Last Time:
Data & Image Models
The Big Picture

- **task**
  - questions, goals
  - assumptions

- **data**
  - physical data type
  - conceptual data type

- **domain**
  - metadata
  - semantics
  - conventions

- **processing algorithms**
- **mapping**
  - visual encoding

- **image**
  - visual channel
  - graphical marks
Nominal, Ordinal & Quantitative

N - Nominal (labels or categories)
  • Operations: =, ≠

O - Ordered
  • Operations: =, ≠, <, >

Q - Interval (location of zero arbitrary)
  • Operations: =, ≠, <, >, -
  • Can measure distances or spans

Q - Ratio (zero fixed)
  • Operations: =, ≠, <, >, -, %
  • Can measure ratios or proportions
Visual Encoding Variables

Position (x 2)
Size
Value
Texture
Color
Orientation
Shape

Others?
Bertin’s “Levels of Organization”

<table>
<thead>
<tr>
<th>Position</th>
<th>N</th>
<th>O</th>
<th>Q</th>
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</thead>
<tbody>
<tr>
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</table>

Nominal
Ordinal
Quantitative

Note: $Q \subset O \subset N$
Choosing Visual Encodings

Assume \( k \) visual encodings and \( n \) data attributes. We would like to pick the “best” encoding among a combinatorial set of possibilities of size \((n+1)^k\).

**Principle of Consistency**
The properties of the image (visual variables) should match the properties of the data.

**Principle of Importance Ordering**
Encode the most important information in the most effective way.
Design Criteria [Mackinlay 86]

**Expressiveness**
A set of facts is *expressible* in a visual language if the sentences (i.e. the visualizations) in the language express all the facts in the set of data, and only the facts in the data.

**Effectiveness**
A visualization is more *effective* than another visualization if the information conveyed by one visualization is more readily perceived than the information in the other visualization.
Design Criteria *Translated*

Tell the truth and nothing but the truth  
(don’t lie, and don’t lie by omission)

Use encodings that people decode better  
(where better = faster and/or more accurate)
## Effectiveness Rankings

[McKean 86]

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## Effectiveness Rankings

[Macroinlay 86]

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A1 Review
A1 Submission Designs

**Fields:** Sunshine, Latitude, Precipitation, Temperature, Physical Activity, Mental Health, ...

**Transforms:** Sums, Averages, Differences, Percentages, Proportions, Filter

**Chart Types:** Line, Area, Bar, Scatter, Heatmaps, Maps, Radial, Compositions
Design Considerations

Title, labels, legend, captions, source!

Expressiveness and Effectiveness
Avoid unexpressive marks (lines? gradients?)
Use perceptually effective encodings
Don’t distract: faint gridlines, pastel highlights/fills
The “elimination diet” approach – start minimal

Support comparison and pattern perception
Between elements, to a reference line, or to totals
Use reader-friendly units and labels
Statistical soundness (regression, interpolation)
Design Considerations

Transform data (e.g., filter, log, normalize)

Group / sort data by meaningful dimensions

Reduce cognitive overhead
Minimize visual search, minimize ambiguity
Appropriate size, aspect ratio, legible text
Avoid legend lookups if direct labeling works
Avoid color mappings with indiscernible colors

Be consistent! Visual inferences should consistently support data inferences.
Line Charts
Avg Hours of Sunshine per Month In US cities

City
- Chicago
- Houston
- Miami
- New York
- San Francisco
- Seattle

Avg Sunshine (hours of)
Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec

Month
Trends in Sunshine Across Different Cities in a Year

- Average Hours of Sunshine

- Month Number

- Chicago
- Houston
- Miami
- New York
- San Francisco
- Seattle
Sunshine distribution of the year in different cities in US

Average hours of sunshine (h)

Month of the year

Cities:
- Chicago
- Houston
- Miami
- New York
- San Francisco
- Seattle
What are the Sunlight trends in different cities throughout the year?
What is the sunlight deficit of tomato plants in our six cities?
How Does the Range of Sunshine Hours Vary by Month Across Select US Cities?

