InfoVis: a semiotic perspective

based on
Semiology of Graphics
by J. Bertin

What is semiotics?

• Study of signs and the people who use them
What is semiotics?

- Study of signs and the people who use them

Semiotics

- **semiotics** the study of signs and the cultures that use them
- a **sign** is something stands for something other than its self
- A sign can be
  - **icon**
  - **symbol**
    - Halloween
    - Christmas
  - **index**
What is semiotics?

Peirce’s Indivisible Triad

A sign entails 3 correlates….

the object represented,

the characteristics of the sign itself (representamen), and

the structures by which the representamen is contextualized and understood (the interpretant).

What is semiotics?

A sign consists of the Signifier, the material object, and the Signified, which is its meaning. These are only divided for analytical purposes: in practice a sign is always thing-plus-meaning. Williamson (1978)

Saussure
Two basic schools of thought

1. Process
• the common sense approach
• concerned with the transmission of messages
• senders and receivers encode and decode
• message is transmitted through some media (TV, voice, hair style, etc.)
• to communicate is to effect another's state of mind or behaviour
• effect should as intended, no intention -> no communication
• involves examination of transmission and explanations of failure
• sender responsible/ receiver viewed as quite passive

2. Semiotics
• a study of signs and the cultures that use them
• a sign is defined as anything that stands for something other than itself
• an exchange of meaning
• recognition the understand a given set of signs can be read differently
• alternate interpretations rather than failures
• a message is made up of signs, signs are then interpreted
• interpreter/receiver/reader rises in importance
• reading becomes active, discovering meaning, putting signs together in terms of ones background and culture
• different readings possible, in fact probable.
How does this apply to infovis?

**Bertin’s disclaimer**

- **Bertin considers**
  - printable, on white paper,
  - visible at a glance
  - reading distance of book or atlas
  - normal and constant lighting
  - readily available graphic means
Where does one start?

• **with marks!**
  - for us, pixels?

• **Visual Variables:** how can we vary marks?
  - by where we place them
  - by how we place them (Bertin calls this ‘implantation’)
  - by their visual characteristics (Bertin calls these retinal variables)
### Visual Variables

<table>
<thead>
<tr>
<th>Visual Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>position</strong></td>
<td>changes in the x, y, (z) location</td>
</tr>
<tr>
<td><strong>size</strong></td>
<td>change in length, area, repetition</td>
</tr>
<tr>
<td><strong>shape</strong></td>
<td>infinite number of shapes</td>
</tr>
<tr>
<td><strong>value</strong></td>
<td>changes from light to dark</td>
</tr>
<tr>
<td><strong>orientation</strong></td>
<td>changes in alignment</td>
</tr>
<tr>
<td><strong>colour</strong></td>
<td>changes in hue at a given value</td>
</tr>
<tr>
<td><strong>texture</strong></td>
<td>variation in pattern</td>
</tr>
<tr>
<td><strong>motion</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Characteristics of visual variables can be**

- **selective**: is a change in this variable enough to allow us to select it from a group?
- **associative**: is a change in this variable enough to allow us to perceive them as a group?
- **quantitative**: is there a numerical reading obtainable from changes in this variable?
- **order**: are changes in this variable perceived as ordered?
- **length**: across how many changes in this variable are distinctions perceptible?
Visual Variable: Position

- selective
- associative
- quantitative
- order
- length

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Visual Variable: Size

- selective
- associative
- quantitative
- order $4 \times \Box = \Box \ ?$
- length

Visual Variable: Size

- selective
- associative
- quantitative
- order $4 \times \Box = \Box \ ?$
- length
VV: Size

Size

points  lines  areas
Visual Variable: Shape

- selective
- associative
- quantitative
- order
- length

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Shape

- Constant size variation in shape
- Quantity is read through the legend

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Shape

points  lines  areas

Visual Variable: Value

- selective
- associative
- quantitative

- Order
- length
Visual Variable: Value

- selective
- associative
- quantitative

Order

- length
  - theoretically infinite but practically limited
  - association and selection ~ < 7 and distinction ~ 10

Value

- Categories of value,
  - various degrees between black and white,
Value

points lines areas

Visual Variable: Value
• Ordered, and can not be re-ordered
Visual Variable: Value
• Value intensity can be mis-read as density
  (population of Paris)

Visual Variable: Colour
• selective
• associative
• quantitative
• order
• length

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Visual Variable: Colour

- selective
- associative
- quantitative
- order
- length

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Colour

- Categories of colour,
  - changes in hue at equal value

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Encoding

- Common advice says use a rainbow scale
  - Marcus, Murch, Healey
  - problems with rainbows

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Visual Variable: Orientation

- selective
- associative
- quantitative
- order
- length

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Orientation

• Categories of orientation,
  - variations is line or line-pattern ranging from the vertical to the horizontal

Orientation

points  lines  areas
Visual Variable: Texture

- selective
- associative
- quantitative
- order
- length

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Texture

- Categories of texture,
  - changes in fineness or coarseness of the marks in an area
  - can be combined changes in characteristics

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Textures

Visual Variables on a computer?

- **motion**
  - direction? speed? speed, frequency, onset, ‘personality’

- **transparency**

- **saturation**
  - colour as Bertin uses it largely refers to hue

- **flicker**
  - frequency, rhythm, appearance

- **depth**
  - occlusion, aerial perspective, binocular disparity

- **illumination**
Visual Variable: Motion

- Selective
  - motion is one of our most powerful attention grabbers
- associative
  - moving in unison groups objects effectively
- quantitative
  - subjective perception
- order

- length
  - distinguishable types of motion?

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The Plane

- **Points**
  - “A point represents a location on the plane that has no theoretical length or area. This signification is independent of the size and character of the mark which renders it visible.”
  - a location
  - marks that indicate points can vary in all visual variables
- **Lines**
  - “A line signifies a phenomenon on the plane which has measurable length but no area. This signification is independent of the width and characteristics of the mark which renders it visible.”
  - a boundary, a route, a connection
- **Areas**
  - “An area signifies something on the plane that has measurable size. This signification applies to the entire area covered by the visible...
References


Social network #1
0 - self
1 knows
2 likes
3 dislikes
4 loves
5 does not know
no self loops
### Information from 4 French communes

<table>
<thead>
<tr>
<th>The communes</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Areas</strong></td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Population</strong></td>
<td>4</td>
<td>8</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td><strong>Density of pop.</strong></td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

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