LIBRARY AND INFORMATION CENTER OF
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DEPARTMENT OF SCIENCE POLICY AND SCIENTOMETRICS

Authors' cognitive distance on collaboration networks via Author Bibliographic Coupling Analysis

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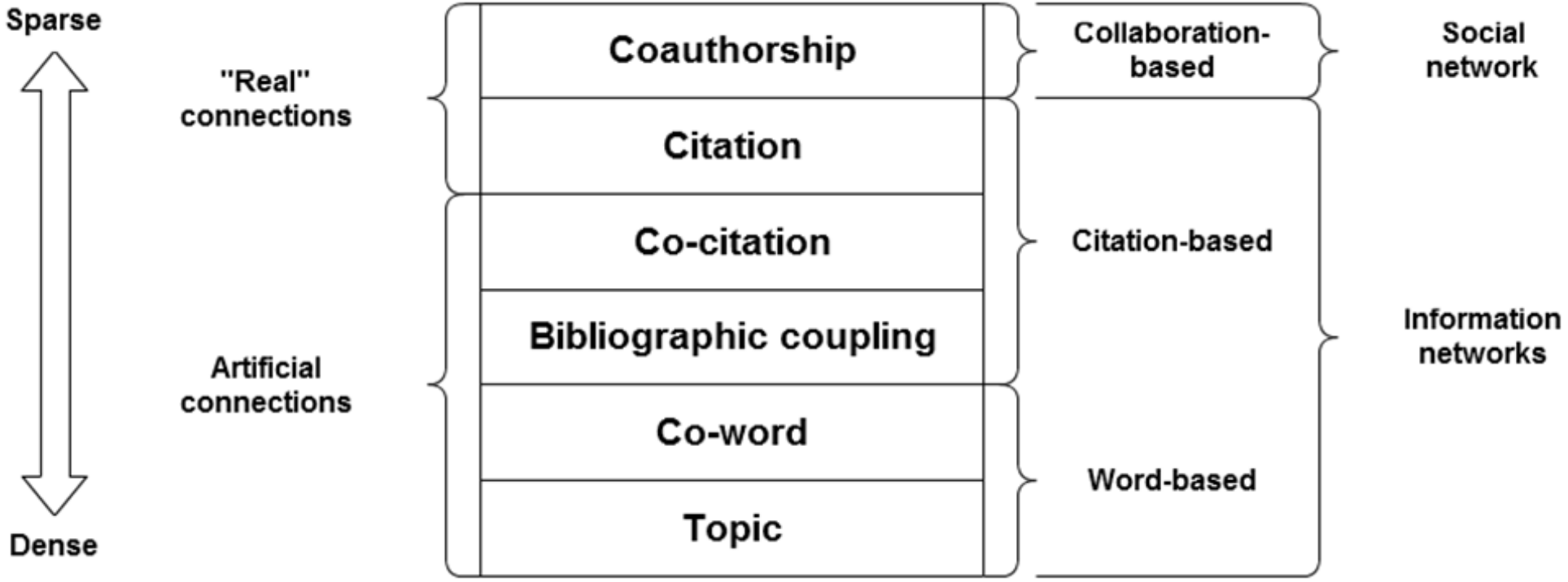
Research Collaboration Networks – RCN

- In this study by ‘collaboration’ we mean only co-authorship.
- Numerous factors influence the formation of research collaboration networks.
- In this study we focus on three main factors: geographical, social and cognitive distance.

