Mobility on a street network

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just(e)intime
URBAN CONSULTING

#too-loose
MARIE DE TOO-LOOSE

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Context

- Mr Rainbow died before he could access the hospital, stuck in the trafic jam
- He donated all his fortune to improve the transport in his city (just in time !)
- We were in charge of finding a model to build solutions to avoid those kinds of tragedies

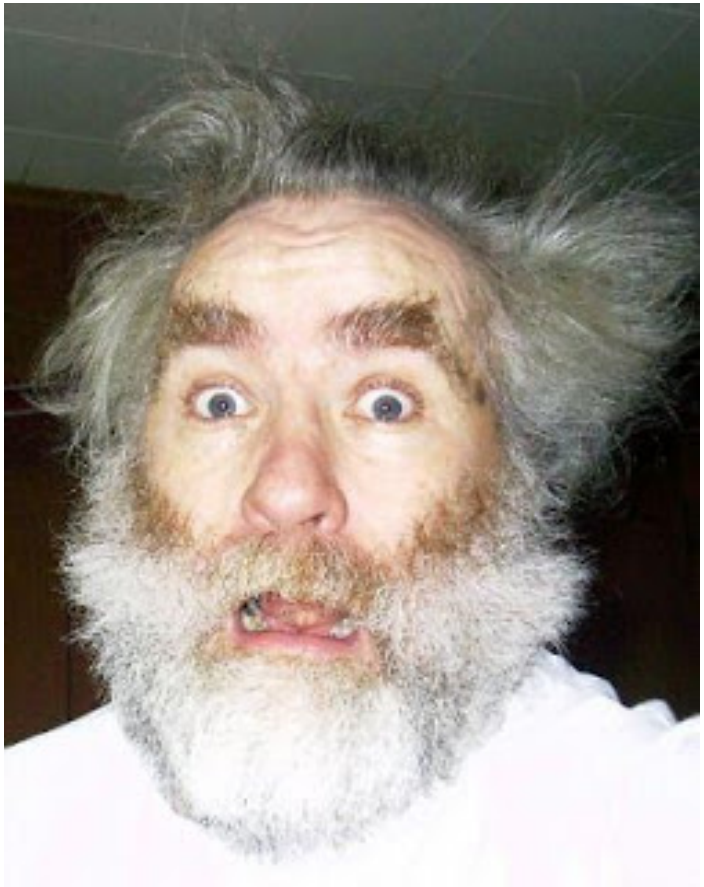

Figure 1.1 : Mr Rainbow right before his heart attack

Research question

How could we build a model to help Mr Rainbow and all the inhabibitants of Too-Loose city to have less congestion?

Objectives

- Build the road network of the city
- Make individuals choose a mode of transport according to their destination
- Make individuals move on the network according to their schedule
- Visualize different solutions for transport network

