Knowledge Synthesis in the Cultural Evolution Literature

Exploratory analysis

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Outline

General project partners

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Outline

Surveying cultural evolutionists I

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comment

Grand challenges for the study of cultural evolution

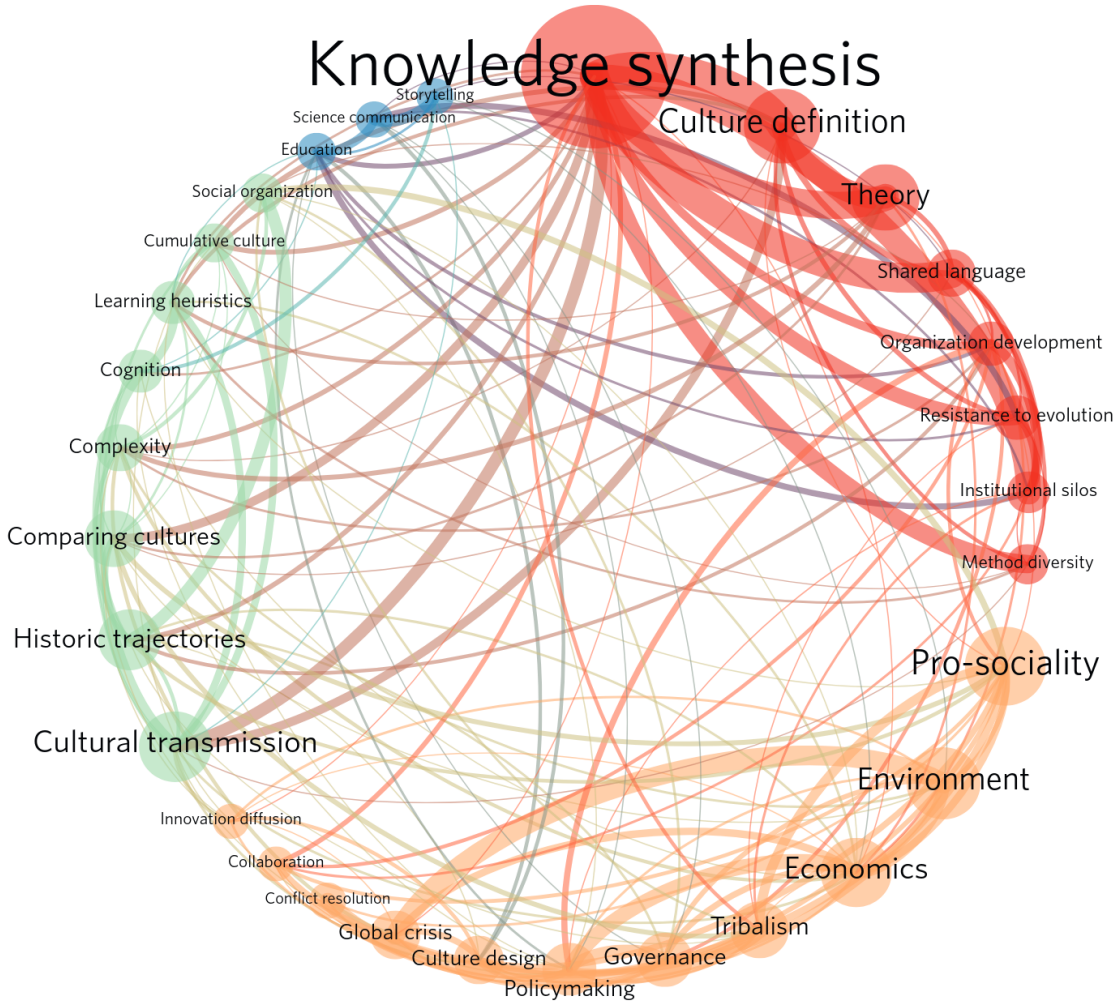
J. Brewer, M. Gelfand, J. C. Jackson, I. F. MacDonald, P. N. Peregrine, P. J. Richerson, P. Turchin, H. Whitehouse and D. S. Wilson

The founding members of the Cultural Evolution Society were surveyed to identify the major scientific questions and 'grand challenges' currently facing the study of cultural evolution. We present the results and discuss the implications for an emergent synthesis in the study of culture based on Darwinian principles.

Surveying cultural evolutionists II

A total of 236 [Cultural Evolution Society] members from around the world completed an online questionnaire in which they could nominate challenges and provide a brief description and rationale for each. A total of 422 grand challenge ideas (GCIs) were received. These GCIs were analysed using close-text semantic analysis, in which each text entry was carefully read and coded for thematic content. (Brewer & MacDonald, 2015, p.6)

Surveying cultural evolutionists III



(Brewer et al., 2017, p.1)

Surveying cultural evolutionists IV

Integration as a grand challenge Progress toward a twenty-first century synthesis in the study of cultural evolution has been slow. (Brewer et al., 2017, p.1)

. . .

Knowledge Synthesis *deals with the need to combine information across disparate fields of inquiry, such as bridging research from social psychology with anthropological studies of indigenous cultures. Each entry tagged with this theme was a call for synthesis and integration of knowledge to tackle otherwise intractable problems. (Brewer et al., 2017, suppl.)*

