



Winter 2017 Geography 128
Analytical and Computer
Cartography

Professor Keith C. Clarke

Old Class web site

<http://www.geog.ucsb.edu/~kclarke/Geography128/Geog128.html>

PersonalWebKit Site - Mozilla Firefox

file:///C:/Documents and Settings/Keith Clarke/My Documents/Geography128/lectures.htm

Google ISI Web of Knowledge... NSS Online Review Sy... Login NPR : National Public... COX.net for Santa Ba... UCSB Dept of Geogra... GauchoSpace Google Calendar

PersonalWebKit Site

UNIVERSITY OF CALIFORNIA SANTA BARBARA GEOGRAPHY

Geography 128 Analytical and Computer Cartography

- Keith Clarke Home
- Lectures**
- Laboratories
- Readings
- Extras

Lectures

All lectures will take place in [North Hall Room 1105](#)

Lecture Schedule

Day	Date	Lecture Topic	Readings
Monday	January 3	Intro to the class	Clarke 1998
Wednesday	January 5	Review: Geodesy and Scale	Geodesy for the Layman
Monday	January 10	Review: Map Projections	Steinwand et al., 1995. Read Wiki site http://en.wikipedia.org/wiki/Map_projection
Wednesday	January 12	Review: Coordinate Systems	Clarke & Battersby 2001
Monday	January 17	Holiday	
Wednesday	January 19	A transformational view of cartography	Tobler 1979
Monday	January 24	What is analytical cartography?	Moellering 2000/Tobler 1959/Tobler 1976
Wednesday	January 26	Data storage and representation	Clarke Chapters 7-9
Monday	January 31	Spatial data structures for mapping	Peucker and Chrisman 1975; Clarke Chapters 7-9
Wednesday	February 2	Algorithms, mosaicing, and conflation	Clarke Chapter 10/Tobler 1979
Monday	February 7	Mid-term examination	
Wednesday	February 9	Geometric map transformations	Clarke Chapter 11
Monday	February 14	Affine and object transformations	Clarke Chapter 11
Wednesday	February 16	Generalization and structure-to-structure	Clarke Chapter 12


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Gauchospace Site

Course: GEOG 128 - COM x

Secure | <https://gauchospace.ucsb.edu/courses/course/view.php?id=15551>

Apps Google Google Calendar Breaking News, U.S., V Breaking News and O Web of Science [v.5.17] The New GauchoSpace Course Login | Online eGrades ScholarOne Manuscri New Tab

 **Geography 128 Analytical and Computer Cartography**

Analytical and Computer Cartography is an upper division Geography class designed to enrich students knowledge and skill in the theory and practice of cartography. Class will consist of lectures that present the concepts behind computer mapping and laboratories in which students use open source mapping software to produce maps for themselves. Grades will be assigned on the basis of a mid-term and a final (each worth 25% of the grade) and five laboratory assignments, each worth 10%. Students are expected to create personal web-sites, and to add the completed maps they create to the site as the quarter progresses.


Occasional PDF files of papers will be added to the Gauchospace site under "Extras", as coordinated to the lectures. While most of the readings are included because they will be mentioned in class, nevertheless you should read and absorb their content. The "Extras" links are for assorted web and other materials that I will mention in lectures and labs.


The class goals are: (1) to create students who can skillfully and knowledgeably create high quality maps and graphics for other classwork, and for professional posters and presentations, both during and after their UCSB experience; and (2) to demonstrate that cartography consists of both theory (analytical cartography) and practice (computer cartography).

Lectures: T R 12:30- 1:45 ELLSN 3621 Instructor: Keith Clarke <http://www.geog.ucsb.edu/~kclarke/>

Lab 1: 50732 W 3:00- 4:50 ELLSN 2610 TA: Haiyun Ye

Lab 2: 50740 W 5:00- 6:50 ELLSN 2610 : TA Marcela Suárez

 Instructor Announcements

 Text Book

Week One

Course Dashboard

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Navigation

Dashboard

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- Current course
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Download Files

(no files available to download)

Latest news

Add a new topic...

