

## GENERAL INFORMATION

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### PROFESSOR INFORMATION

**Instructor:** Prof. Genevieve Reid

**Office:** SIPA, room 314

**Office Hours:** Tu 12:30 PM -1:30 PM or by appointment (zoom meeting or in my office)  
Zoom link provided on canvas

**Phone:** (305) 348-0352

**Email:** greid@fiu.edu

**Course Time Zone:** Eastern Standard Time (EST). Course due dates are according to this time zone.

### COURSE DESCRIPTION AND PURPOSE

Critical GIScience includes a range of research on geographic information systems (GIS) and new geospatial technologies that focus on the social implications of and social biases inherent in the science, technology, and their deployments. This course is designed as a seminar to discuss the theoretical and practical questions arising from the socially constructed nature of geographical information and GIS and their social impacts.

Geospatial technologies are widely used in various disciplines and the public and private sectors. It is an ever-growing multibillion-dollar global business. To be proficient in GIS and new geospatial technologies, one needs to understand the technology but also the science behind the technology. This seminar explores the interconnected relationship between society and GIS/new geospatial technologies and interrogates the implications and impacts of such a relationship. With the recent evolution of geospatial technologies (geoweb, big data, web mapping tools, volunteered geographic information, etc.), critical GIScience includes the study of many aspects of changes since early GIS technologies and explores their impacts on society, such as the issue of potential loss of privacy.

The course is designed as a seminar, with weekly readings, presentations, and a final literature review paper on a topic chosen by the student. The course covers the history and evolution of critical GIScience, participatory approaches to GIS, feminist GIScience, and Indigenous GIScience.

### COURSE OBJECTIVES

The objective of this course is to present the theoretical foundations of the field of critical GIScience. The course focuses on GIS and geospatial technologies, the social-theoretical critiques of these, and alternate approaches within the field. Students will develop their capability of critically assessing geospatial technologies and their use.

Upon completing this course, students will be able to:

- remember definitions of key concepts in GIScience
- understand theoretical foundations of the field of GIScience
- understand social critiques of GIS and geospatial technologies uses
- apply critical theory to the role and place of geospatial information within social fabrics
- analyze how space and society can be represented
- critically evaluate GIS theory and applications
- evaluate their learning process in the course
- create their critical investigation of GIScience studies

## IMPORTANT INFORMATION

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### POLICIES

Please review the [FIU's Policies](#) webpage. The policies webpage contains essential information regarding guidelines relevant to all courses at FIU, as well as additional information about acceptable netiquette for online courses. For additional information, please visit [FIU's Policy and Procedure Library](#).

As a member of the FIU community you are expected to be knowledgeable about the behavioral expectations set forth in the [FIU Student Conduct and Honor Code](#).

### ACCESSIBILITY AND ACCOMMODATION

The Disability Resource Center collaborates with students, faculty, staff, and community members to create diverse learning environments that are usable, equitable, inclusive, and sustainable. The DRC provides FIU students with disabilities the necessary support to successfully complete their education and participate in activities available to all students. If you have a diagnosed disability and plan to utilize academic accommodations, please contact the Center at 305-348-3532 or visit them at the Graham Center GC 190.

For additional assistance please contact FIU's [Disability Resource Center](#).

### Web Accessibility Statements for Partners and Vendors

- [Canvas](#)
- [Microsoft](#)
- [Adobe](#)
- [Google](#)
- [YouTube](#)
- [LinkedIn](#)
- [ProctorU](#)
- [HonorLock](#)
- [Turnitin](#)
- [OpenStax](#)
- [Zoom](#)
- [Respondus LockDown Browser](#)

Please visit our [ADA Compliance](#) webpage for additional information about accessibility involving the tools used in this course.