Surveying cultural evolutionists V

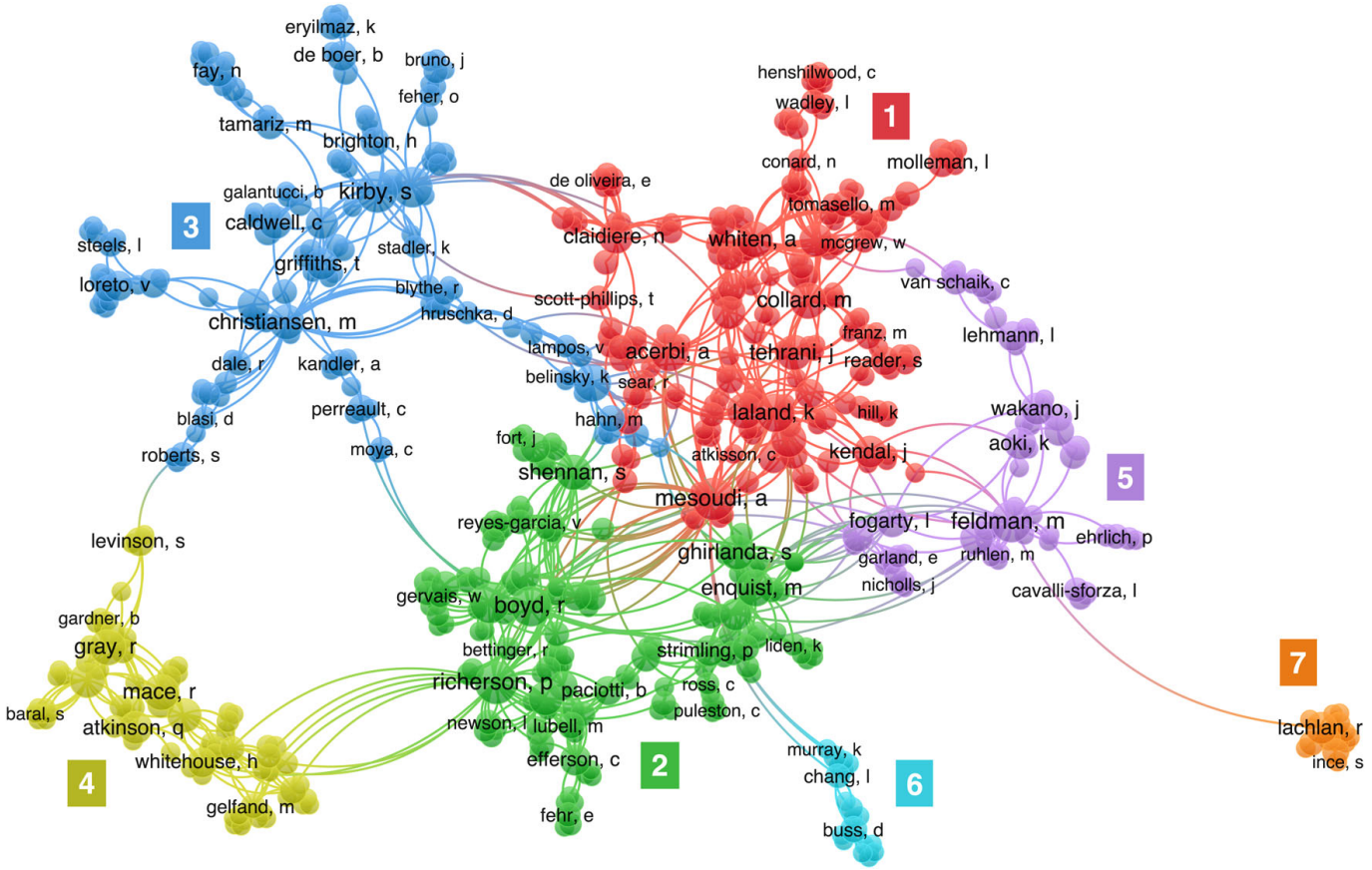


Fig. 2 The largest connected co-authorship network in the dataset, analyzed using VOS clustering ($n = 629$). Red corresponds to group 1 ("biological anthropology and archeology"; $n_1 = 183$), green corresponds to group 2 ("mathematical modeling and dual-inheritance theory"; $n_2 = 146$), blue corresponds to group 3 ("cognitive linguistics and experimental cultural evolution"; $n_3 = 134$), yellow corresponds to group 4 ("cross-cultural and phylogenetic studies"; $n_4 = 75$), purple corresponds to group 5 ("computational biology and cultural niche construction"; $n_5 = 56$), cyan corresponds to group 6 ("evolutionary psychology"; $n_6 = 20$), and orange corresponds to group 7 ("behavioral ecology and birdsong"; $n_7 = 15$). Name size indicates total link strength. Many authors were arbitrarily excluded from the figure by the visualization algorithm in VOSviewer to maximize legibility. A complete, interactive version of the network can be found in the Dataverse repository entry: https://doi.org/10.7910/DVN/LBIDEL

Outline

General project

Main research questions

1. What are the constraint(s) to knowledge integration (CKI) in cultural evolution studies?
2. How should we address them?

Some considerations

- There are probably different types of constraint at play (epistemic, non-epistemic)
- Some types of CKI might influence others (e.g., social constraints promoting conceptual constraints)
- Even if different types of CKI coexist, they might differ greatly in their relative importance

Steps of the project

Three analyses will be successively conducted:

1. Replication and update of Youngblood and Lahti (2018)'s analysis
   - Identification of schools of thought in the field + analysis of collaboration dynamics among them
   - Provides a portrait of the community structure for analysis 3
2. N-dimensional analysis of sources of disagreement (application of Hellsten et al., 2020)
   - Comparison of determining factors for CKI (epistemic vs. semantic vs. social)
   - Will provide a portrait of the types of influence between CKIs for analysis 3 + partial response to questions 1 and 2
3. Analysis at the (full) scale of the study of cultural evolution
   - Analysis of epistemic and non-epistemic constraints
   - Will provide answers for questions 1 and 3

Outline

Corpus description

Collection

- Source: Web of Science via the Observatoire des Sciences et Technologies
- Query: documents with “cultural evolution” in the title, keywords, Keywords Plus or abstract (WoS “topics”)*

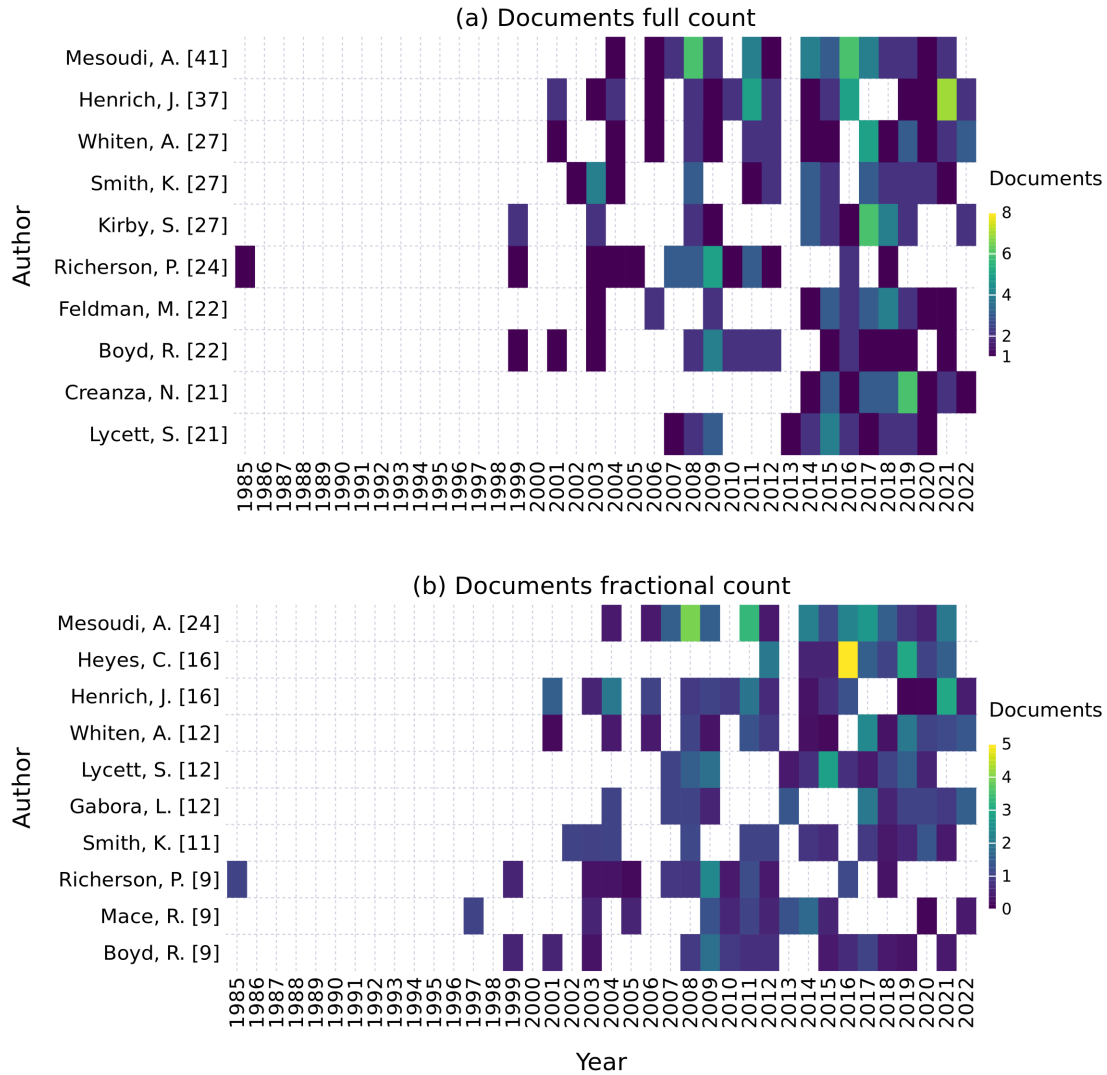
* Same query as Youngblood and Lahti (2018), but including documents published up to 2022, instead of 2017

