

Scaffolding and Concept-Metaphors: Building Archaeological Knowledge in Practice

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Abstract: Scaffolding and concept-metaphors have emerged as key terms within alternative approaches to the epistemological analysis of archaeological practice. Each term contains definitional ambiguities, including distinctly broad and narrow definitions in the case of scaffolding. I argue that the broad application of the scaffolding metaphor, most closely associated with the work of Alison Wylie, allows one to understand concept-metaphors as a specific category of scaffolding. At the same time, the broad application of the scaffolding metaphor provides a dynamic and flexible way of organizing the epistemological analysis of archaeological practice because it is acting as a concept metaphor.

The recent revival of interest in epistemology within archaeology has seen a decisive turn towards the analysis of knowledge formation in practice. This shift has brought with it a number of terms and phrases that do sufficient intellectual work and contain sufficient definitional ambiguity as to warrant further focused attention. In certain cases, these terms benefit not only from individual exposition and clarification but also from juxtaposition and dialogue.

Two such terms are 'scaffolding' and 'concept-metaphors'. Both terms refer to practices, ideas and phenomena that serve to organise, support, and enable the construction of archaeological knowledge. Both terms are also intentionally broad and flexible in their definition and application. I will argue that this allows 'scaffolding' and 'concept-metaphors' to play the same organising and enabling role within epistemological analysis that is played by the phenomena they are meant to describe in the construction of archaeological knowledge more generally. I will also argue that

'scaffolding' and 'concept-metaphors' are closely related, with each at least partially incorporating the other.

1. Scaffolding

"Scaffold" and "scaffolding" are semantically overlapping and syntactically flexible words in English, referring to an object of ambiguous number and specificity ("a scaffold", "the scaffolds", "the scaffolding"), the component parts of that object ("scaffolding") and an action or process ("to scaffold"). Scaffolds and scaffolding are also common metaphors in English that have come to be used widely in academic and technical writing, retaining their original flexibility by referring to both processes and structures (Caporael, Griesemer, and Wimsatt 2014, p. 1).

In archaeological discourse, scaffolding has been deployed as a metaphor most consistently by archaeologists interested in extended cognition and 'human-thing relations' and by philosophers interested in the epistemology of archaeological knowledge formation. As we shall see below, these two metaphorical uses of scaffolding share a common genealogy, although in this paper my attention will be focused primarily on epistemological analysis. Within this epistemological analysis one can identify both broad and narrow applications of the scaffolding metaphor. Hence, in what follows we will consider what these distinct applications share, how they differ and what might constitute an appropriate and effective understanding of the scaffolding metaphor when it comes to the epistemology of archaeological knowledge formation.

The word scaffolding appears 78 times in the text and notes of Bob Chapman and Alison Wylie's important book *Evidential Reasoning in Archaeology* (Chapman and Wylie 2016). It is clearly a *leitmotif* within their work and, as its prevalence suggests, has wide application in the organisation and presentation of their arguments. Chapman and Wylie define scaffolding in archaeological knowledge formation in several ways. Most broadly, they refer to scaffolding as the:

...laden theory, background knowledge (tacit and explicit), technical skill, social networks, institutional infrastructure, and vigilant reflexive critique – required to make archaeological

observation possible and to put the resulting data to work as evidence. (Chapman and Wylie 2016, p. 6).

Chapman and Wylie also define scaffolding more narrowly in places. In relation to fieldwork, scaffolding is the:

....technical expertise and community norms of practice which are internalized by individual practitioners as embodied skills and tacit knowledge, and externalized in the material and institutional conditions that make possible the exercise, and the transmission, of these skills and this knowledge (Chapman and Wylie 2016, p. 55).

In discussing Stephen Toulmin's (1958) schema of the structure of argumentation in practice, Chapman and Wylie equate "inferential scaffolding" with the warrants, backing and rebuttals that Toulmin says connect evidence to knowledge claims or support and defend those connections. In this sense, inferential scaffolding is constituted by "...the gap-crossing assumptions, auxiliary hypotheses, [and] background knowledge that constitute middle-range theory in an archaeological context" (Chapman and Wylie 2016, p. 35).

This broad understanding of scaffolding as something that contributes to both the definition and description of archaeological data and to their deployment as evidence in support of knowledge claims is maintained by Alison Wylie in her more recent work. For example, in a paper focused particularly on the uses of legacy data in archaeology, she defines scaffolding as the assumptions (about the cultural – historical subjects under study), background knowledge and technical resources that facilitate the use of material traces as evidence (Wylie 2017a, p. 204). According to Wylie (2017a, pp. 207-208), rather than only warranting evidence in an argument, the taken-for-granted nature of some scaffolding (e.g. traditions of identifying, recording and describing data) can render some data illegible until the relevant scaffolding is reconfigured.

