Urban segregation

Going beyond residential neighbourhoods

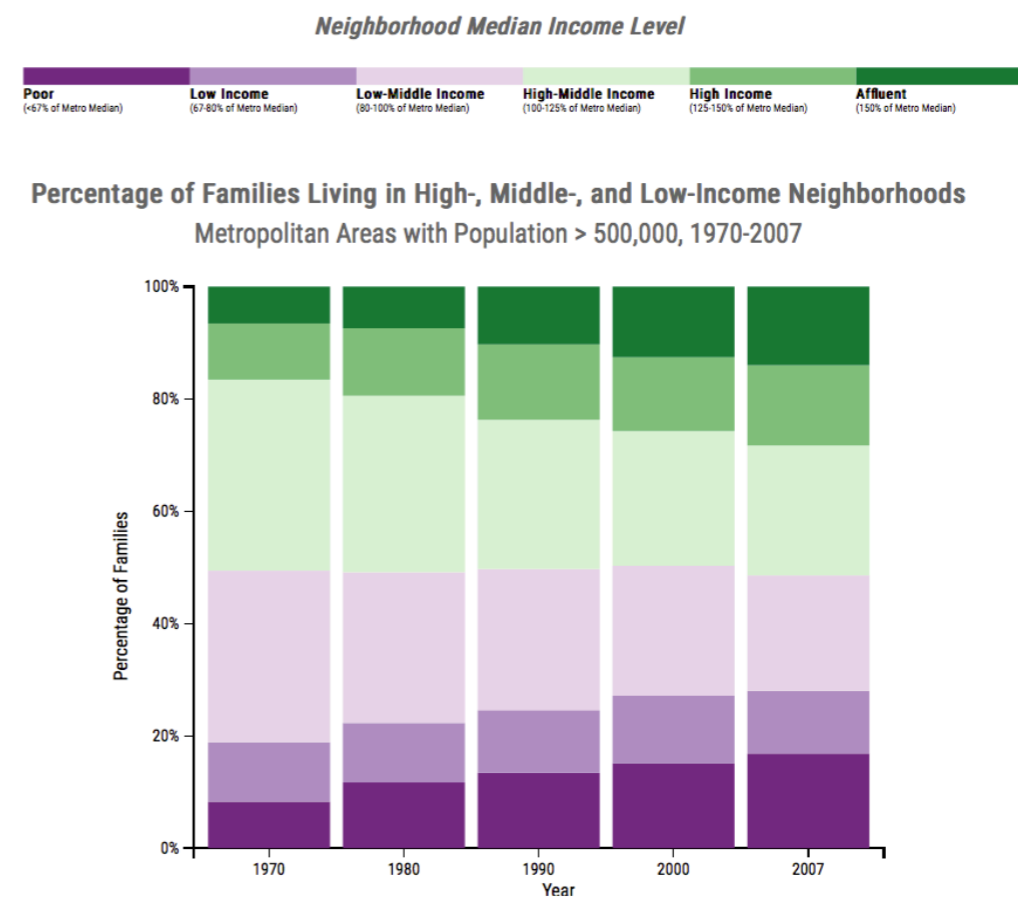Xiaowen Dong

Department of Engineering Science
University of Oxford
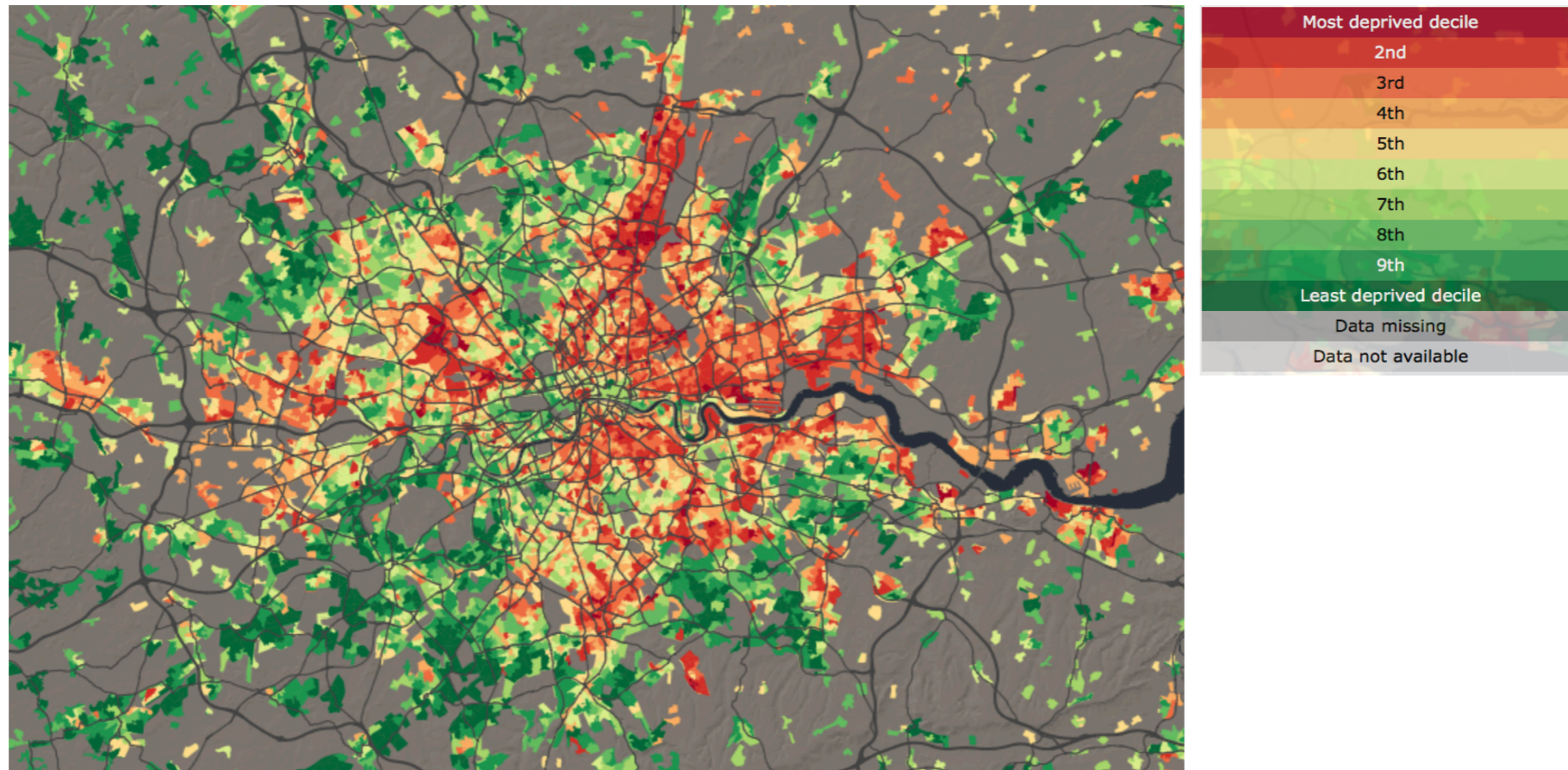
- residential segregation challenges societies across the globe
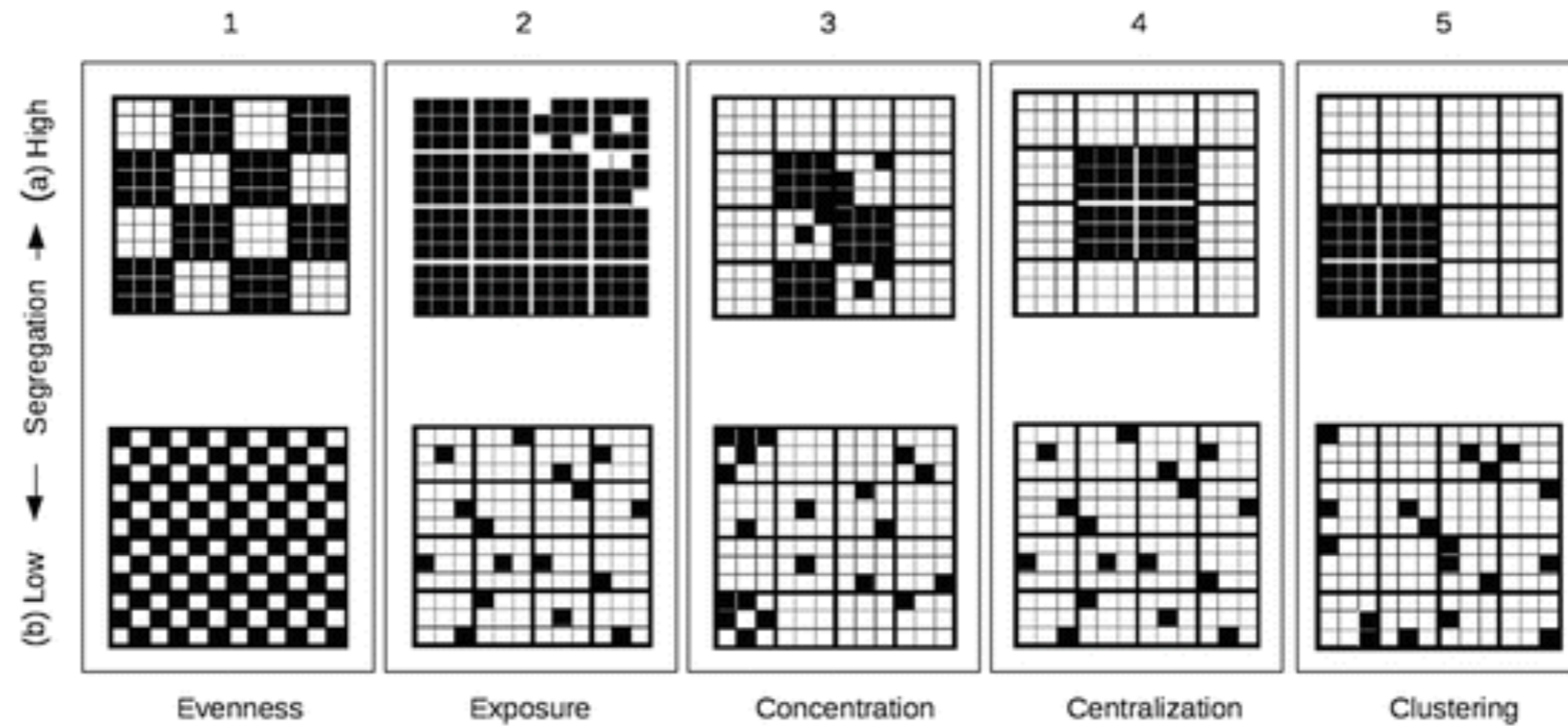
Neighborhood Median Income Level

