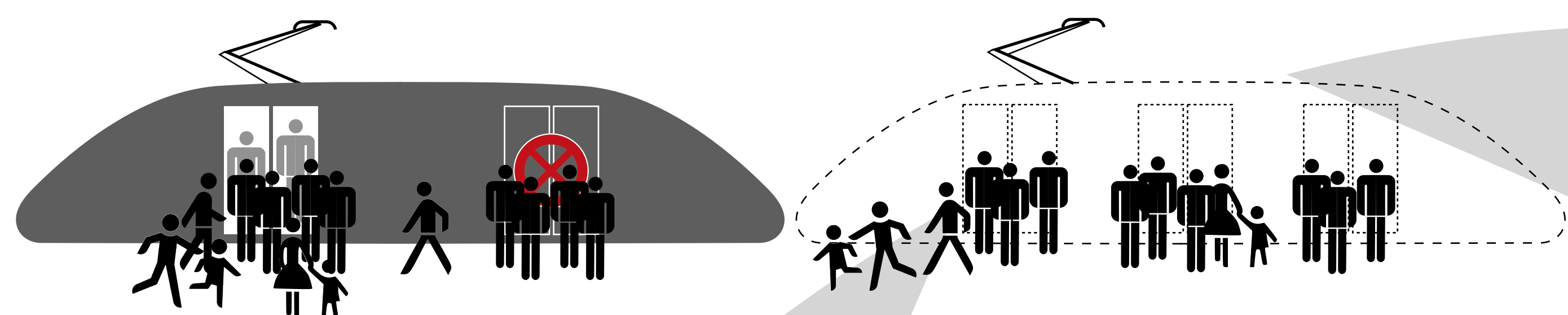


When it comes to assuring functionality of complex systems, **minor causes** may have **major implications** impacting **credibility of simulation results**. At GEONATIVES, we pay considerable attention to details in the domains of geodata processing and simulation. From our observations in **real-world situations**, we would like to postulate that SUMO become more realistic in how it resembles individual agents. We propose extending SUMO with the following **modules**:

### Special Purpose InterChange Experience

The **organization of (de-)boarding processes** at bus, tram, and railroad stops is highly influenced by the vehicle configuration, i.e., different coach classes, missing sections, changed location, and functional state of access means. We propose the modeling of defective doors, class-specific numbers of doors (e.g., ICE 3 vs ICE 3neo), assistance by staff for stuffing (see metro Tokyo), blocking passengers and the like.



#### Input

Coach / train set configuration, door locations, stopping position, accessibility and malfunction information

#### Output

Time for (de-)boarding, passenger numbers, casualties and collateral damage, levels of frustration and rage

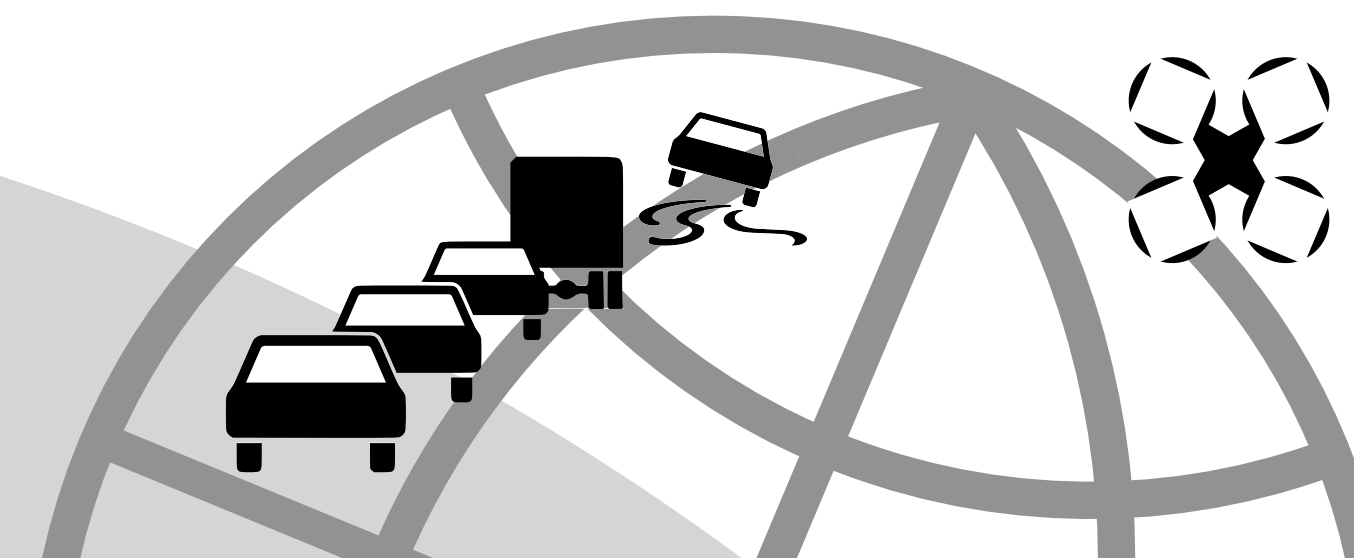
#### Benefits

More accurate simulation of changeovers and — for the example of stuffing assistance by human personnel — a hands-on feeling.

