Backgroung & Research Problem	Methodology	First Results	Conclusion

Toward User-Centred Geovisual Analytics in Maritime Surveillance

Gabriel VATIN, Aldo NAPOLI

MINES ParisTech, CRC







Geoviz 2013, Hamburg

6-8 March, 2013

Backgroung & Research Problem	Methodology	First Results	Conclusion
●○○	0000	00	
Maritime Background			

Maritime Domain

Economy	90% of world's trade is carried
	by sea
Security	Accidents, pollution, protection
	of passengers
Safety	Piracy, drug traffic, terrorism, il-
	legal immigration

- Wide and complex area
- International regulation
- Several moving objects

Constant threat to be monitored



Costa Concordia crash

Pirates in Somalia

Limburg attack

◆□> ◆□> ◆豆> ◆豆> □豆

Backgroung & Research Problem $0 \bullet 0$

Methodology 0000 First Results 00

Maritime Background

Maritime Surveillance Systems (MSS)



Can we really analyze trafic and make decision from this type of visualization?

▲□▶ ▲圖▶ ▲厘▶ ▲厘▶ 厘 の��

Backgroung & Research Problem	Methodology	First Results	Conclusion
000	0000	00	
Research Issues			

Visual Analytics & GeoViz

"Science of analytical reasoning facilitated by interactive visual interfaces" (Thomas & Cook, 2005) "Detect the expected and discover the unexpected": GeoViz leads to better analysis of data, and is a major step in risk management and decision making

Problematic

How can adapted **geovisual analytics** can be proposed to users, based their **skill**, **task** and available **data**?



Backgroung	Research	Problem

Methodology ●○○○ First Results

Related Work

Maritime and trajectory GeoViz

Geovisualization methods based on gaussian models and Kernel density model for maritime dynamic anomalies detection (Willems et al., 2011; Riveiro & Falkman, 2011)

Multi-agent systems for behavior prediction (Petit, 2005; Claramunt et al., 2007), relative visualization of movements (Mallé-Noyon, 2008)

Advanced trajectory visual analysis (e.g., Kraak, 2006; Andrienko & Andrienko, 2011)

User- and Task-centred approach of InfoVis

Need for precise taxonomy of visual tasks in geoinformation analysis (e.g., Fabrikant, 2001; Pfitnzner et al., 2001) Improvement of SOLAP solution based on user queries (Bédard, 2007; Beaulieu, 2009)

Backgroung & Research Problem 000	Methodology ○●○○	First Results 00	Conclusion
Proposed Methodology			
Methodology Steps			

- Formalizing geovisual analytics tasks and methods with detailed taxonomy
- ② Evaluate their contribution to risk analysis and management

- I Place the users at the centre of the methodoloy
- Oevelop the methodology for maritime environment
 - Geovisual analytics methods knowledge-based system
 - Weighted by users preferences

Backgroung & Research Problem	Methodology ○○●○	First Results 00	Conclusion
General Framework of Ontology			



Methodology for the selection of adapted visual methods

- Use of interface for input data
- Data are formalized to be processed
- Output Process of the query
- Selected methods are proposed
- Refinement of selection

くして 前 ふかく 山下 ふゆう ふしゃ



Technology Acceptance Model (Davis, 1993)



Extract of tasks ontology (with Protégé 4.1)

・ロト・日本・モート モー うへぐ

Backgroung & Research Problem	Methodology	First Results	Conclusion
000	0000	○●	
Visualization Ontology			



Extract of visualization ontology, using Chi's Data State Model (Chi, 2000)

・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・
・

Backgroung & Research Problem	Methodology	First Results	Conclusion
000	0000	00	

Conclusion

- Formalizing knowledge in GeoViz allows developping a system for helping the selection of methods.
- Used methods depend on: GeoViz theory (knowledge) ; User's preferences (evaluation)
- Evolutions could be brought by adding: new rules, new methods, new users.

Perspectives

- Develop relations between the concepts.
- Add entities to the ontology: methods and users.
- Evaluate several GeoViz methods with different user to customize the model.



Thanks for your attention! Questions?

aldo.napoli@mines-paristech.fr PhD supervisor

(日) (四) (王) (王) (王)

크

http://crc.mines-paristech.fr/ssem Sécurité, Sûreté et Environnement Maritime (Security, Safety and Maritime Environment)