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Help

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What you will learn

- The cartographic side of Geographic Information Science
- What AC is, where it came from, and where its going
- Aspects of cartographic transformations
- Some extra details on 3D representation
- Several Open Source mapping packages
- How to build a map portfolio

The class

- Lectures 2x a week, video posted on old site
- Labs once a week
- 5 labs, 2 weeks per lab
- Labs are far more self-help based than 176. Use your intelligence!
- Web site
- Papers will be distributed on Gauchospace
- Gauchospace site

Your instructors



Keith Clarke, Professor



Marcela Suarez, TA

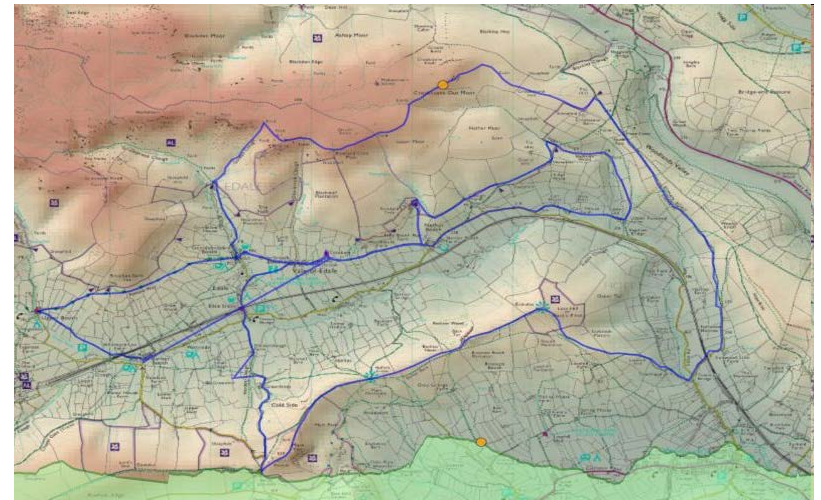
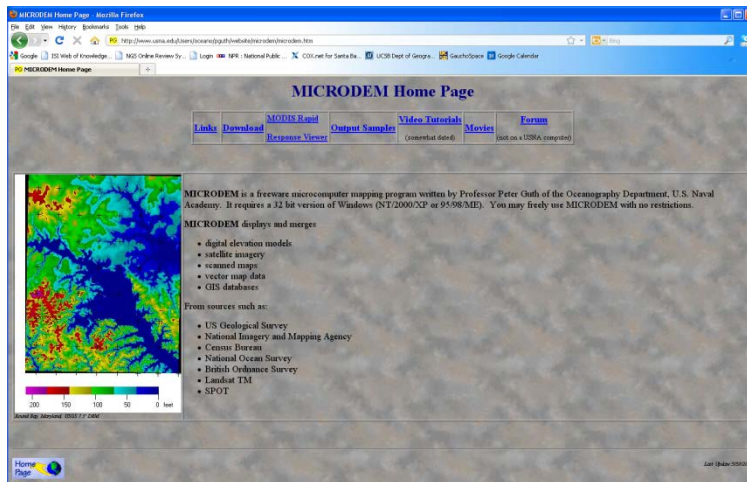
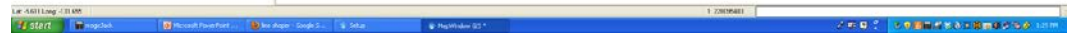
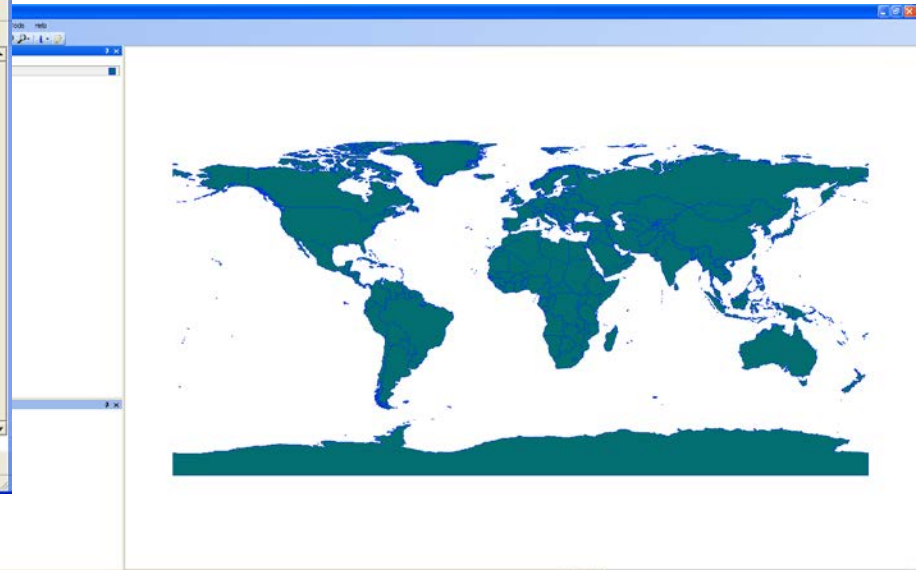
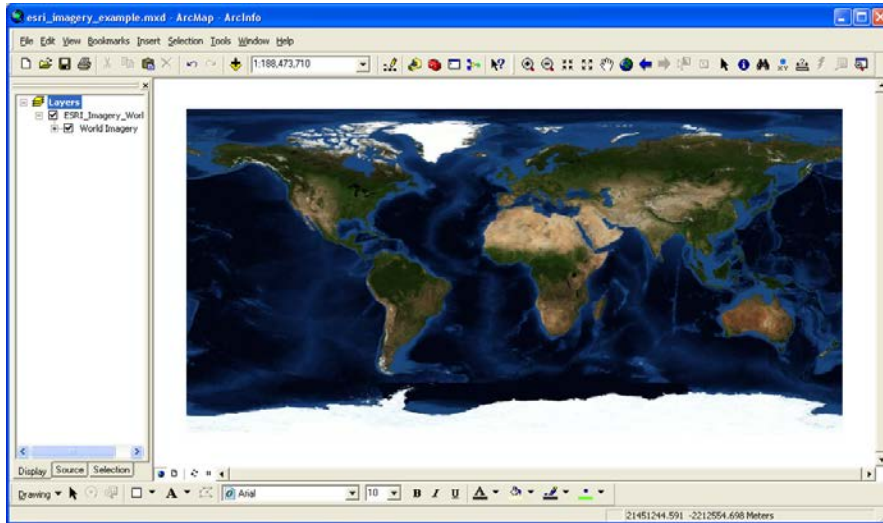


