Art of Information: A Guide to Data Visualization

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Elaine (Yiran) Li

- Human being with lots of:
  - Curiosity + Patience + Empathy
- Experience Designer
- Infrastructure Design, Autodesk
<table>
<thead>
<tr>
<th><strong>What</strong></th>
<th><strong>How</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Brief introduction about data visualization’s purpose, common data relationship and visualization style.</td>
<td>Our design process to visualize data and make civil engineers’ work easier and more efficient.</td>
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</tbody>
</table>
Art of Information: A Guide to Data Visualization
Data


<\/> Raw Unorganized

Information

Data Visualization

Processed Structured
Human exploration of Data Visualization started way before today’s information age.
Cartography

Map of the Tracks of Yu, carved into stone, 1137

A Geological Map of England and Wales and Part of Scotland - William Smith, 1815

Map of Boston - National Geographic, Esri, Garmin et al., 2018
Chart Showing the Value of Quarter of Wheat in Shilling & in Days Wages of a Good Mechanic from 1565 to 1821
-William Playfair, 1786

Diagram of the Causes of Mortality in the Army in the East
-Florence Nightingale, 1856

Chart Showing the Value of Quarter of Wheat in Shilling & in Days Wages of a Good Mechanic from 1565 to 1821
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-Florence Nightingale, 1856

1786

1856
Purpose
Iraq’s bloody toll

Elicit a Strong Emotional Response
A Mixed Recovery

Industries in the health care and energy sectors grew substantially over the last five years, while jobs in real estate and construction continued to shrink. Industries that paid in the middle of the wage spectrum generally lost jobs. And while the economy overall is back to its pre-recession level, it hasn't added the roughly 10 million jobs needed to keep up with growth in the working-age population.

Induce an Exact/Analytical Response

How the Recession Reshaped the Economy

-Jeremy Ashkenas and Alicia Parlapiano, 2014
Visualize Data Relationships
Temporal
Spatial
Hierarchical
Networked
Temporal Data
Data that represents a state in time

Area Chart

What Happens Over Time

Animation
Temporal Data
Data that represents a state in time

Gantt Chart
Spatial Data
Data that relates to the physical world

Planar

Choropleth Map  Dot Map  Contour Map

Volumetric

3D Model
Hierarchical Data
Data that relates to positions in a defined hierarchy

Tree Diagram

Tree Map
Networked Data
Data that connects to each other

Network Diagram

Chord Diagram
Our Story
Stages of Data Visualization Design

1. Purpose
2. Relation
3. Visualize
4. Enhance
5. Validate
Flood Simulation
Visualize Coastal or Inland Flood Risk

- Analyze flood risk based on historical rainfall data in the area
- Make infrastructure design decision to avoid flood
Temporal Data + Spatial Data

Input
1. Inflow Data
2. Area for Analysis
3. Location of inflow
4. Location of outflow

<table>
<thead>
<tr>
<th>Time (hr)</th>
<th>Inflow (cfs)</th>
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<td>4</td>
<td>10</td>
</tr>
<tr>
<td>4.5</td>
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</tbody>
</table>

Example of inflow data (usually comes from database e.g. USGS)
Visualize

Input

Output

Purpose
Relation
Visualize
Enhance
Validate
Use Visual Properties to Define Different Levels of Data
Layering and Separation

Water Surface Elevation

Depth

Water Velocity
Progressive Disclosure
Road Edit
Visualize and Edit Road Profile

- As the result of flood simulation, some roads need to be raised to avoid flood
Designer’s Vision
Edit the spatial data for road elevation within 3D Model

Existing Road

Proposed Road
What Civil Engineer Do

2D Profile view

Purpose  Relation  Visualize  Enhance  Validate

Fill  Cut
Enhancement Based on 2D Profile View
Revised Design

Indicate 2D data in 3D canvas
Define

Purpose is the foundation of your project.

Inspire

Learn from our predecessors for basic visualization style, express interactivity and creativity with technology and form factor.

Validate

Even you are capable of creating great visualization, always be humble in front of your audience.
Resources

- The Data Visualization Catalogue https://datavizcatalogue.com/
- Envisioning Information, Edward Tufte
- The Truthful Art: Data, Charts, and Maps for Communication, Alberto Cairo
Thank You!