UNIVERSITY OF TWENTE.

ADAPTABLE DASHBOARD FOR VISUALIZATION OF ORIGIN-DESTINATION DATA PATTERNS

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ITC FACULTY OF GEO-INFORMATION SCIENCE AND EARTH OBSERVATION

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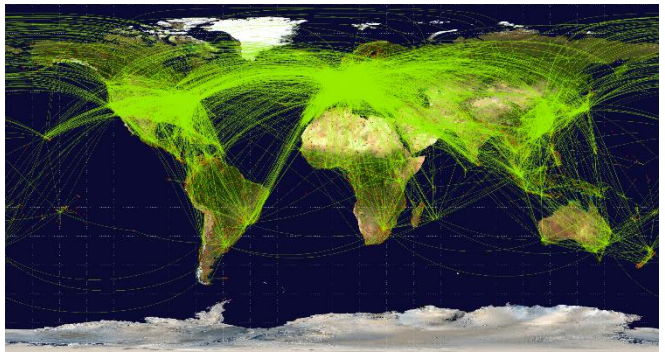
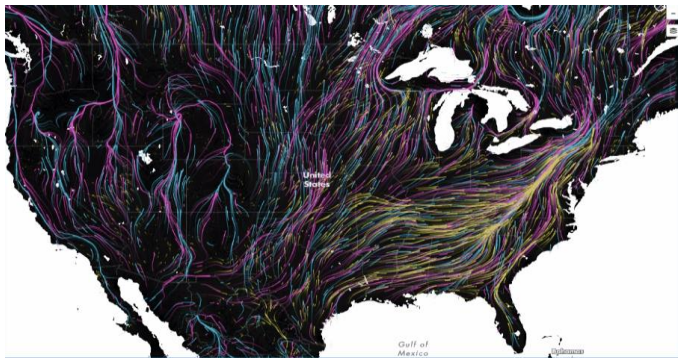
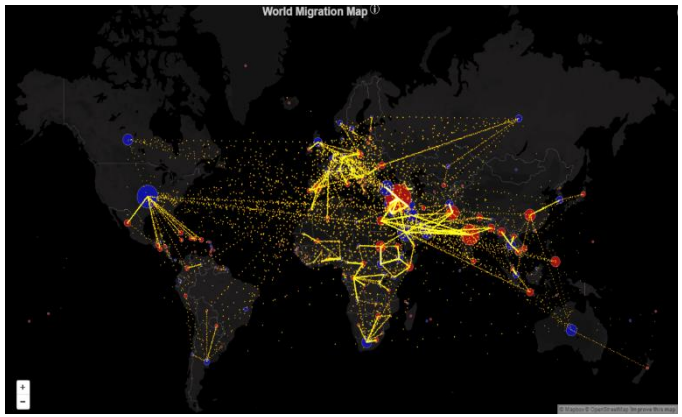
INTRODUCTION



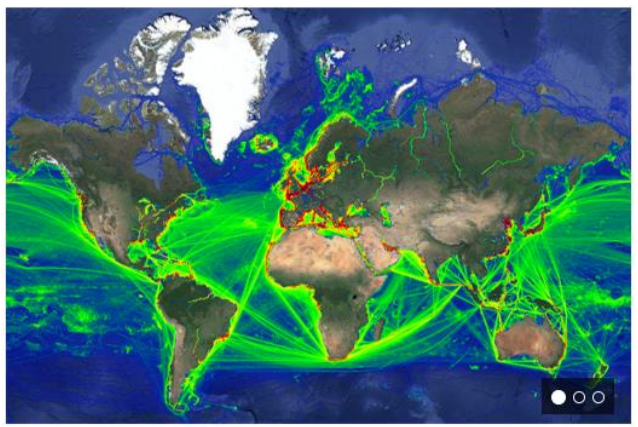
Airplane Movements
(www.openflights.org)



Animal Movements
(www.washington.edu)



Human Movements
(Galka 2016)



