Planes, Trains, and Afflictions

Agent-based modeling for the spread of disease through transportation networks

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27 JUN 2020

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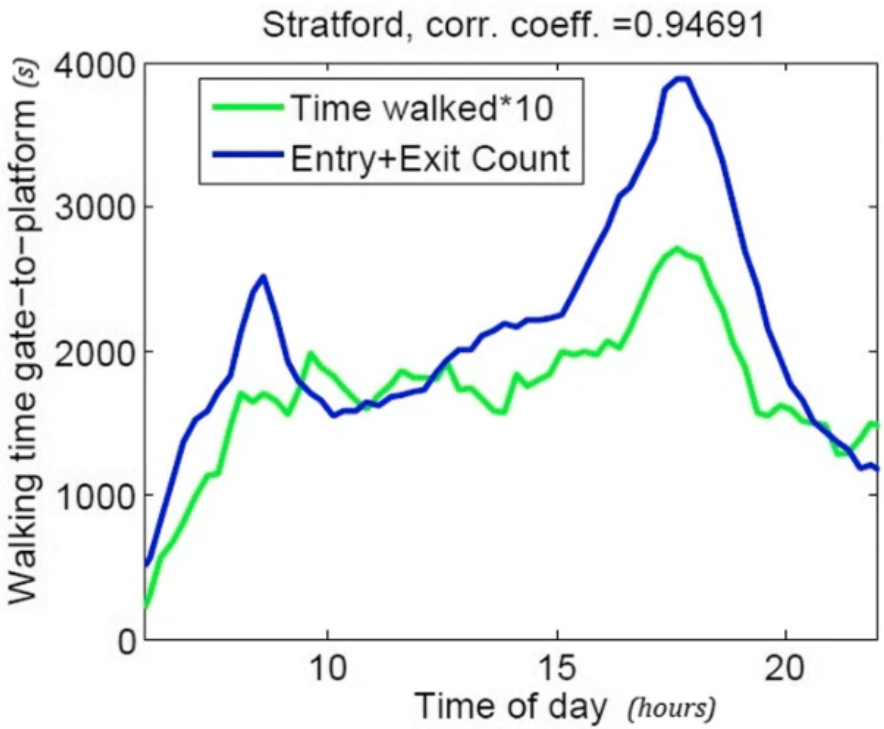
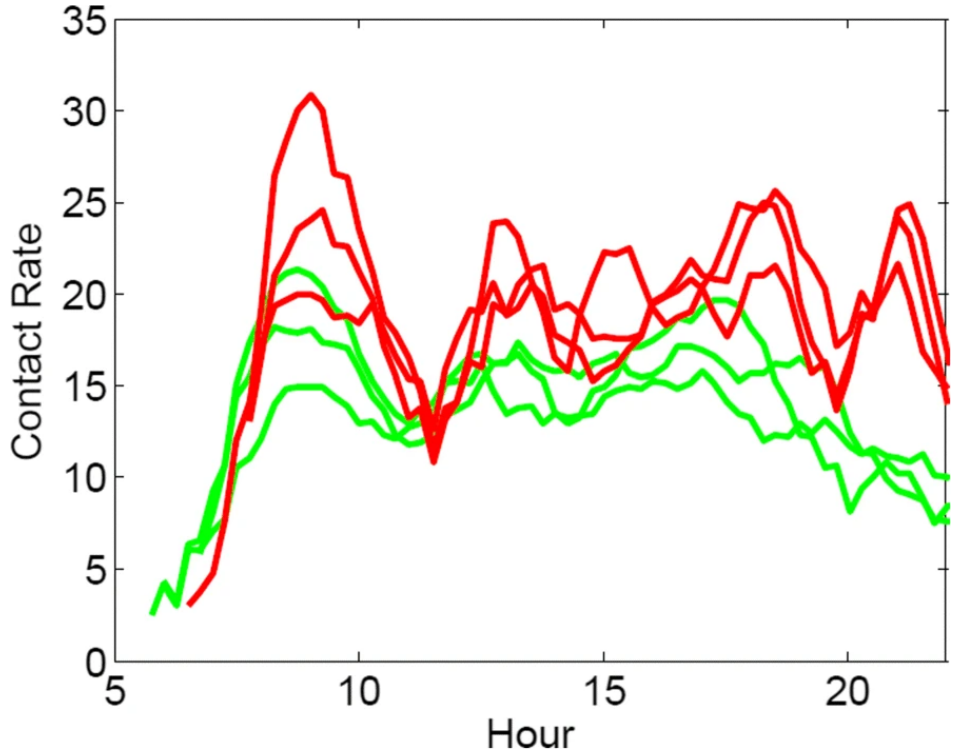
Motivation

