

# ***GIS for Designers***

**Virginia Tech A+D | ARCH 4614 / 5064 | 3 credits**

**Summer Session 1 2023 | Location: online**

**Office Hours: Tuesday 6-8pm over Zoom <https://virginiatech.zoom.us/j/2981092726>**

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## I. DESCRIPTION & GOALS

Maps are rhetorical tools. Designers craft compelling arguments with maps, mapping, and spatial data visualization. Maps represent vast, complex data; they can be seductive and powerfully dense. Designers use maps — not just of geography, but of social, domestic, and political context — to analyze and understand spatial problems, and argue for data-defensible solutions.

This iteration of GIS for Designers will investigate relationships between historically-rooted inequalities and climate change impacts today using free, open-source mapping tools. Students will visualize complex urban issues using GIS (geographic information systems; i.e., digital mapping). The class will discuss how discriminatory government practices have relegated people to ecologically vulnerable areas, how health impacts of heat and pollution disproportionately impact historically-marginalized people, and how the ecological crises we now collectively face stem partly from deeply-rooted social ills. While lectures and readings will introduce a range of social mapping theory and history, the tutorials, examples, and final projects will focus on three Appalachian cities: Richmond, VA, Roanoke, VA, and Lynchburg, VA. Each city has distinctive histories of redlining and urban renewal which are clear in their physical footprints and social-ecological inequalities today.

In this course, we'll cover the basics of finding and evaluating data, representing data sets in GIS, using GIS tools to dig into the meaning of data, and crafting visual arguments in the form of data maps. We'll then translate this into online, interactive maps using Mapbox and Leaflet. You'll use publicly available GIS data, building department records, and census data to explore an ongoing social inequality in the city through variables like race, density, access, income, age, health, and others. Your final project will be a storymap: an interactive essay with maps and images that presents your research and conclusions. This format will address the two major goals of this class: it will display the *technical skills* you've learned, and it will demonstrate your thought process as you construct a *visual argument through maps*.

As an example of the kinds of guiding questions that spatial researchers use, here's an excerpt from *A Research Agenda for Geographic Information Science*, UCGIS (2004):

- “In what ways have particular logics and visualization techniques, value systems, forms of reasoning, and ways of understanding the world been incorporated into existing GIS techniques, and in what ways do alternative forms of representation remain to be explored and incorporated?”
- “How has the proliferation and dissemination of databases associated with GIS, as well as differential access to these databases, influenced the ability of different social groups to utilize this information for their own empowerment?”
- “How can the knowledge, needs, desires, and hopes of non-involved social groups adequately be represented in a decision-making process, and what are the possibilities and limitations of GIS technology as a way of encoding and using such representations?”

Applications used:

- QGIS (compatible with Mac and Windows)
- OpenStreetMaps (online platform for mapping and repository of open-source geographic information)
- Leaflet (javascript library for mapping)
- Mapbox (online platform for importing and beautifying mapping data)

Skills learned:

- Identifying mappable questions
- Finding mappable data online
- Downloading and cleaning datasets for use
- Setting up mapping files
- Importing data into basemap
- Understanding map layers, styling and symbology, queries, buffers, and clipping
- Spatial data analysis
- Data visualization design
- Interactive data visualization

Concepts covered:

- maps as visual arguments
  - maps as tools of power
  - data fidelity and reliability
  - use of maps as a social instrument
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## II. STRUCTURE

This course is a hybrid lecture-lab course. It consists of in-class lectures, readings, and tutorials, as well as a final mapping project divided into three assignments throughout the semester. All assignments should be submitted through Canvas.

Each class session will consist of around 40 minutes lecture, 20 minutes discussion, and 90 minutes tutorial time. Tutorials take around 1-2 hours to complete. Please see the schedule below for weekly tutorial, lecture, and reading assignments. All assignments for each week are due by *Friday at midnight* unless otherwise noted. Discussion prompts like reading responses are due before class as indicated on Canvas. Optional office hours will be held over Zoom on Tuesday from 6-8pm – please sign up for these using the link at the top of the syllabus.

In this class, you will have three types of assignments:

1. Reading response - each week to one of the assigned readings and to another student
2. Tutorials - each week following assigned tutorial
3. Map - these 3 assignments build up to your final storymap project (1. topic choice, 2. static map presentation, and 3. final storymap presentation)

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### III. ASSESSMENT

#### Criteria

1. THOROUGH documentation, including all asked-for materials
2. CLARITY and quality of submission
3. THOUGHTFUL response and participation
4. ON TIME

#### Breakdown (total 1000 points)

180 pts Reading responses / forum discussion (20 pts ea.)

300 pts Tutorials (30 pts ea.)