### ACADEMIC MISCONDUCT STATEMENT

Florida International University is a community dedicated to generating and imparting knowledge through excellent teaching and research, the rigorous and respectful exchange of ideas, and community service. All students should respect the right of others to have an equitable opportunity to learn and honestly demonstrate the quality of their learning. Therefore, all students are expected to adhere to a standard of academic conduct, which demonstrates respect for themselves, their fellow students, and the educational mission of the University. All students are deemed by the University to understand that if they are found responsible for academic misconduct, they will be subject to the Academic Misconduct procedures and sanctions, as outlined in the Student Conduct and Honor Code. Academic Misconduct includes:

### **Cheating**

- The unauthorized use of any materials, information, study aids or assistance from another person on any academic assignment or exercise, unless explicitly authorized by the course Instructor;
- Assisting another student in the unauthorized use of any materials, information, study aids, unless explicitly authorized by the Instructor; and
- Having a substitute complete any academic assignment or completing an academic assignment for someone else, either paid or unpaid; and

### **Plagiarism**

- The deliberate use and appropriation of another's work without any indication of the source and the representation of such work as the Student's own.
- Assisting another student in the deliberate use and appropriation of another's work without any indication of the source and the representation of such work as the student's own.

Learn more about the [academic integrity policies and procedures](#) as well as [student resources](#) that can help you prepare for a successful semester.

### **PANTHERS CARE & COUNSELING AND PSYCHOLOGICAL SERVICES (CAPS)**

If you are looking for help for yourself or a fellow classmate, Panthers Care encourages you to express any concerns you may come across as it relates to any personal behavior concerns or worries you have, for the classmate's well-being or yours; you are encouraged to share your concerns with [FIU's Panthers Care website](#).

[Counseling and Psychological Services \(CAPS\)](#) offers free and confidential help for anxiety, depression, stress, and other concerns that life brings. Professional counselors are available for same-day appointments. Don't wait to call (305) 348-2277 to set up a time to talk or visit the online self-help portal.

### **INCLUSIVITY STATEMENT**

This course will serve to embrace the diversity and inclusivity found within Florida International University. We appreciate and respect diversity, equality, equity, cooperativeness, community, and sustainability within our online courses. We are committed to the ongoing education of our students and their participation within the course regardless of gender, ethnicity, age, sexual orientation, geographical location, religion, and disability. We strive in encouraging collaboration by preparing our students to value the differences in others. At the core of our intentions is the encouragement of acceptance and appreciation of differences within our student population and community.

### **COURSE PREREQUISITES**

There are no prerequisites for this course.

## TEXTBOOK AND EQUIPMENT

There is no textbook for the course. Readings will be assigned each week. Copies of book chapters and academic journal articles will be uploaded to a shared Zotero library. Students are required to create a Zotero account. Although Zotero can be accessed with a web browser, it is recommended that students install the standalone app on their computer to access all capabilities of the reference management application.

## EXPECTATIONS OF THIS COURSE

This is an upper-level seminar class intended for Graduate students or College Seniors. If you are a first- or second-year undergraduate student, you may find this class too difficult. There will be a high reading load, for which you should be prepared. Students are expected to have read assigned readings *before* joining the class.

### Active Learning

This class is designed as a graduate seminar experience. In the first few weeks, I will give lectures introducing students to the study of critical GIScience. As the course progresses, students will increasingly take charge by giving presentations on the week's topics and readings and leading discussions. Every student is also expected to participate in class discussions. This means that students are actively preparing before joining class each week.

### Collaborations

One of this seminar's main pedagogical approaches is fostering group collaborations for students to learn through discussion, clarification of ideas, and evaluation of others' opinions. The seminar includes peer-to-peer teaching and learning strategies for students to learn from each other. For example, each student is expected to become an 'expert' in a specific course topic and give a lecture to share what they have learned with other students. The seminar is also structured around class group discussions when students also take on the moderator role. Students will engage and receive peer-to-peer feedback both informally in the classroom and in formal written reviews. Rather than competing for the highest grade, students will improve their collaboration skills that are crucial for their careers, in and outside of academia.

### Reflexivity

The seminar is also based on a reflexive pedagogical approach. This means that students learn through engaging in a reflexive thinking practice to document their progress, interrogate their learning process, reflect on the significance of topics learned, set their objectives, goals, and expectations, and shed light on their lived experiences. Most of the reflexive process is personal, but students will collectively share parts of the reflections they wish to mention to enrich the group discussions. I hope this process will improve your critical thinking and make you more aware of how you learn, teach, and collaborate.

## COURSE DETAIL

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### ASSIGNMENTS

#### Attendance, Participation, and Discussions

Attendance in class is necessary to achieve a passing grade. Students are responsible for all information, materials, and instructions disseminated during class. If you miss a class, make sure you get notes from classmates. Better still, discuss the missed material with your classmates.

