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Population dynamics, social resilience strategies, and Adaptive Cycles in early farming societies of SW Central Europe

Detlef Gronenborn ^{a, b, c, *}, Hans-Christoph Strien ^b, Carsten Lemmen ^{d, e}

^a Römisch-Germanisches Zentralmuseum, Ernst-Ludwig-Platz 2, 55116, Mainz, Germany

^b Johannes-Gutenberg-University, Institut für Altertumswissenschaften, Vor- und Frühgeschichtliche Archäologie, Schillerstrasse 11, 55116, Mainz, Germany

^c University of the Witwatersrand, School of Geography, Archaeology and Environmental Studies, Bernard Price Building, Braamfontein Campus East, Johannesburg, South Africa

^d C.L. Science Consult, Lauensteinstraße 30, 21339, Lüneburg, Germany

^e Helmholtz-Zentrum Geesthacht, Zentrum für Material- und Küstenforschung GmbH, Max-Planck-Straße 1, 21502, Geesthacht, Germany

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ABSTRACT

Inferred European Holocene population size exhibits large fluctuations, particularly around the onset of farming. We attempt to find explanations for these fluctuations by employing the concept of cycling, especially that of the Adaptive Cycle. We base our analysis on chronologically and chorologically highly resolved ceramic and site data from the Linear Pottery culture (Germ. *Linearbandkeramik*) of the early Neolithic of southwestern Central Europe. Typological seriation with dendrochronological anchor dates provides the age model for these data. Ceramic motifs are analysed with respect to the temporally changing diversity in decoration. The temporal sequence of major decoration motifs is interpreted as an indicator of social diversity: when stylistic diversity is low, social diversity is low and vice versa. The sequence of secondary decoration motifs is interpreted in terms of individual lineage emphasis: when this diversity is low, there is strong emphasis on individual lineage and vice versa. The diversity time series are complemented by a relative population size indicator derived from the count of occupational features. Diversity and population size share a shape that is typical for (part of) an Adaptive Cycle, and they differ in their positioning on the time axis — they are time-lagged. By relating the different curves to the (metaphorical) stages of the Adaptive Cycle, we find that these cycles progress at non-identical speed in different aspects of a social system. By relating the social dynamics to well-dated and highly resolved climate fluctuation records, we find evidence that severe climate excursions shaped the location of tipping points in the social system and that these social tipping points precede inferred population decline by several generations.

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1. Introduction

For a number of years, it has become evident that neither global nor regional Holocene population trajectories followed a steady upward and linear trend, but instead – when investigated at higher temporal resolutions – underwent non-linear increases and decreases (Zimmermann, 2012a; Shennan, 2013). Particularly around the onset of agriculture, population trends show often considerable ups and downs (Bocquet-Appel, 2011; Shennan et al., 2013). These

population dynamics also seem to be reflected in the genetic record with certain haplogroup lineages decreasing during periods of population decline (Brandt et al., 2015). While these Early Neolithic fluctuations have been thoroughly described, hypotheses for their existence and their exact curve progression on the time-line are only beginning to be formulated. The current debate ranges around external forcing such as climate fluctuations (Weninger et al., 2009; Clarke et al., 2016; Sánchez Goñi et al., 2016), or internal forcing such as social factors (Peters, 2012; Zimmermann, 2012a; Shennan, 2013; Downey et al., 2016) or combinations of both (Gronenborn et al., 2014; Gronenborn, 2016). Palaeogenetic research on diseases (Rasmussen et al., 2015) has yet focused on the earlier Neolithic data set – such approaches may eventually add a whole new aspect to the debate on population dynamics.

* Corresponding author. Römisch-Germanisches Zentralmuseum, Ernst-Ludwig-Platz 2, 55116, Mainz, Germany.

E-mail addresses: gronenborn@rgzm.de (D. Gronenborn), strien@uni-mainz.de (H.-C. Strien), carsten.lemmen@hzg.de (C. Lemmen).

In the meantime, we here continue arguing along traditional lines and investigate how a combination of both internal (social/political) dynamics and external (climate/environment) triggering or even forcing might have shaped the population curves of early farming societies in Temperate Europe. Building upon previous work (Gronenborn, 2012, 2016; Gronenborn et al., 2014), we try to specify the application of Resilience Theory (RT) and the concept of Adaptive Cycles (AC) (Holling and Gunderson, 2002), but also the demographic-structural theory (DST) formulated by Turchin and Nefedov (2009), and to classify and define attributes for certain parameters of RT in the archaeological record. As before, we use data from the early farming societies of Temperate Europe, the Linear Pottery culture (Germ. *Linearbandkeramik* – LBK).

2. Resilience and Adaptive Cycles in historiography and archaeology

While the application of RT and AC dates back about a decade within archaeology (Redman, 2005; Kintigh et al., 2014, pp. 11–12) the concept of resilience itself and historical thinking in cyclical dynamics is considerably older, in fact both go back to Classical Antiquity.