+ Bonus (5 pt ea., max 30 pts)

520 pts Map assignments

70pts Assignment 1 (topic choice)

150pts Assignment 2 (static maps)

300pts Assignment 3 (storymap)

**Honor Code:** refer to university honor code for academic integrity standards. While this class encourages collaboration, please be sure to indicate work (images, quotes) which are not your own. Failure to use clear citation in all of your submissions will result in points lost.

**Citations and professionalism:** for all assignments, your sources must be clearly cited using either MLA, APA, or Chicago citation format. A url is not a citation. In-line citations should refer to endnotes, footnotes, or author last name, year. All quotes should include the book or article name, and author as relevant. Assignments will lose points for incorrect spelling and grammar.

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### IV. SCHEDULE

#### PART 1: WHAT IS GIS? (modules 1-4)

	Readings	Tutorial
MODULE 1: Introduction 05/22-28	<ul style="list-style-type: none"><li>● "The Cartography of W. E. B. Du Bois's Color Line", W. E. B. Du Bois's Color Line (Wilson, 2018)</li><li>● "Reveal Submits Testimony to Congress" (Reveal and Glantz, 2020)</li></ul>	Tutorial 1: QGIS 1 Appalachian city map
MODULE 2: Maps as Power 05/22-28	<ul style="list-style-type: none"><li>● "Maps, Knowledge, and Power" (Harley, 1988)</li><li>● "Cartography and Decolonization", Decolonizing the Map (Craib, 2017)</li></ul>	Tutorial 2: QGIS 2 Appalachian city topography

MODULE 3: What is GIS (and why should I care)? 05/29-06/04	<ul style="list-style-type: none"> <li>"Geography's Nature and Perspectives", Geography: Why It Matters (Murphy, 2018)</li> <li>"Human-Scaled Visualizations and Society", The Sage Handbook of GIS and Society (Ballas and Dorling, 2011)</li> </ul>	Tutorial 3: QGIS 3 urban heat map, raster data
MODULE 4: GIS Industry Today 05/29-06/04	<ul style="list-style-type: none"> <li>"The Economics of Maps" (Nagaraj and Stern, 2020)</li> <li>"Mapping the digital empire: Google Earth and the process of postmodern cartography" (Farman, 2010)</li> </ul>	Tutorial 4: QGIS 4 Parcel data

PART 2: MAP IMAGE-MAKING (modules 5-9)

	Readings	Tutorial
MODULE 5: Beautiful maps and charts 06/05-11	<ul style="list-style-type: none"> <li>"Representation and the Necessity of Interpretation", Close Up at a Distance (Kurgan 2013)</li> <li>"Fundamental Principles of Analytical Design", Beautiful Evidence (Tufte, 2006)</li> </ul>	Map Assignment 1 (3 possible topics)
MODULE 6: Truth and data fidelity 06/05-11	<ul style="list-style-type: none"> <li>"A Place for Stories" (Cronon, 1992)</li> <li>"Viral Visualizations: How Coronavirus Skeptics Use Orthodox Data Practices to Promote Unorthodox Science Online" (Lee et al., 2021) or <a href="http://vis.mit.edu/covid-story/">http://vis.mit.edu/covid-story/</a></li> </ul>	Tutorial 5: QGIS 5 census / ACS data
MODULE 7: Storytelling with maps 06/12-18	<ul style="list-style-type: none"> <li>The Agency of Mapping: Speculation, Critique, and Invention (Corner, 1999)</li> <li>Appendix A: Some References to Orientation, from The Image of the City (Lynch, 1960)</li> <li>(optional) Walking in the City (Michel de Certeau, 1984)</li> <li>(optional) Introduction to a Critique of Urban Geography (Debord, 1955)</li> </ul>	Tutorial 6: QGIS 6 proximity analysis and extraction
MODULE 8: Maps, Society, and Ecology 06/12-18	<ul style="list-style-type: none"> <li>"Can the Mosquito Speak?" (Mitchell, 2002)</li> <li>"The Case for Letting Malibu Burn" (Davis, 1998)</li> </ul>	Tutorial 7: choose 2 from supplemental

PART 3: CODING (modules 9-15)

	Readings	Tutorial

MODULE 9: Climate justice and (informal) urban forms - guest lecture 06/19-25	<ul style="list-style-type: none"> <li>“Digital Territories: Google maps as a political technique in re-making urban informality” (Luque-Ayala and Maia, 2019)</li> <li>“Disposition” from Extrastatecraft (Easterling, 2014)</li> </ul>	Map Assignment 2 (static maps)
MODULE 10: guest lecture 06/19-25	<ul style="list-style-type: none"> <li>This Is Not an Atlas</li> <li>Geotiff</li> </ul>	Tutorial 8: Mapbox 1 Intro to Mapbox
MODULE 11: guest lecture 06/26-30	<ul style="list-style-type: none"> <li>Eyal Weizman / Forensic Architecture</li> <li>Laura Kurgan / Center for Spatial Research</li> </ul>	Tutorial 9: Mapbox 2 Scrollytelling Template
MODULE 12: final 06/26-30		Map Assignment 3 (storymap)

