

# TOWARDS A NEW PARADIGM?

## The Third Science Revolution and its Possible Consequences in Archaeology

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### INTRODUCTION

There seems to be a general feeling that some fundamental changes are underway in archaeological thinking and have been for some time now. One need only look at some recent book titles such as *Death of Archaeological Theory* (Bintliff & Pearce 2012), *Paradigm Found?* (Kristiansen, Smedja & Turek 2014) or read the last two issues of *Current Swedish Archaeology*, where such changes were debated first from a philosophical/anti-theoretical perspective (Olsen 2012), and lastly from a natural science perspective (Liden & Eriksson 2013). Both ended with a somewhat pessimistic outlook, at least in my reading. Similar critical discussions can be found in other journals, and among the things they share are a critical stance against a previously predominant post-modern/post-processual hegemony, and the reintroduction of a revised modern/processual approach, whether in cultural heritage (Solli 2011), things and human relations (Barrett 2014) or in materialist and world system approaches (Galaty 2011; Rosenswig 2012; Earle & Kristiansen 2010). These discussions, however, are not confined to archaeology, but reflect a broader break-up in the social and humanistic disciplines. The question has therefore been raised if we are moving out of the postmod-

ern age, in archaeology most recently discussed by Fredrik Fahlander (2012). He concludes that the future holds the answer, but that something is about to change.

I shall now provide a different, more optimistic perspective on the future of archaeology than that of Olsen and Liden, in which I link fundamental changes in archaeological, science-based knowledge and the increasing application of Big Data to necessary changes in archaeological methods, interpretations and theory. The prospects of these changes, I shall argue, open up a new chapter in archaeological knowledge that demand similar changes in archaeological methods and theory, some already underway, some still to be developed. This I shall exemplify first by a historical comparison and then by tracing some recent research trends. My point is that such a “from below” perspective grounded in an ongoing data revolution may provide a better foundation for understanding where we will be going. In conclusion I raise the question whether we are heading towards a new “paradigm” or if we are entering a “post-paradigm” period. Finally, I ask if this puts new demands on the relation between archaeology and the public domain.

## RECENT THEORETICAL TRENDS AND THE THIRD SCIENCE REVOLUTION IN ARCHAEOLOGY

One of the major critiques launched by post-processual archaeologists against processual archaeology some thirty years ago was its reliance on natural science methods with its implied regularities, quantification and modelling of data. It was termed a “dehumanization” of the past by Shanks and Tilley (1987:77), and for the next two decades quantitative methods and science-based knowledge more or less vanished from archaeological interpretation. Instead agency-based, contextual interpretations took the front seat. Those who did not feel at home in this post-processual world of hermeneutic and phenomenological understanding of the past verged towards biological evolution and its application to archaeology as “Darwinian archaeology” (Shennan 2002) or proceeded to develop Social Evolutionary/ World System and Marxist approaches (Kristiansen 1998; Kristiansen & Rowlands 1998). I diagnosed and discussed this divergence ten years ago (Kristiansen 2004), and shall now take another diagnostic look at these trends to see where they have taken us in the meantime.

To begin with we need to recognize that the situation today is fundamentally different from ten years ago in three important respects:

- We have witnessed the breakthrough of the next generation of sequencing of ancient DNA, which took A-DNA studies out of their 20-year-long stagnation and is now rapidly producing new, often surprising evidence on human origins and expansions (Rasmussen *et al.* 2010, 2011 and 2014; Skoglund *et al.* 2012 and 2014). For the first time it is now possible to produce genomic data rather than the very limited mitochondrial DNA, which has nevertheless yielded interesting information about major changes in the genetic composition of Europeans during the Neolithic. New haplogroups were introduced, some pointing to possible origins in the east, others in the Iberian peninsula. By the Bronze Age these changes were completed (Brandt *et al.* 2013; Brotherton *et al.* 2013; Kayser *et al.* 2009, Lalueza-Fox *et al.* 2004; Ricaut *et al.* 2012). However, with the prospect of studying full genomic diversity and comparing prehistoric genomic data from western Eurasia in real time as is done in my own European Research Council project “The Rise” ([WWW.the-rise.se](http://WWW.the-rise.se)) in collaboration with the Centre for GeoGenetics in Copenhagen, and the Centre for Textile Research, we are reaching a new stage in explaining genetic diversity from prehistory to the present, and in defining population changes and bottlenecks which can then be compared to other forms of archaeological and historical evidence. In addition we have seen extensive application of various isotope analyses, where strontium from humans and animals informs about mobility and diet, and where lead analyses of metal, especially bronzes, is now able to locate the origin of copper, which chemical analyses had not been able to. There is still some way to go before these scientific landmarks are fully calibrated and precise, but the accumulating effect of their scientific applications to archaeology is no less than monumental, and only comparable to the effects of radiocarbon dating from the 1950s onwards. We have to rewrite prehistory once more, allowing for much more mobility than ever imagined just ten years ago.
- We have witnessed the formation of the European Research Council ([www.erc.europa.eu](http://www.erc.europa.eu)), which for the first time has allowed the financing of basic research on a grand scale, including humanities and social sciences, and with a special programme for junior researchers as well. It has already had a rather large impact on the formulation and financing of projects on a European scale, which would have been difficult to carry out within the framework of national research councils, with few exceptions. Some of these projects will be referred to later. The long-term effect of the ERC funding will be profound, and will allow research projects that are able to cope with

the ongoing data revolution in archaeology. It also supports a new generation of young researchers who grew up in the digital age and who are just as familiar with complex computer modelling as they are with the latest critical theory. The prevailing opposition between science and humanities, theory and data, is thus disappearing in my vision of the future.

- Finally, we have witnessed the silent collapse of the dominant post-processual framework, as it did not account for the kinds of evidence we have seen emerge during the last ten years. And neither did the processual framework. In short: we are in a period of theoretical and methodological experimentation and reorientations, where everything that was “forbidden” research 10–15 years ago are now among the hottest themes: mobility, migration, warfare, comparative analysis, evolution, and the return of grand narratives. Bjørnar Olsen described his feeling of this collapse of normal post-processual agendas with gripping passion: “It is decaying and withering, exposing a ruin landscape interspersed with cracking black boxes. And with a slight shiver of *déjà vu* running through my body, I started to thinking the unthinkable: that a new revolution is underway; more silent perhaps, but also more radical and different than the previous ones”. (Olsen 2012:18). It could not be better expressed.

Where will these new trends take us? What does the future hold for archaeology? It may be profitable here to look back at archaeological history, as it indeed provides comparative evidence of a related nature.

## HISTORICAL PARALLELS

### First parallel 1850–1860

The formation of archaeology as an independent discipline was closely related to its collaboration with zoology and geology. Thus the period 1850–1860 saw the parallel, and related, scientific breakthroughs of cultural, biological and geological evolution. It paved the way for a period of systematic data collection and methodological ordering of data headed by Oscar Montelius. New typological and chronological systems of knowledge emerged that established a new understanding of human origins in prehistory that replaced biblical accounts. Evolution became the theoretical, comparative framework. Science and ideas of progress went hand in hand, and established archaeology as a scientific discipline. This paradigm was challenged around 1900 and replaced by a cultural-

historical attempt at explanation, headed by Gustav Kossinna, the first theoretical archaeologist

## Second parallel 1945–1955

A hundred years later, another scientific breakthrough occurred with wide-ranging consequences for archaeology. The period 1950–1960 saw the breakthrough of nuclear power and the related method of C14 dating in archaeology. It paved the way for a reorientation of archaeological interpretations, and the assimilation of new scientific methods of analysis from biology (pollen analysis), geography (settlement models), chemistry (trace analyses) etc. During the 1960s it gave rise to the science-based New Archaeology and Neo-evolution. This science-based paradigm was challenged by a culture-historical revival during the 1980s, under the banner of post-processual archaeology.

Thus, both revolutions were later followed by a theoretical critique leading on to a more humanistic and culture-historical archaeology with less emphasis on science. If, however, we look a little more closely into the background of these two scientific revolutions, we see that they share certain traits (Kristiansen 2003): they were both foreshadowed by an initial phase when interdisciplinary experiments were carried out and some of the prospects of the new applications were discussed in cutting-edge international research environments. This was then followed by a breakthrough phase when the new results were universally embraced and redefined their disciplines, such as geology and zoology during the period 1850–1860. This, however, was soon to be followed by a critical consolidation phase where shortcomings were analysed and corrected, as with the C14 calibration curve. But before applying this triple sequence to the present, let me first briefly examine what is left of mainstream theory.

## WHERE IS THE MAINSTREAM?

What we have witnessed during the last ten years is the collapse of a shared – or mainstream – theoretical framework. It has dissolved into a multitude of methodological and theoretical experiments, which is indicative of changing perceptions of the past, and probably also our own society. This is happening at a time when material culture and materiality studies have gained a foothold in the related disciplines of ethnology, anthropology and history, reflected in the *Journal of Material Culture*. At the same time, increasingly esoteric theoretical models with minority status are formulated in archaeology – from the ontological infusion

of “Being” into things, freed from human dominance (Olsen 2010 and 2013), to the application of biological evolution to cultural transmission (Shennan 2009; Mace, Holden & Shennan 2007). They represent two radically different theoretical solutions to the interpretation of objects and their meaning, but perhaps less incompatible than they may look at first sight. Both approaches have been subject to serious critique more recently (Barrett 2013 and 2014; Anderson 2014; Hodder 2013), and from here there seem to emerge new theoretical possibilities of integration. Thus, to me there can be little doubt that a wedding of aspects of materiality/thing theory and evolutionary theory is necessary in order to reassemble some of the theoretical spoils of the recent meltdown of the dominant paradigms. There are already attempts to provide a way out. Ian Hodder’s book *Entangled* is an attempt to restore materiality and evolutionary theory some of the mainstream attraction it lost by becoming too esoteric. He provides a “theory lite” with clever use of case studies, mainly from Catalhöyük. Although alluring, it is not able to transcend the dichotomy between his “micro” archaeology with high empirical resolution and the larger “macro” archaeology, combining all data rather than a single site. But no doubt it represents an important step forward in terms of a more holistic theory of the micro level in archaeology, with attempts to connect to the macro level. In addition, materiality studies have increasingly been adopted to account for larger-scale phenomena in situations where it is possible to focus on a specific material institution, such as traders, or some specific properties of the material record (Maran & Stockhammer 2012; Earle & Kristiansen 2010; Fahlander & Kjellström 2012).

Mobility has by now become a mainstream research theme, and in my book with Thomas Larsson, *The Rise of Bronze Age Society*, we provided a new theoretical and interpretative framework at the macro level in the first two chapters (Kristiansen and Larsson 2005). We wished to reinterpret the larger archaeological configurations that made up the interconnected globalized world of the Bronze Age, and which set it apart from the previous Neolithic (Kristiansen & Larsson 2005; Kristiansen in press). Globalization as a general phenomenon that may appear under various historical circumstances is also increasingly being applied to prehistory (Jennings 2011; Vandkilde 2008), and we have seen a whole series of books and articles that apply a moderate or modernized version of evolutionary and world system approaches (Beaujard 2012; Hornborg & Crumley 2007; Galaty 2011; Kradin 2002). To this belongs a return to systematic comparative studies (Earle and Kristiansen 2010; Smith 2011) with Ian Morris grand narrative: ‘Why the West rules – for now’, as an influential example. It is based on a quantitative comparison of

east and west Asia (Morris 2010), and in a follow-up book Morris explained the methodological approach and the parameters used for comparison. An intelligible reintroduction of quantified comparison (Morris 2013). It represents an expanding trend among younger researchers to apply quantification, various forms of modelling and simulation to be discussed.