Haiyun Ye, TA

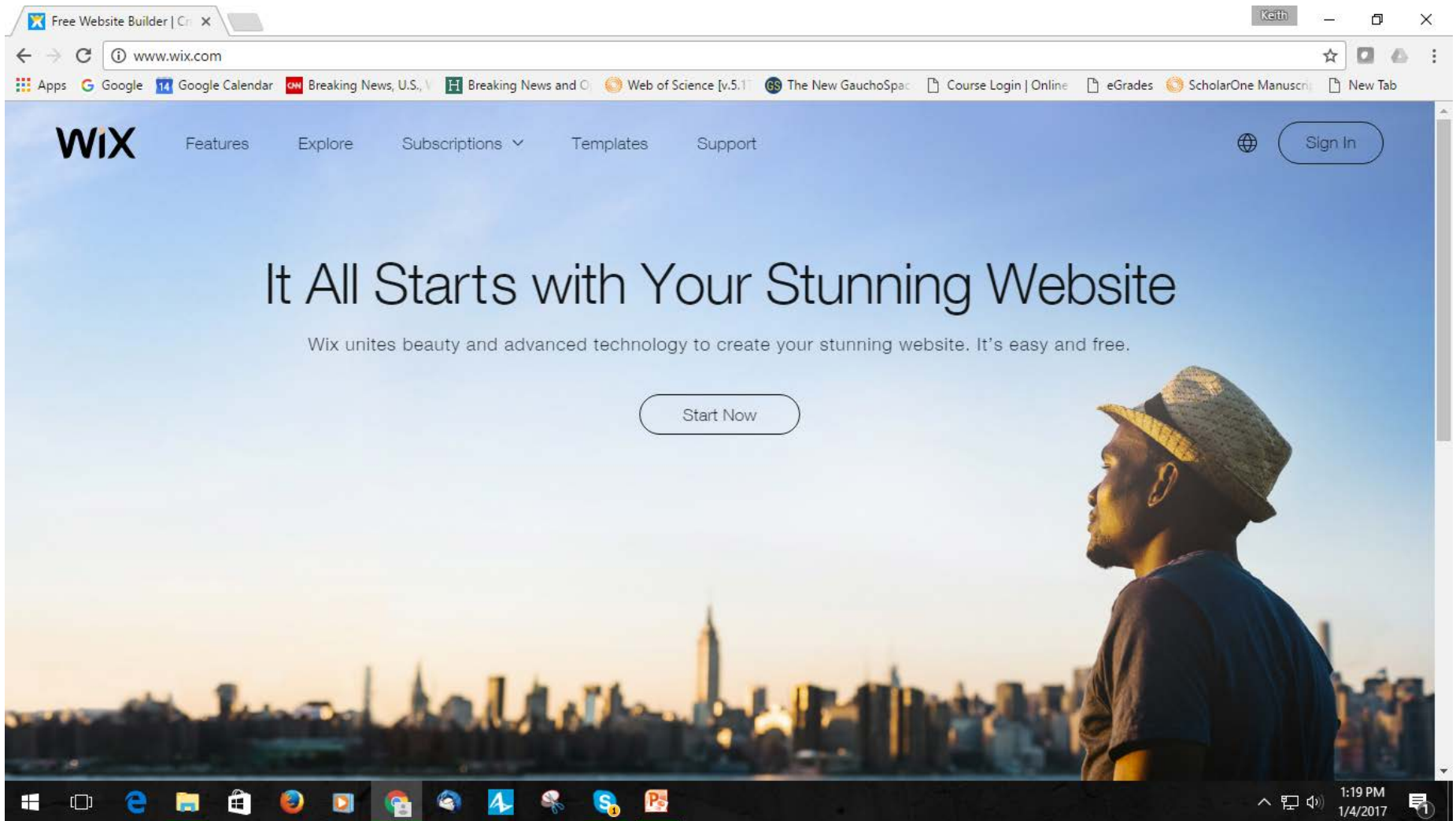
The lab work



ArcGIS/Open source/Freeware



Portfolio of maps



The image shows a screenshot of a web browser displaying the Wix website. The browser's address bar shows "www.wix.com". The page features the Wix logo in the top left, followed by navigation links: "Features", "Explore", "Subscriptions", "Templates", and "Support". A "Sign In" button is located in the top right. The main headline reads "It All Starts with Your Stunning Website", with a sub-headline below it: "Wix unites beauty and advanced technology to create your stunning website. It's easy and free." A "Start Now" button is centered on the page. The background image shows a man in a hat looking out over a city skyline at sunset. The Windows taskbar is visible at the bottom, showing various application icons and the system clock indicating 1:19 PM on 1/4/2017.

