Systematic comparative approaches to the archaeological record

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Increasingly, interdisciplinary research teams come together to seek to establish regularities, over space and time, in the complex system that is the human phenomenon. While vocabulary and tools have changed, the questions that animate this research programme bear striking similarity with those pursued by nineteenth century intellectuals, in a quest to establish universal laws shaping human affairs. In fact, that very quest provided the impetus for the emergence of what would later become distinct disciplines in the social and historical sciences, including anthropology and sociology (see Carneiro 2003; Harris 2001; Trigger 2006).

Why, then, is this interdisciplinary research programme often met with skepticism, or even outright resistance, within anthropology?

In this chapter we provide a brief outline of developments in the history of anthropology leading to this state of affairs, in the hope of alleviating misunderstanding between those who support the interdisciplinary research programme and those who oppose it. As a practical contribution towards this end, we then provide an overview of key established resources for systematic comparative approaches to the archaeological record. We conclude by discussing challenges and opportunities in this area at the interface with recent developments in related archaeological practice.

1 Historical sketch

In large part, the current state of affairs in anthropology can be attributed to the prevailing theoretical paradigm of the late nineteenth century, now known as evolutionism. Broadly, its aim was the reconstruction of human cultural development, understood as the self-evident trajectory from “simple” to “complex” forms of social organization documented in the archaeological and historical records. The ethnographic record contributed evidence of “primitive” contemporary populations, taken to represent earlier stages along the way from “savagery” to “civilization”, with “advanced” European society as the endpoint. This use of the ethnographic data, known as the comparative method, was intended as the objective collection and sorting

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1We refer to anthropology as traditionally practiced in North-American universities, encompassing archaeology as a sub-field.
2The paradigm is sometimes referred to more specifically as “classical evolutionism” or “social/cultural/socio-cultural evolutionism”, to emphasise the distinction, both historical and conceptual, with contemporary approaches to the study of our species in the light of principles derived from evolutionary biology, including evolutionary anthropology and Darwinian archaeology. The branch of contemporary approaches focusing on the process of cultural evolution (defined as change over time in the distribution of cultural traits) is also distinct from evolutionism (e.g. Boyd and Richerson 1985; Cavalli-Sforza and Feldman 1981).
of facts; any form of moral value-judgment was explicitly rejected — in principle at least. In practice, many self-proclaimed intellectuals with no other credentials but wealth and status used this approach to validate stereotypes, often biased by nationalistic interests. The myth of European superiority, with the inferiority of “primitive” societies it implied, was elevated to the status of scientific truth, typically on the basis of dubious information collected by amateur ethnologists, and equally dubious standards of proof masquerading as accurate methodology (Carneiro 2003, chapters 2–5; Trigger 2006, chapters 5–7).

What started as a critique of this abuse of the ethnographic record (e.g. Boas 1896) eventually led to a reconsideration of the assumptions on which the paradigm rested, for example the preeminence of cultural parallelism over other processes and the existence of universal standards of progress (see chapters 9–10 in Harris 2001, for discussion). Within a few decades the paradigm had been rejected, with long-lasting repercussions for the disciplines it had given birth to. For example, key features of contemporary sociocultural anthropology can be traced back to the reaction against evolutionism in the formative decades straddling the 19th and 20th centuries. These include the antipathy towards quantitative approaches and the focus on field-based, site-specific investigation as the hallmark of training and practice. Comparative approaches are viewed with suspicion, even when they are completely detached, conceptually and methodologically, from the comparative method of evolutionism. More broadly, context-heavy description is preferred, and valued, over systematic explanation. Combined, these features set anthropology apart from cognate disciplines such as sociology, political science, and economics. If indeed there are regularities over space and time in the human phenomenon, then they must be documented in the ethnographic and archaeological records. Naturally, anthropologists are best qualified to guide attempts to extract information from these sources. Yet the relative minority of anthropologists willing to engage with this research programme tend to be cautious in their approach, aware that the odious excesses of evolutionism stemmed from 19th-century scientism. Furthermore, this minority operates among a majority who reject the research programme on ideological grounds couched as methodological criticism, dismissing any scientific approach as reductionist.

Interdisciplinary research efforts continue to be hampered by this unfortunate state of affairs. Our reading of the developments that led to it suggests that some caution is indeed justified,
if past mistakes are to be avoided. Yet this attitude tends to frustrate researchers not familiar with the history of anthropology. As a result, the two “sides” often operate in opposition to each other, rather than in concert. We hope that, in exposing the root cause of the tension, this brief historical sketch can lead to more productive exchange between them.

2 Systematic comparison in anthropology

Approaches to comparative analysis in the social and historical sciences can be classified along a continuum from intensive to systematic. Intensive approaches typically involve many variables across few cases, while systematic approaches typically focus on few variables across many cases (Smith and Peregrine 2012, pp. 7–9).

