

# Improving User Confidence in Concept Maps: Exploring Data-Driven Explanations

**Pierre Le Bras**, David A. Robb, Thomas S. Methven,  
Stefano Padilla, and Mike J. Chantler

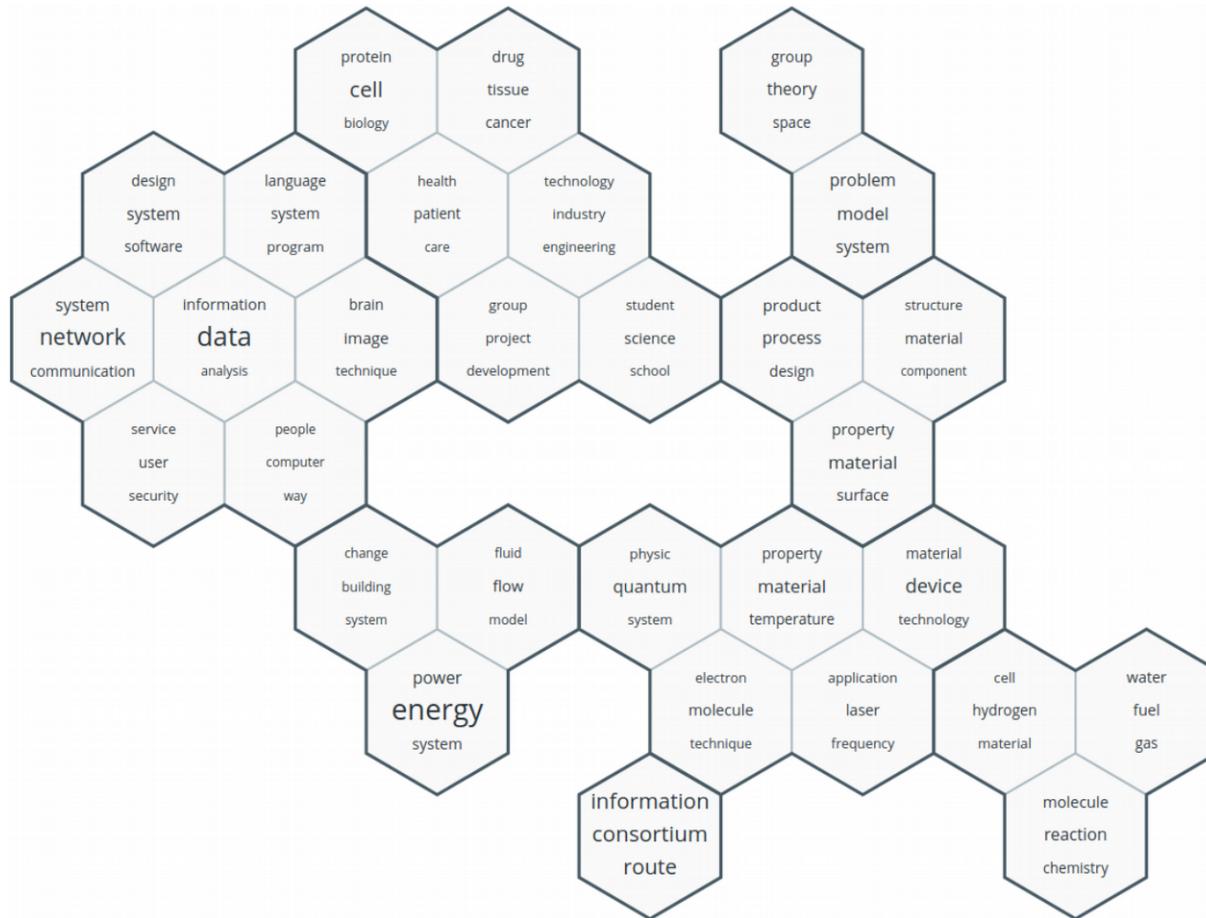
Heriot-Watt University

CHI 2018 – April 23<sup>th</sup> 2018

Strategic Futures  
Laboratory