Description

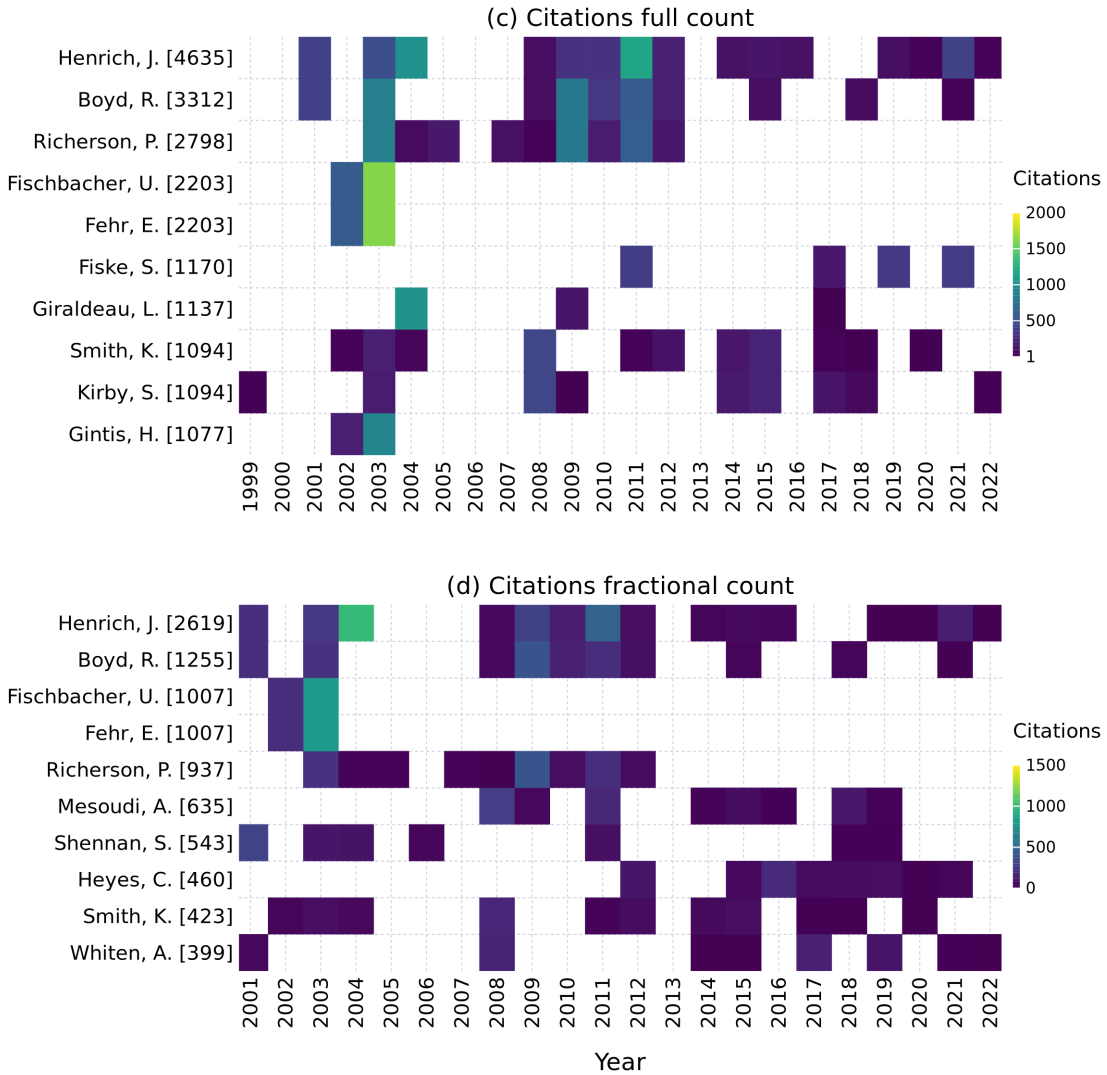
- 2,817 documents; 2,418 unique (with DOI); 1,589 with full text available
- 4,547 authors, 808 journals, 8,590,770 tokens, 92,545 types

