Tableau License for Students

GitHub Student Pack

NYTimes on mapping the brain

Links
Administrative
(stuff)
survey
User interaction/collaboration and control

Analysis, Computational and Synchronization Tools

- Raw data (information)
  - Data/flow transformations
  - Data tables
  - Visual mappings
  - Visual structures
  - View transformations
  - Visualization (multiple views of visual things)

User interaction/collaboration actions

Tasks
<table>
<thead>
<tr>
<th>10.0</th>
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<tbody>
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<tr>
<td>Mean</td>
<td>9.0</td>
</tr>
<tr>
<td>Variance</td>
<td>10.0</td>
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<tr>
<td>Correlation</td>
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</table>

The table above represents the data distribution across four different categories (1 to 4). Each category contains paired values of X and Y, along with calculated Mean, Variance, and Correlation.
Tableau
typical vis design
Key question: how to map data to visuals?
**Set Theory**

- **Bijection** (one visual attribute, one data attribute)

- **Surjection** (multiple visual attribute to one data attribute)

- **Injection** (One to one mapping, but not all data elements are mapped)
What happens when

Data Vars > Visual Vars?
What happens when

Visual Vars > Data Vars?
Data Attributes
Non-ordered and non-numeric

AKA categorical data

[‘apple’, ‘pear’, ‘whiskey’]
Ordered, not necessarily numeric

[1, 3, 5, 7]

“the length is not meaningful”
Ordered, numeric, not ratio-able

['Jan 12', 'Jan 20']       Jan 12/Jan 20 = ???

['17F', '44F', '23F', '30F']    23F / 30F = ???
Ordered, numeric, ratio-able (has a “true” 0)

[1, 3, 5, 7]

[5’8”, 6’1”, 5’4”]
Q \rightarrow O
[0-100] \rightarrow [A, B, C, D, F]

Ratio / Interval (Q)
Ordinal
Nominal
transforms
Q -> O
[0-100] -> [A, B, C, D, F]

O -> N
Q -> O
[0-100] -> [A, B, C, D, F]

O -> N

N -> O
["Jack", "Alex"] -> ["Alex", "Jack"]

transforms

Ratio / Interval (Q)
Ordinal
Nominal
Q -> O
[0-100] --> [A, B, C, D, F]

O -> N

N -> O
[“Jack”, “Alex”] --> [“Alex”, “Jack”]

O -> Q
“Alex”+“Jack” --> 7 ??
Nominal: $== !=$
Ordinal: $> < <= >=$
Interval: $+ -$ Ratio: $/ *$

operations
consider a distance function…
Attribute Types

- Categorical
- Ordered
  - Ordinal
- Quantitative
structure
Tables

Attributes (columns)

Items (rows)

Cell containing value

Multidimensional Table

Key 1

Key 2

Attributes

Value in cell
→ Multidimensional Table
Multidimensional Table

- **Key 1**
- **Key 2**
- **Attributes**
- **time**
- **record #**
- **Value in cell**
Multidimensional Table

Sample

Key 1

Key 2

Record #

Attributes

Value in cell
Datasets

Data Types

- Items
- Attributes
- Links
- Positions
- Grids

Data and Dataset Types

<table>
<thead>
<tr>
<th>Tables</th>
<th>Networks &amp; Trees</th>
<th>Fields</th>
<th>Geometry</th>
<th>Clusters, Sets, Lists</th>
</tr>
</thead>
<tbody>
<tr>
<td>Items</td>
<td>Items (nodes)</td>
<td>Grids</td>
<td>Items</td>
<td>Items</td>
</tr>
<tr>
<td>Attributes</td>
<td>Links</td>
<td>Positions</td>
<td>Positions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Attributes</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


**Dataset Types**

- **Tables**
  - Attributes (columns)
  - Items (rows)
  - Cell containing value

- **Networks**
  - Link
  - Node (item)

- **Fields (Continuous)**
  - Grid of positions
  - Cell
  - Attributes (columns)
  - Value in cell

- **Geometry (Spatial)**
  - Position

- **Multidimensional Table**
  - Key 1
  - Key 2
  - Attributes
  - Value in cell

- **Trees**
data shapes the visual space
data shapes the algorithm space
Visual Attributes
<table>
<thead>
<tr>
<th>LES VARIABLES DE L'IMAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>POINTS</td>
</tr>
<tr>
<td>POSITION</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>SIZE</td>
</tr>
<tr>
<td>VALUE</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>LES VARIABLES DE SÉPARATION DES IMAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEXTURE</td>
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<tr>
<td>COLOR</td>
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<tr>
<td>ORIENTATION</td>
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<tr>
<td>SHAPE</td>
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</tbody>
</table>

Bertin, Semiologie Graphique, ‘67
Magnitude Channels: Ordered Attributes

- Position on common scale
- Position on unaligned scale
- Length (1D size)
- Tilt/angle
- Area (2D size)
- Depth (3D position)
- Color luminance
- Color saturation
- Curvature
- Volume (3D size)
(pay attention to your how you judge these differences)
Position (Common Scale)

- scatterplots
- bar charts
- line charts
- ???
Position (Un-aligned Scale)

- stacked bars
- stacked area
- ???
Use design elements to compensate!
Volume

Accurate encoding does not ensure accurate perception!
Magnitude Channels: Ordered Attributes

- Position on common scale
- Position on unaligned scale
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- Tilt/angle
- Area (2D size)
- Depth (3D position)
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- Volume (3D size)
Luminance and Saturation—really the same?
Identity
Mental Maps

The 2014 Nobel Prize in Physiology or Medicine was awarded to researchers who discovered how specific brain cells help rats and other mammals build spatial maps of their environment.

A RANDOM WALK
At left, gray lines show the path followed by a rat as it moves around a box looking for pieces of food.

IMPOSING A PATTERN
Nerve cells called grid cells fire when the rat moves through certain locations. The firing pattern of a single grid cell is marked here with red dots. Groups of dots form a hexagonal grid, and the firing pattern persists even in darkness, when the rat cannot see where it is.

GRID CELLS
The grid cells seem to form an internal map of the local environment, and help the rat track where it is in space. Grid cells are thought to be involved with navigation, dead reckoning and the formation of mental maps.

Source: Nature
By The New York Times

Photos: D. Bishop, UCL and Geir Mogen/NTNU

2014 Nobel Prize in Physiology or Medicine
Hue bad for magnitude:
Hue is great for identity:

Hue bad for magnitude:
Fig. 2: Palettes of visual stimuli used in our experiments: shape, color, size, shape-color, shape-size, size-color.
Fig. 1: (Left) A crowd-estimated perceptual kernel for a shape palette. The kernel was obtained using ordinal triplet matching. (Right) A two-dimensional projection of the palette shapes obtained via multidimensional scaling of the perceptual kernel.
Motion

(huge attention grabber, use with caution)
**Magnitude Channels: Ordered Attributes**

- Position on common scale
- Position on unaligned scale
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- Area (2D size)
- Depth (3D position)
- Color luminance
- Color saturation
- Curvature
- Volume (3D size)

**Identity Channels: Categorical Attributes**

- Spatial region
- Color hue
- Motion
- Shape
What happens when

Data Vars > Visual Vars?
What happens when

Visual Vars > Data Vars ?
L1: BioVis Critique
A1: Game of Life