To sum up: among these diverse theoretical strands we see a reformulation of both former processual and post-processual approaches, from quantification and agent-based modelling to micro archaeologies of materiality studies. Ecological approaches are likewise coming back under the banner of sustainability and human ecology (Isendahl & Stump 2014). Where will this take us?

## EXPANDING FIELDS OF NEW KNOWLEDGE

I shall now exemplify some recent developments linked to the third science revolution in archaeology. They are in the fields of (1) “Big Data”, (2) new quantitative modelling and (3) results from A-DNA, strontium isotopes and related scientific methods.

1. *The power of Big Data.* The concept of Big Data has become a hot issue in the last decade. National and international research councils allocate huge sums of money for so-called “infrastructure” projects, which basically means funding large research databases and making them accessible. To archaeology this is nothing new, we always relied on national and regional databases from systematic surveys carried out during the last 150 years, and we were among the first to digitize and make them accessible on the web, e.g. in Denmark (<http://www.kulturarv.dk/fundogfortidsminder/>). What is new, however, is the universal demand to making research data accessible, such as the global genome databank, which has demonstrably speeded up genetic research on a global scale. Digital Humanities is another concept referring to the new potential of analysing huge amounts of digitized data, whether in literature, on the web, in news, archives etc. Here mention should also be made of the universal digital access to all forms of geographical and other spatial data employed in GIS modelling. In archaeology we should mention the C14 database published by Radiocarbon (see also [www.jungsteinsite.uni-kiel.de/radon/radon/](http://www.jungsteinsite.uni-kiel.de/radon/radon/)), but also an increasing amount of more specific data is being made available, such as rock art ([www.shfa.se](http://www.shfa.se)). Finally, we need to recognize the hugely increased knowledge database archaeology

can muster compared with the situation 40 or 50 years ago. After 40 years of contract archaeology, real historical knowledge about settlements and landscapes is possible. After the third science revolution, museum collections are becoming revitalized as new evidence can now be extracted from them, just as they are becoming increasingly available for research in databases. All of this invites a re-theorizing of the archaeological record and its history (Lucas 2012). From this follow also new methodological/analytical developments.

2. *The methodological power of quantification and modelling.* Following on access to large datasets, we see new quantitative methods being applied more widely among young researchers in the form of agent-based modelling and network analysis, to name two of the most popular (Barton 2014; Kowarik *et al.* in press; Lake 2014; Verhagen & Whitley 2012). But also palaeobotanical research has seen a breakthrough in landscape reconstruction by combining regional and local pollen diagrams over larger regions in a new computer model called “Reveal”, with real world correction factors for landscape reconstruction (Gaillard *et al.* 2010; Nielsen *et al.* 2012). We are also beginning to see joint European projects financed by the European Research Council, projects taking advantage of Big Data, such as Alistair Whittle’s “The Times of Their Lives: Towards Precise Narratives of Change for the European Neolithic through Formal Chronological Modelling” (<http://totl.eu/>), or Stephen Shennan’s “The Cultural Evolution of Neolithic Europe” ([www.ucl.ac.uk/eurevol](http://www.ucl.ac.uk/eurevol)). Shennan and his team have provided new proxies for population fluctuations by employing tens of thousands of C14 dates from the European Neolithic to trace a possible demographic decline or bottleneck around 3000 BC (Shennan *et al.* 2013; Shennan 2013; also Hingst, Sjoegren & Müller 2012). From the recent genome from Ötzi the Ice-man we know that he lived around this time and has a very few relatives among modern Europeans, mainly in Sardinia (Keller, A. *et al.* 2012). Something dramatic happened after 3000 BC in Europe. By combining high-resolution micro case studies with macro data from archaeological databases it has also become possible to reconstruct absolute population and settlement numbers and calculate resource use in the Bronze Age (Holst, Rasmussen, Kristiansen & Bech 2013). Finally, network analysis has once again come to the forefront of archaeological methodologies, as a means of expanding materiality studies with powerful new analytical techniques and a broader theoretical repertoire (Mizoguchi 2009; Knappett 2011, 2013).



3. *The theoretical power of new knowledge.* The theoretical wedding of agent-based materiality studies/Actor Network Theory with quantitative analytical techniques may be seen as an attempt to overcome the dichotomy of macro versus micro theory: the structural/top-down constraints of world system theory, with its related concepts of institutionalized interaction (Kristiansen & Larsson 2005, chapter 1), and the analytical/bottom-up constraints of personalized, agency-based materiality theory of things and humans (Fahlander & Kjellström 2010; Knappett 2005; Johannsen 2012; Olsen 2010, 2013). Network analysis seems to provide an attractive interpretative “tabula rasa” for a multivariable approach with free moving agents – material and human – at the forefront. It further attempts to integrate both micro and macro perspectives into a scalar approach (Knappett 2011; Earle & Kristiansen 2010: Figure 1.3). This is in line with recent theoretical attempts to bridge the gap between a materiality approach whose success has mainly been at the micro level, often in rich historical/and or archaeological contexts (Meskell & Joyce 2003; Knappett 2005) but now also more widely applied, e.g. in classical archaeology (Maran 2011, Steel 2013), with new insights from the ongoing science revolution in archaeology, such as strontium isotope analysis and A-DNA. So far results of the latter have demonstrated that human mobility was much more profound in prehistory than previously assumed (Knipper & Price 2009), not least in the Bronze Age (Price, Knipper, Grupe and Smrcka 2004; Chenery & Evans 2012; Linderholm 2008; Linderholm *et al.* 2011; Pokutta 2013; Wahl & Price 2013). Therefore migrations, travels and other forms of interaction and mobility have come to the forefront of archaeological interpretations and debate (Cabana & Clark 2011, Dziegielewski, Przybyła & Gawlik 2010; Krenn-Leeb *et al.* 2009), and the first attempts to synthesize new results from A-DNA on a European scale have surfaced (Manco 2013). The theoretical and historical implications of this knowledge revolution will be profound, as it lifts the forces of historical change away from the local context onto a much larger geographical scale of multiple local interactions, creating a constant flux of connectivity and productivity without fixed boundaries.

Where do these new trends take archaeological theory and interpretation? And where in the triple process mentioned above are we at present?

## NEW FIELDS OF (RE)THEORIZING

If I were to compare the third science revolution in archaeology with the second, the radiocarbon revolution, then we are now where  $C_{14}$  was before calibration. In strontium isotope research we are beginning to get a more detailed, high-resolution background of baselines to identify origins in some regions (Frei & Price 2011), and when it comes to A-DNA we are learning more about the conditions for DNA preservation, the best places to sample human DNA (teeth, hair, or some specific small ear bones), but we are only starting to get a comparative database in real prehistoric time. In strontium isotope research we have also witnessed expanding applications in other materials, such as wool, hair, etc. (Frei *et al.* 2009; Frei 2014; Bergfjord *et al.* 2012), in order to trace the origin of textiles/wool, and the life and diet of individuals during their last years in life (sampling hair when preserved). The Iceman Ötzi may provide a good example of this biographical approach (Muller *et al.* 2003), and when part of his genome was published recently we also learned that he has few relatives among modern Europeans, mostly confined to Sardinia (Keller *et al.* 2012).

While it is possible to define new fields of theorizing, it is impossible to predict where this will take us. Let me therefore start with a discussion of what I consider new fields of knowledge in need of critical theorizing as well as currently expanding fields of new analytical techniques. I have summarized my view in Figure 1 in the form of a theoretical wheel to symbolize the main theme of mobility and how it is analysed and theorized. The central part, the axle of the wheel, is occupied by the main research theme during the next two decades: interactions of all things movable (humans, animals, objects, raw materials etc.) and the networks they move through, whether through trade, migration, colonization or other forms of movements. Mobility and interaction draw their data from many fields: strontium and lead isotopes, A-DNA, but also archaeological data on trade, migration and other forms of interaction. Here we have seen new analytical developments, e.g. network analysis and other forms of interaction (Knappett 2013; Nakoinz 2013).

To analyse and theorize mobility and interaction I have paired a number of theoretical or methodological concepts as spokes in the wheel forming dialectic axes. Landscape modelling and settlement modelling represent the man-made landscape dynamics and how this is structured over time, which also includes demography, household economies and other basic variables. The development of new advanced modelling tools for landscape reconstruction, such as Reveal (Nielsen *et al.* 2012; Gailard *et al.* 2011) provides a new framework for interactive settlement

studies and modelling (Diachenko 2013; Robb 2012), including agent-based modelling (Cimler *et al.* 2013). But the calculation of absolute demographic figures is now also within reach, and can be used in comparative studies of demographic and economic/environmental development (Müller 2013).

Agent-based modelling and complexity theory is closely related, but where agent-based modelling is about concrete analytical strategies complexity theory informs about structural relations, causations and thresholds of more complex systems (Barton 2014; Kohler 2011). In the same field simulation models are also coming back (Lakea 2014), just as we have seen a real expansion in the application of agent-based modelling recently (Wurzer, Kowarik & Reschreiter 2013).

The next dialectic in the wheel is that between genetics and culture. This has already been subject to much discussion, but earlier publications were based on modern DNA from which deductions were made backwards in time. We are now beginning to produce prehistoric genomic evidence that opens up several new fields of research: it will allow un-

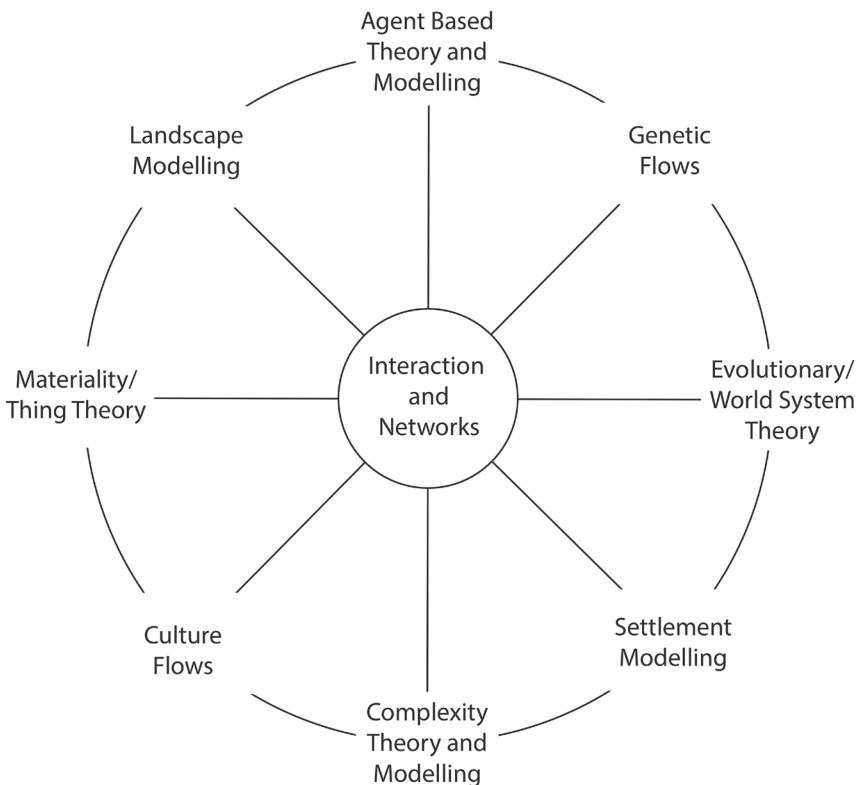


Figure 1. The theoretical wheel, suggesting new axes of theorizing.

precedented insight into genetic variability in real prehistoric time, which can then be compared with modern DNA, and thus form the basis for a genetic history (Pinhasi *et al.* 2012). It will allow the reconstruction of migrations and other ways of renewing the gene pool, which apparently took place several times during prehistory, but especially during the later Neolithic/early Bronze Age in western Eurasia. And when compared with relevant archaeological data and cultures it will allow critical analysis of how the two interact. Recent work on the construction and meaning of cultures and ethnicity (Hu 2013; Roberts & Vander Linden 2011) will thus be amplified. This will inevitably lead to critical discussions about genetic and cultural interaction and transmission. In addition we shall be able to trace human diseases, lactose tolerance, eye and hair colours etc. (Vuorisalo *et al.* 2012).