### Martian Orientation and Regulation Directives

New planets, new rules! Using simulation is key to making sure that traffic jams will not be limited to a single planet only in our solar system. This module shall evolve from early stages addressing the management of rovers to later ones after initial human settlements have been established.

It shall also incorporate the other modules presented here and take into account specifics of alien life forms as they enter the hemisphere of **human imperfection**.



#### Input

Name and topology of the planet, number and type of nations involved, level of decline achieved by human interaction

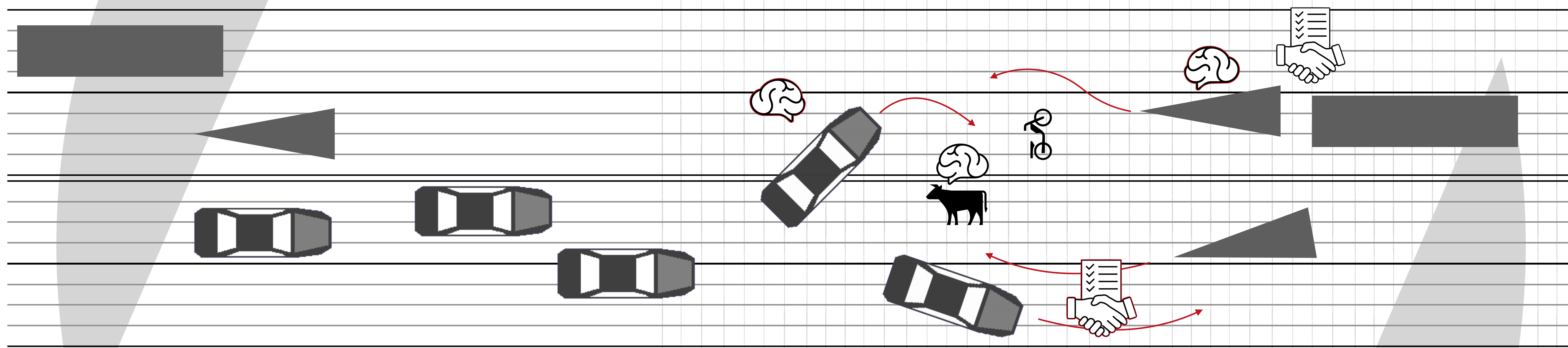
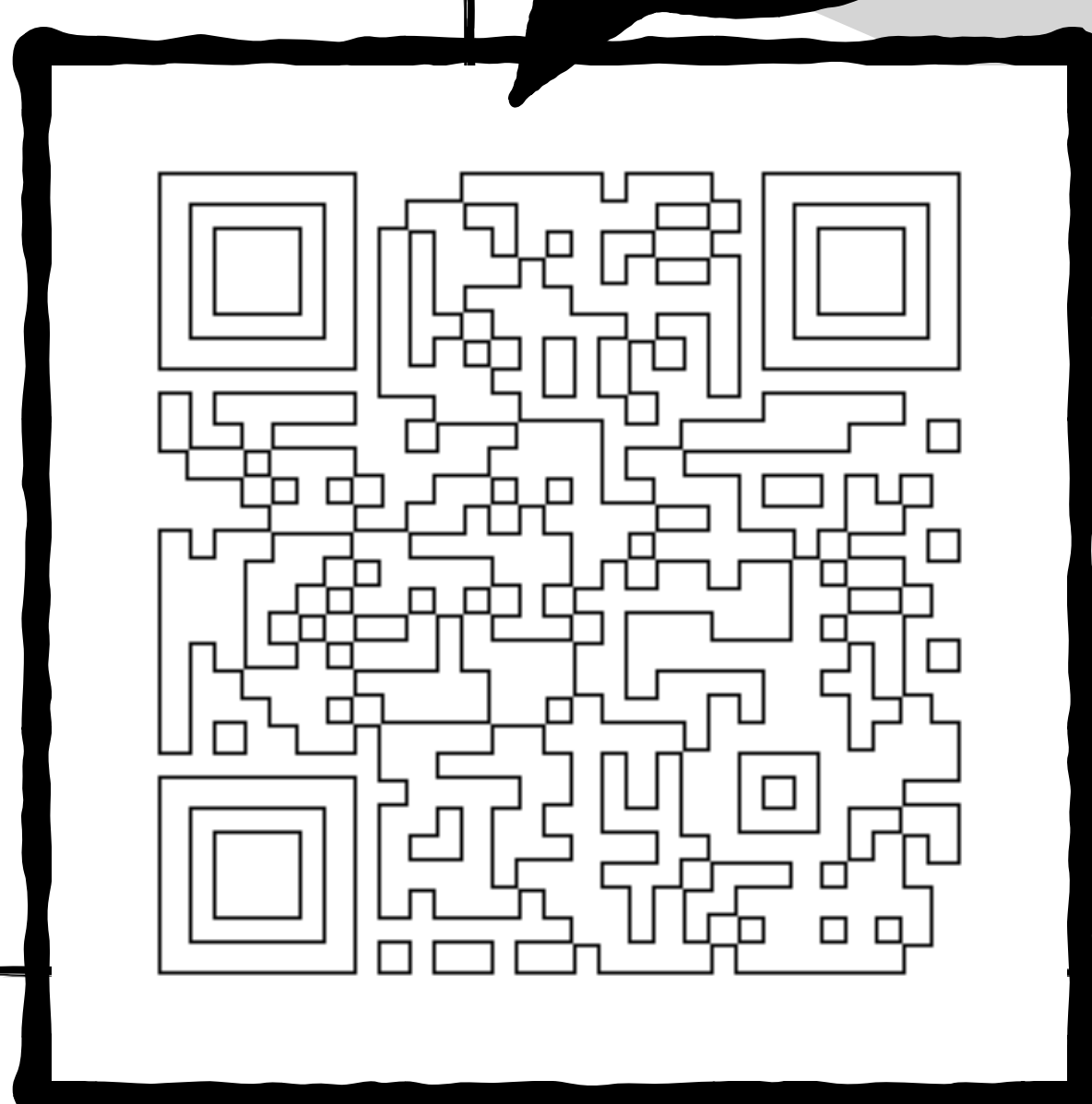
#### Output