Students are expected to come to class prepared to discuss the weekly readings (two papers per week) and lecture materials. The instructor might ask any student to give a short overview of the readings for the week even when they are not scheduled to present.

**A field visit** to see the exhibit Plotting Power: Maps and the Modern Age at the Wolfsonian Museum is planned for November 1st. Students will demonstrate that they remember and understand key concepts and definitions by attending, participating, and discussing the material.

**Reflexive Journal (some journal entries shared in class but written post for the Wolfsonian Museum (due on Nov. 10)**

Students will document their reflections on their learning (and teaching) progress every week and share some of the entries during class discussions. One excerpt from the journal about the field visit is due on November 10. This assignment is in collaboration with The Wolfsonian Museum and will be a contribution to their exhibit.

Additional instructions will be provided.

**Short Research Skills Presentation (on Tuesdays between week two and week 7)**

Each student will give a short presentation (around 20 minutes) on research skills relevant to the seminar, such as reference management skills with Zotero, reflexive journaling, the peer-to-peer review process, annotated bibliography, panel discussant, literature review, and presentation skills. Students and the instructor will decide topics and schedules during the first week of the course.

With these presentations, students will demonstrate their ability to apply research skills in GIScience.

**Lecture Presentation (on Tuesday between week eight and week 13)**

At the beginning of the course, each student will choose a week to present. In their presentation on Tuesday, the student is expected to give a lecture on the topic for that week. Each student is expected to do additional readings about the subject.

When presenting, students must also provide the presentation material to their discussant on Tuesday, allowing sufficient time to prepare for the discussion on Thursday.

With the lecture presentations and discussant roles, students will demonstrate their capacity to understand and analyze in depth a specific area of study in GIScience.

Additional instructions will be provided.

**Discussant (on Thursday between week eight and week 13)**

At the beginning of the course, each student will choose a week to be the discussant and monitor the discussion at the end of another student's presentation or the instructor's presentation. The discussant will receive the presentation material on Tuesday and have two days to complete their preparation for moderating the discussion on Thursday. The discussant is expected to prepare prompts (topics/questions) for the class to discuss. Students will be given feedback on the relevance of discussion points and the quality of monitoring the conversation.

Additional instructions will be provided.

**Annotated Bibliography (due Nov 17)**

Each of you will produce an annotated bibliography in preparation for your presentation and your final literature review paper on the same topic. The annotated bibliography will be made using the reference manager application Zotero. The Zotero bibliography and the annotated bibliography report will be shared with one student in the course for peer-to-peer feedback. Students will also receive feedback from the instructor.

The annotated bibliography is a tool to analyze the literature and prepare your presentation. After your presentation, you have the opportunity to adjust your annotated bibliography according to the feedback you received after your presentation. With the annotated bibliography, students show their ability to analyze the

literature in a specific area of GIScience, draw connections between ideas, and examine and organize the main contributions in the field.

### Peer-to-Peer Feedback

Students are expected to give constructive feedback for all presentations and discussant sessions. Feedback on presentations and discussants will be given informally during class.

Each student will also provide written feedback for one annotated bibliography within one week of receiving the document for review.

In addition, each student will provide feedback for one student's final paper following the guidance of a peer-to-peer journal review process in your field. The peer-to-peer review of the final paper is due one week after receiving the document.

With the peer-to-peer feedback, students will demonstrate their ability to evaluate GIS theory and applications and analyze how space and society can be represented.

### Final Paper (due Dec 1)

Each one of you will write a final paper of around 7,000 words. The final paper is a literature review on your presentation topic. The paper is expected to be of publication quality and follow the guidance of a scientific journal in your field. With this assignment, students will demonstrate their ability to evaluate different perspectives and debates on a specific topic in GIScience. Students will create an original contribution to the literature by assembling existing arguments by leading GIScientists in novel ways.

Students will receive comments from the instructor and peer-to-peer feedback from other students. Additional instructions will be provided.

### Self-Evaluation

Students will produce a short paper at the end of the semester based on their progress documented in their reflexive journal and feedback received. With the self-evaluation paper, students will demonstrate their ability to evaluate their learning process.

### GRADING

Students will monitor their progress in the course in their reflexive journal. Students will also share some of their journal entries and discuss them in class. Students will also receive feedback from their peers and the instructor for each assignment and are expected to reflect on the feedback received.

