Interaction / Navigation

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Interaction in InfoVis
Contents

- Why interaction?
- Interaction Techniques
- Taxonomies
- Categories
- Critique

- 2. paper

Referenced paper

#1: Toward a Deeper Understanding of the Role of Interaction in Information Visualization, *Ji Soo Yi, Youn ah Kang, John T. Stasko and Julie A. Jacko, Proc. InfoVis 2007.*

Why interaction?

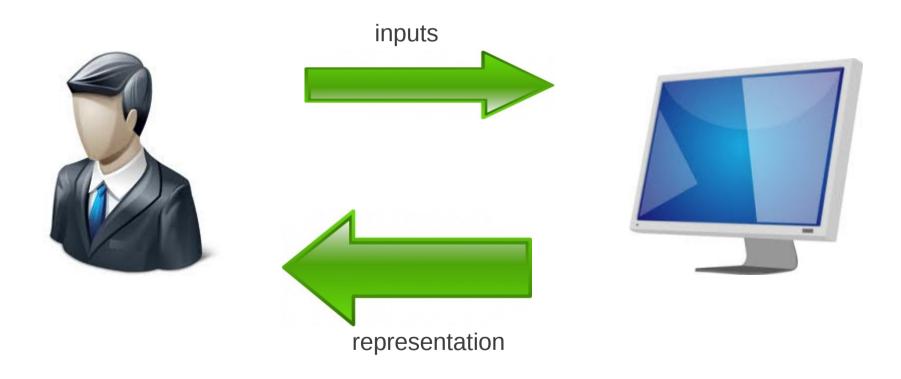- InfoVis persists of two components:

  Representation   ↔   Interaction

- Not separated

  → Without interaction: static image

Interaction Techniques

- Asymmetric data rates

inputs

representation

Interaction Techniques

- What are interaction techniques?

    – Features that allow the user to directly or indirectly manipulate/interpret representations

        → a static image or autonomous animation does not associate any interaction techniques!

Taxonomies

Publications	Taxonomic units
Taxonomies of low-level interaction techniques	
Shneiderman (1996) [37]	Overview, zoom, filter, details-on-demand, relate, history, and extract
Buja, Cook, and Swayne (1996) [9]	Focusing (choice of [projection, aspect ratio, zoom, pan], choice of [variable, order, scale, scale-aspect ratio, animation, and 3-D rotation]), linking (brushing as conditioning / sectioning / database query), and arranging views (scatter plot matrix and conditional plot)
Chuah and Roth (1996) [13]	Basic visualization interaction (BVI) operations: graphical operations (encode data, set graphical value, manipulate objects), set operations (create set, delete set, summarize set, other), and data operations (add, delete, derived attributes, other)
Dix and Ellis (1998) [15]	Highlighting and focus, accessing extra information – drill down and hyperlinks, overview and context, same representation / changing parameters, same data / changing representation, linking representation – temporal fusion
Keim (2002) [24]	Dynamic projections, interactive filtering, interactive zooming, interactive distortion, interactive linking and brushing
Wilkinson (2005) [54]	Filtering (categorical/continuous/multiple/fast filtering), navigating (zooming/panning/lens), manipulating (node dragging/categorical reordering), brushing and linking (brush shapes/brush logic/fast brushing), animating (frame animation), rotating, transforming (specification/assembly/display/tap/2 taps/3 taps)

Taxonomical dimensions of interaction techniques	
Tweedie (1997) [47]	Interaction types (manual, mechanized, instructable, steerable, and automatic) and directness (direct and indirect manipulation)
Spence (2007) [38]	Interaction modes (continuous, stepped, passive, and composite interaction)
A taxonomy of interaction operations	
Ward and Yang (2004) [50]	interaction operators (navigation, selection, distortion), interaction spaces (screen-space, data value-spaces, data structure-space, attribute-space, object-space, and visualization structure-space), and interaction parameters (focus, extents, transformation, and blender)
Taxonomies of user tasks	
Zhou and Feiner (1998) [56]	Relational visual tasks (associate, background, categorize, cluster, compare, correlate, distinguish, emphasize, generalize, identify, locate, rank, reveal, switch) and direct visual organizing and encoding tasks (encode)
Amar, Eagan, and Stasko (2005) [4]	Retrieve value, filter, compute derived value, find extremum, sort, determine range, characterize distribution, find anomalies, cluster, and correlate