2.1. Resilience

The academic application of the term and the concept of resilience dates back several decades in psychology (Werner et al., 1971), sociology (Pettit, 2007), and the environmental sciences (Holling, 1973) from where the idea eventually became introduced to archaeology. However, most archaeological studies have omitted or avoided precise definitions of RT parameters, such as resilience and connectedness, and taken the theory rather as a background template channelling the general line of thought. Indeed, has the definitory vagueness inherent in RT been criticised before (Olsson et al., 2015). It is therefore important to examine how certain factors may be extracted from an archaeological data-set, in order to apply the theory more precisely.

Resilience is the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks (Walker et al., 2004); resilience is an emergent property, which is neither observable in or deducible from any single aspect of a society or ecosystem, and which is a consequence of feedbacks and interactions within the system and across its different scales; resilience may develop unconsciously and is maximised in ecosystems and social systems (Cropp and Gabric, 2002; Kirmayer et al., 2009). Resilience is a continuous process, an active response to constant threats (Holling, 1973; Adger, 2000; Berkes et al., 2008; Keck and Sakdapolrak, 2013; Lorenz, 2013). Furthermore, as individuals, groups, or systems move through time, threats and stressors change as do specific historic situations, therefore resilience strategies change and flexibly adapt to the particular situation or emerge newly; in fact, inflexibility in hazard response strategies may be utterly counterproductive (Janssen et al., 2003, p. 727; Lorenz, 2013, p. 12).

2.1.1. Social resilience

In the social sciences, the wider resilience concept has been criticized for its neglect of the individual, of agency (Olsson et al., 2015, p. 9). However, when environmental resilience is decoupled from social resilience, the latter concept becomes more applicable as research on social resilience focuses on inherently in-group forms or strategies of coping with either external or internal stressors (Keck and Sakdapolrak, 2013).

Social resilience strategies develop as responses to specific

historic situations: Under certain historic circumstances a high level of social diversity may be an appropriate and successful strategy. This would entail a high number of social sub-groups, such as lineages, political fractions, religious sub-groups, or very generally social identities. Other historic circumstances may require more rigid forms of organization and group cooperation (Turchin, 2003, pp. 29–38; Hegmon et al., 2008; Carballo, 2013). This then would be a reverse of previous diversity strategies.

Social diversity encompasses what Turchin (2003, pp. 36–38) calls “collective solidarity”. Collective solidarity is for instance related to Ibn-Ḥaldūn's concept of ‘aṣābiya, best translated as “the sense of social solidarity” (Ritter, 1948, p. 3) (see also below), Durkheim's (1893) “mechanical solidarity” (Fr. *solidarité mécanique*), Weber's (1980) “social acting” (Germ. *soziales Handeln*), or Olson's (2003) “collective action”. According to Turchin and Nefedov's (2009, p. 33) predictions for their DST low diversity should correspond to low collective solidarity and high diversity to high collective solidarity. Albeit problematic, as even in present-day data-sets it is difficult to be discerned in material or textual records, “collective solidarity” may nevertheless be an enormous forcing agent in historical trajectories. The question raised then is, how do these resilience strategies of differing social diversity become visible in the archaeological record?

Social diversity strategies may become expressed in festivities and their archaeological remains (Dietler and Hayden, 2001), or may become visible in the active sharing of styles and style diversification (Sackett, 1977; Conkey and Hastorf, 1990). Particularly styles have been studied extensively both ethnographically and ethnoarchaeologically for their manifold social and political signalling content: Styles may be an essential expression of social identities like ethnicity (Barth, 1969). These are self-ascribed and believed by the respective individuals and their groups, are social constructs to set this group apart from others (Barth, 1969; Lentz, 1995; Kent, 2002). This self-identification operates on various levels, from individuals, to families, to lineages, and to broader socio-political entities like tribes or states (Blanton, 2015).

Intensified cooperation, whether forced or voluntary, may equally leave archaeological traces such as increased erection of communal buildings, discussed e. g. for enclosures of the Upper or Young Neolithic (Edmonds, 1993; Andersen, 1997; Whittle et al., 2011), or warfare (Ember and Ember, 1994; Cacioppo et al., 2011). Warfare – understood here in a very general sense as organized group violence – may not only be indicative of periods of unrest, but may also be a factor leading to stabilization (Bowles, 2009). In times of expansion warfare may become a social and political ideal and successful warriors are seen as heroes whose idealisation serves to build resilience (Divale and Harris, 1976). However, as all too well known, warfare and a warring ideology may have an initially beneficial effect on societies in enhancing group cooperation and solidarity, yet its long-term consequences may lead to widespread material and social destabilization amongst all participating parties, sometimes to prolonged periods of complete social and political destabilization (Ember and Ember, 1992, 2007).

The above, albeit very brief, introduction into resilience and the component of social solidarity shows that these are essentially very volatile concepts. Nevertheless, are there possible archaeological markers, as will be discussed below. Strategies change, depending on the feedback with other parameters operating on trajectories. But are those changes unstructured, or do they follow patterns? This question is related to the concept of cycles.

2.2. Cycles

Cycling of socio-political and economic systems is a concept already documented for ancient Greek historiography (Ryffel, 1949;

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