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Press release

Mainz | 08 October 2026

What Pottery Reveals About Societal Transformations

Mainz. Societal changes do not follow a linear path – this holds true also for Neolithic Europe, approximately 8,000 to 4,000 years ago. Two researchers from the National Academy of Sciences of Ukraine (NASU) and the Leibniz-Zentrum für Archäologie (LEIZA) in Germany have looked at factors driving these dynamics. Using a mathematical model they analysed the interplay between population size, production capacity, and information exchange. The findings demonstrate that pottery style time-series can yield valuable insights into social dynamics. This study has been published in the journal PLoS One.

Recurring phases of increasing and decreasing complexity are known as social cycles. But what triggers these cycles? And how can they be identified through archaeological evidence? These questions stand at the core of a study conducted by Dr Aleksandr Diachenko, senior researcher at the Institute of Archaeology of the Ukrainian NAS, and Prof. Dr Detlef Gronenborn, Deputy Head of the Prehistory Department at LEIZA and Adjunct Professor at Johannes Gutenberg University Mainz, Germany. Their study, titled "Social dynamics signals in archaeological time-series: How cultural transmission and production biases shape assemblage diversity", delves into these questions.

Pottery reflects Societal Change

For their investigation, the researchers focused on pottery – a material usually preserved in large quantities and over extended time periods. Variations in shape and decoration within these datasets can provide clues about changes within the societies that produced them. The researchers tested their algorithm on thousands of pottery shards from Germany and Ukraine. "We developed a mathematical model to describe how the organisation and intensity of pottery

production can influence the quantity of decoration styles. Additionally, the model reveals how pottery styles evolve through human information exchange and population growth," explains Diachenko.

Two Regions, complex Developments

Two empirical archaeological case studies illustrate these dynamics: one examines pottery from southwestern Germany associated with the Linear Pottery Culture approximately 7,000 years ago, while the other focuses on finds from central Ukraine from the Western Trypillia Culture around 6,000 years ago. In both cases, phases of rapid population growth were followed by decline – a typical pattern observed in early farming societies of Neolithic Europe. However, the underlying social behaviour differed between the two regions. In southwestern Germany, increased societal complexity was initially accompanied by greater diversity in pottery decorations, which later diminished. In central Ukraine, the opposite occurred: as social complexity increased, pottery styles became more uniform due to craft specialisation.

Patterns of Societal Behavior

"We are only beginning to unravel the complexity of past social behavior. Linking pottery and population time-series is proving to be highly insightful. However, before drawing robust conclusions, we need to thoroughly understand the underlying mechanisms. Our study is a step toward that goal," explains Diachenko, whose expertise lies in anthropological archaeology and mathematical modeling of Neolithic societies.

"Early farming societies of the Neolithic exhibit patterns of social behavior that help us understand how populations generally respond to changes in size, labor organisation, and information exchange," summarises Gronenborn. "In the long term, our results will provide valuable information for contemporary societies in a globalised world."

The study and its publication were partially funded by the project "Nested Non-Linear Dynamics of the Prehistoric Past" under the fellowship program "Documenting, Recording and Saving Ukrainian Archaeological Heritage" of the German Archaeological Institute (DAI), Berlin, Germany.

Publication

Aleksandr Diachenko & Detlef Gronenborn (2026), Social dynamics signals in archaeological time-series: How cultural transmission and production biases shape assemblage diversity, PLoS One 21(10): e0358135.
<https://doi.org/10.1371/journal.pone.0358135>

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Leibniz-Zentrum für Archäologie (LEIZA)

As a Leibniz Research Institute and Museum for Archaeology, LEIZA studies humans and their development based on material remains that span three million years across time and space. The fundamental insights we gain improve our understanding of human behaviour, actions and the development of societies. In this way, LEIZA enriches our knowledge of humans from an archaeological perspective and creates essential foundations for reflecting on the present and shaping the future. With archaeology, LEIZA views human beings in context and shares the knowledge gained in international dialogue. LEIZA is active worldwide and has successfully and comprehensively conducted research in various regions of Africa, Asia and Europe. The unique concentration of archaeological, scientific, restoration and information technology expertise, combined with important workshops, laboratories and archives, makes it possible to conduct object-oriented research into the archaeology of the ancient world (Asia, Africa, Europe) from the beginnings of human history to modern times. As one of eight research museums in the Leibniz Association, LEIZA combines excellent science with exhibitions and, with its educational mission, is also a place for dialogue with the public.

Until its renaming on 1 January 2023, LEIZA was known internationally as the Römisch-Germanisches Zentralmuseum (RGZM), which was founded in Mainz in 1852 by resolution of the German Historical and Antiquities Societies. Since 2024, LEIZA is represented at four locations in Germany: Mainz, Neuwied, Mayen, and Schleswig. www.leiza.de

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