

Data Visualization

TASK ABSTRACTION

Tea Tušar, Data Science and Scientific Computing, Information retrieval and data visualization

Outline

Motivation

Goals and tasks

Actions and targets

Implications for design

Motivation

Tasks are typically described with the domain language

Transforming them into abstract form allows you to reason about similarities and differences between them

Without abstraction, all tasks are different

- Epidemiologist: *“Contrast the prognosis of patients who were intubated in the ICU more than one month after exposure to patients hospitalized within the first week”*
- Biologist: *“See if the results for the tissue samples treated with LL-37 match up with the ones without the peptide”*
- Both: *“Compare the values between two groups”*

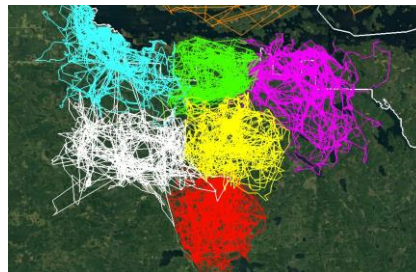
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Goals and tasks

Visualization tasks are activities to be carried out on a visual data representation for a particular **goal**

Goal: *“Understand the extent and overlap of ranges of six wolf packs”*

Task: *“Show the movements of the wolf packs on the map with the ability of looking at each pack separately”*

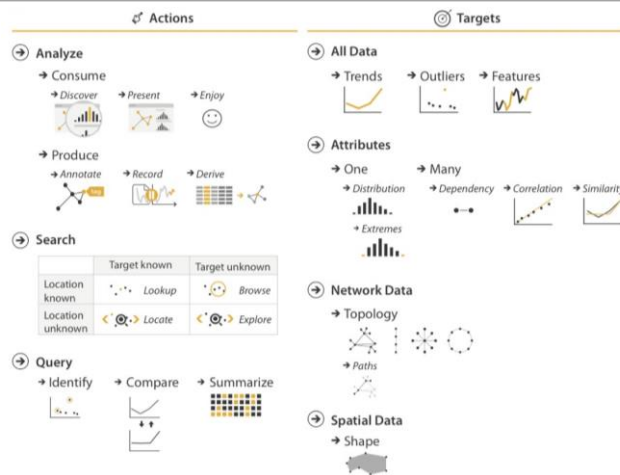


A design can facilitate or hinder the achievement of the goal

<https://earthlymission.com/gps-tracking-shows-how-much-wolf-packs-avoid-each-others-range/>

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Actions and targets



Actions: Analyze



Consume (most often)

- Discover = find new knowledge
- Present = communicate information
- Enjoy

Produce

- Annotate
- Record = capture elements as persistent artifacts
- Derive (transform) = produce new data elements based on existing ones

Actions: Search

Mid-level actions

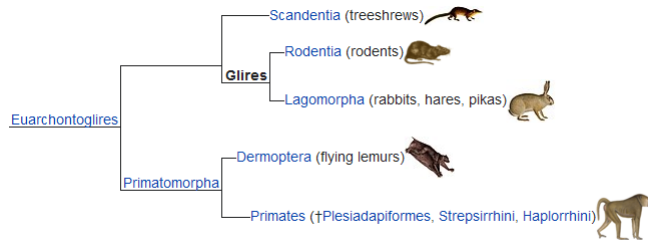
Search

	Target known	Target unknown
Location known	••• Lookup	••• Browse
Location unknown	<•••> Locate	<•••> Explore

Search

- **Lookup** (look up primates)
- **Locate** (find rabbits – they are not rodents!)
- **Browse** (find the closest relative to rabbits)
- **Explore** (find unexpected classifications)

Phylogenetic tree of animals



T. Munzner. *Visualization Analysis & Design*. CRC Press, Boca Raton, 2014
<https://en.wikipedia.org/wiki/Glires>

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Actions: Query

Low-level actions

Query



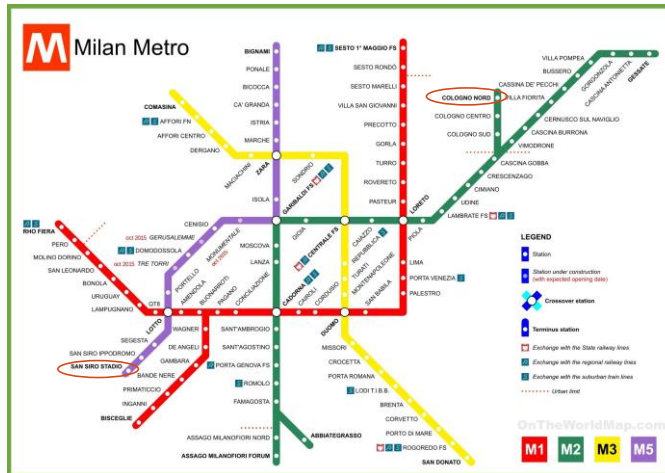
Query

- **Identify** single target
- **Compare** multiple targets
- **Summarize** multiple targets