Climatological Hours of Sunshine

Month

Cities
- Seattle
- Chicago
- New York
- San Francisco
- Houston
- Miami
Is Seattle really not sunny?

The chart shows the total sunshine during each month for different cities. Seattle is represented by a red line, and the 6 Cities Average is shown by a blue dotted line. Other cities represented include New York, Chicago, San Francisco, Houston, and Miami. The x-axis represents the month, and the y-axis represents the total sunshine during the month (in hour). The chart indicates that Seattle has a higher average total sunshine during the summer months compared to other cities, challenging the common perception of Seattle as a 'very wet city'.
Which city has the most sunshine (in general and per month)?

- Chicago
- Houston
- Miami
- New York
- San Francisco
- Seattle
Does latitude predict average daily hours of sunlight?
How do time and latitude contribute to the amount of sunshine?
Line Charts
(+ Precipitation)
Seasonal weather of six U.S. cities

- **Chicago**
- **Houston**
- **Miami**
- **New York**
- **San Francisco**
- **Seattle**

**Graphs:**
- **Hours of sunshine**
- **Avg. Inches precipitation**

**Legend:**
- Red: Chicago
- Yellow: Houston
- Green: Miami
- Cyan: New York
- Blue: San Francisco
- Pink: Seattle

**Axes:**
- **Y-axis:** Hours of sunshine and Avg. Inches precipitation
- **X-axis:** Month (Jan to Dec)

**Notes:**
- The graphs show the seasonal weather patterns of six major U.S. cities, comparing hours of sunshine and average inches of precipitation across the year.
Are Sunshine Hours and Precipitation Correlated?

Sunshine Hours

- Average Hours of Sunshine
- Month (0=Jan, ..., 11=Dec)

Precipitation

- Average Precipitation (Inch)
- Month (0=Jan, ..., 11=Dec)

Legend:
- Chicago
- Houston
- Miami
- New York
- San Francisco
- Seattle
Line Charts (Filtered)
Is there a correlation between hours of sunshine and average precipitation in Seattle?
How does latitude affect monthly sunshine in cities of similar longitude?

*Data collected by Jeff Heer from usclimatedata.com and latlong.net*
Which months should retired tech billionaires spend in Seattle vs. Miami to maximize sunlight?
Which Coastal US Cities get the most sunshine each month?

- Miami
- New York
- San Francisco
- Seattle
Soak Up the Sun This Spring

City
- San Francisco
- Houston
- Chicago
- New York
- Seattle
- Miami

Sunshine (hrs/day)

Month
- Apr
- Jun
- May
Is the sunshine in New York more similar to Seattle, or California?

Cumulative hours of sunshine (Averaged 1981-2010)

- Seattle
- New York
- San Francisco

Month:
- May
- Jun
- Jul
- Aug
- Sep
- Oct
- Nov
- Dec
- Jan
- Feb
- Mar
- Apr

- 273 hours of sunshine in Seattle
- 514 hours of sunshine in California

Graph shows the cumulative hours of sunshine for each month, with different cities represented by their respective curves.
Which U.S. city is the sunniest each month?

- **Miami** summers are below average but its winters outshine the rest.
- **San Francisco** is consistently bright, always shining at, or above, average sunshine levels.
- **Seattle** winters are extra gloomy but its summers shine (slightly) above the rest.
Line Charts (Normalized)
Q: Do different cities cycle from sunny to cloudy in different ways?

**Sunshine Mean+Range**

**Mean-Normalized Sunshine Cycles of Cities**
Hours of sunlight in various cities normalized to Seattle

- Chicago
- Houston
- Miami
- New York
- San Francisco
- Seattle

Ratio of hours of sunlight per month compared to Seattle

Month Number

0 1 2 3 4 5 6 7 8 9 10 11
Is Seattle the least sunny city?