Similarities/ Distances

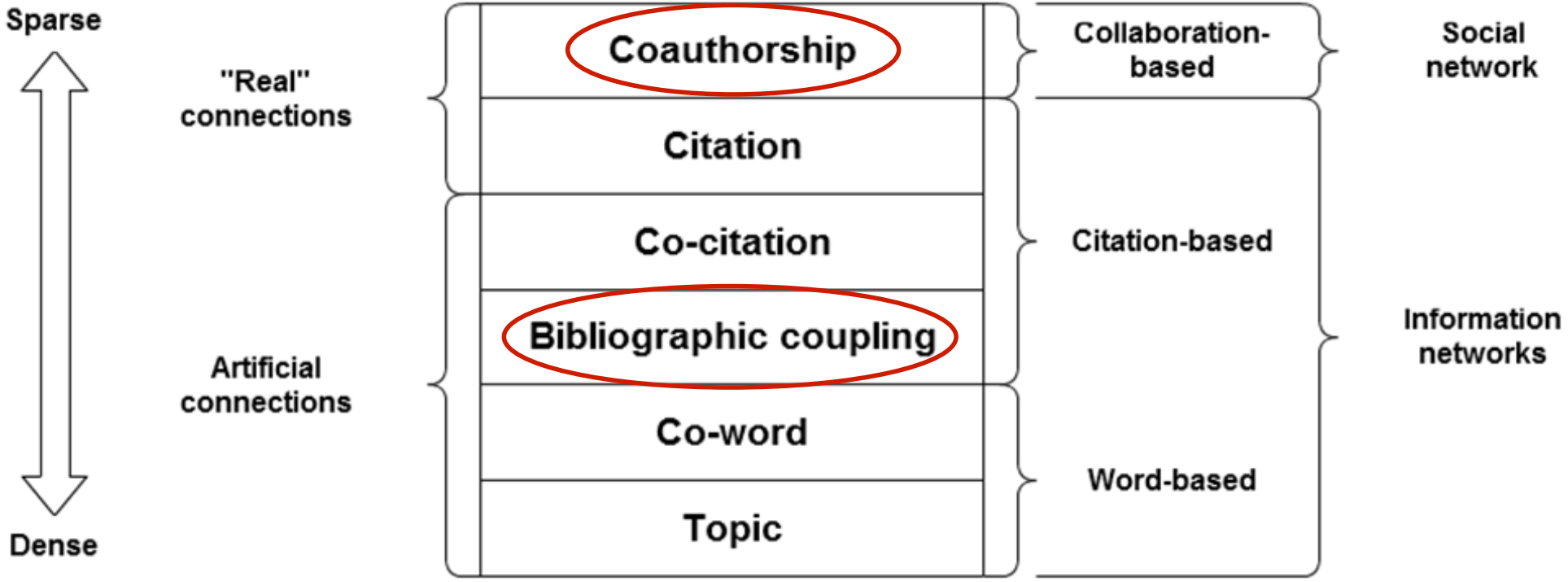
- **The *geographical distance***
  distance in kms between actors (Boschma, 2005, Zitt et al, 2000, Acosta et al, 2011, Hoekman et al., 2010, Frenken et al., 2009)
- **The *social distance***
  dissimilarity of actors along social and economic components (Narin et al. 1991, Zitt et al 2000, Acosta et al 2011).
  researchers' relationships, collaboration (Frenken et al. 2009, White et al. 2004)
- **The *cognitive distance***
  *dis*similarity of researchers' knowledge base (Frenken et al., 2009, Small, 1973, Yan and Ding, 2012, Boyack and Klavans, 2010, Jarneving, 2007, Kessler, 1963)
  Measuring via artificial connections as co-citation, Bibliographic coupling (BC), co-word or topic detection analyses

Viewing scholarly networks from different perspectives



Source: Yan and Ding, 2012, 1331 p.

Viewing scholarly networks from different perspectives



Source: Yan and Ding, 2012, 1331 p.

Research questions

1. How can we measure social and cognitive similarity between authors?
2. What does cognitive similarity contain?
3. What is the relation between social and cognitive similarity?
4. Are there any differences at structure formations between ”hard” and „soft” science fields?