Authors analysis I

Authors analysis II



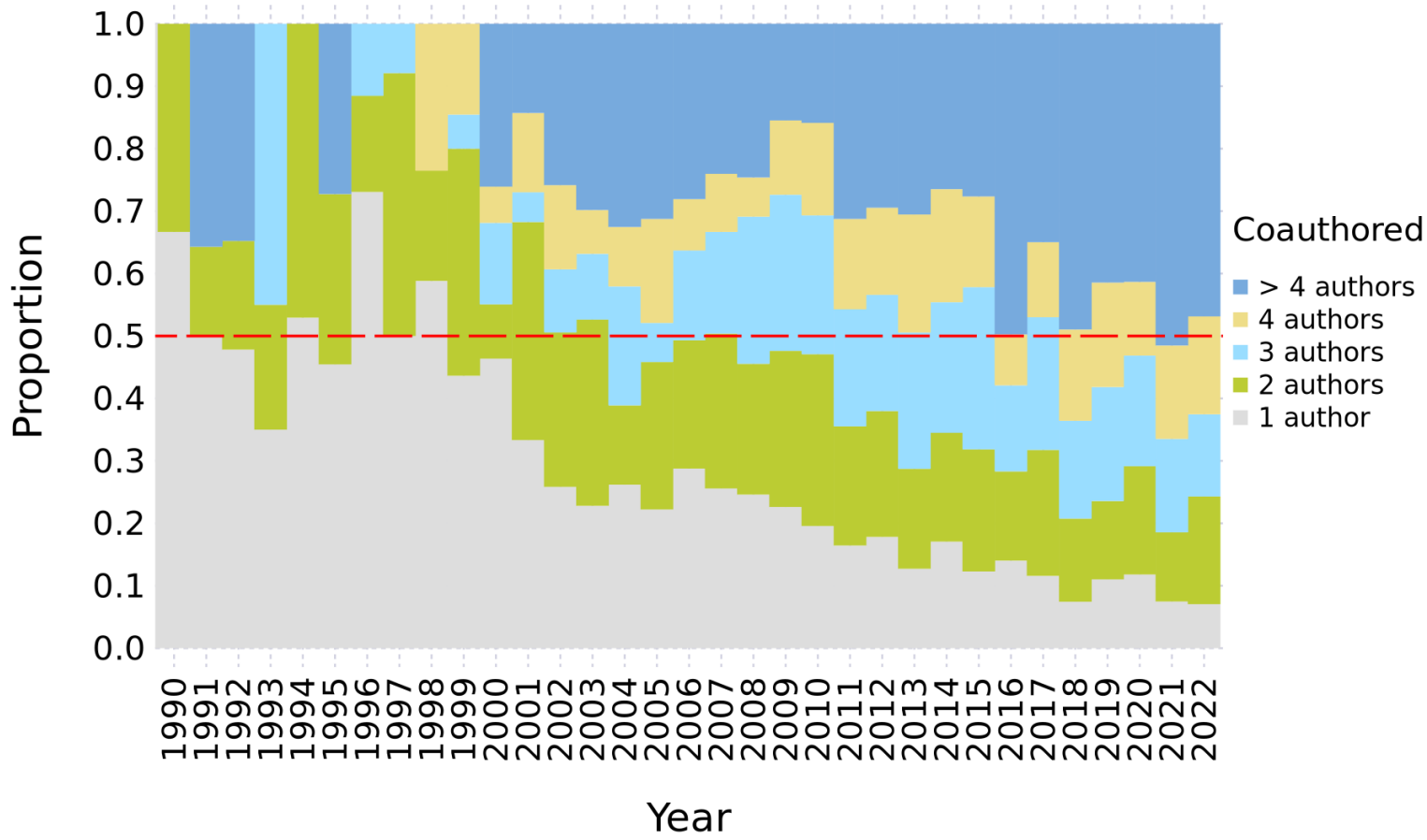
Authors analysis III



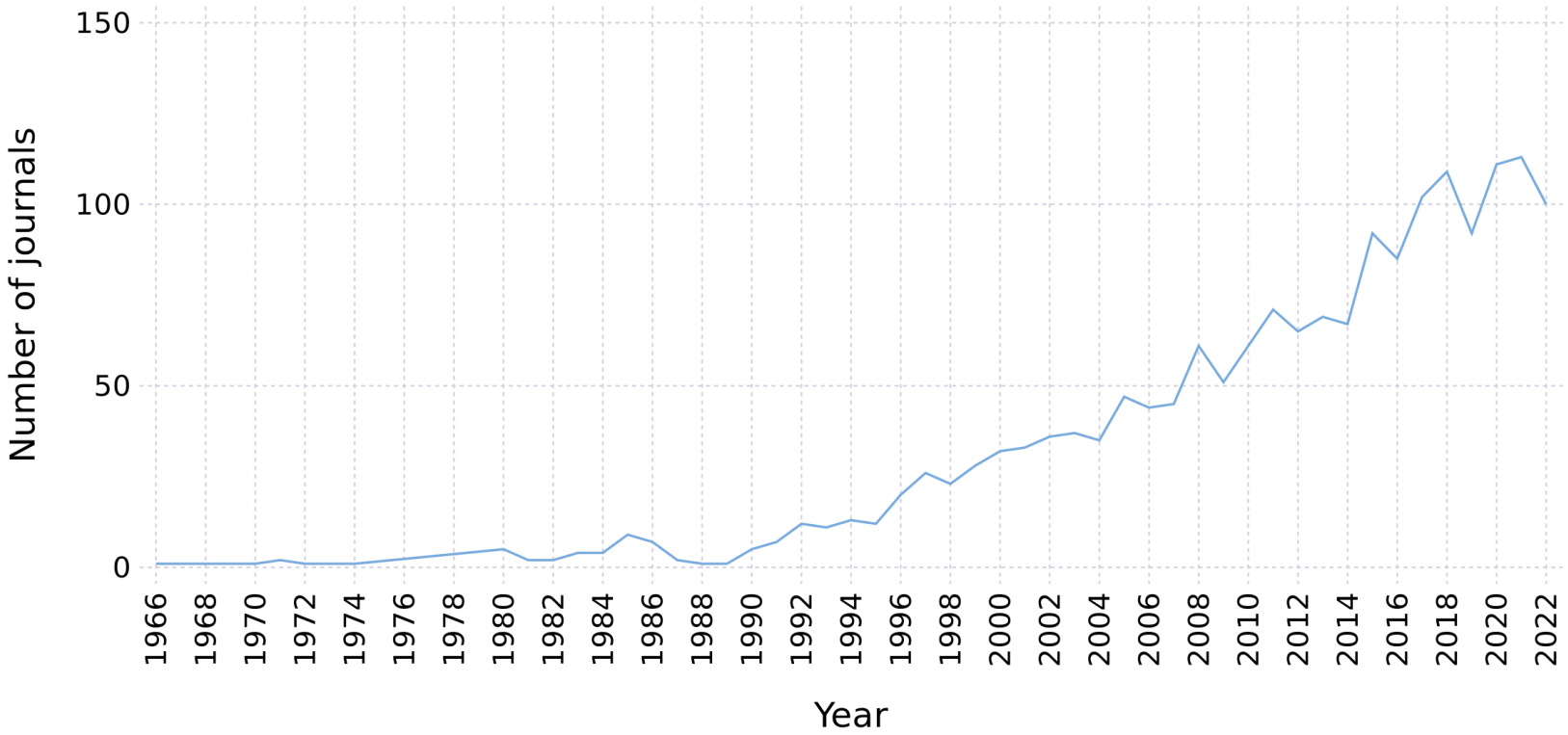
Authors analysis IV

Author name	Rank (full count)	Rank (fractional count)	Change
Henrich, J.	1	1	0
Boyd, R.	2	2	0
Richerson, P.	3	5	-2
Fehr, E.	4	3	1
Fischbacher, U.	5	4	1
Fiske, S.	6	13	-7
Giraldeau, L.	7	18	-11
Kirby, S.	8	11	-3
Smith, K.	9	9	0
Gintis, H.	10	12	-2
Whiten, A.	15	10	5
Mesoudi, A.	16	6	10
Shennan, S.	18	7	11
Heyes, C.	46	8	38

