Identifying the Relationships Between the Visualization Context and Representation Components to Enable Recommendations for Designing New Visualizations

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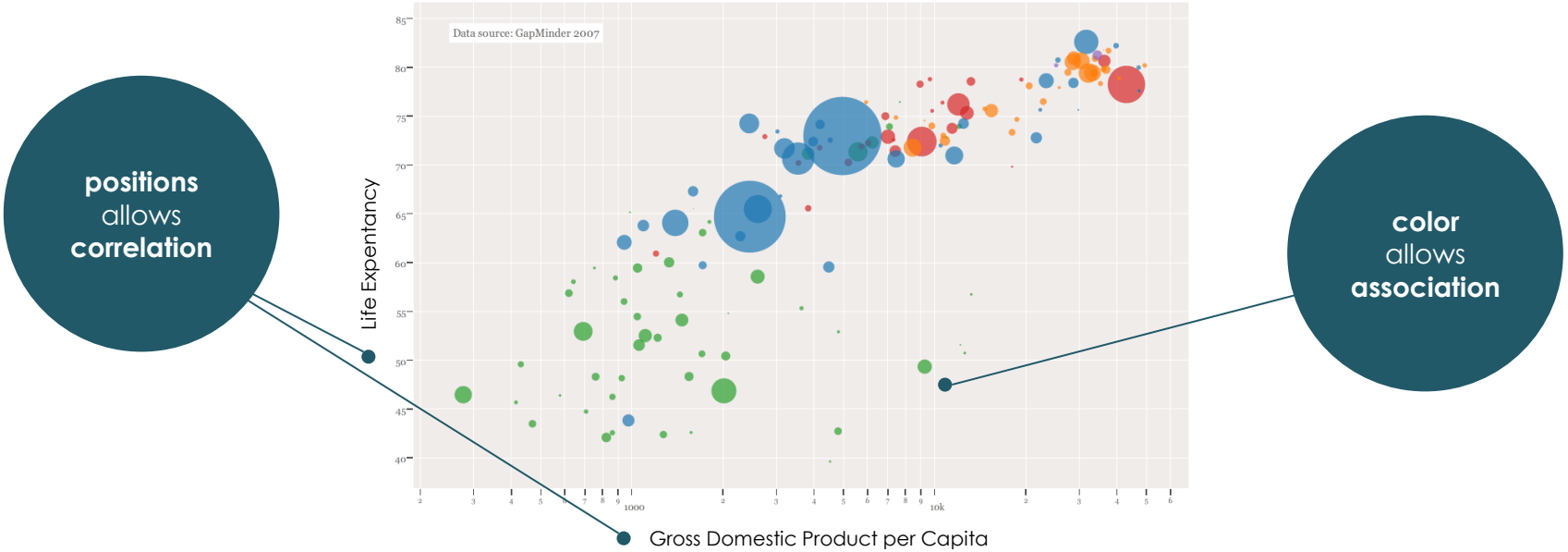
THALES

Motivation

[Hans Rosling]



- What makes existing representations solve challenges?
- Does specific components of a representation solve specific visualization challenges aspects?
- How to understand and describe the relationships between representations components and challenge aspects?

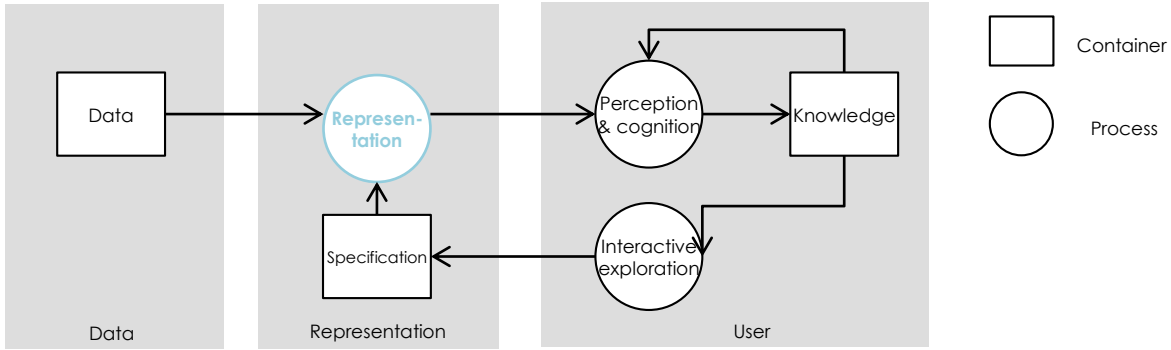
Objectives

- Describe the challenge aspects and the representation components in a manner that allows the characterization of existing representations
- Characterize existing representation and try to understand the relationships between the challenges and the representation components
- Use the extracted relationship to build representations and to highlight unsolved challenges