To varying degrees, anthropologists are comfortable with intensive comparative approaches, generally applied informally (Trigger 2003, chapter 2). For example, it is common practice to compare and contrast societies on subsistence regime, form of social organization, etc. to aid in interpretation of patterns and phenomena documented in the ethnographic and archaeological records. Systematic comparative approaches are more contentious, especially when coupled with formal treatment of the data (i.e. statistical analysis and/or mathematical modelling).

Inevitably, there tends to be a trade-off between the number of cases and variables, and the amount of context (e.g. historical, ethnographic, etc.). Consequently, systematic approaches typically involve the sacrifice of detail for larger samples which, in turn, are amenable to quantitative analysis. To many anthropologists the trade-off bears echoes of the comparative method of evolutionism.¹

This attitude has stifled the application of systematic comparative approaches in anthropology throughout the twentieth century (Murdock 1971). At the same time, it has spurred methodological developments to address specific criticisms raised (see discussions of the key issues in Burton and White 1987; Ember and Ember 2009). One such development is the production of standard samples of cases, drawn from the ethnographic record, specifically for systematic comparative analysis. For example, Murdock and White (1969) collated the Standard Cross-Cultural Sample with the aim to adequately represent the range of cultural variation

¹Indeed, the application of statistical thinking to cross-cultural samples drawn from the ethnographic record was pioneered in this context, with a paper presented by Tylor to the Royal Anthropological Institute in 1888 (Tylor 1889) — according to Harris (2001, p. 158), “[p]erhaps the greatest anthropological paper of the nineteenth century”.

4
documented in the ethnographic record (i.e. avoiding biases towards regions that are overrepresen-
ted), while minimizing the effects of the non-independence of human societies (the result of processes such as descent from a common ancestor and diffusion through contact)\(^1\) (Murdock 1977). Further, by establishing a standard sample, Murdock and White (1969) sought to facilitate integration of data and findings across studies. This strategy proved successful: currently, the *Standard Cross-Cultural Sample* codebook includes coded data on approximately 2000 variables for the 186 societies in the sample (White et al. nd).

In addition to these “endogenous” developments, systematic comparative analysis of the ethnographic record has benefitted from exchanges with other disciplines. For example, since the 1970s researchers interested in the evolution of human social behaviour have used this approach to seek to uncover patterns in behavioural diversity across groups. In turn, they have contributed hypotheses (e.g. Alexander et al. 1979) and methods (e.g. Mace and Pagel 1994) from the biological sciences.

Analogous developments for systematic comparative analysis of the archaeological record have lagged behind (see discussion in Peregrine 2004). As a result, the available resources are less known, and used, than their ethnographic counterparts. We briefly outline the key established resources below before reviewing some challenges associated with their use. We conclude by discussing the interface with recent developments in related archaeological practice.

More general overviews of comparative approaches in archaeology can be found in Peregrine (2001a, 2004).

### 2.1 Resources for systematic comparison in archaeology

The major established tool for systematic comparative analysis of the archaeological record encompasses two resources developed by the Human Relations Area Files, Inc. (*HRAF*) beginning in the late 1990s (http://hraf.yale.edu/): its online archaeological database, *eHRAF Archaeology*, and the *Encyclopedia of Prehistory* (Peregrine and Ember 2002). Both resources, described below, are used extensively across chapters in this volume.

\(^1\)The issue of the non-independence of sample units in comparative analysis was first recognized by Galton in response to Tylor’s 1888 paper (Tylor 1889). To this day, the issue is known in anthropology as “Galton’s problem”.

5
2.1.1 The “archaeological tradition” as unit of analysis

In an effort to address the shortcomings of previous research, development of the HRAF resources focused on the production of a standard sample of cases drawn from the archaeological record, large enough to allow for formal treatment of the data (Peregrine 2004). A key issue was definition of an appropriate unit of analysis. Comparative research hinges on definition of comparable units, allowing for both generality and specificity. In archaeology, generality ensures that the definition is applicable to data from any region and time period, while specificity ensures that distinct cases remain readily distinguishable (Peregrine and Ember 2001–2002, vol. 9, p. 2).

The HRAF resources use the “archaeological tradition” as unit of analysis, defined as “a group of populations sharing similar subsistence practices, technology, and forms of socio-political organization, which are spatially contiguous over a relatively large area and which endure temporally for a relatively long period” (Peregrine 2001b, p. ii).

Archaeological traditions have both a spatial and a temporal dimension: as a rule of thumb, minimal areal coverage is on the order of 100,000 km² and minimal temporal duration on the order of five centuries. The focus is on information that can be recovered from the archaeological record (e.g. subsistence practices and socio-political organization), as opposed to more “labile” traits typically used in the definition of “cultures” in ethnography (e.g. language or ideology). Consequently, an archaeological tradition may or may not correspond to a “culture” as defined for the purpose of comparative analysis of the ethnographic record (Peregrine and Ember 2001–2002, vol. 9, p. 2).