Authors analysis V



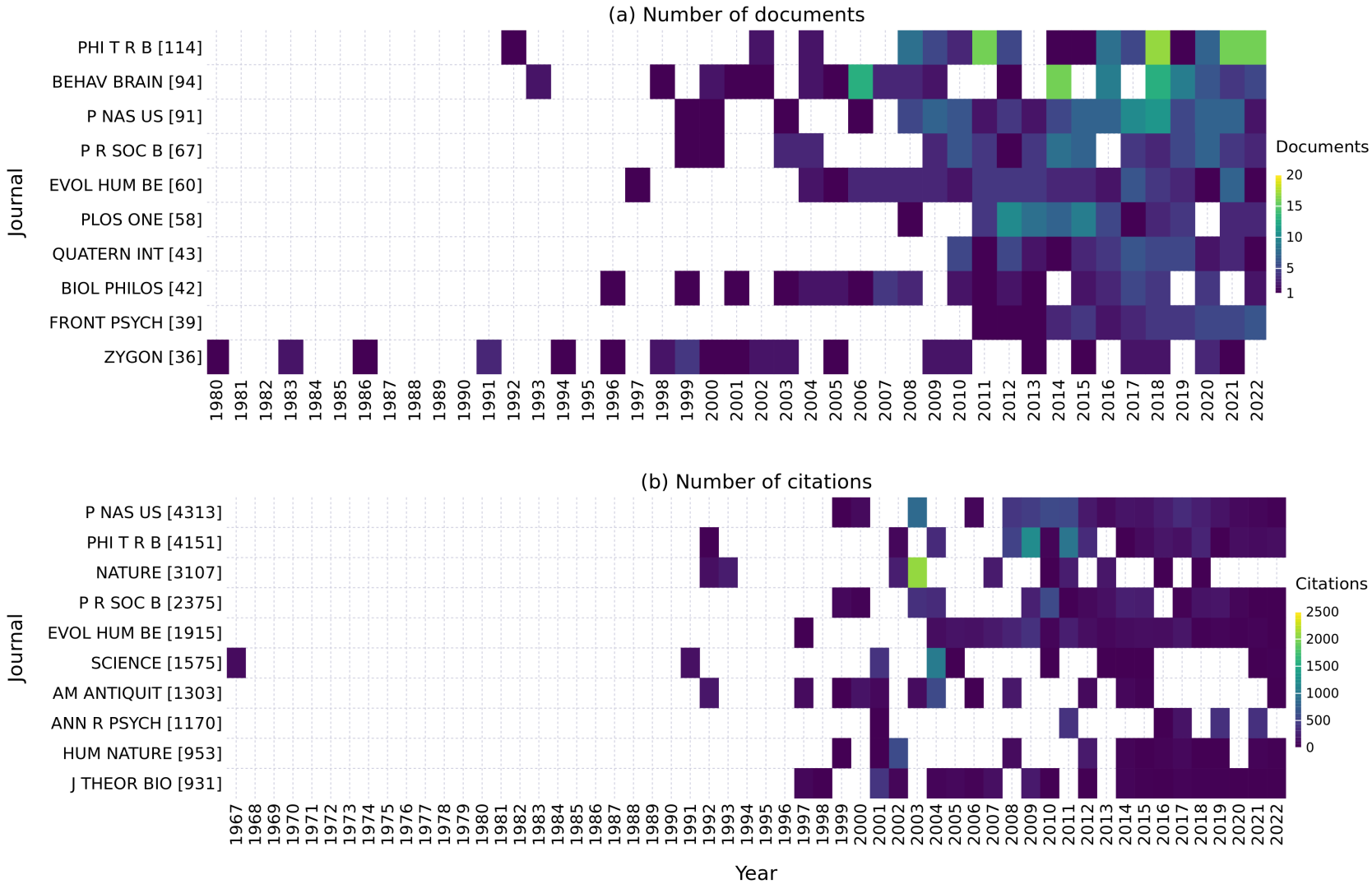
Journals analysis I



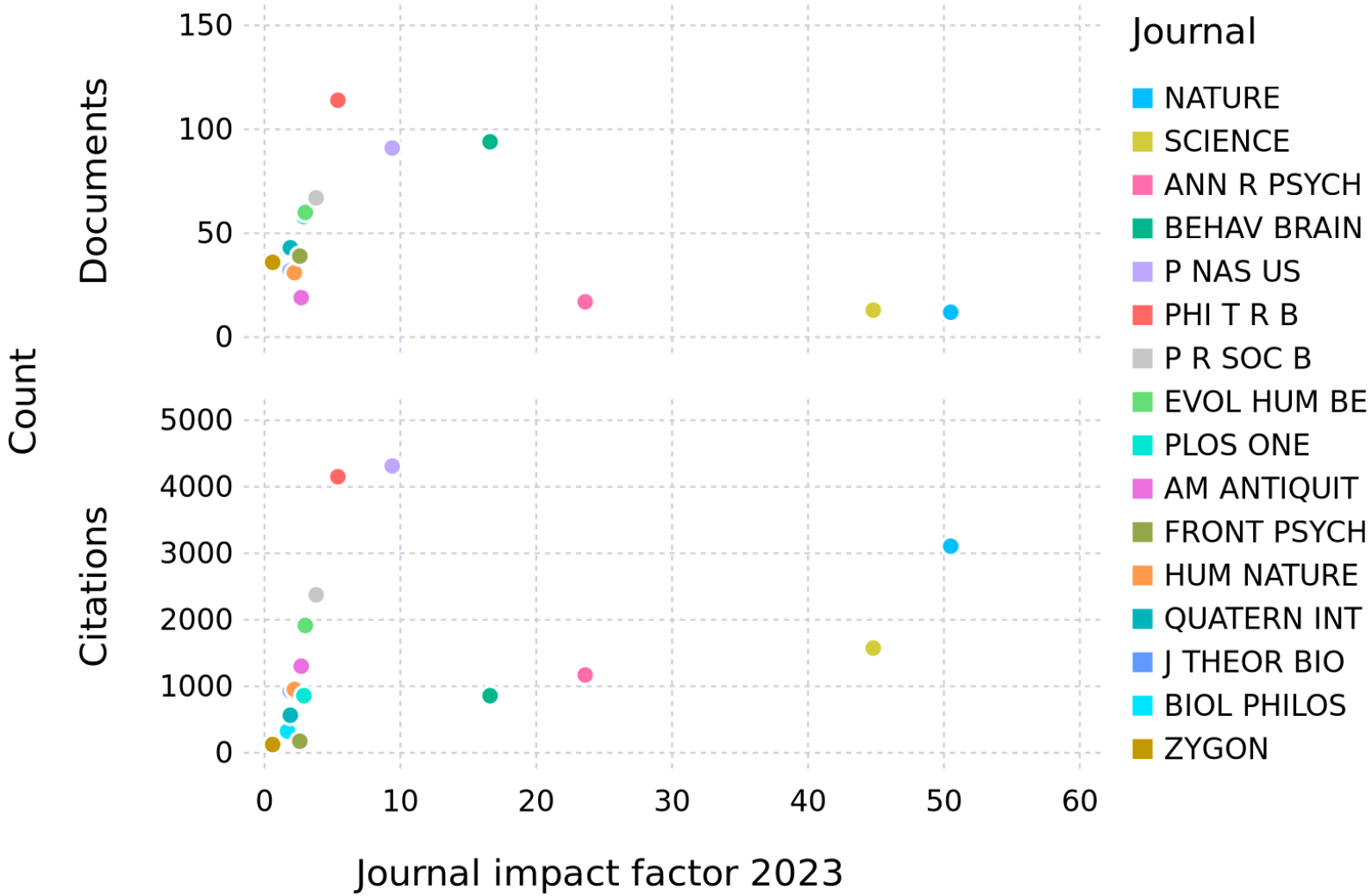
Journals analysis II

Journal	Documents			Citations			Subject areas
	Count	Prop	Rank	Count	Prop	Rank	
PHI T R B	114	4.1%	1	4,151	8.2%	2	Biology
BEHAV BRAIN	94	3.4%	2	859	1.70%	11	Psychology, Biological; Behavioral Sciences; Neurosciences
P NAS US	91	3.3%	3	4,313	8.5%	1	Multidisciplinary Sciences
P R SOC B	67	2.4%	4	2,375	4.7%	4	Biology; Ecology; Evolutionary Biology
EVOL HUM BE	60	2.2%	5	1,915	3.8%	5	Psychology, Biological; Behavioral Sciences; Social Sciences, Biomedical
PLOS ONE	58	2.1%	6	859	1.7%	12	Multidisciplinary Sciences
QUATERN INT	43	1.6%	7	565	1.1%	16	Geography, Physical; Geosciences, Multidisciplinary
BIOL PHILOS	42	1.5%	8	327	0.6%	29	History & Philosophy Of Science
FRONT PSYCH	39	1.4%	9	174	0.3%	57	Psychology, Multidisciplinary
ZYGON	36	1.3%	10	124	0.2%	74	Social Issues; Religion
J THEOR BIO	32	1.2%	11	931	1.8%	10	Biology; Mathematical & Computational Biology
HUM NATURE	31	1.1%	13	953	1.9%	9	Anthropology; Social Sciences, Biomedical
AM ANTIQUIT	19	0.6%	20	1,303	2.6%	7	Anthropology; Archaeology
ANN R PSYCH	17	0.6%	26	1,170	2.3%	8	Psychology; Psychology, Multidisciplinary
SCIENCE	13	0.4%	35	1,575	3.1%	6	Multidisciplinary Sciences
NATURE	12	0.4%	45	3,107	6.1%	3	Multidisciplinary Sciences

Journals analysis III



Journals analysis IV



Content analysis I

We have preliminary data that looks interesting, but it's a touch out of date and we're running out of time. So…

Outline

Conclusion

What's next?

