Ethics in Mapping – Integrity

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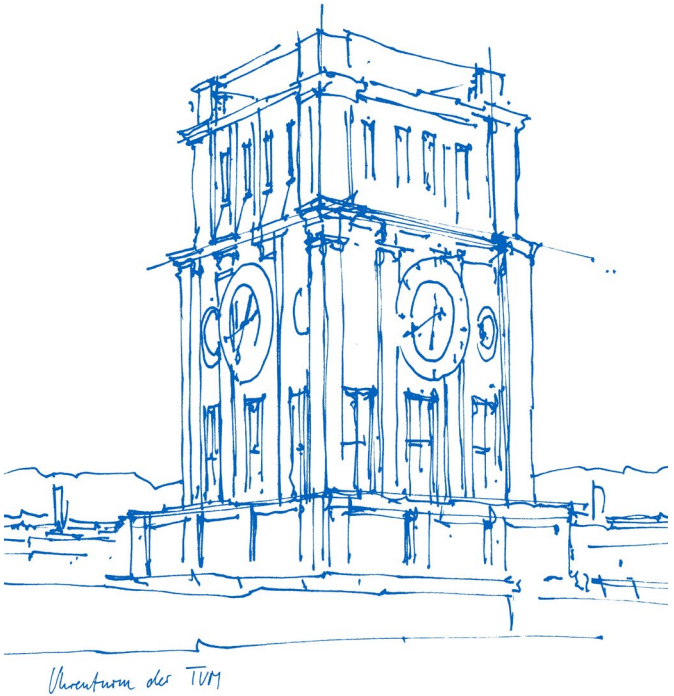
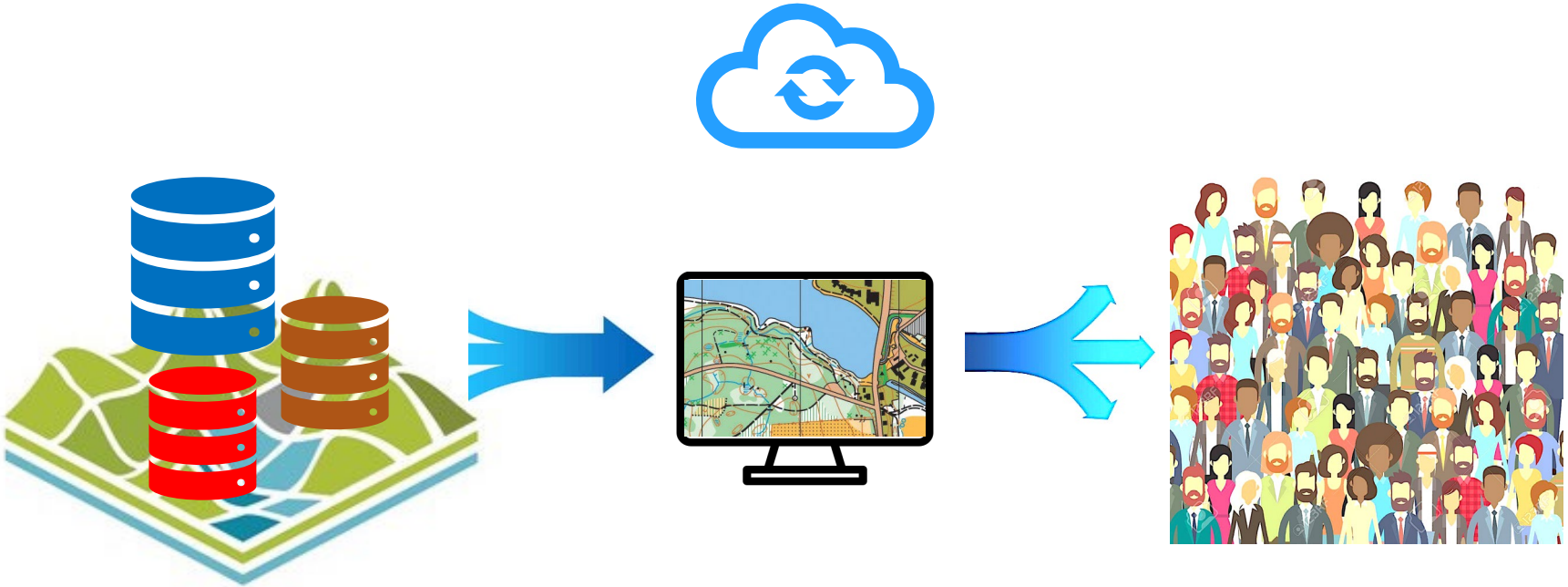
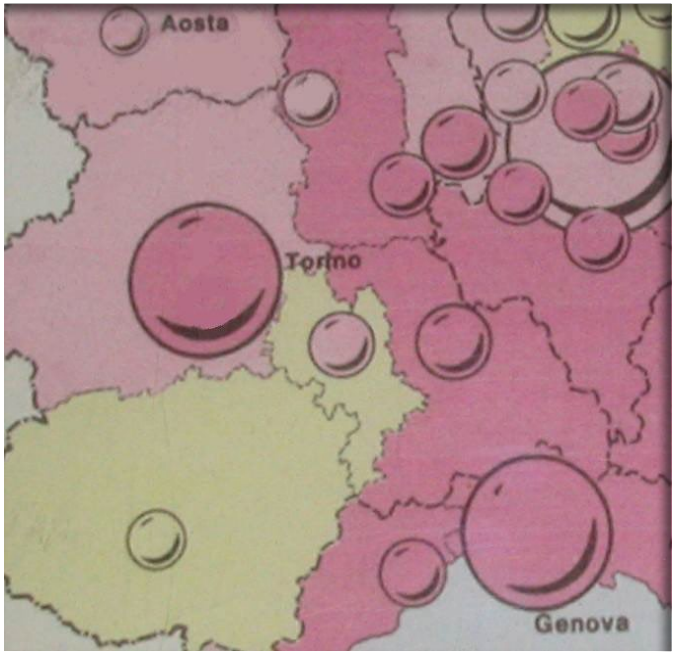
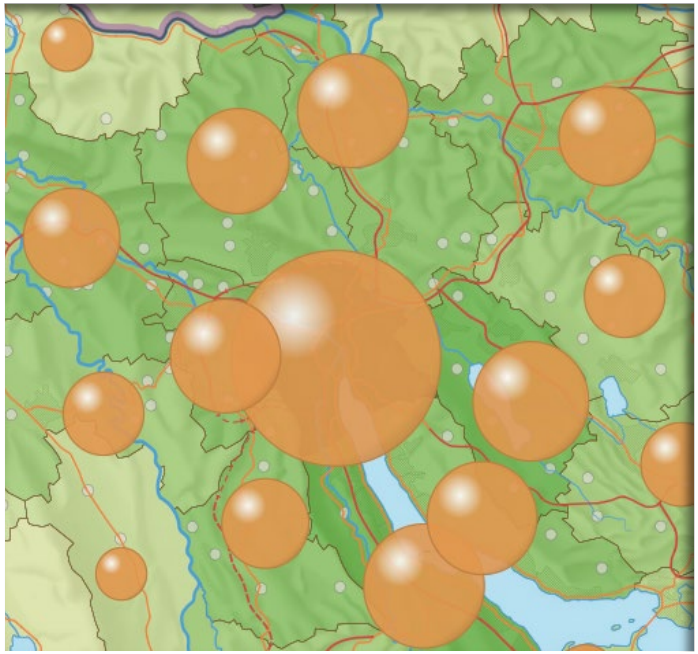
2022-11-03