- residential segregation challenges societies across the globe

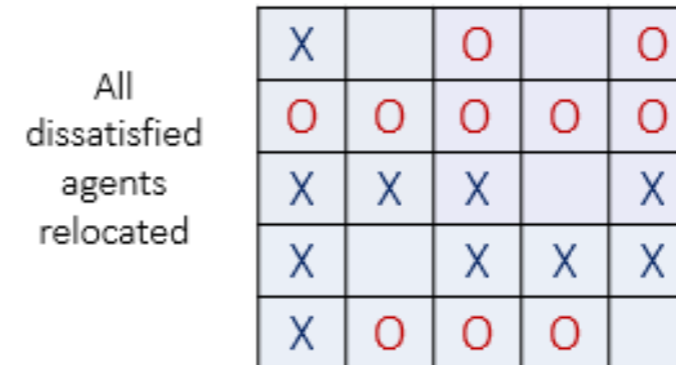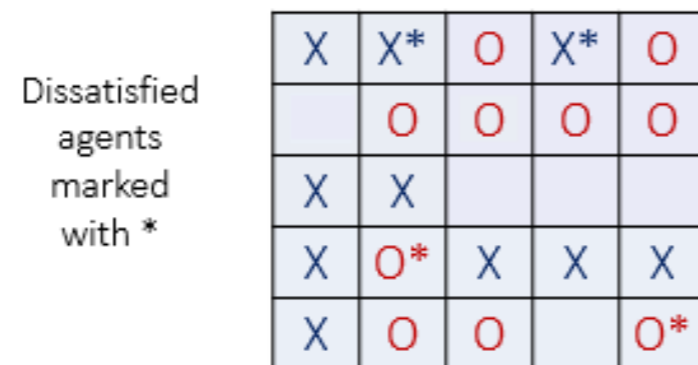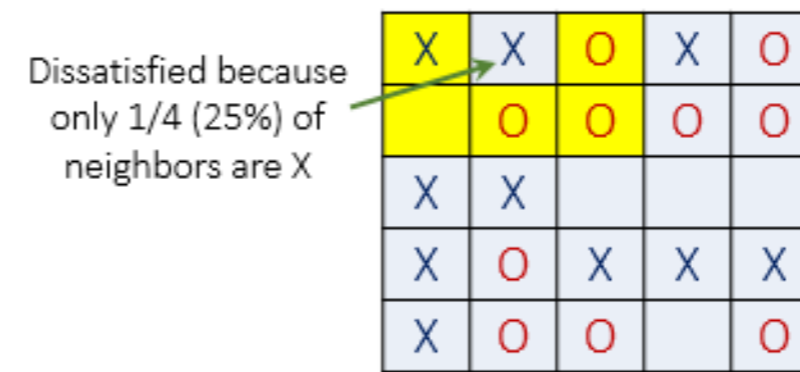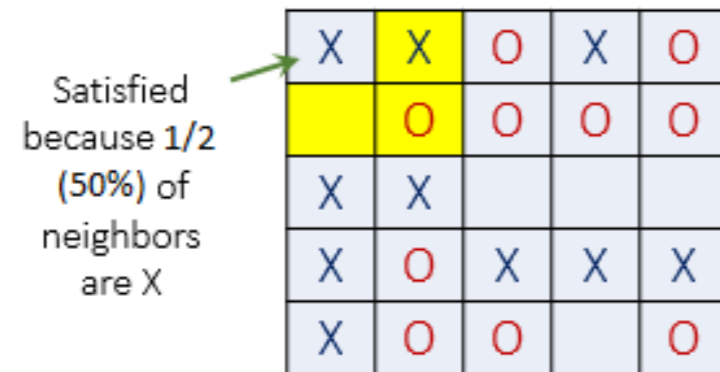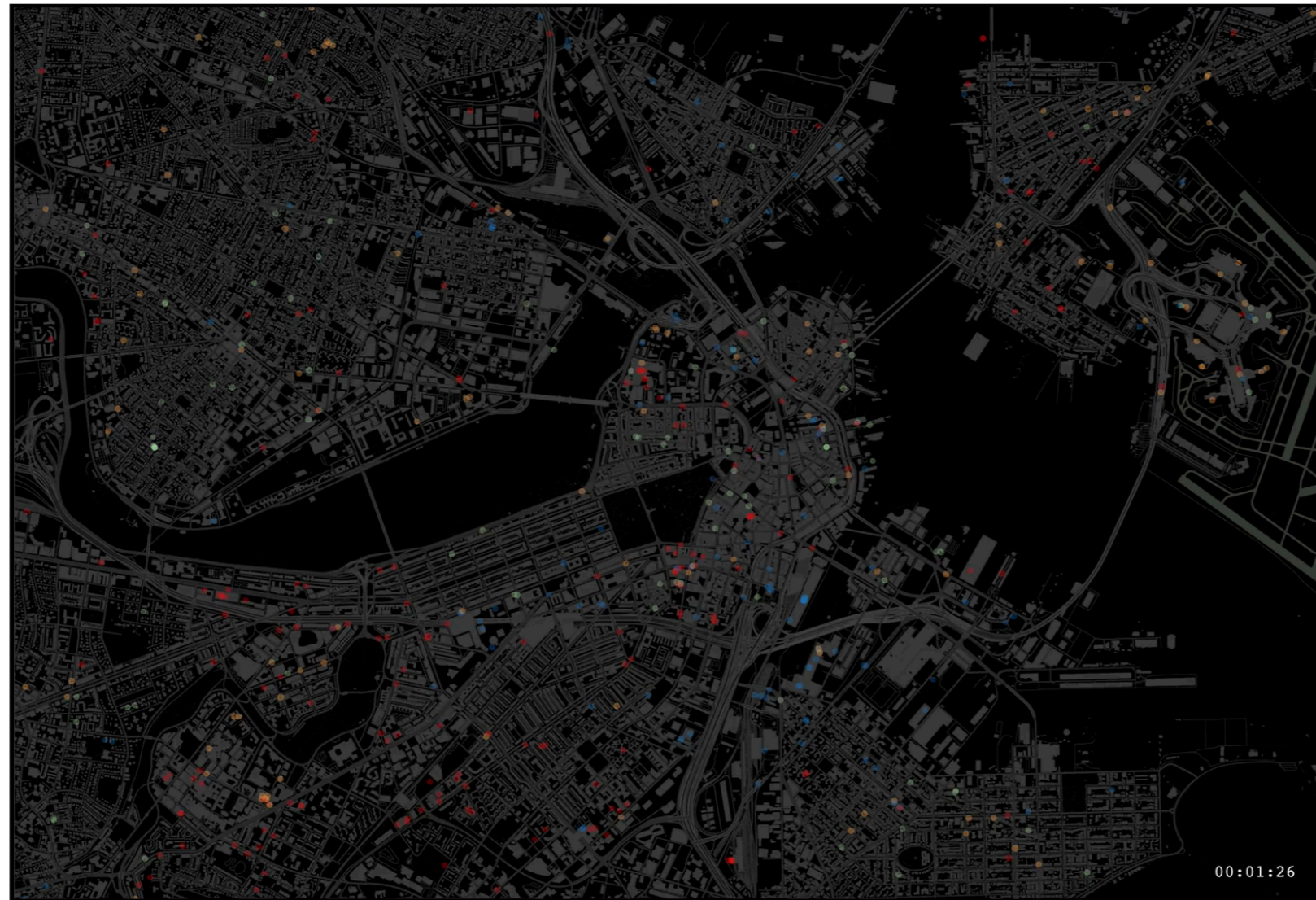- income segregation has been rising in the US in the last 40-50 years
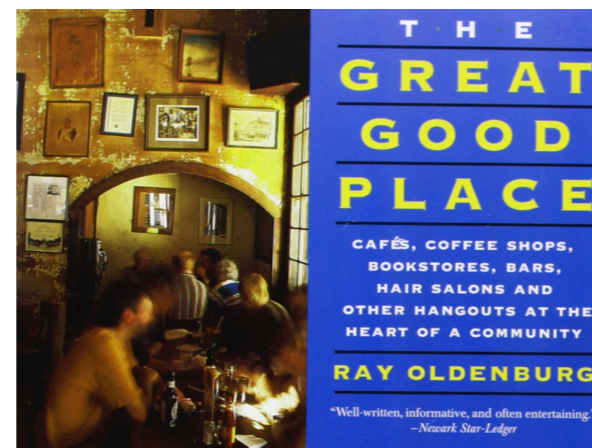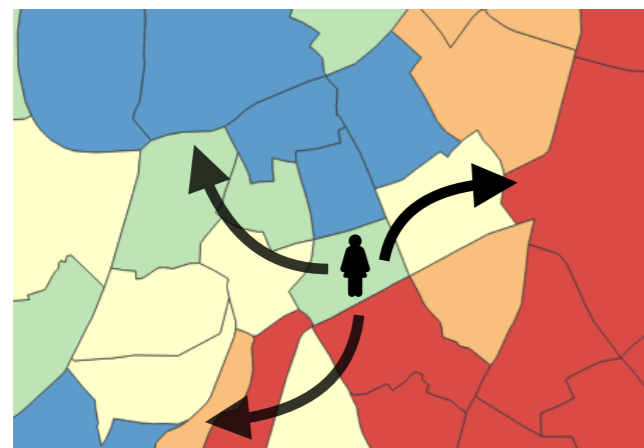
English Indices of Deprivation (2019)

five dimensions of segregation in US census report (2002)

Schelling's model of segregation (1971)