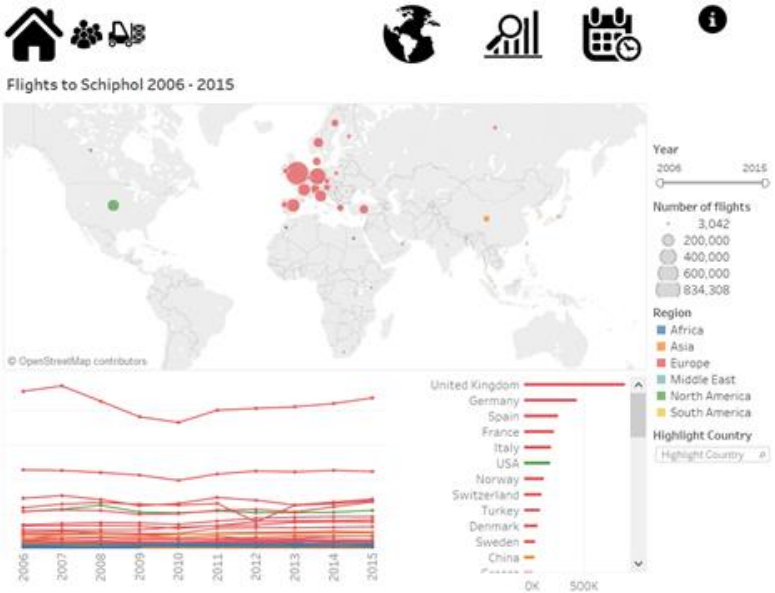
Ship Movements
(www.marinetraffic.com)

BACKGROUND

THE ROLE OF A DASHBOARD

The main purpose – to communicate complex information and encourage user for further exploration

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



Dashboard example

(Rahman 2017)

BACKGROUND
ADAPTABILITY

Adaptation – the process to fit the system for current usage situation

Adaptable system – provides users with tools that change the system according to the required context of use

Levels – Information, Technology, User interface, Presentation

(Reichenbacher 2003)

- ***When?*** (in case of differences, change)
- User
- Tasks
- Context

(Reichenbacher 2001, 2003)

- ***How?*** (ways to adapt)
- Generalization level
- The way information is visualized

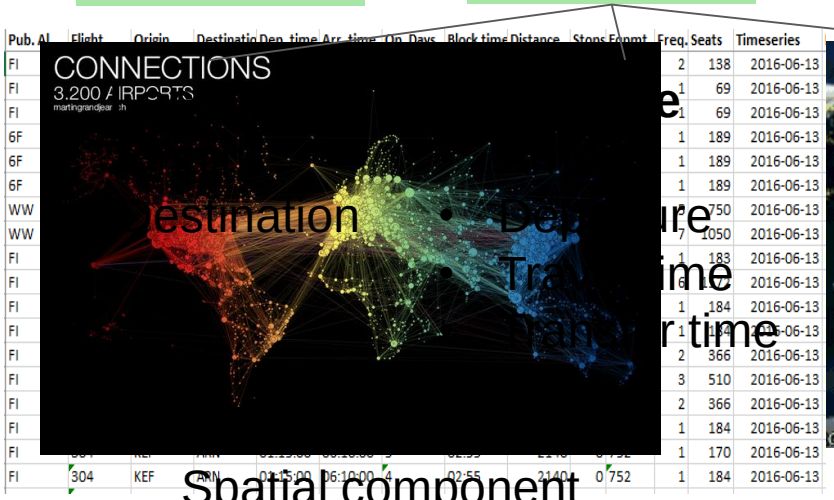
- ***What?*** (types of adaptation)
- User interface
- Content
- Presentation
- Function

(Zipf & Jöst 2006)