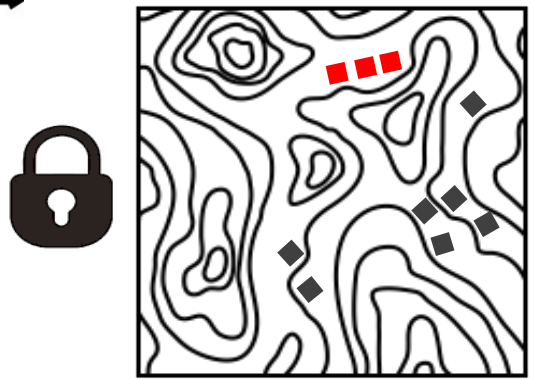



heterogeneous data
diverse users





various design options based on the same principle



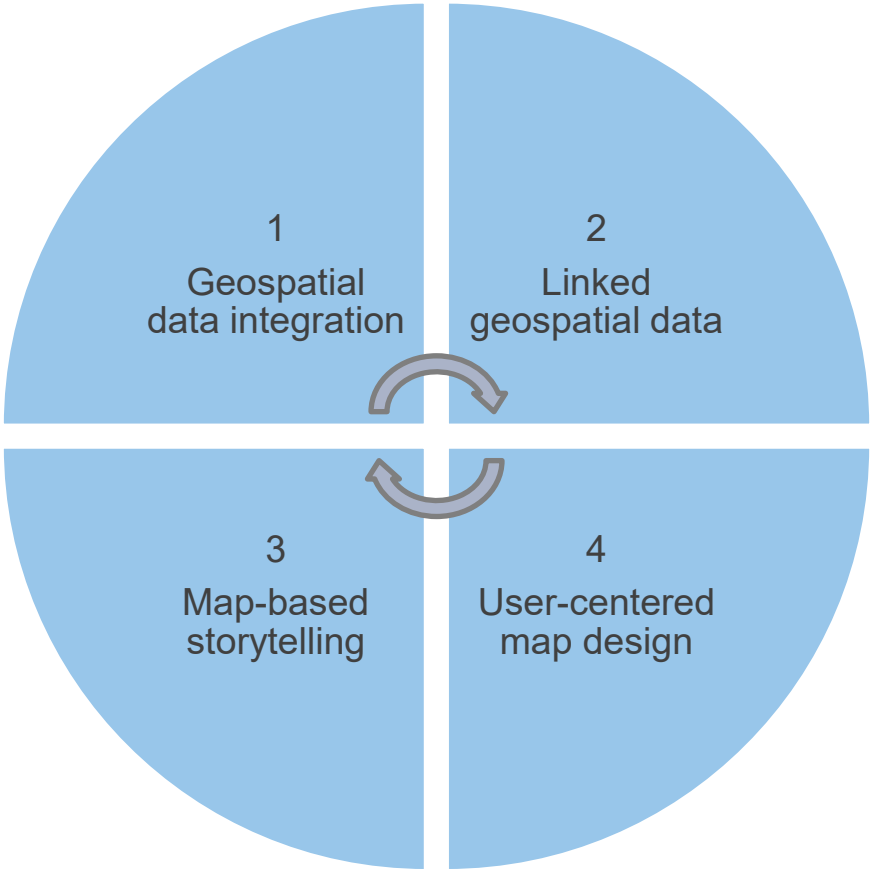
confidential use

demo

public use

Research focuses

- Integrity concerns
- Empirical approaches



1 Geospatial data integration

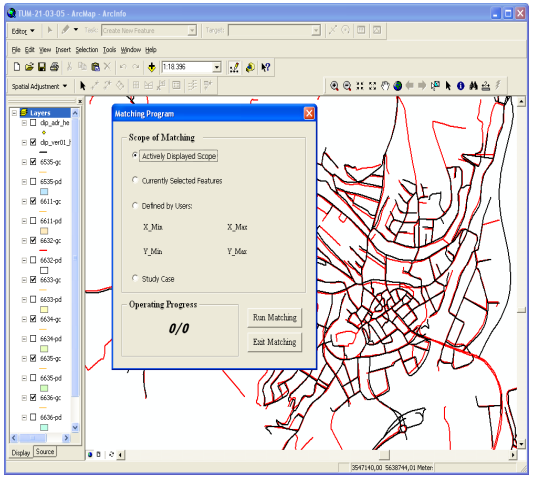
Algorithms
- Sparse matching
- Buffer growing
- Delimited stroke
- Iterative Hierarchical Conflation
- Switch-point docking
- Conditional Random Field
- …

Quality indicators
- Success rate
- Robustness
- Computing speed
- Scalability
- Transparency
- Replicability
- Uncertainty
- …

performance

integrity

- None of the data sources to be integrated is ground truth
- No agreeable strategy exists on how to make use of semantic information
- Integration results are not replicable due to lack of a shared infrastructure
- Uncertainty is difficult to define, measure and visualize



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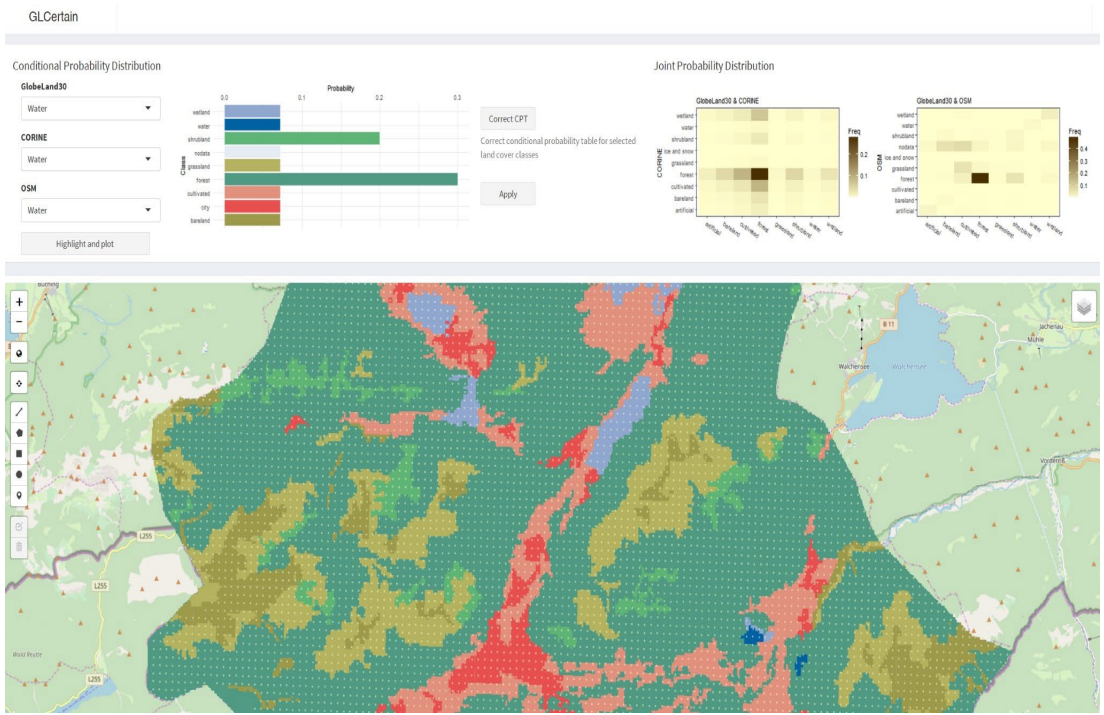
- explainable parameter settings
- applicable scope & side effects
- traceable user interactions
- traceable responses to user feedback