Data

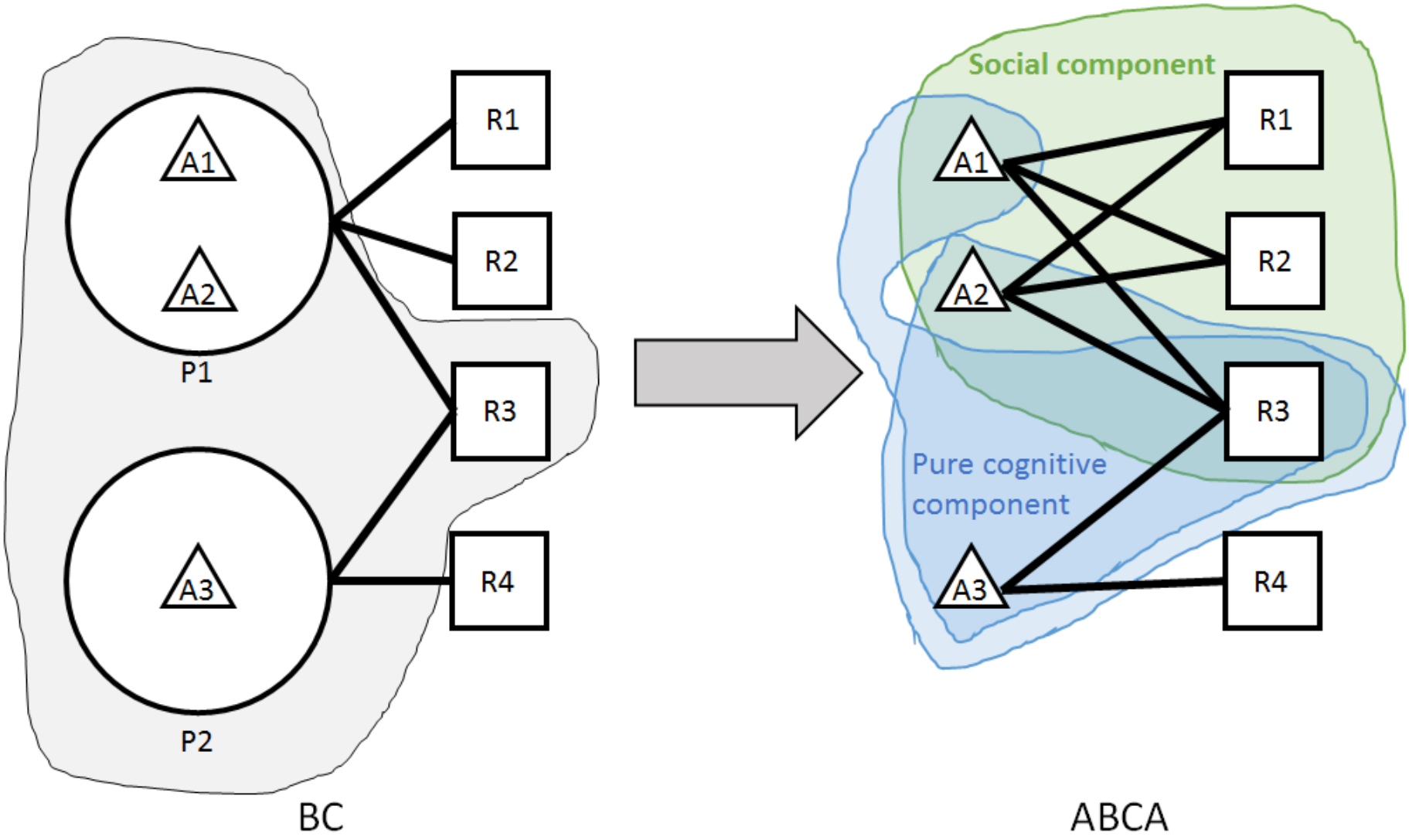
- We analyzed WoS records of two fields with cited references between 2010-2014 which contain at least one Hungarian author.
- We chose a “soft” field, economics and a “hard” one, physical geography
- We don’t only use the tighter Web of Science Category (WC). We use those WCs which are in strong relation with these WCs.
- The chosen WCs:
  - **economics:**
    - agricultural economics & policy;
    - business, finance;
    - economics;
  - **physical geography:**
    - geography, physical;
    - geosciences, multidisciplinary;
    - imaging science & photographic technology;
    - remote sensing;
    - engineering, geological

METHODS

ABCA – Author Bibliographic Coupling Analysis

- Bibliographic coupling (BC) is a method addressing the cognitive similarity of papers based on the overlapping in references (Kessler, 1963, Jarneving, 2007)
- ABCA is a version of BC which addresses the similarity of authors by the overlap between the aggregated references of their papers. (Zhao and Strotmann 2008a, 2008b)

Similarities on Author level – New model



Methods

- ***Full cognitive distance:*** We set up the ABCA adjacency matrix and we determined the similarity between authors with Salton's Cosine similarity (Hamers et al., 1989, Nguyen and Bai, 2010).
- ***Social distance:*** As we saw in the previous Figure the social component derives from co-authorship. To determine it, we described the co-authorship with similarity matrix using Salton's Cosine similarity.
- **P*ure cognitive distance:*** We subtracted the social component similarity matrix from the entire cognitive similarity matrix.