MOTIVATION AND PROBLEM STATEMENT

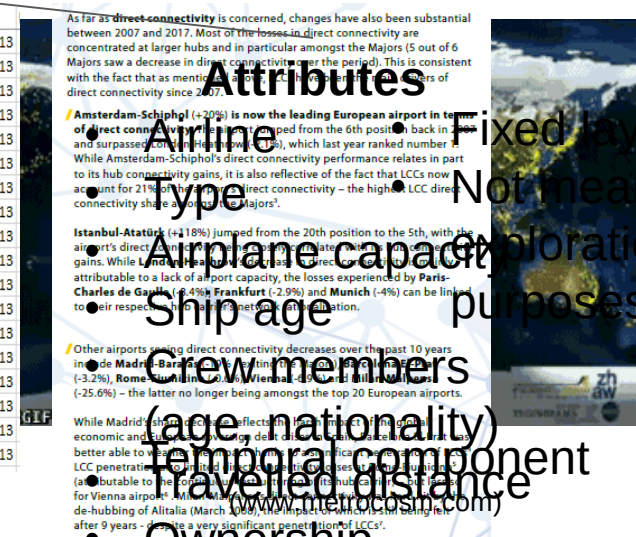
To get insights into O-D data

- The need for visualization
- Number of variables
- Spatial and temporal components
- Limitations of traditional dashboards



Spatial component
