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Carl Knappet. *An Archaeology of Interaction: Network Perspectives on Material Culture and Society* (Oxford: Oxford University Press, 2011, 251pp., 50 figs., hbk, ISBN 978-0-19-921545-4)

Complex systems are composed of many interacting components organized into nested groups, which can be represented as organizational hierarchies or hierarchically structured networks: the more complex the system, the deeper the nesting of the groups of components. In human terms, such nested groups could be households within clans within chiefdoms, individuals within craft guilds, or cities within states. It should be apparent by now that it is the character of the interactions among the components, rather than their inherent characteristics that determines the behaviour of complex systems. Complex adaptive systems (CAS) are a kind of system in which these interactions can change dynamically through endogamous processes and transmit information about the state of the system among its components.

Dynamic interactions among individuals and groups in human societies can be represented as networks, in which the nodes are social agents and the connections between the nodes (*edges* in network terminology) are the interactions between them (Wasserman & Faust, 1994). Hierarchical organizations typical of CAS often exhibit particularly structured

network topologies (i.e. organizational patterns of nodes and edges).

This characteristic allows the application of a wide range of mathematical models, with which to understand the evolutionary dynamics of complex systems and complex networks. During the last decades, the analysis of complex networks has raised significant interest, especially since it was discovered that these are ubiquitous among different scientific fields (Newman, 2010) Recent literature reflects the fact that social networks are complex networks, which exhibit some special characteristics such as modularity and assortativity (Boguña et al., 2004).

Social networks display strong assortative mixing, expressed as the tendency of highly connected nodes to preferentially link with others that are equally highly connected. Social networks possess a complex community structure in which individuals typically belong to groups or communities with a high degree of internal connection, but which are more loosely connected to one another. In turn, these will belong to groups of groups and so on, giving rise to a hierarchy of nested social communities of practice.

The impact of these theoretical and methodological tools on issues concerning exchange and interaction is evident and their utility has been perceived by archaeologists (e.g. Mills et al., 2013). The book by Knappet reviewed here is a good example of how interesting the application of such tools can be in the field of archaeology. The title, *An Archaeology of Interaction*, highlights the interpretative possibilities offered by these new approaches, referred to in the book as 'network thinking', in which greater emphasis is placed on the relationships rather than their categorization. From this perspective, there is no doubt that this work is related to the so-called 'complexity sciences'.

The book is divided into three parts. The first three chapters present the objectives and methods within their corresponding theoretical background. Particularly interesting is the introductory chapter in which the objectives and their theoretical foundations are clearly summarized. These issues are further developed in the following two chapters, while in the central part of the book, entitled 'Networks in Practice', they are enriched with examples from the author's studies, especially on the Aegean Bronze Age.

In this sense, it is not by chance that the book starts with two long paragraphs in which the author describes the work of many archaeologists, past and present, myself included, working directly with material culture. This is important, since, according to the author, the interactions among humans cannot be understood without the support of material culture (artefacts or general materiality). From the author's point of view, both the human being and the object are active entities in these relationships, and therefore they should be considered as nodes of a single network of relationships, though with very

different natures. For this reason, the author uses a particular approach, namely Actor-Network Theory (ANT). This assumes that both humans and objects may be 'actors' in social relations. A good example of this is the relationship between archaeologists and excavations. Archaeologists interact with the excavations in which they participate, and for this reason both should be considered nodes within the network.

ANT has not developed a way to represent networks. In order to do so, we should turn to Social Network Analysis (SNA), which has a long tradition in sociology, but has not been widely applied in other disciplines. The present impact of network analysis is in part due to the discovery in the last decades of the so-called 'complex networks'. Network analysis, which the author describes in Chapter 2, is a combination of both traditions.

Despite the fact that both complex and social networks originally followed separate paths, in the past few years they have come together, especially since the physicists and mathematicians working with complex networks recognized the particularities of social networks. The advantage of complex networks is that they provide powerful formal tools with which research questions can be defined and described in greater detail, as well as providing the means to evaluate between the alternative hypotheses.