Bigger corpus to come

It would be helpful to see what **distinguishes** cultural evolution work from **non-cultural-evolution** work! (e.g., for understanding differences between biological and cultural evolution)

Run a search for a large set of cultural evolution terms (including things like “dual-inheritance theory,” “gene-culture coevolution,” etc.). Find the top twenty journals in Web of Science where those terms occur most. Get **the whole journal.**

Bigger questions to come

1. What sense of “cultural selection” is used in cultural evolution, and how does it relate to natural selection (or other ‘selection’s elsewhere)?
2. Do those senses of selection relate to the well-known geographic “school” structure of cultural evolution research (California vs. Paris vs. …)?
3. Is there a kind of “explanatory dualism” in cultural evolution work, where a given feature is explained using only either purely cultural or purely biological processes?

Outline

Bibliography I

Brewer, J., Gelfand, M., Jackson, J. C., MacDonald, I. F., Peregrine, P. N., Richerson, P. J., Turchin, P., Whitehouse, H., & Wilson, D. S. (2017).Grand challenges for the study of cultural evolution. *Nature Ecology & Evolution*, *1*(3), 0070. https://doi.org/10.1038/s41559-017-0070

Brewer, J., & MacDonald, I. (2015). *What Are the Grand Challenges for Cultural Evolution? A Research Report for the Society for the Study of Cultural Evolution* (tech. rep.).

Hellsten, I., Opthof, T., & Leydesdorff, L. (2020).N-mode network approach for socio-semantic analysis of scientific publications. *Poetics*, *78*, 101427. https://doi.org/10.1016/j.poetic.2019.101427

Youngblood, M., & Lahti, D. (2018).A bibliometric analysis of the interdisciplinary field of cultural evolution [Number: 1]. *Palgrave Communications*, *4*(1), 120. https://doi.org/10.1057/s41599-018-0175-8

Questions?

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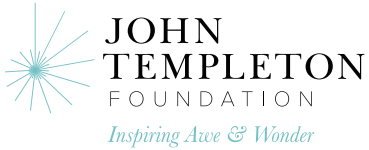
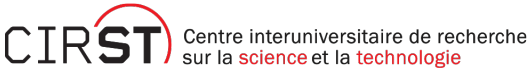




Outline

Clustering

Resulting network: 621 authors (preserved the largest connected subgraph)

1. Biological anthropology and archaeology
2. Mathematical modeling and dual-inheritance theory
3. Cognitive linguistics and experimental cultural evolution
4. Cross-cultural and phylogenetic studies
5. Computational biology and cultural niche construction
6. Evolutionary psychology
7. Behavioral ecology and birdsong

Disciplinary structure

Authorship is disparate, with most authors publishing only a single study, and fewer highly productive authors in the field than expected. Collaborations coalesce within seven topical clusters that differ in their level of interaction within and between groups, although the clusters overlap substantially in the references they cite. (Youngblood and Lahti 2018, 6–7)

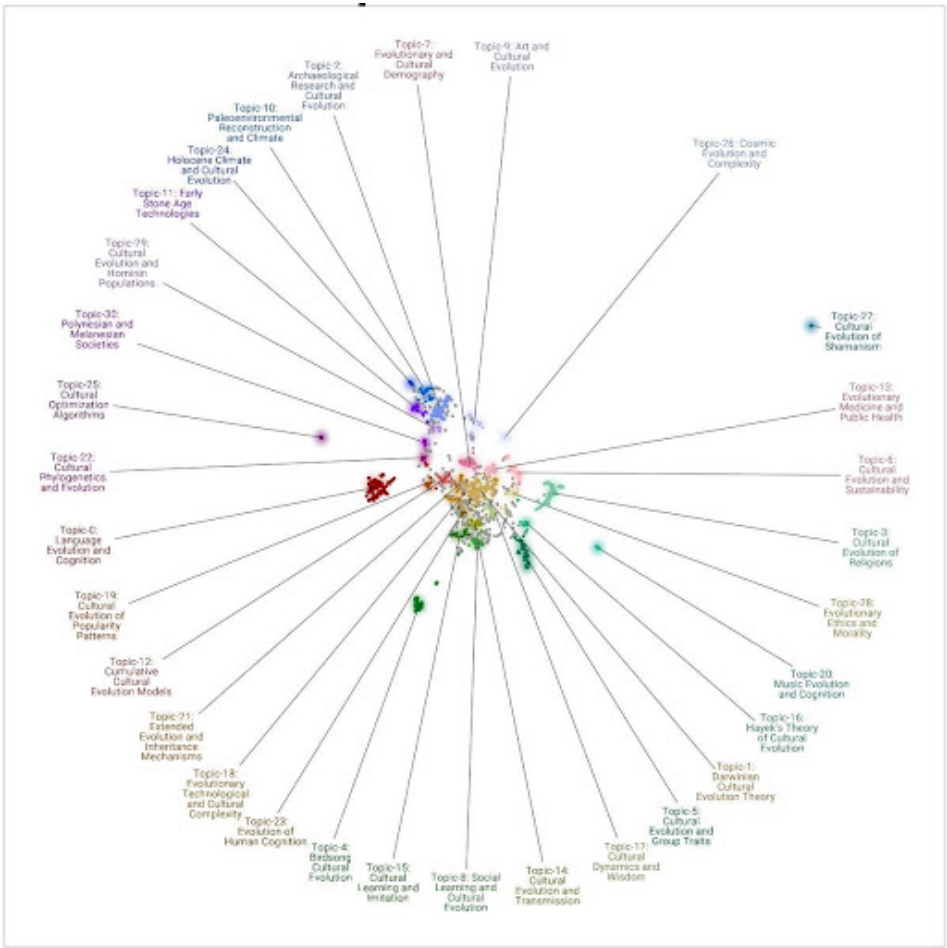
Topics

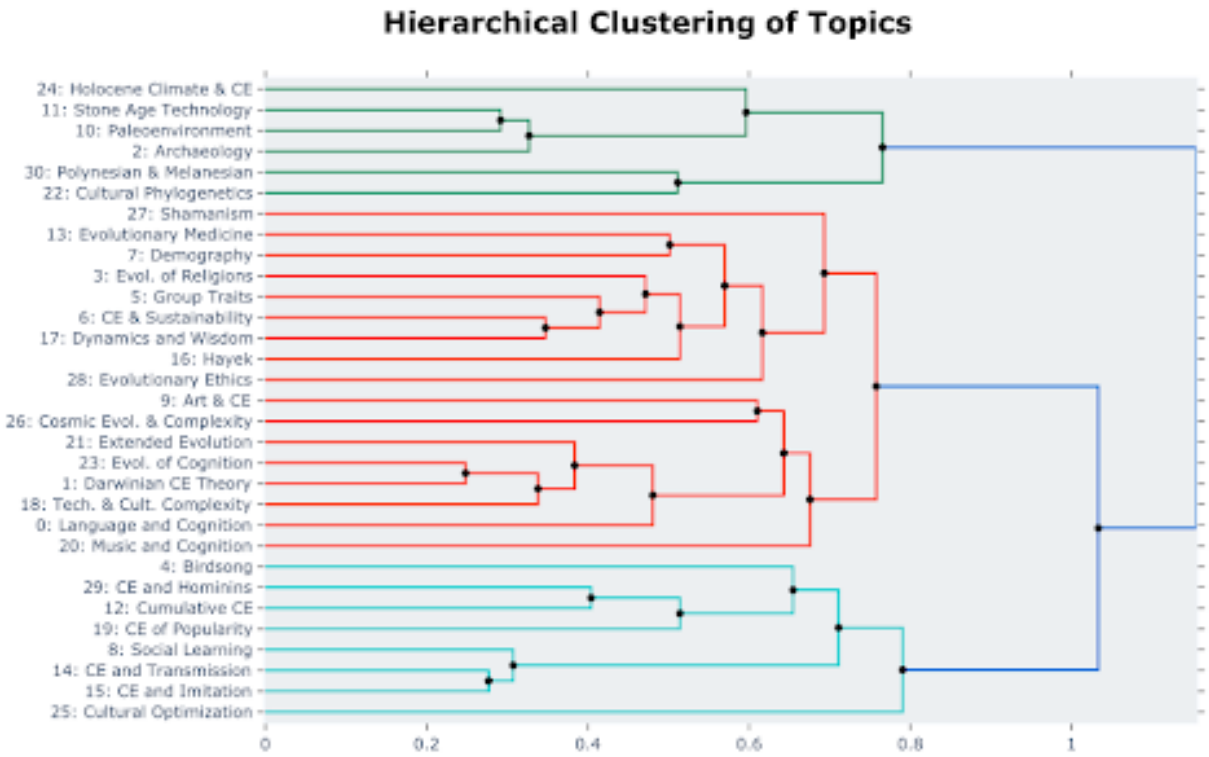
- Topic 1: Cumulative Culture
  human, chimpanzee, culture, learning, tool, cumulative
- Topic 2: Language
  language, evolution, structure, system, model, meaning
- Topic 3: Bird Song I
  population, syllable, song, structure, finch, zebra
- Topic 4: Cognitive Linguistics
  language, evolution, brain, human, structure, cognitive
- Topic 5: Evolutionary Modeling
  population, model, cultural, trait, individual, transmission
- Topic 6: Methodology
  effect, culture, variable, study, social, sample, model