Size of the gap until the specified planet adopts earth-like chaos and it is time to look for the next one

#### Benefits

The question whether it is worth investing in interstellar travel might finally be solved.

Pick a pen and color before scanning!



### FREE Action Controller

Lane-independent driver models shall use **free-space-only tactics** to navigate through complex situations and to resemble real-life situations in crowded locations. This feature shall enable scooter-heavy traffic, vehicles moving against the legal driving direction, and the occasional holy cow blocking parts of the road and mandating detours. The sub-lane model shall be extended by vertical sub-sections to be-come a grid enabling the simulation of cross traffic in urban areas.

#### Input

Bounding boxes of participating vehicles, social status, skill level and aggressiveness of drivers

#### Output

Average speed, degree of road usage, location and speed vectors of vehicles

#### Benefits

A realistic simulation of overcoming rules by good practice.

### Embedded MOTivation Or Negligence

An agent controller's **mental state** shall be considered as well as the influence of other agents on its evolution. Traffic jams, waiting for an extended time at an intersection, missing or not being admitted to a train or a bus, trying to get to a meeting while traffic is moving slowly, are just examples of negative influences on driver behavior and resilience level. On the positive side, there shall also be "happy" agents (by means of personality or intoxication), taking it easy.

#### Input

Starting state (how was the day so far?), length of the personal fuse, density of bullshit around the agent, overall resilience

#### Output

Desired TTC (time to collision), volatility in throttle / brake / steering operation; TTR (time to rampage)

#### Benefits

This module might help simulation prove that a relaxed state of mind will get you to your goals faster.

### Traffic Rules Under Moderate Pressure

Potent agents negotiate their way through traffic situations, making **progress on a per-deal basis**. Threatening other participants, blocking lanes, calling on friends for help, and bribing opponents shall lead to a quicker journey for the privileged ones among the players. Immunity from consequences shall be directly linked to the total amount of bribes paid and the resources consumed during a journey.

#### Input

Level of wealth and status, vehicle size, levels of moral and mental decline

#### Output

Progress on planned journey, money spent, number of friends lost and followers gained

#### Benefits

What works in real life should also work in simulation and teach the next generation that moral decline can achieve great goals. SUMO should consider simulating maritime routes.