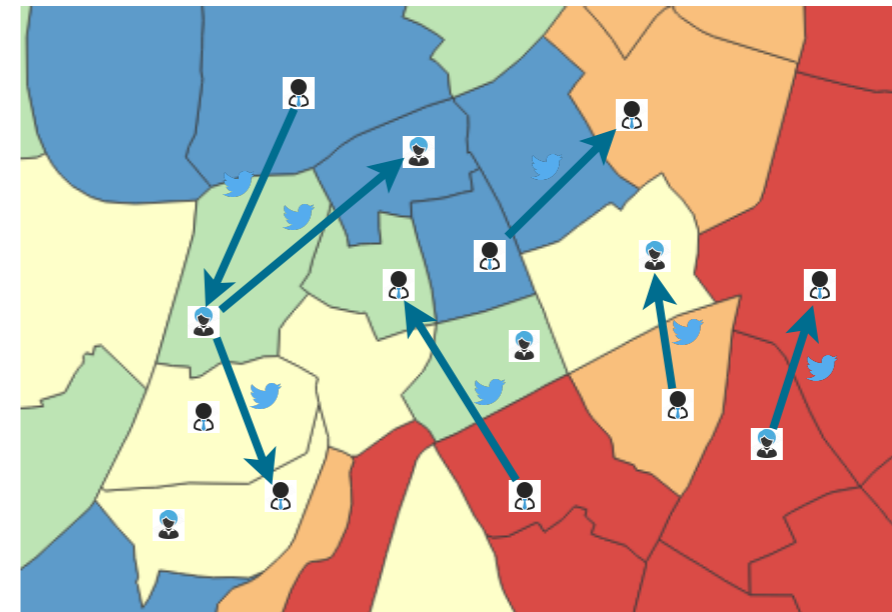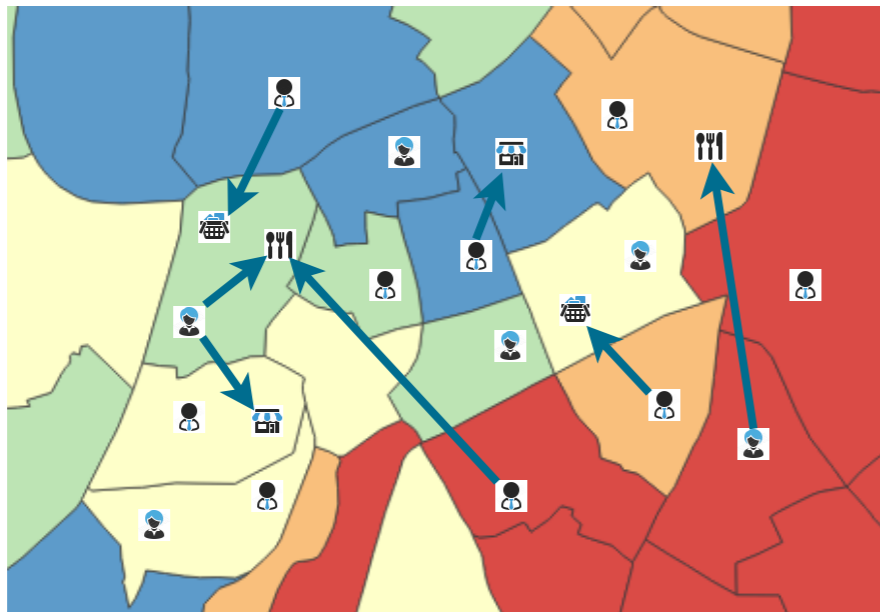$ $$ $$$ $$$$

Step 1
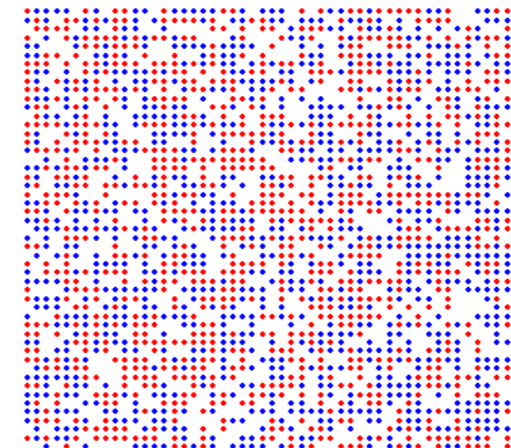
going beyond residential neighbourhoods

- from **residential** to **behavioural** segregation

- from **macro level (neighbourhood)** to **micro level (places)**

- from **quantification** to **modelling/simulations/predictions**

- from **physical** to **virtual** space

segregation in economic and social interactions

- nodes: neighbourhoods (colour: socioeconomic status)

- edges: # purchases by users in area i at stores in j or # mentions by users in area i to users in j

Dong et al., "Segregated interactions in urban and online space," EPJ Data Science, 2020.

Purchase
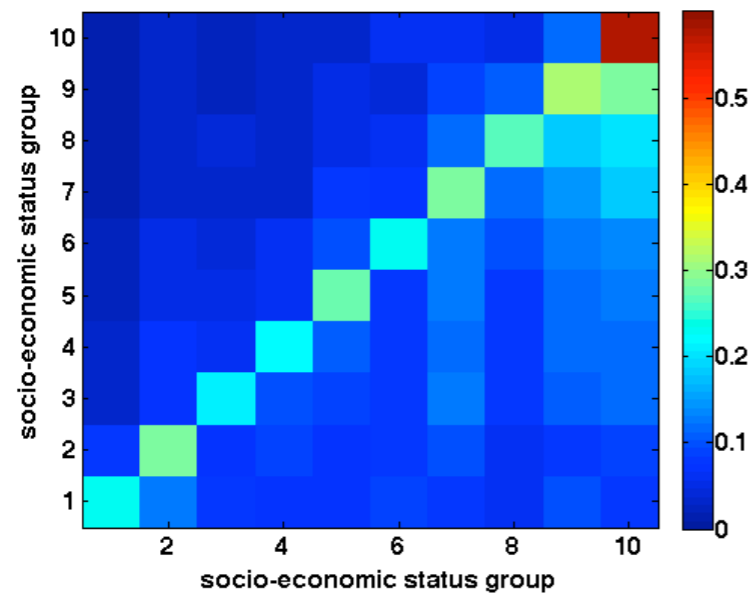
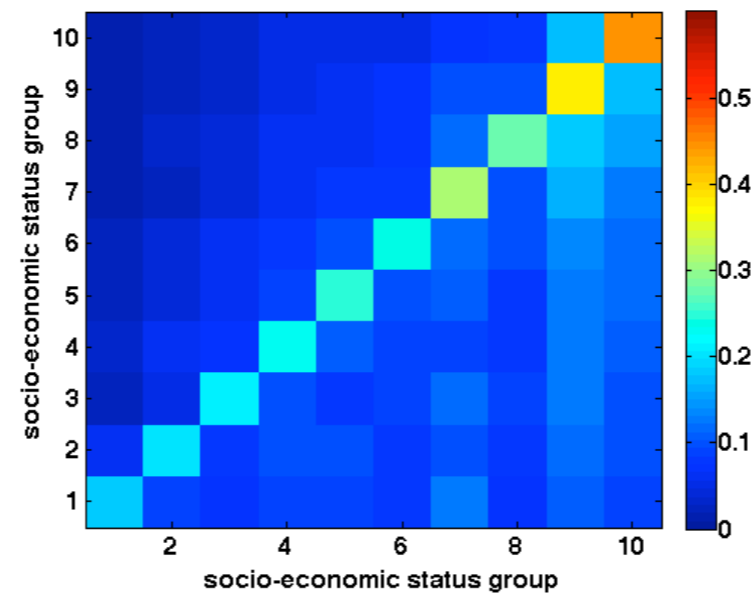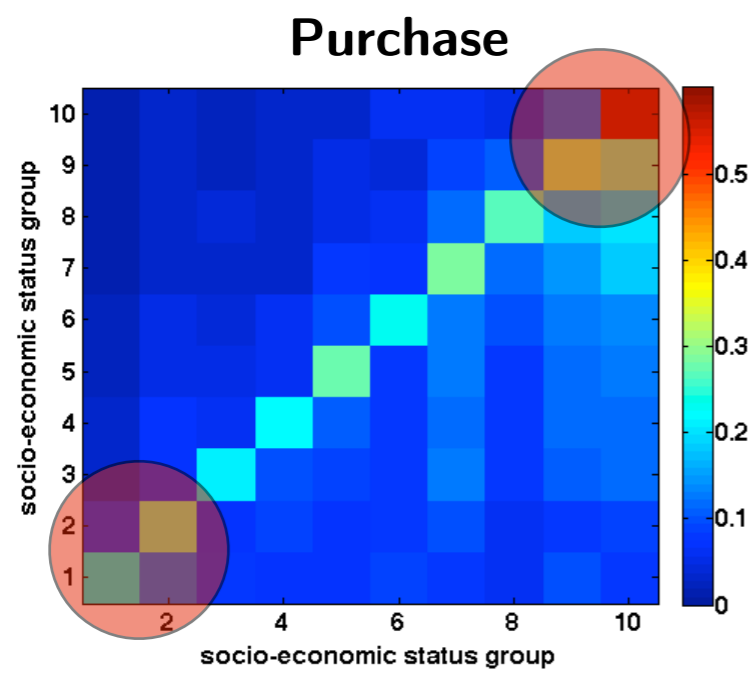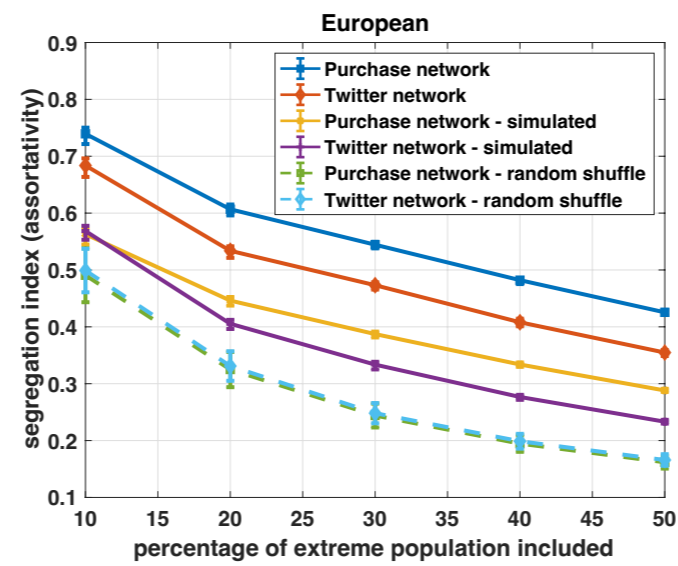assortativity: 0.43

