Running Stop Signs Agent Based Model

modeling the rationality, actors, & system behind drivers running through stop signs

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Concept

Drivers drive from their origin to destination on a network graph of streets & intersections. At intersections, drivers calculate their 'run the stop sign' probability based on their social/selfish state, recent actions, & external actors. If a driver runs a light, they could collide with drivers or pedestrians – potentially ending in fatality.

Agents

Drivers

States

SOCIAL_METER == 'selfish',   'ambiguous',   'social'

RUNNING_STOPSIGN_PROBABILITY   **0% – 100%**

RUNNING_STOPSIGN_THRESHOLD   **0% – 100%**

DRIVERS_PEDS_IN_VIEW == 'yes', 'no', or 'running_stop_sign'

DRIVER_MEMORY == 'on' or 'off'

IN_INTERSECTION == 'yes' or 'no'

DRIVE_IS_HOME == 'yes'

IS_ALIVE == 'yes' or 'no'

Pedestrians

IN_INTERSECTION == 'yes' or 'no'

IS_ALIVE == 'yes' or 'no'

continuous walking in random pattern across intersections

Auto Drivers

IN_INTERSECTION == 'yes' or 'no'

IS_ALIVE == 'yes' or 'no'
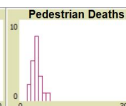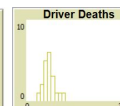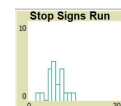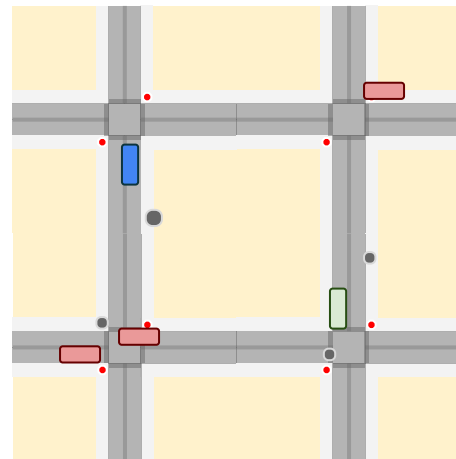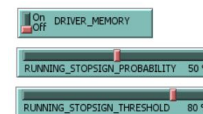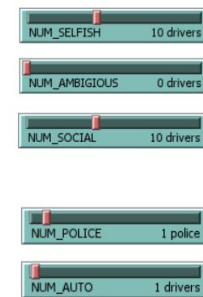
driving like a driver but stops at intersections

Police

IN_INTERSECTION == 'yes' or 'no'

IS_ALIVE == 'yes' or 'no'

clone of auto driver but drivers lower probability near it

Similar Models Taxi Cabs, El Farol Bar Problem, Traffic Intersection

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Instructions

Step 1
START

IF IS_ALIVE == 'yes'
    driver defines optimum route, driver leaves origin, travels down street

Step 2
PRE-INTERSECTION

driver approaches intersection, re-calculates   **RUNNING_STOPSIGN_PROBABLITY**

IF SOCIAL_METER == 'selfish' or 'ambiguous'
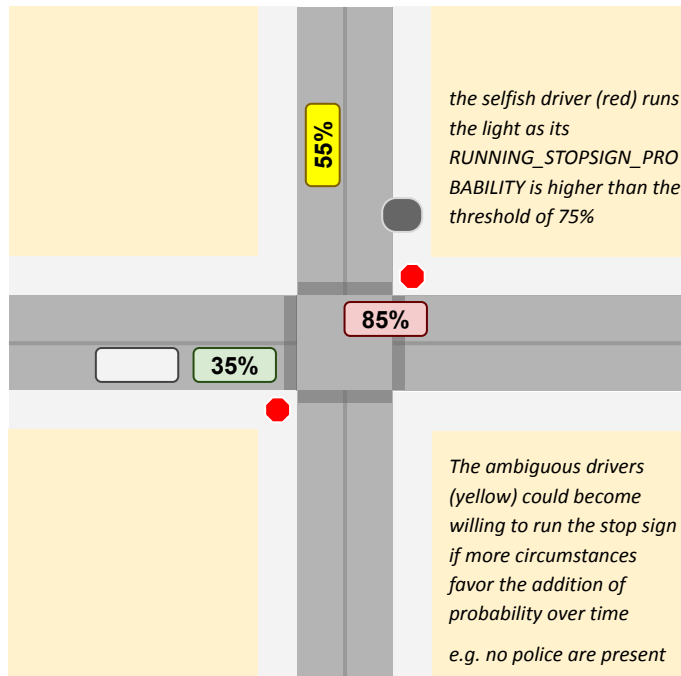   **IF** driver's DRIVERS_PEDS_IN_VIEW == 'no'   **add 5%**
    IF DRIVER_MEMORY == 'on'
        IF N_SUCCESSFUL_RUNNING_STOP > 0   **add 5%**

