CIS 4930/6930-902
Scientific Visualization

MAPS

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slides credits Miriah Meyer (U of Utah)
ADMINISTRATIVE

Final project topics due tonight!

Project 4 presentations Thursday
MAPS!

landmarks

discrete data

continuous data

choropleths

cartograms

projections
Rendering Effective Route Maps: Improving Usability Through Generalization

Maneesh Agrawala  Chris Stolte
Stanford University

Figure 1: Three route maps for the same route rendered by (left) a standard computer-mapping system, (middle) a pen and, (right) LineDrive, our route map rendering system. The standard computer-generated map is difficult to use because its large, constant scale factor causes the short roads to vanish and because it is cluttered with extraneous details such as city names, parks, and roads that are far away from the route. Both the handdrawn map and the LineDrive map exaggerate the lengths of the short roads to ensure their visibility while maintaining a simple, clean design that emphasizes the most essential information for following the route. Note that the handdrawn map was created without seeing either the standard computer-generated map or the LineDrive map.

(REnding Effective Route Maps)
RECOMMENDATIONS

- straighten wiggly lines
- snap turns to right angles
- expand regions with turns
- contract long straight roads
- label carefully
- maintain overall orientation
DISCRETE DATA
DATA AS ICONS/GLYPHS
DATA AS POINTS

data : ordered/quantitative
encoding : size
TRAFFIC
DATA AS POINTS

data : categorical  
encoding : hue
DATA AS POINTS

data: categorical
encoding: hue

HTTP://WWW.FLICKR.COM/PHOTOS/SHAZBOT/3282821808/IN/SET-72157614736071588/
DATA AS LINES

HTTP://FATHOM.INFO/ALLSTREETS/
DATA AS CHARTS

[Map showing data as charts with catch composition legend]

HTTP://ALASKA.USGS.GOV/SCIENCE/BIOLOGY/SEABIRDS_FORAGEFISH/FORAGEFISH/ALEUTIAN/RESULTS.PHP
CONTINUOUS DATA
ISOPLETH

map which overlays continuous data using a third encoding channel
HEATMAPS
CHOOSE THE APPROPRIATE COLOR MAP
ISOCURVES
WIND MAP
first weather map

EDMOND HALLEY, 1686
CHOROPLETHS
**CHOROPLETH**

map in which areas are shaded, colored, or patterned relative to a data attribute value
2004 Popular Vote

- Bush: 62 million
- Kerry: 59 million

Amount of red and blue shown on map

- Bush: 2,500,000 mi²
- Kerry: 525,000 mi²
The deep red down the center of this map highlights the president’s support in sparsely populated areas.
This map removes mostly uninhabited areas, revealing Mr. Bush’s suburban and rural support in the East and South.

* Areas with less than three people per square mile.

MATTHEW ERICSON, NY TIMES
CARTOGRAM

map in which areas are scaled and distorted relative to a data attribute value

Emile Levasseur, 1868
RECTANGULAR CARTOGRAM

2006 ELECTION GUIDE

New York Times ratings

SENATE RACES

HOUSE RACES

GOVERNORS' RACES

RACE PROFILES

198 Safe Dem.
16 Leaning Dem.
17 Toss up
24 Leaning Rep.
180 Safe Rep.

Click on a district below to learn more.

Each box represents a House district.

ANALYZE RACES
CREATE OUTCOMES

Shade the map using the pulldown...

New York Times ratings

...then show only certain states
New York Times ratings

Democrat: Safe  Leaning  Toss Up
Republican: Safe  Leaning


Margin in 2004 House race
Democrat: >50%  25-50%  <25%
Republican: >50%  25-50%  <25%

Votes for president
Bush  Bush
Kerry  Gore

Appearances by big fundraisers
George W. Bush  Bill Clinton

☐ Races to watch
☐ Open races
☐ Switch districts

Urbanization
☐ Urban  ☐ Suburban  ☐ Rural  ☐ Mixed

Race/Ethnicity
☐ White  ☐ Black  ☐ Hispanic

Median income
☐ <$30K  ☐ $30-50K  ☐ >$50K

HTTP://WWW.NYTIMES.COM/REF/WASHINGTON/2006ELECTIONGUIDE.HTML
What Your Global Neighbors Are Buying

How people spend their discretionary income—the cash that goes to clothing, electronics, recreation, household goods, alcohol—depends a lot on where they live. People in Greece spend almost 2.5 times more money on clothing as they do on electronics. People living in Japan spend more on recreation than they do on clothing, electronics and household goods combined. Americans spend a lot of money on everything.
Population
first nonrectangular cartogram

Apportionment Map of the United States

BY WILLIAM B. BAILEY, PH.D.
ASSISTANT PROFESSOR OF POLITICAL ECONOMY IN YALE UNIVERSITY.

Population and Federal Taxes
first modern cartogram

GRUNDY'S MAP OF THE UNITED STATES

William Bailey, 1910

Joseph Grundy, 1929
Elvis Concerts

Attendance per State, 1970 - 1977

Note: NY, with an estimated concert attendance of over 600,000, is excluded because of space limitations.