Twitter

assortativity 0.35
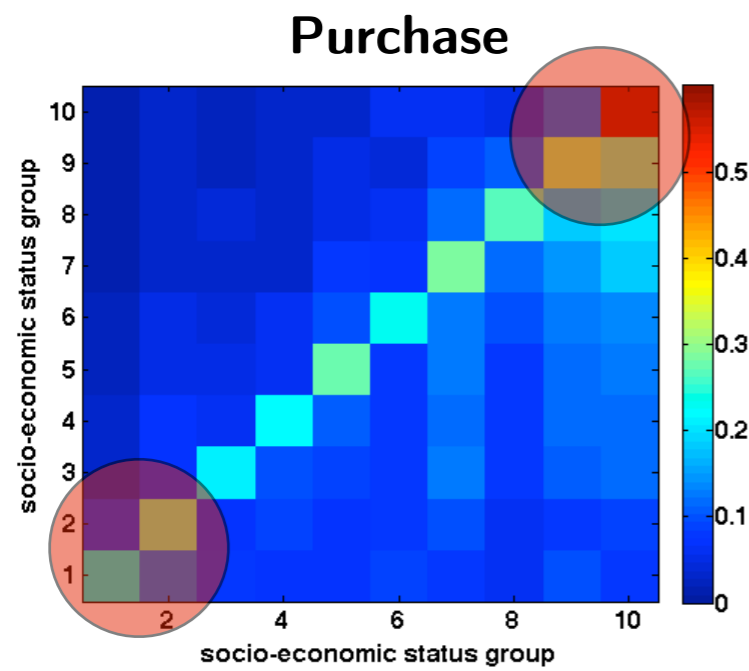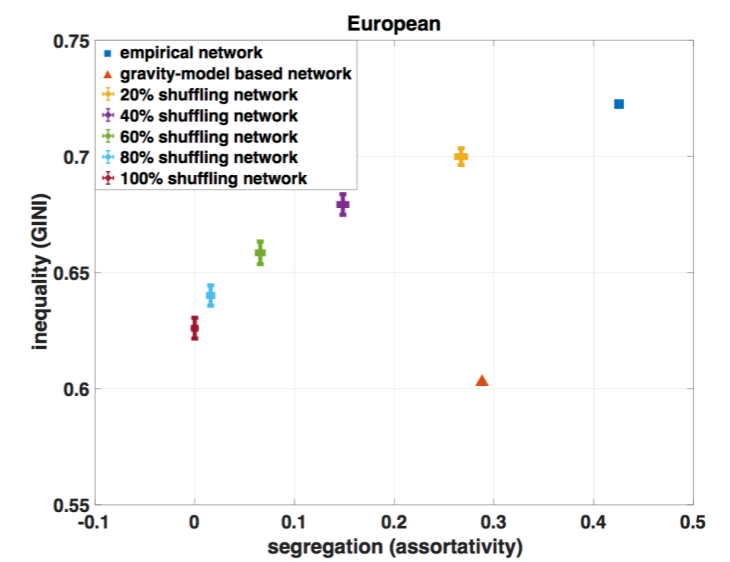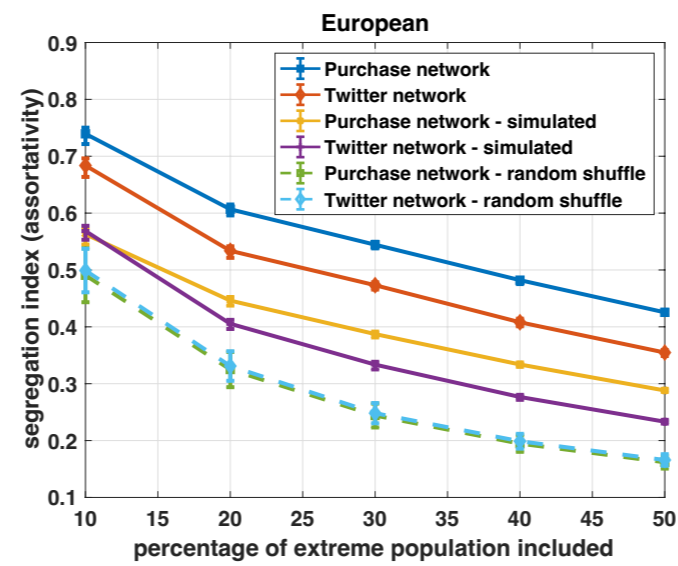
segregation in economic and social interactions

segregation in economic and social interactions

Purchase

assortativity: 0.43

European

European

segregation in economic and social interactions

European

Topic-1a

Topic-2a

Northern American

Topic-1b

Topic-2b

0

0.5

1
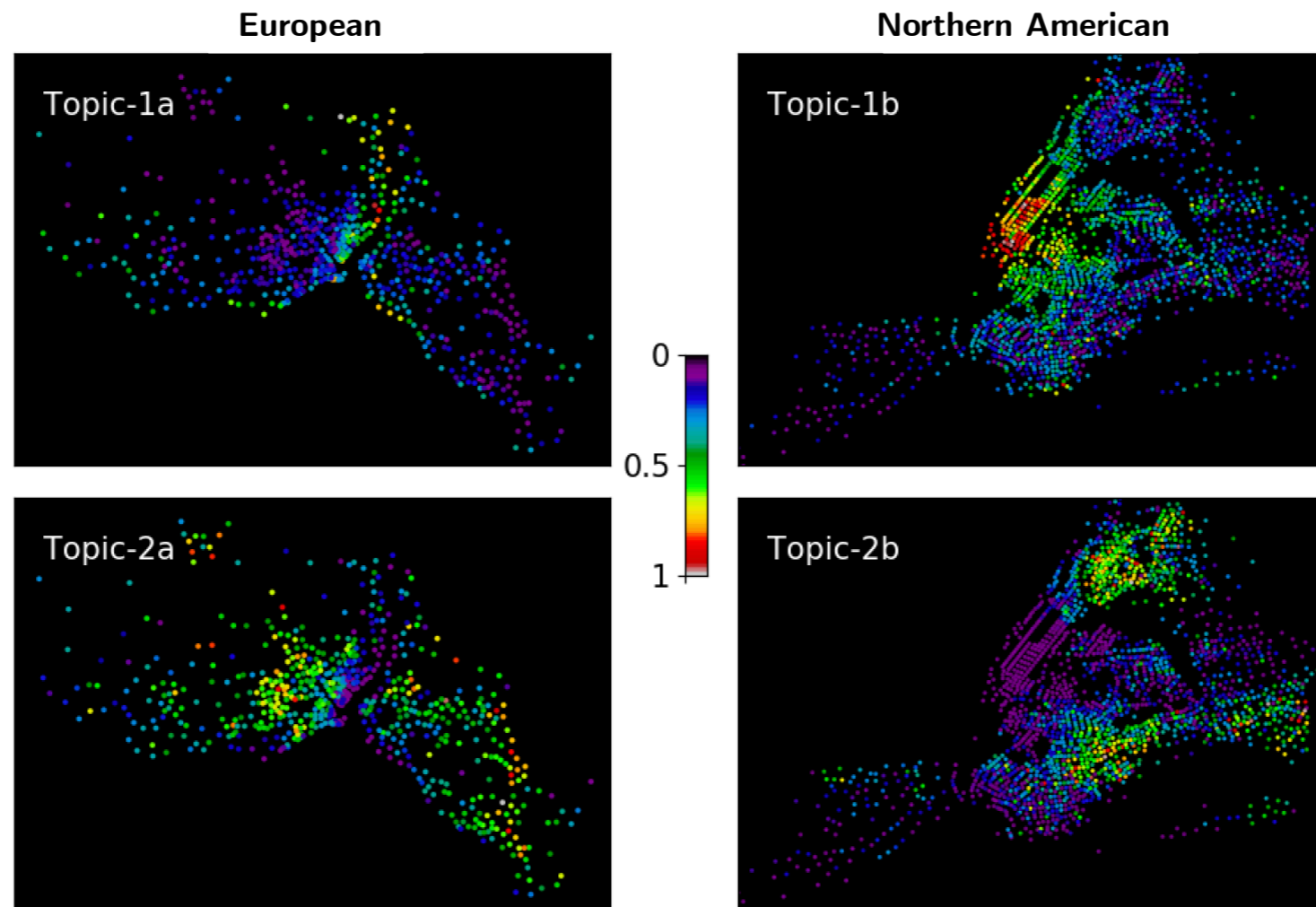
segregation and (inhomogeneous) information flow

Morales et al., "Segregation and polarization in urban areas," Royal Society Open Science, 2019.
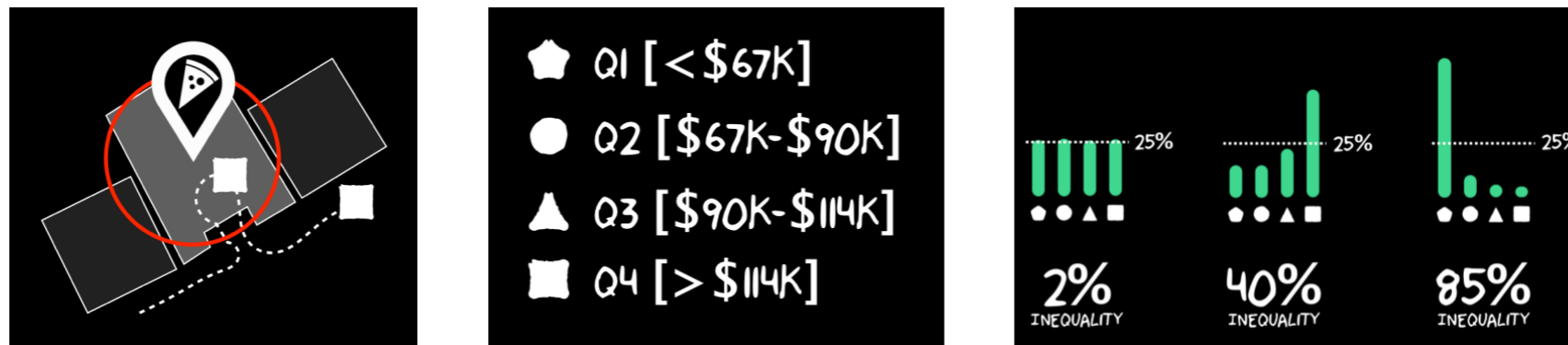
experienced income segregation at places

- extract "stays" and attribute stays to places

- assigns users to home areas (income groups)