Based on their reflections and feedback, students will produce a self-evaluation paper and assign themselves a final grade at the end of the semester. The instructor still has the final say in the final overall grade that students give themselves. The instructor could decide to lower or higher the grade and will provide justifications to the student for any grade change.

Suggestions of grading criteria:

Grade	Attendance, Participation, and Discussions	Reflexive Journal	Short Research Skills Presentation	Lecture Presentation	Discussant	Annotated Bibliography	Peer-to-Peer Feedback	Final Paper	Self-Evaluation
A	0-1 absence Demonstrate that they remember and	Demonstrate ability to understand and analyze theoretical foundations	demonstrate their ability to apply research skills in the	demonstrate their capacity to understand and analyze in depth a	demonstrate their capacity to understand and analyze in depth a	show their ability to analyze the literature in a specific area of	Demonstrate ability to evaluate applications of social theory and	Demonstrate ability to apply and analyze theoretical foundations,	Ability to integrate feedback and evaluate their

	understand key concepts and definitions	and social critiques in GIScience	field of GIScience	specific area of study in GIScience	particular area of study in GIScience	GIScience, draw connections between ideas, and examine and organize the main contributions in the field.	critiques in GIScience	and create a contribution in compiling debates in the literature	learning experience
	All assignments completed and submitted on time; appropriate length; quality of writing (i.e., organization, support arguments with evidence, sources, grammar, and style); quality of presentation (i.e., oral delivery, design of PowerPoint, organization, sources)								
<b>A-</b>	0-2 absences	All assignments completed and submitted on time; one to two major issues with the assignments							
<b>B+</b>	0-2 absences	All assignments submitted but one or two are late or incomplete. There is one or two major issues with the assignments							
<b>B</b>	0-2 absences	All assignments submitted but one or two are late or incomplete. There are two to three major issues with the assignments							
<b>B-</b>	0-2 absences	All assignments submitted but more than two are late or incomplete. There are more than three major issues with the assignments							
<b>C</b>	0-3 absences	More than two assignments are late or incomplete. There are more than four major issues.							
<b>D</b>	0-4 absences	More than three late or incomplete. More than five major issues.							
<b>F</b>	5 or more absences	More than four late of incomplete. More than six major issues.							

Letter	Range (%)	Letter	Range (%)	Letter	Range (%)
A	95 or above	B	83 - 86	C	70 - 76
A-	90 - 94	B-	80 - 82	D	60 - 69
B+	87 - 89	C+	77 - 79	F	59 or less

## COURSE OUTLINE

The following course schedule and suggested readings are subject to minor changes and adjustments depending on the students' choices of topic and their research interests.

Dates	Week	Lecture/Student Presentations	Topics	Suggested Readings	Assignments
Tu Aug 23 Th Aug 25	Week 1	Introduction to Critical GIScience	GIS as tool or science; early debates, Friday Harbor, qualitative turn, science wars, GIS wars, early debates	Lake, 1993; Sheppard, 1995 (On Canvas)	Choose your topics for the semester Short Professional Presentation 1: Reflexive journaling