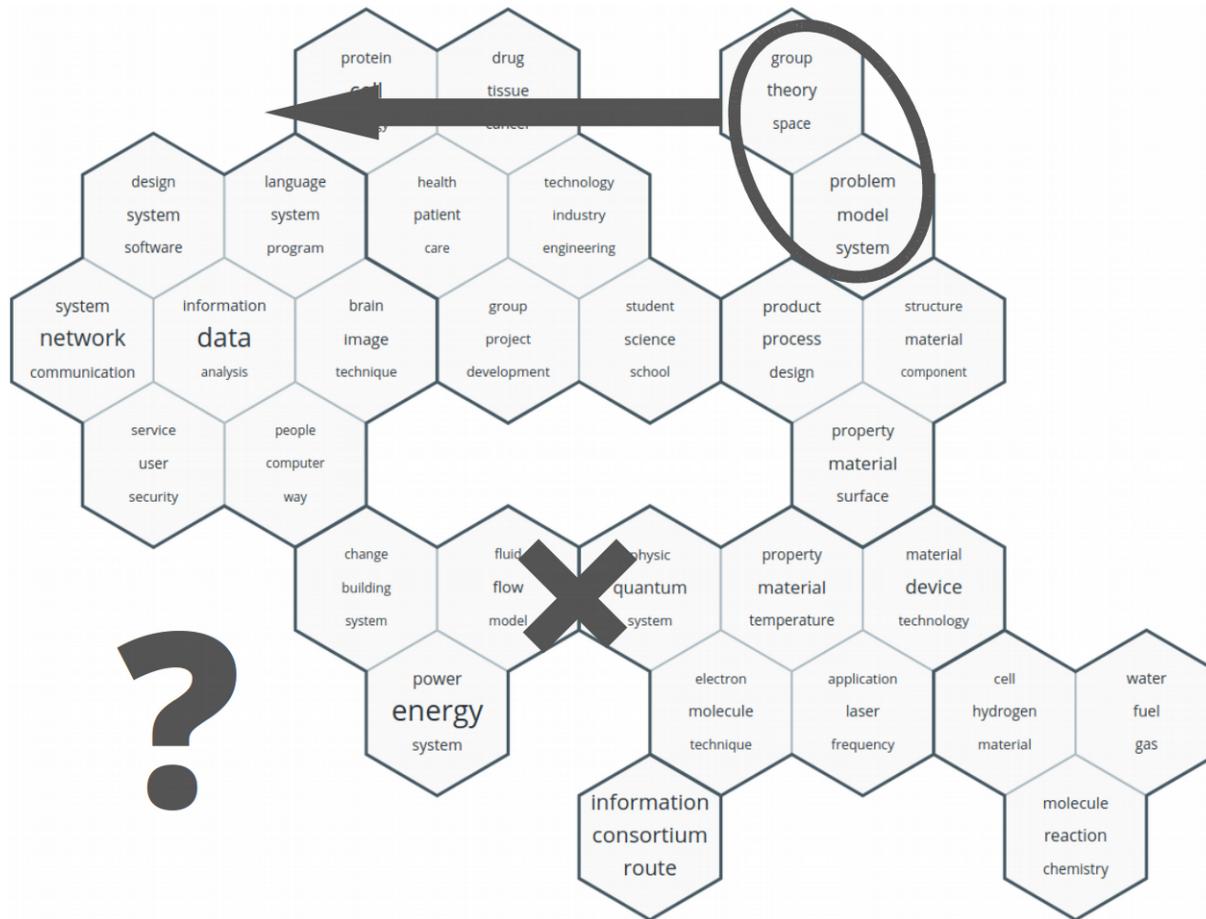


# Users and Concept Maps

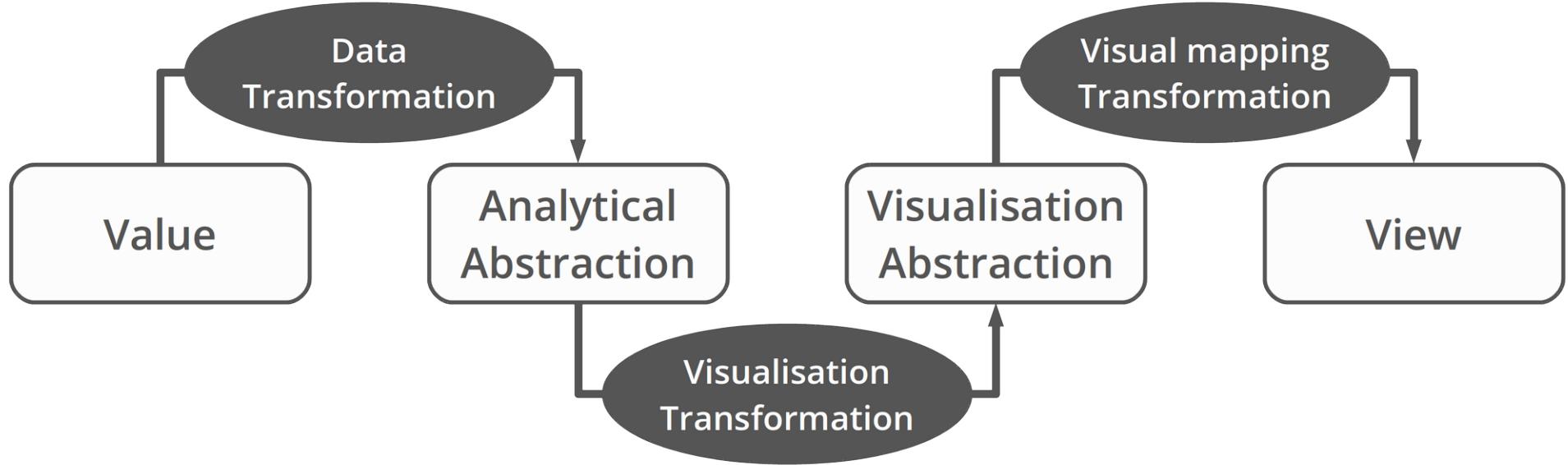


- Stefano Padilla, Thomas S. Methven, David W. Corne, and Mike J. Chantler. 2014. Hot topics in CHI: trend maps for visualising research. In *CHI'14 Extended Abstracts on Human Factors in Computing Systems*. ACM, 815-824.

