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What is Visual Analytics?

Methods@Manchester

Oscar de Bruijn

Decision and Cognitive Sciences

Manchester Business School

Overview

- What is the problem?
- How does Visual Analytics offer a solution
- What is visual Analytics?
- Examples
  - ADVISES
  - CoCo
- Conclusions
- What DCS has to offer

The problem

- The data deluge
- Automated processing and analysis
  - Data mining
  - Text mining
  - Multi-criteria decision analysis (e.g., optimisation algorithms)
  - Naturalistic Decision analysis (e.g., Bayesian models)
- Fully automated search, filter and analysis tools work reliably only for well-defined and well-understood problems

Example: Web information retrieval

- The World Wide Web
- IR performance measures
  - Recall: the fraction of the documents that are relevant to the query that are successfully retrieved
  - Precision: the fraction of the documents retrieved that are relevant to the user's information need
  - The trade-off: Increasing recall may decrease precision, increasing precision may decrease recall.
- Relevance - ranking

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Visual Analytics and Web information retrieval

P.C. Wong, Adding a visualization feature to Web search engines: It's time. IEEE Computer Graphics and Applications. November/December 2008.

Visual Analytics

- "Visual analytics combines automated analysis techniques with interactive visualisations for an effective understanding, reasoning and decision making on the basis of very large and complex datasets" (Keim et al, 2010, p.7)
- What is visualization?
- The activity of guidance and observation, by a human analyst, of automated data processing and analysis tools and algorithms through interactive graphical representations for …
- The goal of visual analytics is to make our way of processing data and information transparent for an analytic discourse.

Keim et al. (Eds.) 2010. Mastering the Information Age: Solving Problems with Visual Analytics. The Eurographics Society

ADVISES*

- ADaptive VISualisation for E-Science – EPSRC e-science project 2006-2009
- Objectives
  - To analyse user's research methods and questions using sub-language – Research questions drive workflow
  - To develop a prototype, interactive graphical representation/data analysis tool driven by research questions
  - To evaluate the prototype with researchers in the medical e-science community
  - To develop a user-centred requirements analysis and design method for e-science
- Vision
  - Research questions are the e-science interface
  - Interactive representation allows you to see the effect of your question AND you can interpret the results in context

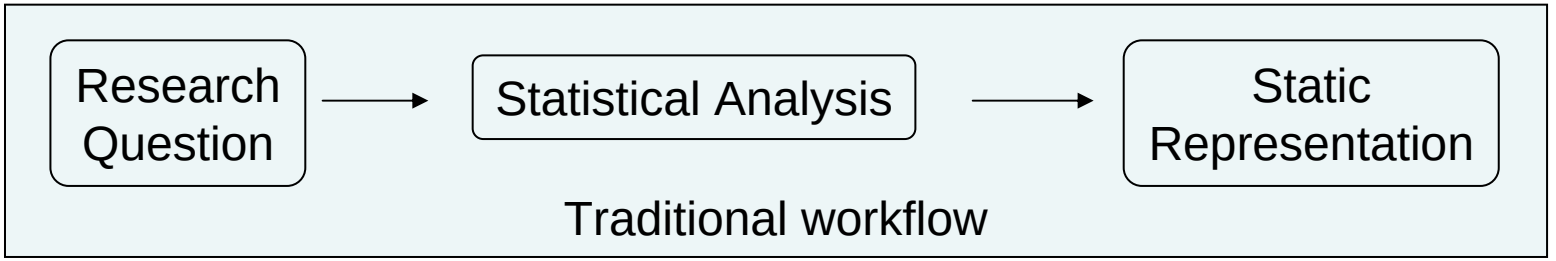
*Alistair Sutcliffe (PI), Oscar de Bruijn, John MacNaught, Rob Proctor & Iain Buchan