Figure 1.2 : Decision process

Existing Networks

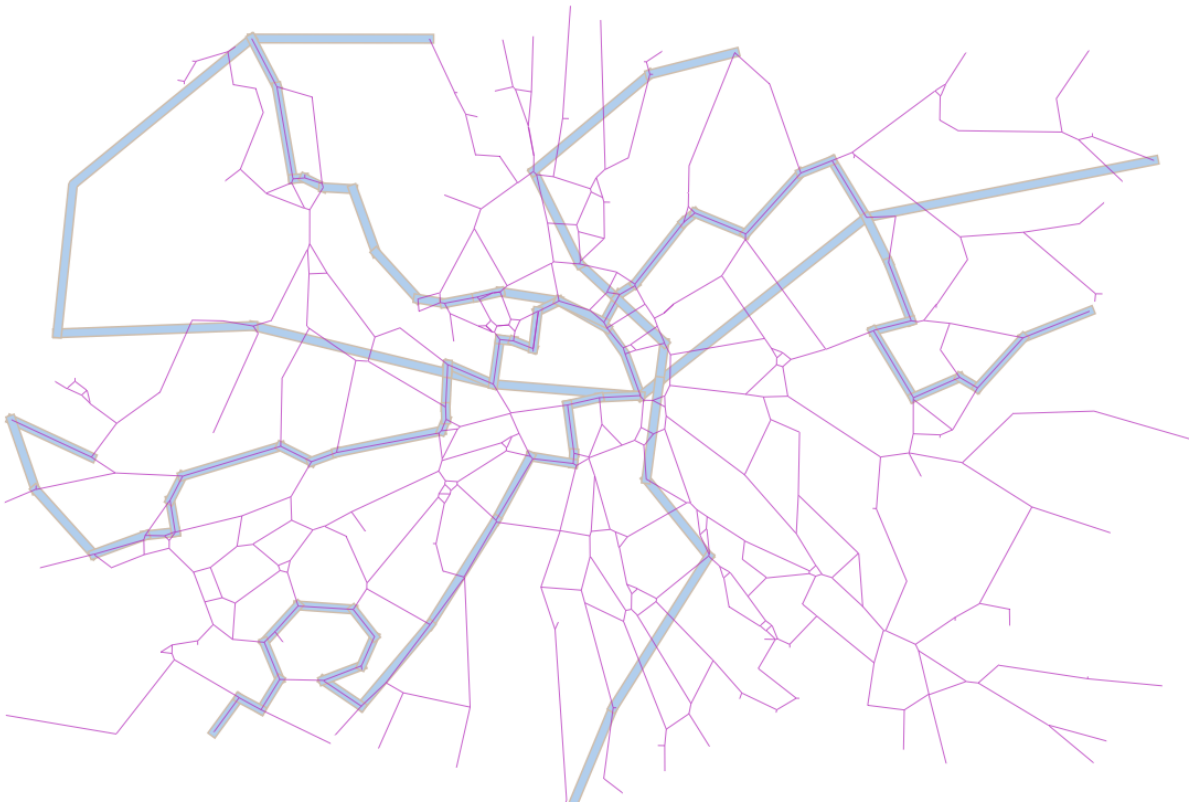

Figure 2.1 : Roads and public transport network

Alternative Networks

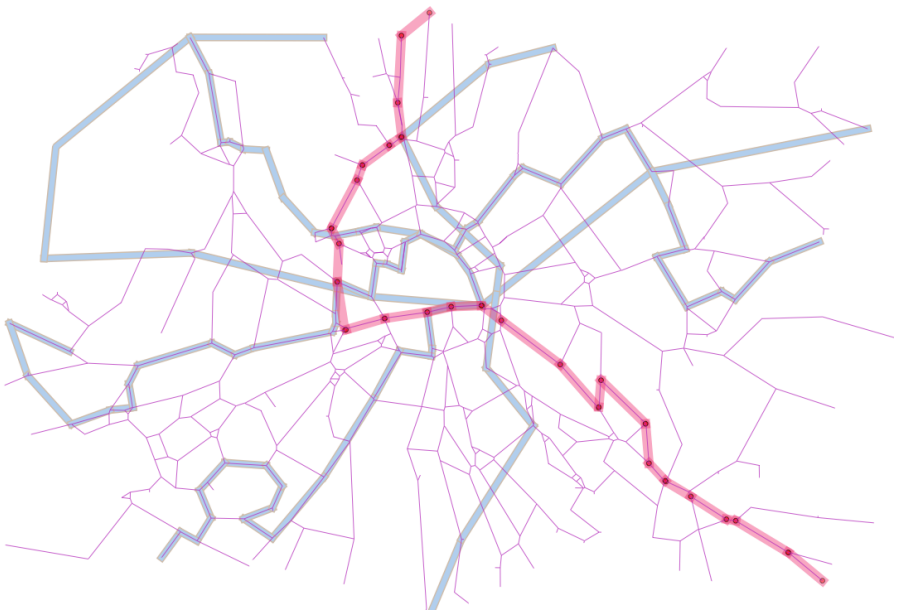

Figure 2.2 : New bus line

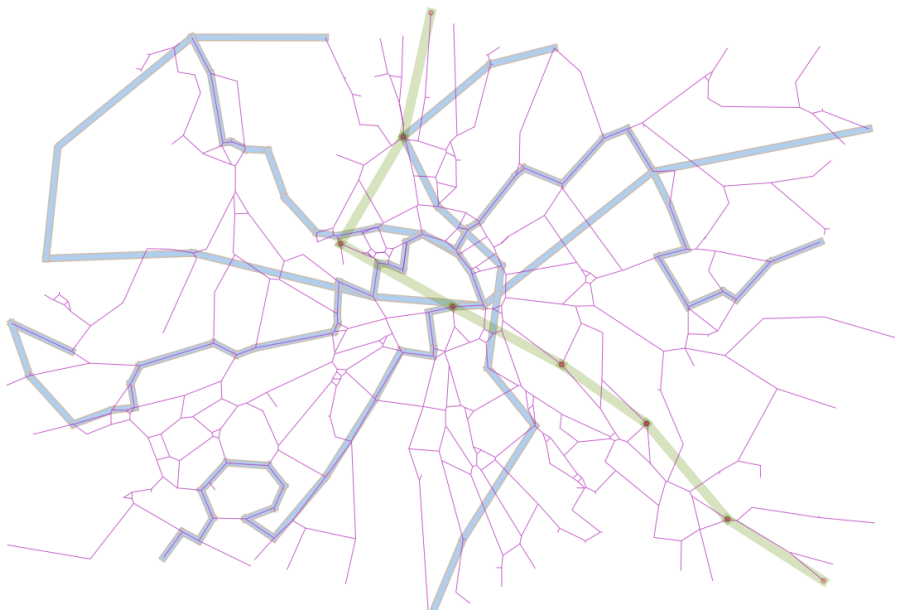

Figure 2.3 : New tramway line

Agents Creation

- 3 kinds of agents
  - students (turtles)
  - workers (sheeps)
  - inactives (fish)
- Some of them own cars
  - 10% of students
  - 70% of workers
  - 20% of inactives