Why were certain areas of NYC more affected by COVID-19?
How were the subways involved?
image here of NYC afflictions
credit: NYC DoH **image here of line analysis**
credit: Jeffrey whoever mabob *Speaker's note:*
- What is a transportation network? What is a subway? - How infections spread on transportation networks
- Learn

Prior Research (London Underground)

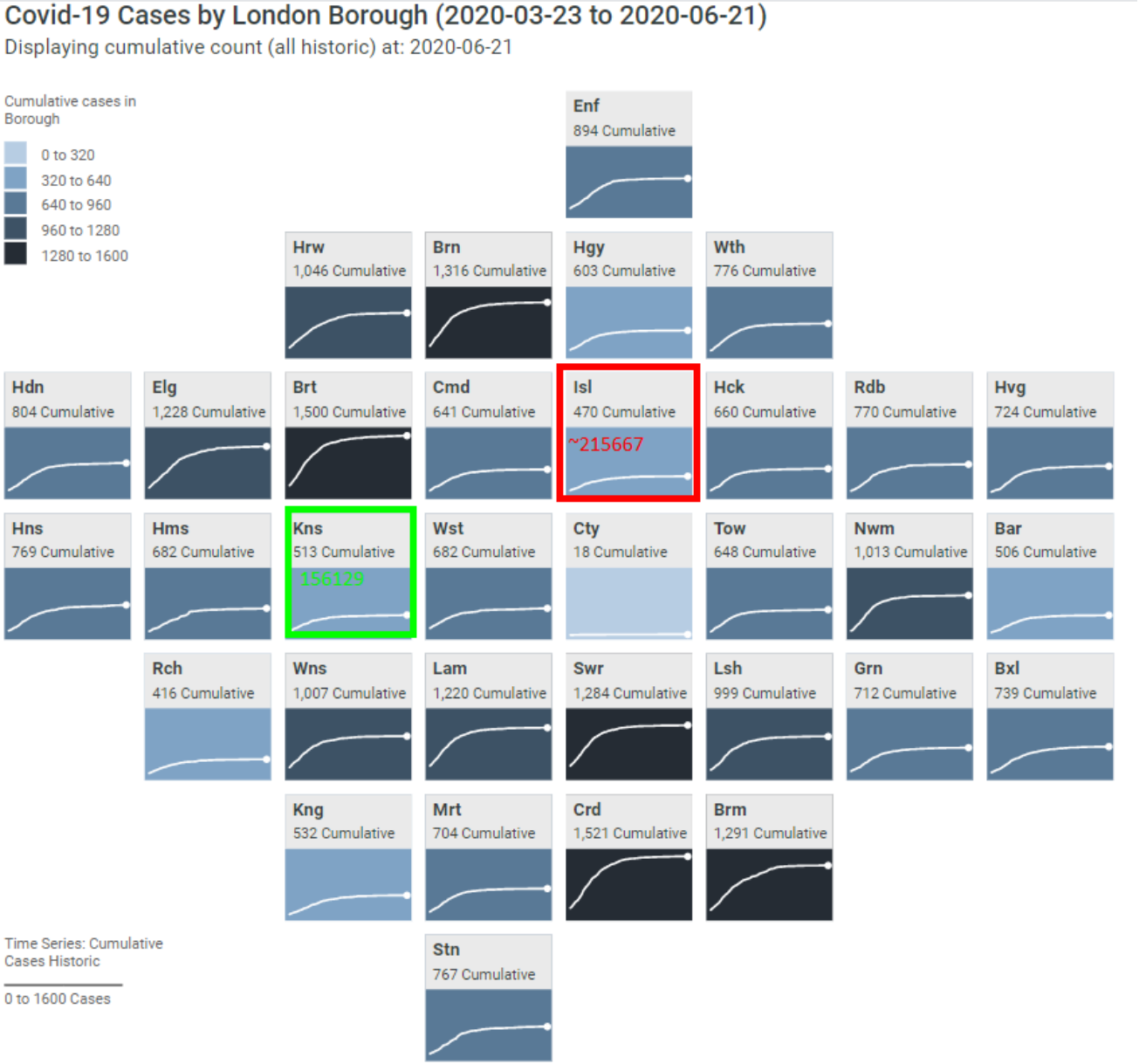
Data: Oyster (Card), CASA (Timetable), PHE Data (Demographics)