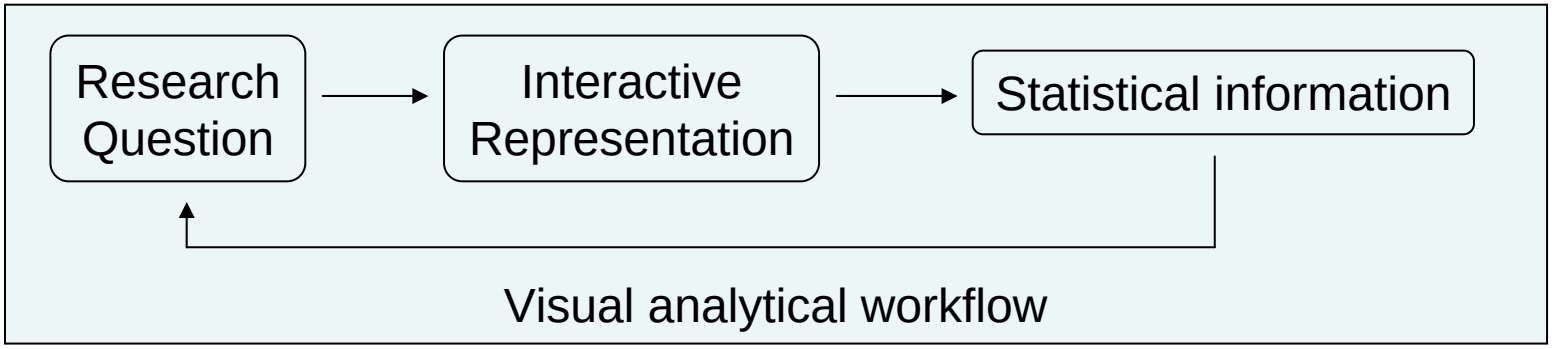
ADVISES Domain: Epidemiology

Understanding childhood obesity

Causal analysis from complex multivariate spatio-temporal evidence

Multi-variate statistical analyses – differences between cohorts over time, between areas





