. Course materials and student privacy: All course materials posted to Blackboard or other course site are private; by federal law, any materials that identify specific students (via their name, voice, or image) must not be shared with anyone not enrolled in this class. Videorecordings of class meetings that include audio or visual information from other students are private and must not be shared. Live Video Conference Meetings (e.g. Collaborate or Zoom) that include audio or visual information from other students must be viewed privately and not shared with others in your household. Some/All of our synchronous meetings

in this class will be recorded to provide necessary information for students in this class. Recordings will be stored on Blackboard [or other secure site] and will only be accessible to students taking this course during this semester.

- c. Students must follow the university policy for [Responsible Use of Computing](#)
- d. Student services: The University provides range of services to help you succeed academically and you should make use of these if you think they could benefit you. I also invite you to speak to me (the earlier the better).
- e. Students are responsible for the content of university communications sent to their George Mason University email account and are required to activate their account and check it regularly. All communication from the university, college, school, and program will be sent to students solely through their Mason email account.
- f. [The George Mason University Counseling and Psychological Services \(CAPS\)](#) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops and outreach programs) to enhance students' personal experience and academic performance. Counseling Center: Student Union I, Room 364, 703-993-2380.
- g. Students with disabilities who seek accommodations in a course must be registered with the [George Mason University Office of Disability Services \(ODS\)](#) and inform their instructor, in writing, at the beginning of the semester. All academic accommodations must be arranged through that office. Please note that accommodations **MUST BE MADE BEFORE** assignments or exams are due. I cannot adjust your grade after the fact.
- h. Students must follow the university policy stating that all sound emitting devices shall be turned off during class unless otherwise authorized by the instructor.
- i. [The George Mason University Writing Center](#) staff provides a variety of resources and services (e.g., tutoring, workshops, writing guides, handbooks) intended to support students as they work to construct and share knowledge through writing. University Writing Center: Robinson Hall Room A114, 703-993-1200. The writing center includes assistance for students for whom English is a second language.
- j. Diversity: George Mason University promotes a living and learning environment for outstanding growth and productivity among its students, faculty and staff. Through its curriculum, programs, policies, procedures, services and resources, Mason strives to maintain a quality environment for work, study and personal growth.