# Users and Concept Maps



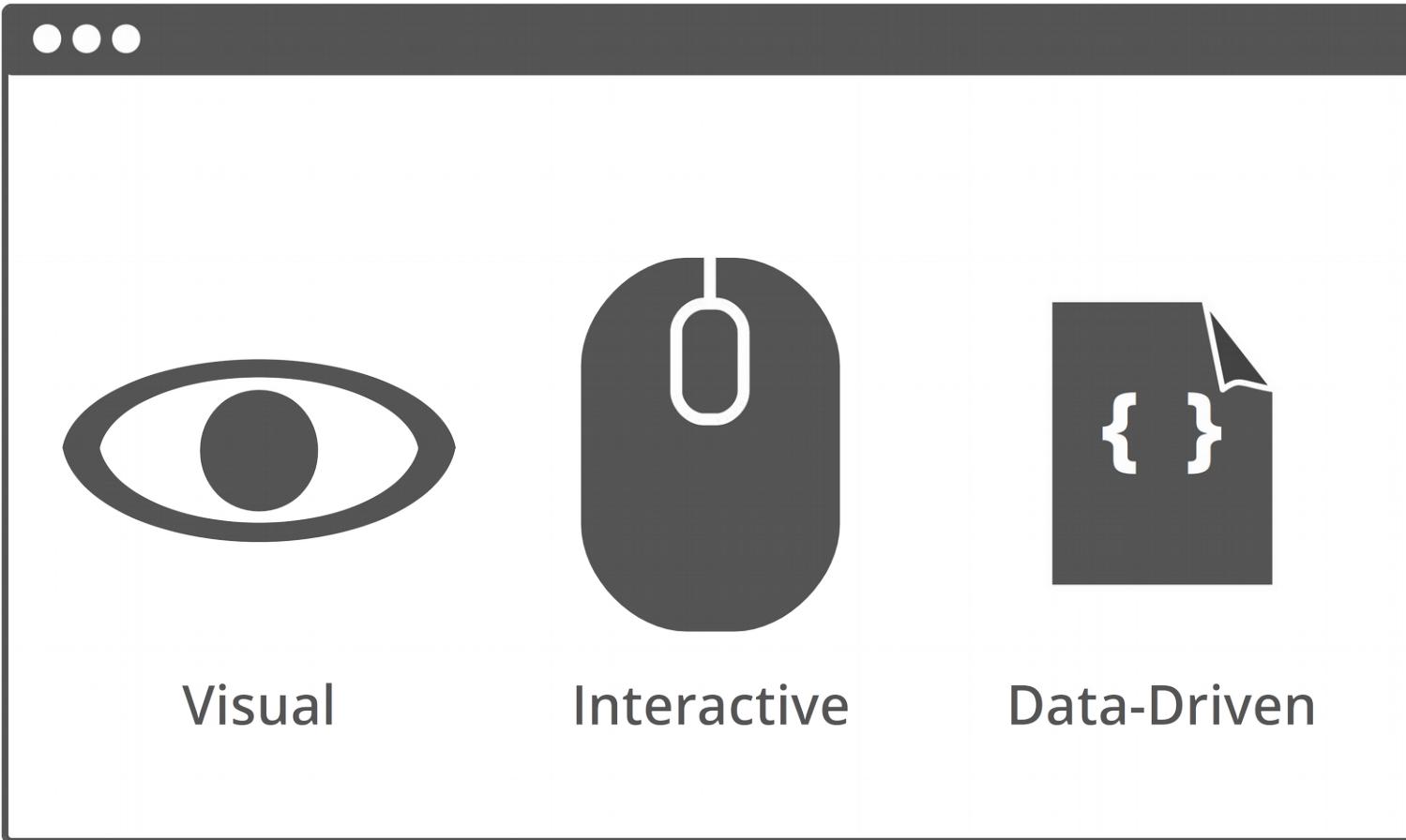
## Users and Concept Maps



- Ed Huai-hsin Chi. 2000. A taxonomy of visualization techniques using the data state reference model. In *Information Visualization, 2000. InfoVis 2000. IEEE Symposium on.* IEEE, 69-75.

*"It makes sense when you explain it."*

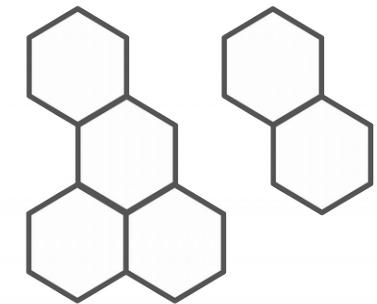
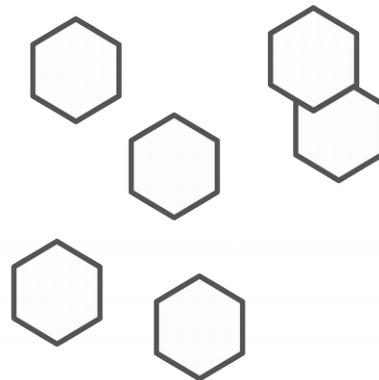
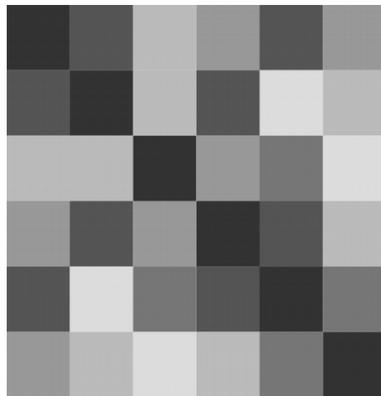
## Explanation Mechanisms



RQ 1.What are the overall effects of data-driven explanations on confidence?