Similarly, in a paper that places archaeological modelling into a more expansive philosophical context, Wylie (2017b) defines three types of models in archaeology; *phenomenological* models, which systematically redescribe archaeological data or interpretive analogs, *reconstructive/*

explanatory models, which seek to reconstruct and/or explain target archaeological contexts or cultural processes, and *scaffolding* models which are "...auxiliary hypotheses that mediate the interpretation of archaeological data as evidence relevant for positing and testing hypotheses about the archaeological target of interest" (Wylie 2017b, p. 995). While it is tempting to equate scaffolding models narrowly with inferential scaffolding within a Toulmin schema of practical argumentation, Wylie is clear that scaffolding models are phenomenological models used to scaffold arguments and that explanatory models are assemblages of smaller scale phenomenological and scaffolding models. Hence, what counts as the descriptive versus the warranting or explanatory resources of archaeology are not easily teased apart.

Independently, Marcos Llobera (2012, pp. 503-505) has also used the phrase "scaffolding models and/or methods" in the context of GIS applications that might serve as "middle-ground" solutions to the problem of bridging between interpretive narratives and concrete archaeological landscapes. Llobera describes these "in-between links" as "...the different measures, techniques, constructs, and strategies archaeologists may mobilize when constructing and exploring possible arguments" (Llobera 2012, p. 500). Again, this could be understood narrowly as inferential scaffolding, however, the examples given by Llobera (2012, pp. 504-505) include systematic redescriptions of data that could serve in concept exploration or narrative construction, as well as in the warranting of arguments.

Wylie's broad definition of scaffolding as encompassing the material, institutional and conceptual resources of domain specific knowledge formation is seen by some scholars as a distinctly original contribution (e.g. Monterio et al. 2018). Wylie herself, however, makes no such claim to originality, citing John Norton (2014) and William Wimsatt (2014) as sources for her understanding of scaffolding as a metaphor (Wylie 2017a, p. 221, n. 5; Chapman and Wylie 2016, p. 53, n. 32). As neither of these scholars provide a straightforward model or exemplar of 'scaffolding analysis' of which Wylie's work could be said to be an application, it is worth looking at each of these sources more closely.

John Norton (2014) defends and expands his well-known “material theory of induction” (Norton 2003) in part by deploying the metaphor of scaffolding. Norton’s core argument is that inductive inferences escape ‘Hume’s problem’ of infinite regress because in a mature science such inferences are warranted not by asserting a universal rule but by the deployment of well-supported facts within a given domain. As he states:

Facts are inductively grounded in other facts; and those in yet other facts; and so on. As we trace back the justifications of justifications of inductions, we are simply engaged in the repeated exercise of displaying the reasons for why we believe this or that fact within our sciences. (Norton 2003, p. 668)

Importantly, “...all inductive inference is local” (Norton 2003, p. 647) and this local induction avoids an infinite regress because its domain specific facts are densely intertwined rather than hierarchically related in a chain of dependence. Indeed, Norton compares scientific knowledge to an arch built with mutually supporting stones rather than a tower where each course is dependent on its predecessor in a sequence (Norton 2014, pp. 685-686). This image of knowledge construction shares key attributes with Wylie’s long-standing metaphor of cables to describe the robustness of evidential reasoning in archaeology when it involves the consilience of multiple, independent (relative to each other), lines of evidence (Wylie 1989). However, there is an important difference. Whereas Wylie classifies all of this warranting activity as scaffolding, along with the institutions, materials, practices etc that make this warranting possible, Norton deploys the metaphor much more narrowly.

For Norton, “scaffolding” refers to the initial conjectures or hypotheses that shape the early stages of research programmes before domain specific facts are sufficiently well-established to justify inductions. This scaffolding of preliminary hypotheses allows research to be conceived and executed in a given domain but will eventually be replaced by well-supported facts in a mature science (Norton 2014, p. 687).