Free Website Builder | Cr X

Keith

www.wix.com

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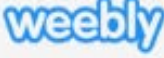









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Many Choices

Website Builder	Score	Features We Like	Ease Of Use	Best Deal	
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	9.4 Read Review	<ul style="list-style-type: none"> ✓ Free Domain ✓ 10,000 Design Templates ✓ Drag & Drop Builder ✓ Powerful SEO Tools 		Free Domain with all packages	Visit Site
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	7.9 Read Review	<ul style="list-style-type: none"> ✓ Numerous Templates ✓ Point-and-Click Easy Editing 		Domain name, Professional design layouts, Point and click editing included	Visit Site
	7.3 Read Review	<ul style="list-style-type: none"> ✓ Free Domain Name ✓ Professional Design Layouts ✓ 24/7 Support 		Free Domain, E-mail & Hosting are Included	Visit Site

The Class

- Taught as *Analytical Cartography* (Geog 482) at the University of Michigan by Waldo Tobler late 1960s on
- Topic of paper by Tobler in 1976, published the curriculum (more detailed than actual class!)
- Adopted by Keith Clarke at Hunter College in 1982, after taking the class at Michigan
- Led to *Analytical and Computer Cartography* 1990 textbook. 2 editions
- Moved the class to UCSB in 1996, taught in several other universities, including CUG Wuhan
- Many subsequent additions to the literature

Geog 482

COURSE OUTLINE

Analytical Cartography. Geography 482. 3 credits. Prof. Waldo R. Tobler University of Michigan, Ann Arbor, Michigan 48109, U.S.A.

Week I. Introduction. Relation to mathematical geography, geodesy, photogrammetry, remote sensing. Replacement of map data storage by computer data storage. Technological change and the need for theoretical approach. Historical perspective.

Week II. Computer Graphics. Turing's theorem in relation to cartography. Output devices: lines, halftones, color. Sources of programs and algorithms. Dynamic cartography and computer movie making. Interactive graphics in cartography and geography.

Week III. Geographical Matrices. Triagonal, quadrilateral, hexagonal, and Escher types. Notation, neighborliness property, topological invariance. The varieties of geographical data: nominal, binary, scalar, complex, colored, N-valued, and infinite-valued matrices. Isomorphism to the surface of the earth.

Week IV. Geographical Matrix Operators. Functions of matrices: algebraic, logical, differentiable, invertible; linear, local, spatially invariant (translationally and rotationally). Parallel processing, windows, edge effects. Finite difference calculations.

Week V. Response Functions. Fourier and other orthogonal series. Operations in the frequency domain. Two-dimensional transforms.

Week VI: Sampling and Resolution. Fourier interpretations of aliasing, band limited functions, Nyquist limit, comb functions. The sampling theorem, random plane sampling, invisible distributions.

Week VII. Quantization and Coding. Analogue and digital processing. Quantization error, reduction of. Information theory: how many aerial photographs are there? Huffman coding, higher order statistics, spatial autocorrelation functions. Television and choropleth maps.

Week VIII. Map Generalization. Textual, acoustical, visual abstractions: smoothing and reconstruction, spread functions and inverses. Information loss. Point, line, network, binary to N-valued matrix generalization. Digital implementation, optical data processing. How the brain works: Limulus, frog, cat, human.

Week IX. Pattern Recognition. Preprocessing, enhancement, feature extraction; discrimination and classification (linear, Gaussian); signal-to-noise ratios; perceptrons.

Week X. Generalized Spatial Partitionings. Census tracts and the like, *ad nauseum*. Point functions versus interval functions, a false dichotomy. Spatial resolution redefined. Generalized neighbors in a point set: epsilon neighborhood, K^{th} surround, minimal triangulation, Gabriel contiguity, Thiessen polygons. Higher order neighbors. Interval sets associated with a point set; point sets associated with an interval set. Higher dimensional cases.

Week XI. Generalized Geographical Operators. Expansion of matrix operators to irregular point sets, to interval data, in such a manner as to include matrix as a special case. Generalized two-dimensional sampling theorem and reconstructions from sampled data.