# Explanation Mechanisms

## Reductive / Projective Method



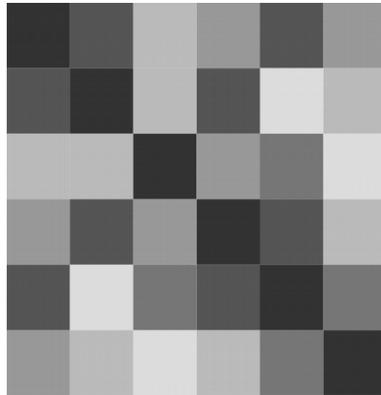
Isomap

Kuhn-Munkres  
Algorithm

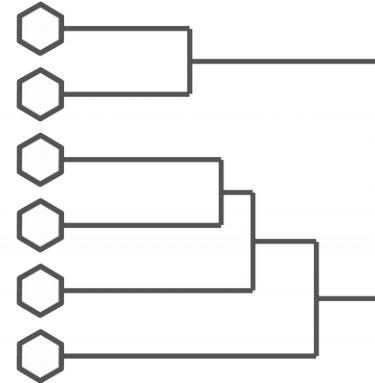
- Ohad Fried, Stephen DiVerdi, Maciej Halber, Elena Sizikova, and Adam Finkelstein. 2015. IsoMatch: Creating informative grid layouts. In *Computer graphics forum*, Vol. 34. Wiley Online Library, 155-166.

# Explanation Mechanisms

Constructive / Agglomerative Method



Complete-link  
Clustering

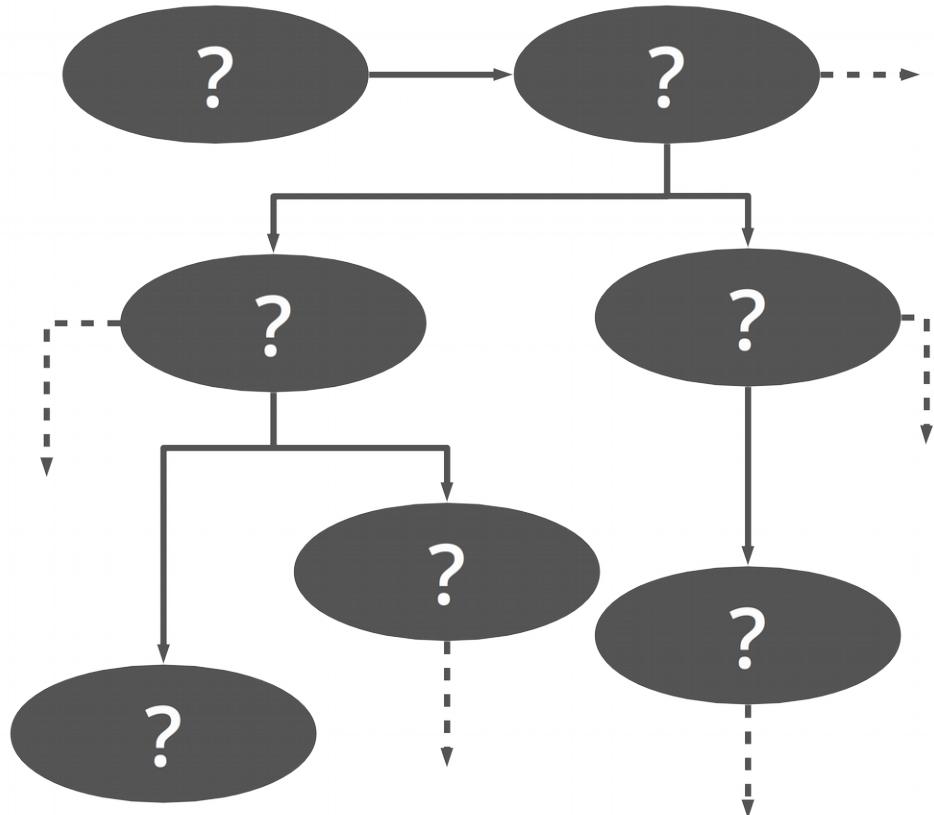


Relative  
Positioning

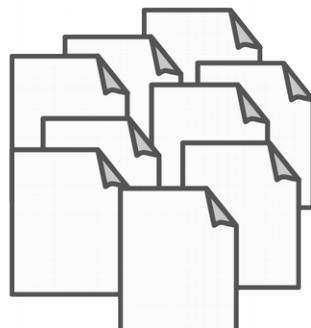


- RQ 1.What are the overall effects of data-driven explanations on confidence?
- RQ 2.What are the specific effects of reductive and constructive methods on confidence?