improve algorithmic and process transparency wherever possible



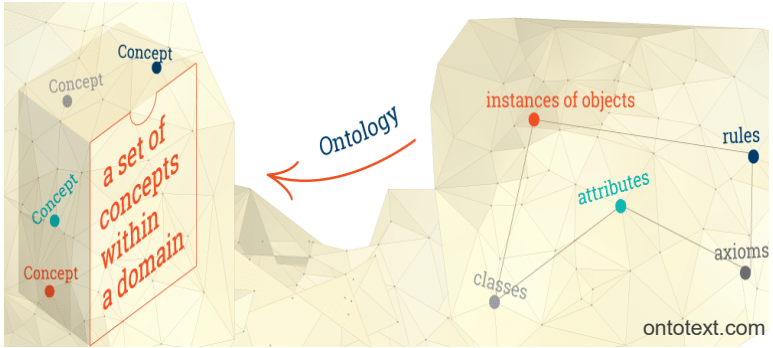
Chuprikova E 2019: Visualizing Uncertainty in Reasoning - A Bayesian Network-enabled Visual Analytics Approach for Geospatial Data. PhD thesis, TUM

interactive uncertainty visualization and handling

2 Linked geospatial data

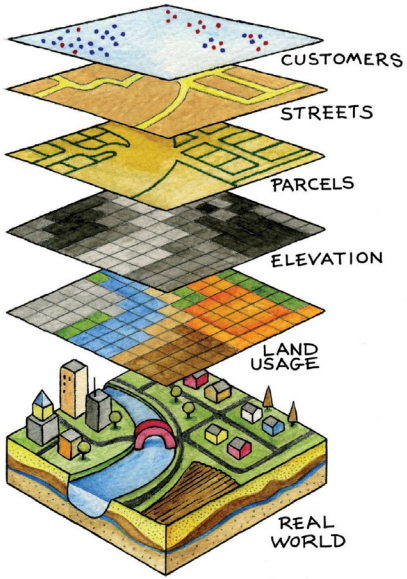
Ontological thinking

- Semantic data enrichment
- Holistic knowledge acquisition
- Access to dynamic relations
- Incremental event detection
- …



Layered thinking still dominates

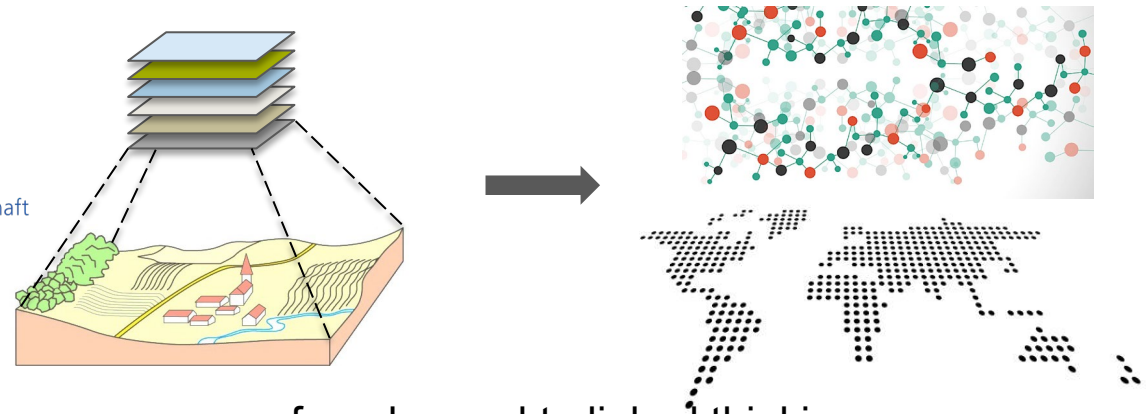
- artificial slicing of the boundless geospatial knowledge
- limited knowledge of well-defined problems
- difficult to manage inconsistencies
- lack of semantic associations across and beyond layers



saylordotorg.github.io

- Geographic Virtual Knowledge Graph for consistent geodata management
- Explainable visual analytics of dense and deep knowledge

DFG Deutsche Forschungsgemeinschaft

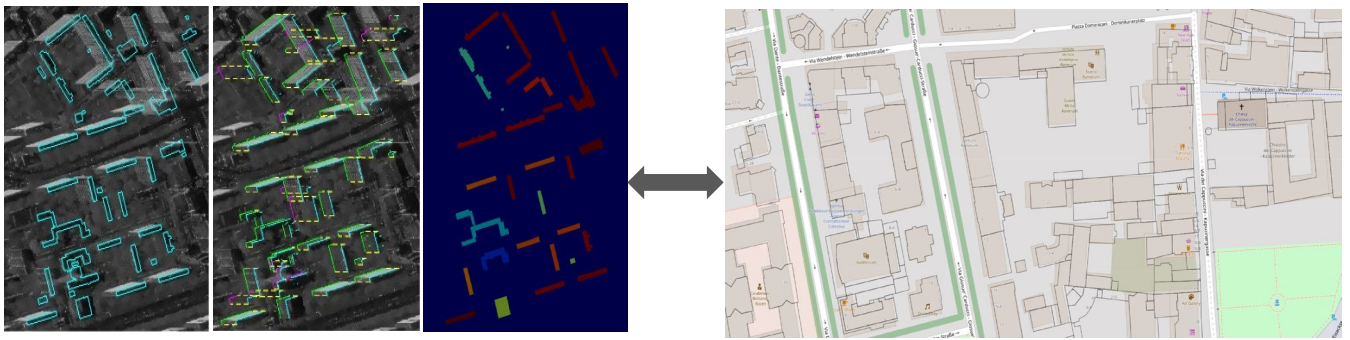


from layered to linked thinking

Ding L, Xiao G, Calvanese D & Meng L 2019: Consistency assessment for open geodata integration: an ontology-based approach. GeoInformatica, DOI: 10.1007/s10707-019-00384-9

- Semantic data acquisition without violating privacy

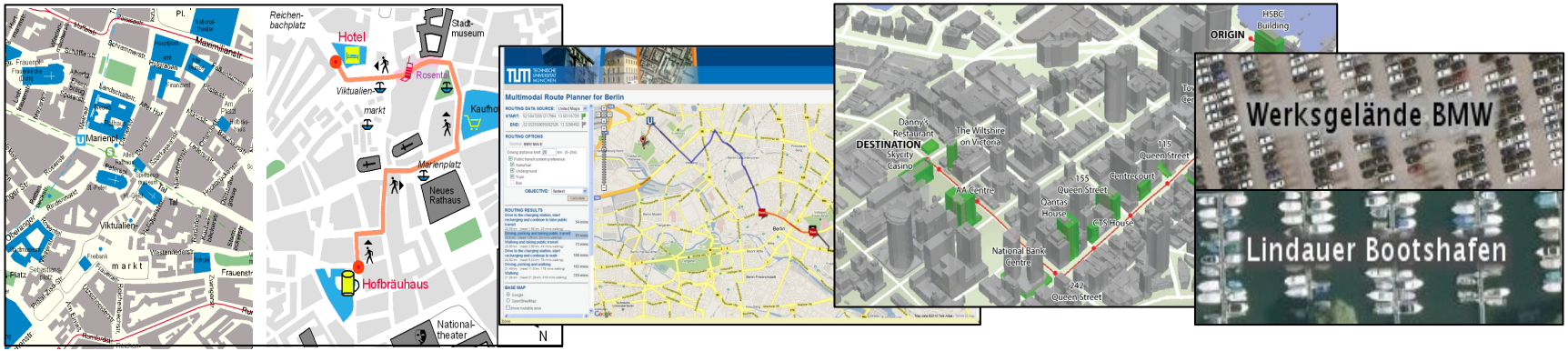
DFG Deutsche Forschungsgemeinschaft



semantic enrichment of OSM with high-precision geometry information

Sun Y, Shahzad M & Zhu X 2017: Building height estimation in single SAR image using OSM building footprints. Joint Urban Remote Sensing Event, doi: 10.1109/JURSE.2017.7924549