Results show a correlation between the use of the underground and ILI cases in London, specifically they show that higher numbers of ILI cases arise in those boroughs where the population spend more time in the Underground and/or incur in a higher number of contacts when travelling. [?]

COVID in London



Speaker's Remark:

Prior Research (Singapore Buses)

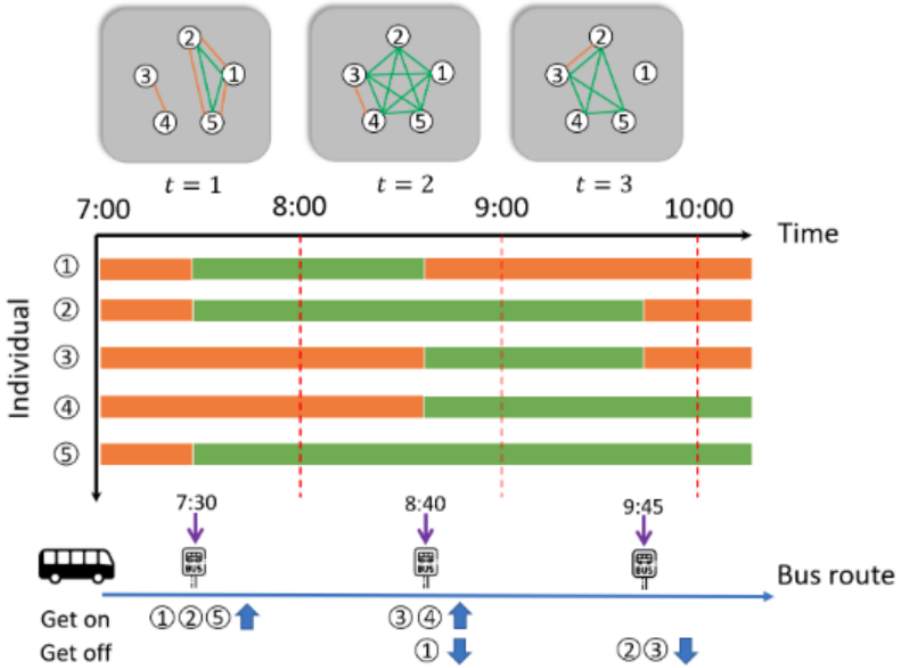
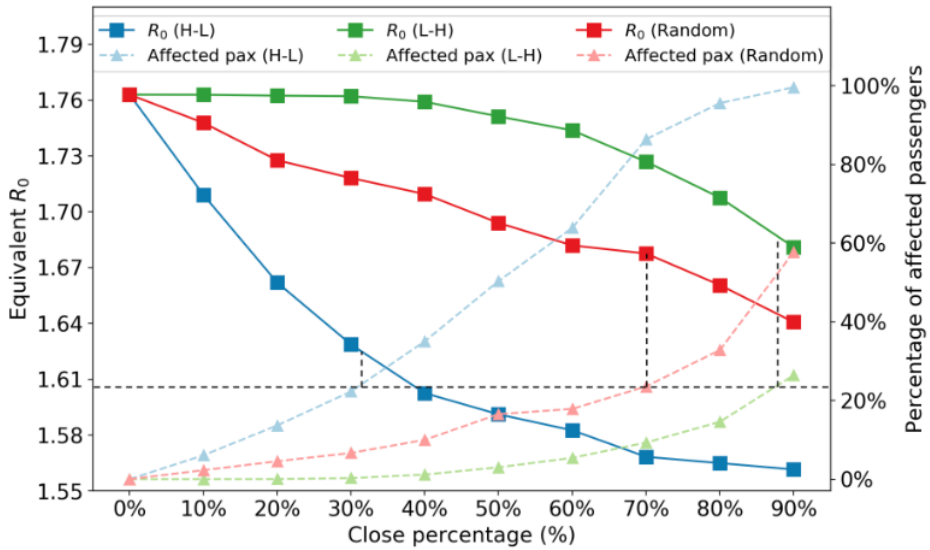