Tu Aug 30 Th Sept 1	Week 2	Guest lecture:  Lea Nickless, Curator at the Wolfsonian Museum, discusses the Exhibit <i>Plotting Power: Maps and the Modern Age</i>	Origins and history of critical cartography and critical GIS, Power of maps	Kitchin and Dodge 2007 (On Canvas)	Short Professional Presentation 2: Literature Review
Tu Sept 6 Th Sept 8	Week 3	Technocratic nature of GIS	History of technocracy, construction of GIS	Obermeyer, 1995; Reid and Sieber, 2020a (on Canvas)	Short Professional Presentation 3: Annotated Bibliography
Tu Sept 13 Th Sept 15	Week 4	Evolution of critical GIScience	Evolutions of debates and significant themes in critical GIScience	Schuurman, 2000; Thatcher et al, 2016 (on canvas)	Reflexive journal post, Short Professional Presentation 4: Zotero
Tu Sept 20 Th Sept 22	Week 5	Dissecting components of new geospatial technologies 1	Geoweb versus GIS, new tools, new visualizations, new practices, privacy issues, surveillance	Elwood and Leszczynski, 2011(in Zotero)	Reflexive journal post, Short Professional Presentation 5: Presentation Skills
Tu Sept 27 Th Sept 29	Week 6	Dissecting components of new geospatial technologies 2	VGI, Neogeography, crowdsourcing, democracy	Sieber and Haklay, 2015; Warf and Sui, 2010 (in Zotero)	Reflexive journal post, Short Professional Presentation 6: Panel Discussant
Tu Oct 4 Th Oct 6	Week 7	Dissecting components of new geospatial technologies 3	Big Data, Open Data, Platform Economy	Chen and Quan- Haase, 2020 (in Zotero)	Reflexive journal post, Short Professional Presentation 7: Peer-to-Peer Review
Tu Oct 11 Th Oct 13	Week 8	PPGIS	Participation, the ladder of participation, challenges of PPGIS, the digital divide	Elwood, 2006; Sieber et al., 2016	Reflexive journal post, Student lecture presentation and discussant
Tu Oct 18 Th Oct 20	Week 9	Crisis Mapping, disease mapping, epidemiology	Temporal data, emergency mapping, digital activism	Brandusescu and Sieber, 2018; Haworth, 2018	Reflexive journal post, Student lecture presentation and discussant
Tu Oct 25 Th Oct 27	Week 10	Artificial Intelligence, Smart Cities	Benefits and challenges of new technologies in urban planning applications	Roche, 2016; Tenney et al., 2020	Reflexive journal post, Student lecture presentation and discussant
Tu Nov 1 Th Nov 3	Week 11	Field visit at The Wolfsonian Museum to see <i>Plotting Power: Maps and the Modern Age</i>			Reflexive journal post, Student lecture presentation and discussant
Tu Nov 8 Th Nov 10	Week 12	Qualitative GIS	Qualitative versus quantitative visualizations practices; emotional mapping, affect, flaneur, care	Taylor et al., 2020; Wilson, 2009	<b>Reflexive journal post for the Wolfsonian Museum (due Nov 10)</b> Student presentation and discussant



Tu Nov 15 Th Nov 17	Week 13	Feminist GIScience	Feminist Theory; Data feminism; alternate representations, too much data/not enough data, gender and the geoweb; feminist digital geography	Elwood and Leszczynski, 2018; Kwan, 2002; Stephens 2013	ANNOTATED BIBLIOGRAPHY(due Nov 17)  Student lecture presentation and discussant
Tu Nov 22	Week 14	Indigenous GIScience	Epistemologies, ontologies, Indigenous Knowledges, Sharing/protecting, data sovereignty, too much data/not enough data, counter data, countermapping; to map or to be mapped.	Reid and Sieber, 2020b; Rundstrom, 1995	<b>Peer-to-Peer Review of Annotated Bibliography (due Nov 22)</b>  Student lecture presentation and discussant
Tu Nov 29 Th Dec 1	Week 15	Wrap up	What have we learned? Future of critical GIScience?	Pavlovskaya , 2018; Wilson, 2017	FINAL PAPER (due Th Dec 1), Peer-to-peer review of final papers (due Tu Dec 6), Self-Evaluations (due Th Dec 8)