All of these analytical results should ideally also be interpreted from a materiality/evolutionary perspective as it provides social models with historical time depth. Evolutionary and World System theory remain strong interpretative models in both North America and Russia, and we have seen refinements as well as new results that accounts for much of the diversity we find in prehistory (Bondarenko, Grinin & Korotayev 2011; Grinin & Korotayev 2011; Hall, Kardulias & Chase-Dunn 2011). Also, the ongoing discussion of the relationship between biological and cultural/social evolution shows the attractions and strength of such an approach (Anderson 2013; Barrett 2013; Cochrane & Gardner 2011; Hodder 2013).

## THE FUTURE OF ARCHAEOLOGICAL THEORY: TOWARDS A NEW PARADIGM OR PARALLEL MAJOR AND MINOR PARADIGMS?

A paradigm is a shared foundational set of theoretical beliefs and priorities that govern the way one or several disciplines interpret their data. When Thomas Kuhn introduced the concept in 1962 for the natural sciences (Kuhn 1962) it was soon applied in archaeology to characterize the major changes in thinking from cultural history to processual and later to post-processual archaeology. However, several researchers later argued that paradigms, or discourses to use the French concept, are much more encompassing and relate to the way humanities and social sciences interact with society throughout history. Major shifts in theoretical and philosophical priorities have thus oscillated between “modern” and “postmodern”, or “rationalistic” and “romanticist” perceptions of the world since the Enlightenment (Friedman 1994; Wolf 1999;

Kristiansen 1998: Figure 14; Bintliff 2008). In the words of Eric Wolf: “Tracing out a history of our concepts can also make us aware of the extent to which they incorporate intellectual and political efforts that still reverberate in the present” (Wolf 1999:22). He sees the original debate between Enlightenment and its enemies as having formed all subsequent debates. Or in his own words: “Each encounter provoked reactions that later informed the position taken during the next turn. The issue of Reason against Custom and Tradition was raised by the protagonists of the Enlightenment against their adversaries, the advocates of what Isaiah Berlin called the Counter-Enlightenment. In the wake of this debate Marx and Engels transformed the arguments advanced by both sides into a revolutionary critique of the society that had given rise to both positions. The arguments put forward by this succession of critics in turn unleashed a reaction against all universalizing schemes, schemes that envisioned a general movement of transcendence for humankind. This particularism was directed against Newtonian physics, Darwinian biology, Hegelian megahistory, and Marxian critique, on the debatable premise that they all subjugated the human world to some ultimate teleological goal” (Wolf 1999:22).

There is, in my opinion, little to suggest that we are past these classic debates and shifts in ideological and intellectual climate. I therefore tend to see the present changes in archaeology as part of a larger shift from postmodernity to a revised modernity. If this were not the case we should instead consider the third science revolution as inherently archaeological, which it is not: the DNA revolution of human genetics penetrated and redefined not only medicine but many natural science disciplines as well, and also indirectly influenced the social and historical disciplines. Here the parallel computing and digital revolution in modern media and communication also had huge impact by creating Big Data. This combined data and knowledge revolution is thus interdisciplinary and global, and therefore changes observed in archaeology are also likely to be observed in other disciplines. There are, however, two conditions that influence the course of the new paradigm, and whether it is still possible to maintain a dominant global position. It is the relation between the “dark” and “bright” side of globalization, and it is the specific position archaeology holds between science and the humanities.

Paradigms/discourses were defined in the past as relating to a dominant global condition, whether modern or postmodern (Friedman 1994). This implies that there were marginalized regions, such as former eastern Europe under communism, which was cut off from such global developments, or disciplines with minority status, which lacked the critical mass and importance to enter the global cultural and intellectual trends. In

the present we are faced with uneven economic development resulting in a “dark” (neo-nationalism) and “bright” (expanding global welfare) side of globalization. We may therefore also expect this to have an influence on the acceptance of new theoretical ideas, and a more sceptical approach in some academic camps towards the third science revolution and its impact. In addition to this, archaeology occupies a specific position among the social and historical disciplines, between science and the humanities, which may suggest a stronger acceptance of the science revolution than in other social and humanistic disciplines.

Archaeology is concerned with long-term history, as well as its constituting sequences of short-term history and personal lives. The A-DNA and strontium revolution redefines human origins, health and mobility, and establishes a new prehistory. A more holistic theoretical approach must be developed to account for this new diversity, one that integrates micro and macro perspectives – from human life stories (A-DNA/strontium) to their larger social/cultural framework (travels/interaction/networks/major genetic shifts). One such example is Eulau in central Germany: a cemetery of what turned out to be several family groups. The DNA analysis could demonstrate that children buried together with a man and a woman were their offspring. But in addition the strontium isotope analyses revealed that the males were local but the women were non-local, originating in a nearby, but different Neolithic Culture. The arrowheads used to kill some of the buried were also from this “other” culture. Here the combined evidence from A-DNA, strontium isotope analysis, osteological analysis of skeletal trauma and archaeological analysis of flint arrowheads revealed an ancient drama of potential wife robbing and later revenge (Meyer *et al.* 2009; Meller, Muhl & Heckenhahn 2010). The reconstruction of such a singular historical event is powerful as it opens the door to social and political dynamics and tensions on the ground, which, however, were played out and should be situated in the larger context of the expansion and consolidation of the Corded Ware culture among neighbouring and retreating Neolithic cultures during the third millennium BC. Here future genomic DNA analyses will be able to reveal how this happened.

Thus, the ongoing scientific revolution of archaeological knowledge has implications for theory and interpretation, as well as critical thinking. When the contours of this new prehistory become clearer we will see new theoretical and interpretative models emerge, and I have suggested what they may look like (Figure 1). Prehistory will thus in some situations be subject to the same level of detail as modern material culture studies. This opens up for a truly human history from the Palaeolithic till today, and a truly interdisciplinary understanding of human history.

It will require the development of a critical archaeology that engages in a discussion of biology vs culture, genetic versus cultural evolution. However, we are past theoretical hegemonies in the humanities. What we will see is rather a heavier reliance on large datasets, whether from micro or macro studies, as exemplified by Ötzi the Iceman or the victims of a third-millennium drama in Eulau, and more complex modelling. This invites theorizing that is more integrated in actual modelling, such as agent-based modelling or complexity theory. Some will see this as a return to a more processual, positivistic approach, which may in part be true, but it is one that is also informed by critical theory about the use of the past. It will therefore be more engaged in political and ethical issues. This new discourse is emerging already, but will become dominant during the next decade. We may still see part of the post-processual agenda continue in some camps, and critical heritage studies will keep expanding and thus force archaeology to confront political issues about the use of the past. Let me therefore finally, and very briefly, discuss archaeology and the public domain.

## TOWARDS A NEW PUBLIC ROLE FOR ARCHAEOLOGICAL AND HISTORICAL RESEARCH?

During the last generation we have tended to separate the public domain of archaeology from its scientific domain: the public domain was relegated to cultural heritage, which represents a reworking of the past in the present, whereas academic research was considered to be about the past, even if its relation to present concerns and questions was acknowledged. Museology likewise became the professionalized management of collections and exhibitions, and taught as courses along with cultural heritage at universities. During the last decade or so both fields have developed critical academic research: we talk of Critical Heritage Studies (CHS), and Critical Museology, dealing with the formation of collections during European imperialism and colonization. They have also developed their own journals (*Journal of Heritage Management*, *Critical Heritage Studies*, *Public Archaeology*), and an international association (Association of Critical Heritage Studies: [www.criticalheritagestudies.org.preview](http://www.criticalheritagestudies.org.preview)) – a sure sign of a more mature field of research and management. This professionalization and critical development of new fields of archaeological engagements and research was necessary, but tends to obscure the close relation between the three: new knowledge about the past has implications for how we present the past in museums and at public monuments, and questions of identity, nationalism,

political uses of the past cannot be completely separated from ongoing research, which has become painstakingly clear with the influence of ultra-nationalism on research in many regions of the world (Shnirelman 1996). A recent example is the attempt by (ultra-nationalist) Indian researchers to claim that Indo-European languages had their homeland in India (see debate articles in *Journal of Indo-European Studies* vols 30 and 31). Very much in the way Gustav Kossinna wanted a Nordic homeland for Indo-European a hundred years ago, based on ideological conviction. There are no easy solutions to such ideological infiltrations, other than maintaining high-quality, critical research programmes.

Another area of debate that has resurfaced, as exemplified by Liden and Eriksson (2013), is that of the “Two Cultures”, as originally presented by C. P. Snow in his classic lecture from 1959, later published as *The Two Cultures and the Scientific Revolution*. We are now in a similar situation, where science has taken a big leap forward in archaeology too (just see how the *Journal of Archaeological Science* has increased its annual issues in recent years). Thus the natural science turn in archaeological knowledge during the last ten years left archaeological theory, as well as most archaeologists, somewhat baffled and behind. There emerged a situation where biologists took centre stage and wrote popular syntheses about human and social evolution, such as Brian Sykes’s *Seven Daughters of Eve* (Sykes 2001), presenting to the general public a mitochondrial Eve located in Africa, or the hugely popular books by the biologist Jared Diamond (1997 and 2006), which tended to simplify things in a dangerous, deterministic way. A scientist recently came to the defence of the humanities in the book *Aping Mankind* (Tallis 2012), against what he considered the misrepresentation of humanity. However, the debates that have followed point to another dimension of modern DNA research: it raises fundamental questions about what it means to be human, what genetic variation means, and the prospects of such knowledge for ideological propaganda, whether racist/anti-racist, nationalist or anti-nationalist. In short: it demands a stronger public engagement by archaeologists, scientists and humanists, perhaps to a degree we are not used to. While archaeology has a long and glorious history of popularization, there is less experience of taking part in critical public debates, whether in newspapers, television or on the web. Here Germany has a special tradition of “Historikerstreit” about crucial questions linked to the world wars and what came after, but the humanities and archaeology in particular need to engage in discussing the implications of the expanding frontier of knowledge just described, from A-DNA and genetics to the diet and mobility of individuals, from demography to sustainability in the long term. The archaeologist as a



public figure was the theme of a recent volume of *Archaeological Dialogues*, presenting some relevant papers and examples from around the world (Tarlow & Stutz 2013).

