Digitally Charting Cultural Evolution

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Outline

1. Diversity and unity in cultural evolution
2. Youngblood and Lahti's analysis
3. From social structure to semantic structure
4. Future work

The take-home: Digital approaches seem to be a valuable way to direct philosophy of science useful for cultural evolutionary researchers.

Thanks to Ryan Nichols and Kevin Kaiser!

Diversity and unity in cultural evolution

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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

A total of 236 CES 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 et al. 2017, 1)

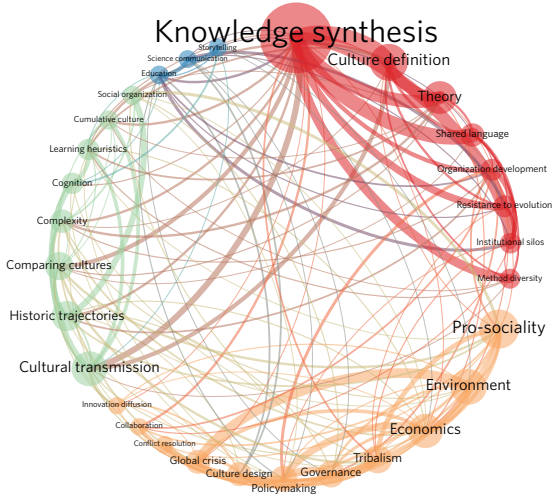
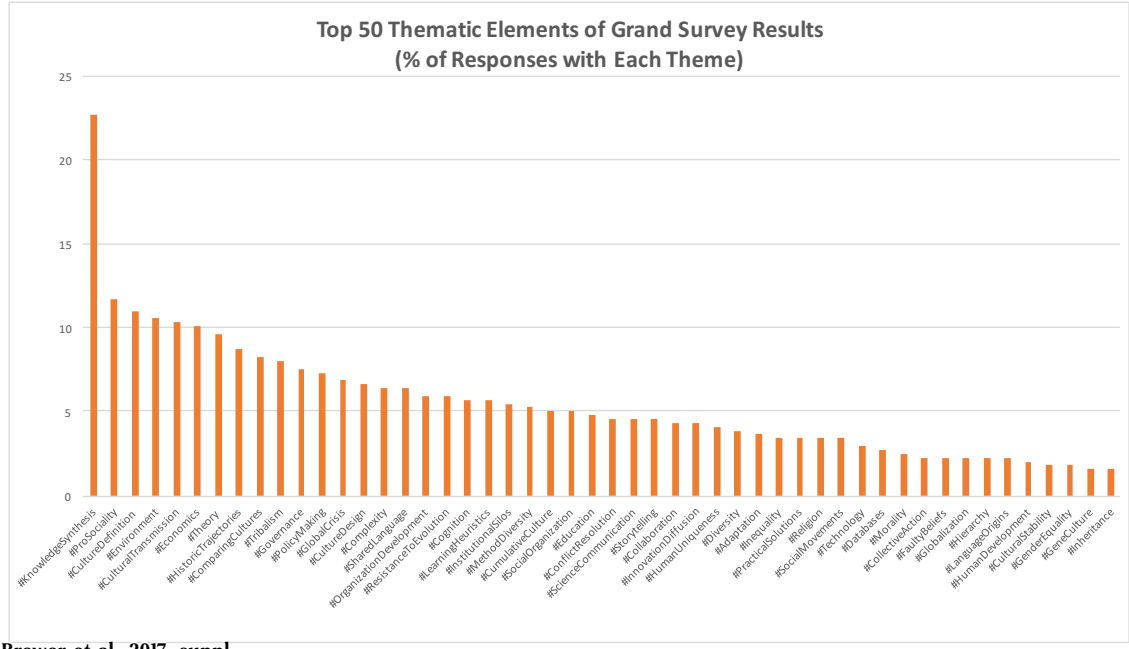


Figure 1 | Frequency and co-occurrences of themes identified in the grand challenges survey responses. Node (theme) size is scaled to the number of times each appeared in the pool of grand challenge ideas (GCIs) and edges (co-occurrences) are scaled to the number of times any two themes appeared in a given GCI nomination. Node colour indicates cluster membership as revealed by a community detection algorithm applied using open source software[10]; clusters are laid out clockwise in decreasing order based on the size of each cluster's largest node (that is, most frequently occurring theme).

Brewer et al. 2017, fig. 1



Brewer et al. 2017, suppl

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, 1)

Knowledge Synthesis

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)

Youngblood and Lahti's analysis

First intuition: This is an empirical claim about the state of the field of cultural evolution, that should be visible in the journal literature.

palgrave
communications
HUMANITIES | SOCIAL SCIENCES | BUSINESS

Correction

ARTICLE

DOI: 10.1057/s41599-018-0175-8 OPEN

A bibliometric analysis of the interdisciplinary field of cultural evolution

Mason Youngblood [1,2] & David Lahti[1,2]

ABSTRACT The science of cultural evolution is unified in its application of evolutionary logic to socially transmitted behavior, but diverse in methodologies and assumptions. Qualitative reviews have encouraged integration by illuminating points of divergence and fos-

Corpus

All articles used in this study were retrieved from the WoS Core Collection. The search term “cultural evolution” was used in the topic field, and results were filtered by publication year through 2017.