Figure 2.4 : Agents

Agents Creation

- Agents are dispatched on the map according to residential areas
- Cars are distributed by the same means taking into acount where agents live

Figure 2.5 : Cars distribution and density in city (the ligther, the less)

Agents Schedule

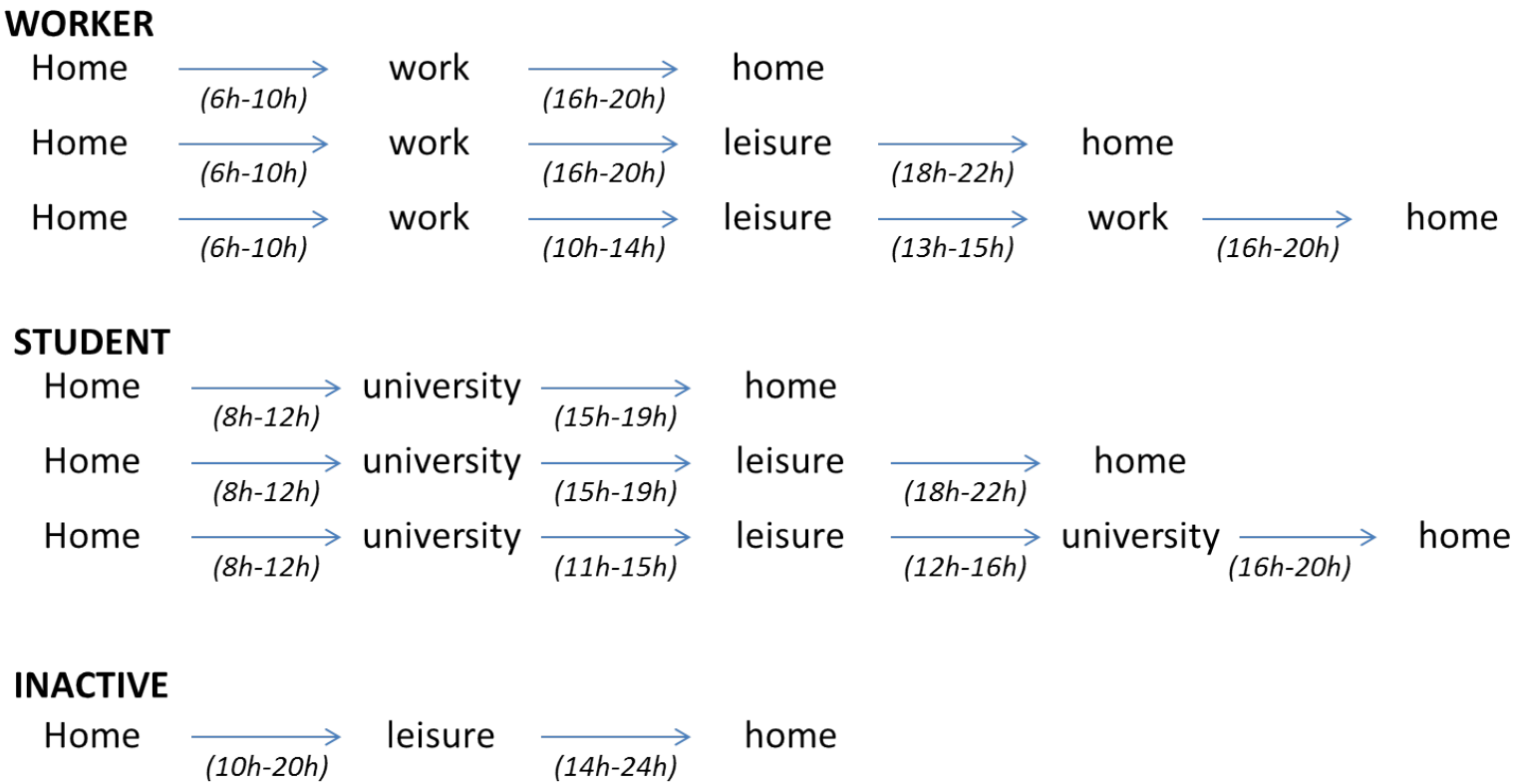

Figure 2.6 : Schedules according to the agents activity

Agents Decision Process