IF SOCIAL_METER == 'social' or 'ambiguous'
    IF DRIVERS_PEDS_IN_VIEW == 'yes'   **subtract 10%**
    IF DRIVER_MEMORY == 'on'
        IF N_ACCIDENTS_LAST_DAY > 0   **subtract 10%**

IF DRIVERS_PEDS_IN_VIEW == 'running_stop_sign'
    IF SOCIAL_METER == 'selfish' or 'ambiguous'   **add 10%**
    ELSE SOCIAL_METER == 'social'   **add 5%**

IF POLICE_IN_VIEW == 'yes'   **subtract 50%**
    IF DRIVERS_PEDS_IN_VIEW == 'running_stop_sign'   **subtract 100%**

the selfish driver (red) runs the light as its RUNNING_STOPSIGN_PROBABILITY is higher than the threshold of 75%

55%

85%

35%

The ambiguous drivers (yellow) could become willing to run the stop sign if more circumstances favor the addition of probability over time

e.g. no police are present

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Step 3
INTERSECTION

at intersection
IF RUNNING_STOPSIGN_PROBABLITY >= RUNNING_STOPSIGN_THRESHOLD
driver does not stop, IN_INTERSECTION == 'yes'

ELSE *driver stops at light till all driver / pedestrians have IN_INTERSECTION == 'no',*
drives through intersection & IN_INTERSECTION == 'yes'

IF *multiple drivers or pedestrians are have IN_INTERSECTION == 'yes'*
any related driver receives **subtract 100%**
N_ACCIDENTS_LAST_DAY += 1
each driver/pedestrian selects one number between 1 and 10

IF DRIVER_FATALITY_CHANCE <= GLOBAL_FATALITY_CHANCE
IS_ALIVE == 'no'

Step 4
AFTER INTERSECTION

after intersection / IN_INTERSECTION == 'no'
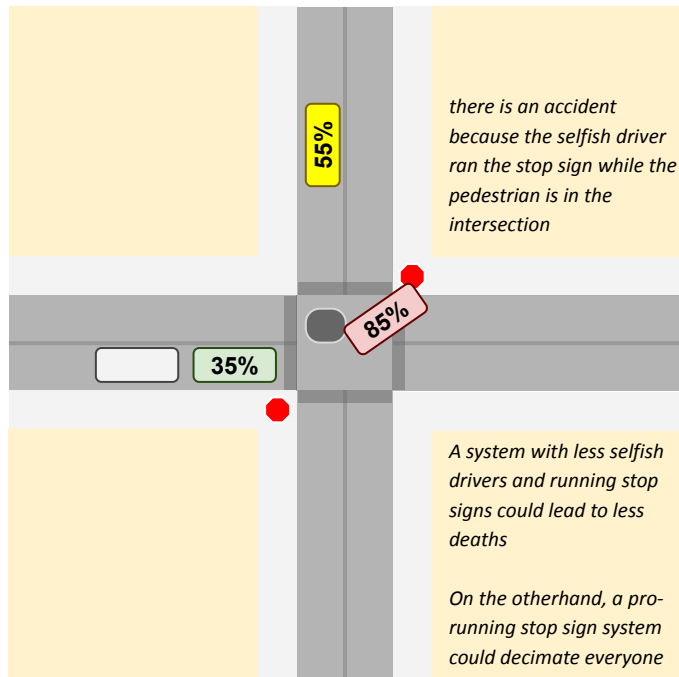**IF** DRIVER_IS_HOME == 'no'
continue on street, restart to step 2

ELSE DRIVER_IS_HOME == 'yes' *(within space of destination)*
IF DRIVER_ARRIVAL_TIME > EST_ARRIVAL_TIME x 10% **add 10%**

Step 5
RESET

IF all drivers have DRIVER_IS_HOME == 'yes'
reset day

55%

85%

35%

there is an accident because the selfish driver ran the stop sign while the pedestrian is in the intersection

A system with less selfish drivers and running stop signs could lead to less deaths

On the otherhand, a pro-running stop sign system could decimate everyone

Academic References: Joglekar (2015); Romano, Voas, & Tippetts (2005); NHTSA (2004)