2.1.2 The Outline of Archaeological Traditions (OAT)

Based on the above definition Peregrine (2001b) developed the Outline of Archaeological Traditions (OAT) as a catalogue of all known archaeological traditions documenting human prehistory.

The main focus in development of the OAT was on extracting units roughly equivalent across areas (Peregrine and Ember 2001–2002, vol. 9, pp. 2–3), covering the entire period from the origin of the genus Homo in Africa approximately 2 million years ago to European exploration and colonization of Oceania, the Americas, and sub-Saharan Africa approximately 500 years
ago. The current version includes 289 entries (Peregrine 2001b, revised 2010).

2.1.3 **eHRAF Archaeology**

The OAT is the sampling frame for *eHRAF Archaeology*, *HRAF*’s online archaeological database ([http://hraf.yale.edu/online-databases/ehraf-archaeology/](http://hraf.yale.edu/online-databases/ehraf-archaeology/)). To the extent that the OAT is a comprehensive list of all prehistoric human societies known archaeologically (Peregrine 2004) — an assumption we discuss below — then a random sample drawn from it will be a representative “snapshot” of human prehistory. Based on this reasoning, *eHRAF Archaeology* provides information for a simple random sample of archaeological traditions in the OAT.

In addition to the random sample, *eHRAF Archaeology* provides information for complete sequences of archaeological traditions for selected world regions, including to date (July 2015): Egypt, Mesopotamia, the Highland and Coastal Andes, Highland Mesoamerica, the Maya area, the Mississippi River Valley, and the U.S. Southwest.

*eHRAF Archaeology* is continually expanding and updated annually; as of June 2015 it covered 94 archaeological traditions overall, 46 of which are included in the random sample. In addition to a general summary for each tradition the database provides full-text source documents, including books, journal articles, dissertations, and manuscripts. The documents are numerically subject-indexed, paragraph by paragraph, following the *Outline of Cultural Materials* (Murdock et al. 2008), a vast compendium of indexing terms that seeks to cover all aspects of human social and cultural life. This indexing system, unique to *HRAF* databases, allows users to search for and connect related anthropological concepts across documents, irrespective of the language of the documents, the specific terms used, and spelling conventions. For example, a simple keyword search for “metalworking” or “smithing” would fail to retrieve related information expressed with different terms or in a language other than English. A search based on relevant subjects in the *Outline of Cultural Materials* (325: metallurgy; 326: smiths and their crafts; 327: iron and steel industry; 328: nonferrous metal industries) would instead retrieve all related information available across all documents in the database.

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1In addition to *eHRAF Archaeology*, *HRAF* develops and maintains an online ethnographic database, *eHRAF World Cultures* ([http://hraf.yale.edu/online-databases/ehraf-world-cultures/](http://hraf.yale.edu/online-databases/ehraf-world-cultures/)).


2.1.4 The Encyclopedia of Prehistory


In addition to details of the archaeological record and the environment pertaining to each tradition, topics covered include the tradition’s settlement pattern, economy, socio-political organization, religion and expressive culture (Peregrine and Ember 2001–2002, vol. 1, p. x). Also included is a list of the descendants for each tradition, as determined from time and location (Peregrine and Ember 2001–2002, vol. 9).

2.2 Outstanding issues

Development of a working draft of the OAT involved some 30 scholars over two years, called to revise and refine successive iterations of the list. Compilation of the Encyclopedia of Prehistory involved 200 scholars from 20 nations over four years (Peregrine and Ember 2001–2002, vol. 9, pp. 2–3). eHRAF Archaeology is a work in progress started in the late 1990s. These figures point to the impressive scale of the projects and, more generally, to the benefits of collaborative work in systematic comparative archaeology. The range of applications of the resources across chapters in the volume illustrates how they can be used to help uncover trends and patterns in human prehistory.

At the same time, awareness of the challenges encountered in using these resources can prove useful in guiding future efforts (see discussion in Peregrine and Ember 2001–2002, vol. 9, pp. 1–4). We limit discussion to two issues as they apply specifically to systematic comparative analysis of the archaeological record: derivation of a sampling frame and the statistical non-independence of sample units.

The OAT is, effectively, an attempt to catalogue all known prehistoric human societies (Peregrine 2004), intended as a “statistically-valid sample of cases for comparative archaeological research” (Peregrine 2001a, p. 12). But is it? One practical consideration is that, just like the ethnographic record, the archaeological record is biased. In archaeology, the bias will be towards wealthier areas and/or those with greater political stability — factors that facilitate archaeological field-work (Peregrine and Ember 2001–2002, vol. 9, p. 3). Thus, to the extent
that the *OAT* and the *Encyclopedia of Prehistory* provide “a snapshot of our current knowledge of the archaeological record” (Peregrine and Ember 2001–2002, vol. 9, p. 3), they will reflect these biases, as will the random sample in *eHRAF Archaeology*.

