Rush hour metro crowd governed by people's eagerness to go home

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Ever found yourself crushed in a metro station at rush hour? The mathematician Carlo Bianca and physicist Caterina Mogno, both from the engineering research lab ECAM-EPMI in Cergy-Pontoise, France,

have developed a new model to study the movement of crowds exiting a metro station. In a recent study published in *EPJ Plus*, they have for the first time employed models typically used to study gases consisting of a large number of molecules that collide at random (known as thermostatted kinetic theory) to study the consequences of the different interactions occurring among pedestrians in a crowd while exiting a metro station.

The authors assume that what motivates pedestrians to leave a metro station can be modelled as an external force that explains the conditions under which they leave due to the crowd pressure. Their model combines aspects representing the interactions between pedestrians and governed by thermostatted kinetic theory with the cooperation between pedestrians as intelligent and self-organised decision-makers, which is governed by game theory.

The model thus depicts what happens to a crowd of pedestrians trying to leave a metro station consisting of different exits at rush hour. Bianca and Mogno seek an approximate solution to the problem by starting from the exact solution of a simpler, related problem. The results show how, as pedestrians try to make their way out of the station, the interaction dynamics among them can in fact be negligible, as they do not influence the flow of pedestrians toward the exit as much as their motivation to leave (the external force) does.

Numerical simulations on the magnitude of the external force explain how internal interactions between pedestrians can be affected by an external force driving them to leave the station. What matters most is that all of the pedestrians are individually in the same hurry to exit the station and get away from the crowd. The latter aspect is gauged by a thermostat modelling the temperature of the molecules in a gas, which represents the individuals in the crowd, who are under a steady level of crowd pressure pushing them toward the exit.

More information: Carlo Bianca et al, A thermostatted kinetic theory model for event-driven pedestrian dynamics, *The European Physical Journal Plus* (2018). DOI: 10.1140/epjp/i2018-12055-5

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