Supplemental Tutorials:

- QGIS 7: Finding and cleaning census data
  - QGIS 8: Historical census data (HGIS, IPUMS)
  - QGIS 9: Isochromatic maps (walking, driving)
  - QGIS 10: Creating your own point data (Google Map results to QGIS)
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## V. RESOURCES

1. GIS DATA SOURCES - by City
  - o [Data Folder](#) (pre-downloaded and cleaned)
  - o Roanoke:
    - i. [City Open Data Portal](#)
  - o Lynchburg:
    - i. [City Open Data Portal](#)
  - o Richmond:
    - i. [City Open Data Portal](#)
2. GIS DATA SOURCES - General
  - o [IPUMS](#) (detailed census data, historic GIS data, health data, international data, and much more)
  - o [NOAA](#) (broad-scale weather, climate, and atmospheric data)
  - o [HealthWatch](#) (city-level heat data)
  - o [Mapping Inequality](#) (redlining data and shapefiles)
  - o [MRLC Viewer](#) (land coverage data over time, USA)
  - o [Natural Earth](#) (global country boundaries, oceans, lakes, etc)
  - o [Berkeley GIS Natural Sciences](#) (collection of many useful ecology data links)
3. QGIS

- QGIS training manual: [https://docs.qgis.org/3.16/en/docs/training\\_manual/](https://docs.qgis.org/3.16/en/docs/training_manual/)
- A gentle introduction to QGIS: [https://docs.qgis.org/3.16/en/docs/gentle\\_gis\\_introduction/](https://docs.qgis.org/3.16/en/docs/gentle_gis_introduction/)
- QGIS tips and tutorials: <https://www.qgistutorials.com/en/index.html>
- Methods in Spatial Research (GSAPP) tutorials:  
<https://github.com/CenterForSpatialResearch/methods-in-spatial-research-sp2020/tree/master/tutorials>
- Conflict Urbanism (GSAPP) tutorials:  
<https://github.com/michellejm/ConflictUrbanism-InfraPolitics/tree/master/Tutorials>
- Points Unknown tutorials: [https://pointsunknown.nyc/tutorial\\_list/](https://pointsunknown.nyc/tutorial_list/)
- A lot of great additional ways of visualizing census data can be found here:  
<https://spatialthoughts.com/2021/03/15/qgis-in-urban-and-regional-planning/>
- Brendan Harmon, GIS for Designers: <https://baharmon.github.io/gis-for-designers>

#### 4. Leaflet and Mapbox

- Mapbox tutorials: <https://docs.mapbox.com/help/tutorials/>
- Leaflet tutorials: <https://leafletjs.com/examples.html>
- Conflict Urbanism (GSAPP course) tutorials:  
<https://github.com/michellejm/ConflictUrbanism-InfraPolitics/tree/master/Tutorials>
- Axis Maps tutorials: <https://www.axismaps.com/blog>

#### 5. Data visualization

- NYT's Data Journalism training drive:  
[https://drive.google.com/drive/u/0/folders/1ZS57\\_40tWuIB7tV4APVMmTZ-5PXDwX9w](https://drive.google.com/drive/u/0/folders/1ZS57_40tWuIB7tV4APVMmTZ-5PXDwX9w)
- Visualizing Data resources: <https://www.visualisingdata.com/resources/>
- Information is Beautiful website: <https://informationisbeautiful.net/>
- Earth climate visualization: <https://earth.nullschool.net/>
- Gapminder world health chart: [https://www.gapminder.org/tools/#\\$chart-type=bubbles&url=v1](https://www.gapminder.org/tools/#$chart-type=bubbles&url=v1)
- Chart of Universal Commercial History (Playfair)
- History of world conquest (Rand MacNally 1931)
- Overlapping map projections: <https://observablehq.com/@mkfreeman/overlapping-projections>