- compute time spent by each income group at given place

- compute segregation measure for each place
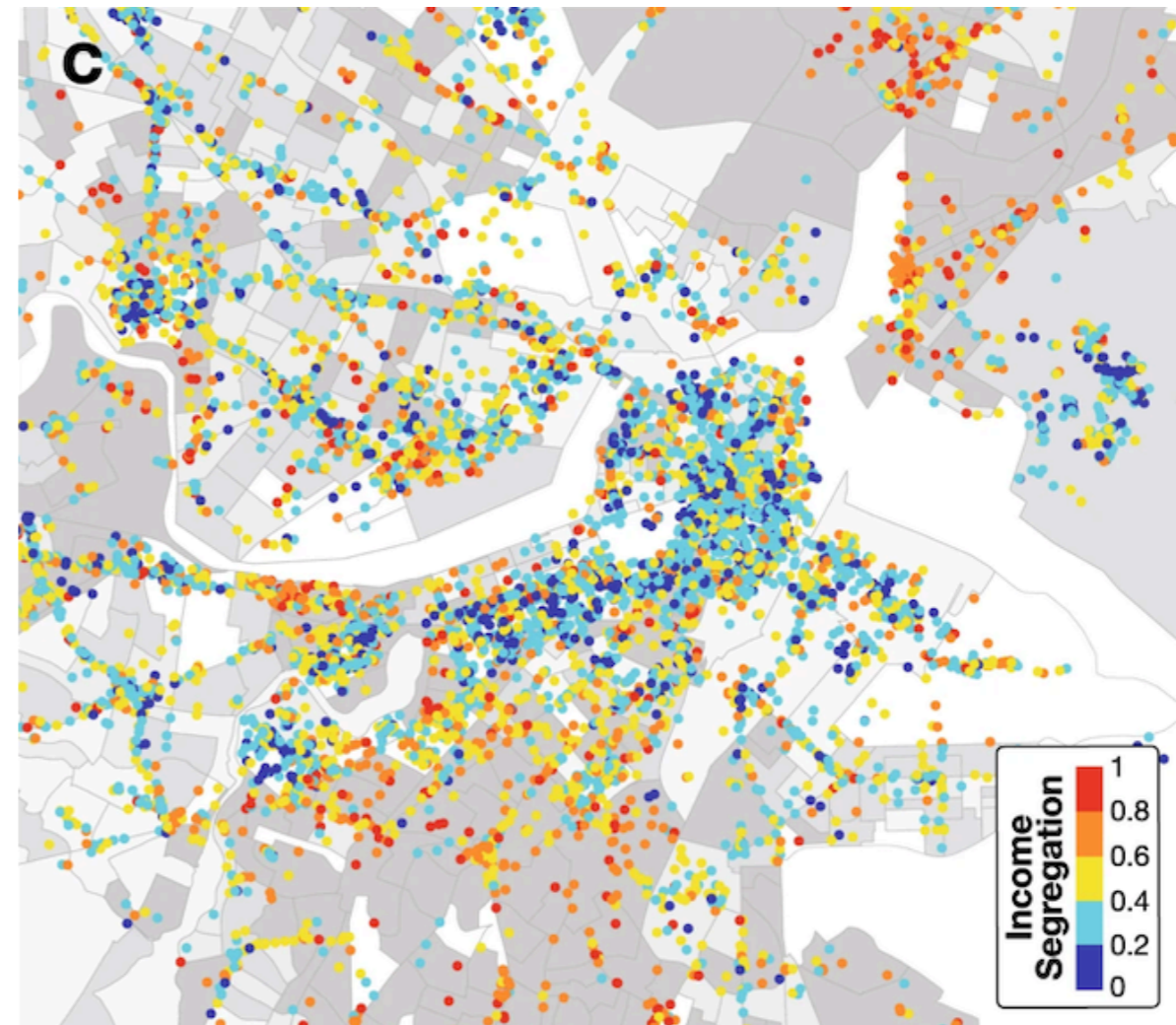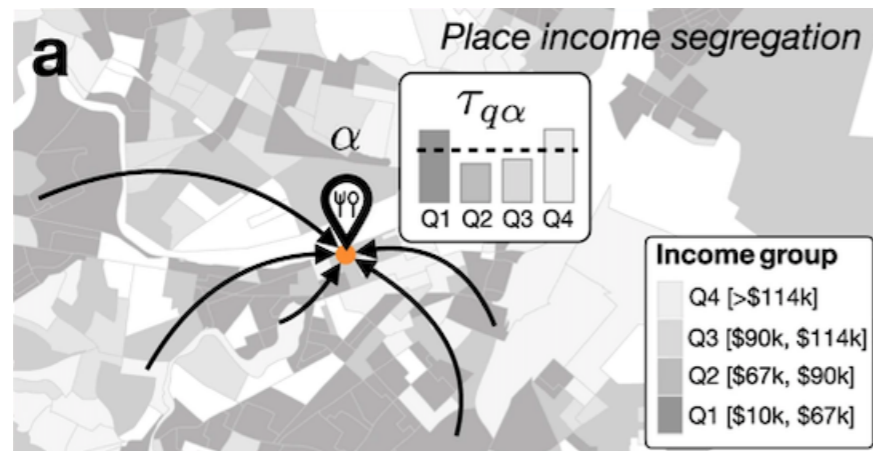
Moro et al., "Mobility patterns are associated with experienced income segregation in large US cities," Nature Communications, 2021.