In an archaeological context, Norton's use of the scaffolding metaphor is best compared with that of Adrian Currie's, a philosopher who has analysed archaeological inferences as one component of his larger research programme investigating the epistemology of the historical sciences (Currie 2018). Like Wylie, Currie emphasizes what he calls the "methodological omnivory" of historical scientists, who opportunistically make use of a diverse range of evidence in building knowledge about the past. Unlike Norton, Currie gives detailed attention to exactly how material postulates licence inferences in domain specific ways within the historical sciences through, for example, middle-range theories, analogies, and causal models. However, like Norton, Currie (2015; 2018, pp. 266-273) deploys the scaffolding metaphor narrowly around what he terms "investigative scaffolding". As Currie notes, research in the historical sciences often proceeds in a piecemeal or incremental fashion. Frequently, the evidential relevance of data only becomes evident when a knowledge claim is already on the table. These initial hypotheses serve as scaffolds supporting the recognition of newly relevant data sources, more refined hypotheses and more sharply discriminating empirical tests. Currie argues that investigative scaffolding is often characterised by idealisations, "one-shot" (single cause) hypotheses (Currie 2019), gap-filling narratives (Currie and Sterelny 2017) and obvious simplifications or conflation as the granularity of initial hypotheses must match that of the available data. Once new data has been recognised as relevant, hypotheses can be modified, made more precise or replaced through a process that Currie terms de-idealisation.¹

One should not exaggerate the differences between Currie and Wylie in their use of the scaffolding metaphor. For example, Chapman and Wylie (2016, p. 45) use the term "epistemic iteration" (citing Chang 2004) to describe what Currie has called "investigative scaffolding", incorporating it into their account of how the overall scaffolding of archaeological knowledge is constructed. However, there are at least two significant differences in how each is deploying the

¹ Walsh (2019) provides an elegant analysis of this process in relation to Newton's experiments on the periodicity of light, while Janssen (2019) describes the history of the development of relativity and quantum theory through the metaphor of arches built on scaffolds of earlier theories that were then wholly or partially discarded.

metaphor of scaffolding. Whereas both Norton and Currie stress the temporary nature of conceptual scaffolding, Wylie stresses its entrenchment. Indeed, in a review of Chapman and Wylie (2016) Currie admits:

...some disquiet with 'scaffolding' as an analogy....An architectural scaffold isn't such simply because it supports, but because it is not a proper part of the completed structure—often, a scaffold is removed at or before completion. However, for Chapman and Wylie it's not obvious that there is a completed product for archaeology....Moreover, it isn't clear that archaeological scaffolds are removable, or separate to the 'building': although the scaffolds might be removed or at least altered, it isn't part of their function to be so.

(Currie 2017, p. 785)

The second clear difference lies in Wylie's more expansive use of the scaffolding metaphor to incorporate the material and institutional resources of archaeological knowledge formation as well as its conceptual resources. This difference is recognised to some extent by Marco Tamborini (2020) who uses Chapman and Wylie (2016), amongst others, to argue that in the case of palaeontology, Currie's definition of investigative scaffolding should be expanded to incorporate the technological infrastructure of research practice (e.g. initially paper-based and now digital technologies). Tamborini (2020, p. 65) argues that new technological settings play as significant a role as preliminary hypotheses in scaffolding the recognition of previously unimaginable data, modes of analysis and hypotheses.

Both an expansive definition of scaffolding and its entrenchment can be found in the work of William Wimsatt (Wimsatt 2019; 2014; Wimsatt and Griesemer 2007), Wylie's other source for her understanding of the metaphor. However, despite Wimsatt being a philosopher of science (e.g. Wimsatt 2007), the epistemological implications of his use of the scaffolding metaphor are somewhat opaque and have been actively extracted by Wylie. Wimsatt's larger project is concerned with constructing a non-reductionist model of cultural evolution that is nonetheless compatible with evolutionary developmental biology (so-called "evo-devo"). To this end, Wimsatt focuses on the

role of scaffolding and generative entrenchment in the formation of cultural environments within which human beings develop and which themselves change over time. For individual humans, the development of competencies (e.g. language, social skills, motor skills, etc) must be scaffolded by a variety of relational and environmental means, creating dependencies that entrench such skills so as to scaffold future performative elaborations and innovations. At the same time, new cultural phenomena are scaffolded on a base of existing phenomena linked through networks of dependencies.

Wimsatt defines scaffolding most succinctly as:

...structures or structure-like dynamic interactions among performing individuals that are the means through which other structures or competencies are constructed or acquired by individuals or organizations....something scaffolds an action or class of actions for an individual or group of individuals, often in a larger system of interactions, in a characteristic environment or set of environments relative to a goal. Material or ideational entities that contribute to achieving this goal are scaffolds. (Wimsatt 2019, p. 22)

What counts as scaffolding for Wimsatt is very broad indeed, although he defines three general categories (Wimsatt and Griesemer 2007, pp. 276-281; Wimsatt 2014, p. 81): “artifact scaffolding”; “infrastructure scaffolding”; and “developmental agent scaffolding” or more simply “agent scaffolding” (i.e. agents who facilitate skill development in other agents). Scaffolding that supports a wide range of other phenomena can be said to be entrenched insofar as the disruptive ‘downstream’ implications of changes to that scaffolding acts as an incentive for its conservation. For Wimsatt, “generative entrenchment” occurs when entrenched scaffolding is used to generate new phenomena principally because it is already available in the environment. A simple archaeological example would be the way in which the ‘born digital’ coordinate data generated by total station surveying instruments has scaffolded the introduction of further digital recording methods that employ this coordinate data, such as GIS and digital photogrammetry, as well as the introduction of alternative technologies for collecting digital coordinate data such as dGPS or laser

scanning. All of this entrenches digital surveying instruments into the infrastructure of archaeological fieldwork in ways that are rarely the subject of explicit reflection (but see Huggett 2017).