(www.martingrandjean.ch)

- Destination
- Departure
- Traditional
- Transfer time



Attributes

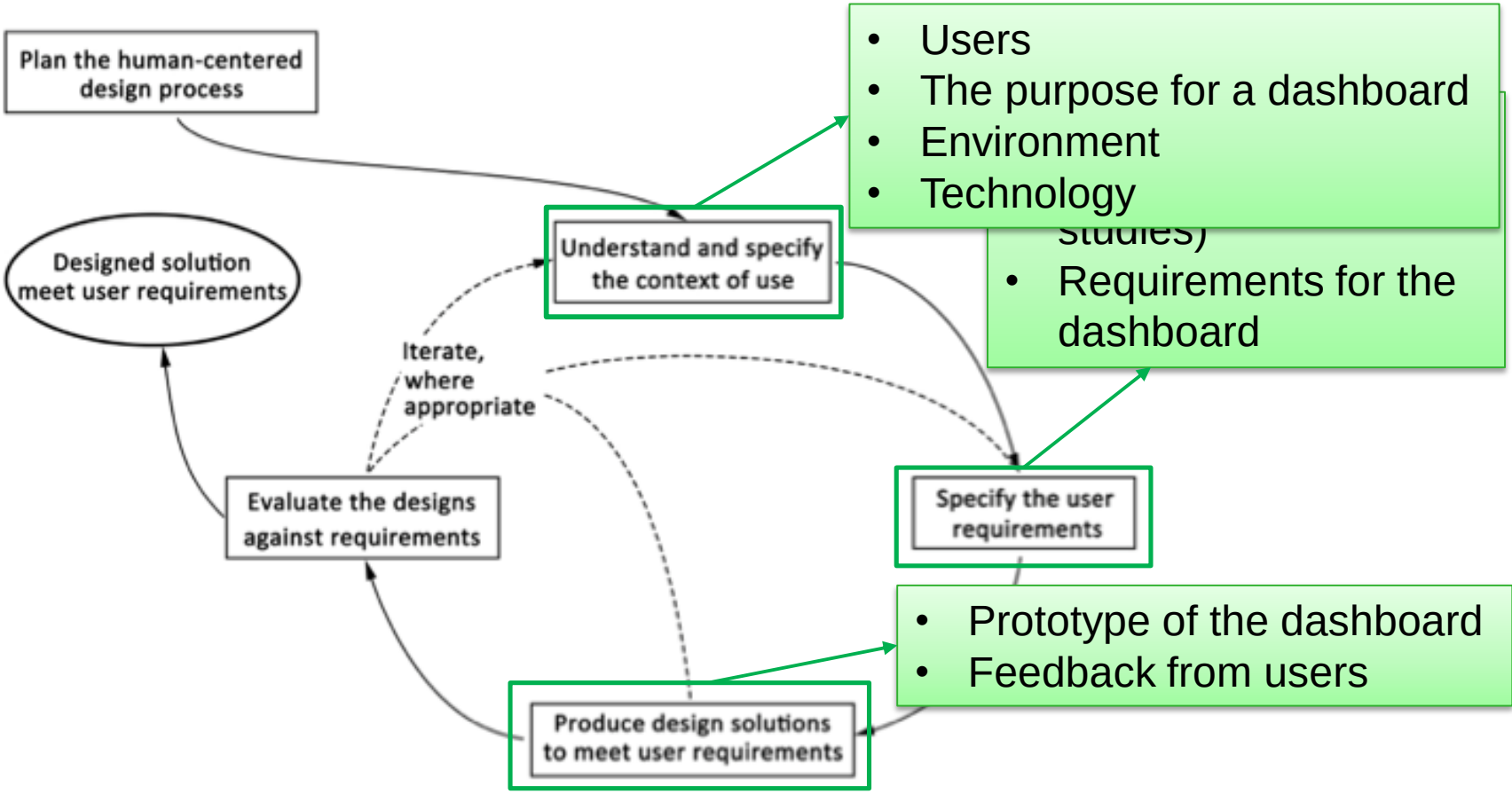
- Airline
- Type
- Airplane capacity
- Ship age
- Crew members (age, nationality)
- Temporal component
- Traveled distance
- Ownership