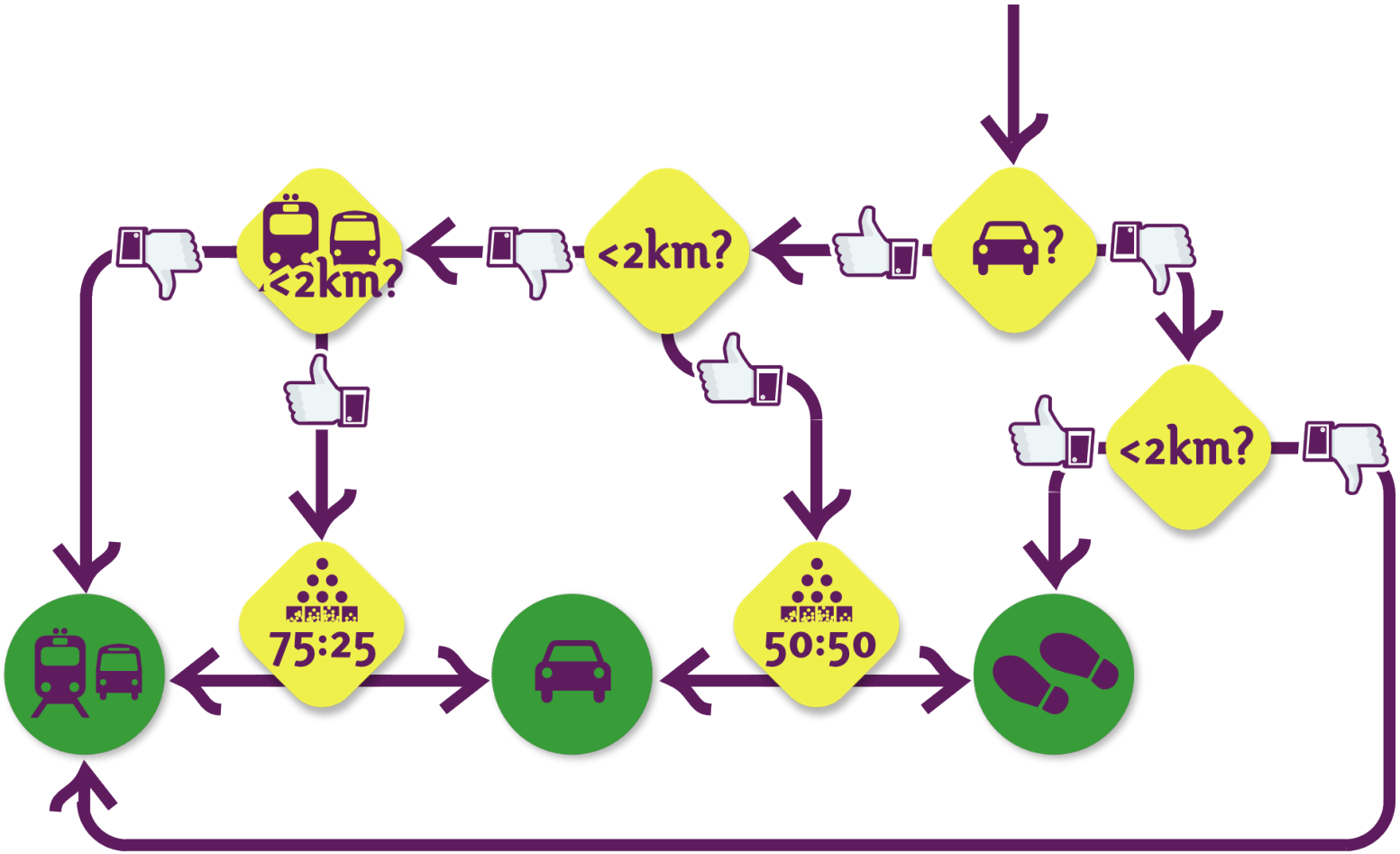

Figure 2.7 : Agents decision tree

Agents Deplacement

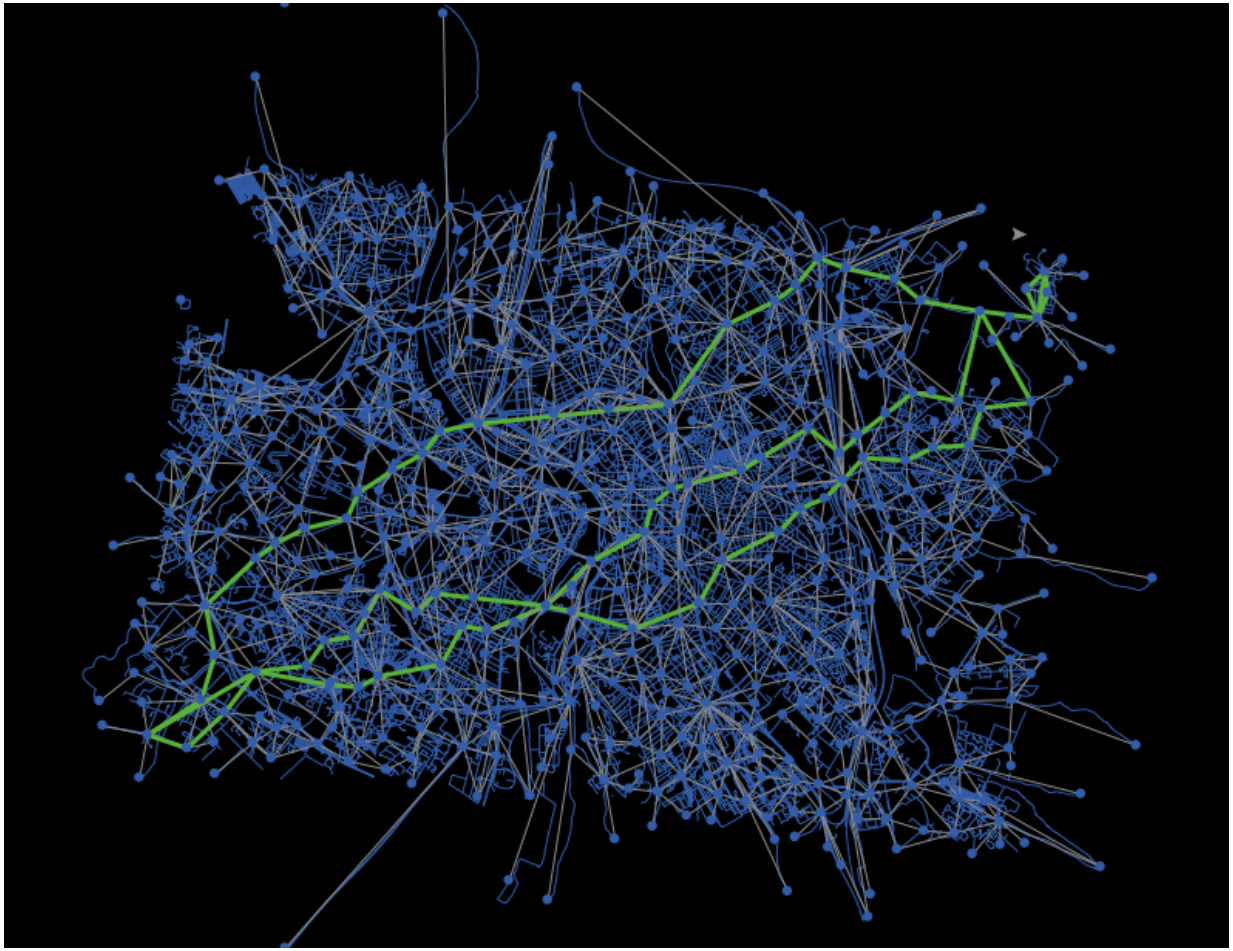

Figure 2.8 : The 3 possible paths known by agents

Evaluating the model and comparing several configurations

Simple indicators

- Congestion rate per edge
- Travel time of agents
- Share of agents using public transportations

Graph based indicator

Study the correlation between congestion and betweenness edge centrality