The idea of development is essential for Wimsatt since it provides the elements of inheritance and change necessary to make his descriptive model evolutionary. Indeed, Wimsatt borrows the metaphor of scaffolding directly from developmental and educational psychology where it has deep roots, albeit transformed in this borrowing through its pairing with entrenchment.

In his comprehensive review of the use of the scaffolding metaphor in developmental and educational psychology, C. Addison Stone (1998) traces its introduction to the paper “The role of tutoring in problem solving” by Wood, Brunner and Ross (1976). This paper analyses the role played by a tutor in teaching a group of 3-5 year olds to build a three dimensional structure with blocks that requires skills initially beyond those that the children possess. The authors define six kinds of interactions between the tutor and the children that help the children master the task, referring to these interactions as “the scaffolding process” (Wood, Brunner and Ross 1976, p. 98). This study is linked closely to the translation and reception in the English-speaking world of the work of the early Soviet psychologist Lev Vygotsky, especially his concept of the Zone of Proximal Development (Vygotsky 1978, pp. 84-91). The Zone of Proximal Development (ZPD) for any given child “...is the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers” (Vygotsky 1978, p. 84). While Vygotsky does not use the word “scaffolding” (i.e. строительные леса) and Wood, Brunner and Ross (1976) do not cite Vygotsky, Stone (1998, p. 345) shows that the metaphor of scaffolding was quickly attached to Vygotsky’s ZPD in English language studies within developmental and educational psychology. Indeed, scaffolding became (and seems to have remained) the primary means of describing the methods, resources, and settings (e.g. classrooms) used to facilitate skills development in children.

Importantly, amongst the four generally accepted characteristics of scaffolding in developmental psychology is the assumption that it is temporary, such that the initial scaffolding will be withdrawn as responsibility for learning is transferred from the adult to the child (Stone 1998, p. 349). Brendan Larvor (2018) notes that the use of scaffolding to refer to more permanent, or indeed entrenched, features arises when the metaphor 'jumps' from developmental psychology to cognitive science through its key role in Andy Clark's influential model of extended cognition. Clark is also influenced by Vygotsky and links Vygotsky's ZPD to the scaffolding metaphor in his early work on extended cognition, especially his book *Being There* (Clark 1997). Clark's work appears to be the primary source of the scaffolding metaphor as deployed by archaeologists interested in extended cognition and "human-thing relations" (e.g. Coward 2016; Hodder 2011, pp. 35-36; Knappett 2005, pp. 58-62; Malfouris 2013).

Clark's idea of human cognition as being embodied and extended via external augmentation makes extensive use of the scaffolding metaphor:

We may call an action scaffolded to the extent that it relies on some kind of external support. Such support could come from the use of tools, or the knowledge and skills of others; that is to say, scaffolding (as I shall use the term) denotes a broad class of physical, cognitive and social augmentations -- augmentations which allow us to achieve some goal which would otherwise be beyond us Clark (1998, p. 163).

While initially appearing rather similar to its application in developmental psychology, Clark's use is distinct in that many of the augmentations that scaffold human actions are not temporary – one can learn how to drive a car under instruction and ultimately remove the instructor, but remove the car and one cannot drive (cf. Larvor 2018).

From here it is only a short step to Wimsatt's entrenched scaffolding, although one further transformation is needed, namely the shift from Clark's focus on scaffolded individual cognition to what Kim Sterelny (2010, p. 471) terms environmentally scaffolded intelligence (see also Sterelny 2012). The collective, distributed and social nature of cognitive scaffolding implied by a scaffolded

environment (as against extended individual cognition) is necessary for Wimsatt's focus on cultural evolution and better suited to Wylie's interest in archaeology as a community of practice.

Wylie's expansive use of the scaffolding metaphor to describe all of the material, institutional and conceptual resources that make possible the creation of archaeological knowledge fits within a genealogy that stresses the multifarious forms of external support that enable cognitive activity and shape it in path-dependent ways. To be clear, Wylie has sharpened and transformed Wimsatt's broad evolutionary programme into a focused tool for epistemological analysis. However, her analysis of knowledge formation in archaeology retains both the open-ended definition of scaffolding as all forms of epistemic support, and the dynamic of its entrenchment through 'downstream' path-dependencies. The question remains, however, as to whether scaffolding is in fact a good metaphor for the complex and heterogeneous set of resources that Wylie highlights in her analysis?