I would like to see new forms of academic engagements with the public that cross-cut our professional domains. I do not recommend a return to a Romantic past where the polymath and antiquarian was a central figure, as illuminated by Michael Shanks (2012; see also [mshanks.com](http://mshanks.com) - blog - all things archaeological, one of the earliest in archaeology), but we can follow Shanks in taking this historical figure as a parable for our need to engage more holistically with the past and its role in the present and future (also Otto & Bubandt 2010), and in the process we need to find new forms of such engagements, from blogging to online histories that are revised and expanded on a daily basis. It can take the form of national histories, European histories or gender histories, immigration histories etc. The sky is the limit. But this would also demand a revision of the role of the historian/archaeologist/intellectual as a publicly engaged figure, and a redirection of funding towards new forms of public engagements. Books, like vinyl, will continue as a physical, analogue format, but we need to explore in a scientific way the many new possibilities of engaging with the past in the present.

## THE MOST EXCITING OF TIMES

I shall end this diagnostic and predictive essay on a personal note. I feel that we are right now experiencing the most exciting of times in archaeology – at least during my own lifetime. The 1950s must have held some of the same excitement, at least for some: suddenly you could walk back into the museum stores and select material for absolute dating. A dream fulfilled. Like now: we can once again walk back into the museum stores and select material that will tell us whole life stories of individuals, their diet, mobility and close family stories, as well as their larger genetic family stories from prehistory until the present. A new door has been opened to previously hidden absolute knowledge that once again will reduce the amount of qualified guessing and thus both refine and redefine theory and interpretation.

Is there more knowledge of similar magnitude stored to be unleashed from the archaeological record? We know that DNA is stored in frozen soils and perhaps in other soils under good conditions of preservation, which if successfully applied to archaeology could open the door to full environmental reconstruction, including animals and humans (Hebgaard *et al.* 2009). My own unfulfilled dream is that one day we shall

be able to release the sounds of prehistory: talking, music etc. stored in some mysterious way in the atomic particles of pottery and metal during the process of their production. It will probably never happen, but the point I wish to make is that innovative research is fostered by dreams about what the past was like and how we can find new ways to get to know about it, and secondly what we can learn from it in the present. This dialogue between dreams and hard evidence, past and present concerns, keeps research going during the long, laborious and unglamorous weeks, month and years in the laboratory, in the museum stores, and at the excavations. At least it does for me.

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# PLUS ÇA CHANGE

## From Postprocessualism to “Big Data”

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I appreciate the opportunity to comment on Kristiansen’s provocative keynote article, “Towards a New Paradigm? The Third Science Revolution and Its Possible Consequences in Archaeology.” The main argument put forth by Kristiansen is that archaeology is moving out of a “postmodern/postprocessual hegemony, and ...[towards] a revised modern/processual approach.” In the wake of the presumed collapse of postprocessualism he points to the rise of “big data” and “big funding” for archaeology. The latter he characterizes as having led to the disappearance of the boundary between science and humanities and between theory and data. While there is no doubt that new technological innovations and sources of funding will have a direct and profound impact on archaeology – as other disciplines – in this short response I wish to highlight where I diverge from Kristiansen’s perspective in three key areas: (1) the definition of postprocessual archaeology; (2) his characterization of the demise of postprocessual archaeology; and (3) his assertion that there is in fact a “third scientific revolution,” which provides the answer to the future of archaeology.

## DEFINING THE POSTPROCESSUAL CRITIQUE AND ITS LEGACY

My first point of departure from Kristiansen is that he presents post-processual archaeology in contrast to other theoretical approaches. Instead, I view it as primarily a critique of processual archaeology – specifically its idealist quest for generalizing laws of human history and behavior. Postprocessual archaeology was and is not a cohesive theoretical approach or paradigm, and proponents embrace a wide variety of theoretical perspectives: neo-Marxism, postmodernism, feminist theory, post-structuralism, critical theory, etc. As Preucel (1995:147) puts it, “the term refers not to an unified program but, rather, to a collection of widely divergent and often contradictory research interests.”

While I would not characterize postprocessual as a paradigm unto itself, there have nevertheless been a number of changes in archaeological theory and practice that grew out of the postprocessual critique and that were spawned by postmodernism more broadly. These perspectives and critiques have had several lasting and significant effects on archaeology as a whole: there is a greater acknowledgement of the subjective position of the archaeologist, a greater emphasis on the role of human agency in interpretations of the past, and a persistent call for multivocality – for including the voices, perspectives, and values of marginalized peoples (who have traditionally been the objects of study of archaeologists and anthropologists).

The postprocessual critique and debate had a profound effect on the field of archaeology – even for those who would never call themselves postprocessualists. In the U.S. most of the archaeological practice was and is in Cultural Resource Management (CRM) or compliance archaeology. Postprocessualism has probably only affected CRM archaeology to a small degree, specifically with respect to the kinds of stakeholders consulted and the more diverse array of interpretations offered (i.e., beyond subsistence). On the other hand, in academia much has changed. The types of subjects that are undertaken in archaeology include the African Diaspora, social inequality and racism, Indigenous archaeology, repatriation, and heritage values. The pursuit of new subjects has not led to the diminution of field methods, labs methods, and data management. But it *has* affected how we do what we do – how we create categories in our data, who we consult with and when, who we share our data with, and how we interpret our data. As Dobres (1999) argues, “even seeing empirical variability in the archaeological record ... is a learned skill.” Having learned how to “see” the challenge, as she puts it, is “to explore how thinking and seeing differently can lead to potentially dif-

ferent empirical findings and alternative understandings of the past.” By highlighting agency in prehistory and in our analytical methods “seeing differently” can be labeled as postprocessual or humanistic, but it can also just be *good science*. Some archaeology that has been labeled as “postprocessual” was simply social scientific archaeology that focused on subjects that had been ignored by the New Archaeologists, such as social inequality (e.g., McGuire & Paynter 1991), gender in prehistory and archaeology (e.g., Gero & Conkey 1991), and power (e.g., Sweely 1999). A new focus on such topics led not only to new data but to the development of new theoretical approaches as well.

## WHAT'S IN A NAME?

If one agrees that postprocessualism was a critique – and not a paradigm – then its legacy can be left to live on, and one does not need to make a choice between it and a “new scientific paradigm.” Perhaps the postprocessual critique was more agreeable to academic archaeology in the U.S. because most of us are anthropologists and very comfortable in our role as social scientists – not feeling we have to choose between natural science and humanities. When I was interviewed for my first tenure track position after receiving my PhD in 1996, at the interview a tenured professor said to me “So you are from UMass. Does that mean you are a postprocessualist?” “Actually,” I replied, “I am a flexible generalist.” He chuckled and I then went on to describe both my theoretical and methodological work, but the point of my response is that I did not – and do not – feel it useful to categorize all archaeology as either processualist or postprocessualist, as either science or humanities. Perhaps this is a manifestation of what Preucel and Mrozowski call the “new pragmatism,” that is, not the dominance of one theory but the “explicit integration of archaeology and its social context in ways that serve contemporary need” (2010:3). As archaeologists we know that typologies and nominal variables in general should be used only in so far as they are useful. At this point I think it is most useful to think of 21st-century archaeology as a palimpsest of its own history and as inextricable with the values and priorities of the times, which includes the role of big data, a need for heritage management in the context of competing values, and a challenge to the role of the historiographical expert. If you add to this list of challenges the devaluing of science *and* humanities (at least in the United States), self-preservation would dictate that there is good reason to gravitate towards more scientific approaches, especially in an era where there is a renewed optimism that science will solve the world's problems.

## A THIRD SCIENTIFIC REVOLUTION OR PLUS C'EST LA MÊME CHOSE?

Does this mean we should declare a third scientific revolution in archaeology? From his brief overview of the history of archaeology Kristiansen concludes, “a wedding of aspects of materiality/thing theory and evolutionary theory is necessary in order to reassemble some of the theoretical spoils of the recent meltdown of the dominant paradigms.” He points to the signs of a third scientific revolution in archaeology: (1) the arrival of our ability to amass and analyze “Big Data”; (2) the methodological power of quantification and modeling; and (3) the theoretical power of new knowledge. While the Internet, faster computers, and more sophisticated applications have advanced both the scale and speed of potential research avenues, I do not share his perspective on the how these advances will impact archaeological theory. Our creation and use of archaeological databases and data set is largely undertheorized. Amassing larger datasets does not remove the interpretive nature of the creation of these datasets in the first place: “what makes the archaeological data speak to us, when we interpret it, when it makes sense, is the act of placing it in a specific context or set of contexts” (Shanks and Tilley 1987:104). Acknowledging the value-laden and context-specific nature of datasets does not stymie us from moving forward, but it does present a challenge – especially as larger and larger datasets are combined from multiple sources and contexts. As Alison Wylie (2002) puts it, “Archaeologists can and routinely do make empirically grounded and conceptually reasoned judgments about the relative credibility of claims about the evidential significance of archaeological data; these are by no means certain, but neither are they entirely arbitrary. The problem is to give a systematic account of how researchers make such judgments.” In this vein, I do not see the arrival or use of big data as requiring an inevitable return to processualism – it simply continues to improve and expand the powerful toolkits that archaeologists have at their disposal.

## PUBLIC ARCHAEOLOGY AND HERITAGE STUDIES

I would like to touch on the point that Kristiansen raises with regard to public archaeology; he characterizes public archaeology as having been more about cultural heritage or “the past in the present” and academic archaeology as having been more about “the past.” Perhaps this is a distinction between European and U.S. archaeology. In the U.S. the various forms of “public archaeology” (whether in museums or public digs

of various kinds) have very much been in the historiographical expert realm. Most often archaeologists are portrayed as scientists (alongside paleontologists). I am most often asked to speak to various schools and museums about how archaeologists conduct excavations and laboratory analyses – and about what *really* happened in the past. Heritage as a concept and field of research – and even as a *word* – in the U.S. is not well developed and understood. Archaeology outside the academy has been relegated to the field of “historical preservation” and is seen as being about the past – not about people’s contemporary cultural heritage or values. I believe this is in part because of the colonial nature of U.S. history. But it is only recently that there has been increasing attention to what Randy Mason and I have termed a “social science of the past” (Chilton & Mason 2010). The kind of heritage studies I have developed and promoted at UMass Amherst with the Center for Heritage & Society and the journal, *Heritage & Society*, is not so much about “public archaeology” – that is, engaging with the public about what we learn from archaeology – but about why and how the past matters in contemporary society. It is a social scientific study of contemporary social behavior vis-à-vis understood pasts. As such, of course, it is not archaeology at all. And in this vein, archaeology itself is a kind of heritage practice worthy of study (see Chilton & Silberman 2012; Holtorf 2012). This is very much in line with Kristiansen’s call for more scientific ways of engaging with the past in the present.

To conclude on a personal note, as a child of the 1960s I optimistically consider humans to be *capable* of using scientific and technological methods to solve any number of pressing global problems (disease, war, violence, food stress, global warming, etc.). But as a social scientist I also strongly believe that we need to first work on issues that will not be solved with data alone: social inequality, the sustainability of our natural resources, equitable decision-making and priority setting, and an understanding of the politics of science and funding mechanisms. This is certainly not a call for hyperrelativism. One of the most serious critiques of postprocessual archaeology is that it addressed “the politics of archaeology in so highly abstract a way that it provides no reference point for those archaeologists who must deal with immediate political issues” (Smith 1994). Trigger (1989:347) similarly points to the danger of hyperrelativism for those who wish to take action. In the end, Trigger’s (1989:369) optimism about the future of archaeology was based on his perception that there was a “growing sense of unity and complementarity of historicism and evolutionism in Western archaeology.” My own personal optimism comes from trends in archaeology, and heritage studies more broadly, to focus on problems that emanate from non-ac-

ademic communities – community engagement and social justice, economic and social development, and environmental and cultural resource management. These types of public engagements will keep archaeology relevant, grounded, and innovative.