A line graph shows the percentage of sunny hours per day or daylight hours for different cities over the months. The cities are labeled as follows:
- Chicago
- Houston
- Miami
- New York
- San Francisco
- Seattle

The graph indicates that Seattle has the lowest percentage of sunny hours throughout the year compared to other cities listed.
What percentage of the daytime was sunny 1981-2010?
Line Charts
(Small Multiples)
The effect of latitude on daily hours of sunshine across during a year.
How does Sunshine Duration Change in a Year in Major U.S. Cities?

- Chicago
- Houston
- Miami
- New York
- San Francisco
- Seattle

City:
- Chicago
- Houston
- Miami
- New York
- San Francisco
- Seattle

Sunshine Duration (hours)

Months
How much sunshine do US cities receive on an average all year round (low to high)?

- Seattle
  - Average: 180.3
  - Monthly sunshine: 69, 108, 178, 207, 253, 268, 342, 281, 221, 142, 72, 52

- Chicago
  - Average: 208.7

- Houston
  - Average: 219.4
  - Monthly sunshine: 144, 141, 193, 212, 266, 298, 294, 281, 239, 239, 181, 146

- New York
  - Average: 223.1

- Miami
  - Average: 241.9
  - Monthly sunshine: 222, 227, 266, 275, 280, 267, 263, 215, 212, 209

- San Francisco
  - Average: 245.8
Area Charts
SUNSHINE IN THE CITY: AVERAGE DAILY DOSE

Average hours per day (cumulative)

Seattle

Latitude: 47.6

Chicago

Latitude: 41.9

New York

Latitude: 40.6

San Francisco

Latitude: 37.7

Houston

Latitude: 24.7

Miami

Latitude: 25.8

1. Hours of sunshine per month averaged over 1980-2010 N.O. Climate Data
2. 1980 monthly average hours of daylight astronomical application data - N.O. Navy
Where is the sun?
When to visit Chicago
From Seattle, Maximising Sunshine

![Graph showing the difference in average sunshine hours per day between Chicago and Seattle over the months.]
Bar Charts
Monthly variation of hours of sunshine of six major U.S. cities, roughly covering the edges of the continental United States.

Seattle

Chicago

New York

San Francisco

Houston

Miami
How amount of sunshine changes in a city over time?

Seattle

Chicago

New York

San Francisco

Houston

Miami
How Could Latitude Have an Impact on the City Monthly Sunshine Hour?

City Monthly Sunshine Curve

- Miami
- Houston
- San Francisco
- New York
- Chicago
- Seattle

Relative City Sunshine Ratio

Latitude
Where should a sun-chaser vacation?

Average hours of sunshine between 1981 and 2010 (size of bar) broken down by month vs. city. Cities are ordered by total hours of sunlight per year (highest to lowest) on average between 1981 and 2010.
Which city has more sunshine?

Annual Sunshine Hours

<table>
<thead>
<tr>
<th>City</th>
<th>Seattle</th>
<th>Chicago</th>
<th>New York</th>
<th>San Francisco</th>
<th>Houston</th>
<th>Miami</th>
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</thead>
<tbody>
<tr>
<td>Sunshine Hours</td>
<td>2300</td>
<td>2800</td>
<td>2200</td>
<td>1800</td>
<td>2000</td>
<td>3000</td>
</tr>
</tbody>
</table>
How does the amount of sunshine differ between Seattle and other cities by season?