Brendan Larvor (2018), for example, thinks that scaffolding is a very poor metaphor for similar aspects of mathematics if evaluated on a literal and point-by-point basis (e.g. scaffolds are temporary, extrinsic, rigid, non-responsive etc). Larvor states:

...the scaffolding metaphor radically misdescribes the help that we get from mathematical inscriptions and other elements of mathematical material culture (such as cardboard models, computer-generated images and shapes drawn in the air). It does not readily express the to-and-fro between inward cogitation and the manipulation of symbols and diagrams, nor the process of internalising shared, materially mediated mathematical practices. (Larvor 2018, no pagination)

However, metaphors are not productively evaluated in this strictly literal sense. A metaphor works in terms of what we gain from the juxtaposition of the tenor and the vehicle, especially the insights that this juxtaposition makes possible that might not otherwise cohere. In this sense, metaphors can still work when they are partial or incomplete. As Stone notes in his discussion of the scaffolding

metaphor in developmental psychology, the real danger lies in the dissipation of a metaphor's impact through its overextension.

Part of the power of a metaphor derives from the richness of the image it evokes and from the analogy between elements of that image and the as-yet undiscovered or poorly conceptualized elements of the novel domain to be explored. To the extent that a metaphor fails to constrain our thinking about that novel domain, it loses some of its inherent power.

Stone (1998, p. 351).

In this sense I would argue that Wylie's broad use of the scaffolding metaphor is productive because of the work it does in constraining our thinking regarding "as-yet undiscovered or poorly conceptualised elements" within the epistemology of archaeological knowledge formation. To demonstrate this point, I will try to explicate the epistemological work done by Wylie's use of the scaffolding metaphor. I will begin from two unlikely sources: a brief but explicit critique of Wylie's broad application of scaffolding; and V. Gordon Childe's understanding of the Three-Age (i.e. "Stone Age, Bronze Age, Iron Age") System.

2. Concept-Metaphors

In an otherwise positive review of *Evidential Reasoning*, Gavin Lucas (2017a, pp. 742-743) directly questions Chapman and Wylie's broad application of the scaffolding metaphor. Lucas argues that while inferential scaffolding works quite well within some version of Toulmin's schema, its utility is dissipated when applied to settings, such as fieldwork, that are less clearly structured as an argument. Unlike Kristin Kokkov (2019) who seems to only recognize scaffolding in the narrower sense of inferential scaffolding in her critique of Chapman and Wylie, Lucas recognises but rejects their broader application of the metaphor. He does so on grounds that are introduced in his review but most fully developed in his subsequent book, *Writing the past: knowledge and literary production in archaeology* (Lucas 2019). To summarise briefly, Lucas argues that archaeological knowledge is formed through distinct genres of writing, each characterised by distinct knowledge

practices and epistemic registers. For Lucas (2019, p. 61) scaffolding works as inferential scaffolding and finds its place as a practice of argumentation, one of his four modes of archaeological knowledge formation. In contrast, scaffolding appears to play no part in Lucas's discussions of his other modes of archaeological knowledge formation; namely narrative, description and exposition.

Lucas recognises the artificial fragmentation implied by his definition of distinct literary genres, since archaeological knowledge moves between these modes, both across and within actual texts. Hence, in the final section of *Writing the past* he explores the different means by which archaeological knowledge moves between literary modes and actual texts, offering 'paradigms'/'exemplars', 'models'/'analogies' and 'concepts'/'concept-metaphors' as common strategies by which archaeological knowledge is 'packaged' in order to make it mobile (Lucas 2019, pp. 136-159). According to Lucas, these three strategies are distinguished by their decreasing (from paradigm to concept-metaphors) ontological commitments and their concomitantly increasing mobility.

My purpose in this paper is not to critique or develop Lucas' schema of literary modes nor his extended discussion of how archaeological knowledge so constructed moves about. Instead, I want to focus on one example that Lucas deploys in discussing the mobility of concepts and theories within archaeological knowledge formation.