place segregation occurs at micro level (within 25 meters)
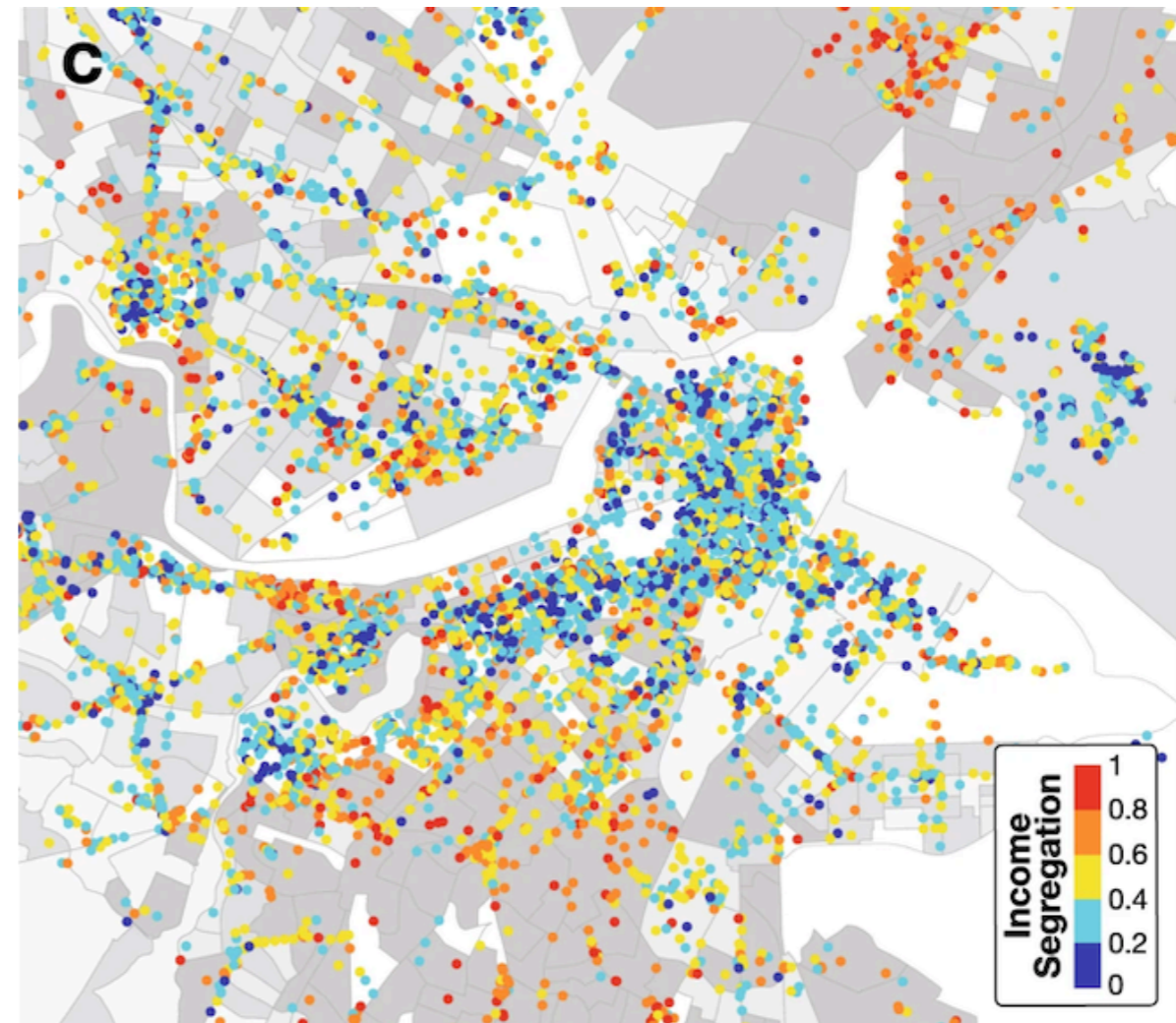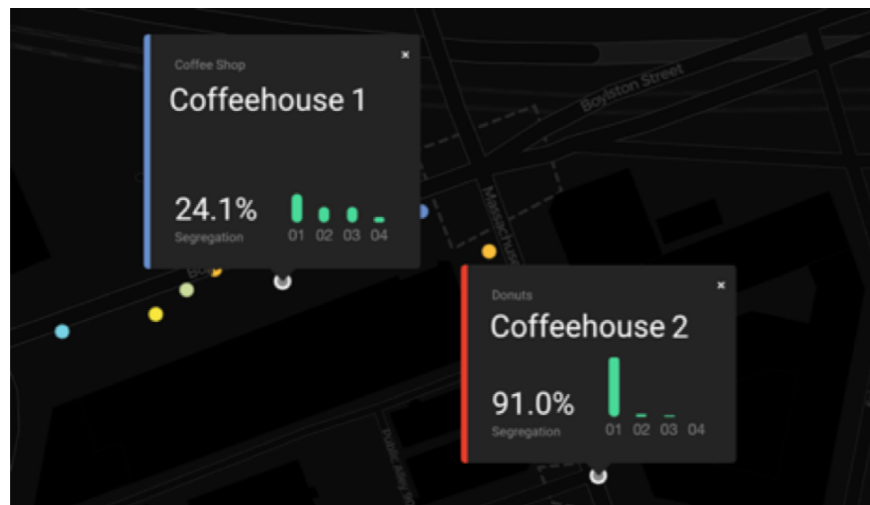
place segregation occurs at micro level (within 25 meters)
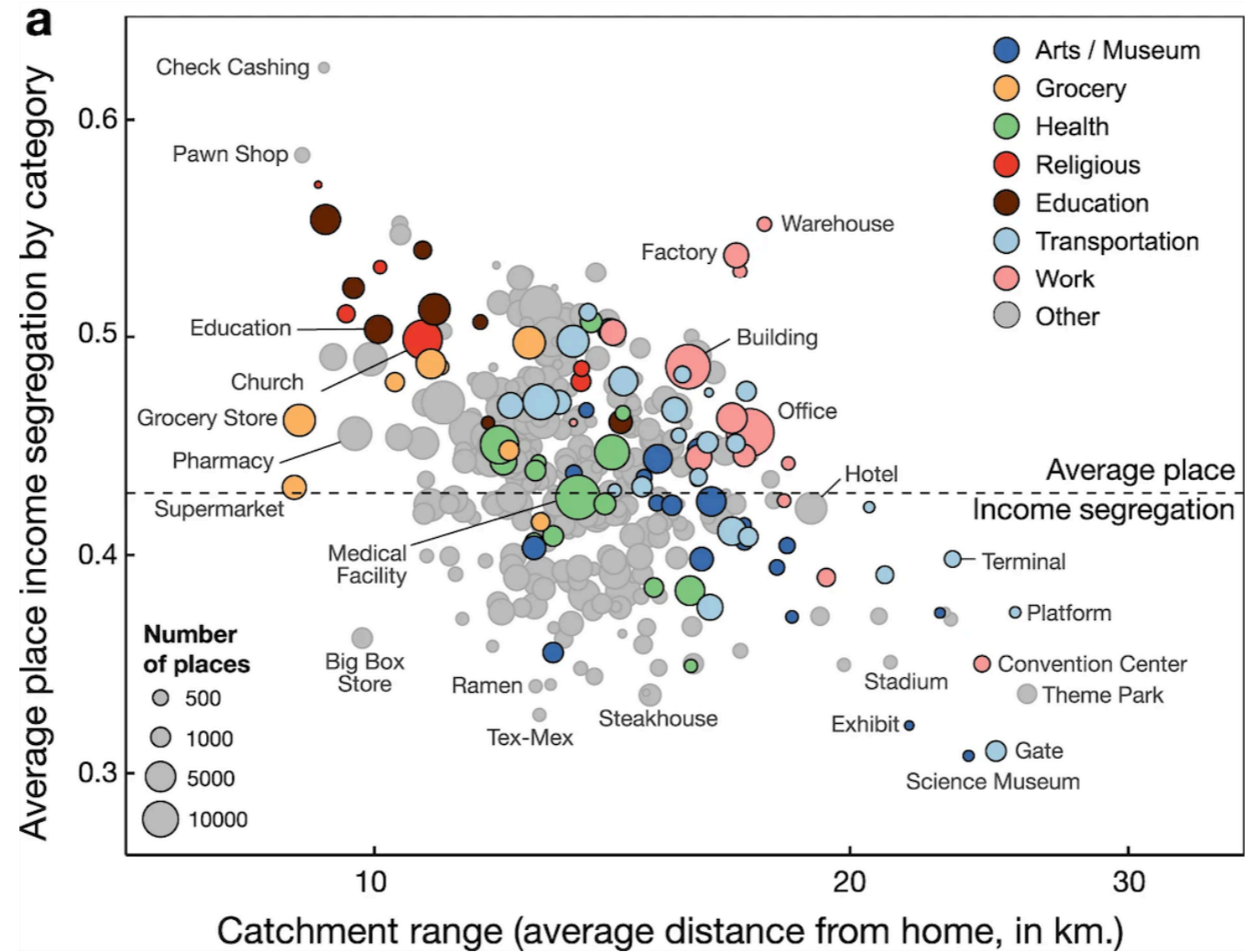
place segregation is determined by category and accessibility
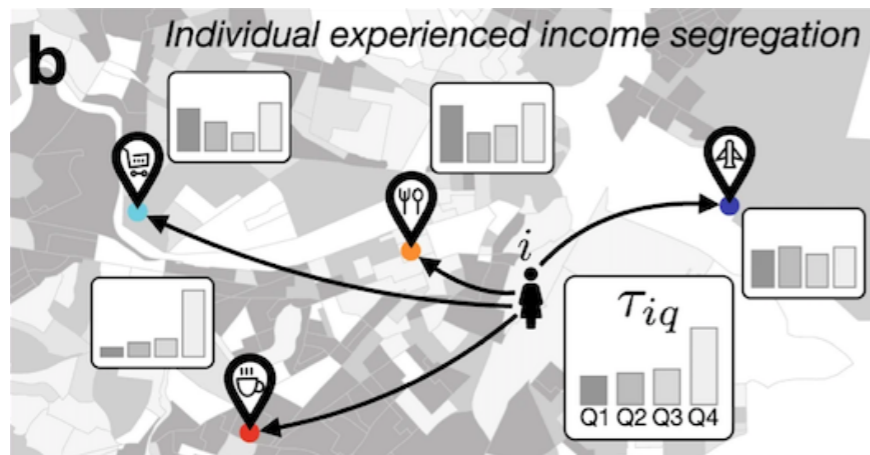
individual segregation is not only determined by residence
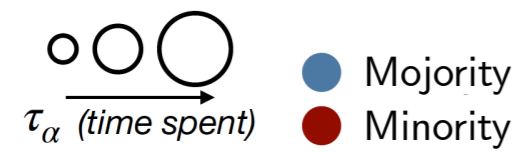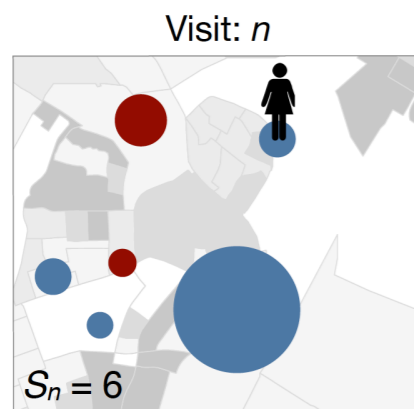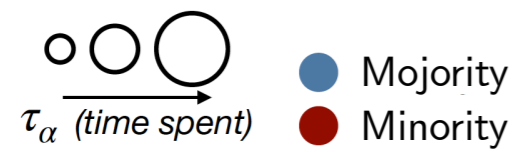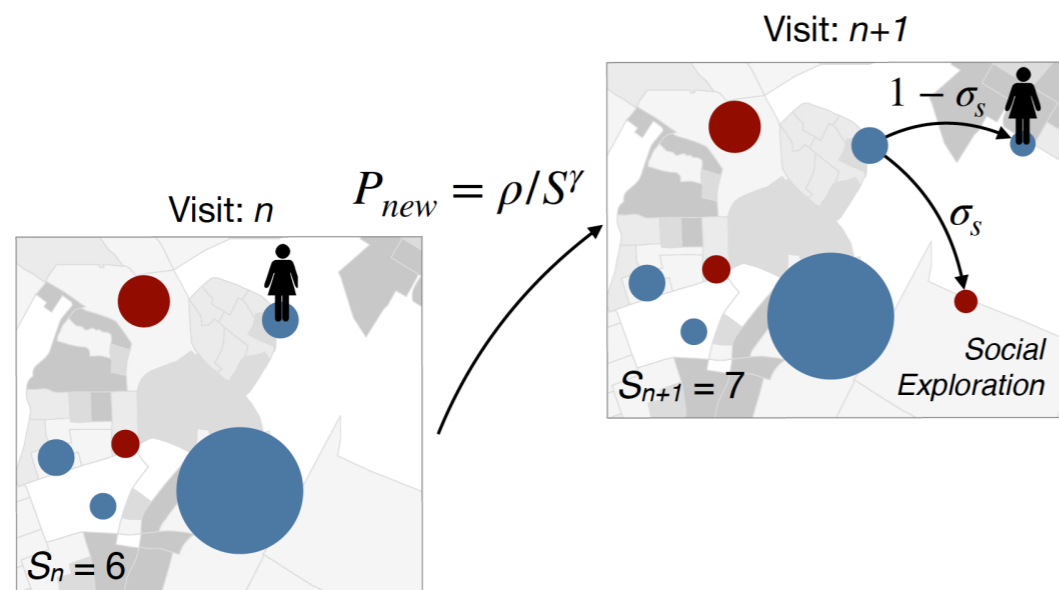
Visit: *n*