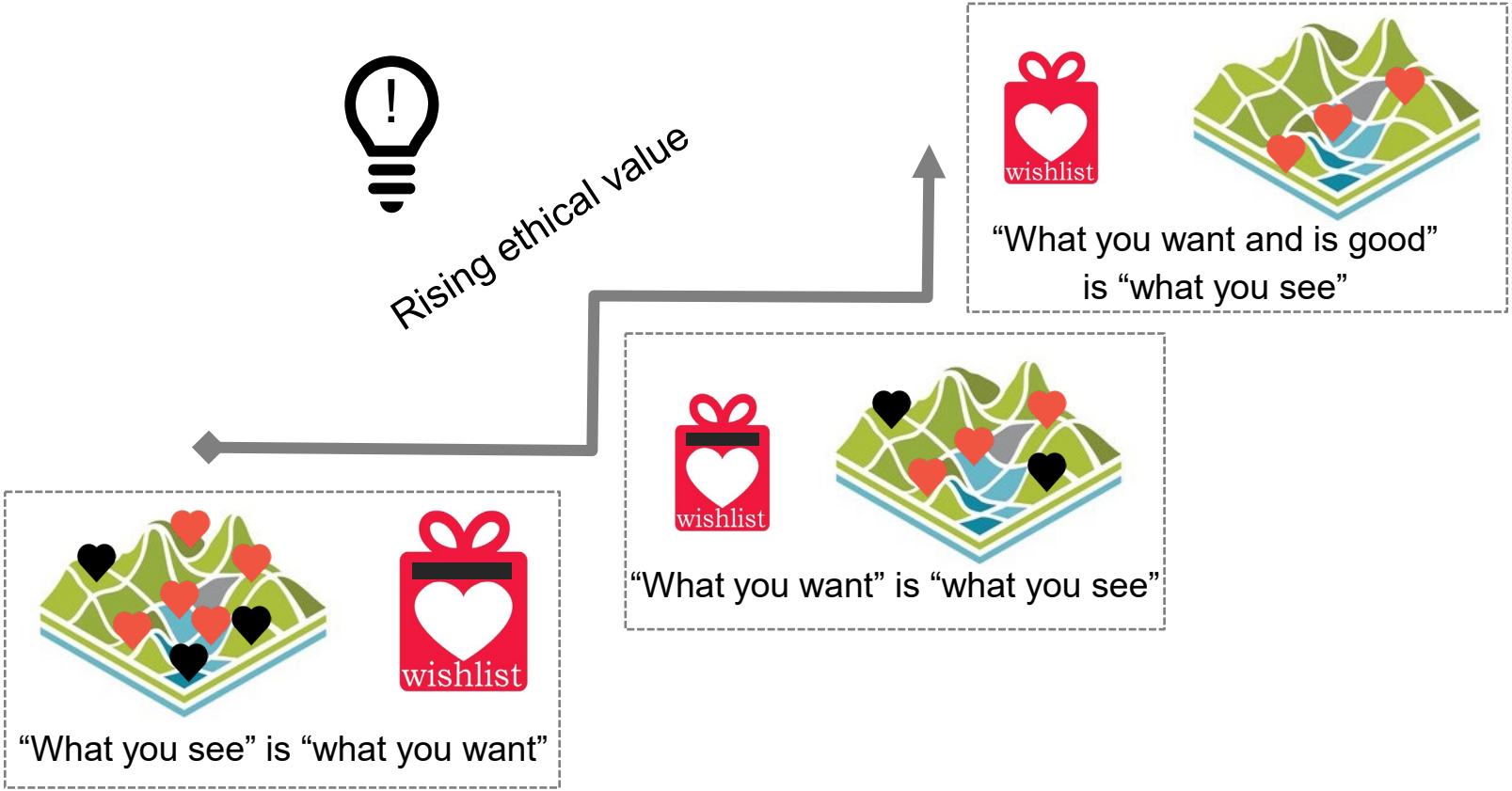
3 User-centered design



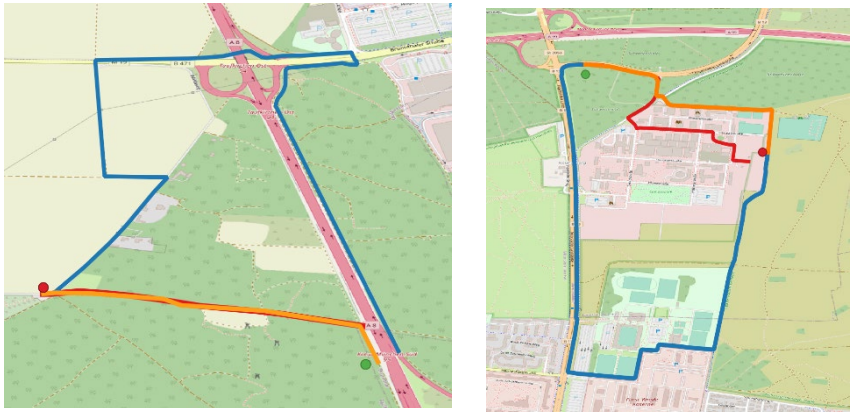
Cartographic services
- self-adaptive
- context-aware
- task-oriented
- just-in-time
- personalized
- …

User
- gender, age …
- task-related behavior
- sensory motor ability
- information need
- personal preferences
- …

- User-centered design is not inclusive
- Intrinsic needs differ from extrinsic interests
- User-centeredness can be manipulated
- What users dislike is not excluded
- Not all user needs are to be encouraged
- Service efficiency causes sometimes declining spatial thinking


Rising ethical value
wishlist
“What you want and is good” is “what you see”
wishlist
“What you want” is “what you see”
wishlist
“What you see” is “what you want”