In the final part of the Chapter 2, the author summarizes the reasons for focusing on networks, and outlines their present limitations. The network perspective's emphasis on relationships enables us to concentrate on the interaction between humans and socio-material objects; flexibly consider problems at multiple scales (from micro to macro); integrate both physical and social space; and understand the topology and geometry of networks. Networks also allow us to consider

different classes of nodes, for example humans and objects, as well as different quantitative and qualitative connections. Among the difficulties involved in the application of network analysis, the author highlights the high level of mathematical knowledge required, not generally available in the social sciences, and, above all, a tendency towards structuralism and description instead of explanation.

Nonetheless, recent studies have clearly shown that these are not insurmountable obstacles (Lozano, 2009, for *Complex Adaptive Networks*), especially regarding issues of structuralism and 'agency'. The same studies demonstrate that the structure of the network and its topological characteristics are the result of interactions between its parts (nodes), which are in turn influenced by the former. In other words, agency and structure are two closely related concepts that interact and are mutually affected.

The second part of the book includes examples of the application of networks at multiple scales, from micro to macro. Except for the case of Palaeolithic stone tool production, all are taken from the Aegean Bronze Age, which is the study area of the author. The differentiation that the author makes between networks of affiliation, praxis communities, and interaction stands out. These concepts are discussed in the various chapters, which focus on networks of affiliation at the micro scale, where face-to-face interaction predominates, praxis communities comprising groups (household or craftsmen) that are connected within or among settlements, and, finally, different methods of exchange at the macro scale. Although the examples presented for each of the different scales are remarkable, it is in this last part of the book where the ideas are fleshed out in greater detail, and the value of network analysis in archaeology is highlighted.

The author argues that interaction is not synonymous with cultural transmission. Nonetheless, the discussion of the data indicates that the frequency and intensity of interactions constitute an adequate proxy with which to investigate processes from simple exchange to identity in smaller or larger communities (groups). Moreover, the author presents the ways in which interaction develops during production, distribution, and consumption within groups. This is an example of how the process of acculturation intensifies (Minoisation in this case) in parallel with increasing contact (interaction).

In relation to the formation of exchange and interaction networks that facilitated the acculturation process, the author presents a model that was developed in collaboration with other researchers. This model highlights how the formation of small-world networks may be explained from the point of view of interaction among agents (nodes) at the local scale, guided by the principle of cost–benefit. In other words, the small-world effect reflects locally made decisions following certain basic rules, which is one of the main ideas of complex systems.

In the final part of the book, the author discusses in general terms the process of increasing scales of spatio-temporal interaction, along with the accumulation of the means to facilitate connections beyond face-to-face interaction. In the preceding chapters, the ways in which objects become incorporated in social interactions at multiple scales were described. In the last chapters, much attention is paid to the analysis of the potential reasons for which humans continuously strive to widen the range of their interaction. What are the benefits of interaction centred around objects and groups of objects and what are the costs incurred?

The answers to these questions are addressed in Chapters 7 and 8, where it is

inferred that the primary benefit of object networks is stability of identity, along with the potential to explore new dimensions within that identity. The downside or cost is that object networks need work and investment in order to avoid becoming devalued and irrelevant (the destabilising effects of the 'world of things' in the book). Objects need to be taken care of and repaired, while the concept of their value needs constantly to be reasserted and transmitted through space and time. These activities, which aim to preserve identity through time, require significant investment in terms of ritual, cost, and effort.

The book by Knappet helps us to understand the importance of interaction and the role that objects and groups of objects play in this process, as well as the advantages offered by approaches based on the concept of networks. Many of these approaches are applied here, and originate from the so-called 'complexity sciences'. Other advantages are related to recent approaches that perceive material culture as beyond mere scenery or simply the result of human interaction. What the author achieves in his book is to '... show how network ideas have associated methods ... that can be applied to data to bring out new patterns and interpretations', offering new ways to study

material culture and its role in human interaction across multiple scales.

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Michael B. Schiffer. *Studying Technological Change: A Behavioral Approach* (Salt Lake City: University of Utah Press, 2011, 224pp., 38 figs., 7 tables, pbk, ISBN 978-1-60781-136-7)

Academia, like many other fields of cultural production, has its fashions, whether we like it or not. Archaeology is no exception; in the aftermath of Post-Processualism it has been all too easy to dismiss (probably prematurely) those such as Lewis Binford whose work in

New Archaeology was once considered radical. Mike Schiffer is one of those people, like certain rock musicians, whose work seems to defy the vagaries of fashion—remaining as topical today as when he published *Behavioural Archaeology* in 1976.