District indicators

K-means to split the city in several districts

- Average congestion per cluster
- Standard deviation of congestion between clusters

$\Longrightarrow$ Study the traffic balance between districts

Graph based indicator

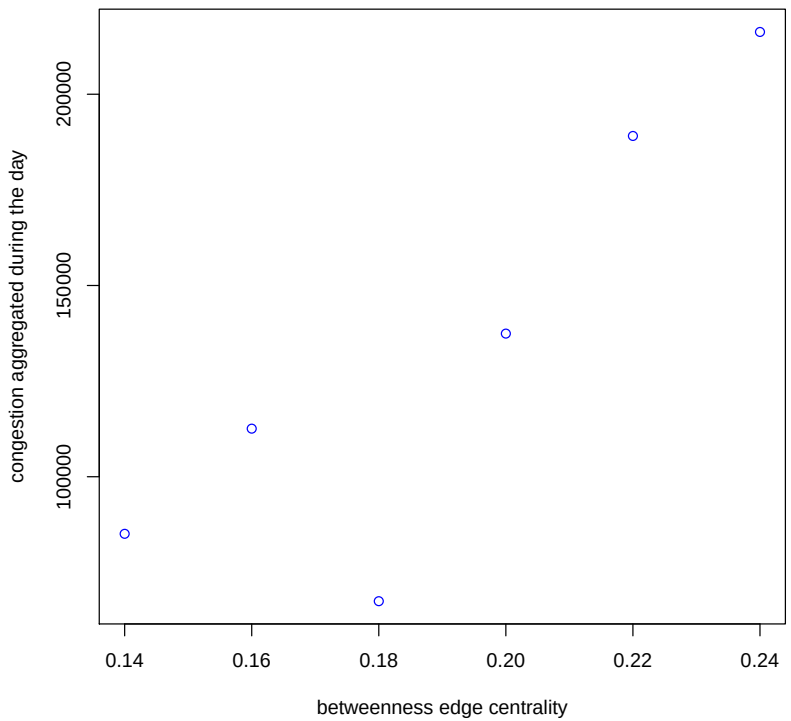

Figure 3.1 : Correlation between congestion and centrality betweenness

Results : Demonstration

See netlogo file.