ELFinder

AREA SCALED BY DATA

Kerry vs. Bush, 2004

Michael Gastner, Cosma Shalizi, and Mark Newman
University of Michigan
distortion via diffusion
THE WORLD

HTTP://WWW-PERSONAL.UMICH.EDU/~MEJN/CARTOGRAMS/
GDP

HTTP://WWW-PERSONAL.UMICH.EDU/~MEJN/CARTOGRAMS/
CHILD MORTALITY

HTTP://WWW-PERSONAL.UMICH.EDU/~MEJN/CARTOGRAMS/
PEOPLE LIVING WITH HIV/AIDS

HTTP://WWW-PERSONAL.UMICH.EDU/~MEJN/CARTOGRAMS/
TOTAL SPENDING ON HEALTHCARE

HTTP://WWW-PERSONAL.UMICH.EDU/~MEJN/CARTOGRAMS/
HARRY BECK’S TUBE MAP

Central Line extension
Liverpool Street to Stratford
open January, 1947

LONDON UNDERGROUND
Transport

Metropolitan and District Lines
Bakerloo Line
Central Line
Northern Line
Lines under construction
DO THEY WORK?
PROJECTIONS

flattening the globe
LATITUDE, LONGITUDE

P=40° N, 60° W

Point

Center

Equator
A SPHERE TEARS WHEN YOU FLATTEN IT

HTTP://WWW.OOCITIES.ORG/SUZY_GILLECE/
MANY WAYS TO TEAR...

myiahedral projection

Unfolding to...

...the coastline of the earth.

Wijk 2008
**What Your Favorite Map Projection Says About You**

**Mercator**

You're not really into maps.

**Van der Grinten**

You're not a complicated person. You love the Mercator projection; you just wish it weren't square. The Earth's not a square, it's a circle. You like circles. Today is gonna be a good day!

**Robinson**

You have a comfortable pair of running shoes that you wear everywhere. You like coffee and enjoy The Beatles. You think the Robinson is the best-looking projection, hands down.

**Dymaxion**

You like Isaac Asimov, XML, and shoes with toes. You think the Segway got a bad rap. You own 3D goggles, which you use to view rotating models of better 3D goggles. You type in Duotone.
WINKEL-TRIPEL

NATIONAL GEOGRAPHIC ADOPTED THE WINKEL-TRIPEL IN 1998, BUT YOU'VE BEEN A WAT FAN SINCE LONG BEFORE "NAT GED" SHOWNED UP. YOU'RE WORRIED IT'S GETTING PLAYED OUT, AND ARE THINKING OF SWITCHING TO THE KAVRYSKY. YOU ONCE LEFT A PARTY IN DISGUST WHEN A GUEST SHOWED UP WEARING SHOES WITH IZES. YOUR FAVORITE MUSICAL GENRE IS "POST-".

GOODE HOMOLOGINE

THEY SAY MAPPING THE EARTH ON A 2D SURFACE IS LIKE FLATTENING AN ORANGE PEEL, WHICH SEEMS EASY ENOUGH TO YOU. YOU LIKE EASY SOLUTIONS. YOU THINK WE WOULDN'T HAVE SO MANY PROBLEMS IF WE JUST ELECT NORMAL PEOPLE TO CONGRESS INSTEAD OF POLITICIANS. YOU THINK AIRLINES SHOULD JUST BUY FOOD FROM THE RESTAURANTS NEAR THE GATES AND SERVE THAT ON BOARD. YOU CHANGE YOUR CAR'S OIL, BUT SECRETLY WONDER IF YOU REALLY NEED TO.

HOBO-DYER

YOU WANT TO AVOID CULTURAL IMPERIALISM, BUT YOU'VE HEARD BAD THINGS ABOUT GALL-PETERS. YOU'RE CONFLICT- AVERSE AND BUY ORGANIC. YOU USE A RECENTLY-INTRODUCED SET OF GENDER-NEUTRAL PRONOUNS AND THINK THAT WHAT THE WORLD NEEDS IS A REVOLUTION IN CONSCIOUSNESS.

PLATE CARRÉE

(UNEQUILIBRATED)

YOU THINK THIS ONE IS FINE. YOU LIKE HOW X AND Y MAP TO LATITUDE AND LONGITUDE. THE OTHER PROJECTIONS OVERCOMPLICATE THINGS. YOU WANT ME TO STOP ASKING ABOUT MAPS SO YOU CAN ENJOY DINNER.

A GLOBE!

WATERMAN BUTTERFLY
NEEDS IS A RESOLUTION IN CONSCIOUSNESS.

A GLOBE!

YES, YOU'RE VERY CLEVER.

PEIRCE QUINTUNICAL

YOU THINK THAT WHEN WE LOOK AT A MAP, WHAT WE REALLY SEE IS OURSELVES. AFTER YOU FIRST SAW INCEPTION, YOU SAT SILENT IN THE THEATER FOR SIX HOURS. IT BRINGS YOU TO REALIZE THAT EVERYONE AROUND YOU HAS A SKELETON INSIDE THEM.

YOU HAVE REALLY LOOKED AT YOUR HANDS.

WATERMAN BUTTERFLY

REALLY? YOU KNOW THE WATERMAN? HAVE YOU SEEN THE 1909 OHLL MAP IT'S BASED UPON? YOU HAVE A FRAMED REPRODUCTION AT HOME? Whoa. ...LISTEN, FORGET THESE QUESTIONS. ARE YOU DOING ANYTHING TONIGHT?

GALL-PETERS

I HATE YOU.
CLASSES OF PROJECTION
AZIMUTHAL
preserves direction

EQUAL-AREA
preserves area

CONFORMAL
preserves local shapes