Stimulate critical thinking about data sources and ranking criteria



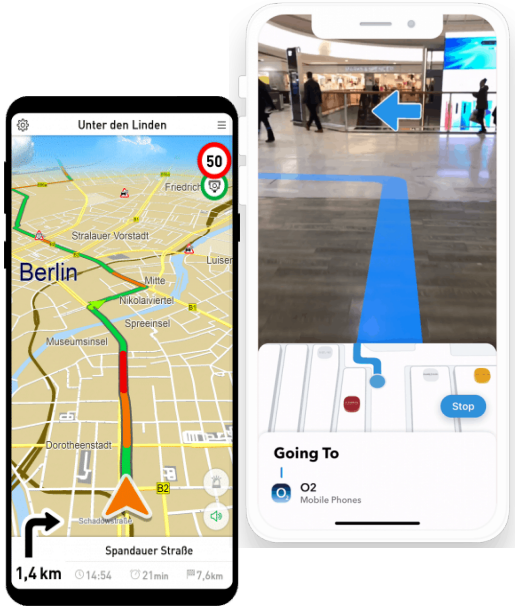
Pedestrian routes generated by

Commercial provider 1
Commercial provider 2
OpenSourceRoutingMachine

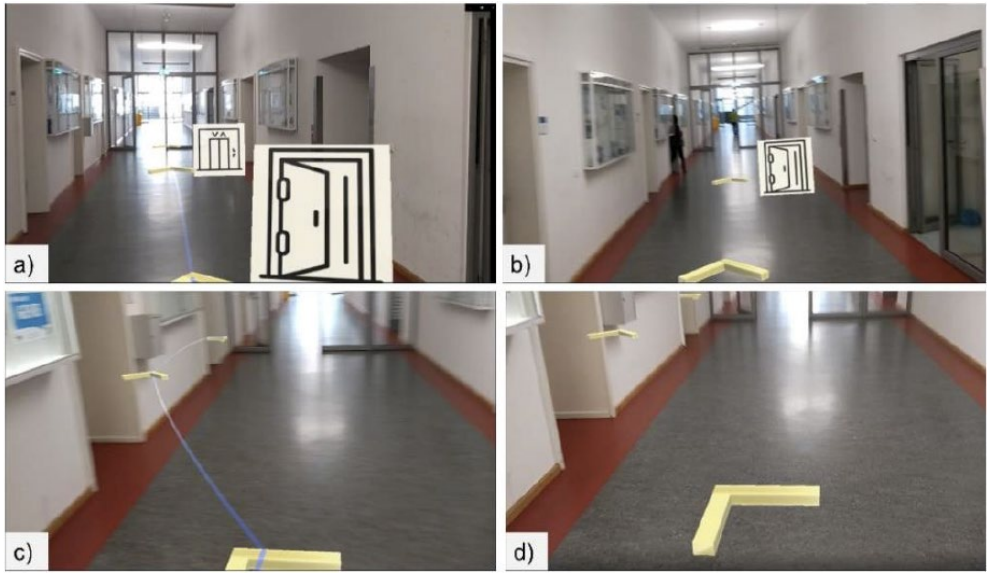
? Maximum clean air
? Best physical exercise
? Most scenic spots
? Shortest time
? Shortest distance

? Profit-driven nudging effect

Incidental spatial learning during efficient navigation

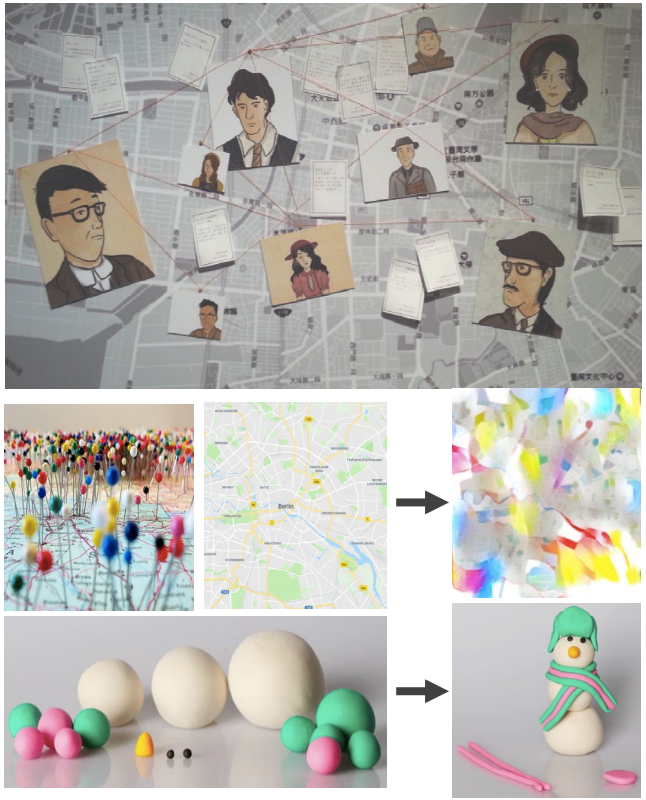


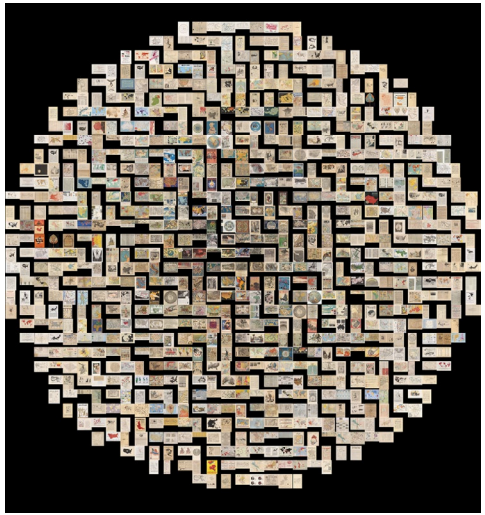
www.maptrip.de

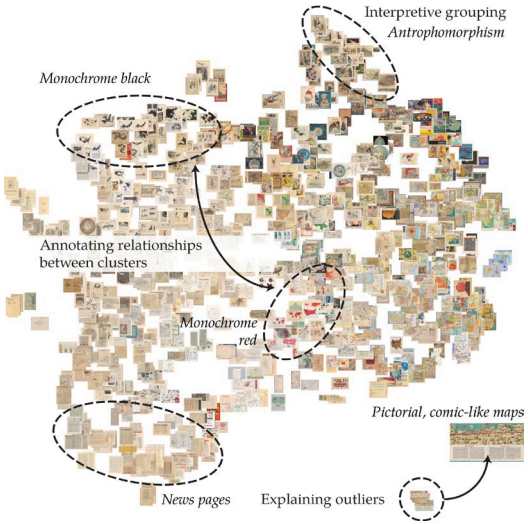


Liu B 2022: Spatial Learning with Mixed Reality-based Navigation. PhD thesis, TUM

4 Map-based storytelling







Bogucka E P 2022: Data-driven design and analysis of map-based storytelling. PhD thesis, TUM

Categories of the Paul Mode Collection with 800 persuasive maps (persuasivemaps.library.cornell.edu)

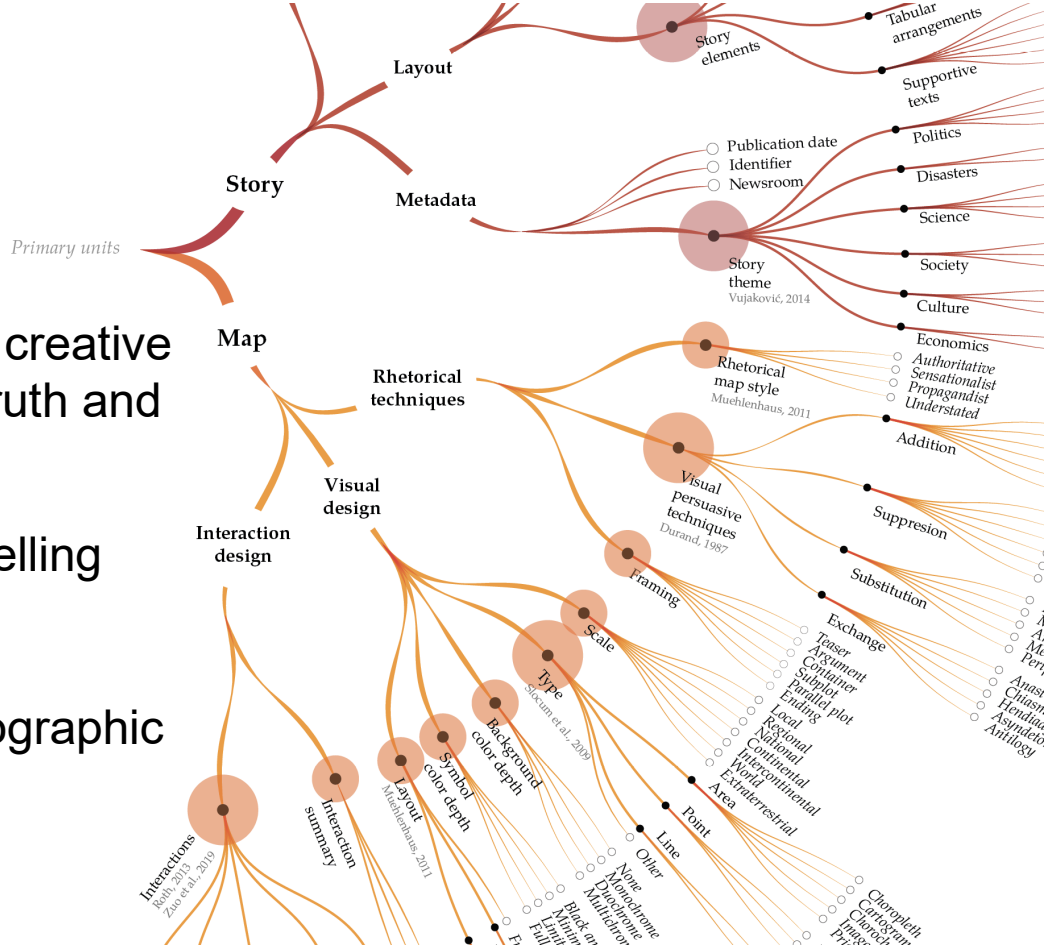
reddit/halfabluesky: each European nation's iconic artwork

