The history of archaeology is often told as a sequence of prominent individuals and their publications. Due to the focus on a small number of big names and big papers, the diversity of archaeological ideas is often underestimated. Here, we introduce a quantitative method that illuminates historical trends in archaeological writing by investigating a large number of journal articles. The identification of patterns in archaeological ideas starts by bringing together citation communities by creating a network of co-occurrences. We then model the diversification and competition of citation communities by implementing a Bayesian framework developed in paleontology for estimating rates of origination and extinction from fossil occurrence data.

**Key Questions**

1. Can we identify the emergence and loss of ideas in archaeology using patterns in citation behaviours?
2. When do major changes occur in the diversification of archaeological ideas?
3. Does the addition of new ideas create competition between different disciplinary realms?

**Data Source**

We searched Clarivate Analytics’ Web of Science database using these parameters: topic = “Archaeology”, document type = “Article”, year = 1975-2017, and downloaded all article citations, and all citations of items cited in these articles. We cleaned the citations to merge equivalent citations using key collaboration and regram fingerprint clustering methods. This resulted in 12,674 articles containing a total of 431,179 unique citations.

The data, R and Python code used for this study are openly available online at [this link](http://doi.org/10.17605/OSF.IO/TZ6S5).

**Trends In Archaeology Articles and Citations**

Our data shows a dramatic increase in the number of archaeological articles over the last decade to approximately 300 (2005) to 1,100 (2015). At present, 61% of articles are published in archaeology and anthropology journals while 36% are published in journals associated with related subjects.

The average number of citations in an archaeology article has also increased from approximately 40 per publication in 2005 to nearly 65 per publication in 2015. If we look closer at citations in articles we can identify the most widely cited publications of the last 40 years.

**The Diversification of Items Cited by Archaeologists**

How to identify communities of citations?

We identified clusters of similar citations according to their co-occurrences in citation lists of articles (cf. Sinclair 2016; Brughmans 2013; Small 1973). We detected community structure among these co-occurrences using an edge betweenness algorithm (Neiman and Girvan 2004). These communities are akin to topical foci or themes in the archaeological literature. The network diagram on the right shows co-occurrences for items cited 25+ times in our data.

Trends in citation communities

We can identify coherent, interpretable citation communities that show changes over time. For example, around the year 2000 the dominant community switched from ‘debates about theory’ to ‘social theory and phenomenology’.

Bayesian Estimation of the Diversification of Citation Communities

To understand how citations communities change through time, we implemented a Bayesian framework developed in paleontology to estimate continuous rates of origination and extinction. We rely exclusively on occurrence data to measure changes in citation communities through time.

Results

- A few citation communities have been continually emerging in the archaeological literature since 1975 with very few citation communities going extinct (no longer being cited)
- The most significant period of change most likely occurred in the late 1990s when the origination rate of new citation communities is reduced by over 50%. The lower rate of new citation communities continues to this day (see figure 5).

Conclusions

- Analysis of citations in journal articles using methods from network analysis and comparative paleontology reveals interesting patterns in the emergence and loss of ideas in archaeology.
- In the late 1990s the origination rate of new citation communities (‘ideas’) declined by over 50%. This is also when we see ‘social theory’ take over from ‘theory debates’ as the dominant citation community.
- The addition of new ideas in one topic has a small positive effect by increasing the diversity of citation communities in other topics.

References cited