Quaternary International 446 (2017) 109–127

Contents lists available at ScienceDirect

Quaternary International

journal homepage: www.elsevier.com/locate/quaint

Socioeconomic complexity and the resilience of hunter-gatherer societies

Martin Solich [a, *], Marcel Bradtmöller [b]

[a] University of Cologne, CRC 806, Bernhard-Feilchenfeld-Str. 11, 50969, Cologne, Germany
[b] University of Rostock, Heinrich Schliemann-Institute of Ancient Studies, Neuer Markt 3, 18051 Rostock, Germany

ARTICLE INFO

Article history:
Received 23 June 2016
Received in revised form
23 February 2017
Accepted 29 June 2017
Available online 25 July 2017

Keywords:
Resilience research
Hunter-gatherer
Adaptive cycle model
Upper Paleolithic
Complexity
Complex adaptive systems

ABSTRACT

Human societies have been challenged by internal and external disturbances throughout history. However, our knowledge of the dynamics and parameters of their resilience remains remarkably incomplete. This deficiency is particularly evident for the longest part of our past, when humans lived as hunter-gatherers.

Following Holling's *adaptive cycle* model, we propose an approach to reconstruct socio-economic developments in hunter-gatherer populations as transitions between different attractor states of complex adaptive systems, with *connectedness* as a key concept. This allows a reinterpretation of the classical 'simple'–'complex' hunter-gatherer dichotomy by shifting attention to the mechanisms of adaptation and dynamics holding *socio-ecologic systems* of hunter-gatherers in tension. Applied to the situation in Europe during the late Pleistocene, a model explaining the different long-term dynamics observable in the aftermath of the arrival of the first anatomically modern humans is discussed.

1. Introduction

Holling's *adaptive cycle* (**AC**) model is commonly used to explain successive historical events observable in archaeological records of a particular region (see Bradtmöller et al., 2017). The model, grounded in *complex systems theory* (**CST**) and *resilience theory*, can also be used to analyze human system dynamics by providing an intriguing perspective that sheds light on more general long-lasting questions and debates. The drivers of the emergence of phases of increasing socio-economic complexity and their decline among prehistoric hunter-gatherer societies remain among these questions (see Barton, 2013; Henrich, 2004; Vaesen et al., 2016). Next to environmental factors (see e.g. Price and Brown, 1985; Torrence, 1989; Kelly, 1995; Nelson, 1996), population or internal dynamics of societies have been suspected to play a key role in these processes (e.g. Ames, 1985; Arnold, 1996; Bender, 1978; Hayden, 1994, 1997; Lourandos, 1985).

In this article, we point out how the rather general AC model in combination with a consistent interpretation of CST can be applied to identify long-term dynamics of hunter-gatherer societies and the drivers of these dynamics. The strategy proposed here differs from alternative approaches to identification of historical ACs in archaeology by specifying the Holling's *connectedness* concept in regard to the socioeconomic characteristics of hunter-gatherer societies. Building on this, a range of parameters is suggested, considering different archaeological detectable proxies of connectedness to identify AC-related trends. Challenged by the fragmented nature of archaeological datasets available for prehistoric societies, future work grounded on a wider range of parameters is expected to be unavoidable for interconnecting and contextualizing archaeological datasets. This will lead to more substantiated statements on past developments but also requires an elaborated specification of the theoretical framework used and the inherent methodologies, as provided in this article. To indicate their applicability to a particular archaeological context, the case of the European Upper Paleolithic is discussed at the end of the paper.

2. Setting the framework: complex systems and adaptive cycles

Considering individual behavior and also social or rather socio-ecological system properties is a special feature of a CST approach, facilitated by inspiring research that integrates different former approaches of analysis in the field of hunter-gatherer research. By

* Corresponding author.
E-mail address: solich@posteo.de (M. Solich).

http://dx.doi.org/10.1016/j.quaint.2017.06.064
1040-6182/

the mid-twentieth century, system-focused frameworks dominated the discourses oriented towards human–environment relations, such as the *cultural ecology* approach (see e.g. Steward, 1938, 1955; Lee, 1969; Rappaport, 1968). After their decline of influence in the following decades, an alternative has become available with the establishment of *behavioral ecology*, which is oriented towards the individual as the central agent of visible behavioral patterns (Smith, 1983; Winterhalder, 1981; Bettinger, 1980; Winterhalder and Smith, 1992; Kelly, 1995). While the focus on systems originated in the search for adaptive benefits of cultural institutions under the assumption of systems in equilibrium, behavioral ecology shifted the attention to individual behavioral strategies assumed to reflect close-to-optimum performance under the given conditions offered by the particular environment (Smith, 1983; Winterhalder and Smith 2000; Kelly, 1995). In contrast to classical ecological approaches, *behavioral ecology* promises to explain not only behavioral patterns but also behavioral change in cases of altered conditions, such as the appearance of new techniques or a significant variation in the resource availability (Winterhalder and Smith, 1992). Nevertheless, the focus on the individual has its limits when recognizing system-level developments. *Behavioral ecology* and similar individual-actor-centered approaches (see e.g. Henrich, 2004), disregard, for example, socio-cultural dynamics, which are expected to be relevant for group-level resilience capacities too.