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# ARCHAEOLOGICAL REVOLUTION(S)

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I understand Kristian Kristiansen's enthusiasm for the seemingly infinite possibilities offered by the collaboration between the natural sciences and archaeology. Gone are the days when archaeometry was associated with a narrow, functionalist agenda. We know now that we can recover past habitus, memory or social identity through the application of "archaeological science". (I hate the concept, though: is it not science when we do not use a microscope?) I also agree with his plea for a return to the production of grand narratives. In fact, I have always been a great fan of his masterful grand narrative: *Europe before History* (Kristiansen 1998). The approach proposed in this article, however, does not reject the small and the local. On the contrary, it tries to bridge the gap between the micro and the macro, bypassing an unhelpful dichotomy. I also find very revealing the historiographic analysis proposed by the author. Nevertheless, I have some misgivings about his paradigmatic enthusiasm that I will try to flesh out in this comment.

My first question has to do with the real relevance and novelty of the present archaeological revolution described by Kristiansen. The two previous scientific revolutions in archaeology were indeed decisive for the development of the discipline. The first one in the mid-nineteenth century actually allowed for the emergence of archaeology as a science, finally separating it from antiquarianism. The second one in the mid-twentieth century goes hand in hand with the rise of New Archaeology,

which proposed a truly new way of studying and understanding the past. Although I do see the potential of archaeometry for the transformation of our knowledge of the past, I do not think that it is actually promoting a different understanding of it, at least not on a revolutionary scale. The first two scientific revolutions implied radically new sets of ideas regarding society, time and the archaeological record. I find it hard to see any of this in the coupling of cutting-edge natural science methods and archaeology today. Quite the opposite: with some remarkable exceptions, including several of the archaeologists mentioned by Kristiansen and a few others (e.g. Jones 2004; Llobera 2011), my impression is that archaeometry has made many people lazy – and justified their laziness. Why should we try to think deeper and in a different way when all these methods tell us *how the past actually was*? They tell us exactly what they ate, where they came from, which diseases they suffered from. What else do we need?

The author puts a lot of emphasis on a totally different understanding of mobility and connections in the past made possible by archaeometric procedures. I would contend that it is not archaeometry that has made this understanding possible. It is the *esprit du temps*. We live in the network society (Castells 1996), a world where time and space have collapsed, where mobility is greater than ever and economic, cultural and political globalization mark the rhythms of each and every society. Networks, connectivity and mobility are the buzzwords of the social sciences and the humanities: from cultural geography to literary studies. As archaeologists, I am sure that we would be finding mobility without isotopes as well. In fact, we do: there is a lot of interest in mobility in archaeological subfields where scientific methods are not so widely used or needed, such as classical, historical and contemporary archaeology (Horden & Purcell 2000; Van Dommelen & Knapp 2012; Beaudry & Parno 2013). What Kristiansen sees with excitement, I see with some concern. I fear that we may end up finding again a past modelled on our own present.

My impression is that we are finding too much movement in the past or at least that we are making too much fuss out of the movement that we find. Of course people (and things, and ideas) moved: there were migrations, exogamy, long-distance trade, pilgrims, peddlers, wandering holy men and women, war raids and travelling mercenaries. We knew that already without hard sciences (even if some processualists tried to deny mobility for a while). But the network-globalization paradigm prevents us, in my opinion, from grasping the actual nature of movement in the deep past as well as in many non-Western societies in the present. Ian Morris (2003) already defended, in a critique of Horden and Purcell's



book, that it is necessary to understand the different rhythms of the ancient Mediterranean, with its episodes of connectivity and disconnection, movement and stasis, acceleration and deceleration. This is a perspective that could be shared by two historians that understood well the alterity of the past and its different rhythms – Braudel (1958) and Leroy Ladurie (1974). Jonathan Friedman (2002) has noted how the mobility paradigm is very much in tune with both the ideology of global capitalism and the lives of cosmopolitan academics. There is nothing strange, therefore, in archaeologists finding mobility in Prehistory today. In fact, they found it before. Interestingly, during the second half of the nineteenth century and the early twentieth-century movement was all over the place. Australians travelled to Eastern Africa with their boomerangs, African hunters arrived to Iberia with their arrowheads, Mycenaean architecture influenced the monuments of Wessex. Is it a coincidence that evolutionary and diffusionist archaeology saw their heyday during the Age of Empire and the first cycle of globalization?

My biggest concern, however, is not with archaeometry or mobility, but with what I see as an unconscious exclusionary tactic in Kristiansen's paradigmatic discourse. The situation that he describes is presented as the great revolution in archaeology. For me it is not *the* revolution; at best, *a* revolution. I do not have any problem with people fighting for their paradigm and utopias, as long as they do not try to impose them as the single possible way of doing archaeology – or rather, the only way of doing good archaeology. My archaeology is different, although it can perfectly cohabit (indeed coalesce!) with Kristiansen's. I am not so sure, however, that he or his colleagues, in his desire to find scientific convergence and consensus, will be so magnanimous with other approaches. My archaeology, which I believe I share with many, is less fascinated with isotopes and radiocarbon, and more with the possibility of breaking the temporal limits of archaeology, dissolving divisions between past and present; an archaeology that can study the deepest prehistory as well as modernity, even the present (Harrison 2011) – there is not much room for the recent in Kristiansen's revolution. It is an archaeology that is more interested in opening the range of questions that we ask of the archaeological record, than with the devices that we use to make those questions answerable. It is an archaeology that welcomes many "esoteric theoretical models with minority status". Not only the new materialisms (Witmore forthcoming) that Kristiansen is eager to accept, but also alternative ontologies, indigenous archaeologies, decolonial thinking, feminism, queer theory, political archaeologies, Critical Theory (capitalized) or the archaeologies that reflect on the relationship between the discipline and the arts. These are all perspectives that

have proposed new questions and raised new problems for archaeology, but that may not fit easily in the third scientific revolution of archaeology. The archaeology in which I believe overflows disciplinary limits as well, not just to walk together with biology and physics, but also with philosophy, anthropology, geography, history and cultural studies. And when I say walk together, I envisage an archaeology that instead of passively foraging from other fields, enlightens them. An archaeology that is relevant, therefore, not just because it manages heritage, works with communities and is conscious of its public role, but that is relevant because it is intellectually powerful. Because it helps us think and problematize society (past and present) as much as anthropology or philosophy, but in its own way. An archaeology, in sum, that produces theoretical insights and ideas for others to share and not just knowledge of the deep past (González-Ruibal 2013). To be sure, Big Data can contribute much to this archaeology, as do isotopes and radiocarbon, but it can also be done without them.

My questions also include a practical worry: will I be allowed to do my archaeology under the new revolutionary regime? This is not a mere rhetorical question. By “allowed” I mean: will there be funding for projects that do not fit the model proposed in the article? Will there be positions opened in universities and research institutions? Postgraduate and postdoctoral fellowships for those who take a different path? Furthermore, what happens with those of us who fail to attract the large (and scarce) amount of funding needed for systematic DNA analyses or isotope databases? Are we condemned to do second-rate archaeology? Or even worse, what happens with those thousands of archaeologists who do not even have the chance to apply for funding in places like Africa, the Middle East, or Latin America? In my archaeology, there is no problem with one working in a provincial university or tiny museum in a bankrupt country. One can still do first-class science. However, in Kristiansen’s revolutionary archaeology, there does not seem to be much room for Third World practitioners, no more, at least, than there is for an astrophysicist in the Central African Republic. This is a pity: unlike the natural sciences, the social disciplines were (are?) still a somewhat democratic sphere of knowledge. I wonder, then, what is the political economy behind the paradigm proposed in this article? Will it aggravate the divide between North and South, the poor and the rich? Will we allow economically-disadvantaged archaeologists to participate in the big debates only as foot soldiers in a colonial army of data-providers? Of course, grand narratives are still mostly produced in the North, despite efforts by the World Archaeological Congress to redress the trend, but this situation will be more and more acute if we agree that the only

progressive and cutting-edge archaeology is the one that needs millions (or at least hundreds of thousands) to be properly done.

Apparently, my lack of optimism for the brave new world places me in the “dark side of globalization”, with resented neo-nationalists and perhaps some jihadists as well. But I cannot help but feel that Kristian Kristiansen’s optimism sounds a bit too self-congratulatory: it is a celebration of the world as it exists now (for those who fare well). A world in which scientific paradigm, funding and academic establishment are seamlessly intertwined and inhabit a particular geography. Coming from a different place in the political, economic and academic world, I find it difficult to share his scientific utopia. I only hope that he will accept others.

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# BE INFORMED OF YOUR INFORMATION

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My reading of Professor Kristiansen's essay is necessarily an act of balancing between different possible perspectives. As an information science scholar of archaeology, my interest is obviously in making observations on how archaeologists and archaeology works with information: how different things are documented, how they will be documented in the future and have been documented in the past and how these documents and various other types of sources of information are used to inform research and public ideas of past human undertakings. Further, I am interested in developing ideas on how to improve information work, how to make it "better" and fit for various individual and collective purposes. At the same time, from my other perspective as a trained professional historian with an admittedly strong interest in ancient (material) culture, I cannot help sharing Kristiansen's enthusiasm about the new possibilities offered by the emerging scientific methods and the huge leap in our capability to process unprecedented amounts of digital data in our quest to better understand the human past.

I agree that there is indeed a "general feeling that some fundamental changes are underway" in archaeology. However, changing back to my hat as an information scholar, it is necessary to raise a question about the locus of the fundamental change. Kristiansen sees the current revolution in the continuum with earlier paradigm shifts from (in his words) biblical to scientific to cultural-historical to processual to post-proces-

sual as a precedence of models of explanation. Another slightly different way of looking at the paradigmatic evolution in archaeology is to see it (in parallel) as an alteration of (primarily) information-oriented and interpretative approaches to practising archaeology. The formation of archaeology as a scientific discipline (i.e. *Wissenschaft*) can be seen as a shift of focus to new sources and ways of working with information about the past in a more systematic manner than before. In contrast, the cultural-historical archaeology of the early 20th century can be seen as an attempt to put more focus on interpretation and understanding of the remains of the past with all of its ideological consequences. Similarly, the two major intellectual movements of the second half of the 20th century, the processual and post-processual paradigms, may be seen as respectively information-first and meaning-first projects for advancing archaeological scholarship. In contrast to meaning-oriented post-processualism, the current data- and methods-driven shift seems to be propelled by a promise of the emergence of new sources and methods for extracting new information about the past. This particular type of reading of the paradigmatic evolution does not need to substitute other models or imply that the information-oriented paradigms would have come without theorizing and meaning-oriented arrangements without new methods or sources of information, but I am still somehow inclined to believe that this type of framing can be helpful in understanding the some of the real (sic!) opportunities (and limitations) of the emerging research approaches.