- Fixed layout
- Not meant for exploration purposes

(www.metrocosm.com)

Source: ACI EUROPE & SEO AVIATION ECONOMICS (2017)

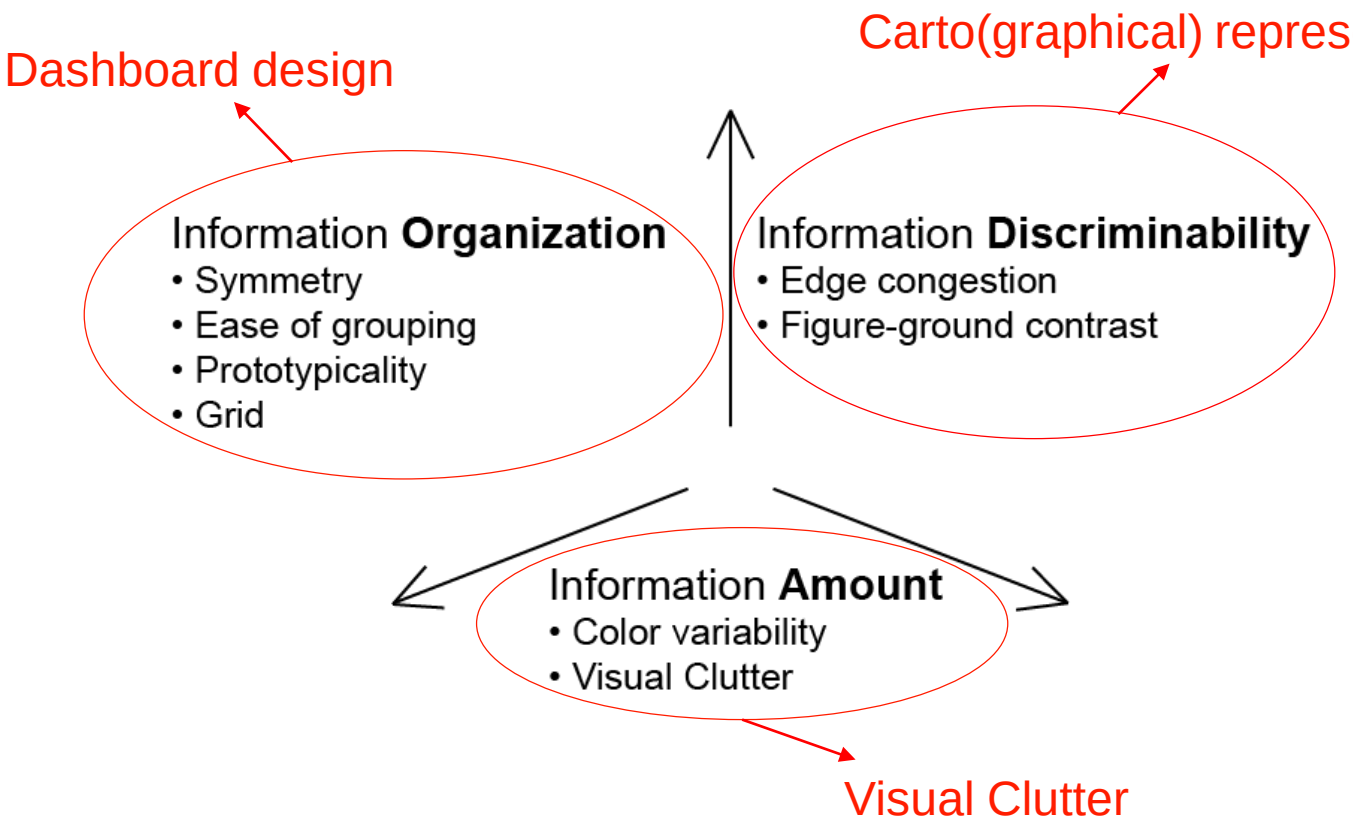
USER-CENTERED DESIGN (UCD)



