Ethics in Mapping – Integrity

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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
2. Linked geospatial data
3. Map-based storytelling
4. User-centered map design
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
- ...

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- 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
improve algorithmic and process transparency wherever possible

explainable parameter settings

applicable scope & side effects

traceable user interactions

traceable responses to user feedback

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


from layered to linked thinking
Semantic data acquisition without violating privacy

semantic enrichment of OSM with high-precision geometry information

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
"What you see" is "what you want"

Rising ethical value

"What you want and is good" is "what you see"

"What you want" is "what you see"
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

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)
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
- ...

Normative mapping

- objective
- emotionless
- authoritative
- professional
- trustworthy
- map-centered
- 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
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
- code of integrity
- professional conduct
- rules and standards
- diagnostic instructions
- rewards and sanctions
- extrinsic incentives
- restraining effect

Value-based
- best practices
- role models
- trust culture
- conscious learning
- conscious unlearning
- intrinsic motivation
- universally actionable

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

Cognitive biases of “progressive visualization”:

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

Example 2

Seeing is believing

confirmation bias

Believing is seeing
Example 3

perceptual biases in judging quantities in different arrangements


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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
…

benchmark solutions
without unlearning
with unlearning

“confirmation bias”
“framing bias”
“sampling bias”
“scale bias”
“anchoring bias”
“reactive devaluation bias”
“influencer effect”
"bandwagon effect”
…
• transparency of visual analytical processes
• systemic understanding of cognitive pitfalls
• capacity building of critical reasoning
Messages to share

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

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

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