**spring**
- Chicago
- Houston
- Miami
- New York
- San Francisco
- Seattle

**summer**
- Chicago
- Houston
- Miami
- New York
- San Francisco
- Seattle

**fall**
- Chicago
- Houston
- Miami
- New York
- San Francisco
- Seattle

**winter**
- Chicago
- Houston
- Miami
- New York
- San Francisco
- Seattle

**month**
- Jan
- Feb
- Mar
- Apr
- May
- Jun
- Jul
- Aug
- Sep
- Oct
- Nov
- Dec
What are the sunniest city to visit in different seasons of the year

Spring (March, April, May)
- Chicago: 700 hours
- Houston: 600 hours
- Miami: 900 hours
- New York: 800 hours
- San Francisco: 600 hours
- Seattle: 500 hours

Summer (Jun, July, Aug)
- Chicago: 900 hours
- Houston: 800 hours
- Miami: 1,000 hours
- New York: 700 hours
- San Francisco: 900 hours
- Seattle: 600 hours

Fall (Sept, Oct, Nov)
- Chicago: 600 hours
- Houston: 500 hours
- Miami: 700 hours
- New York: 800 hours
- San Francisco: 900 hours
- Seattle: 400 hours

Winter (Dec, Jan, Feb)
- Chicago: 400 hours
- Houston: 300 hours
- Miami: 500 hours
- New York: 600 hours
- San Francisco: 700 hours
- Seattle: 200 hours
How many more days of sunshine each month, compared to Seattle, for:

**Winter (December-February)**

- Miami: 3
- San Francisco: 1
- New York: 2
- Houston: 1
- Chicago: -1

**Spring (March-May)**

- Miami: 2
- San Francisco: 3
- New York: 1
- Houston: 0
- Chicago: -1

**Summer (June-August)**

- Miami: -1
- San Francisco: 1
- New York: -2
- Houston: 0
- Chicago: -1

**Autumn (September-November)**

- Miami: 3
- San Francisco: 2
- New York: 1
- Houston: 0
- Chicago: -1
Does Seattle have the gloomiest seasons?

City

Seattle  Chicago  Houston  New York  Miami  San Francisco

Season
Fall  Spring  Summer  Winter

Hours of Sunshine

0  500  1,000  1,500  2,000  2,500  3,000
US cities compared for sunshine: San Francisco shines above all!

Seattle, Chicago, Houston, New York, Miami, San Francisco

Total hours of sunshine

US cities

Graph showing the total hours of sunshine for US cities, with San Francisco having the highest amount.
Which city experiences the largest fluctuation in sunlight across months?
Scatter Plots
Which City Is The Sunniest?

Hours of Sunshine Per Day Across America: From Northern to Southern Latitudes

Average hours of sunshine per day for each city. Color shows sum of percent of day sunshine, size shows sum of percent of day sunshine. The bars are labeled by month and averaged per centennial by sunshine.
Irregularity in Monthly Sunshine Increases with Latitude

City
- Chicago
- Houston
- Miami
- New York
- San Francisco
- Seattle

Summerness
- 1
- 2
- 3
- 4
- 5
- 6
Which is the "sunniest" city?

Monthly sunshine

City: Seattle, Chicago, Houston, New York, Miami, San Francisco

Months: Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec
Is Seattle Actually the Least Sunny Major City in the US?

- **Seattle**
- **Chicago**
- **New York**
- **San Francisco**
- **Houston**
- **Miami**

**Legend:**
- **Seattle**: Black Line
- **Chicago**: Light Blue Circles
- **New York**: Purple Circles
- **San Francisco**: Yellow Circles
- **Houston**: Red Circles
- **Miami**: Green Circles

**Axes:**
- **X-axis**: Months from January to December
- **Y-axis**: Hours of Sunshine
- **Right Y-axis**: Difference in Hours of Sunshine from Seattle
Is Seattle actually as dreary as its reputation? Yes.
Percent of daylight hours that are sunny, by month and annually, for six US cities.
How rainy and sunny are different cities in winter and summer?