#### 6. Example Maps / Storymaps

- MapMania maps of the year:  
<http://bl.ocks.org/mapsmania/raw/90a698d0feda36203648b0932c6c26f6/?raw=true>
- This Is Not an Atlas: <https://notanatlas.org/#atlas-maps>
- Lapham Quarterly's maps: <https://www.laphamsquarterly.org/archive/maps>
- David Rumsey map collection:  
[https://www.davidrumsey.com/luna/servlet/view/search:JSESSIONID=53e3937e-7bda-4339-a374-46b9229f950f?q=subject%3D%22data+visualization%22+LIMIT%3ARUMSEY%7E8%7E1&sort=Pub\\_List\\_No\\_InitialSort%2CPub\\_Date%2CPub\\_List\\_No%2CSeries\\_No&pgs=50&res=1](https://www.davidrumsey.com/luna/servlet/view/search:JSESSIONID=53e3937e-7bda-4339-a374-46b9229f950f?q=subject%3D%22data+visualization%22+LIMIT%3ARUMSEY%7E8%7E1&sort=Pub_List_No_InitialSort%2CPub_Date%2CPub_List_No%2CSeries_No&pgs=50&res=1)
- Fuck Yeah Cartography (tumblr): <https://fuckyeahcartography.tumblr.com/>
- World population density map: <https://luminocity3d.org/WorldPopDen/#3/11.87/76.46>
- River Run map: <https://river-runner.samlearner.com/>

- LIDAR story map:  
<https://wadnr.maps.arcgis.com/apps/Cascade/index.html?appid=36b4887370d141fcbb35392f996c82d9>
- Human footprint story map:  
<https://storymaps.arcgis.com/stories/2f289f1a06ba4f2d95b3fbf3133c50f9>
- NYT Easter Island story map:  
<https://www.nytimes.com/interactive/2018/03/14/climate/easter-island-erosion.html>
- ArcGIS story map gallery: <https://storymaps-classic.arcgis.com/en/gallery/#s=0>
- Redlining impacts story map:  
<https://storymaps.arcgis.com/stories/0f58d49c566b486482b3e64e9e5f7ac9?adumkts=product>
- Beautiful maps (variety of older and newer): <https://mapsdesign.tumblr.com/>
- COVID funeral pyres in India:  
<https://graphics.reuters.com/HEALTH-INDIA/CORONAVIRUS-DEATHS/qzjvqrqaqpx/index.html>
- Fivethirtyeight on redlining: <https://projects.fivethirtyeight.com/redlining/>
- Interactive geological map: <https://macrostrat.org/map/#/z=1.5/x=16/y=23/bedrock/lines/>

## 7. Organizations applying mapping and data visualization

- Anti-Eviction Mapping Project: <https://antievictionmap.com/>
- Center 4 Spatial Research: <https://c4sr.columbia.edu/>
- NYT's The Upshot: <https://www.nytimes.com/section/upshot>
- Truth and Beauty (blog): <https://truth-and-beauty.net/>
- NASA Earth Observatory: <https://earthobservatory.nasa.gov/>
- Stamen (design company): <https://stamen.com/work/here-xyz/>
- Fathom (design company): <https://fathom.info/projects/>
- Smell Walks: <https://sensorymaps.com/projects/>
- Info We Trust (design company): <https://infowetrust.com/>
- Reuter's Graphics: <https://graphics.reuters.com/>
- 80 Data Visualization Maps (Carto):  
<https://carto.com/blog/eighty-data-visualizations-examples-using-location-data-maps/>

## 8. ADDITIONAL REFERENCES

### Textbooks and Guides

- [Sage Handbook of GIS and Society \(2011\)](#)
- GIS Fundamentals (Bolstad)
- Principles of GIS (Burrough et al)
- Qualitative GIS: A Mixed Methods (Approach Sarah Elwood & Meghan Cope, eds., 2009)

### Map Design

- Designing Better Maps (Brewer)
- Beautiful Evidence (Edward Tufte)
- The Visual Display of Quantitative Information (Edward Tufte)
- Cartography (Kenneth Field)
- Journal: Cartographica (canada)

### Theory (spatial / data)

- A Social History of Truth (Shapin)
- Theory and Reality (Godfrey-Smith)

- The Image of the City (Lynch)
- Culture and Society (Johnson, ed.)
- A History of Data Visualization (Friendly)
- All Data Are Local (Loukissas)
- “Raw Data” Is an Oxymoron
- Learning from Las Vegas (Venturi, Scott Brown, and Izenour, 1972)

Theory (mapping)

- Geography: Why It Matters (Murphy)
- Close Up at a Distance (Laura Kurgan, 2013)
- Rethinking the Power of Maps (Denis Wood & John Fels, 2010)
- **Mapping Society (Laura Vaughan, 2018)**
- Rethinking Maps: New Frontiers in Cartographic Theory (ed. Dodge et. al., 2009)

9. POTENTIAL FINAL TOPICS

- food deserts (grocery access)
- healthcare access (hospitals / clinics)
- urban heat island effect
- redlining and urban renewal (impact today)
- climate change (flooding, ecology change, biodiversity)
- heavy industry pollution (legacy, outcomes)
- spatial proximity to greenspace and health outcomes