Lucas (2019, pp. 156-157) uses Julian Thomas' (1993) analysis of the changing referents of 'the Neolithic' to illustrate what he terms mobile concepts (following Bal 2002) or concept-metaphors (following Moore 2004). To summarise, the term "Neolithic" was originally coined in the late nineteenth century as a universal technological stage, it was transformed by V. Gordon Childe into a functional-economic mode ("food-producing societies") and by the mid-twentieth century had moved decisively away from a technological definition towards a regional/cultural one. Since the 1990s, "the Neolithic" has come to refer also to a *discursive field* with intersecting themes, concepts, and issues, albeit one that still carries some taxonomic implications within relative chronological sequences. Lucas' argument is that the Neolithic has become a *concept-metaphor*, that is to say a

Commented [AK1]:

It is still used by many researchers to refer simply to the technological stage too

flexible concept with relatively weak ontological commitments that can be deployed across a wide range of text types and data sets to facilitate the creation and movement of archaeological knowledge. Thomas's (1993) intellectual history of Neolithic studies is contestable, but for our purposes the details of his sequence of developments are secondary to Lucas's suggestion that the Neolithic so-conceived is a concept-metaphor. Here it is helpful to quote Henrietta Moore's definition of concept-metaphors at length:

Concept-metaphors like global, gender, the self and the body are a kind of conceptual shorthand....They are domain terms that orient us towards areas of shared exchange....Their exact meanings can never be specified in advance – although they can be defined in practice and in context – and there is a part of them that remains outside or exceeds representation. One of their very important roles is to act as a stimulus for thought...and to act as domains within which apparently new facts, connections or relationships can be imagined. (Moore 2004, p. 73).

What makes Moore's definition interesting for our purposes, is that V. Gordon Childe himself repeatedly deployed the metaphor of scaffolding when discussing the relationship of his own work on the Neolithic to Thomsen's Three-Age system, and he does it in a manner that is very compatible with Moore's definition and Lucas's analysis. How then might Childe's understanding of the Neolithic as scaffolded by the Three-Age System relate to Lucas's understanding of the Neolithic as a concept-metaphor?

3. V. Gordon Childe on Scaffolding

Throughout the 1940s and 1950s V. Gordon Childe repeatedly deployed the metaphor of scaffolding to describe the role of Thomsen's Three Age System in constructing then current understandings of relative chronology, technological change and social evolution (Childe 1944, p. 7; 1946, p. 249; 2004 [1947], p. 89; 1953, p. 88; 1956, p. 93). Childe's statements were succinct but very focused and consistent. While the Three-Age system was no longer an accurate representation of specific

archaeological sequences, either in terms of chronology or technological development, it "...did give a scaffolding within which a more coherent structure could be, and has been, reared." (Childe 1944, p. 7). For our purposes, it is secondary that Childe's representation of the Three-Age system as stages based on the isolated traits of material and technique was misleading (cf. Rowley-Conwy 2007, pp. 48-81). Childe understood himself to be working within Thomsen's system but using it as a vehicle to build something new, namely a functional-economic understanding of the Three-Ages that fused the evolution of the forces and modes of production (e.g. Childe 1935). For Childe, "Nowadays, archaeologists merely use the scaffolding provided by Thomsen's classification as a frame for describing cultures and their succession and finding out how their relics functioned in a working economy" (Childe 1946, p. 249).

Childe uses the metaphor of scaffolding to describe something that is useful and provisionally necessary for the creation of new knowledge but is, at the same time, extrinsic to that knowledge. Like scaffolding on a building site, Childe even argues for the Three-Age System's ultimate redundancy. Chronologically he wished that "...the editors of *Danske Oldsager* had had the courage to discard the scaffolding constructed by their illustrious predecessor, Thomson [sic]...[in order] to divide the whole of prehistory from Bromme on into a single series of periods, numbered consecutively and undistorted by superfluous technological adjectives" (Childe 1953, p. 88; see also Childe 1956, p. 92). In terms of social evolution, he argued that "If archaeological data are to be really serviceable in the social sciences, they must be presented classified on a new and less superficial basis" (Childe 2004 [1947], p. 90). However, in tension with this disposability, Childe also recognised the deep entrenchment of the Three-Age System, such that "Various attempts have been made to give these hallowed terms some other content..." (Childe 2004 [1947], p. 89). Hence, like actual scaffolding, Childe recognised that the Three-Age System might also be usefully reconfigured as a bridge between the old and the new rather than simply discarded.

4. Concept-Metaphors as Scaffolding

In presenting his functional-economic Neolithic as scaffolded by the technological Neolithic which emerged from the Three-Age System, Childe makes rather effective use of the scaffolding metaphor. The Three-Age System may have been wrong in detail and emphasis, but it organised a fuzzy set of sequences, sites, assemblages, types, and technologies that were interrelated in time and space. As such, it could scaffold a reimagining of the relationship between members of this set, while also making relevant new forms of evidence and new programmes of research. The subsequent iterations of the Neolithic as detailed by Thomas (1993) could be understood in similar scaffolding terms. Each transformation in the referents of the Neolithic was scaffolded on an already entrenched understanding of the Neolithic while at the same time making possible the recognition of new, or newly relevant, sources of data (e.g. the increasing importance of monuments as a component of the Neolithic in Europe). But if the Neolithic is a form of scaffolding can it also be a concept-metaphor?