- Topic 7: Inheritance
  social, individual, cultural, transmission, model, information, trait
- Topic 8: Cultural Anthropology
  cultural, analysis, fertility, evolution, human, variation
- Topic 9: Quantitative Methods
  sequence, player, metric, datum, high, unit, team, game, similarity
- Topic 10: Child Psychology
  child, condition, model, folk, study, participant
- Topic 11: Archaeology
  tool, point, archaeological, site, stone, time
- Topic 12: Psychological Modeling
  population, model, people, belief, human, cultural

- Topic 13: Cultural Phylogenetics
  distance, language, geographic, tale, analysis, datum
- Topic 14: Adult Psychology
  participant, signal, experiment, condition, sign
- Topic 15: Innovation
  population, cultural, rate, change, innovation, complexity
- Topic 16: Memory and Thought
  memory, future, time, social, information
- Topic 17: Bird Song II
  song, type, male, female, learn, element, bird
- Topic 18: Group Selection
  group, social, human, individual, level, cultural

- Topic 19: Religion
  religion, norm, god, cultural, belief, punishment, moral
- Topic 20: Language Evolution
  language, tree, cultural, phylogenetic, evolution, method
- Topic 21: Metatheory
  cultural, evolution, evolutionary, culture, human, selection
- Topic 22: Game Theory
  social, individual, learning, group, model, cultural, strategy, payoff
- Topic 23: Agent-Based Models
  model, variant, frequency, tie, distribution, word, agent, population


Topic-7: Evolutionary and Cultural Demography
Topic-9: Art and Cultural Evolution
Topic-2: Archaeological Research and Cultural Evolution
Topic-10: Paleoenvironmental Reconstruction and Climate
Topic-24: Holocene Climate and Cultural Evolution
Topic-11: Early Stone Age Technologies
Topic-29: Cultural Evolution and Hominin Populations
Topic-33: Polynesian and Melanesian Societies
Topic-25: Cultural Optimization Algorithms
Topic-22: Cultural Phylogenetics and Evolution
Topic-0: Language Evolution and Cognition
Topic-19: Cultural Evolution of Popularity Patterns
Topic-12: Cumulative Cultural Evolution Models
Topic-21: Extended Evolution and Inheritance Mechanisms
Topic-18: Evolutionary Technological and Cultural Complexity
Topic-23: Evolution of Human Cognition
Topic-4: Birdsong Cultural Evolution
Topic-15: Cultural Learning and Imitation
Topic-8: Social Learning and Cultural Evolution
Topic-14: Cultural Evolution and Transmission
Topic-17: Cultural Dynamics and Wisdom
Topic-5: Cultural Evolution and Group Traits
Topic-1: Darwinian Cultural Evolution Theory
Topic-16: Hayek's Theory of Cultural Evolution
Topic-20: Music Evolution and Cognition
Topic-28: Evolutionary Ethics and Morality
Topic-3: Cultural Evolution of Religions
Topic-6: Cultural Evolution and Sustainability
Topic-13: Evolutionary Medicine and Public Health
Topic-27: Cultural Evolution of Shamanism
Topic-26: Cosmic Evolution and Complexity


