Designing and Implementing an Interactive Scatterplot Visualization for a Tablet Computer

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Norms in visualization systems
Norms in visualization systems

• Cursor driven
Norms in visualization systems

- Cursor driven
- WIMP based
Why is ‘data + touch’ hard?
Why is ‘data + touch’ hard?

- Compensate for lack of mouse
Why is ‘data + touch’ hard?

- Compensate for lack of mouse
- # of features can to be too many
Why is ‘data + touch’ hard?

• Compensate for lack of mouse
• # of features can to be too many
• Isn’t immediately clear how these systems should look
Existing apps
Past work
Past work
Past work
Past work
Our goal
Our goal

To design touch interactions for a comprehensive suite of visualization techniques
One size fits all?
One size fits all?

• Too complex with too many variables.
• Need to narrow the focus
One size fits all?

- Too complex with too many variables.
- Need to narrow the focus

Scatterplots
Scatterplots
Scatterplots

• Well known and widely used
Scatterplots

• Well known and widely used

• Glyph sizes impose particular constraints
What features?
What features?

Tableau and Spotfire
35 features
35 features

- Changing axis attribute
- Changing axis scale
- Legend
- Characterize distribution
- ...

...
Pruning the list
Pruning the list

• Primary features
Pruning the list

- Primary features
- Complexity
Pruning the list

- Primary features
- Complexity
- Redundancy
Pruning the list

- Primary features
- Complexity
- Redundancy
- System-related functions
9 features
9 features

- Assign x and y
- Assign color
- Assign size
- Select
- Find detail
- Zoom
- Filter on points
- Filter on values
- Change axis scale
Demo
Designing interactions
Classifying features
Classifying features
Classifying features

View-driven
Classifying features

View-driven  |  Data-centric
Classifying features

View-driven
1. Select
2. Zoom
3. Filter on points
4. Find detail

Data-centric
Classifying features

View-driven

1. Select
2. Zoom
3. Filter on points
4. Find detail

Data-centric

1. Assign X & Y
2. Assign color
3. Assign size
4. Filter on values
5. Change axis scale
## Classifying features

<table>
<thead>
<tr>
<th>View-driven</th>
<th>Data-centric</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Select</td>
<td>1. Assign X &amp; Y</td>
</tr>
<tr>
<td>2. Zoom</td>
<td>2. Assign color</td>
</tr>
<tr>
<td>3. Filter on points</td>
<td>3. Assign size</td>
</tr>
<tr>
<td>4. Find detail</td>
<td>4. Filter on values</td>
</tr>
<tr>
<td></td>
<td>5. Change axis scale</td>
</tr>
<tr>
<td>- Gestures -</td>
<td></td>
</tr>
<tr>
<td>- WIMP -</td>
<td></td>
</tr>
</tbody>
</table>
Classifying features

Data-centric
Classifying features

Data-centric

Essential

1. Assign X & Y
Classifying features

Data-centric

Essential
1. Assign X & Y

On-demand
1. Assign color
2. Assign size
3. Filter on values
4. Change axis scale
Designing interactions
Designing interactions

Selection
1. Lasso
1. Lasso
1. Lasso
2. Marquee
1. Lasso
2. Marquee
1. Lasso
2. Marquee
3. Off-centered Pointer

[Vogel et al., CHI 2007]
1. Lasso
2. Marquee
3. Off-centered Pointer

[Vogel et al., CHI 2007]
1. Lasso
2. Marquee
3. Off-centered Pointer
4. Axis Pan
1. Lasso
2. Marquee
3. Off-centered Pointer
4. Axis Pan
1. Lasso
2. Marquee
3. Off-centered Pointer
4. Axis Pan
5. Lens
1. Lasso
2. Marquee
3. Off-centered Pointer
4. Axis Pan
5. Lens
6. Swipe + Lens

[Mankoff et al., UIST 2000]
Designing interactions

Zoom
1. Pinch-to-zoom
   A. Fixed-aspect ratio
1. Pinch-to-zoom
   A. Fixed-aspect ratio
1. Pinch-to-zoom
   A. Fixed-aspect ratio
   B. Flexible-aspect ratio
1. Pinch-to-zoom
   A. Fixed-aspect ratio
   B. Flexible-aspect ratio
1. Pinch-to-zoom
   A. Fixed-aspect ratio
   B. Flexible-aspect ratio

2. Axis-based zoom
1. Pinch-to-zoom
   A. Fixed-aspect ratio
   B. Flexible-aspect ratio

2. Axis-based zoom
1. Pinch-to-zoom
   A. Fixed-aspect ratio
   B. Flexible-aspect ratio

2. Axis-based zoom

3. Select + zoom
1. Pinch-to-zoom
   A. Fixed-aspect ratio
   B. Flexible-aspect ratio

2. Axis-based zoom

3. Select + zoom
1. Pinch-to-zoom
   A. Fixed-aspect ratio
   B. Flexible-aspect ratio

2. Axis-based zoom

3. Select + zoom

4. Zoom lens
1. Pinch-to-zoom
   A. Fixed-aspect ratio
   B. Flexible-aspect ratio
2. Axis-based zoom
3. Select + zoom
4. Zoom lens
1. Pinch-to-zoom
   A. Fixed-aspect ratio
   B. Flexible-aspect ratio
2. Axis-based zoom
3. Select + zoom
4. Zoom lens
5. Automatic zoom
1. Pinch-to-zoom
   A. Fixed-aspect ratio
   B. Flexible-aspect ratio

2. Axis-based zoom

3. Select + zoom

4. Zoom lens

5. Automatic zoom
Other features
Other features

- Filter
- Changing attributes, data preview
- Modify visual mapping
Future work
Future work

• User evaluation
Future work

• User evaluation

• Other visualization techniques
Future work

• User evaluation
• Other visualization techniques
• Operating system constraints
Thank you!
Questions?