## SUGGESTED READINGS

- Brandusescu, A., & Sieber, R. E. (2018). The spatial knowledge politics of crisis mapping for community development. *GeoJournal*, 83(3), 509–524.
- Chen, W., & Quan-Haase, A. (2020). Big Data Ethics and Politics: Toward New Understandings. *Social Science Computer Review*, 38(1), 3–9. <https://doi.org/10.1177/0894439318810734>
- Elwood, S. (2006). Critical Issues in Participatory GIS: Deconstructions, Reconstructions, and New Research Directions. *Transactions in GIS*, 10(5), 693–708.
- Elwood, S., & Leszczynski, A. (2011). Privacy, reconsidered: New representations, data practices, and the geoweb. *Geoforum*, 42(1), 6–15. <https://doi.org/10.1016/j.geoforum.2010.08.003>
- Elwood, S., & Leszczynski, A. (2018). Feminist digital geographies. *Gender, Place & Culture*, 25(5), 629–644. <https://doi.org/10.1080/0966369X.2018.1465396>
- Haworth, B. T. (2018). Implications of Volunteered Geographic Information for Disaster Management and GIScience: A More Complex World of Volunteered Geography. *Annals of the American Association of Geographers*, 108(1), 226–240. <https://doi.org/10.1080/24694452.2017.1321979>
- Kwan, M.-P. (2002). Is GIS for women? Reflections on the critical discourse in the 1990s. *Gender, Place and Culture: A Journal of Feminist Geography*, 9(3), 271–279.
- Kwan, M.-P. (2007). Affecting Geospatial Technologies: Toward a Feminist Politics of Emotion. *The Professional Geographer*, 59(1), 22–34.
- Obermeyer, N. J. (1995). The hidden GIS technocracy. *Cartography and Geographic Information Systems*, 22(1), 78–83.
- Pavlovskaya, M. (2018). Critical GIS as a tool for social transformation. *The Canadian Geographer / Le Géographe Canadien*, 62(1), 40–54. <https://doi.org/10.1111/cag.12438>
- Reid, G., & Sieber, R. E. (2020a). Unavoidable expertise, ‘technocratic positionality,’ and GIScience: Eliciting an indigenous geospatial ontology with the Eastern Cree in Northern Quebec. *Gender, Place & Culture*, 1–23. <https://doi.org/10.1080/0966369X.2020.1811209>
- Reid, G., & Sieber, R. E. (2020b). Learning from critiques of GIS for assessing the geoweb and indigenous knowledges. *GeoJournal*. <https://doi.org/10.1007/s10708-020-10285-2>
- Roche, S. (2016). Geographic information science II: Less space, more places in smart cities. *Progress in Human Geography*, 40(4), 565–573. <https://doi.org/10.1177/0309132515586296>
- Rundstrom, R. A. (1995). GIS, Indigenous Peoples, and Epistemological Diversity. *Cartography and Geographic Information Science*, 22(1), 45–57. <https://doi.org/10.1559/152304095782540564>
- Schuurman, N. (2000). Trouble in the heartland: GIS and its critics in the 1990s. *Progress in Human Geography*, 24(4), 569–590. <https://doi.org/10.1191/030913200100189111>

- Sheppard, E. (1995). GIS and society: Towards a research agenda. *Cartography and Geographic Information Systems*, 22(1), 5–16.
- Sieber, R. E., & Haklay, M. (2015). The epistemology(s) of volunteered geographic information: A critique. *Geo: Geography and Environment*, 2(2), 122–136. <https://doi.org/10.1002/geo2.10>
- Sieber, R. E., Robinson, P. J., Johnson, P. A., & Corbett, J. M. (2016). Doing Public Participation on the Geospatial Web. *Annals of the American Association of Geographers*, 106(5), 1030–1046. <https://doi.org/10.1080/24694452.2016.1191325>
- Stephens, M. (2013). Gender and the GeoWeb: Divisions in the production of user-generated cartographic information. *GeoJournal*, 78(6), 981–996. <https://doi.org/10.1007/s10708-013-9492-z>
- Tenney, M., Garnett, R., & Wylie, B. (2020). A theatre of machines: Automata circuses and digital bread in the smart city of Toronto. *The Canadian Geographer*, 64(3), 388–401. <https://doi.org/10.1111/cag.12636>
- Thatcher, J., Bergmann, L., Ricker, B., Rose-Redwood, R., O'Sullivan, D., Barnes, T. J., Barnesmoore, L. R., Imaoka, L. B., Burns, R., Cinnamon, J., Dalton, C. M., Davis, C., Dunn, S., Harvey, F., Jung, J.-K., Kersten, E., Knigge, L., Lally, N., Lin, W., ... Young, J. C. (2016). Revisiting critical GIS. *Environment and Planning A*, 48(5), 815–824. <https://doi.org/10.1177/0308518X15622208>
- Warf, B., & Sui, D. (2010). From GIS to neogeography: Ontological implications and theories of truth. *Annals of GIS*, 16(4), 197–209. <https://doi.org/10.1080/19475683.2010.539985>
- Wilson, M. W. (2009). Towards A Genealogy of Qualitative GIS. In M. Cope & S. Elwood, *Qualitative GIS* (pp. 156–170). SAGE Publications Ltd. <https://doi.org/10.4135/9780857024541.n9>
- Wilson, M. W. (2017). Chapter 1: Criticality: The Urgency of Drawing and Tracing. In *New Lines: Critical GIS and the Trouble of the Map* (pp. 25–46). University of Minnesota Press. <https://doi.org/10.5749/j.ctt1pwt6q4>