Statistical Physics and Social Systems: a critical perspective. The case of urban mobility

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The application of Statistical Physics to social systems is mainly related to looking for macroscopic laws that are derived from experimental data average in time or space under the assumption that the averaged system is in a stationary state. The final goal is to correlate the statistical laws to the microscopic properties of the system: for example to understand the nature of the microscopic interactions or to point out the existence of interaction networks. However the probability theory suggests the existence of few classes of stationary distributions in the thermodynamics limit, so that the question is if a statistical physics approach could be able to point out the complex nature of the social systems. We have analyzed a GPS data base for individual mobility (2% of individual vehicles are monitored in Italy for insurance reasons) to look for statistical laws on path length distributions, elapsed time in the different activities related to mobility, flux distribution in the road network and frequency rank distribution for the individual destinations. We show as simple generic assumptions on the microscopic behavior could explain the existence of stationary macroscopic laws. Our conclusion is that the understanding of the system complexity requires dynamical data base for the microscopic behavior on a large scale time-dependent environment that allows to study the evolution of the transient states. Theoretical results on long range interacting systems suggest that the transient states may provide much more information of the microscopic interaction nature. Concerning human mobility the GPS data base will be improved in the next future by enhancing the recording time sampling and by increasing the sample size.