Sensitivity analysis : Demonstration

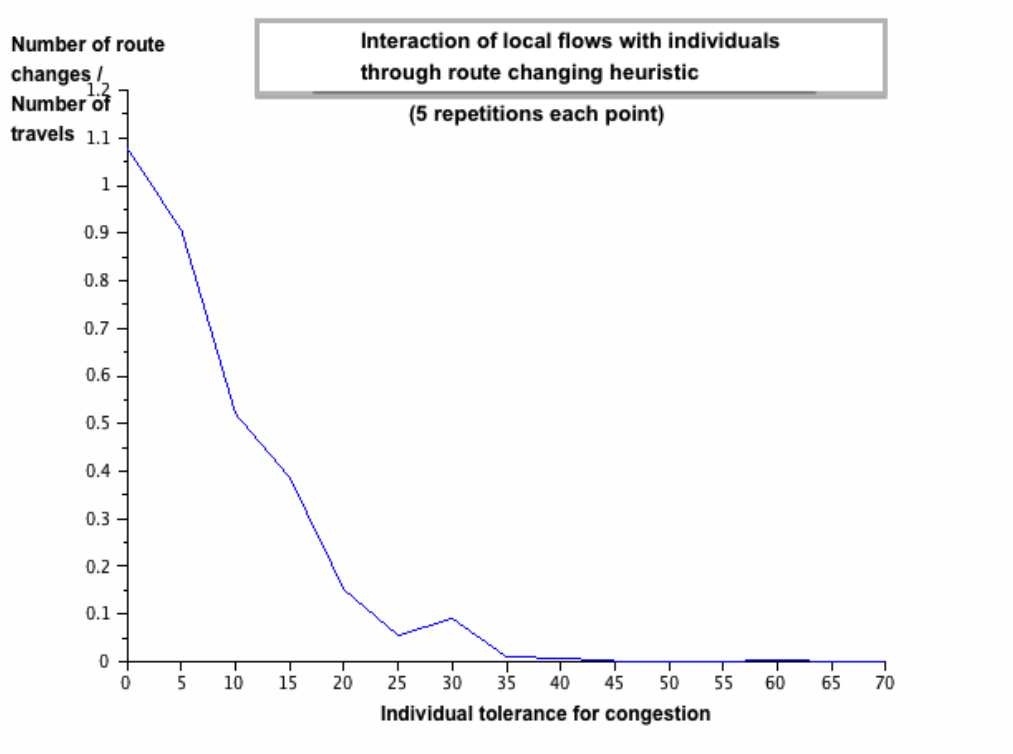

Figure 4.1 : Number of route changes according to individual tolerance to congestion