2,091 articles; 3,451 authors

Co-authorship network

> [They then constructed] a collaboration network based on co-authorship. In order to prevent articles with many co-authors from biasing network structure, we utilized fractional counting and excluded articles with more than 10 co-authors. (Youngblood and Lahti 2018, 3)

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

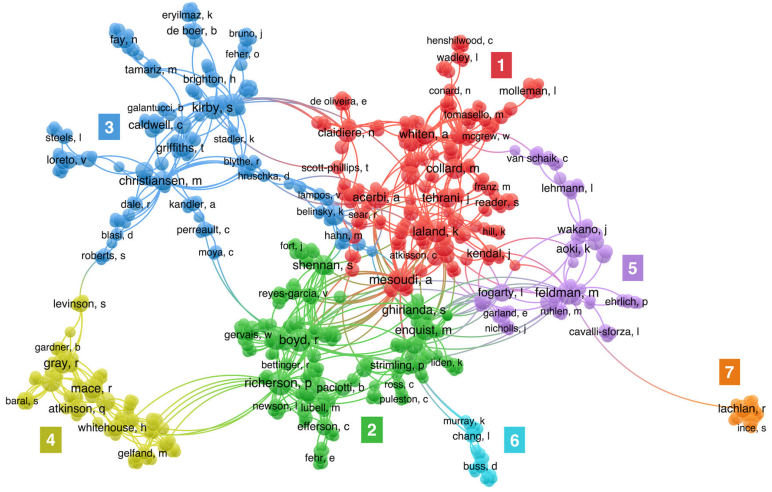


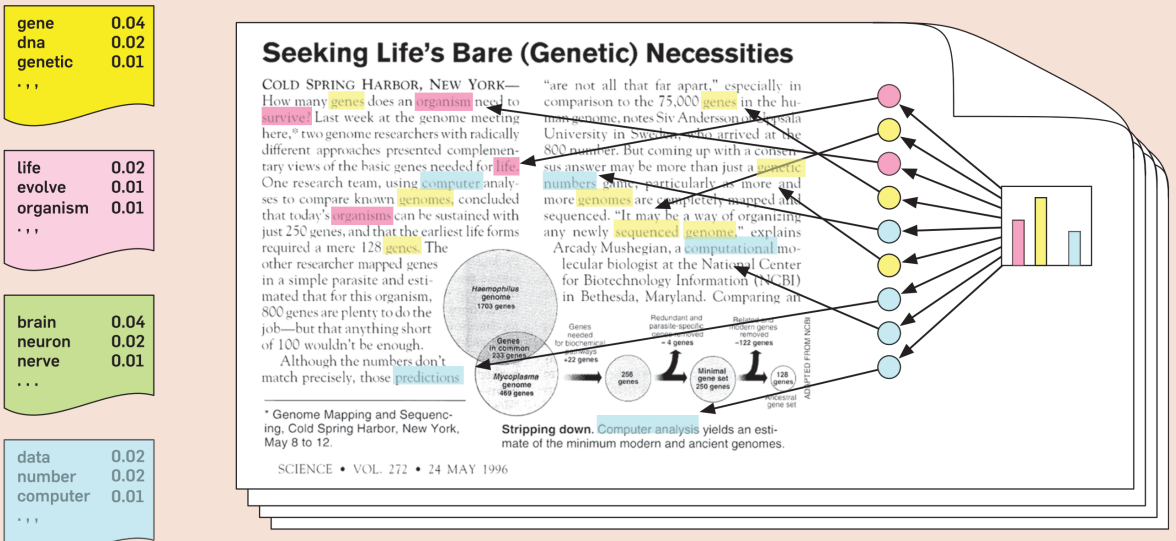
Fig. 2 The largest connected co-authorship network in the dataset, analyzed using VOS clustering ($n = 629$). Red corresponds to group 1 ("biological anthropology and archeology"; $n_1 = 183$), green corresponds to group 2 ("mathematical modeling and dual-inheritance theory"; $n_2 = 146$), blue corresponds 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

Youngblood and Lahti 2018, fig. 1

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)

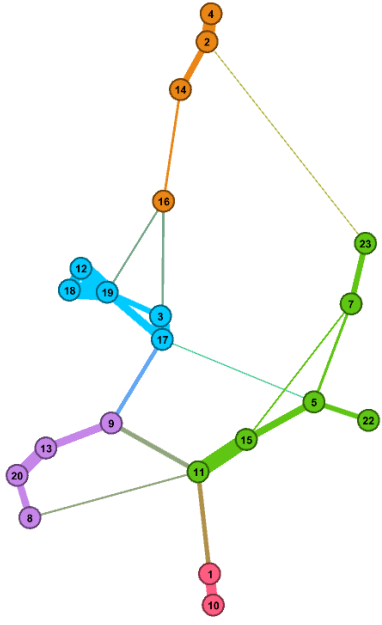
From social structure to semantic structure



Blei 2012, fig. 1

Topic modeling

Construct a 23-topic model of Youngblood and Lahti's corpus. Then, determine the correlations between the topics in each document (Pearson coefficient), and cluster the topics on the basis of those correlations.


4
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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

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

1. Cognitive language and lingusitics
2. Psychology
3. Cumulative culture
4. Quantitative language and culture
5. Evolution and anthropology

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.

Future work

Citation networks

Another way to get at sharing and interaction of content between groups (obviously enough): **citation network analysis.**

Currently working with Kevin Kaiser on building citation networks with Web of Science data for these corpora.

Comparative analysis

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)

But in an analysis like that of Youngblood and Lahti, you **don't have a comparison class.**

Extended corpus

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.**

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

Extended corpus

Setting aside PLOS ONE, around 250,000 articles.
Still in processing...

Bigger research questions

1. What sense of “cultural selection” is used in cultural evolution, and how does it related 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?

Questions?

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- 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