T. Munzner. *Visualization Analysis & Design*. CRC Press, Boca Raton, 2014

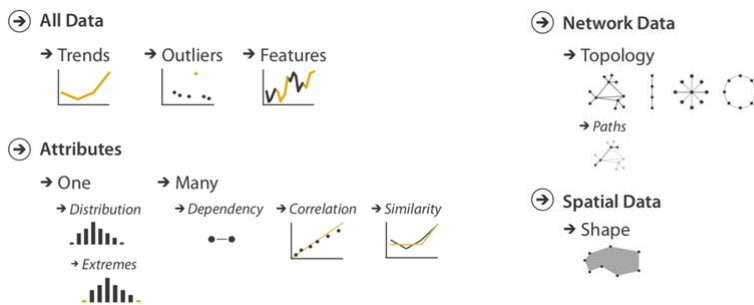
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Example: Which trains connect Cologno Nord and San Siro Stadio?



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Targets



Target = some data aspect that is of interest to the user

Implications for design

Design choices highly depend on the goals and tasks

Actions

- Analyze**
 - Consume: Discover, Present, Enjoy
 - Produce: Annotate, Record, Derive
- Search**

	Target known	Target unknown
Location known	Lookup	Browse
Location unknown	Locate	Explore
- Query**
 - Identify, Compare, Summarize

Targets

- All Data**: Trends, Outliers, Features
- Attributes**
 - One: Distribution, Extremes
 - Many: Dependency, Correlation, Similarity
- Network Data**
 - Topology: Paths
- Spatial Data**: Shape

Visualization Types (Icons):

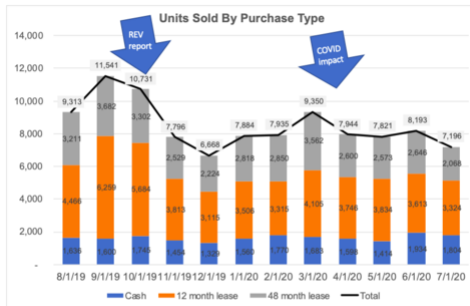
- Comparisons, Proportions, Relationships, Hierarchy
- Concepts, Location, Part-to-a-whole, Distribution
- How things work, Processes & methods, Movement or flow, Patterns
- Range, Data over time, Analysing text, Reference tool

<https://datavizcatalogue.com/search.html>

Example: Automobile units sold in 2019



Example: Showing change in consumer behavior



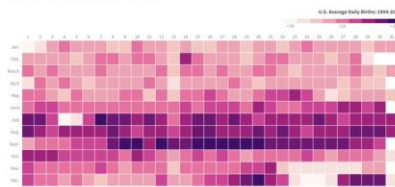
ANALYSIS FINDINGS: Total unit decline in 12-month (-26%) and 48-month (-36%) from August to July, while cash grew (10%).

<https://www.storytellingwithdata.com/blog/2021/1/10/lets-improve-this-graph-yt9xj>

Example: Popular birth dates in America

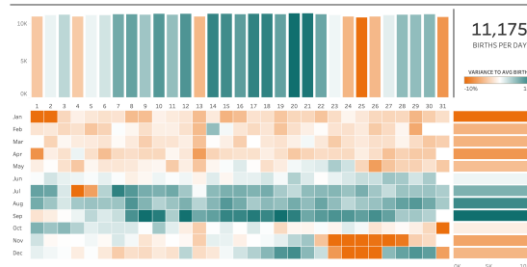
HOW POPULAR IS YOUR BIRTHDAY?

How popular is your birthday? <https://www.vizwiz.com/2021/06/mm2021-w26.html>



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HOW POPULAR IS YOUR BIRTHDAY?



DATA SOURCE: U.S. National Center for Health Statistics (1994-2019); U.S. Social Security Administration (2004-2019) - www.fhcr.com/ • CREATED BY: ANDY KREIBEL (@VIZWIZ)

<https://www.vizwiz.com/2021/06/mm2021-w26.html>