

## | Cultural evolution of social complexity in ancient civilisations across the globe |

### 1. Introduction/background

The transition from small-scale human groups to complex, multilevel, and hierarchically structured human societies has long been a scientific puzzle. Major transitions in complexity over evolutionary time are of extraordinary interest to scholars from widely different fields such as archaeology, anthropology, biology, psychology, sociology, and philosophy. Therefore, it is of utmost scientific relevance to better understand what drives the change of social complexity in human societies worldwide and to what extent there are generalisable processes and patterns in the evolution of human societies (1,2). When we investigate the complexity of human civilisations, this where biological evolution and cultural evolution meet, and this exciting endeavour makes a large-scale interdisciplinary collaboration necessary. The data set used for this project is about social complexity in various ancient human societies across the globe, and we are going to explore how social complexity changed over time.



Figure 1 | Image of an ancient civilisation.

### 2. Methods

For this project, I used a data set available from *SESHAT – The Global History Databank*, a large databank collecting archaeological and anthropological data (2,3). This database is meant to advance our understanding of how modern human societies evolved from their ancient predecessors. I created my script containing annotated and commented code for the data exploration and analysis using a notebook in the *Jupyter Lab* interface (version 2.1.5) for *Python*. I focused on a descriptive visualisation of the data without conducting in-depth inferential and quantitative analyses.

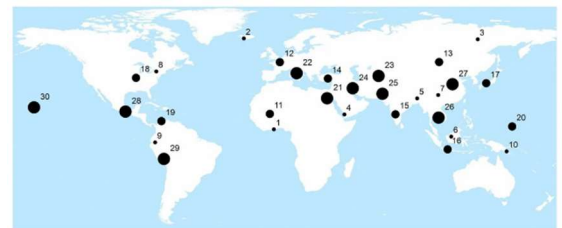


Figure 2 | Global map of the NGAs in the social complexity data set. Figure taken from Turchin et al 2017.

### 3. Results

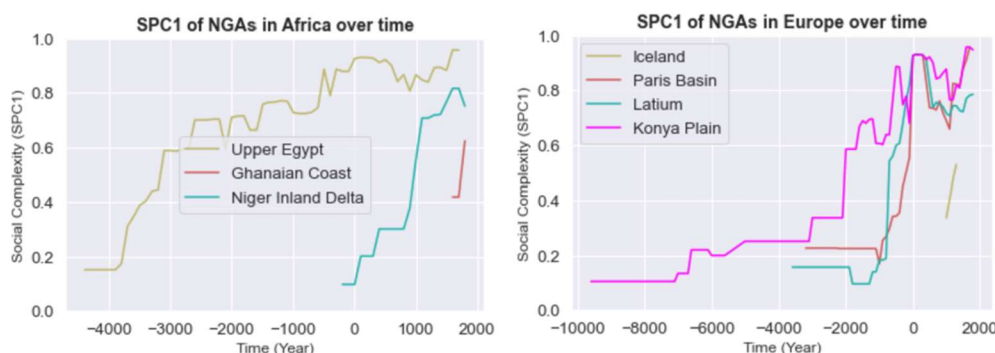
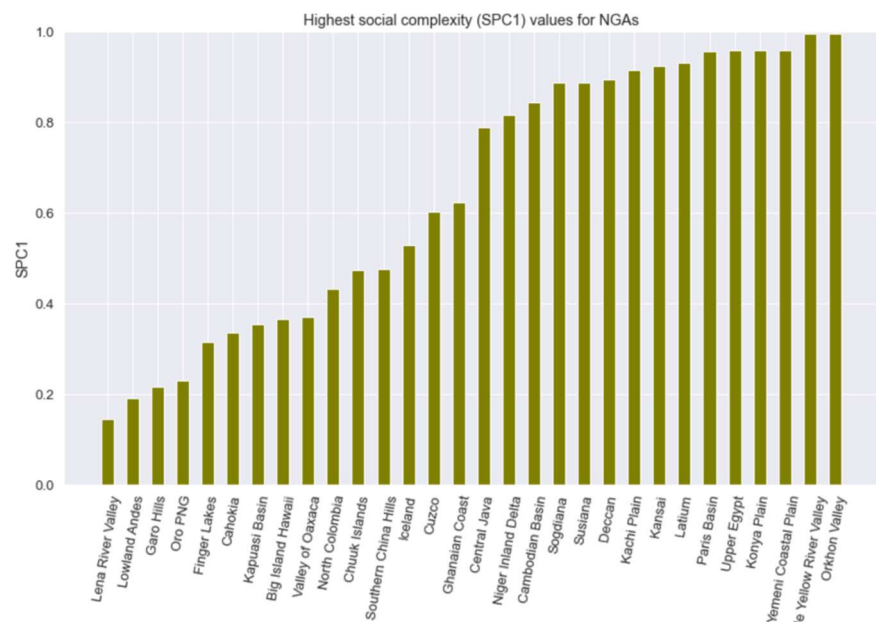


Figure 3 | Change in social complexity (SPC1) over time in three natural geographic areas (NGAs) in Africa and four NGAs of Europe.

Social complexity values changed over time and increased for most NGAs (Natural Geographic Areas) (Figure 2,3). There was no clear difference in terms of how social complexity changed between NGAs from different continents. Older societies seemed to reach higher values of social complexity overall. The highest values for NGAs differed quite remarkably, with nine NGAs characterised by values over 0.9 and nine NGAs staying below 0.4 (Figure 4).



**Figure 4 |** Highest social complexity (SPC1) values for different NGAs across the globe.

#### 4. Summary and conclusion

We have seen that geographic areas across the globe differed quite remarkably in social complexity, and many areas underwent a marked increase in social complexity over time. Some of the variables characterising social complexity were highly positively correlated, and therefore it was sensible to use SPC1 as a proxy for social complexity. This also suggests that several measures of the complexity of human societies might be closely linked and do not evolve independently of each other. More inferential and quantitative research is needed to draw more solid conclusions.

#### 5. References

1. Turchin P, Currie TE, Whitehouse H, François P, Feeney K, Mullins D, et al. Quantitative historical analysis uncovers a single dimension of complexity that structures global variation in human social organization. *Proc Natl Acad Sci U S A*. 2017;115(2):E144–51.
2. Whitehouse H, François P, Turchin P. The role of ritual in the evolution of social complexity: Five predictions and a drum roll. *Cliodynamics*. 2015;6(2):199–210.
3. Turchin P, Brennan R, Currie TE, Feeney KC, François P, Hoyer D, et al. Seshat: The Global History Databank. *Cliodynamics*. 2015;6(1):77–107.

This research employed data from the Seshat Databank ([seshatdatabank.info](http://seshatdatabank.info)) under Creative Commons Attribution Non-Commercial (CC By-NC SA) licensing. Some of the data visualisation was inspired by a published data exploration by Muskan Jain on Kaggle.

Links: (1) Personal *GitHub* - <https://github.com/lucaqu/social-complexity-ancient-civilisation> (2) *SESHAT* - <http://seshatdatabank.info/> (3) Social complexity data set on *Kaggle* - <https://www.kaggle.com/datasets/usharengaraju/social-complexity-dataset-ancient-civilization> (4) Evolution of social complexity: a data analysis - <https://www.kaggle.com/code/muskan2006/evolution-of-social-complexity-a-data-analysis>