Figure 1: Network representation of a five-passenger system

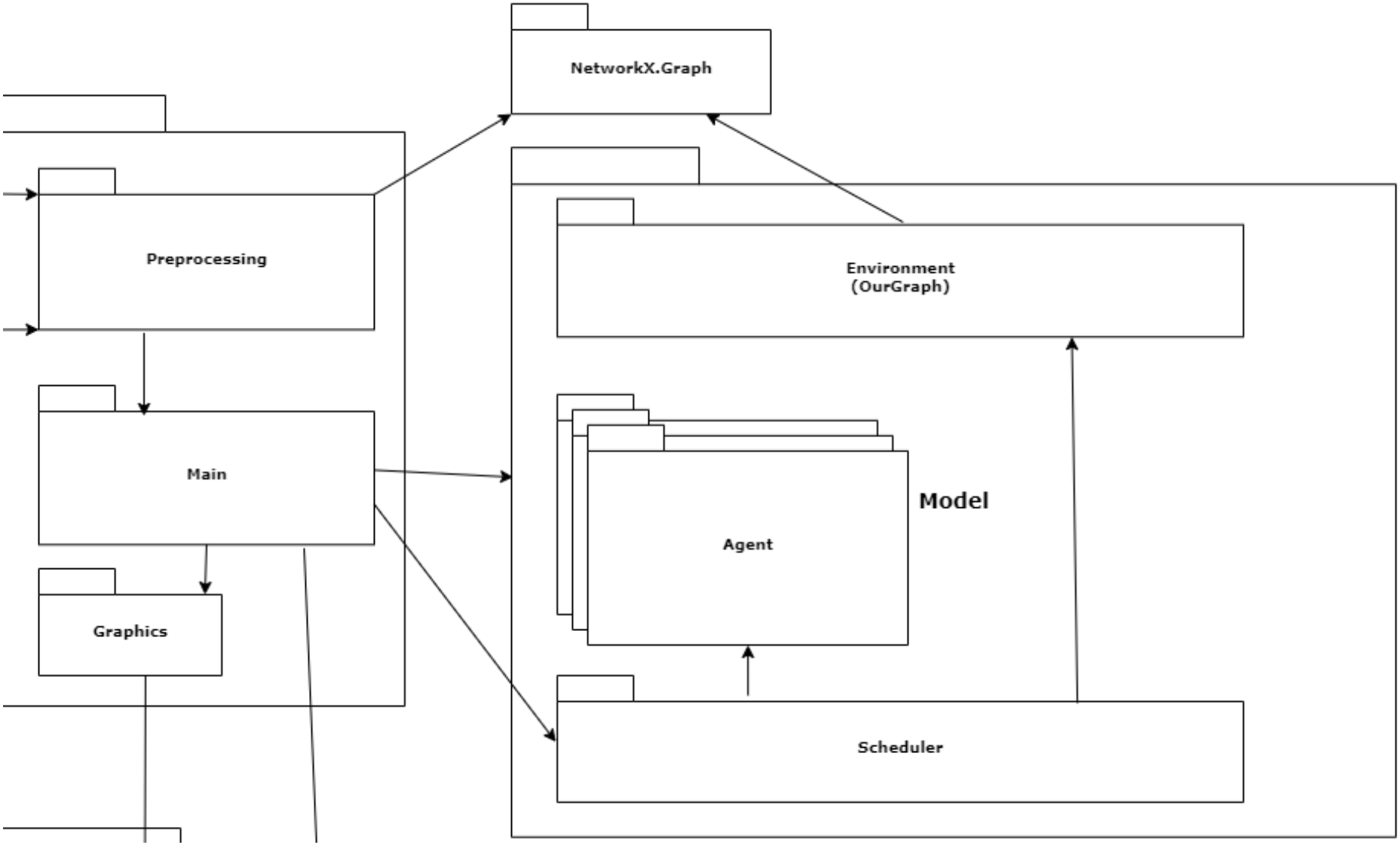


The direct contact in trains is, however, difficult to obtain from smart card data because the transactions are recorded at the station level [?]