- Semi-structured scenario-based interviews
- 3 stages:
  1. No explanation
  2. Explanation X (RQ 1)
  3. Explanation Y (RQ 2)



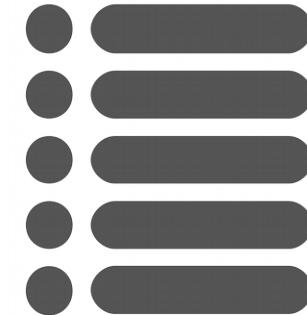
## Concept Data



Corpus



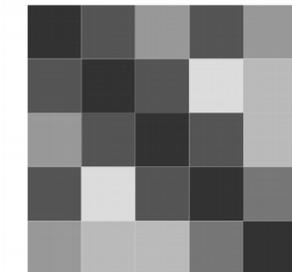
Latent Dirichlet  
Allocation



Concept Data



Cosine Distance

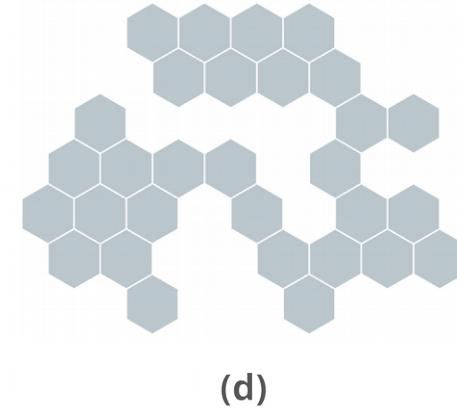
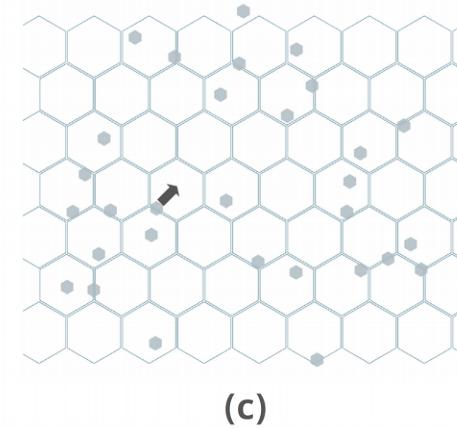
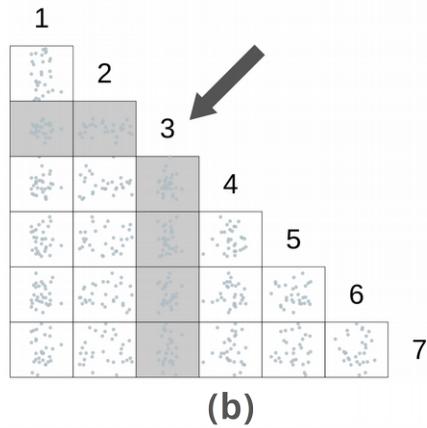
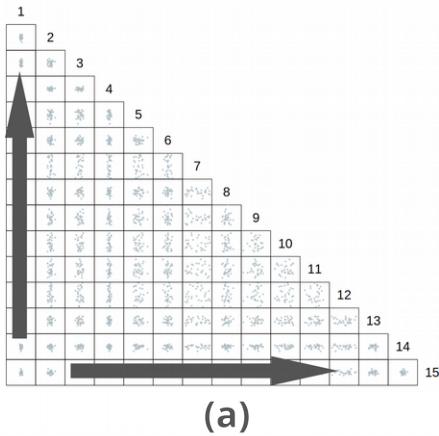


Similarity Data

- Research Councils UK, Gateway To Research, <http://gtr.rcuk.ac.uk>, data retrieved in June 2016, last accessed August 2017
- David M. Blei, Andrew Y. Ng, and Michael I. Jordan. 2003. Latent dirichlet allocation. *Journal of machine Learning research* 3, Jan (2003), 993-1022.

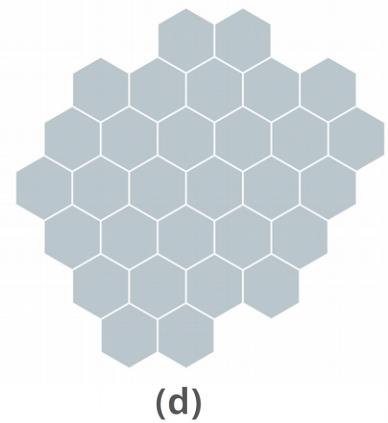
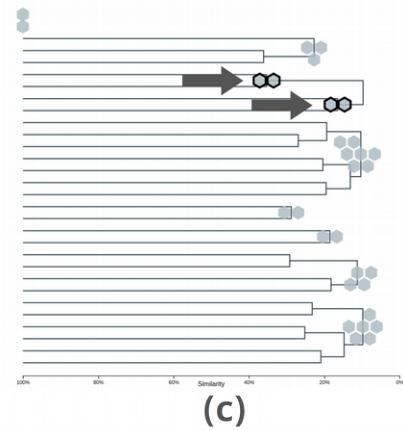
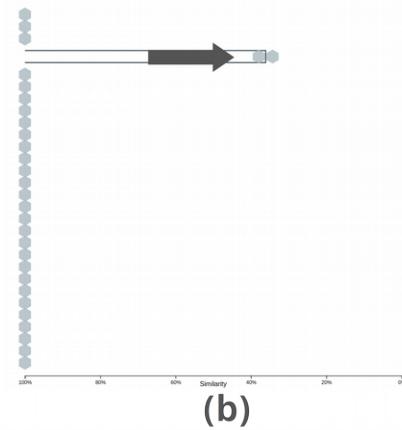
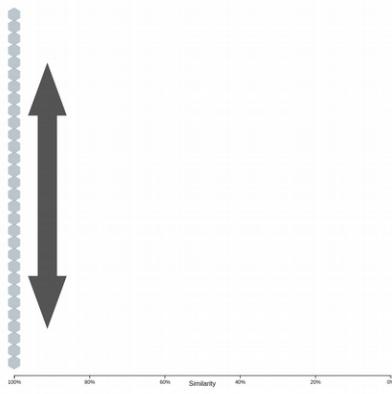
# Applications