Zhi L 2015: A world of harmony, mapdesign.icaci.org

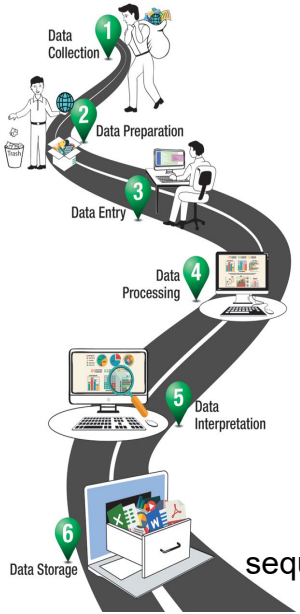
The aesthetic values and local flavors are not objectively measurable, but they reflect the changing relations between the world and the designer or between the map and the viewer.

- Journalistic persuasion
- Subjective perspective
- Emotional design
- Sensual aesthetics
- Map as a component
- …

- Map-based storytelling as a creative lie that helps users realize truth and infer future possibilities
- Data-driven mining of storytelling principles
- Inclusion as a genre of cartographic design



Bogucka E P 2022: Data-driven design and analysis of map-based storytelling. PhD thesis, TUM



sequential value chain

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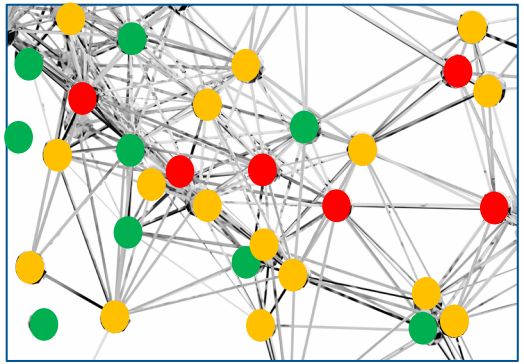
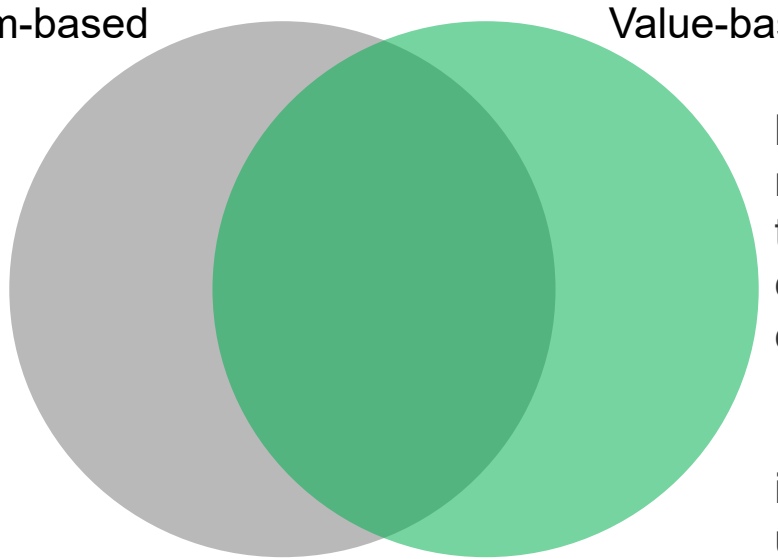
incremental data streaming & processing

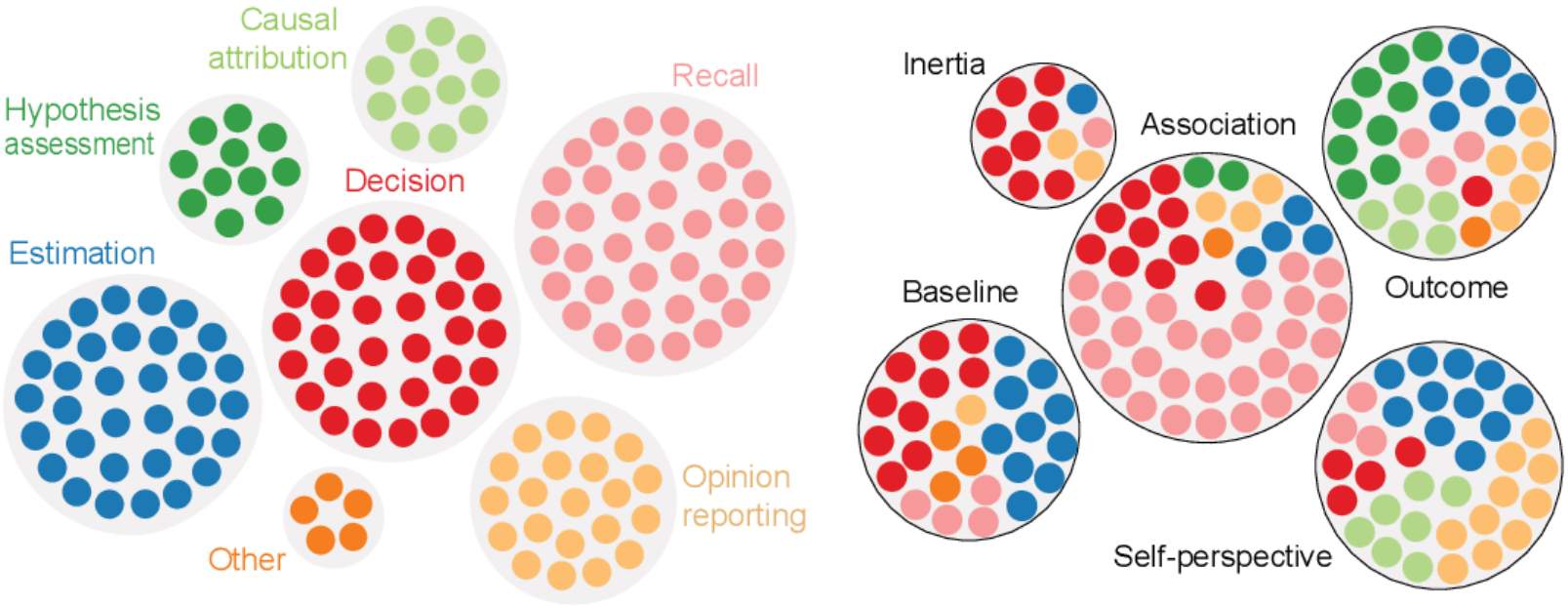


networked value loop

Our ongoing research works have revealed

- we can't avoid the omnipresent issue of integrity, but only face it
- we face the challenge of spotting and mitigating biases in each value loop

