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Department of Medicine
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Channing Network Science Seminar

Mar 06, 2015, 11am @ 5th floor conference room

Speaker: Juan Fernandez Gracia, Ph.D
Harvard School of Public Health

Title: **The power of a toy model: The Voter Model and presidential elections**

Abstract: Interaction networks shape the way diseases, ideas, opinions and behaviors spread or compete in our society. The last decades have witnessed a growing body of theories about all those phenomena. Some have been more successful in contrasting models to data like disease spreading, but opinion competition and diffusion has remained more elusive. Election data are a perfect opportunity to test opinion models. The data is aggregated at certain spatial scales that depend on the country we are looking at. This mesoscopic measurements of the opinion of the electorate should serve us to know more about the topology and mechanisms of the interactions at the micro level (between individuals). In this stimulating effort we identify three tasks, characterizing election data, choosing an interaction mechanism and an appropriate network of interaction. First we find statistical regularities of election data that a basic opinion model should capture. Here we focus on two regularities that have been found in several different electoral systems with heterogeneous characteristics (two-party systems, multiparty systems, countries with different spatial and population sizes), namely the approximate stationarity of the dispersion of the distribution of turnout across the different aggregation districts and the logarithmic decay of spatial turnout correlations. Here we show that this is not true only for turnout, but also for the vote shares of the different parties involved in the election. We propose a microscopic model that captures these features. For the interaction mechanism we use a voter model like interaction, i.e., random imitation as the basic manifestation of social influence, with the introduction of a noise that allows for imperfect imitation. Last we have to choose an appropriate network of interaction that captures the nation wide mixing patterns of individuals. For doing so we use the commuting patterns (working in one city or county and living in another one, thus having to move recurrently between both places), as a proxy for the social context of the agents. This data can be easily accessed for a variety of countries and, when incorporated into the model we are taking into account spatial and sociodemographic heterogeneities naturally. Given this commuting network, agents interact a proportion α of their time in their home location with other agents who also live there and otherwise they interact at their working location with other agents who work there. Last we show that this basic model, being fed with real commuting data of the USA captures the statistical regularities from US presidential elections.

Bio: Juan Fernández Gracia studied Physics at the University of Barcelona and got his degree in 2009. At that moment, he was interested in the application of physics tools and concepts to non-traditional physics topics, in particular the application to human activities which provide a bridge between micro- and macro-behavior. Juan moved to Mallorca (Spain), a beautiful island in the western Mediterranean sea, where he received a grant from the government of the Balearic Islands to do a PhD in physics at a center called IFISC, the Institute for Cross-Disciplinary Physics and Complex Systems. Simultaneously he started a PhD program in physics at the University of the Balearic Islands. He got his PhD in physics in february 2014 for a thesis titled 'From mechanisms to data-inspired modeling of collective social phenomena', which he did under the supervision of Prof. Maxi San Miguel and Dr. Víctor M. Eguíluz. After a half year postdoc on animal movement under the perspective of complex systems, under the supervision of Prof. Carlos Duarte, he moved to Boston to join Harvard's School of Public Health as a postdoc under the supervision of Drs. Caroline Buckee and JP Onnela. The topics he tries to cover in his research are the fundamental aspects of human (and animal) behavior and the global patterns that appear due to the behavior of the units in the system, i.e., the individuals. Therefore interests in opinion dynamics, epidemiology, mathematical ecology, network theory, connection of models to data, dynamical models, stochastic modeling, among others.

Hosted by Yang-Yu Liu