$S_n = 6$

τ_α *(time spent)*

● Mojority
● Minority

modelling of segregation dynamics

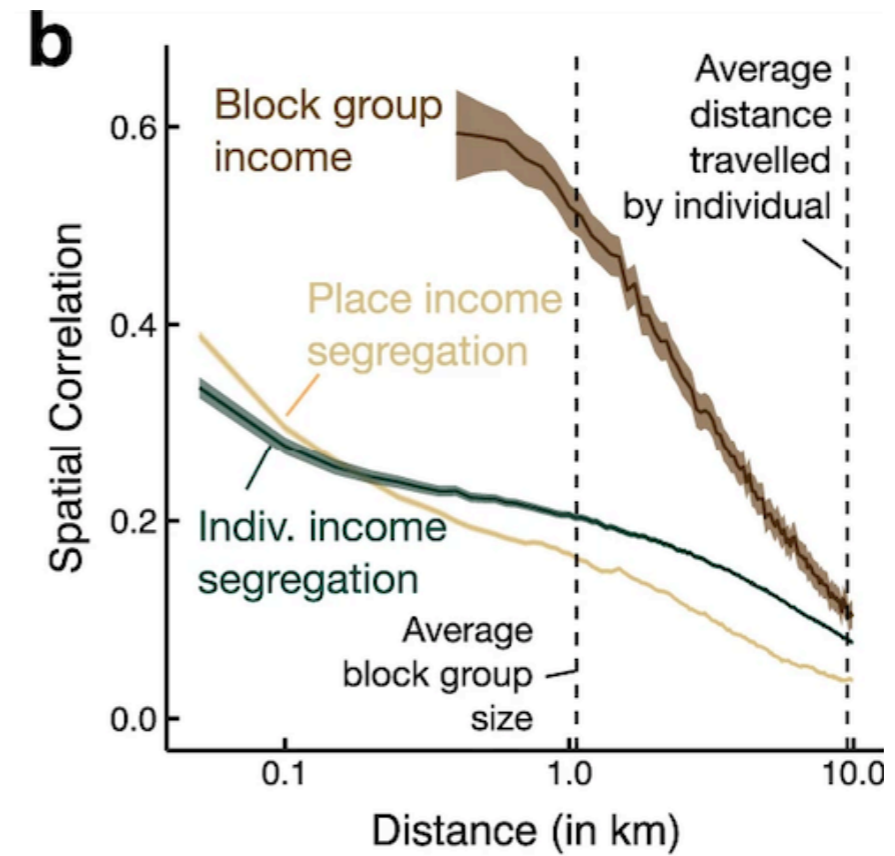Visit: n

$P_{new} = \rho/S^\gamma$

Visit: $n+1$

$1 - \sigma_s$

σ_s

Social
Exploration

$S_{n+1} = 7$

$S_n = 6$

τ_α *(time spent)*

Mojority

Minority

modelling of segregation dynamics
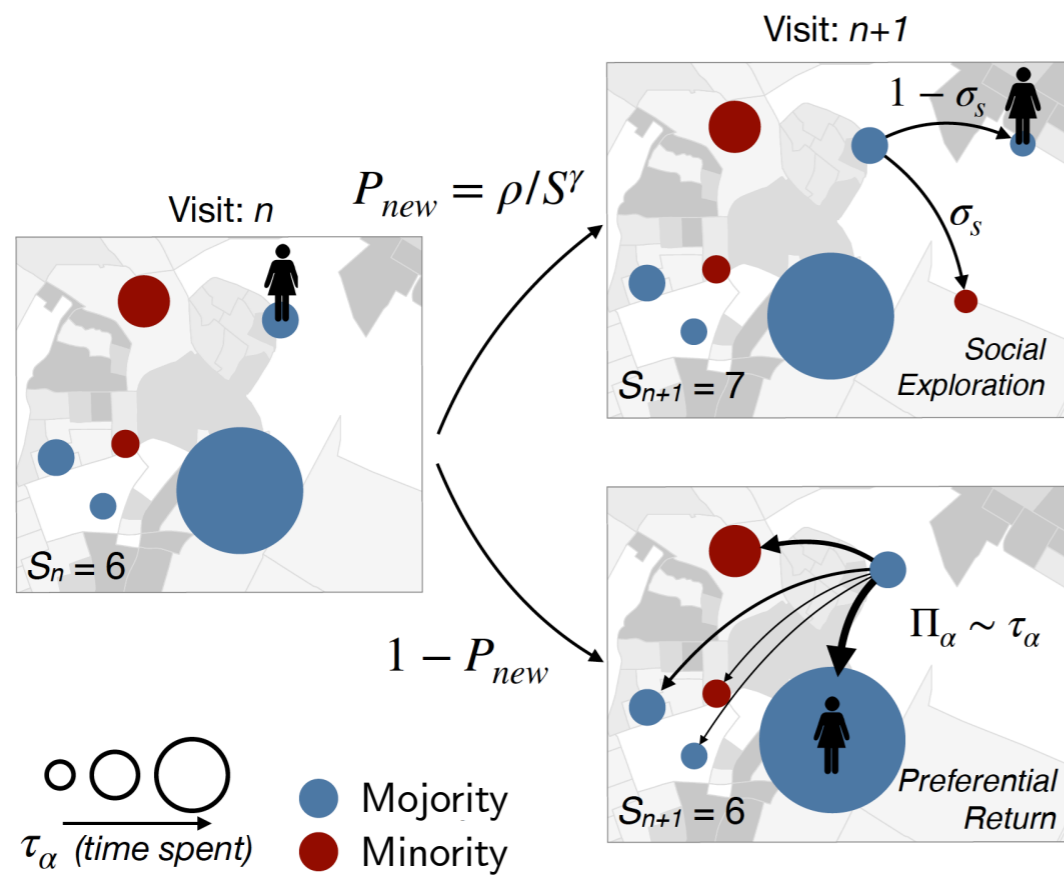
modelling of segregation dynamics

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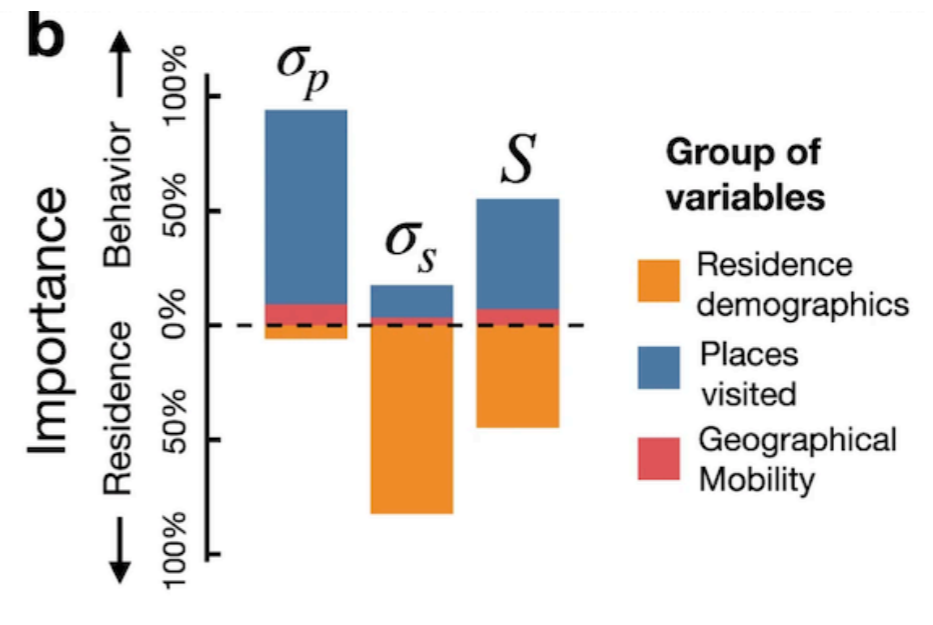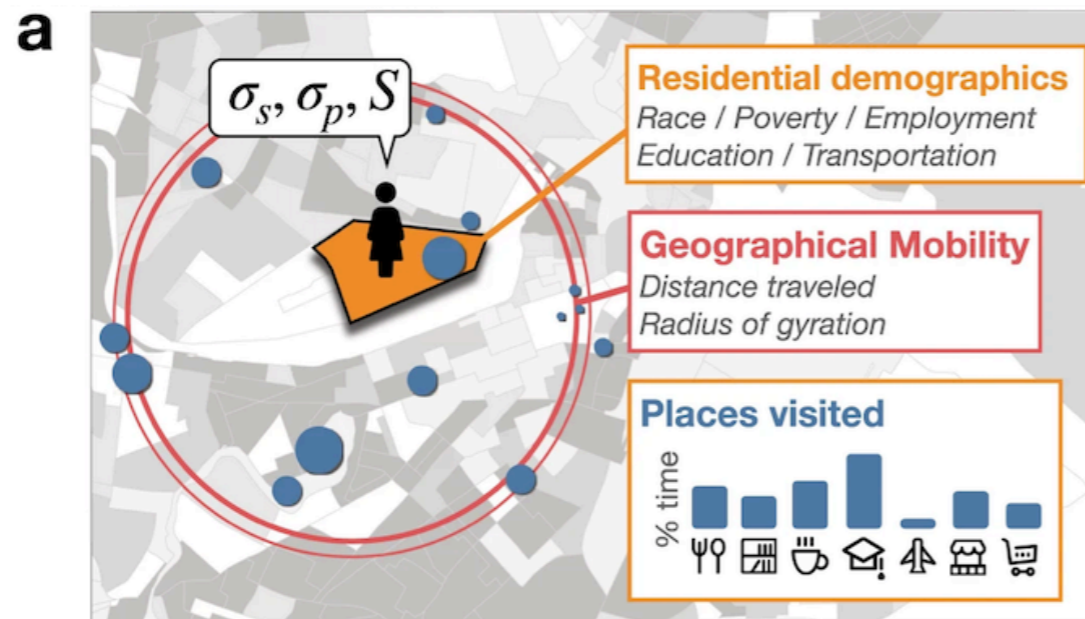
user income segregation = behaviour (55%) + residence (45%)