Methods

- We compared the three similarity matrices
- For comparison we obtained a network analitic method called Qadratic Assignment Procedure (QAP) correlation.
- From the three similarity matrices we created weighted non-directed networks:
  - Nodes: authors
  - Edges: similarity values
- We compare the three networks via different QAP correlation.
- For the calculation we used the R statistical software (R Core Team, 2015, Meyer and Buchta, 2015).

FINDINGS

Size of dataset – Hungarian articles between 2010-2014 in two fields

	Economics	Physical Geography
Number of articles	722	653
Number of articles with cited references	470	644
Number of authors	704	2294

Main characteristics of networks

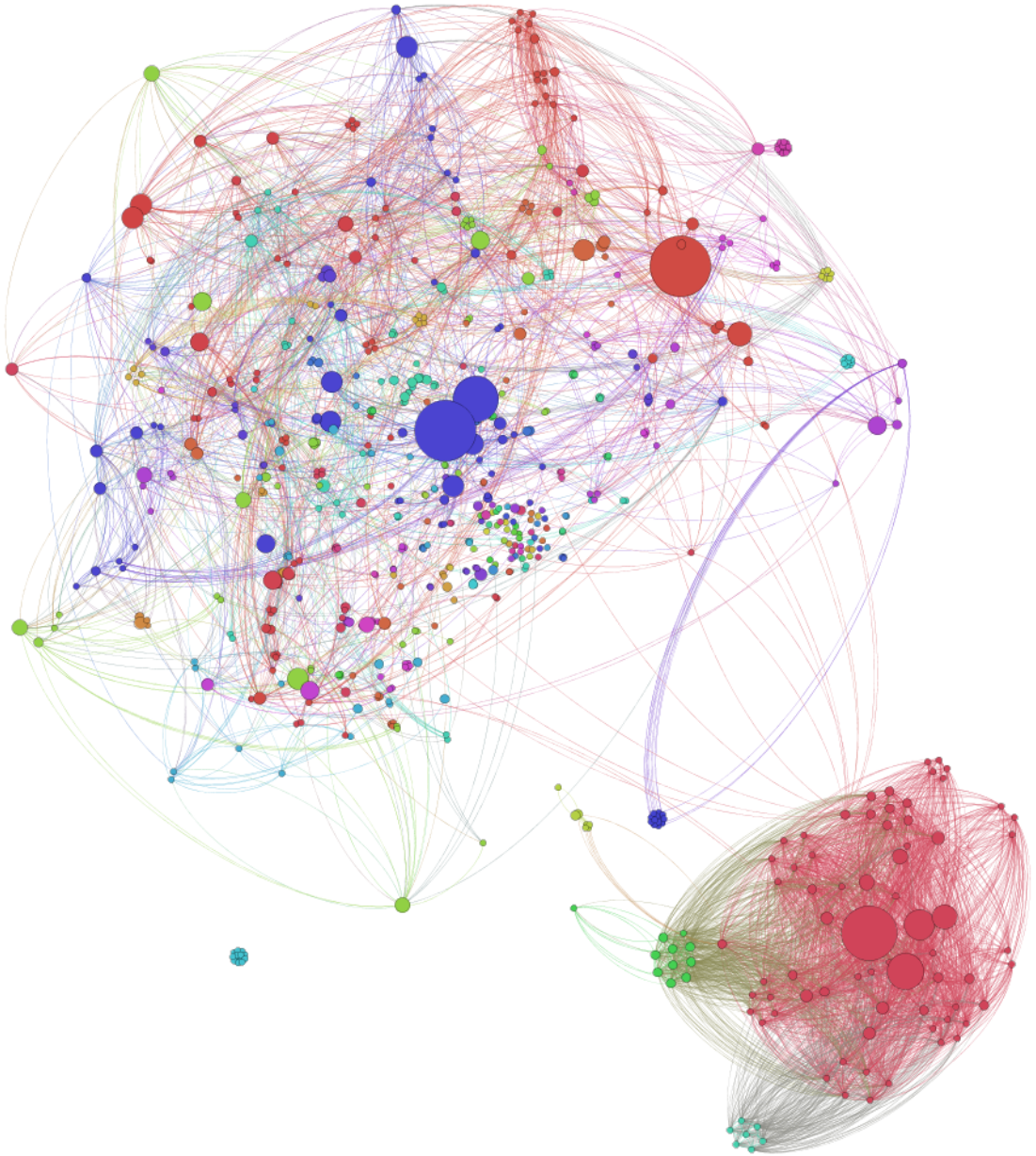
		Economics	Physical Geography
Full cognitive network	*# nodes*	704	2294
	# edges	5145	67282
	density	2.0792	2.5582
Social network	*# nodes*	704	2294
	# edges	1347	16351
	density	0.5443	0.6217
Pure cognitive network	*# nodes*	704	2294
	# edges	4874	61157
	density	1.9696	2.3253