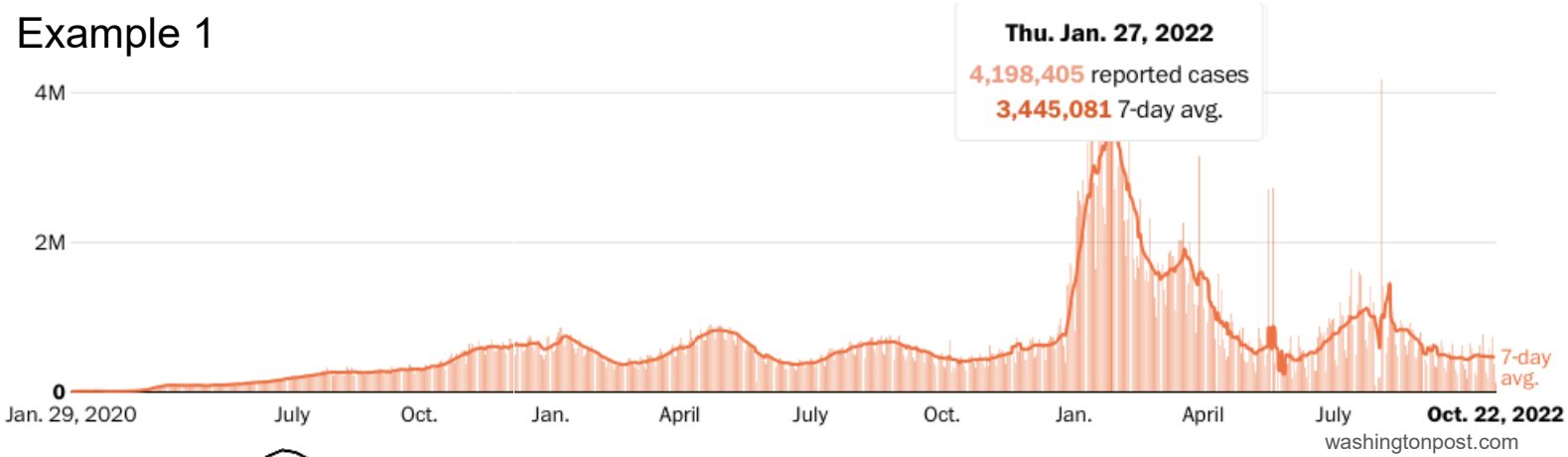

Norm-based
Value-based
code of integrity
professional conduct
rules and standards
diagnostic instructions
rewards and sanctions
extrinsic incentives
restraining effect
best practices
role models
trust culture
conscious learning
conscious unlearning
intrinsic motivation
universally actionable

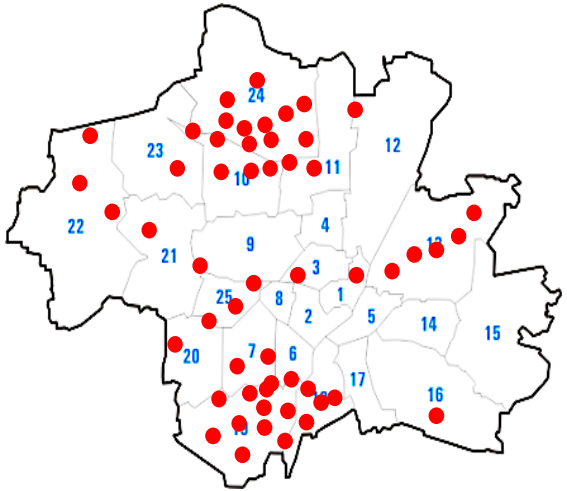


Taxonomy of 154 cognitive biases organized in 7 main task categories (left), or 5 flavors. Each dot represents a cognitive bias.

Dimara E, Franconeri S, Plaisant C et al. 2020: A Task-Based Taxonomy of Cognitive Biases for Information Visualization. IEEE Transactions on Visualization and Computer Graphics.

Example 1



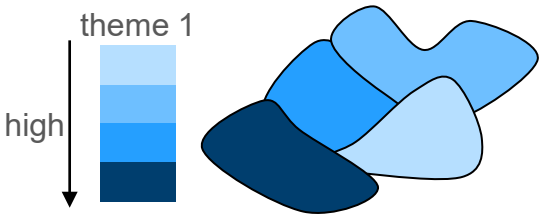


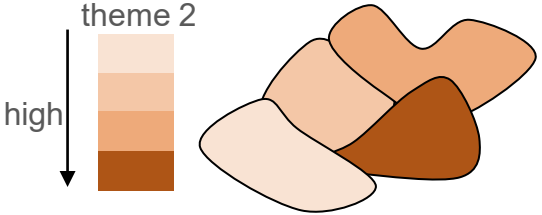
Cognitive biases of “progressive visualization”:

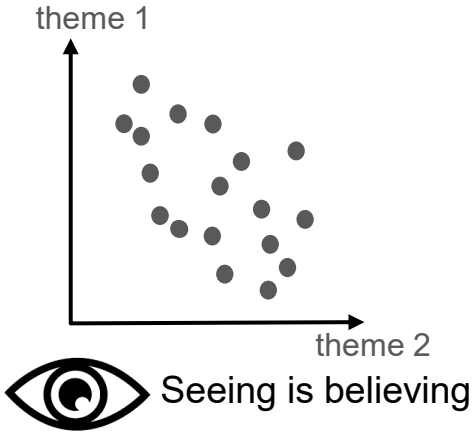
- uncertainty bias
- illusion bias
- control bias
- anchoring bias

Procopio M, Mosca A, Scheidegger C et al. 2022: Impact of Cognitive Biases on Progressive Visualization. IEEE Trans Vis Comput Graph, 2022, 28(9): 3093-3112