Activities and iterative process of UCD

(ISO 9241-210 2010)

THE MAIN CHALLENGES IN VISUALIZATION OF O-D DATA



Determinants of Visual Complexity

(Miniukovich & De Angeli 2014)

CASE STUDIES

SUB CASE STUDIES

Case Study 1 *Airport Connectivity*

- Global connectivity of world airports
- Connectivity of an airport of interest
- Development over time
- Trends:
  - Connectivity between Europe and Asia Pacific
  - Development of low cost carriers (LCC)

Case Study 2 *Maritime Migration*

- Connectivity
  - Labor migration patterns
  - Shipping patterns
  - Temporal patterns
- Links between ship efficiency and literacy level of crew members

Storytelling
(to represent known information)

- Growth patterns
- Developments

Exploration
(to discover new information)

- What are the main flow patterns?
- Are there changes over time periods?
- Are there relations between parameters?

CASE STUDIES
DATA SETS

- **Airport Connectivity**

  Data set of flights from European airports

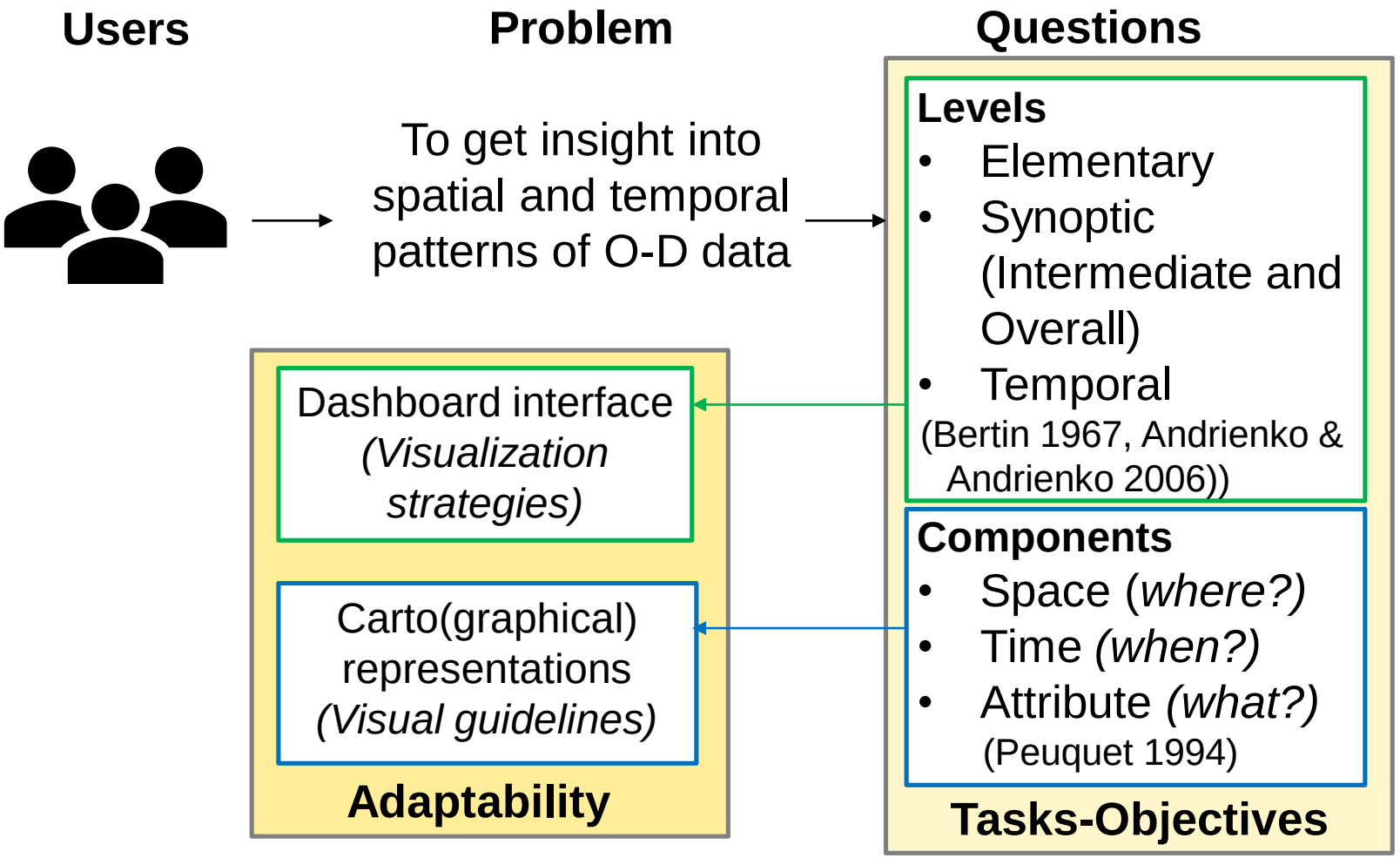
  - Scheduled flights for 1 week (3rd week of June) for several years
  - Direct and indirect flights

- **Maritime Migration**

  2 data sets:

  - Ships
  - Crew members of the ships

CONCEPTUAL FRAMEWORK



DASHBOARDS FOR BOTH CASE STUDIES

Storytelling
Airport Connectivity

→ Sub case studies as storylines →

- Dashboard helps to tell the story behind the data
- Storylines lead the user through dashboard based on the user questions

How to **represent patterns** in a graphical way so that **it tells the story** behind data?