QAP correlation between networks

Economics	*Full cognitive network*	*Social network*	*Pure cognitive network*
Full cognitive network	1	0.9872	0.1899
Social network	0.9872	1	0.0311
Pure cognitive network	0.1899	0.0311	1

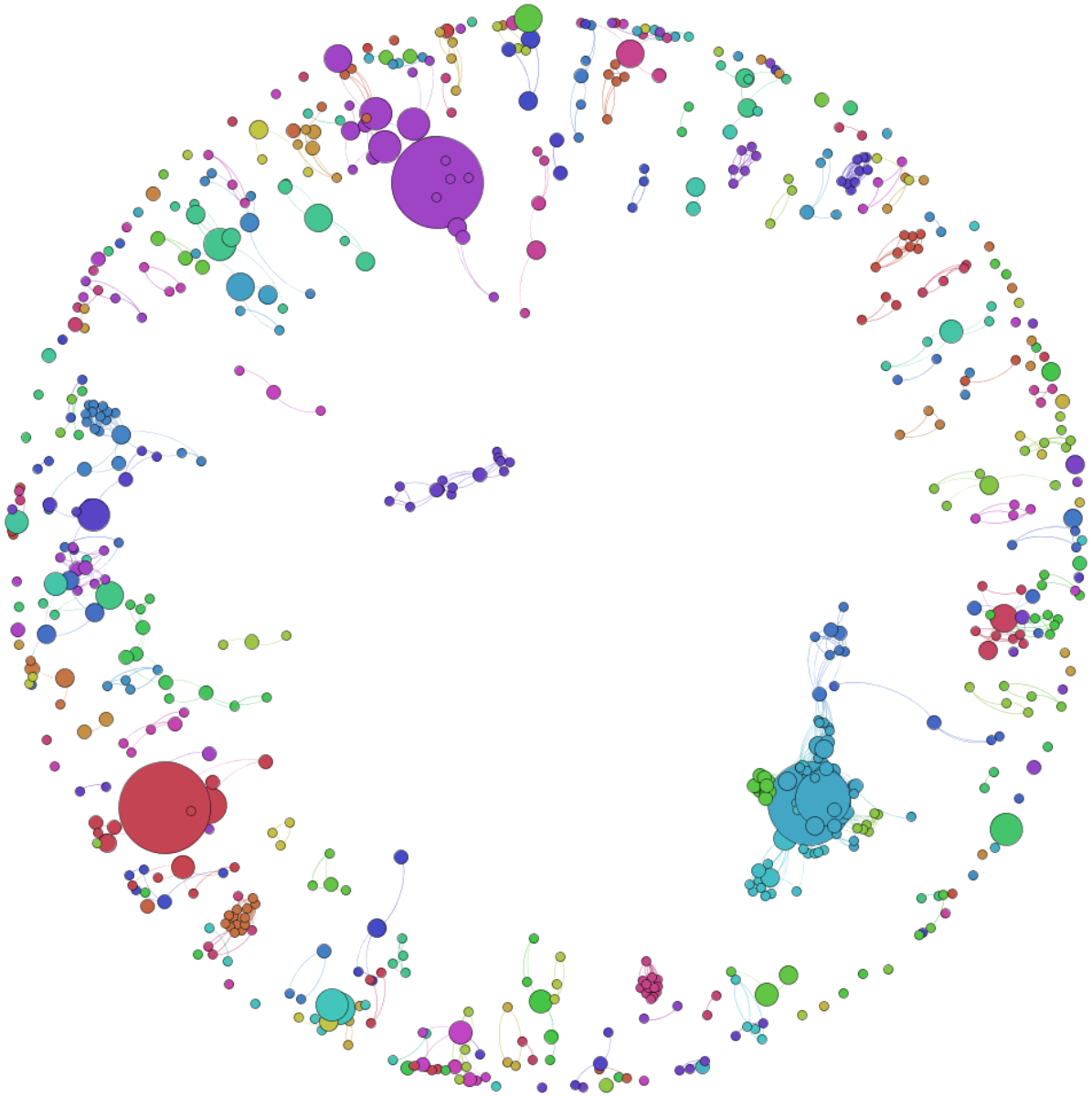
Physical Geography	*Full cognitive network*	*Social network*	*Pure cognitive network*
Full cognitive network	1	0.9896	0.1930
Social network	0.9896	1	0.0499
Pure cognitive network	0.1930	0.0499	1