Categories

- **Select**: *Mark something as interesting*

- **Explore**: *Show me something else*

- **Reconfigure**: *Show me a different arrangement*

- **Encode**: *Show me a different representation*

- **Abstract/Elaborate**: *Show me more or less detail*

- **Filter**: *Show me something conditionally*

- **Connect**: *Show me related items*

Critique

- There may be techniques, which fit to multiple categories

- Discussable

- A valuable bridge between user objectives and interaction techniques

- Points out the importance of interaction

Attribute Explorer Contents (2. part)

- Exploration

- Dynamic Queries

- Attribute Explorer

- Critique

Referenced paper

The Attribute Explorer: information synthesis via exploration, *Robert Spence and Lisa Tweedie, Interacting with Computers, Vol. 11, pp. 137-146, 1998.*
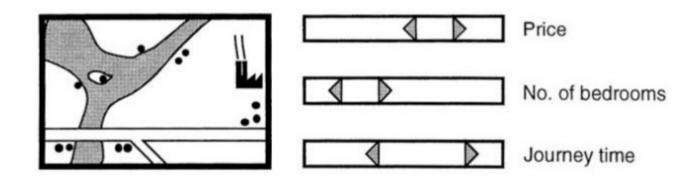
Exploration

- Users with no knowledge need to explore the available data

"I hear and I forget, I see and I remember, I interact and I understand, I interact responsively and I discover."

Dynamic Queries

- Famous example, widely used in many applications:
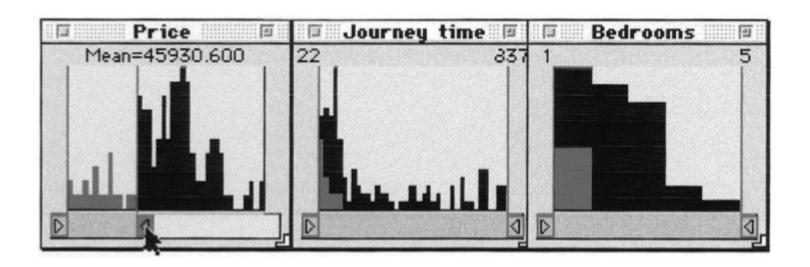
Attribute Explorer

- Main disadvantages of DQ

    – Only visible data, which satisfy the query

    – Small fraction

  Solution

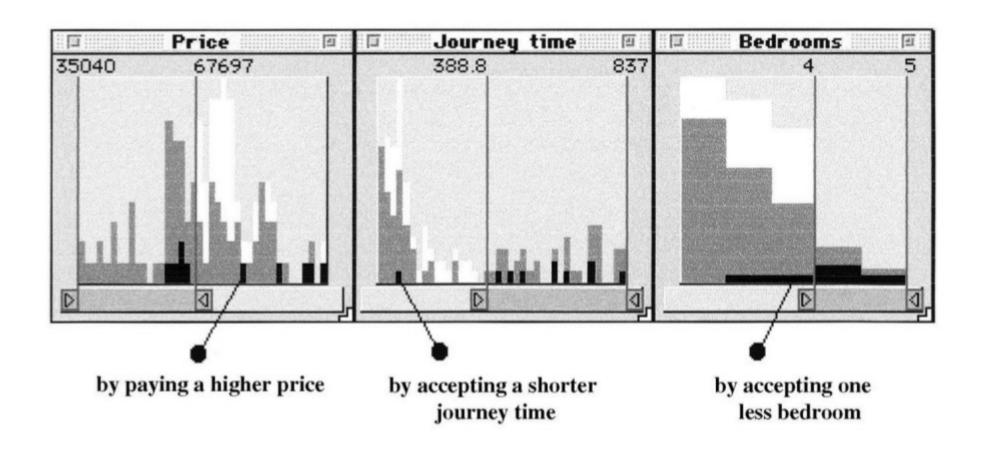 → show distribution of every attribute by a histogram

Attribute Explorer

- Connect information over multiple attributes (brushing-technique)

Attribute Explorer

- Added sensitivity information

by paying a higher price   by accepting a shorter journey time   by accepting one less bedroom

Critique

- DQs are widely used

- Good idea to add sensitivity information
    - → user is able to get a better overview

- In my opinion these tools solve the problem, that users get only fixed-view data

- I personally didn't saw anything like this before (paper was published in 1998)

Questions and Discussion