## Projective

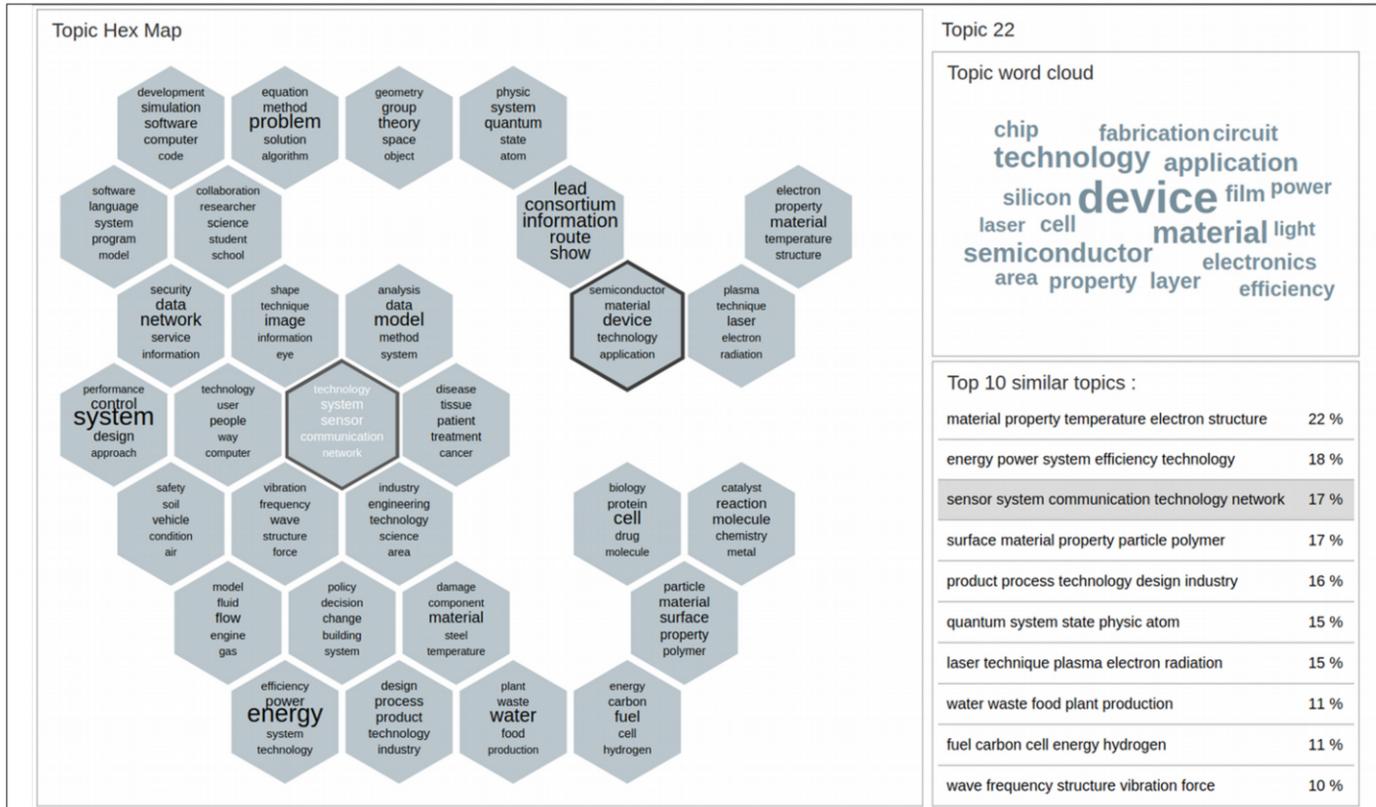


# Applications

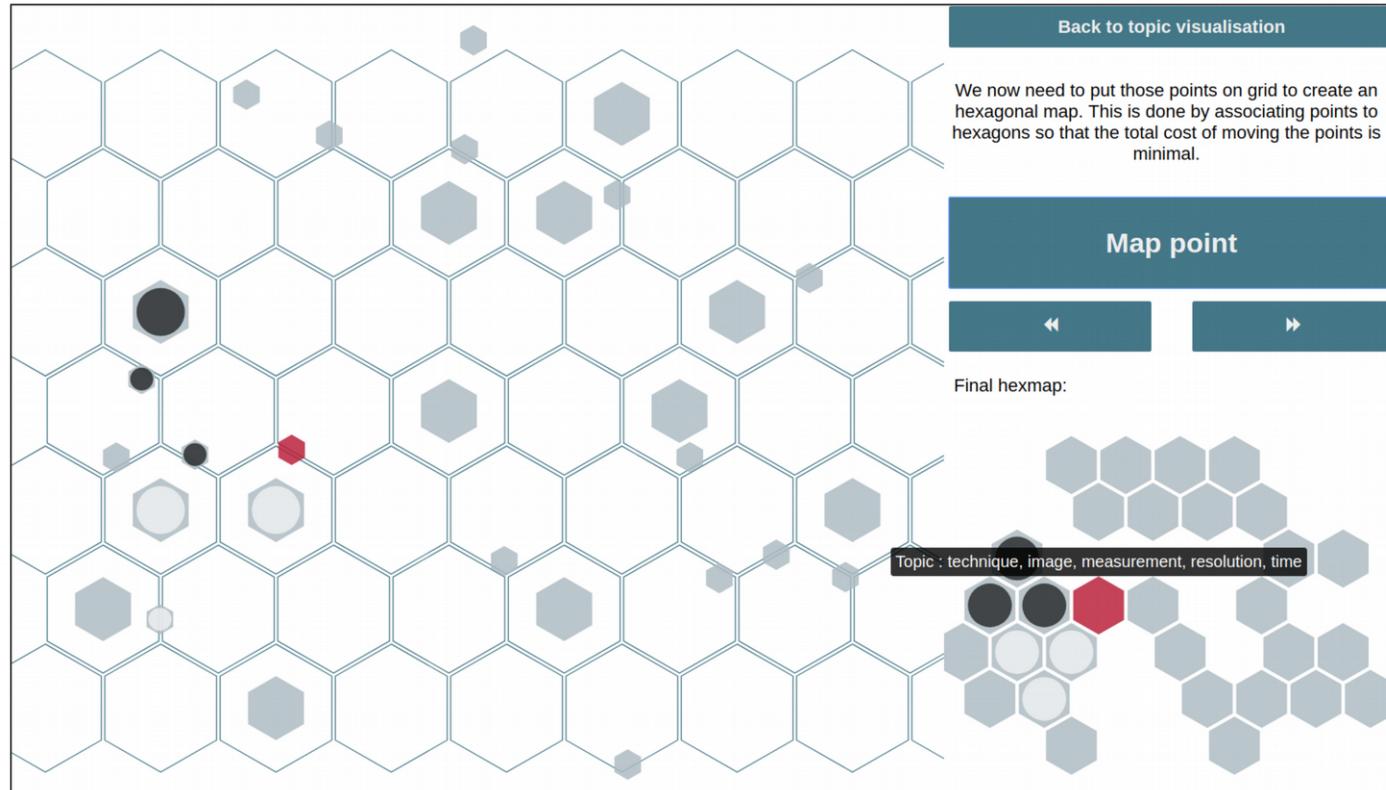
## Agglomerative



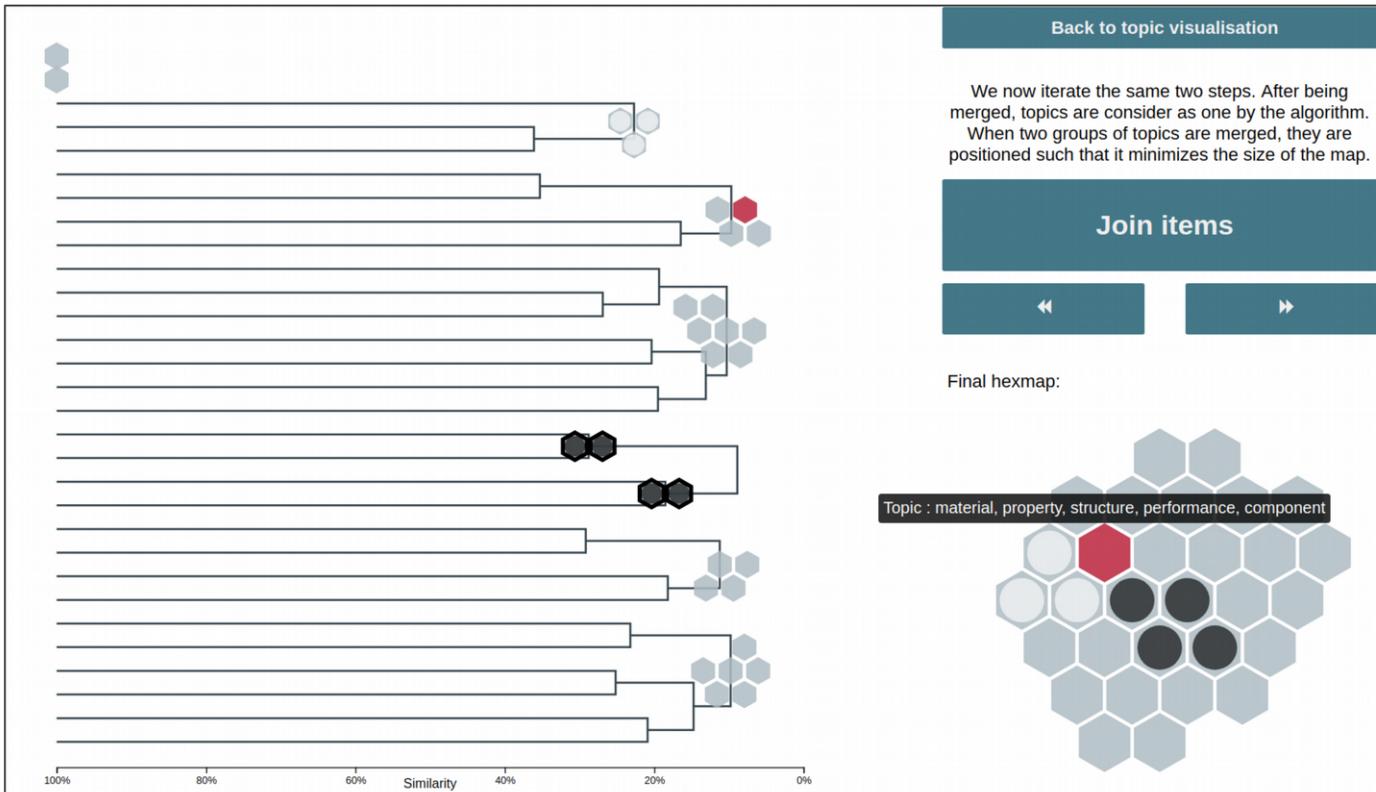
# Applications Interfaces



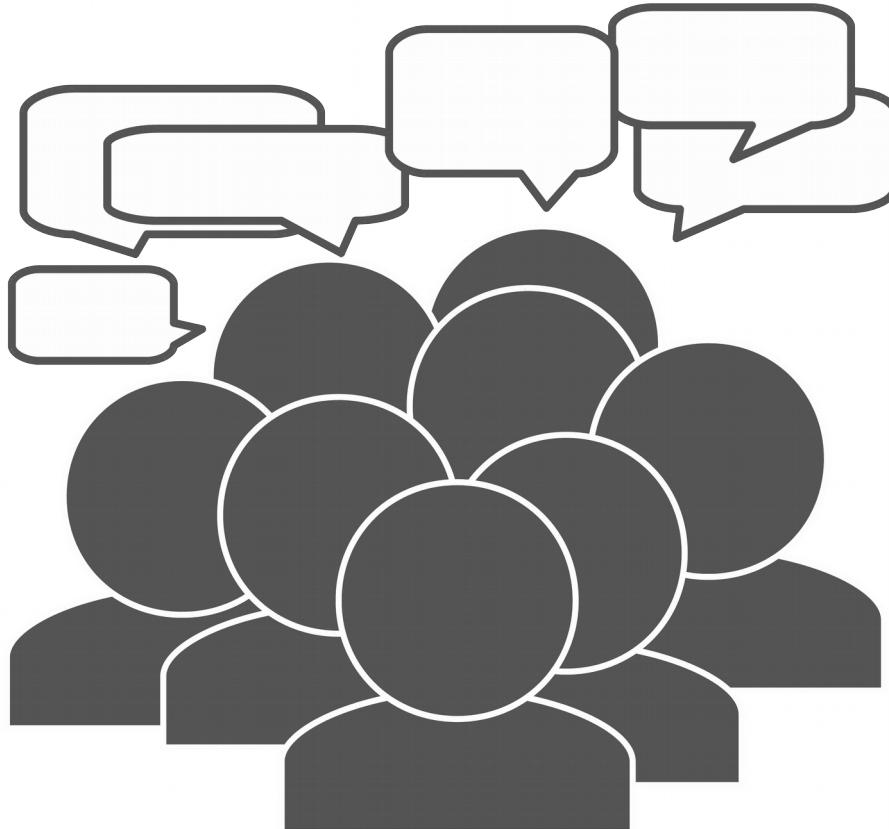
## Concept Map View



## Projective Application



## Agglomerative Application



- 10 Participants
- No expert in Data Visualisation

# Interview Coding



## RQ 1 Results – Overall Effect of Explanations

- Without explanation, participants expressed concerns about their confidence in using concept maps
- With explanation, they reported stronger confidence

## RQ 1 Results – Overall Effect of Explanations

Evidence

- Explanations particular to the underlying data:
  - Increased participants' understanding of the layout decisions
