Visualization

Visualization is the creation and study of the visual representation of data
Input: data Output: visual form Goal: insight

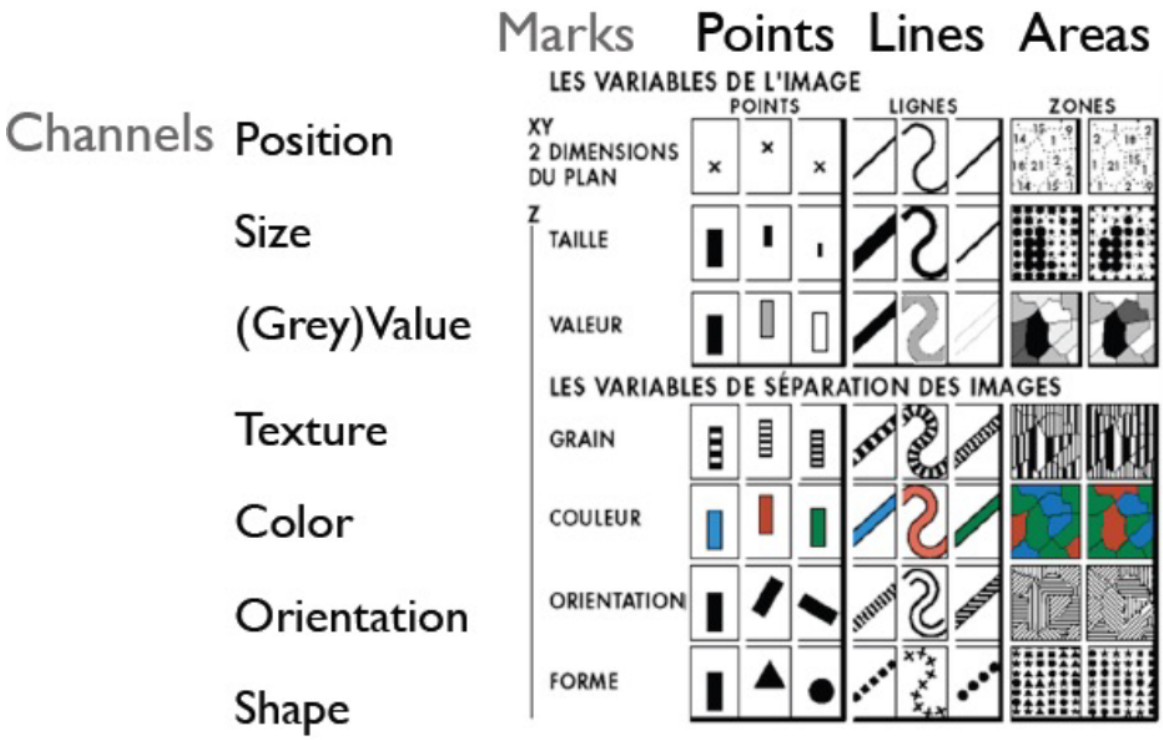
Three purpose of visualization:
• Represent information
• Analyze data
• Communicate data

perception & cognition

visual is:
• Perception: about the nature of the signals coming in; what you see (sensory)
• Cognition: about how you understand and interpret what you see (mental processes)

Visualization must serve as an external aid to augment working memory;
Make changes visible in visualizations to reduce the cognitive load;
Use high contrast between objects that should be distinguishable.

Visual Encoding



Representation and Interaction

two major components of visualization:
• ***Representation*** of objects users pay attention to;
• ***Interactions*** which are operations users can apply.

Fundamental Interaction methods

• Select
• Explore
• Reconfigure
• Encode
• Abstract/Elaborate
• Filter
• Connect

Select

1, Method 1: Pop-up Tooltips
Hovering mouse cursor brings up details of item.

2, Picking (in 2D or 3D)
Clicking on an item on a 2D projection: selects it, attributes of the selected item are shown.

3, Method 3: Lasso (in 2D or 3D)
Select a region on the map and use amplification technology to visualize clusters in the selection.

Explore

1, Direct Walk
Linkages between cases : Exploring one may lead to another.
• Follow the hyperlinks on web pages.

2, 3D Navigation

Reconfigure

• “Show me a different arrangement.”
• Reconfiguring provides different perspectives by changing the spatial arrangement of representation.

1, Method 1: Rearrange View
• Keep same fundamental representation and what data is being shown, but rearrange elements by:
– Alter positioning
– Sort

2, Method 2: Sorting
Sort data with respect to a particular attribute.

3, Method 3: Reposition

Encode

• “Show me a different representation.”
• Change visual appearances.

Abstract/Elaborate

• “Show me more or less detail”.
• Adjust the level of abstraction (overview and details)

Filter

• “Show me something conditionally.”
• Change the set of data items being presented based on some specific conditions.

1, Dynamic Query

Connect

• “Show me related items.”
• Highlight associations and relationships.
• Show hidden data items that are relevant to a specified item.

1, Linked Views
• Viewer may wish to examine different attributes of a data case simultaneously.
• Alternatively, viewer may wish to view data case under different perspectives or representations.
• But need to keep straight where the data case is.
• Applies when you have multiple views about the same data.

Brushing

• Selects and check the related infomation.
• Applies when you have multiple views of the same data

Interaction models

• Overview + Details
• Focus + Context

Overview + Details

• Scale-Many data sets are too large to visualize on one screen.
– Too many cases.
– Too many variables.
– May only be able to highlight particular cases or particular variables, but viewer’s focus may change from time to time.

用户可以看到整体，之后再选择细节进行查看。

Focus + Context

突出表现一个部分，但也包括其他剩余内容。

Tasks, Techniques and Devices

Interaction Tasks for Visualization
• View and Object Manipulation
• Visualization Widgets Manipulation
• 3D Data Selection and Annotation

Interaction Techniques and Devices
• Touch Interaction
• Tangible Interaction
• Mid-air Interaction
• Hybrid Interaction

Touch / Pen-based Interaction

• Pros:
• fast, precise, direct
• increase the user's impression they are making direct manipulations

• Cons:
• limited: used as a discrete interaction mechanism
• limiting: many complex tasks (in particular for 3D manipulations) require input/control with more than three degrees of freedom

Tangible Interaction

allow users to achieve complex 3D manipulations with simple real-world style gestures.

more flexible than other interaction paradigms.

Hybrid Interaction

• overcome the inherent limitations of a device
• augmenting the number of DOF that can be manipulated
• reduce the occlusion limitation with tactile interaction
• combine the benefits of two interaction paradigms
• simply tackle complicated tasks