Exploration
Maritime Migration

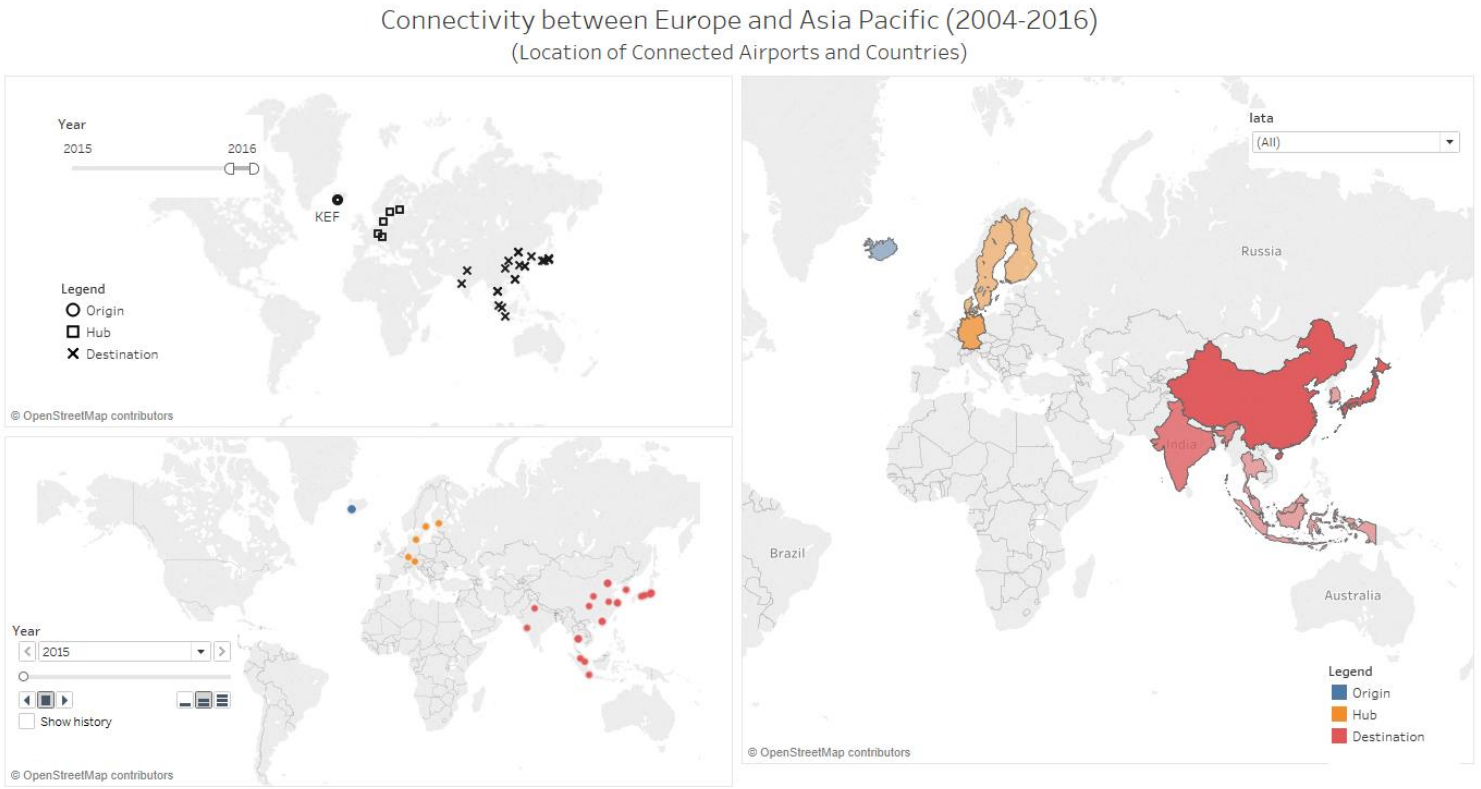
→ Sub case studies and hypothesis based questions as potential storylines →

- Dashboard helps to see patterns and links of involved components
- Sub case studies and hypothesis based questions help to ensure exploration approach

Which graphical representations to use to **show the patterns and links**?