Importantly, each iteration of the Neolithic was scaffolded by its predecessors in very particular ways. Superficially, there is some resemblance between the succession of scaffolded reinterpretations of the Neolithic and Currie's "investigative scaffolding", especially the iterative process and sequential revelation of new sources of evidence. However, any given version of the Neolithic is conceptually broader, ontologically thinner, and nominatively more durable than the preliminary hypotheses that scaffold a specific programme of research. This nominative durability is important. Unlike a preliminary hypothesis, the Neolithic is not replaced, only redefined. Lucas (2019, pp. 136-159) has stressed the "deracinated" nature of concept-metaphors, which minimises the ontological commitments they demand and thereby facilitates their movement between disciplines and research programmes. However, he also recognises that (much as we have already noted for metaphors in general) if concept-metaphors become too elastic, too 'hollowed out', they lose their analytical potential (Lucas 2019, p. 155). For example, Lucas suggests that the wide application of the concept of 'landscape' within archaeology in the 1990s and early 2000s had just such a dissipating effect on its interpretive value (Lucas 2019, p. 155). This raises an important point

that is otherwise underemphasised by Lucas, to maintain their creative analytical potential concept-metaphors must retain certain focal points. These focal points justify the nominative durability of concept-metaphors and provide the coherence necessary for them to act as scaffolding. Perhaps, as Thomas (1993) suggests, the Neolithic is best approached as a field of discourse rather than as a totality, but it is a discursive field that retains certain focal points. In Britain, for example, the Neolithic is a field of discourse that continues to include Grooved Ware and Stonehenge while excluding *Terra sigillata* and *The Mary Rose*.

Archaeology makes extensive use of concept-metaphors to scaffold new research programmes in this sense. For example, Lucas (2017b, p. 187) has already suggested that ‘assemblage’ can be thought of as a concept-metaphor. Traditional uses of this term in archaeology typically include two seemingly distinct referents, assemblages are heterogenous sets of artefacts associated via their depositional proximity and assemblages are homogenous sets of artefacts associated via their typological similarity (see Lucas 2012, pp. 193-198). The classic debate between Lewis Binford (Binford and Binford 1966; Binford 1973) and François Bordes (Bordes 1953; Bordes and de Sonneville-Bordes 1970) over functional versus cultural/ethnic explanations for variability between Mousterian lithic assemblages ultimately hinges on distinct understandings of what an artefact assemblage represents. Most recently, the unusual choice of the English word “assemblage” to translate Deleuze and Guattari’s (1987) use of “*agencement*” in French (Philips 2006) has reinvigorated theoretical discussions of assemblages within archaeology (Hamilakis and Jones 2017). Despite these seemingly fundamental changes in research programmes, “assemblage” remains an essential archaeological term. Consider V. Gordon Childe’s normative view that:

...artefacts hang together in assemblages that recur repeatedly not only because they were used together in the same “age”, but also because they were used by the same people, made or executed in accordance with techniques, rites or styles prescribed by a social tradition, handed on by precept and example (Childe 2004 [1947], p. 83).

in comparison with Yannis Hamilakis’s Deleuzian view that assemblages are:

...temporary co-presences, deliberate arrangements and articulations of things, beings, enunciations, memories and affects brought together and enacted as such by sensorality (Hamilakis 2017, p. 176).

Whilst representing radically different views of assemblages, they also intersect around the interpretive importance of association, evident in words and phrases like 'hang together', 'co-presences' and 'articulations'. This focal point is what gives 'assemblage' its nominative durability and allows it to act as a concept-metaphor, repeatedly scaffolding quite distinct programmes of archaeological research, each of which accepts that associations are important in order to focus on what, how and why phenomena are associated in specific contexts. In this sense, Moore's definition of concept-metaphors highlights a specific kind of scaffolding, one characterised by domain terms that: 1) point to areas of shared exchange; 2) exceed representation; but 3) can be defined in practice and context; and 4) thereby allow new facts, connections and relationships to be imagined.

5. Scaffolding as a Concept-Metaphor

Trowels and Munsell Soil Color Charts, field schools and teaching traditions, investigative scaffolding, inferential scaffolding and concept-metaphors constitute a heterogenous mix of material, infrastructural and conceptual resources. In the broad application of the scaffolding metaphor these all constitute scaffolding insofar as they support and shape the production of archaeological knowledge. I suggested that this stretching of the scaffolding metaphor was justified because it did significant epistemic work. So, what is this work and how does the scaffolding metaphor get it done?