The principal implication of this reading is, in rough terms, that in archaeology the emphasis of new methods and the discovery of new sources of information has been followed by a new paradigm that focuses on pointing out that (mere) data or information is not enough. Genetics, isotope analysis and big data analytics, among other methods, have a capability to make a difference in what and how many things can be known in archaeology. At the same time, as an information scholar I am deeply concerned with the limits of information (and data) and the complexity of how it translates to knowledge. Even if I see much promise in network analysis, ecological theorizing, ANT and related theories like Pickering's mangle of practice (Pickering 1995) and have relied on them to a significant extent in my own research, I probably cannot stress enough the importance of being explicit about what a particular constellation of data and theory can possibly imply, what are their premises and what is left unexplained. It is undoubtedly possible to perforate the previously impenetrable boundary between the local and the global, but not without carefully considering how different types of datasets and observations scale with and are comparable with each

other. In some cases, especially when observations are simple, easily quantifiable and verifiable, the problems can be small. When the steps of producing data are complex, the information is more dependent on interpretations, local situations and practices, making it more difficult to compare with other data sets.

Even if there is a fast-increasing number of easily accessible archaeologically relevant datasets and new research infrastructures that together collect these data from different sources around the world, there is much work to do, and much of that work is going to be difficult. Harmonizing information that has been compiled by a large number of individuals with slightly different perspectives, skills and practical possibilities to conduct their work is onerous. Data are not always easily accessible and are currently held by a large number of organizations with limited resources to preserve and keep track of them and make them available. This applies especially to the huge and largely unexploited corpus of material from contract archaeology, but applies also to many research data archives. A recently conducted study in the context of the Archaeological Information in the Digital Society (ARKDIS) research project has explicated the current situation of archaeological archiving in Sweden, showing that there are many gaps in the continuum of information from the field to researchers' desks and further to the societal and public uses of archaeological knowledge. There is a major gap between contract archaeology and academic archaeology. Even if they share a similar ethos of knowledge production, they have different practical premises for conducting fieldwork and research, which influences their predominant modes of knowledge production. Creating infrastructures is possible and necessary for working with data-intensive methods and research questions. Much of the data processing in the integration of resources can be automated or it can be significantly facilitated by a clever use of tools, but it is obvious that both automatic and semi-automatic approaches need to be based on a firm understanding of what is being processed. Archaeology needs tools and infrastructures, but in order to be useful, they both require insights into the human processes by which the data have been created, selected, organized, managed and preserved in practice by individual scientists, field archaeologists and collection managers. Much valuable information can be extracted from the existing and forthcoming archaeological collections using new methods and approaches, but there is still a threshold between the possible and impossible that cannot be passed by mere quantity and clever methods, even if they both are highly useful for sure. Good and detailed guidelines for working with data and conducting fieldwork are helpful if they exist, but as studies of scientific work and archaeological reporting prac-

tices show, they do not replace the need to account for the limits of the data. Even in the context of data-intensive research it is important to keep enthusiastically drilling deeper into the data but with considerable analytical thoughtfulness about the positive and negative consequences and limits of the information and knowledge obtained.

It is possible that at least for a time archaeology might be past the “theoretical hegemonies in the humanities” and will see a positive “heavier reliance on large datasets” as Kristiansen describes his view of the current paradigmatic state of evolution of archaeology. From the perspective of the evolution of the archaeological understanding of the past this posited shift could undoubtedly be seen as a favourable turn as long as the “theoretical hegemonies” are not replaced by an atheoretical and non-analytical hegemony of claiming that a huge pile of data and a nice algorithm or method (which all have implicit, even if only seldom explicitly articulated theoretical premises and implications) would automatically make us know relevant things. It takes an effort to avoid getting a perfect, simple and comprehensive answer like Douglas Adams’s 42 to a question no one really knows or is capable of defining. Failing to do so might lead us to witness a perhaps eventually necessary but from a paradigmatic point of view a “premature” raise of a new post-paradigm as a reaction to the mechanistic assumptions of the explanatory power of datasets.

There are at least two different remedies to avoid this particular pitfall, one directly and the other somewhat more indirectly addressed by Kristiansen in his text. The first one, firmly stressed by Kristiansen, is to see that the new empirical openings are properly theorized. The second is to keep in mind that critical theorizing and awareness of the political nature of information and knowledge is not only needed in the context of the use of the past but also as a part of the practices and premises of how researchers pursue their studies. Even if the methodological apparatus of the research efforts were based on genetics and big data analysis rather than discourse analysis, the outlook of the understanding of the past is reminiscent of and a product of the methods applied. Archaeologists and all other producers of scientific knowledge of the past are a part of a methodological-political debate about the subject of their study, not only in the public arena but also with their colleagues in academia. Even if there is a definite, albeit often fine, line between the paradigmatic origins of archaeological knowing and the (state) political claims of their implications, the high quality of each critical research programme, its premises and outcomes need to be articulated to the public and the peers alike to avoid (or at least work against) unwanted infiltrations of societal and academic ideologies. For an information scholar, it



is a question of understanding the implications of how researchers and non-researchers inform and become informed, and of information as a basis for how and on what premises we happen to know the things we know. In very simple terms it is a question of knowing your data and information and their consequences irrespective of whether you are an archaeologist or a politician.

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# THE THIRD SCIENCE REVOLUTION AND ITS POSSIBLE CONSEQUENCES IN ARCHAEOLOGY

## A Personal Reflection

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I must confess to not being exactly certain about what Kristian Kristiansen is aiming at. Perhaps the article should be read as an expression of the joy of life, in these “most exciting of times” as Kristian Kristiansen puts it. And that is not a bad thing. We can do with an occasional reminder of how exciting archaeology can be, being bogged down in applications for funding or struggling inside the planning system. The article caused me to stop, sit down and make some reflections.

Are the times for archaeology exciting? Possibly, considering all the advances in science, the rapid development in computer technology and the massive expansion of archaeological data, both quantitative and qualitative, now being made available through an increased number of publications. The latter is somewhat of a flood, making it difficult to keep tabs even within one's own limited field of archaeology.

Unfortunately, the times for archaeology are also exciting in a more worrying way, with increasing difficulties and limitations following in the wake of the commodification of archaeology and cultural heritage.

Making forecasts is always difficult, especially if we have the feeling of being in the midst of a change. There is an inherent possibility of exaggerating the importance of the present situation, which I suppose is only human. Kristian Kristiansen is wondering about, and arguing for, a possible new paradigm within archaeology. Whether he perceives this as driven by recent theoretical trends or what he calls the third science

revolution in archaeology is somewhat unclear to me. It probably does not matter, and is more related to me than to Kristian Kristiansen. I, somewhat resignedly, think we are in some kind of constant flow. Ideally it is the nature of archaeology with an ongoing dialectic between an ever-increasing amount of produced data, readjusted theoretical standpoints and questions, and methodological and technical possibilities.

As with the phenomena we are dedicated to study, changes within archaeology, or I might say “archaeologies”, are of different tempo and duration, follow a variety of trajectories and are of different magnitude related to what kind of “needs” they can fulfil. When the dust has somewhat settled we stand with additional interesting perspectives to try out empirically and methodically. This makes it difficult, even with hindsight, to make out distinctive turning points, when and exactly with what text or lecture did post-processual archaeology start? As Kristian Kristiansen points out, elements of processual (“New Archaeology”) have been maintained and developed during the reign of post-processual archaeology, while they also, together with elements of the latter will remain either independently or integrated in this (rather exciting) “return of the artefact”/“neo-material turn” we now can see.

A large proportion of what is ascribed to shifts of paradigms is usually produced through positioning within academia. In the varying practices of field archaeology the approaches tend to be more eclectic, applying what proves to be operational in the circumstances.

Does this mean that I disagree with Kristian Kristiansen? Not at all, since there obviously is an epistemological change going on. Whether this is the outcome of a general conscious or subconscious fatigue from the last decades of neo-liberal and post-modern mayhem or in fact based on the advances within science is open for discussion. Kristian Kristiansen mentions both, but in the end appears to lean towards the latter. Needless to say, the relationships between technical and methodological developments are complex and translated (in an ANT sense) along different and changing trajectories. We often get infatuated by the potential possibilities before sitting down and think about how to utilize it. I spent a lot of the 1990s being frustrated about the conceptual muddling of technical development being called “methodological development”. Digital recording, surveying with total stations, is still in its essentials the same as using pen and paper, i.e. the same methodological idea differing in technical application. Computerization has enabled us to make our plot charts within minutes rather than days, handle and cross-reference larger amounts of data without going balmy, and so forth. Of course this rapid technological development will have repercussions on our ontology. Kristian Kristiansen points out three expanding fields of

new knowledge: “the power of Big Data”, “the methodological power of quantification and modelling” and “the theoretical power of new knowledge”. Perhaps it is the intersection between quantitative and qualitative production of knowledge that ought to be of interest and elucidated if we want to identify a “new paradigm”.

Concerning the power of Big Data and the methodological power of quantification and modelling I have only second-hand knowledge. When asked, my colleagues are much excited, supporting Kristian Kristiansen’s statement about a new prehistory. In this case my ignorance is interesting. I hope it says more about our professional division of labour than about me. Obviously these large sweeps, spanning vast areas, long time spans and whole cultures, are not common within the field of medieval/historical archaeology. One might wonder why. We are certainly used to handling large amounts of complex data, and there ought to be some heritage from the French *Annales* school with its attempts at *histoire totale*. Is it self-imposed problems in approaching “cultures” in early historical times, not looking for different sets of connections and interrelations, that shows us to be still subordinate to the written sources and “established history”? Are we afraid of getting tangled up in the present political turmoil of nationalistic and regionalist agendas? We clearly have a thing or two to learn here from the prehistorians, so yes, I think there is reason for some mild excitement here.

My reading of Kristian Kristiansen’s text is that the theoretical side is presented as an outcome of the technical developments (actually being able to handle “big data”), and more particularly what Kristian Kristiansen describes as “the third scientific revolution in archaeology”.

It is the possible, future, potential of the advances in genetics, DNA and strontium analyses that are closest to Kristian Kristiansen’s heart: “The A-DNA and strontium revolution redefines human origins, health and mobility, and establishes a new prehistory” (my emphasis). This is of course interesting; migration is, for very different reasons, being placed high on the contemporary political agenda, the question being how we formulate this possible new knowledge.

On the plus side of things it shows the enormous mobility over time. In short, we are all so mixed up that all contemporary populist attempts at a “Balkanization” based on “origins” will finally be seen to be as futile and stupid as they really seem. Kristian Kristiansen holds out a small warning finger about “the dark side of the force”, every possibility can be misused, making the analogy of the present situation with that of C14 dating before calibration. Indeed we run the risk of being naïve, and political idiots initially by uncritical and unreflecting adaptation of these advantages simply because they are there and are “new”. That is, however, another discussion.

I do agree with Kristian Kristiansen that the present situation calls for increasing integration between different fields of knowledge, not only between science and archaeology, but also between archaeology and other humanities, to flag a hobbyhorse of mine. This involves a reformulation and renegotiation of the relationships between disciplines. We all know of “inter-disciplinary” work in reality being “parallel-disciplinary”. If these later scientific and theoretical developments, whether paradigmatic or not, are to change archaeology I believe we have to rethink not only theories, questions and techniques, but also organization and the whole order of the discourse.

