

# A MULTIAGENT URBAN TRAFFIC SIMULATION

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**Abstract.** We built a multiagent simulation of urban traffic to model both ordinary traffic and emergency or crisis mode traffic. This simulation first builds a modeled road network based on detailed geographical information. On this network, the simulation creates two populations of agents: the Transporters and the Mobiles. Transporters embody the roads themselves; they are utilitarian and meant to handle the low level realism of the simulation. Mobile agents embody the vehicles that circulate on the network. They have one or several destinations they try to reach using initially their beliefs of the structure of the network (length of the edges, speed limits, number of lanes etc.). Nonetheless, when confronted to a dynamic, emergent prone environment (other vehicles, unexpectedly closed ways or lanes, traffic jams etc.), the rather reactive agent will activate more cognitive modules to adapt its beliefs, desires and intentions. It may change its destination(s), change the tactics used to reach the destination (favoring less used roads, following other agents, using general headings), etc. We describe our current validation of our model and the next planned improvements, both in validation and in functionalities.

**Keywords.** Multiagent, urban traffic model, simulation, crisis management, risk management, emergence, complex systems.

## 1 Introduction

One of the major interrogations in a catastrophe is: will people react correctly to preserve their own security, and doing so, preserve the security of all? This question is most of the time linked with the idea of *risk culture* and *risk training*, which are supposed to produce safe reactions at the right time. Is risk education therefore a key factor to preserve life? Thinking so, we assume that the description of behaviors in risk situations should be engaged in term of personal dispositions, which are mostly related to education. In society, norms such as the highway code, or safety instructions in risk situations, are supposed to govern citizen's behaviors. Do circumstances or local contexts produce different behaviors than those acquired, and then alter global vulnerability? The re-

lation between inherited-based behaviors, which can be viewed here as a "follow the rule" behavior, and the circumstances-based behavior, is an interesting perspective to study the question of the vulnerability of populations.

Space is an important factor of risks situations, not only as a support of activities and populations, but also as an actor in itself of the situation. Risk is space related. One defines risk as a probability of space-time interactions between a source (ex: an industrial plant) and a target (ex: an inhabitant building) [1, 2]. Space can produce many different contexts throughout its organization. The main difficulty to characterize and manage the risk is then the huge amount of interactions that links entities. Risk has spatial impacts : consider the real estate value near or far from a chemical factory. Risk management transforms the environment, it can be perceived (e.g. type of allowed constructions, fences etc.). Risk sometimes outlast their management : contaminated soil can remain contaminated decades after the factory generating the contamination has disappeared, along with its most active risk management. This is all the more important in urban area which concentrate a high number of activities, and then reveals some tensions between them. The sharing of a same resource, space, implies some regulations tools in term of laws, of infrastructures and of behaviors. Risks are multi-layered and imply different kinds of actors, human and non-human. A catastrophe in an urban context implies a large number of people and groups, each endowed with their own skills, behaviors and resources. Efforts of public services made in order to mitigate the outcome of the catastrophe are different from, sometime even in contradiction with, those followed by individuals to save their life, but they occur at the same time and the same place. And the same person can respond differently to an event, depending of the context. Furthermore, risks are dynamic, feedbacks and nonlinearities are important. One can observe a domino effect as an explosion in one site produces secondary accidents in the neighborhood, due to the high concentration of activities.

The MOSAIIC project [3, 2] aims to observe and understand local and global effects of individual behaviors in the dynamic of a transportation network system after an industrial accident. Few researches take into account the behaviors of group or individual when studying the risk at the scale of a city. Physical aspects override the

\*The authors would like to thank the GRR SER and the region Haute-Normandie for the funding of the MOSAIIC program from which this work stems from.

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