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

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CONTENTS

- 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

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**Connectivity Types**

(ACI EUROPE & SEO Aviation Economics 2016)
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)
“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) *when*?
  - objects (set of moving entities) *what*?
  - space (set of locations) *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

Information Organization
- Symmetry
- Ease of grouping
- Prototypicality
- Grid

Information Discriminability
- Edge congestion
- Figure-ground contrast

Information Amount
- Color variability
- Visual Clutter

Visual Clutter
“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 → Questions

Users: Source: www.freepik.com

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

Questions:
- Elementary
- Intermediate
- Overall (Bertin 1967)
- Space (*where*?)
- Time (*when*?)
- Attribute (*what*?) (Peuquet 1994)
CONCEPTUAL FRAMEWORK
EXAMPLES

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*)

Connectivity between Europe and Asia Pacific (2004-2016)
Connectivity by Airlines

Flights per Country per Year

Number of Flights per Airline

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Country of Destination
- China
- India
- Indonesia
- Japan
- Korea Republic of
- Malaysia
- Singapore
- Thailand
- Vietnam

Legend Airlines
- AI
- AF
- BA
- CA
- CX
- DL
- LH
- NE
- ES
- SK
- SQ
- TG
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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