Visualising Social Complexity: Scaling, Size and Space-Time Dynamics

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Abstract

The signature of scaling in human systems is the well-known power law whose key characteristic is that the size distributions of their objects display self-similarity in space and time. In many systems such as cities, firms, and high buildings used here as examples, power laws represent an approximation to the fat or heavy tails of their rank-size distributions, appearing stable in time with little change in their scaling over tens or even hundreds of years. However, when the detailed dynamics of how their ranks shift in time is examined, there is considerable volatility in such distributions. To explore this micro-volatility, we introduce measures of rank shift over space and time and visualize size distributions using the idea of the ‘‘rank clock.’’ We illustrate this for populations of Italian towns between 1300 and 1861 and then compare this analysis with city-size distributions for the world from 430 B.C.E., the United States from 1790, Great Britain (England, Scotland, Wales) from 1901, and Israel from 1950. When we extend this analysis to the distribution of US firms from 1955 and high buildings in New York City and the world from 1909, we generate a rich portfolio of space-time dynamics that adds to our understanding of how different systems can display stability and regularity at the macro level in the face of considerable volatility at the micro.