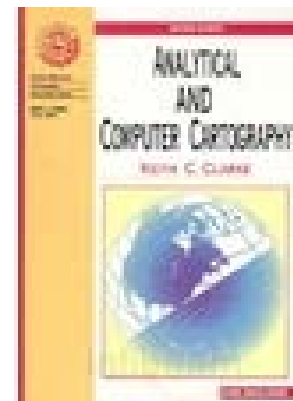
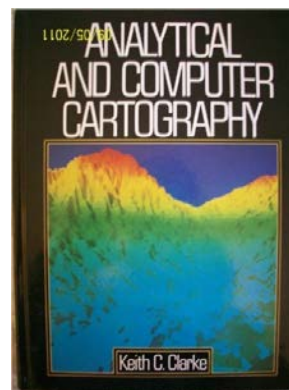
Week XII. Geographical Coding. Information theoretical content of Latitude / Longitude, street address, ZIP code, telephone number, Public Land Survey, and the like.

Topological and metrical properties of place naming schemes. Gaussian coordinates. A variety of plane coordinate schemes. Formulae for working on sphere and ellipsoid.

Week XIII. Geographical Code Conversions. Complete-partial, redundant-optimal, invertible & non-invertible codes. Blum geometry and skeletal invariants. Point-point, point-interval, interval-interval conversions and their inverses. Polygonal and skeletal approaches; error measures. Street address, Latitude Longitude, and so forth.

Week XIV. Map Projections. The classical theory: Ptolemy, Mercator, Lambert, Euler, Gauss, Airy, Chebyshev, Tissot. Finite and differential measures of distortion. Applicability to “mental maps.” Simplifying computations by using map projections. Some new ways of inventing projections. Computation of cartograms.

Week XV. Geographical Information Systems. Band width requirements; dollar requirements; hardware and software. Input schemes, manipulation algorithms, output schemes. Historical overview and examples: TIROS-ERTS, CATS-PJ-BATS, CLIMLADS-DIME. Analytical approaches to using geographical data: optimization techniques, sensitivity testing, regionalization, spatial trend analysis, dynamic simulation, growth models, regional forecasting.



Curriculum

- Week 1:
 - Review: Geodesy and Scale
 - Review: Map Projections
- Week 2:
 - Review: Coordinate Systems
 - A transformational view of cartography
- Week 3:
 - What is Analytical Cartography?
 - Data storage and representation

