FACILITATING INSIGHTS WITH A USER ADAPTABLE DASHBOARD, ILLUSTRATED BY AIRPORT CONNECTIVITY DATA

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- Introduction
- Case Study
- Research Motivation and Problems
- Conceptual Framework
- Conclusion
INTRODUCTION
TYPES OF MOVEMENT

Airplane Movements
(www.openflights.org)

Human Movements
(Galka 2016)

Animal Movements
(www.washington.edu)

Ship Movements
(www.marinetraffic.com)
INTRODUCTION
SPATIAL AND TEMPORAL PATTERNS

Spatial patterns
www.martingrandjean.ch

Temporal patterns
www.metrocosm.com
Users:
Researchers interested in airport connectivity

Connectivity Types
(ACI EUROPE & SEO Aviation Economics 2016)
RESEARCH MOTIVATION AND PROBLEMS

- Traditional dashboards are **not meant for exploration**
- Traditional dashboards usually have a **fixed layout**
- How to get insight into data?

![Visual Clutter](www.flightradar24.com)
DASHBOARD

“A visual display of the most important information needed to achieve one or more objectives; consolidated and arranged on a single screen so the information can be monitored at a glance”

(Few 2006)

Dashboard example

(Source: Rahman 2017)
DASHBOARD
DASHBOARD ROLE

- Displays the most important information on one screen
- Contains multiple graphic representations
- Shows overview, patterns, trends, outliers
- Storytelling

The main purpose – to communicate complex information and encourage user for further exploration
## DASHBOARD
### TYPES OF DASHBOARDS

<table>
<thead>
<tr>
<th>Category</th>
<th>Characteristics</th>
<th>Interactivity</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic</td>
<td>Simple display mechanism, consists of static snapshots</td>
<td>Low</td>
<td>See and decide or question</td>
</tr>
<tr>
<td>Analytical</td>
<td>Contains various parameters and comparisons</td>
<td>High</td>
<td>See and question, explore what-if scenarios</td>
</tr>
<tr>
<td>Operational</td>
<td>Simple media to attract user’s attention</td>
<td>Moderate</td>
<td>See and act</td>
</tr>
</tbody>
</table>

Source: Pappas & Whitman (2011)
SPATIO-TEMPORAL MOVEMENT DATA

- Movement Data Components:
  - time (set of moments) \textit{when}?
  - objects (set of moving entities) \textit{what}?
  - space (set of locations) \textit{where}?

- Change of physical position

- Origin-Destination data
CHALLENGES IN VISUALIZATION OF DATA
VISUAL COMPLEXITY AND CLUTTER

Determinants of Visual Complexity
(Miniukovich & De Angeli 2014)

Dashboard design
Carto(graphical) representation
Visual Clutter
VISUALIZATION STRATEGIES

- “Visual Information-Seeking Mantra”:
  Overview first, zoom and filter, then details-on-demand
  (Shneiderman 1996)

- “Visual Analytics Mantra”:
  Analysis First-Show the important-Zoom, Filter and Analyse
  Further- Details on Demand
  (Keim 2006)
VISUAL CLUTTER REDUCTION METHODS

- Algorithms
- Representation
- Environment

Interaction and Animation
(Galka 2016)

Aggregation Algorithm
(van den Elzen & van Wijk 2014)
CONCEPTUAL FRAMEWORK
QUESTION-DRIVEN APPROACH FOR SPATIO-TEMPORAL PATTERN EXPLORATION

Users

Problem
To get insight into spatial and temporal patterns of airport connectivity

Questions
Elementary
Intermediate
Overall
(Bertin 1967)

Space (where?)
Time (when?)
Attribute (what?)
(Peouquet 1994)

(Source: www.freepik.com)
Elementary questions

- Where is airport X located? *(space)*
- What are the attributes of airport X? *(attribute)*
Intermediate question

- Which airports can be reached from airport X via hub airport X?
CONCEPTUAL FRAMEWORK
EXAMPLES

Overall questions

- What is the overall spatial pattern of flights from airport X? (space)
- How the connectivity of the airport X has changed between years X and Y? (time and attribute)
CONCEPTUAL FRAMEWORK
ADAPTABILITY

How to adapt?

- **View** based on the involved parameters (location, attribute, time)
- **Content** based on the user interest (such as map, diagram)
CONCLUSION

- Adaptable dashboard – **analytical dashboard**, based on **question driven** approach
- The **view** and **content** will be adapted to questions
- Adaptable dashboard will help to unravel the information that is displayed in the summary
- Avoid the visual complexity and clutter
Thank you!

Questions?

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