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Comment

We need more empirical investigations and model validation for a better understanding of crime
Comment on "Statistical physics of crime: A review" by M.R. D'Orsogna and M. Perc

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Since the seminal works of Wilson and Kelling [1] in 1982, the "broken windows theory" seems to have been widely accepted among the criminologists and, in fact, empirical findings actually point out that criminals tend to return to previously visited locations. Crime has always been part of the urban society's agenda and has also attracted the attention of scholars from social sciences ever since. Furthermore, over the past six decades the world has experienced a quick and notorious urbanization process: by the eighties the urban population was about 40% of total population, and today more than half (54%) of the world population is urban [2]. The urbanization has brought us many benefits such as better working opportunities and health care, but has also created several problems such as pollution and a considerable rise in the criminal activities. In this context of urban problems, crime deserves a special attention because there is a huge necessity of empirical and mathematical (modeling) investigations which, apart from the natural academic interest, may find direct implications for the organization of our society by improving political decisions and resource allocation.

Despite being a naturally interdisciplinary topic, the idea of a physicist studying crime may still cause some surprise (despite the fact that physicists have investigated, more than ever, several systems very far from the traditional domain of physics), but the review by D'Orsogna and Perc [3] shows us that several collective patterns related to crimes are analogous to those exhibited by classical physical systems such as the reaction–diffusion equations, which model the evolution of chemicals under chemical reactions and diffusion, but also describe the evolution of crime hotspots. D'Orsogna and Perc bring us a concise and general view of the recent applications of mathematical methods for modeling crime related problems. The review covers the modeling of crime hotspots by generalized reaction–diffusion equations and by self-exciting point process; presents an overview of the evolutionary game theory for addressing crime as a social dilemma; illustrates the use of network tools for understanding criminal organizations; and, by combining these tools with random walks methods, demonstrates how it is possible to infer the network topology of

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street gangs. Finally, within a more sociological view, the authors discuss the role of punishment for rehabilitation and to prevent recidivism.

What I found special in this review is that the authors do not only stay in the "physicists' comfort zone", that is, too focused on models and proprieties that resemble those of phase transitions, which are beautiful for theoretical physicists but much less interesting for creating methods and tools to help us prevent and understand crimes from a more social perspective. D'Orsogna and Perc drive us towards an empirical and applied approach by reviewing and discussing several sociological concepts of crime in connection with statistical models. They also present specific examples of real-world applications such as the case of the Los Angeles Police Department. This police department employed earthquake-like models aiming to prevent crime by sending police patrols to geographical areas where models indicated that crimes were more likely to occur. Another striking example is the inference of the network topology of street gangs via agent-based simulations, in which it is quite impressive to see how this simple model agrees with the empirical data.

I totally agree with the authors when they mention that methods from statistical physics can provide direct sociological implications for crime-related problems. But, in order to reach these implications, physicists need to move further away from the "comfort zone" I previously mentioned. Contrary to what occurs, for example, in materials science, there is no "social engineer" who will be responsible for implementing models and tools that we need for a better control over the criminal activities. It seems that, although this task requires skills from both science and computing (a rare combination, even today [4]), statistical physicists may represent the ideal professional to take on this challenge.

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