Kristian Kristiansen also asks if we are going “towards a new public role for archaeological and historical research”. “In short: it demands a stronger public engagement by archaeologists, scientists and humanists, perhaps to a degree we are not used to.” I fully agree, since archaeology to a large degree tries to stay out of contemporary politics (there are obvious historical reasons for this). A new public role being necessary is beyond doubt, but does also require a “rethink” and reorganization of the whole shaboom. We are, as Kristian Kristiansen points out, facing a new set of challenges, forcing us to take a more explicit place in the fields of politics. This is perhaps more discussed within the field of “rescue archaeology”, being a public function and, at least in theory, in closer interaction with different segments of society and politics. But even here we are quite comfortable outside the fields of contemporary politics, meaning we do not act upon those fields. However the fields of contemporary politics constantly act upon us, and at the moment not in a very constructive way if we want a stronger public engagement. Kristian Kristiansen is rather optimistic about the future (i.e. the present). I am rather more worried, looking at the deteriorating conditions for the “archaeological production line”, so to speak. The introduction of competitive archaeology on an immature “market” is already having an effect on the production of data. A “re-instrumental” archaeology is producing smaller quantities of data of a slowly decreasing quality. The fields of contemporary politics also act upon the academic sphere in a way that in the end will restrict necessary development (Högberg 2013) and hamper the way towards a new paradigm.

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# SHUTTING THE STABLE DOOR AFTER THE HORSE HAS BOLTED

## Critical Thinking and the Third Science Revolution

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In this article, pursuing breadth rather than depth, Kristiansen does not set out to convince as much as to add to the last decade's cavalcade of diagnostic statements about the discipline (consistently put forward and curiously in line with the agendas of the well-established archaeologists offering them). As promised, we are presented with a rather optimistic scenario of the road ahead, leading into nothing less than revolutionary times. That is, if you are surfing the waves of the so-called "third science revolution" and not stuck in post-modernist discourse, in which case you are doomed to be left at the shoreline. In Kristiansen's scenario, fuelled by the sheer force of new types and levels of data input (e.g. DNA, isotope analysis) – mainly dealt with and stemming from large projects enabled by the EU – the wedding of micro and macro perspectives in archaeology is to finally take place. Potential spouses in this shift towards a "revised modernity" are evolutionary/world system approaches combined with micro materiality/agent-network approaches. Their offspring – destined to change the way we understand mobility, interaction and cultural/genetic transmission in prehistory – is made possible through the combination of increased levels and availability of scientific data, and a renewed focus on quantification and agent-based modelling methodologies. Through this recipe an entirely "new prehistory" is made possible, a prehistory anchored more heavily in absolute

data, minimizing our previous reliance on “qualified guessing”. Finally these changes, Kristiansen points out, also call for a critical commitment in research, and a new investment in public discourse.

Having somewhat crudely outlined my understanding of Kristiansen’s perspective, it may come as no surprise that it is a scenario which I – coming from a vibrant cross-humanist research environment – do not fully recognize, nor is it one I hope for. I will concentrate this comment on what I consider to be some of the most important points raised in this article and the aspects which I found wanting, relating especially to the state of ideological critique in archaeology and the ethics of scale involved in Big Data and EU-funded projects.

## ADD CRITICS AND STIR

I was happy to realize that in this piece, the word “critical” was used a similar amount of times to that of other, more dramaturgical terms, such as “revolution” (24/24 times). Kristiansen points out the need for critical theorizing and critical discussion in relation to everything from data analysis, theory development and quality research programmes to ideological uses of the past. But this does not mean it takes centre stage. According to the order of events suggested, critical thinking and public engagement will have to stand back at first to let large scientific data sets, new methodologies and theoretical models of explanation emerge. Therefore, in most of these instances I am left wondering *what* it is, in Kristiansen’s view, to be critical, *when* we should be critical and *on whom* the bulk of the critical work, or the burden, should lie.

For it does seem to be a burden to Kristiansen, at least in parts. When it comes to “political issues about the use of the past” we are reassured that critical heritage studies will keep growing and thus “force” archaeology to confront such matters. In the same vein, the contributions of critical archaeologists investigating the concepts of ethnicity and culture will “inevitably” (whether we like it or not) lead to critical discussions on how (rather than *if*) ancient DNA can work as evidence in archaeological interpretations about cultural interaction and transmission. In other parts of the text, “critical thinking” and awareness of “critical theory” seems to be something almost taken for granted, or something that will come about by itself. Young researchers are trusted to be well versed in both “complex computer modelling” and “the latest critical theory”, thereby bridging the “opposition between science and humanities, theory and data”. And when it comes to the science revolution, Kristiansen insists that, since we are “past theoretical hegemonies



in the humanities”, the necessary critical discussion of “biology versus culture, genetic versus cultural evolution” will now emerge in the intersection between large data sets and methods of analysis and interpretation. This can be regarded as a turn towards a more positivistic approach Kristiansen states, “but it is one that is informed also by critical theory about the use of the past. It will therefore be more engaged in political and ethical issues.” Most of this engagement seems to refer to the increased contacts with the public, demanded of archaeologists in light of the attractiveness of DNA research in current society and the growing number of political movements looking to use such research for propaganda.

On the whole, these revolutionary changes enabled by science, in which data comes first, methods to deal with it later, and the development of theories to explain the results after that, already signals an understanding of theory (and of archaeology for that matter) as something that should emerge primarily from the researcher’s interaction with neutral data rather than her interaction with society. According to this logic it follows that critical evaluation and dealing with the public come later on, the main problem seemingly resting with society rather than with the researcher. Therefore, most of the direct critical incentive comes from devoted critical theorists or next-door neighbours rather than the archaeologists doing the complex modelling, although they and all the rest of us are so well read and informed today that we will somehow automatically engage in critical and ethical issues. To be fair, Kristiansen does point out the need for “maintaining high-quality, critical research programmes”, but in this instance too the corrupting influences we need to protect ourselves from come from the outside, from “ideological infiltration”. From such statements one might be led to assume that good critical research is normally ideology-free, that data is clean.

To my mind, critical thinking involves examining the premises and frames of our undertakings and should come before data collection and explanation, not after. A critical perspective involves critique of ideology, of hegemonic ideas engraved into society, upheld by people within and outside institutional contexts. Meaning that when archaeologists start incorporating, for example, genetic data into a “new prehistory”, not only do we need to critically discuss potential links between biology/culture (among ourselves and with the public), but we must also ask why such research is so popular right now and why there is so much funding directed that way. Genetic research “raises fundamental questions about what it means to be human” Kristiansen states, and this is true, but more explicitly, it raises questions about difference and sameness, evident from its uses elsewhere in society, such as in ancestry testing

and criminal profiling (Duster 2014). When combined with questions of *origin* it therefore – rather than raising new ones – taps directly into the same old questions asked within the framework of modernity for centuries, questions of belonging that archaeology as a discipline (as one out of many conditions) have made possible. I am not saying archaeology is by default ultranationalist or anything of the kind, but we know very well by now that there are deep-seated causes why archaeological interpretation “lends itself” well to political needs, and that using, for example, DNA as a source of knowledge in archaeology is not the same as using it in medicine. In times of globalization and unrest, it is not a secluded movement within academia or archaeology that has brought big questions of migration and grand narratives back to the table. It is a part of, and a response to, the same societal motion that gives rise to ultranationalism on the other side of the spectrum. This is why we must remember the level of critique dealing with ideology as a part of the archaeological venture, not merely as an “infiltrator”.

If we talk about being critical without including this level, I believe the renewed vows between archaeology and natural science – just as with the “add women and stir” critique directed towards researchers taking feminist directions to be about writing women into prehistory – will perpetuate a kind of “add critics and stir” approach.

## BETWEEN WHAT WE KNOW AND WHAT WE DO

This “add critics and stir” tactic struck a chord with me because it echoes the kind of reasoning I often face in my own research efforts. As an archaeologist studying the uses of the past by archaeologists and EU officials in relation to the key link between them – that of funding – I often hear that, “Yes, of course archaeology and politics go hand in hand, we all know that by now” or “Are we not past that discussion at this point?” But there is still a huge difference, I argue, between what we say and what we write in archaeology, or perhaps more accurately, a *gap between what we know and what we do*.

To me, archaeology has never been about *matters of fact* as much as it has been about *matters of concern* (see Latour 2004). And a key place where the concerns of archaeologists and political spheres meet is in the policies guiding the distribution of funds for research, as well as archaeological responses to the same. Kristiansen talks affectionately about the power and accessibility of large and “wide” data sets (Big Data), especially as utilized within current European-scale projects funded by the European Research Council (linked to the EU Horizon 2020 frame-

work). The funding source “has already had a rather large impact on the formulation and financing of projects on a European scale”, Kristiansen states, adding that the “long-term effect of the ERC funding will be profound”, allowing us to cope with the “data revolution”.

Actually, I could not agree more. I too believe this will have a profound effect, and I have already noticed some of that impact in my own undertakings. I agree that the potential involved in this kind of funding is huge and beneficial to archaeologists everywhere, but it is certainly not free of ideology. Going through research reports and narratives produced by large-scale archaeological EU projects, I have often found that the level of critique outlined above, the one concerned with ideological critique, is missing when it comes to the frame of *EUrope*. For most such projects, dealing with the bureaucracy and infrastructure of making the multinational effort itself operational, not to mention the hard work of mining Big Data for clusters that can actually say something about a research problem, seems to obscure questions of research context.

Just as projects financed on a regional or national basis, EU funding comes with certain frames. Aside from the basic matters of concern directing them – such as direct “impact” (reports, policy briefings with quantified results), the development of “excellence” in EU research for a world market (research as merchandise), or the generation of “European added value” (relating to goals on EU integration and a type of “tax return”) – there is also an important question of scale involved. The choice of scale is both an empirical and a political one as it coincides with political matters of concern. Working on a European level becomes an ethical issue. Kristiansen has discussed the “Europeanness” of archaeology in Europe elsewhere, going so far as to state that it is “impossible to discuss the concept of Europe without considering this historical and ideological baggage” (2008:6). Yet, when it comes to many large EU projects, the concept is not discussed at all. Instead applications talk about European identities, and results are summarized for the sponsor/public with titles like “A Bronze Age Identity for Europe” (Forging Identities FP-7 2012: <http://cordis.europa.eu/result/rcn/88471>). At one of the most important points of interaction with political spheres, all our reading on critical theory and knowledge about uses of the past does not always make itself known. This gap between *what we know and what we do* is especially visible and potent in the craft of writing narratives of the past. Ironically, this can be exemplified by how Ötzi, one of the most potent “European” characters used in Kristiansen’s text, has already entered German schoolbooks on history as the “first European” and as being of “European nationality” (Sénécheau 2006).

What we need then, is not only more public engagement and new ways of presenting our narratives, but an increased focus on the structure and “meta-stories” (Holtorf 2010) of those narratives, and we find those by valuing what the humanities do best, critique of ideology and qualitative analysis (see also Larsson 2013; Källén 2012). Big Data does not mean better data; after all it is often just the same data linked up. It makes “bigger” interpretations possible, which is great, but this does not equal “better” interpretations. And importantly, just because it is true, it does not mean it is right. Changes in data and infrastructure mean changes in thinking, and while this might be changes for the better, we still have to consider and evaluate the context we operate in already at the beginning of a project, and employ our critical minds in the places where it matters most, such as in the interaction with funding bodies. Otherwise, if this “add and stir” approach dictates the place of critique in a “revised” modernity, if being critical is connected mainly to source criticism (albeit crucial) and to developing critical models of explanation – pushing concerns regarding our contexts as researchers, our theoretical and analytical origins to the sidelines – I believe archaeologists risk contributing to the same structures that upheld practices of exclusion in modernity (what is it, in other words, that is “revised”?).