Entire cognitive network - Economics

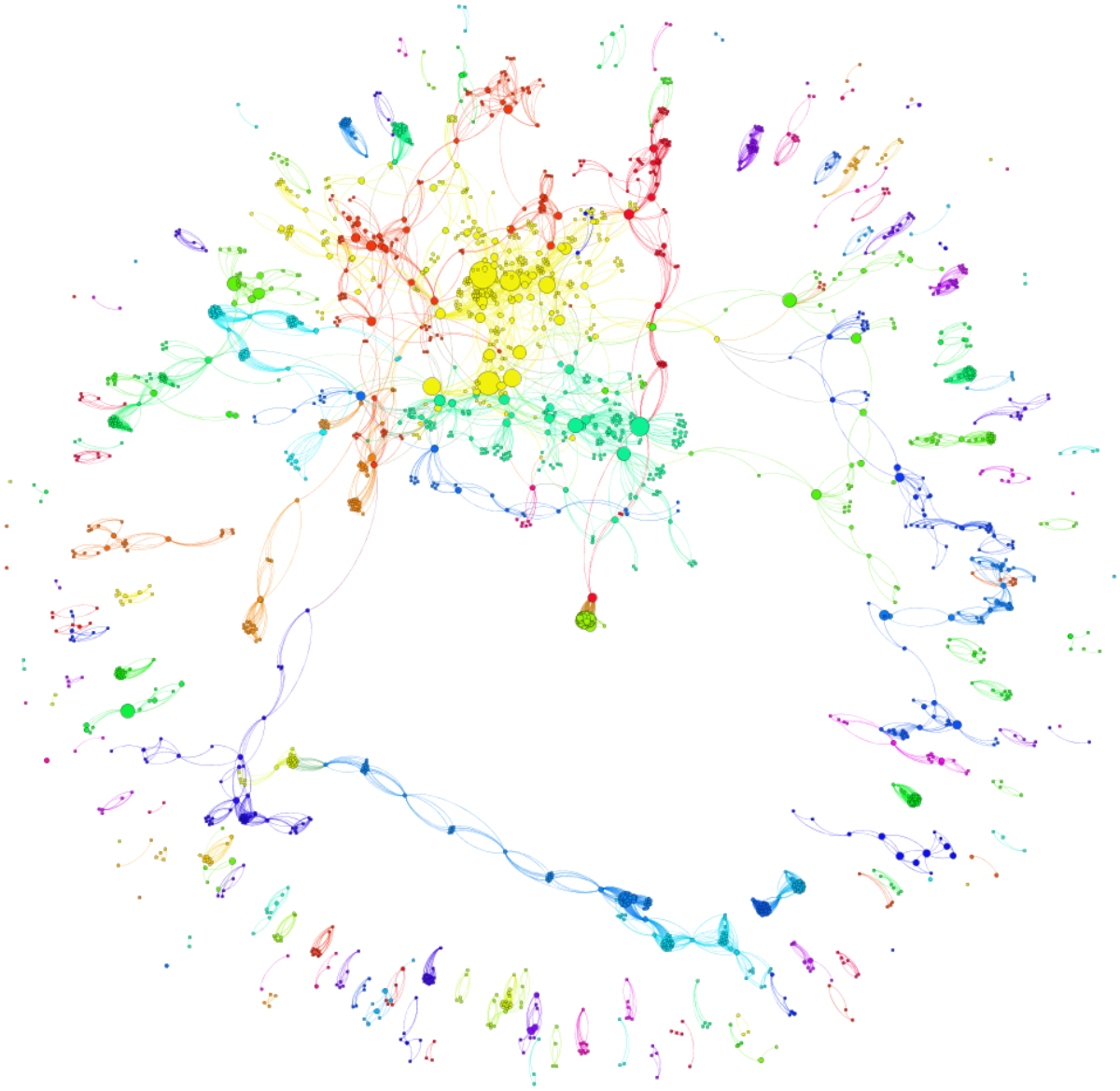


Entire cognitive network - Physical Geography

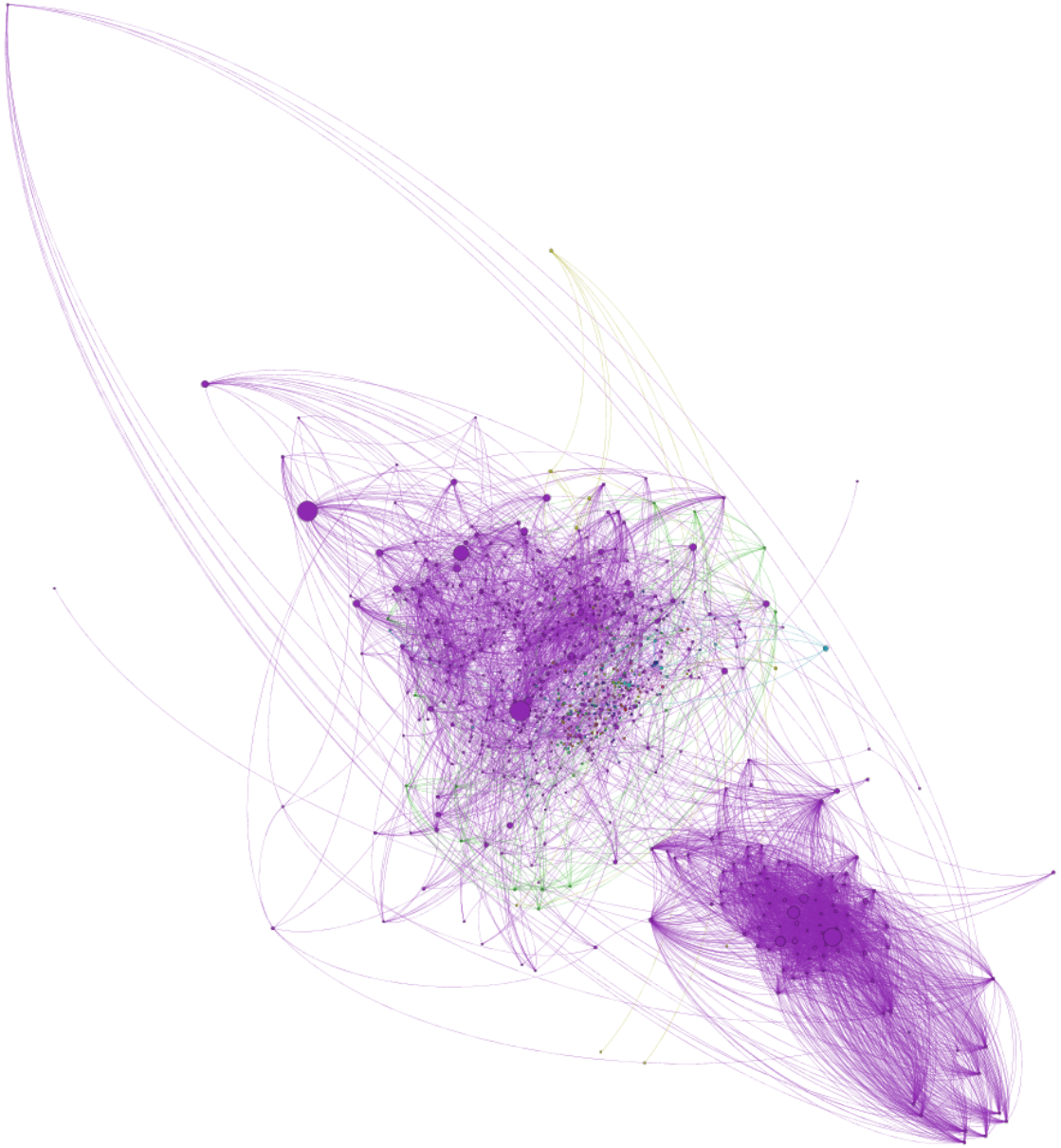
Social network - Economics



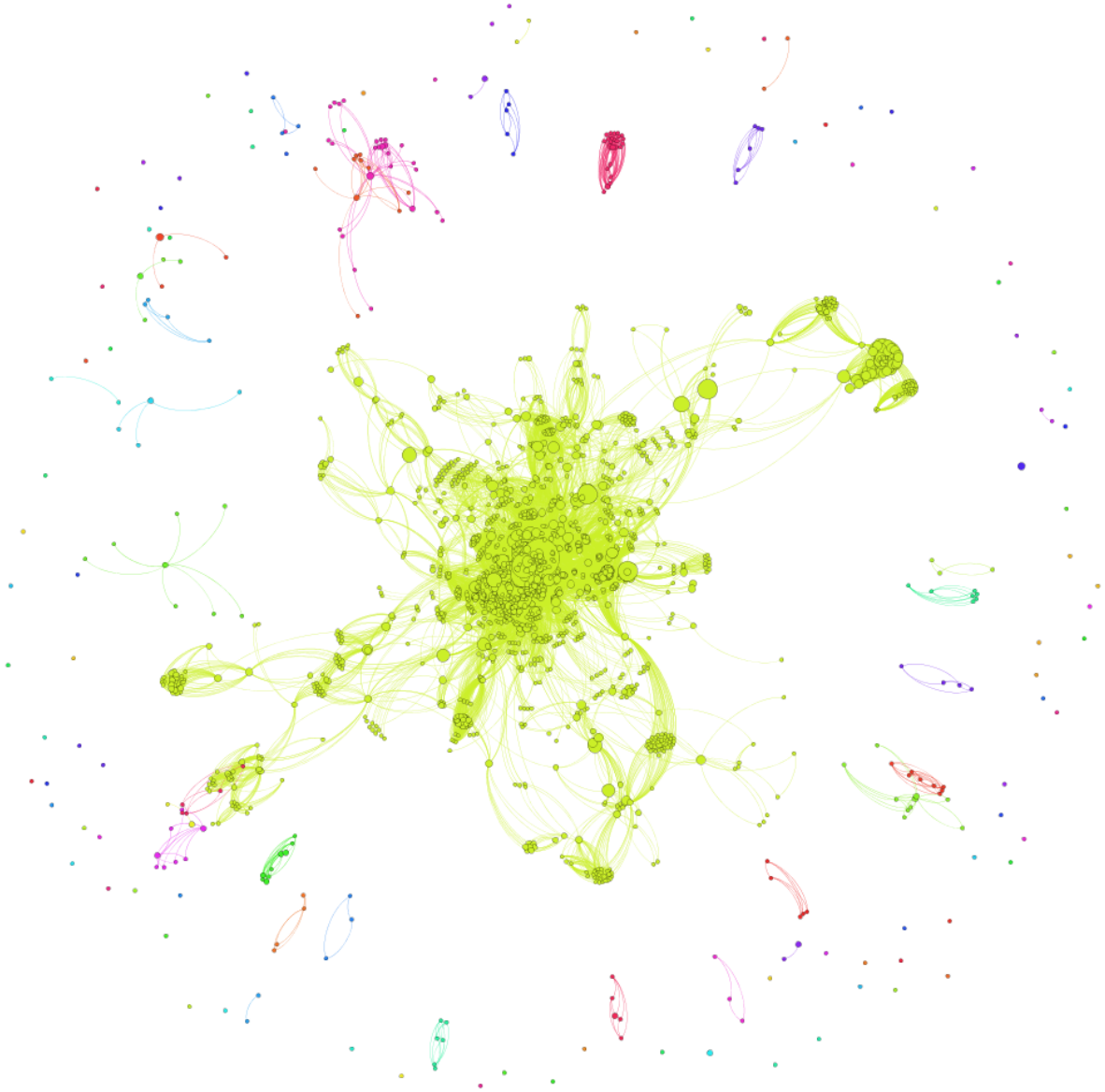
Social network - Physical Geography



Pure cognitive network - Economics



Pure cognitive network - Physical Geography



Summary

- We determine the entire cognitive distance between authors via ABCA
- We separate two components within entire cognitive distance
  - Social component which derives from co-authorship
  - Pure cognitive component; the cognitive distance without the effect of co-authorship
- The social component had a stronger relation with entire cognitive distance than pure cognitive distance. This was more relevant in Physical Geography

THANK YOU!

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