Speaker's note:

- We show these things not to embarrass ourselves, but the depth of research available even just looking at one system. - List some other research

ABM Framework

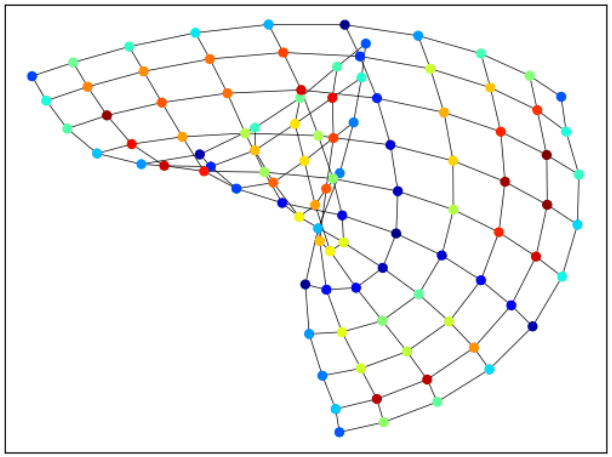


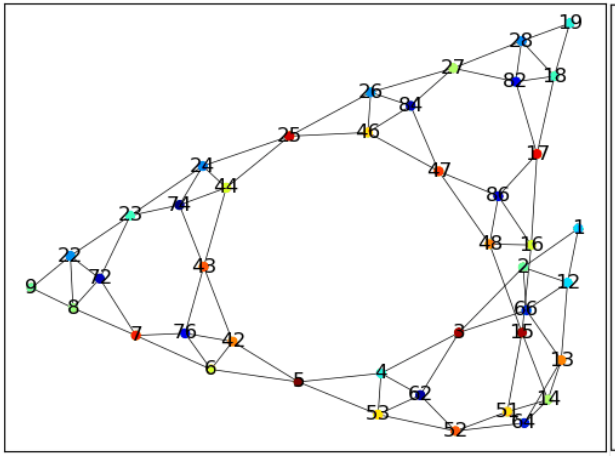
Components: Python, MESA, Networkx

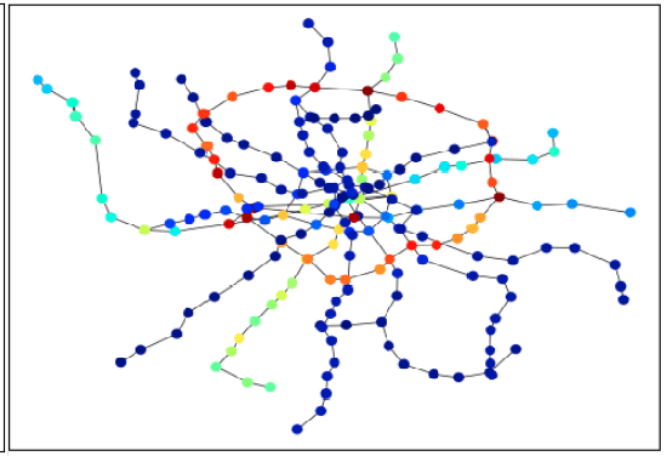
Transportation Model

SEIR Agent

Simple Geometries







- Grid
- Sierpinski's Triangle
- Moscow

World Airline Network (Passenger Flow)

Data Source (openflights, articles) Methods (ABM)

World Airline Network (Passenger Flow)

Madrid Commuter Trains (Central Hubs)

Data Source (madrid renfe gtfs) Methods (ABM)

Results (Madrid)

NYC COVID Demographics

Subway Systems

NYC Subway Data

90% loss.

NYC Subway Modeling

NYC Model Hyper-parameters

Compartmental Modeling Results (NYC)

Results by MODZCTA (NYC)

Discussion

All models are wrong!
- Passenger Flow - Outer suburbs phenomenon exists - Simple GDP/capita data

Conclusions

Credits, Links, References

Frank Acquaye - WAN, Passenger Flow
Ho Lum Cheung - NYC, Organization, Research, Testing
Dimas Muñoz-Montesinos - Madrid, Hotspots
Elie Wanko - Theory, Consulting
github link references used in slides