Like Kristiansen, I too like to dream. I dream about new sources of information in archaeology making things more complicated than ever before, resulting in an avalanche of contradictory results. I dream of finding out new details and nuances in past human experiences through transparent hermeneutic efforts which recognize the value of preceding discourses in archaeology, not using them as straw men and rhetorical fuel to power new revolutions. But an inescapable part of dreaming is the part where you wake up, scrutinize your own questions and methods and actually incorporate what you have learnt and not just deal with society’s receptions later on. While Kristiansen’s dialogue between “dreams and hard evidence, past and present concerns” may inspire “innovative research”, it does not necessarily foster responsible and reflexive research. These are indeed exciting times, but I find them to be equally worrisome.

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# WHAT IS IN A PARADIGM?

## Reply to comments

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My essay was a predictive one: by looking across the disciplines from science to humanities and social sciences, I see a related trend of a new approach to data and knowledge, based on the digital revolution and the DNA revolution among others, which I predicted are in the process of creating a new interpretative universe. This is still but a bold hypothesis, based upon incomplete evidence, like any other archaeological hypothesis. I took a mostly positive stance on these changes, although in other places I have stated my critical concerns with the darker sides of the use of the past in the present and with the rather conservative outlook of much European archaeology (Kristiansen 2008, 2012).

My positive stance, therefore, does not imply that important issues should disappear such as gender studies, the politics of the past, including the related forces of nationalism and globalization. Rather I believe that new knowledge will allow new insights, which in turn will challenge us into more critical reflection. Ideally it is a dialectic process, but looking at reality I find that archaeology has so far missed the opportunity to take the lead in critical reflections on the effects of the DNA and digital revolution, with few exceptions (an early example is Welinder 2003). I see critical reflection today as mostly the preoccupation of a rather small politically and theoretically informed group of archaeologists, and I wish we could expand such debates to larger segments of the

archaeological environment, hence my concern also with our responsibility towards the public.

Elizabeth Chilton embraces so much under the umbrella of critical post-processualism that it quite rightly no longer can be characterized as a paradigm. However, I disagree in her definitions, which are too inclusive: Marxism and the study of power relations is certainly not just a post-processual critique, nor is gender studies, as they both existed long before, and as much as she wishes that post-processualism used science in more clever ways, it never took the front seat and was more or less abandoned in phenomenological landscape studies. Post-processual archaeology, like other paradigms, started as a critique of what went before, but implementing this critique came to define a post-processual theory and practice, originally defined by Ian Hodder in his book *Reading the Past* (Hodder 1986). While Hodder later employed science cleverly at Catalhuyuk, and branded it a reflexive, multi-vocal archaeology, it represents a return to a more positivistic stance, whose practitioners also believed in opening up multiple interpretations through increased documentation. I would thus argue that we have been on the way towards a new paradigm for some time, but that it is only in recent years that many converging trends, some of which I describe, have finally gained the momentum and the potential to redefine archaeological theory and practice on a grand scale.

Quite rightly, however, there are concerns of the present that should always be part and parcel of a critically informed archaeology, and in this we do not disagree. I would rather see such a socially informed critical approach as a generalist stance in archaeology irrespective of paradigms, but although I share Elizabeth Chilton's wishful thinking about a progressing archaeology embracing it all, history unfortunately does not support such a view. I also wholeheartedly support the efforts to map future problems in need of research (also Kintigh *et al.* 2014), but I do not believe research councils should engage in defining what researchers should do, but rather provide food for thought. Otherwise we end up with research priorities defined by politics or a dominant research paradigm or both – which leads on to some of Alfredo Gonzales-Ruibal's critical concerns.

Alfredo Gonzales-Ruibal raises an important issue: that of academic or even political exclusion, or both, as a consequence of a dominant paradigm. However, I do not foresee an exclusion of critical approaches to either contemporary archaeology or critical heritage studies in a new paradigm with a stronger emphasis on science. On the contrary, they are two sides of the same coin. In Gothenburg I am presently leading a four-faculty research project: Critical Heritage Studies ([www.criti-](http://www.criti-)



calheritagestudies.se), a discipline Gonzales-Ruibal himself has contributed significantly to. This type of critical research is expanding in today's society, precisely because of globalization and the multiple uses of the past in the present, some of which represent a dark side of heritage through exclusion and racism, some of which represent a bright side through inclusion and critical discussion (Högberg 2013). I would rather see an expanded research potential in linking such discussions to the more solid empirical evidence that can be derived by combining in-depth case studies with Big Data on attitudes to past and present identities (Biehl *et al.* 2014).

However, all critical and innovating research must position itself in relation to a discourse to become meaningful, and right now we are experiencing a change of discourse. We can therefore expect this also to be reflected in research panels. Having had the experience of sitting on one of the ERC (European Research Council) panels, and on several national research panels as well, it is not my experience that an uncritical approach to the concept of Europe is mostly rewarded. It is correct that frontline research including the new archaeological sciences often receives money for the time being, quite naturally, but then coupled with strong theory and critical reflection. Non-theoretical or uncritical projects rarely receive grants in my experience. Committees nowadays are mostly so large and of such a mixed disciplinary composition that a single theoretical position cannot dominate. But no rule without exceptions, and we have all had our share of misfortune when it comes to funding. We are participating in an academic competition where you constantly have to prove yourself through international peer reviews, whether for publications or for grants. To me it represents a huge advantage compared to the small closed academic power circles of my student time, where a single professor could exclude unwanted research/researchers for life.

Isto Huvilla makes the observation that positivistic or processual paradigms have been driven to some extent by new sources of information, and that hermeneutic/culture-historical or post-processual critiques represent a wish to critically contextualize this information. Following this line of thinking, we can see the shifts between paradigms as a shift from pushing the frontier of knowledge forward which is then periodically stopped by a wish to understand that new knowledge better. There is some truth to this observation: the previous science revolutions allowed controversial or relatively uncertain knowledge to be replaced by safer knowledge; in this way it freed intellectual capacity to concentrate on better understanding the newly achieved knowledge. Today we need not spend as much time doing typology alone for dat-

ing purposes as 50 years ago due to C14 and the second science revolution, and likewise A-DNA and the third science revolution will allow us to spend more time on understanding migrations rather than debating their existence. However, it would be misleading to consider processual/science-based discourses as merely providing new safer knowledge. They also came/come with a theoretical agenda stressing, among other things, regularities in human history, which post-processual/hermeneutic discourses reacted against.

I share Stefan Larsson's concern about the "production line" in archaeology, and its future (Kristiansen 2009). However, in contract archaeology there is a real potential to engage the public in presenting the results of ongoing excavations, and in the EU-funded NEARCH project (meaning: New scenarios for community involved archaeology) new ways of engaging with the public are being tested (<http://www.nearch.eu>). The challenge is really to combine such on-the-ground experiences with the way meta-narratives are used for political and ideological purposes. We know far too little about the actual processes of employing the past in the politics of identity formation. At the University of Gothenburg we have created a Heritage Academy, which functions as a platform for meetings and workshops with the heritage sector, researchers and politicians ([www.criticalheritagestudies.se](http://www.criticalheritagestudies.se)). It has indeed provided much new food for thought in all camps, but such engagements are long-term investments if they are to have effect. We have only existed for two years as yet.

To Elisabeth Niklasson: in my darker moments, and they sometimes also appear in print (Kristiansen 2011), I see more similarities between the present and the 1930s than I should have wished, which is disconcerting for optimism. Although history does not repeat itself, some of its components are certainly reused, and I am still worried about the outcome of the ongoing fights between the dark and the bright forces we are witnessing in the rise of nationalism throughout the world and the conflicts arising from it in present-day Ukraine, and not so long ago in the former Yugoslavia, to name just two (Kristiansen 2004). Critical Heritage Studies are needed not only for academic careers, but for dissecting the manipulation of the past. One might say that heritage is gaining its economic success at least in part for the wrong political reasons. That is, if, like me, you are an engaged internationalist, and anti-nationalist (national identity *per se* is not bad, but some of its political uses become bad when they turn into excluding nationalism). However, we can never let new, basic research be directed by fear of misuse. Most historical research has been misused at one time or another, and for different purposes whether radical or conservative. Our only guard against

that is to maintain high scientific quality that is less easily manipulated. Otherwise we end up with political evaluations of what is useful or not useful (dangerous) basic research. Applied research is what we reserve for such more instrumental purposes.

Elisabeth Niklasson's prescription is to constantly engage in the structure of meta-histories and their potential impact, which is precisely what I have kept doing (as an example: see Kristiansen 1998, chapter 1.2). According to Niklasson: "critical thinking involves examining the premises and frames of our undertakings and should come before data collection and explanation, not after". Unfortunately the world does not often operate in this idealized way. What I describe in my paper is how it happened and still often happens when fundamentally new knowledge with direct bearing upon archaeology/the humanities is produced in other sciences. Critical theorizing nearly always takes the back seat, and I have been deeply concerned over the lack of engagement in meeting the challenge from the biological sciences, when they started to produce their own historical master narratives rather than collaborating with archaeologists and humanities researchers (see critique in Tallis 2011). That is also why I engage personally in collaborating with science researchers in my projects, and always have done.

However, it takes some effort to familiarize oneself with the new developments, and many critical archaeologists do not seem willing to make that investment, or believe they can do without it (Gonzales-Ruibal's response is an example). Rather they will invest in critically discuss the potential dangers of entering this new age of more science-based knowledge, because as Elisabeth Niklasson states: that is "what the humanities do best, critique of ideology and qualitative analysis". If that were their only role humanities would soon have ceased to exist. Here Niklasson exposes that her real interest is not in the past, but in its use in the present. Archaeologists, who, like myself, are deeply interested in knowing about the past (perhaps also to learn something meaningful about the present), are consequently being critically scrutinized from a moral position of social, political or global responsibilities, but without engaging in the hard work of understanding the context of the basic research in question (referring to a single sentence from the project "Forging Identities" being a prime example). There is no easy, predictable or clear-cut relation between basic research and its political use/misuse, and it is mostly with hindsight that such relations can be detected and understood.

To conclude: the general tenor of the comments relates to my omission of references to critical theory and the effects of the new science turn upon the present. I hope that my answers have provided some back-

ground to the stance I have taken, which is neither uncritical nor unaware of potential misuses of the past. But I remain opposed to the political and moral correctness implied in knowing beforehand what is worth knowing. It is true, however, that a paradigm tends to shape the worldview of its practitioners in a certain way, and the possible consequences of that should always be open to debate. The other critical question is whether we are in the process of forming a new paradigm or not. There is understandably some reluctance on the part of more dedicated post-processualists to accept that this is really happening, and I have myself considered for a while whether the present changes amounts to a change of paradigm. In the end it depends on what we believe is in a paradigm. My position is that we can indeed speak of a post-processual paradigm, and that it is more or less disappearing in the wake of the third science revolution, perhaps in tandem with a changed global climate with less regard for culture and humanities, as reflected in recent national budget cuts for culture and the humanities in the USA, Denmark and Sweden. The crisis in the humanities, however, has been a matter of debate for some time now, and whether the new budget cuts are related to shortcomings of the post-modern perception of knowledge or to the appearance of a new more science-based perception of knowledge would be an interesting theme for another keynote article.

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