

# Understanding the impact of residential segregation on the emergence of polarized attitudes towards ethnic minorities

Thomas Feliciani<sup>1</sup>, Andreas Flache<sup>1</sup>, Jochem Tolsma<sup>2</sup>, Michael Mäs<sup>1</sup>

<sup>1</sup> ICS / Department of Sociology, University of Groningen, Groningen, The Netherlands.

<sup>2</sup> ICS / Department of Sociology, Radboud University, Nijmegen, The Netherlands.

Increasing ethnic diversity in western societies raises concerns about effects on the emergence and spread of xenophobic attitudes. Because diversity often entails residential segregation, scholars debate whether and if so, how residential segregation may impact the emergence of xenophobic attitudes.

To investigate this, scholars follow one of two approaches. Some scholars turn to classical theories of intergroup relations: contact theory and ethnic threat theories. Following this tradition, they study the spatial arrangement of individual-level predictors of xenophobic attitudes (like ethnicity, age, or socio-economic status), or of aggregate-level predictors (like the degree of visibility of ethnic minorities)[1–3]. However, the empirical evidence on the effects of segregation on xenophobic attitudes is mixed [1, 2, 4, 5].

In the light of this, other scholars take a step back to the microfoundations of social interactions that may explain the relationship between segregation and xenophobia. Instead of focusing on *predictors* of xenophobic attitudes, these scholars investigate the *processes* of opinion formation that may give rise to such attitudes. By means of formal and computational modeling, they take into account the spatial dimension and how this may affect the opinion dynamics [6]; some also model the spatial distribution of demographic attributes, and how this affects the dynamics [7]. Others model how spatial segregation by demographic attributes affects the opinion dynamics that could generate polarized opinion distributions [8]. However, hitherto this work relied on highly stylized models, limiting the generalizability of results to real-world ethnic segregation.

Our paper follows this latter approach and targets its limitation by decreasing the level of abstraction of these models. We do so by adopting more realistic assumptions about the characteristics of individuals and of their environment, and by calibrating the model on census data of real cities. In doing so, we test the robustness of previous modeling work to the assumption of more realistic populations, explore for the first time which realistic segregation patterns

could be more likely to trigger the emergence of strong xenophobic attitudes, and how this depends on the underlying mechanisms of social influence.

We build on existing agent-based models of social influence to model the emergence of attitudes towards ethnic minorities. Xenophobia can be considered the extreme embodiment of such attitudes: this is the reason why we make use of models of opinion formation which can generate opinion polarization.

Following the line of previous research [8], we focus on two models of opinion polarization, the negative influence model [9–12] and the model of persuasive argument exchange [13, 14]. These have three useful features. First, to generate polarization, they do not need to assume strong initial opinion differences between groups, allowing us to understand how these differences come about in the first place. Second, they define agents' opinion changes as function of the dynamic opinion and static demographic attributes of the other agents in their local environment. In other words, agents in these models are influenced by the opinions and some other demographic attributes of the other agents they interact with. This feature is crucial because static demographic attributes are the ones that we calibrate on census data in order to model realistic spatial patterns of segregation as an exogenous condition. Thirdly, previous research has shown that these two models make competing predictions about the effects of segregation on the emergence of polarized opinions [8].

In short, the negative influence model is grounded in cognitive theories claiming that individuals strive for balanced cognitions [15, 16]. This model assumes that agents, while interacting, may average their opinion (positive influence), or increase their opinion difference (negative influence). The direction and the strength of the positive or negative influence are determined by similarity in opinion and demographic attributes that the interacting agents have: stronger similarity results in stronger positive influence, whereas stronger dissimilarity results in stronger negative influence. The negative influence model predicts that segregation reduces opinion polarization – it also predicts that segregation strengthens the alignment of opinions and demographic attributes. This means that individuals with the same group identity have much higher chances to develop a similar opinion, opposite to the opinion of the out-group.

The persuasive argument model, on the other hand, is based on the homophily principle and the so called argument-communication theory of bi-polarization [17, 18]. It assumes that

agents are more likely to interact with alters with whom they have a stronger demographic similarity. Then, if the interacting agents happen to share a similar opinion, too, they will provide each other with new arguments in support of their initial tendency. Over time, these reinforcing interactions lead them to shift towards the extreme end of the opinion scale. According to previous research based on a novel implementation of this principle, the persuasive argument model predicts that segregation has a very mildly negative effect on polarization, and that group identity and opinion tend to be aligned only in local neighborhoods.

So far, the predictions of the two models were tested in very abstract settings: for instance, agents' demographic attributes were limited to only a single dichotomous attribute. Moreover, agents were spatially segregated by means of a Schelling-like segregation procedure. This implies a number of unrealistic assumptions, like that the population density across the map is constant, and that the spatial clusters generated are internally demographically homogenous. Lastly, the population size adopted in previous studies was insufficient for generating realistic geographical distribution of demographic attributes.

With this work we move beyond all these limitations, aligning the models of negative influence and persuasive argument exchange in a more realistic setting. We calibrate the models by using fine-grained geo-coded census data provided by Statistics Netherlands. This data informs the model on agents' demographic attributes which play a key role on the development of xenophobic attitudes (i.e. ethnicity, age, income). We focus on different Dutch cities, which provide a high variety of segregation patterns. With this data, we generate a synthetic environment that imitates, on a fine-grained scale, the population density and spatial distribution of different demographic attributes of the inhabitants of these cities.

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