Further, any sample drawn from these resources will comprise units that are statistically non-independent. This can result from contact between the populations captured by different archaeological traditions, or because the populations shared a common ancestor. Both processes may lead to greater similarity between archaeological traditions that are closer geographically, for example, compared to others. Additionally, because the *OAT* is diachronic, two traditions in a sample drawn from it may represent populations that are one the direct descendant of the other. So, for example, if the earliest of these traditions developed metalworking, then it is likely that its descendant will also display metalworking. This would have to be taken into account in determining trends in, or correlates of, the acquisition of metalworking over the course of prehistory based on the sample (see discussion in Peregrine 2003).

Accounting for the effects of all the processes described above poses non-trivial methodological challenges. Some of the issues have been discussed extensively in the ethnographic literature, as they also apply to systematic comparative analysis of the ethnographic record (see discussions in Ember and Ember 2009; Levinson and Malone 1980). For example, the issue of the statistical non-independence of units in synchronic samples due to contact between populations or to descent from a common ancestor (i.e. Galton’s problem) has attracted considerable attention, with possible recent “solutions” including the application of phylogenetic comparative methods (Mace and Pagel 1994) or of network autocorrelation analysis (Dow 2007). Efforts to explore how these approaches can be extended to systematic comparative analysis of the archaeological record are ongoing (P. Peregrine, pers. comm., July 2015).

### 2.3 Future directions

It is becoming increasingly clear that collaboration between anthropologists and data scientists will be crucial in addressing the underlying methodological issues. For example, as discussed above the *OAT* and related resources rest on definition of a “fixed” unit of analysis (the archaeological tradition) and a “fixed” set of units (the 289 traditions in Peregrine 2001b). With the adoption of flexible digital tools for the crowd-sourcing of data, researchers will instead be
able to refine the unit they use to reflect the question at hand (see e.g. Turchin et al. 2015, for an application to historical data).

Better still, in the future researchers may be able to bypass the a priori definition of the unit of analysis altogether. Rather, the most appropriate unit for the question at hand will be “extracted” computationally from the data. For example, data mining and machine learning techniques may be used to establish comparable foci of social interaction across sites based on statistical patterns in the frequency distributions of unearthed artifacts. These techniques have been fruitfully employed in the study of other cultural domains (e.g. Michel et al. 2011), following the digitization of large bodies of data. Their application now seems within reach also in archaeology, in light of recent efforts to establish digital repositories for the preservation and some forms of integration of primary data (including the raw data and contextual information) from archaeological investigations (e.g. tDAR: the Digital Archaeological Record, http://www.tdar.org/).

The aggregation and integration of both legacy and newly-generated data in dedicated repositories and databanks promises an ever-changing picture of the archaeological record — a picture that will become more and more focused as the data accumulate. While several challenges remain (Kintigh 2015; Kintigh et al. 2015), the further development of digital infrastructure in this direction is likely to transform how systematic comparative archaeology is conducted, for example extending its scope from prehistory to history (recall that the OAT and related resources are restricted to prehistory). Perhaps the most important transformation will rest with how the data themselves are used. By necessity, the typical mode of synthesis in archaeology (including any form of comparative analysis) relies on interpretations of the primary data by the original investigators, or even summaries of these interpretations by others (Kintigh et al. 2015). Interpretations and summaries several steps removed from the data can become entrenched in the literature as “facts”, serving as the basis for subsequent work by archaeologists and researchers in other disciplines. However, they cannot be refined as more data or improved inferential procedures become available. By contrast, the ability to access and analyse the primary data directly will remove the need to rely on often outdated, or even flawed, interpretations and summaries, eventually leading to reassessment of erroneous “facts” in the literature. Additionally, the data will be more readily shared with researchers in other disciplines and combined with
complementary sources of information, such as ecological data (Kintigh 2006).

More broadly, discipline-wide efforts towards the development of digital infrastructure will be a crucial step in addressing archaeology’s grand challenges — fundamental questions about the human phenomenon whose answers require information on “facts of the past”, such as long-term cultural dynamics or the interplay between ecological and social factors (Kintigh et al. 2014). For example, why, and how, do leaders emerge in some societies, and what sustains inequality in the long term? What drives the decline and eventual collapse of societies? And how do societies respond to rapid environmental change? Tackling these and related questions will involve both synthetic work within archaeology and interdisciplinary collaboration, entailing substantial practical and intellectual challenges (Kintigh et al. 2015). The reward will be the ability to contribute to contemporary scientific and societal debates.

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References