https://inequality.media.mit.edu
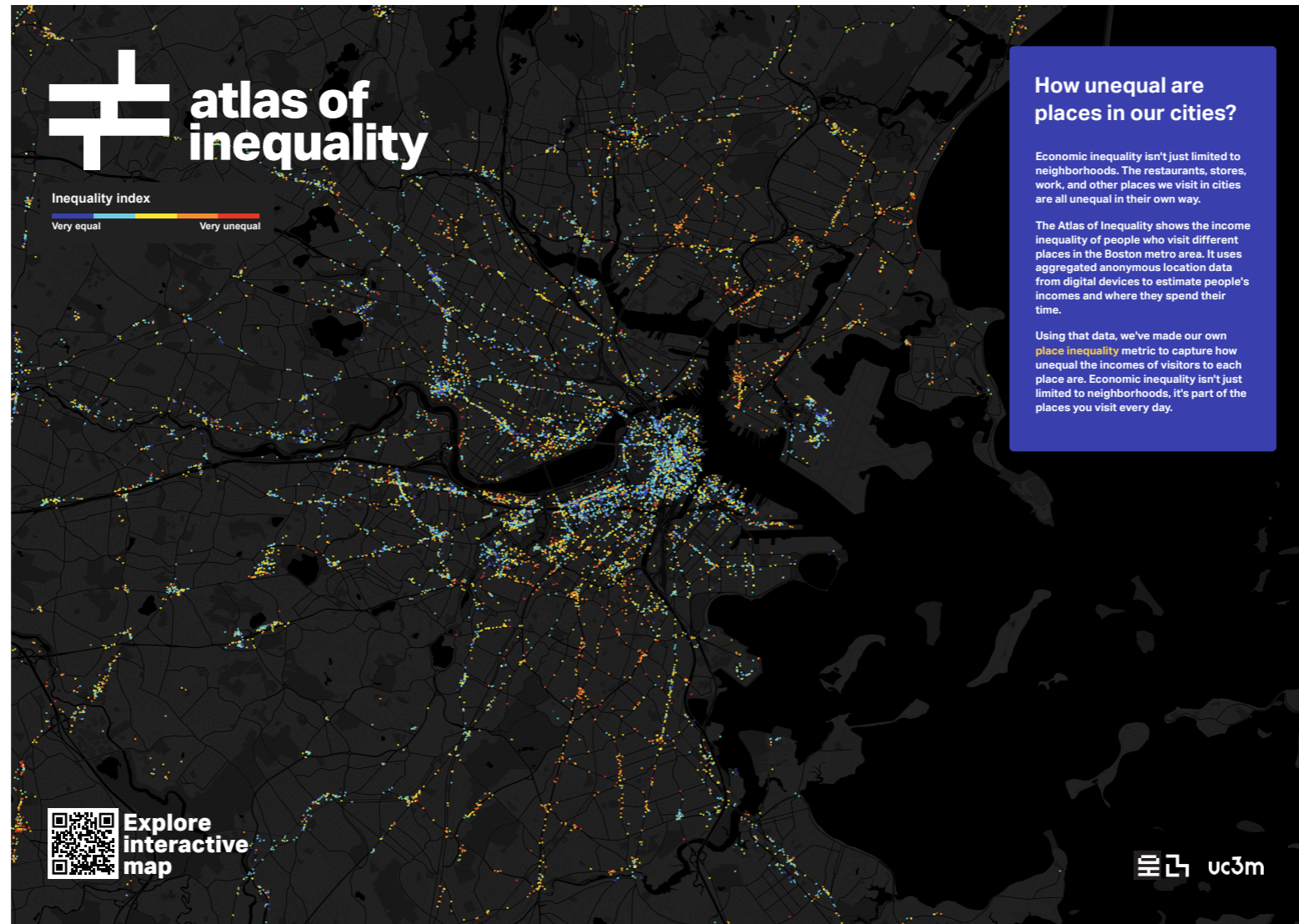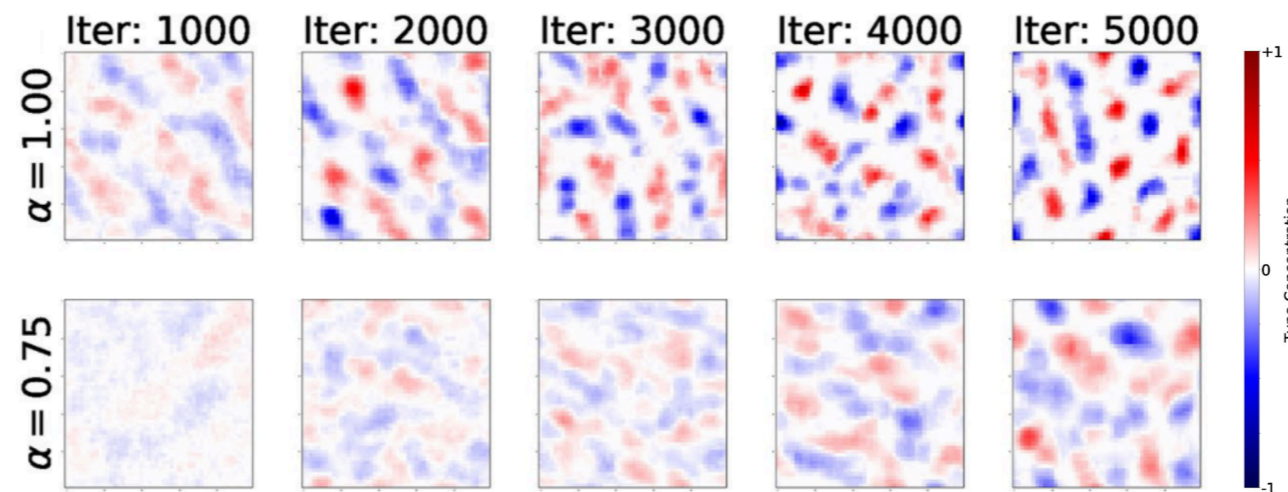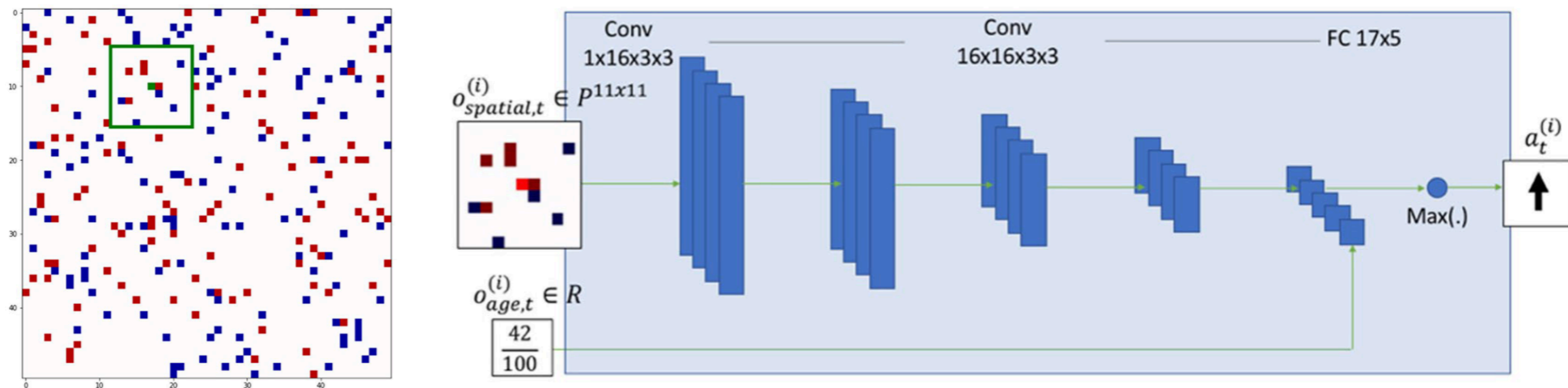
simulation of segregation dynamics

Sert et al., "Segregation dynamicswith reinforcement learningand agent based modeling," Scientific Reports, 2020.

conclusion

- urban segregation studies require understanding beyond residential neighbourhoods

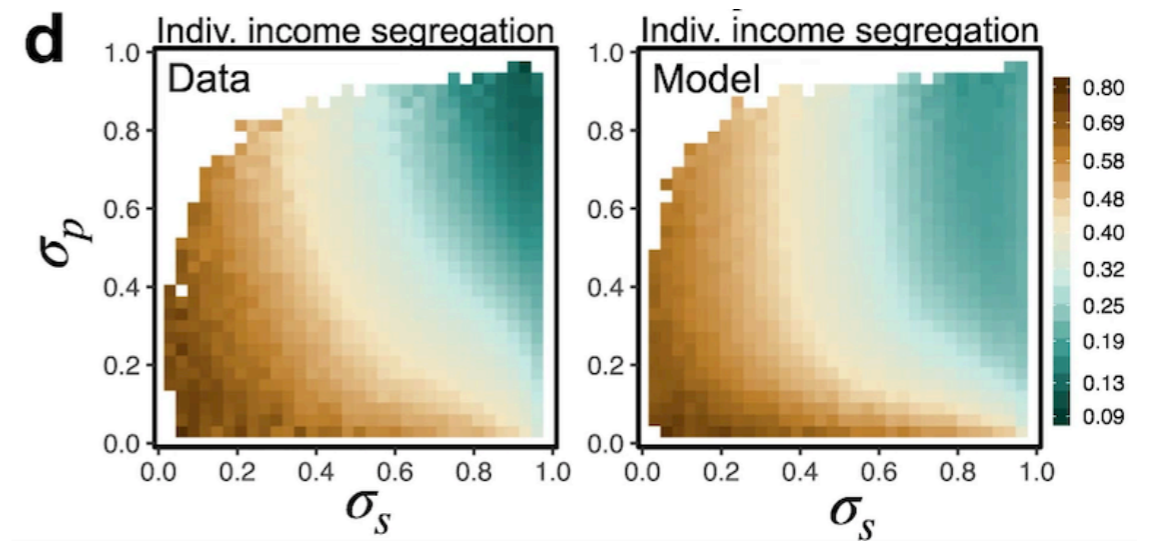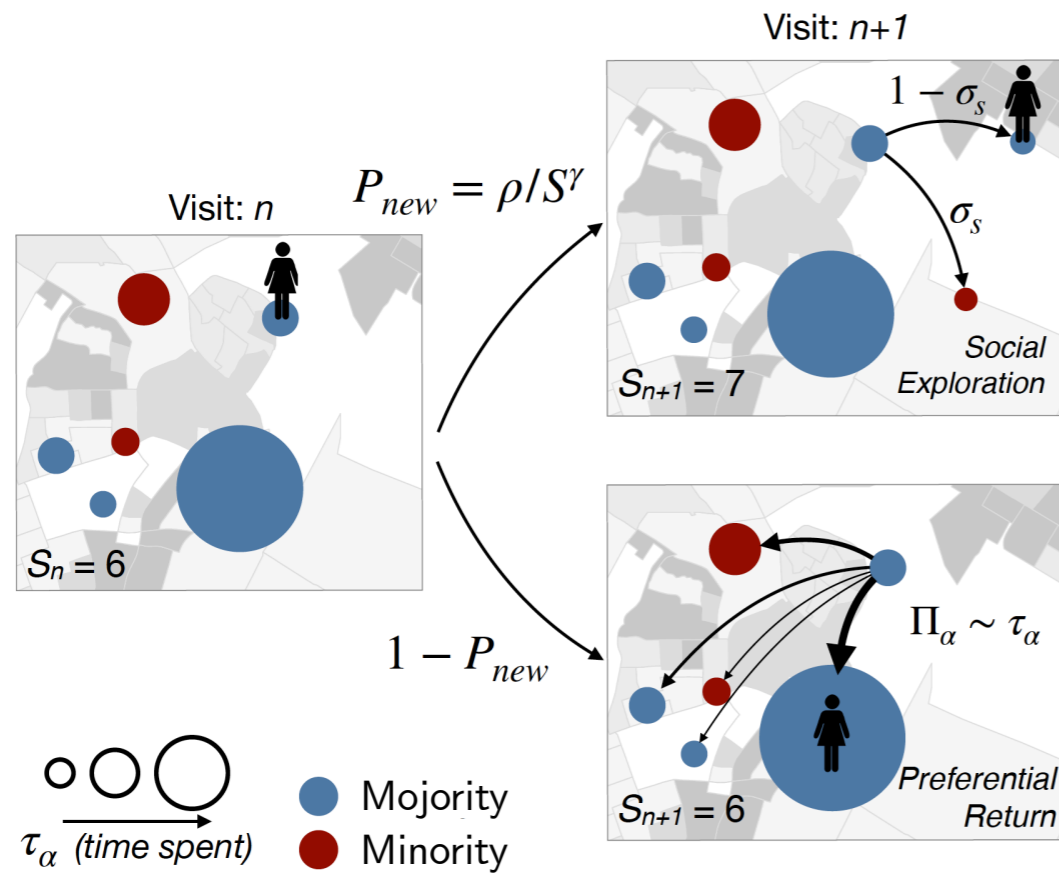- segregation may operate at higher order and micro level

- online space may mirror urban issues such as segregation

- generative modelling and simulation may assist prediction and explanation

references

- Morales et al., "Segregation and polarization in urban areas," Royal Society Open Science, 2019.

- Dong et al., "Segregated interactions in urban and online space," EPJ Data Science, 2020.

- Gardiner and Dong, "Mobility networks for predicting gentrification," Complex Networks, 2020.

- Moro et al., "Mobility patterns are associated with experienced income segregation in large US cities," Nature Communications, 2021.

- Yabe et al., "Behavioral changes during the COVID-19 pandemic decreased income diversity of urban encounters," Nature Communications, 2023.

- Zhang et al., "Predicting polarisation of dynamic social networks via graph auto-encoders," IC2S2, 2023.

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