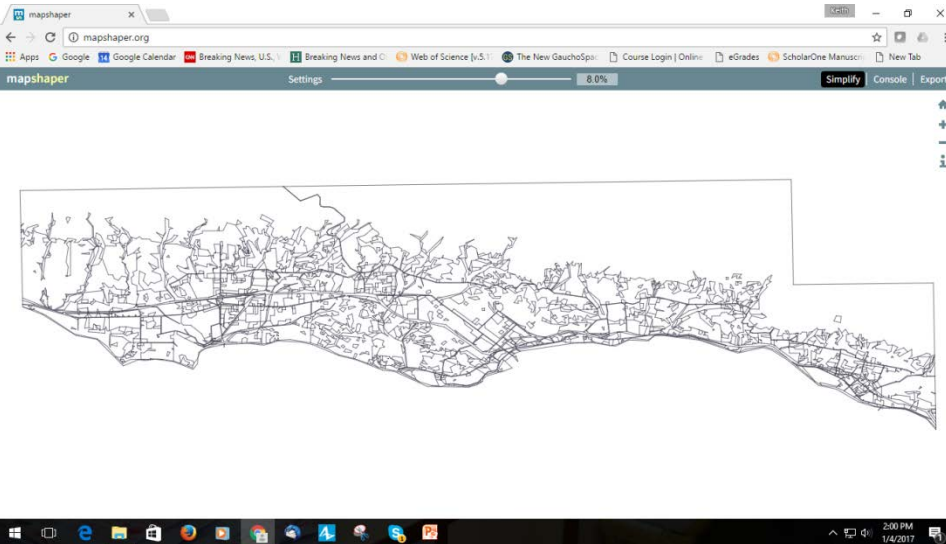
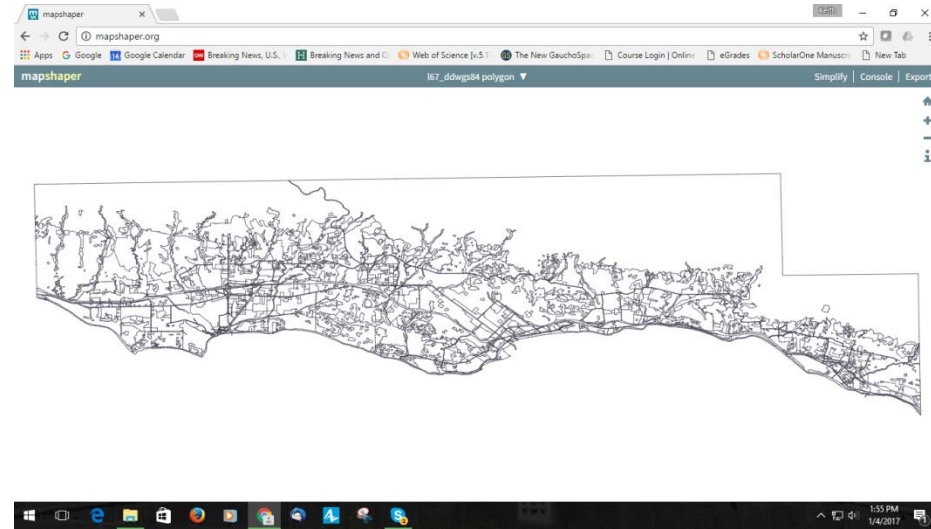
- Week 4:
 - Spatial Data Structures for Mapping
 - Algorithms, mosaicing, and conflation
- Week 5:
 - Mid-Term
 - Geometric map transformations
- Week 6:
 - Open Source Cartography
 - Generalization and structure-to-structure transformations

- Week 7:
 - Grids, interpolation and extrapolation
 - Cartography's institutions and past
- Week 8:
 - 3D Mapping and modeling
 - Technical Issues for 3D rendering
- Week 9:
 - The NSDI and A Digital Earth
 - Current research in Analytical Cartography
- Week 10:
 - A selective history of computer cartography, GIS and remote sensing
 - Class summary and review for final

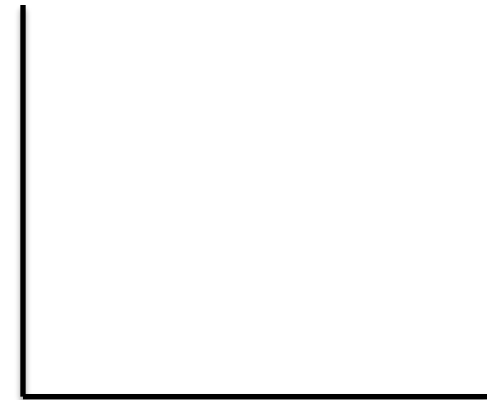
The labs

- Topics: Map projections for grids, the fractal nature of line generalization, terrain analysis and rendering, more terrain analysis
- Software: ArcGIS, MapShaper, MapWindow GIS, Excel, MicroDEM, Landserf (on UNIX server)
- Instruction template as word doc—read carefully!

For example: Map Shaper



Line Length



Level of detail

What I expect of you

- Stay up to date with the class, readings, lectures labs
- Turn in labs on time
- Do original work
- Ask questions, come to office hours
- Use Gauchospace completely
- Try experiments
- Work hard, but work smart not too hard