- Chicago
- Houston
- Miami
- San Francisco
- Seattle

**City**
- Black: summer
- Blue: winter

**Axes**
- Y-axis: Average monthly hours of sunshine
- X-axis: Average monthly rainfall (in)

This scatter plot compares the average monthly hours of sunshine and rainfall for different cities across winter and summer seasons.
Seattle

\[ y = -0.006x + 1.932 \]
\[ r = -0.758 \]
\[ p = 0.004 \]

Chicago

\[ y = -0.010x + 4.115 \]
\[ r = -0.843 \]
\[ p < 0.001 \]

San Francisco

\[ y = -0.013x + 5.567 \]
\[ r = -0.824 \]
\[ p < 0.001 \]

New York

\[ y = -0.019x + 5.911 \]
\[ r = -0.755 \]
\[ p = 0.005 \]

Houston

\[ y = -0.031x + 10.069 \]
\[ r = -0.937 \]
\[ p < 0.001 \]

Miami

ILI data not available
Heatmap
Which city in which month has more sunshine?

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<th></th>
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* The hours of sunshine per month, averaged over 1981-2010.
Hours of sunshine per month, averaged over 1981-2010

A comparison of six US cities: Seattle has the greyest winters

Seattle

Chicago

Houston

New York

Miami

San Francisco

Scale for hours of sunshine

Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sep  Oct  Nov  Dec

50  60  70  80  90  100  110  120  130  140  150  160

210  220  230  240  250  260  270  280  290  300  310  320

330
How to escape dark Seattle winters?

- Seattle
- Chicago
- New York
- San Francisco
- Houston
- Miami

Latitude

<table>
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<th>Months</th>
<th>Jan</th>
<th>Feb</th>
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Hrs of Sunshine

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<th>Hours</th>
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Percentage of daylight hours with sunshine for 6 U.S. cities, according to month

City (sorted by latitude):
- Seattle
- Chicago
- New York
- San Francisco
- Houston
- Miami

Month:
- Jan
- Feb
- Mar
- Apr
- May
- Jun
- Jul
- Aug
- Sep
- Oct
- Nov
- Dec

Sunshine ± daylight:
- 10%
- 30%
- 50%
- 70%
Latitude
The effect of latitude on daily hours of sunshine during a year

City
- Seattle
- Chicago
- New York
- San Francisco
- Houston
- Miami

Latitude (°)

Daily hours of sunshine
How does latitude affect the range of hours of sunlight?

city
- Seattle
- Chicago
- New York
- San Francisco
- Houston
- Miami

hours of sunshine
Annual Average Sunshine of US Cities with Different Latitude
What is the relationship between latitude and hours of sunshine in U.S. cities?
How does monthly sunlight correlate with latitude in US cities?

- December (winter solstice)
- June (summer solstice)
- March (spring equinox)
- September (autumnal equinox)
- Other months

City examples:
- Miami
- Houston
- San Francisco
- New York
- Chicago
- Seattle
Do hours of sunshine correlate with latitude in major US cities?
How does latitude affect the hours of sunshine per season for coastal cities in the US?

Cities (ordered North to South)
- Seattle (lat = 47.61)
- Chicago (lat = 41.88)
- New York (lat = 40.73)
- San Francisco (lat = 37.73)
- Houston (lat = 29.75)
- Miami (lat = 25.76)

Seasons:
- Fall (September - November)
- Winter (December - February)
- Spring (March - May)
- Summer (June - August)
How does the amount of sunshine change with the seasons?
How does the average amount of sunshine (in hours) compare (greater, equal, or less than) between Seattle and other U.S. cities across seasons?

- **Winter (Dec., Jan., Feb.)**
- **Spring (Mar., Apr., May)**
- **Summer (June, July, Aug.)**
- **Fall (Sept., Oct., Nov.)**

**Graphical Key:**
- Yellow: More hours of sunshine on average than Seattle
- Light yellow: Same hours of sunshine on average than Seattle
- Gray: Less hours of sunshine on average than Seattle
Is Seattle always the gloomiest city?

Average hours of sunshine per month

Maximum hours of sunshine per month

Minimum hours of sunshine per month

Distribution of monthly hours of sunshine per year
How polarized is the annual weather throughout the continental United States?