Here it is important to note that in Wylie's broad use of the scaffolding metaphor one cannot define what constitutes scaffolding *a priori*; her definitions are composed of open-ended lists of exemplars rather than parameters. Instead our attention is drawn in a very focused manner to two key points. First, knowledge is not self-warranting, it depends upon a potentially vast array of material, infrastructural and conceptual supports and, second, these supports can engender

dependencies with downstream implications for the shape and direction of future knowledge formation. From these limited foci, key issues for epistemological research emerge. Evoking the scaffolding metaphor immediately requires one to specify for a given context what is the scaffolding, what is being scaffolded, by what means and with what downstream path-dependent effects. Scaffolding as a noun, if you will, can only be revealed by first paying attention to what it means 'to scaffold' as a verb in a given context. In other words, scaffolding reveals itself in the analysis of practices in context. Wylie has expressed this more generally as one of the implications of the work of postpositivist philosophers of science such as Ian Hacking and Andrew Pickering, stating:

The upshot then, is that for those engaged in philosophical science studies, now more than ever before the questions of just what sorts of factors contingently shape the practices, goals, standards, regulative ideals and products of the sciences is genuinely open-ended - an empirical, a posteriori question. Philosophy is thus returned to active engagement with the sciences on several dimensions... (Wylie 2002, p. 12).

The sharp focus, but limited specification, of Wylie's scaffolding metaphor is therefore potentially generative of new research programmes and forms of evidence that were not necessarily imagined in the metaphor's original formulation. In this way, the scaffolding metaphor itself scaffolds the epistemological analysis of knowledge formation in practice and I would suggest it does this because the scaffolding metaphor is a concept-metaphor.

Much as Lucas (2019, pp. 136-159) suggests, the scaffolding metaphor has undergone some degree of "deracination" as it has moved from developmental psychology, to cognitive science, to cultural evolutionary theory, to epistemological analysis. In so doing, its key attributes have narrowed such that scaffolding is now a domain term that provides a focal point for research, highlighting phenomena that support and shape knowledge production, while exceeding any representation of those phenomena outside of the analysis of specific contexts and practices. Indeed, it is because the constitution of scaffolding cannot be defined wholly in advance, that the scaffolding metaphor invites evidential and analytical innovation.

6. How entrenched are our scaffolds? How 'emptied' are our concept-metaphors?

One further strength of Alison Wylie's broad application of the scaffolding metaphor is the recognition that any epistemic scaffolding can become entrenched via the path-dependencies it engenders. As such, scaffolding analysis demands a critical/reflexive orientation as well an exploratory/analytical one. Entrenched scaffolds need regular re-examination to uncover their downstream effects and evaluate their fitness-for-purpose. Concept-metaphors present a particular challenge due to their flexibility and changing referents. How 'emptied' of ontological commitments are our concept-metaphors? Do these concepts really move 'baggage-free' from iteration to iteration? How do earlier understandings adhere with continuing effects? It is well-known, for example, that regardless of what archaeologists make of terms like 'the Neolithic', the progressivist underpinnings of the Three-Age system continue to impact popular understandings of these terms (e.g. the use of "Stone Age" in the writings of Jared Diamond). As Harry Allen notes, with regards to the impact of our progressivist taxonomic terms on representations of Australian Aboriginal history and culture:

The archaeologist's dilemma lies in the fact that they continue to use the same terms but argue that these have new meanings. The rub, however, is the singular lack of success archaeologists have had in convincing the public to accept new and technical meanings for long familiar terms. Archaeology cannot easily free itself from concepts which represent a nineteenth-century metaphysic and episteme. (Allen 2015, p. 190).

The point is not that we should (or should not) cease to talk about the Neolithic, but rather that the critical analysis of its downstream effects arises naturally from Wylie's dual focus on scaffolding and its entrenchment. The same applies to Wylie's scaffolding analysis itself. If, for example, we were to agree with Larvor [2018] that scaffolding was a poor metaphor for our domain specific epistemic supports, or with Lucas (2017a, p. 742) that the metaphor was being stretched too far, our critique would need to be justified on these same grounds; the path-dependencies that the scaffolding

metaphor engendered and the routes to understanding that these dependencies obscured. This potential for auto-critique highlights the fruitfulness of Wylie's approach. As a concept-metaphor, entrenched scaffolding invites evidential and analytical innovation in terms of the analysis of knowledge formation in practice, but it does so with a demand for vigorous, on-going, reflexive critique.

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