

# How Well Does the Circumscription Theory Explain the Formation of Complex Societies? Using Agent-Based Models to Evaluate Archaeological Theories against Existing Archaeological Data

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How and why human societies began to form and sustain increasing levels of social complexity are heavily debated questions in archaeological research. Every region has unique trajectories of societal change but whether there are shared features between regions is a contentious issue. Similar factors relating to an increase social complexity are relatively easy to identify, such as the presence of warfare, organizational and agricultural intensification, charismatic leaders, or circumscribing barriers to population movement. It is much more difficult to objectively assess the influence of each of those factors and their general applicability across different societies and regions. The discussion on Carneiro's [circumscription theory](#) exemplifies this point. Multiple examples can be cited in either support or rejection of the importance of geographical, resource, or social barriers to population movement on the formation of social complexity. To resolve this debate, I developed agent-based models based on the assumptions of Carneiro's circumscription theory. These models allowed me to clarify the explicit and implicit assumptions of the theory and explore the range of conditions under which the theory is supported in abstract landscapes. To test the real-world applicability of the circumscription theory, I parameterized the models based on archaeological and environmental data from specific regions. The results from these experiments allow the precise quantification of the effects of circumscribing conditions on the formation of social complexity, and importantly, precisely highlight the gaps in archaeological research that need to be filled to firmly support or reject the circumscription theory. This research therefore shows the benefits of using agent-based models to move archaeological debates beyond stalemates, even when the data are limited.

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