  - Increased participants' perception of concept map robustness
  - Improved participants' confidence in their ability to explain the layout process to stakeholders

## RQ 1 Results – Overall Effect of Explanations

### Interactivity

- Incorporating interactivity in data-driven explanations:
  - Let participants have control and understand at their own pace
  - Allowed participants to query individual items
  - Increased engagement and confidence

## RQ 1 Results – Overall Effect of Explanations

Adoptability

- Participants expressed their wish to reuse explanations, to convince and support their arguments

## RQ 2 Results – Specific Effect of Explanations

### Map Density

- Dense layouts appear to force concepts together for participants, creating an unnatural feeling, decreasing their confidence
- Sparser layouts are perceived to make relationships more obvious and meaningful to participants, increasing their confidence

## RQ 2 Results – Specific Effect of Explanations

Process Clarity

- Participants found the agglomerative explanation:
  - Clearer to understand
  - More natural
  - Increasing their confidence in understanding and explaining

- Users are less likely to use visualisations they can not account for
- Implement explanation mechanisms for automatic layouts
- Consider more explainable and controllable layouts methods

# Improving User Confidence in Concept Maps: Exploring Data-Driven Explanations

Pierre Le Bras

[strategicfutures.org](http://strategicfutures.org)

[pl196@hw.ac.uk](mailto:pl196@hw.ac.uk)

[M.J.Chantler@hw.ac.uk](mailto:M.J.Chantler@hw.ac.uk)

Strategic Futures  
Laboratory