CHALLENGE ASPECTS

From the visualization process

[vanWijk 2005]



- What impacts the visualization process, defines the challenges that the representations handle
- The existing visualization process definitions permit to extract the following impacting factors
  - Data type
  - Context of use
  - User's need (tasks)
- A representation challenge can be describe by a data type, a user need and a context of use

Data type characterization

- Data volume [Jankun-Kelly et al. 2014]
  - Low volume
  - Intermediate volume
  - High volume

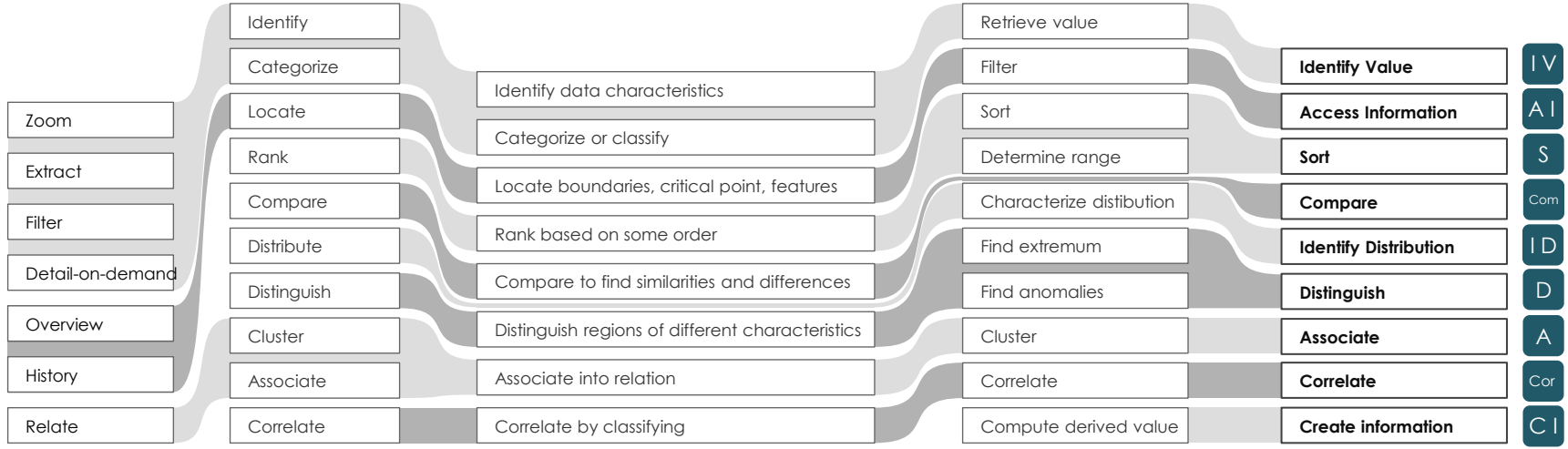
- Structural organization [Hascoët and Beaudouin-Lafon 2001]
  - Unstructured
  - Un-oriented relation
  - Oriented relation

- Attributes cardinality [Shneiderman 1996]
  - 1-dimentional
  - 2-dimentional
  - 3-dimensional
  - Multidimensional

- Attribute structural properties [Bertin 1967]
  - Nominal
  - Ordinal
  - Quantitative

- Attribute nature [Purchase et al. 2008]
  - Characteristic
  - Referential

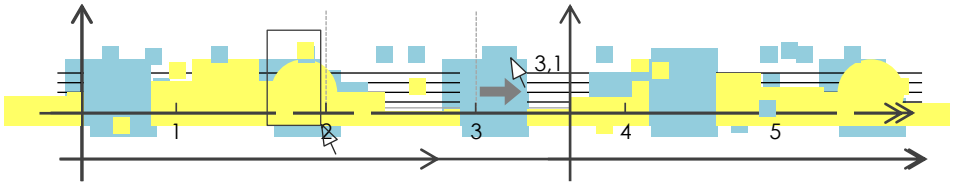
Tasks



[Shneiderman 1996] [Keller 1993] [Purchase 2008] [Amar 2005] *Our taxonomy*

Tasks

- Identify value
- Access information
- Sort
- Compare
- Distinguish
- Identify distribution
- Associate
- Correlate
- Create information



[Shneiderman 1996]

Zoom

Overview

Correlate

History

Detail-on-demand

[Keller 1993]

Cluster

Distinguish

Associate

[Purchase 2008]

Correlate by classifying

Categorize or classify

[Amar 2005]

