WHAT IS IT?

This is an urban dynamics agent-based model (ABM) of abstraction of a city and residents' activities there.

In this model, the changes of urban structure emerge through the household agents' autonomous daily travel and residential relocation.

And it allows you to evaluate the effects of urban policies, such as an introduction of an open facility for residents with pedestrian-friendly accommodations, promotion of bicycle use, and control of private automobile use in an urban central area, in controlling urban sprawl.

HOW IT WORKS

The model space is the abstraction of a part of typical cities, which have a central business district and bedroom towns connected by railway.

In the model space, the two primary domains are a residence district and a central business district.

In the residence district, residences of the same number as household agents are located based on normal distribution centering on the suburban station (green patches).

The residences are the starting point and the final destination of each household agent's daily travel.

The number of household agents are 1,000. These correspond to 10,000 households in the real world.

Similarly, in the central business district, job locations of the same number are located based on normal distribution centering on the central station (blue patches).

The job locations are a halfway point of the daily travel.

Two railway stations, the suburban station and the central station, are located at the center of each district, and they are connected by a railway (dark red patches).

Additionally, a highway is located north of the railway (dark green patches), and uniform and high density sidewalks and roads are located on this entire model space.

Each household agent does daily travel according to the selected linked trip and fixes travel modes in one way through the learning period of repeating this daily travel 30 times.

After that, a portion of the household agents relocate their residences based on the total living cost.

The change in land-use pattern is brought about through these residential relocations.

After the loop process of residential relocation is repeated 20 times, the model stops running.

This one process corresponds to simulating 40 years in the real world.

HOW TO USE IT

Select the location of the open facility for stopping off (using the chooser OFS-location, the sliders OFS-xcor and OFS-ycor).

Select the coefficient of attraction (using the slider coeff-attraction).

Select the combined transport policies (using the sliders bicycle-promotion and park&walk).

Press the SETUP button.

Start the simulation by pressing the GO button. You can't change the setting while the simulation is running.

Buttons

SETUP - generates a new model space based on the settings of the location of the open facility for stopping off, the coefficient of attraction, and the combined transport policies. This also clears the plot. And all the monitors display the initial setting values.

GO - runs the simulation

Choosers

OFS-location – sets the location of an "open facility for stopping off (OFS)" in the central area or the suburb of the central business district.

This is assumed to be the complex facilities that residents can visit freely in their daily life.

After household agents arrive at each job location, next they leave for the OFS.

And after arriving and staying the OFS, they leave for each residence.

When you choose "A: no," the OFS is not introduced. So, household agents don't stop off in the OFS.

When you choose "B: suburb-hw," the OFS is located in suburb along highway, 0.5km north and 2km east from the central station.

When you choose "C: suburb," the OFS is located in suburb away from highway, 2km south and 0.5km east from central the station.

When you choose "D: same-sta," the OFS is located in urban central area, same place as the central station.

When you select "E: near-sta," the OFS is located in urban central area, 0.5km south and 0.5km east from the central station.

When you choose "by-slider," you can select the position of the OFS in detail by the sliders OFS-xcor and OFS-ycor.

bicycle-promotion - when you choose "yes," promotion of bicycle use is implemented in combination.

By this promotion of bicycle use, the bicycle-related changes to travel are as follows:

The velocity in traveling by bicycle increased by 120%.

The fatigue cost in traveling by bicycle was reduced by 50%.

Bicycle and railway in combination users can travel by bicycle after getting off.

park&walk – when you choose "yes," control of private automobile use in an urban central area is implemented in combination.

By this control of private automobile use, 10 parking lots are located along the circle within a 1.5-kilometer radius centering on the central station (yellow dots).

And within this radius, private automobile users must travel on foot from the nearest parking lot to their job locations.

Additionally, a highway is placed 1.5-kilometer north of a railway, and private automobile users should relocate to only the residence candidate out of this radius.

people-fig - when you choose "visible," you can observe the movement of the household agents step by step.

However, the calculation load increases and the model processes slowly.

If not a test, "invisible" is recommended.

Sliders

OFS-xcor and OFS-ycor – sets the location of the OFS in detail if you choose "by-slider" of the chooser OFS-location.

Each is the relative distance from the central station in the east-west direction and north-south direction, and the unit is kilometer.

coeff-attraction - sets the coefficient of attraction when the OFS is introduced.

It is assumed that street activeness can be generated when household agents, which travel on foot or by bicycle around the OFS, interact face-to-face - namely when they agglomerate geographically.

And during this time, the total travel cost of relevant household agents is reduced by benefit brought about by the street activeness.

The coefficient of attraction can be regarded as a level of effort to bring further street activeness according to the agglomeration of pedestrians.

An increase in this coefficient enhances the benefit for travel on foot or by bicycle, reducing the total travel cost.

Therefore, this coefficient can be regarded as a coefficient of gain.

Plots

travel-modes - displays the number of household agents who travel by the following, over time:

0-walk - travel on foot throughout

1-bicycle - travel by bicycle throughout

2-rail (w) - travel by railway and on foot in combination

3-rail (b) - travel by railway, by bicycle, and on foot in combination

4-car - travel by private automobile throughout

5-car (hw) - travel by private automobile via highway

Monitor

0-W - displays the number of household agents who travel on foot throughout

1-B - displays the number of household agents who travel by bicycle throughout

2-wRw - displays the number of household agents who travel by railway and on foot in combination

3-bRw - displays the number of household agents who travel by railway, by bicycle, and on foot in combination

4-C - displays the number of household agents who travel by private automobile throughout

5-Ch - displays the number of household agents who travel by private automobile via highway

ratio-walk (%) - displays the percentage of household agents whose representative travel mode is on foot ("0-W")

ratio-bicycle (%) - displays the percentage of household agents whose representative travel mode is by bicycle ("1-B")

ratio-railway (%) - displays the percentage of household agents whose representative travel mode is by railway ("2-wRw" and "3-bRw").

The initial value of this monitor is 100%, according to the original urban planning philosophy.

ratio-car (%) - displays the percentage of household agents whose representative travel mode is by private automobile ("4-C" and "5-Ch")

CO2-emission (%) - displays the total carbon dioxide emission relative to the basic scenario: no OFS, no pedestrian attraction, and no combined transport policy

average-travel-time (min) - displays the average travel time of all household agents, and the unit is minute

cnt-house-xcor (km) and cnt-house-ycor (km) - displays the center of residences' distribution in the east-west direction and north-south direction based on the center of the view, and the unit is kilometer.

The initial values of these monitor are -2 km and 0 km.

sd-house-xcor (km) and sd-house-ycor (km) - displays the standard deviation of residences' distribution in the east-west direction and north-south direction, and the unit is kilometer.

The initial values of these monitor are 0.8 km.

HOW TO CITE

If you mention the NetLogo software in a publication, we ask that you include the citations below.

* Wilensky, U. (1999). NetLogo. http://ccl.northwestern.edu/netlogo/. Center for Connected Learning and Computer-Based Modeling, Northwestern University, Evanston, IL.