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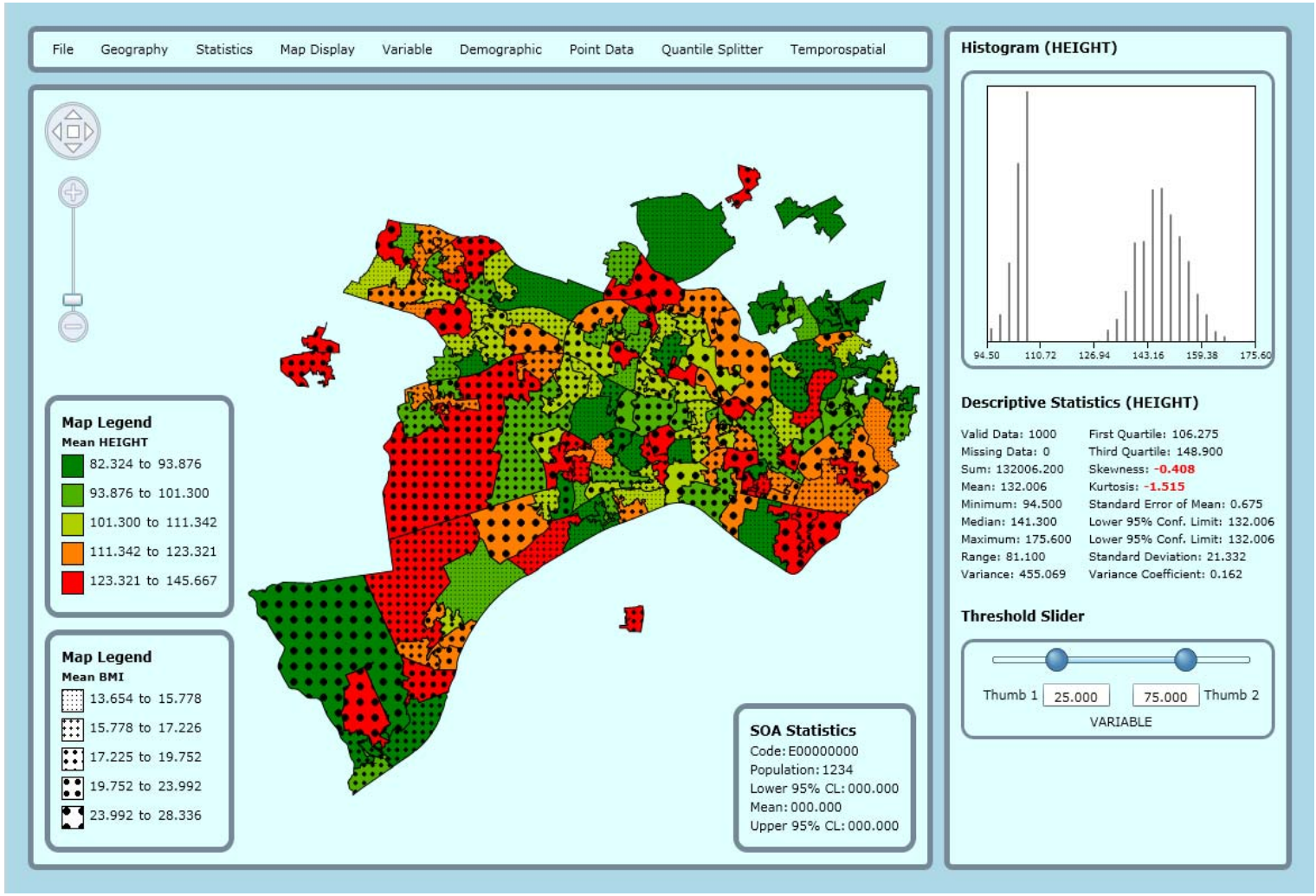
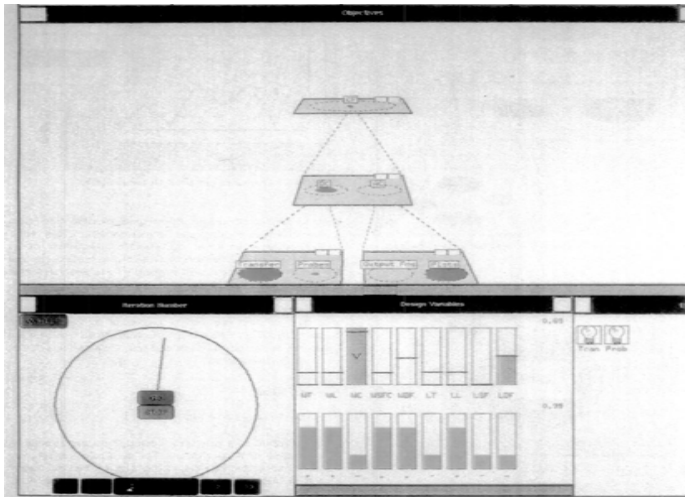
ADVISES Prototype



CoCo: Control and Observation of Circuit Optimization*

- Arguably the first Visual Analytics application
- Supports human guidance of automated design
- Video



- Applications include engineering design and multi-criteria decision making

*Colgan, Rankin & Spence (1991) Steering automated design. In J. Gero (Ed) Artificial Intelligence in Design.

Conclusions

- Advantages
  - Sensitivity
  - Flexibility
  - Insight
  - Collaboration
- Issues to be resolved
  - Analytical discourse
    - Exploration/exploitation trade-offs
      - Cognitive biases
  - Analytical and worldview gaps

DCS: http://research.mbs.ac.uk/decision-science/

- Decision Science
  - Multiple Criteria Decision Analysis
  - Naturalistic decision making and decision support systems
- Cognitive Science
  - Behavioural decision analysis
  - Analytical Discourse
  - Adaptive systems

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Thank you and Questions

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DCS - http://research.mbs.ac.uk/decision-science/