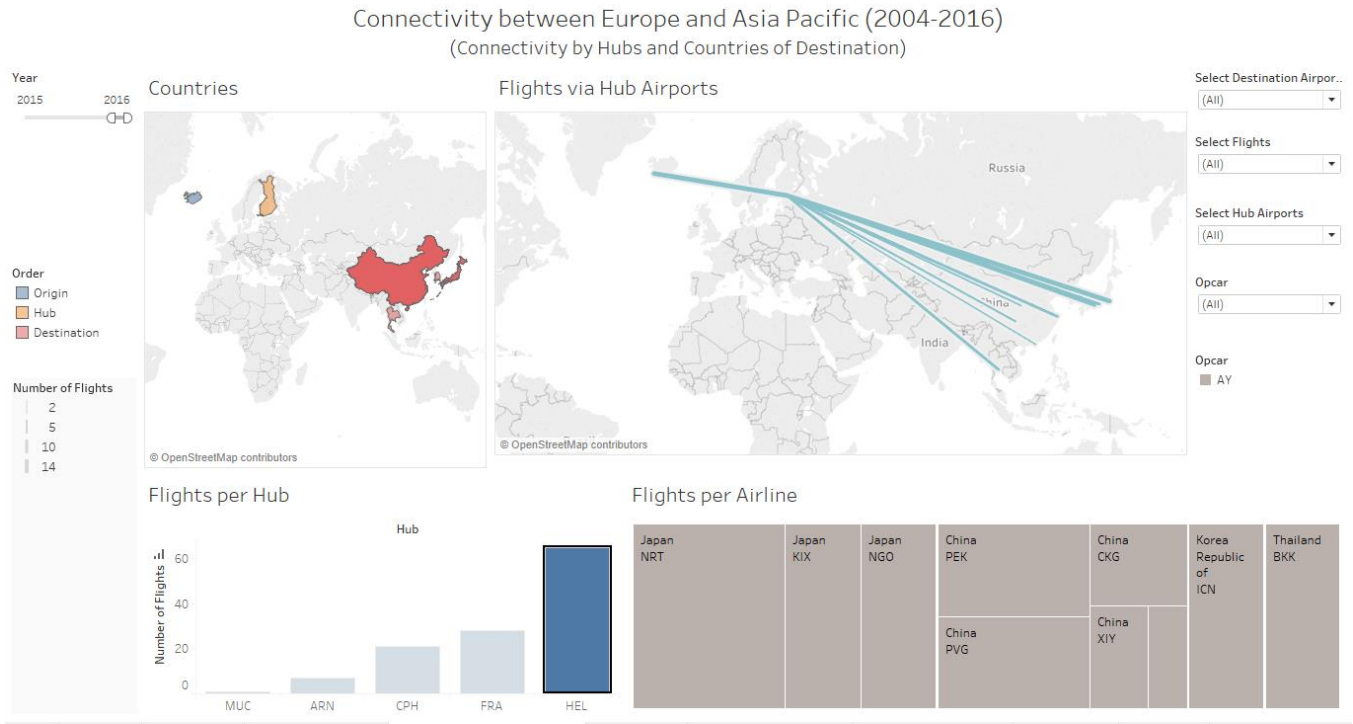
CASE STUDY 1 (EXAMPLES)
ELEMENTARY QUESTIONS

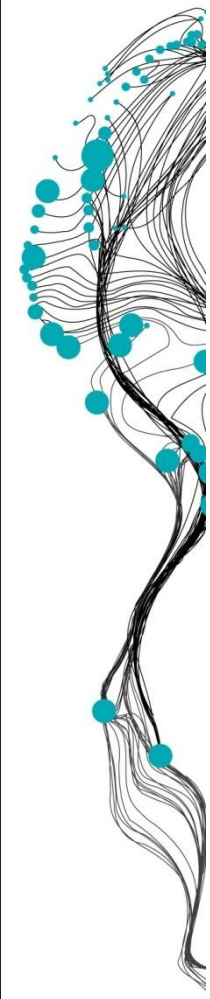
- Where is airport X located? *(space) (Lookup/Locate/Search)*
- Where are located airports with which airport X has connections? *(space) (Lookup)*



CASE STUDY 1 (EXAMPLES)
SYNOPTIC QUESTIONS

- Which hub airport provides the most onward connections to Asia Pacific from airport X? *(space and attribute) (Compare)*
- Which airlines provide connections between airport X and Asia Pacific? *(attribute) (Identify)*





FUTURE WORK

- Prototype of the dashboards for both case studies
- Feedback from users
- Usability test

Thank you!

Questions?

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