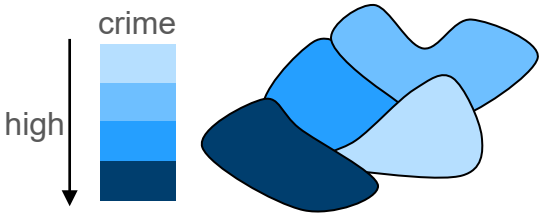
Example 2

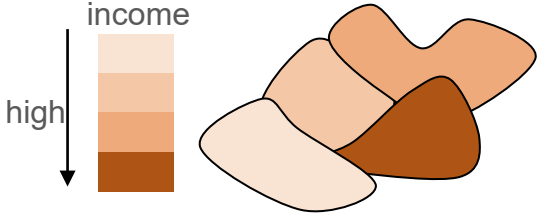


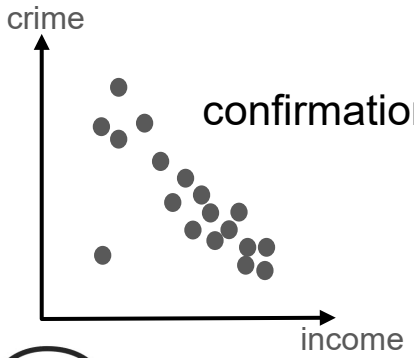




Seeing is believing



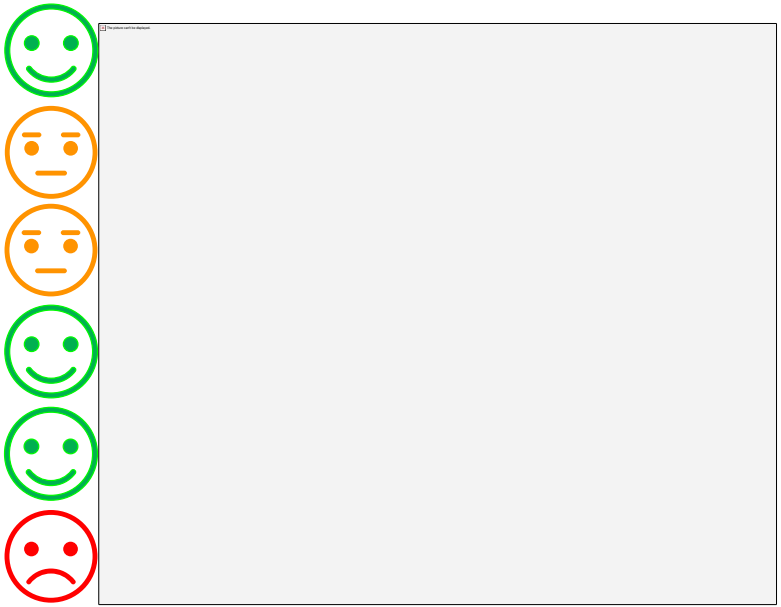




confirmation bias

Believing is seeing

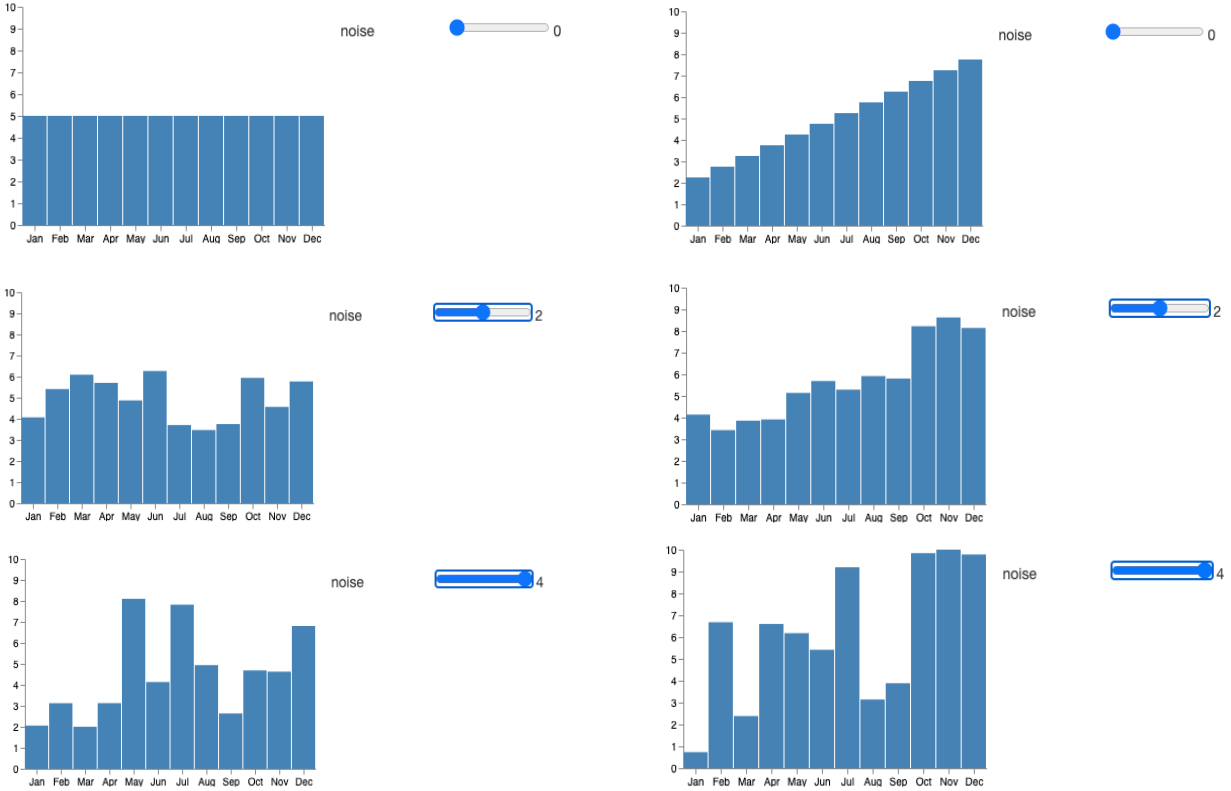
Example 3



perceptual biases in judging quantities in different arrangements

Xiong C, Sarvghad A, Goldstein D et al 2022: Investigating Perceptual Biases in Icon Arrays. Psychology, DOI:10.1145/3491102.3501874

Example 4



https://vega.github.io/vega/examples/hypothetical-outcome-plots

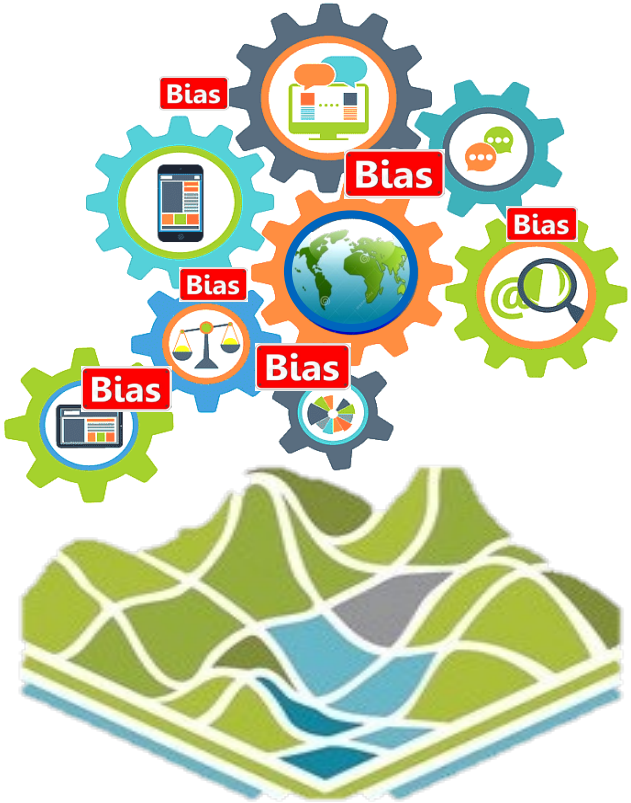
interactive tools for HOPS showing how noise may blur trends and cause “hallucination” of other patterns

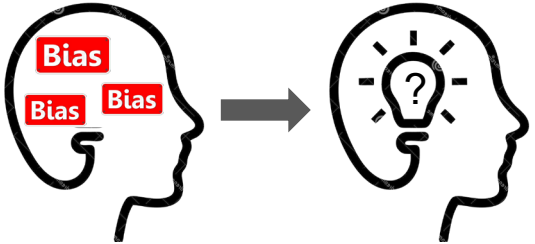
Geovisual analytical platform for guided unlearning

joint fact finding
trusted mediator
turn-taking storytelling
…

“confirmation bias”
“framing bias”
“sampling bias”
“scale bias”
“anchoring bias”
“reactive devaluation bias”
“influencer effect”
"bandwagon effect”
…

benchmark solutions
without unlearning
with unlearning





- transparency of visual analytical processes
- systemic understanding of cognitive pitfalls
- capacity building of critical reasoning

Messages to share

Cartographers can take an overarching responsibility for integrity - a joint concern among geodata providers, system developers, map designers, and target users.

A combination of “code of integrity and professional conduct” with “conscious learning and unlearning” can help promote sustainable and actionable integrity.

As long as there are multiple mapping solutions to a geospatial problem, it is always possible to identify a more ethical one.

www.asg.ed.tum.de/lfk