Schelling models of Immigration: Parameters and Sensitivities

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The Schelling model of racial segregation has made a vital contribution to our understanding of how ethnic segregation can occur even if residents of a neighbourhood are not particularly segregationists. Since its introduction in 1971[Schelling, 1971] the model has become widely used in the field of immigration research as a means to determine the various circumstances that foster or curtail segregation behaviour. Building on previous iterations of the Schelling model by [Hatna and Benenson, 2015] and the findings of [Collier, 2014], I have previously introduced the physical migration of new agents onto the existing grid[Urselmans, 2016]. Migrants are agents that are not previously present in the Schelling model. The aim of this adaptation is to model immigration as an external shock to the existing system, rather than treat it as an initial state. The findings indicate that short-term effects of the rate and size migration weigh heavily on agent happiness and segregation behaviour, but that in the long run, population density is the most crucial determinant in model outcomes.

This paper builds on these findings and introduces a larger number and range of parameters to test the impact of external migration. Particular attention is paid to the geographic determinants of incoming migration: how does the initial placement of newcomers alter the short- and longterm behaviours of both migrant and 'native' agents? The rate and size of migrant influxes is expanded to see whether the model exhibits tipping behaviours that change model outcomes once certain migration rates are reached. This paper is part of an ongoing project combining external migration and segregation behaviour in Schelling models in an effort to understand migration as a demographic change within an existing system.

Figure 1 demonstrates the immigration mechanism. The cyan-coloured tiles are the tiles that will be populated by migrants in the future. The now-placed migrants (dark blue) have settled. The existing migrants exert an appeal to future migrants, and thus, their neighbouring tiles are a darker shade of grey. In the following migration wave, the cyan-coloured tiles start off by surrounding existing migrants, but the cyan tiles exert an appeal themselves, so that the future settlement will always prefer a cluster when possible. Randomised elements prevent a perfect sphere and provide a more natural clustering. After the first settlement, several migrants have moved from the cluster. Their appeal rating is visible around each of them. By the time the second migration wave occurs, the cluster has completely dissolved and existing agents are randomly scattered throughout the map. The incoming migrants now arrive in smaller, dispersed clusters. The influx mechanism (cyan tiles) seeks out the most populated areas and will try to form clusters nearby.
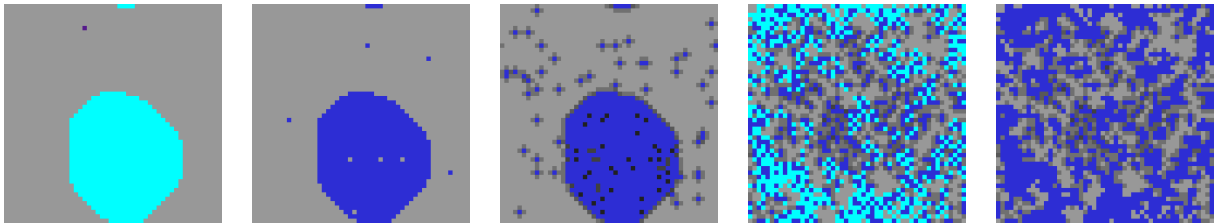
(a) An empty map is populated over time. Agents move around randomly.
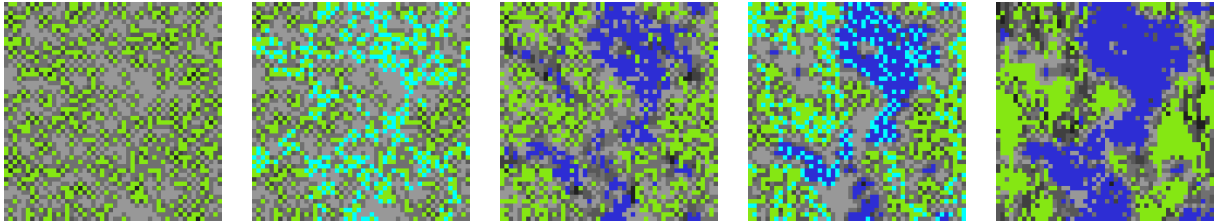
(b) An already-populated (30%) map is populated so that the density reaches 80%.

Figure 1: Screen captures of the influx mechanism in progress. The darker the shade of grey of an empty tile, the higher its appeal rating. Migrants are blue, Natives are green.

The second row demonstrates the influx mechanism with existing agents, the 'natives' (green-coloured tiles). The natives exert the same appeal to future migrants as existing migrants would do. This is deliberate; as there may not be existing diasporas when migrants arrive; diasporas might be too small and thirdly, not all migrants will automatically seek out 'their kind' . The first migration wave will form the same snaky clusters. In this particular instance, both groups favour large majorities for themselves and segregation occurs quickly. The newly arriving migrants are usually placed in the empty space between the two groups, and will quickly move away and increase the size of each respective cluster.

It is common to evaluate agent-based models on their final-state outcomes or equilibria (if they exist). From the perspective of policy makers on immigration, this approach is of limited value. Due to the speed and frequency of policy and election cycles, the intermediate patterns of this Schelling model are of particular interest. This paper aims to contribute to our understanding of how immigration affects segregation patterns and tolerance levels among both the native population and the migrant communities.

References

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