Find extremum

Compute derived value

Find anomalies

Context of use

- Platform [Sundén et al. 2007]
  - Mobile display
  - Standard screen
  - Large-scale display
  - Immersive device

- User expertise [Rasmussen 1983]
  - Skill
  - Rule
  - Knowledge

Synthesis

CHALLENGE

a device

a user expertise

activities

S R K

ACTIVITY

a task

a data volume

a data structure

attributes

IV AI S Com ID D A Cor CI

ATTRIBUTE

a structural prop.

a nature

N O Q C R

REPRESENTATION COMPONENTS

Representation components

- Data transformation
  - Filtering
  - Clustering
  - Density computation
- Visual mapping
  - Visual variables
    - Position
    - Color
    - Size
    - …
  - Linking
- View transformation
  - Focus + Context
  - Navigation
  - Multi-view

Shape

Size

…

[Bertin 1967, Wilkinson 1999, Cockburn et al. 2009, etc.]

RELATIONSHIP BETWEEN CHALLENGE AND REPRESENTATION

Relationship extraction

CHALLENGE

ACTIVITY 1

Cor 2

ACTIVITY 2

A 1

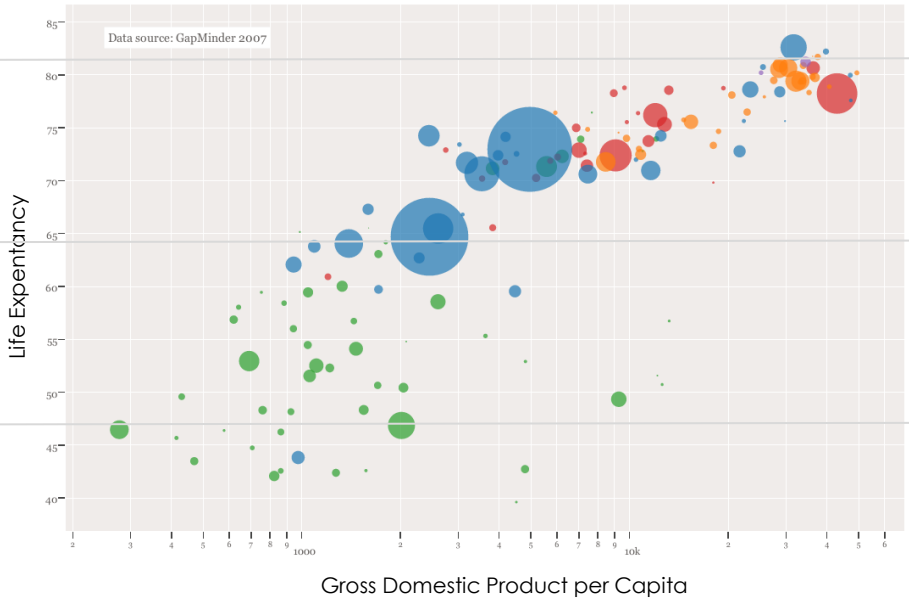
ACTIVITY 3

D 2

ACTIVITY 4

Com 3

[Hans Rosling]



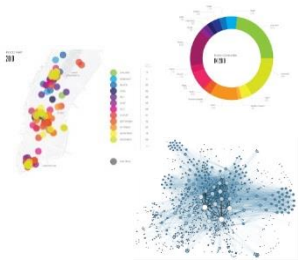
position x + position y

colorization

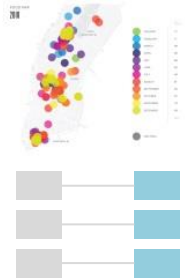
position x + position y

interaction + position x + position y

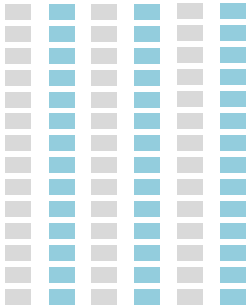
Toward a recommendation tool



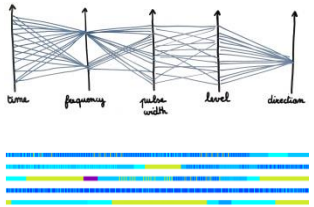
Identification of existing representations



Extraction of relationships



Construction of a knowledge repository



Manual use of the repository on new challenges

Conclusion and perspectives

Conclusion

- Definition of a visualization context characterization
  - Data type
  - User need
  - Context of use
- Proposition of a methodology to extract existing relation between representation components and challenge aspects
  - Analysis of existing representations
  - Use of theoretic contribution of representation components

Perspectives

- Implementation of a recommendation tool
  - Express relationships in prolog predicates
- Evaluation of the given recommendation