With the increasing attention paid to the concept of CASs by social scientists since the end of the last century (e.g. Axelrod, 1984; Gell-Mann, 1995) and also archaeologists (e.g. Kohler and Gumerman, 2000; Binford, 2001; Barton, 2013), a promising method was introduced to adequately combine individual- and system-directed approaches. Deeper understanding of human social systems as based on dynamic interactions among individuals – and also environmental agents if the focus is on *social-ecological systems* (**SESs**) – opens the view of individuals as elements of systems in which system-level properties are the outcome of local-level actions affected by the very same properties. Holling (2001) argues that these feedbacks can be of high relevance for the resilience of systems and hence for their stability within the panarchy of inter-nested systems. Stability and change, and hence the history of past hunter-gatherer cultures, would accordingly also be a question of these system-internal dynamics.

2.1. Individuals, societies, and their environments

Adopting the idea of CST begins with the definition of the relevant levels of a system. In the case of social and socio-ecological systems, the hierarchical structure of nested systems provides several potential levels of analysis. Taking a look at social systems among a wide range of contemporary hunter-gatherers, it is possible to differentiate between households, residential units (or camps), inter-band clusters, and societies representing sociocultural clusters of a wider interconnected human population of a larger region (see Birdsell, 1993; Kelly, 1995; Hamilton et al., 2007; Layton et al., 2012). With reference to Gunderson and Holling (2002), who promoted the consideration of at least three levels of a particular system, we propose the analysis of socioeconomic features via three established levels of analysis, all of them considered to be of central relevance for a more complex understanding of change and stability in behavioral patterns that are identified in the analysis of the archaeological records: (1) the individual human agents constituting (2) a society as a part of a (3) (supra) regional social-ecological system.

The individual as a distinct biological system is the actual agent performing the actions that in fact produce the archaeologically visible traces. Individual action is expected to be based on semi-autonomous habits and decisions, both usually highly influenced by a history of social learning. Social learning is the central driver for the emergence of cultural clusters and institutions reflecting social systems of interacting humans (see e.g. Castro and Toro, 2004; Henrich, 2004). This means that individual behavior is consequently not free and unconditional but biased by the social transmission of norms, values, skills, and techniques that form a shared cultural body including cultural institutions allocable on the level of aggregated behavior. Cultural groups, as social systems sharing 'a' culture, are traditionally the focus of ethnographic studies and are therefore characterized, inter alia, by the common behavioral patterns.

Particularly, but not only, in the case of hunter-gatherers, cultural institutions (e.g. values, norms, beliefs or rituals) also contain a significant body of expertise regarding the particular environmental context of a society accumulated in the past (Boyd and Richerson, 1995). The emergence of a more or less stable cultural system is expected to reflect the adaptive capacity of a society accordingly. Environmental conditions, such as the variety and temporo-spatial distribution of potential resources, are expected to be considered in the behavioral patterns observable for a particular group. On the other hand, the motor of change is the individual capable of using the free spaces within the sociocultural frame to modify or adopt alternative individual behavioral strategies (Dobres and Robb, 2000; Hodder, 1987; Redman, 1977). Such processes in turn have the potential to alter the sociocultural frame. If it is accepted that this interrelationship between individuals and their cultures is convincing, the identification of societies or cultural groups as a class of CASs is evident.

That human social systems are considered to constitute CASs is not new (see e.g. Axelrod, 1984; Barton, 2013; Waldrop, 1992; Gumerman and Gell-Mann, 1994). A short definition of CAS was given by Holland (2006, p. 1) as "[…] systems that have a large number of components, often called agents that interact and adapt or learn." This corresponds well with the definition of societies with agents representing human individuals. In another paper, Holland (1992) describes in more detail the central features of a CAS: *evolution*, *aggregated behavior*, and *anticipation*. The precondition of the evolution of a system is the existence of components "attempting to improve the ability of their kind to survive in their interactions with the surrounding parts" (Holland, 1992, p.19). In the case of humans, this can be observed well in children learning from the elders and adopting subsistence-related strategies that are perceived as more efficient (see e.g. Blurton-Jones, 1993; Hewlett et al., 2011) or in the relatively quick historic replacement of stone arrow tips with metal within the groups of hunter-gatherers in southern Africa (Bosc-Zanardo et al., 2009). Examples of emergent structures or properties of systems that are more than simply the sum of local actions, named *aggregated behavior* by Holland, are in turn cultural institutions, like ritual aggregations, but also seasonal alternating settlement patterns as observed for the *Dobe Ju/'hoansi*. The pattern of dispersal and aggregation phases independent of the individual group composition described by Yellen (1977) for hunter-gatherer groups from Southern Africa is a case of a society-level phenomenon with relevance for local behavior. The conditions of an individual vary significantly depending on the current group size. Also, *anticipation*, described as follows: "[…] parts can be thought of as developing rules that anticipate the consequences of certain responses" (Holland, 1992, p. 20), is generally nothing unfamiliar among human actors. The expectation is that local level behavior is relatively simple and selected depending on the response.

A probable particularity of human systems is the evolution of specific time- and place-dependent group-level structures that influence individual decision-making. Elaborated normative