Understanding and engineering the firearm ecosystem in the United States

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Abstract: The United States leads high-income countries in both firearm homicide and suicide rates, with close to fifty thousand firearm-related deaths per year – a figure higher than motor vehicle-related deaths. A fundamental step toward reducing firearm-related harms is to understand causal relationships among potentially contributing factors, such as firearm prevalence, state legislation, media exposure, and people's opinion on firearm safety. These factors, linked to one another in a complex and multifaceted way, form the "firearm ecosystem." This talk presents new insight into the firearm ecosystem on three different scales. On the macroscale (nation and states), we put forward an information-theoretic framework to unravel causal links between mass shootings, media coverage on firearm control, and firearm prevalence. Our analysis points at a previously overlooked link between media and firearm prevalence, suggesting that people might rush to buy guns after a mass shooting as they fear that new regulations may come into effect and their right to acquire a weapon be challenged. On the mesoscale (cities), we apply scaling theory to study firearm prevalence, accessibility, and violence throughout the country. We demonstrate a superlinear scaling of violence and a surprising sublinear scaling of both prevalence and accessibility, suggesting that guns are seen as a class of infrastructure for the country (like roads or bridges). On the microscale (people), we detail the modus operandi of fame-seeking mass shooters using the information-theoretic concept of surprisal. Our analysis demonstrates that these individuals carefully plan their attacks to be different from past shooters and that the tendency to deviate from history is, in fact, rewarded by fame.

Maurizio Porfiri is an Institute Professor at New York University Tandon School of Engineering (Departments of Mechanical and Aerospace Engineering, Biomedical Engineering, and Civil and Urban Engineering) and the Director of the Center for Urban Science and Progress. He received M.Sc. and Ph.D. degrees in Engineering Mechanics from Virginia Tech; a "Laurea" in Electrical Engineering and a Ph.D. in Theoretical and Applied Mechanics from Sapienza University of Rome and the University of Toulon. He is engaged in conducting and supervising research on complex systems, with applications from mechanics to behavior, public health, and robotics. He is an IEEE Fellow and the author of more than 400 journal publications, including papers in Nature, Nature Human Behaviour, PNAS. He was awarded with numerous awards, including the Aspen Institute Italian Award for Scientific Research