Hierarchical Clustering of Topics
24: Holocene Climate & CE
11: Stone Age Technology
10: Paleoenvironment
2: Archaeology
30: Polynesian & Melanesian
22: Cultural Phylogenetics
27: Shamanism
13: Evolutionary Medicine
7: Demography
3: Evol. of Religions
5: Group Traits
6: CE & Sustainability
17: Dynamics and Wisdom
16: Hayek
28: Evolutionary Ethics
9: Art & CE
26: Cosmic Evol. & Complexity
21: Extended Evolution
23: Evol. of Cognition
1: Darwinian CE Theory
18: Tech. & Cult. Complexity
0: Language and Cognition
20: Music and Cognition
4: Birdsong
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12: Cumulative CE
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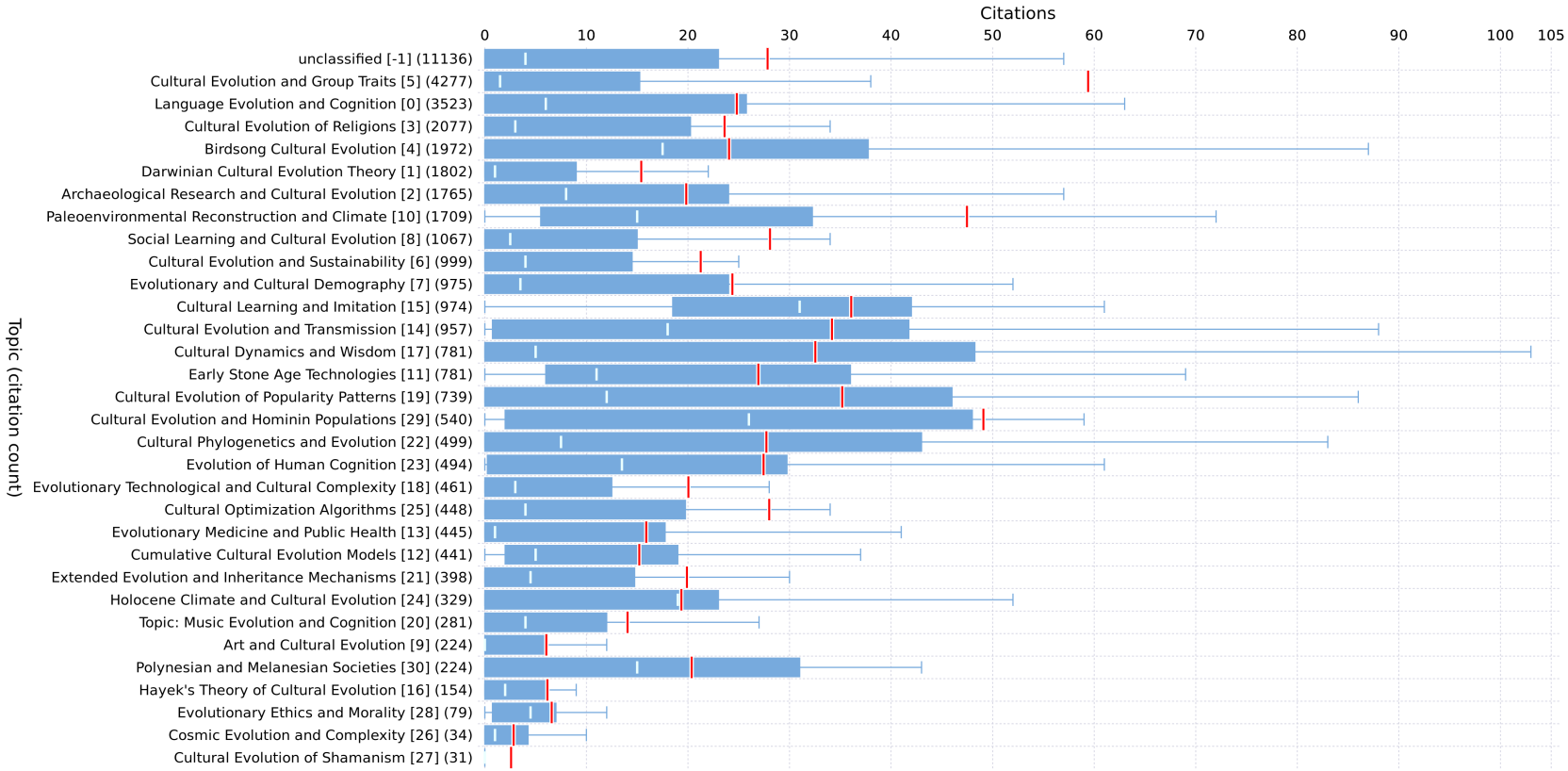
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Cultural Evolution of Popularity Patterns [19] (739)
Cultural Evolution and Hominin Populations [29] (540)
Cultural Phylogenetics and Evolution [22] (499)
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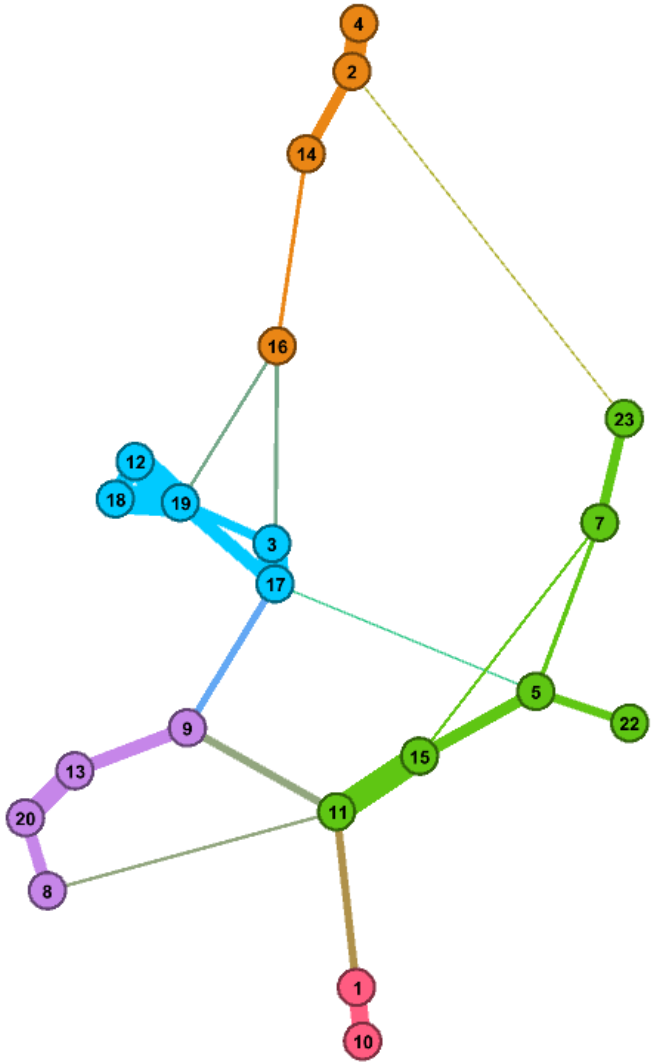
Hayek's Theory of Cultural Evolution [16] (154)
Evolutionary Ethics and Morality [28] (79)
Cosmic Evolution and Complexity [26] (34)
Cultural Evolution of Shamanism [27] (31)

Extended corpus

1. Philosophical Transactions Biological Sciences
2. Behavioral and Brain Sciences
3. Proceedings of the National Academy of Sciences
4. Proceedings: Biological Sciences
5. Evolution and Human Behavior
6. PLOS ONE
7. Frontiers in Psychology
8. Biology & Philosophy
9. Quaternary International
10. Journal of Theoretical Biology
11. Theoretical Population Biology
12. Human Nature
13. Cognitive Science
14. Evolutionary Human Sciences
15. Royal Society Open Science
16. Zygon
17. Physics of Life Reviews
18. Animal Behaviour
19. Journal of Anthropological Archaeology
20. Cognition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Cluster A: Cognitive Language and Linguistics

- Topic 14: Adult Psychology
- Topic 2: Language
- Topic 4: Cognitive Linguistics

Cluster B: Evolutionary Psychology

- Topics 3 and 17: Bird Song
- Topic 19: Religion
- Topic 18: Group Selection
- Topic 12: Psychological Modeling

Cluster C: Cumulative Culture

- Topic 1: Cumulative Culture
- Topic 10: Child Psychology

Cluster D: Quantitative Language and Culture

- Topic 9: Quantitative Methods
- Topic 13: Cultural Phylogenetics
- Topic 20: Language Evolution
- Topic 8: Cultural Anthropology

Cluster E: Evolution and Anthropology

- Topic 11: Archaeology
- Topic 15: Innovation
- Topic 5: Evolutionary Modeling
- Topic 22: Game Theory
- Topic 7: Inheritance
- Topic 23: Agent-Based Models

Jargon Topics

- Topic 16: Memory and Thought
  memory, future, time, social, information
- Topic 6: Methodology
  effect, culture, variable, study, social, sample, model
- Topic 21: Metatheory
  cultural, evolution, evolutionary, culture, human, selection

Connections

Cognitive Language and Linguistics is connected to **Evolutionary Psychology** only by a jargon topic containing words about the mind and brain. In other words, work on adult psychology is connected to that on religion and bird song *in virtue of their mental, epistemic, or representational subject matter.*

Connections

Evolution and Anthropology is connected to both **Quantitative Language and Culture** and **Cumulative Culture** by the fact that quantitative methods are important in archaeology, and that cumulative culture studies discuss archaeological data.

Connections

One unexplored one that I can't quite make sense of yet: bird song is tightly enough linked to the discussion of religion that they both cluster into the **Evolutionary Psychology** cluster.

Comparisons

- The topic model is pretty adept at distinguishing *evolutionary* from *experimental* psychology (topics in the evolutionary psychology cluster versus those in either cognitive language/linguistics or cumulative culture). And the two are **quite distant** in the graph.
- Studies of cumulative culture seem much **more semantically distinct** than they are by authorship; they have a distinctive idiom.
- Models using **group selection in evolutionary psychology** also have a detectably distinctive idiom from those using selection concepts elsewhere.