Sensitivity analysis : Demonstration

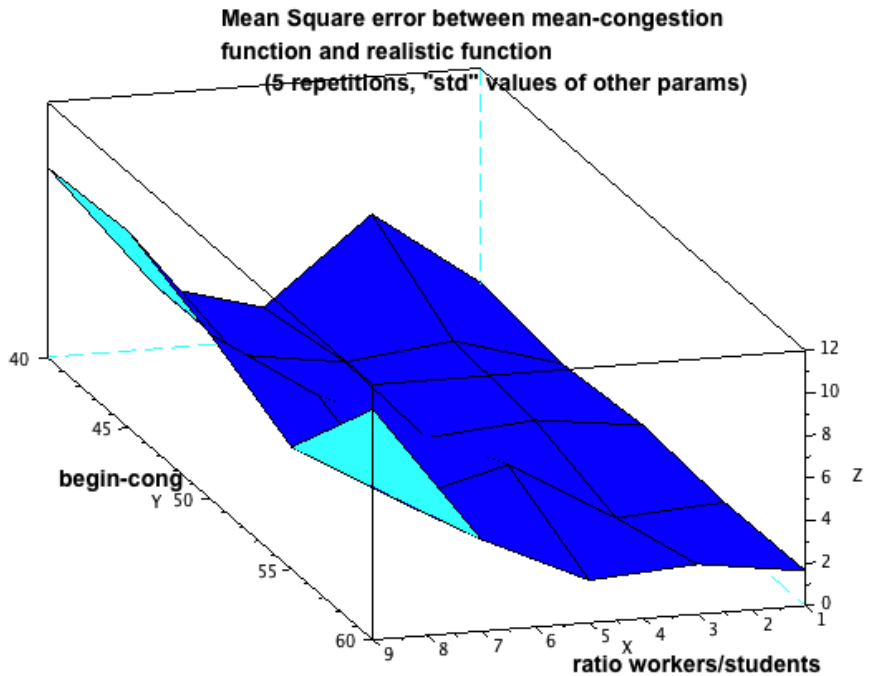

Figure 4.2 : Preliminary work for calibration

Influence of ratio between workers and students

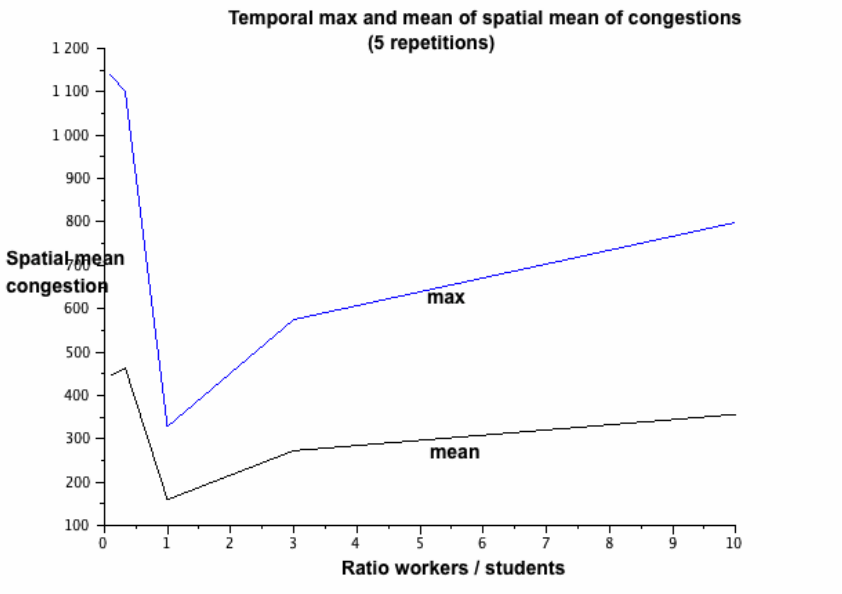

Figure 4.3 : Congestions day

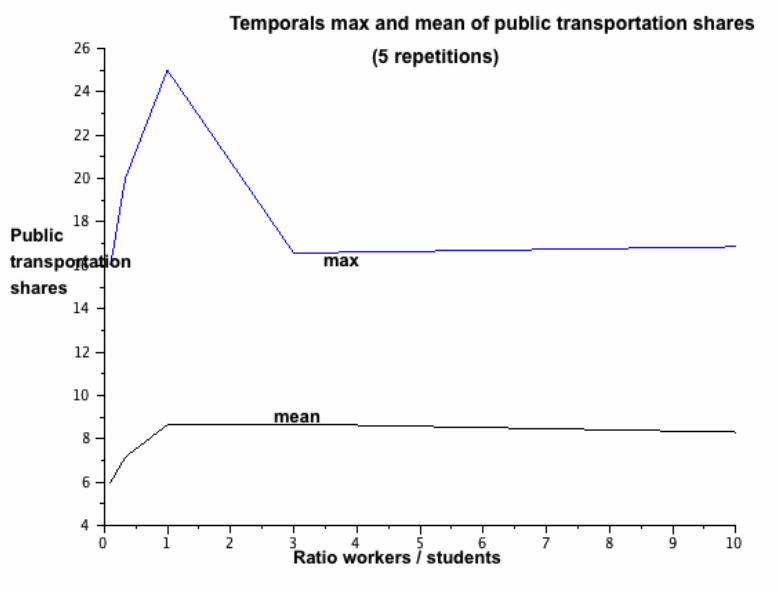

Figure 4.4 : Transportation shares

Answer to the research question

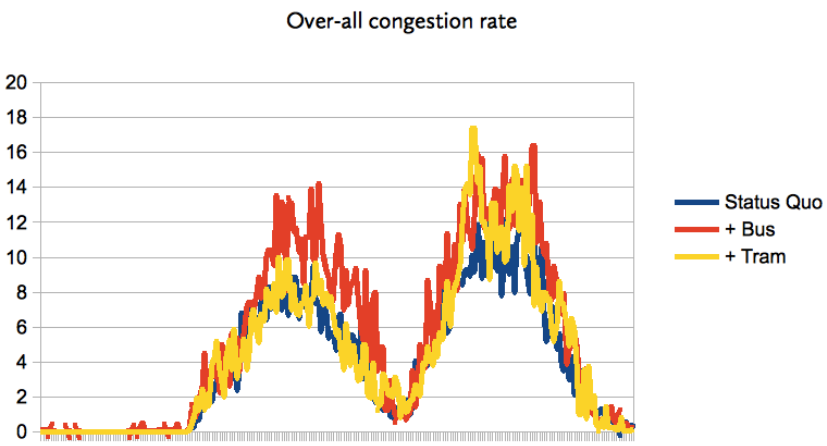

Figure 4.5 : Congestion

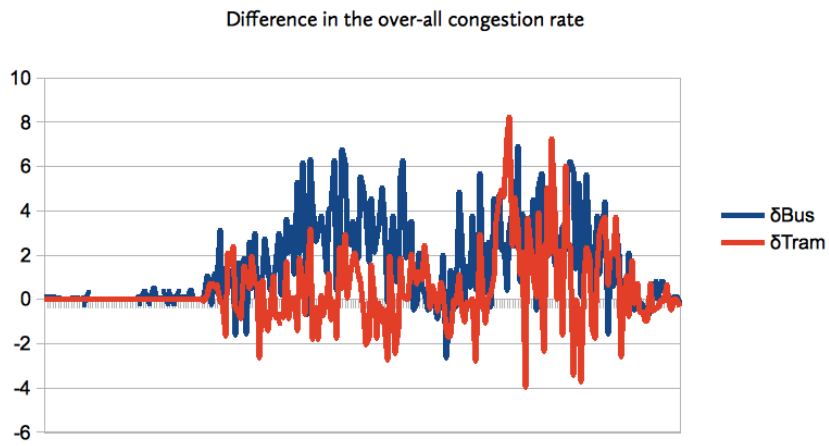

Figure 4.6 : Change in congestion

Answer to the research question

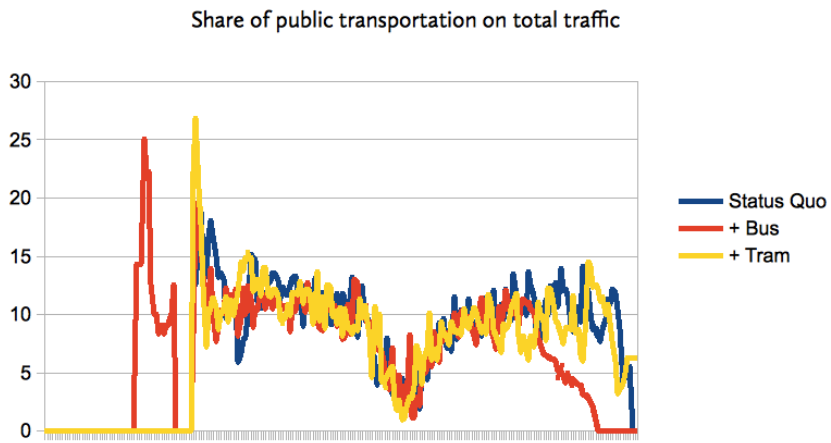

Figure 4.7 : Public transportation share

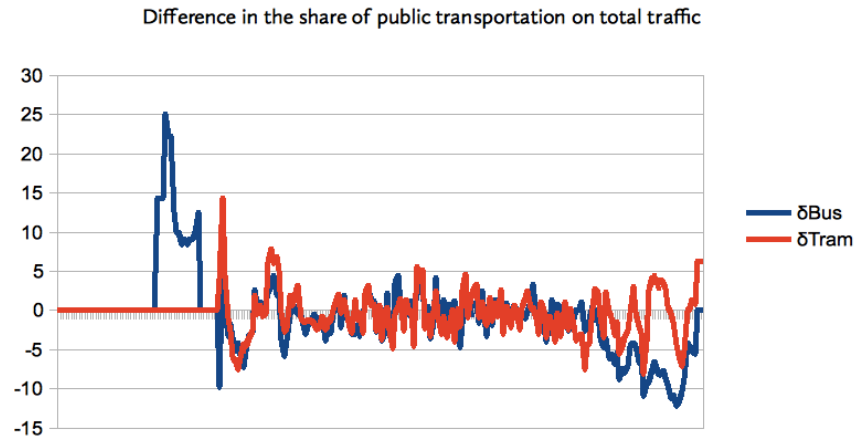

Figure 4.8 : Change in public transportation share

Conclusion

- Mr Rainbow didn't die for nothing
- It has been a learning process for us !

Introduce bus :

- Increases public transport share in morning rush hour
- Reduces users in evening (!)
- Increases congestion (!)

Figure 5.1 : Confused Too-Loose's mayor

Introduce tram :

- Fluctuations throughout the day with overall increase in congestion

What's next ?

- Finish debugging (!)
- Use the model to consider the impact of land use change on traffic congestion
- Consider impacts on air quality, noise, achieving environmental targets
- Deeper analysis is tram taking commuters from cars or those travelling on foot?

Figure 5.2 : Ideas of future

Do you have questions ?