Which regions have the most consistent weather? Which are the most varied?

This figure depicts the difference between the months with the most and least hours of sunlight in a 12-month period, throughout the United States. The data is sampled at 6 locations, indicated with red markers, and interpolated across the rest of the country.
Relative Yearly Hours of Sunshine in Major U.S. Cities

- Seattle
- San Francisco
- Chicago
- New York
- Houston
- Miami
West Coast Best Coast? Does the West Coast have more sunshine than the rest of the country?
Which city should I (a sunshine and hiking lover) choose to live?

- **Seattle**
  - Location: (122.34, 47.61)
  - Avg sunshine: 180.25
  - Std sunshine: 90.51

- **San Francisco**
  - Location: (122.45, 37.73)
  - Avg sunshine: 245.83
  - Std sunshine: 59.53

- **Chicago**
  - Location: (87.62, 41.88)
  - Avg sunshine: 200.67
  - Std sunshine: 76.66

- **New York**
  - Location: (73.94, 40.73)
  - Avg sunshine: 223.08
  - Std sunshine: 52.63

- **Houston**
  - Location: (-95.36, 29.75)
  - Avg sunshine: 219.42
  - Std sunshine: 58.65

- **Miami**
  - Location: (-80.13, 25.75)
  - Avg sunshine: 241.92
  - Std sunshine: 27.43

Comparison of monthly sunshine hours of six amazing cities:

- **Chicago**
- **Houston**
- **Miami**
- **New York**
- **San Francisco**
- **Seattle**
Temperature
Correlation between average temperature and average hours of sunshine

Name of City
- Seattle
- Chicago
- New York
- San Francisco
- Houston
- Miami

Amount of Sunshine
- 50
- 100
- 150
- 200
- 250
- 300
- 350
Which City's Average Temperature Changes Drastically During the Year?

city
- Chicago
- Houston
- Miami
- New York
- San Francisco
- Seattle

Average Temperature Averaged Between 1981-2010 (°F)

Month (January = 0, ..., December = 11)
Fitness
Is there a relationship between my iOS health data (steps, elevation) and average sunshine in Seattle?
A two-year timeline of runs/walks as a case study of miles travelled on foot and monthly sunshine averages.
Mental Health
Do Sunnier Cities Have Better Mental Health?

The graph shows a positive correlation between the average annual hours of sunshine and the annual prevalence of <14 poor mental health days across various cities. Cities with higher average annual hours of sunshine tend to have lower prevalence of poor mental health days.
What is the relationship between sunlight and mental health?

$r = 0.554$

- Chicago
- Houston
- Miami
- New York
- San Francisco
- Seattle
Correlogram of mental health and yearly average sunshine for six major US cities.
Does the amount of sunshine correlate with mental health issues in large cities?
Is annual sunshine correlated with suicidal ideation?

![Graph showing the relationship between annual sunshine and suicidal ideation rates across different cities.](image)
Do correlations between variability in sunniness, latitude and rates of suicide attempt in adults exist?
Does the number of suicides increase in sunnier months?

Seattle

Chicago

Houston

Miami
What is the relationship (if any) between happiness and the amount of sunshine in American cities?
Weather and Well-Being

PURPOSE
Liking what you do each day and being motivated to achieve your goals

SOCIAL
Having supportive relationships and love in your life

FINANCIAL
Managing your economic life to reduce stress and increase security

Notes:
Lower rankings indicate higher quality in each category.
- Data on well-being along with category descriptions were gathered from the Gallup 2017 Community Well-Being Rankings.
Does hours of sunshine influence sentiment word usage on Reddit?
Vice
Does less sunshine encourage alcohol overconsumption in big cities?
What Crimes in NYC Are More Likely on Sunny Days?

