

# Computer model simulates Neolithic transition from egalitarianism to leadership and despotism

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The Archaeological Site of Çatal Hüyük in the Konya Plain in Turkey. Credit: Szwedzki/Wikipedia

(Phys.org) —A pair of researchers at Lucerne University has created a computer simulation that helps explain how it was that humans evolved from small egalitarian groups to larger societies with control in the hands of the few during the Neolithic. In their paper published in *Proceedings of the Royal Society B*, Simon Powers and Laurent Lehmann describe how they put together their model and what the resulting simulation showed about a time during early human history that is not very well understood.

Scientists know that for hundreds of thousands of years, people lived in small hunter/gatherer communities. Because the groups were small and the projects undertaken were relatively simple, it's believed that such groups were relatively egalitarian—there wasn't a single person or small group bossing everybody else around. But then, something changed, people began living in much larger communities which were run by one person, or small groups of people, resulting in less freedom

of choice for everyone else.

But why would people willingly give up some of their freedom to some despot? Historians have several theories, but to date, no one has been able to prove any of them correct. In this new effort, the researchers try another approach, entering data into a computer model that creates simulations of what might have occurred during the Neolithic. To do so they converted human proclivities such as tolerance for authority or desire for a better life due to living in a more productive society, into data that could be modeled on a computer. Critical to the model was the ability to include offspring inheriting their parent's values—that allowed for running simulations over several generations, allowing for group dynamics to emerge under different circumstances.

In running the simulations, the researchers found that one scenario appeared to demonstrate the most logical explanation for the changes that occurred during the Neolithic—as people learned to control nature, such as by building dams or large water capture systems, a means of central control became necessary to avoid a chaotic work environment. As with any group of people, leaders arose along with associated followers. The leaders were then able to exert influence because both leaders and followers experienced a higher standard of living due to their collaborative efforts. Over time, as projects grew larger, so too did the number of people required to build them and the leaders gained even more power. Eventually, the leaders grew too powerful to ignore and thus was born the despotic types of governance that has since become one of the hallmarks of civilizations ever since.

**More information:** An evolutionary model explaining the Neolithic transition from

egalitarianism to leadership and despotism,  
*Proceedings of the Royal Society B*,  
[rspb.royalsocietypublishing.org ...  
nt/281/1791/20141349](https://royalsocietypublishing.org/doi/10.1098/rspb.2014.1349)

### **Abstract**

The Neolithic was marked by a transition from small and relatively egalitarian groups to much larger groups with increased stratification. But, the dynamics of this remain poorly understood. It is hard to see how despotism can arise without coercion, yet coercion could not easily have occurred in an egalitarian setting. Using a quantitative model of evolution in a patch-structured population, we demonstrate that the interaction between demographic and ecological factors can overcome this conundrum. We model the coevolution of individual preferences for hierarchy alongside the degree of despotism of leaders, and the dispersal preferences of followers. We show that voluntary leadership without coercion can evolve in small groups, when leaders help to solve coordination problems related to resource production. An example is coordinating construction of an irrigation system. Our model predicts that the transition to larger despotic groups will then occur when: (i) surplus resources lead to demographic expansion of groups, removing the viability of an acephalous niche in the same area and so locking individuals into hierarchy; (ii) high dispersal costs limit followers' ability to escape a despot. Empirical evidence suggests that these conditions were probably met, for the first time, during the subsistence intensification of the Neolithic.

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