The trends of % of Total Number of Records and Hours of Sunshine for Month Month broken down by Offs Desc. Color shows detail about % of Total Number of Records and Hours of Sunshine. The view is filtered on Offs Desc, which keeps Trespassing and Gambling.
Do sunnier summers correlate with higher crime?

summer months are June, July, and August
Melanoma
Sunnier cities have more cases of melanoma.

Total annual average hours of sunshine (1981-2010)

21,630
20,500

Total annual number of melanoma cases (2001-2010)

- 193,632
- 400,000
- 600,000
- 826,464
High rates of melanoma in Seattle may be attributed to a high variation in sunlight throughout the year along with a larger “at-risk” population.

Caption. Top: Map of the United States showing percentage of each state identifying as white (non-Hispanic) along with a symbolic representation of the maximum and minimum sunlight in each marked city during the year. Bottom left: Age adjusted melanoma rate in each city plotted against the range of sunlight hours throughout the year. Bottom right: A plot of the minimum and maximum of sunlight hours for each city.
Other
What months exhibit the most variance in hours of sun across US cities?

A  Hours of Sun in 5 U.S. Cities

<table>
<thead>
<tr>
<th>City</th>
<th>December</th>
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</tbody>
</table>

B  Winter months exhibit most variance in sun hours

C  Does latitude of each city correlate with hours of sun in the winter?

- Seattle
- Chicago
- New York
- San Francisco
- Houston
- Miami
Hours of Sunshine for Six Major U.S. Cities

- Seattle
- Chicago
- New York
- San Francisco
- Houston
- Miami

Sum of sunshine:
- 500
- 1,000
- 1,500
- 2,000
- 2,500

City legend:
- Chicago
- Houston
- Miami
- New York
- San Francisco
- Seattle
How does sunlight compare across six major US cities over the course of months?
How do major US cities compare in terms of daily sunshine hours?

Chicago
Houston
New York
Miami
San Francisco
Seattle
Comparison of changes in sunlight by month for 6 major cities

Seattle

Chicago

New York

San Francisco

Houston

Miami

Color scale is shared across cities, presenting an objective representation of changes in hours of sunlight by month within the year.
Which cities have the most sunshine year-round?

Chicago: Has 2504 hours of sunshine per year.
Houston: Has 2633 hours of sunshine per year.
Miami: Has 2903 hours of sunshine per year.
New York: Has 2677 hours of sunshine per year.
San Francisco: Has 2950 hours of sunshine per year.
Seattle: Has 2163 hours of sunshine per year.

Data from [https://usclimatedata.com/](https://usclimatedata.com/)
Created by: Melinda McClure Haughey
Re-Design Exercise
Re-Design Exercise

Task: Analyze and Re-design visualization
Identify data variables (N/O/Q) and encodings
Critique the design: what works, what doesn’t
Sketch a re-design to improve communication
Be ready to share your thoughts with the class

Break into groups with those sitting near you (~4 people per group)
## Effectiveness Rankings

*Mackinlay 86*

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Teacher Salaries: Is It Really That Bad?

National and State averages for K-12 Public-School Teachers

Source: Good Magazine
Source: The Atlantic 300 no. 2 (September 2007)
Number of Classified U.S. Documents
Washington Dulles Airport Map
Source: United Airlines Hemispheres
Source: National Geographic, September, 2008, p. 22.
Silver, Mark. "High School Give-and-Take."
It was a very good year?

Robert Parker's ratings for vintages of Napa Valley cabernet sauvignon

2005 90T 2004 91R 2003 92I 2002 95E 2001 96T
1995 90T 1994 95E 1993 90E

2001 94T
96 points. It was a relatively modest year in terms of yield from the vineyards, and that worked to the vintner's advantage. The results: some of Napa's most concentrated, structured, long-lived wines. Built for aging, they are rich, densely colored, fusty and alluring. But at their tender age, they are by no means ready to drink.

Source: Business Week, June 18, 2007
Preparing for a Pandemic

Source: *Scientific American*, 293(5). November, 2005, p. 50
Music: Super Cuts (page 92)