

ADDING MIGRATION TO A MODEL OF INTER-ETHNIC MARRIAGE

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Abstract. This paper reports on preliminary results obtained with an agent-based model of inter-ethnic marriage incorporating empirical data on migration flows. Migration has been a main driver of increased ethnic diversity and opportunities for inter-ethnic contact and partnership formation in the UK. However, the few existing models of inter-ethnic marriage tend to ignore migration and apply the processes underlying partner choice to a static population of individuals. We demonstrate that particularly in highly diverse areas where population composition is substantially shaped by international and internal migration, these migratory flows have to be taken into account, thus resulting in modelling a dynamic population.

Introduction

Rates of inter-ethnic partnerships, where individuals marry outside of their own ethnic group, are generally seen as an important gauge and consequence of the long-term effects of migration and group relations [1] [5] [6] [10] [11]. Investigations of the decision-making process in choosing an out-group mate tend to see exogamous partnering as stemming from considerations that go beyond those theorised by traditional approaches, which tend to focus on personal preferences and opportunities for contact.

In approaches focussing on personal preferences, assortative mating [3] emphasises the importance of similarity in traits between partners for driving mate choice, especially with regard to age, class, attractiveness, ethnicity, and education. Exchange theory [7][8], on the other hand, asserts that, at least on the part of migrants and minorities, a specific trade-off exists between preferences in socioeconomic status and ethnicity when choosing a mate. With regard to opportunities for (out-)group contact, many have emphasised the importance of structural factors such as the level of ethnic diversity and the sheer size of ethnic groups in influencing inter-ethnic partnership formation [1][2]. These not only influence partnership formation per se, but also the characteristics of the social networks through which individuals encounter potential mates, which tend to have high levels of homophily [12].

A main driver of increased ethnic diversity and opportunities for inter-ethnic contact and partnership formation in the UK in recent years has been migration [15][16]. Yet, existing empirically-driven models of (inter-ethnic) partnership formation have tended to ignore such migratory flows, focusing instead on the processes underlying partner choice and applying those to a static population of individuals. They usually regard a cohort of agents who are of the same age group (e.g. [19] [13]) or even all of the same age [9] at the beginning of the simulation. This cohort then ages over the course of the simulation while searching for possible mates and forming partnerships. The simulated time span of the different models ranges from 5 years [19][4] to 10 years [13], i.e. an inter-census period, to 70 years [9], i.e. the life span of the simulated agents, with population sizes varying from a few hundred [9] to tens of thousands [19].

None of these models take into account that real populations are changing over time, which may have an important impact on rates of inter-ethnic partnership formation via increased diversity and opportunities for contact. Whilst it can be argued that births and deaths are less relevant in models that focus on the age group of young adults (18-30), international and internal migration contribute to the pool of potential partners to a non-negligible extent, in particular in highly diverse urban areas like London.

In this paper, we incorporate migration flows derived from the 2001 Census for England and Wales into an existing agent-based model of inter-ethnic partnership to assess the impact that diverse population movements have on rates of inter-ethnic partnerships.

Model Description

We extend the agent-based DITCH model (“Diversity and Inter-Ethnic Marriage: Trust, Culture and Homophily”), whose source-code is available from openABM [14], to include migration based on empirical data. Both the original and the extended version of the model are implemented in NetLogo. DITCH regards a population of single agents characterized by five traits (age, gender, ethnicity, education, which are determined from empirical data derived from the 2001 UK Census, and a random-normally distributed compatibility score). Population size and proportions of ethnicities are model parameters; the latter depending on the particular Local Authority District (LAD) chosen as a scenario.

Agents have preferences regarding the traits they seek in a potential partner. As a general rule, these are driven by homophily (similar age, same or similar education level, higher preference for own ethnicity, similar compatibility score) or, in the case of gender, assume that opposites attract, resulting in a strictly heterosexual population for simplicity’s sake. To search for partners, agents employ their social network. This is initialized to contain both same-ethnic links across ages (family, neighbours) and cross-ethnic links with agents of similar age (school/university friends) and evolves during the simulation with agents forming new links (mostly with similar friends of friends) and occasionally dropping existing links.

DITCH version 2 incorporates migration into the model, which results in a dynamic population. Both immigration and emigration rates are derived from the Census 2001 on the level of LADs for each ethnic group [18]. Migration rates are given as a proportion of the respective ethnic group per year. To spread migration across the year during the simulation, the model calculates the total numbers of new agents arriving / old agents leaving per ethnic group at the beginning of a year and then distributes these numbers over the ticks per year (stored in global variables *arriving* and *leaving*, with one entry per tick and ethnic group).

Each tick, according to the number in *leaving*, agents from each ethnic group are picked randomly to leave the model. This deletes all their links. If any of those agents is married, the spouse is selected to leave as well and will take the place of one of the leaving agents of the spouse’s ethnicity. If this is not possible (no other agents of this ethnicity are supposed to leave at this tick), the future numbers in *leaving* are adjusted accordingly. After out-migration is finished, in-migration takes place by creating new agents for each ethnic group according to the number in *arriving*. These agents are treated just like agents created at the beginning of the simulation in that they follow the same rules for initialization of traits, preferences and social network links.

Preliminary Results

We present some preliminary results obtained with the extended model and compare it to results obtained with the original model. All results are based on runs using population proportions derived from sample areas representing different typologies of ethnic diversity within local authorities in England & Wales in 2001. As described in [13], four types of LAD are distinguished based on the proportion of the White British majority (‘homogeneity’) and the number of ethnic groups (‘fragmentation’): *super-diverse* (low homogeneity, high fragmentation; represented by the London borough of Newham), *cosmopolitan* (high homogeneity, high fragmentation; Trafford), *bifurcated* (low homogeneity, low fragmentation; Bradford) and *parochial* (high homogeneity, low fragmentation; Chester). For each scenario, the parameter *love-radar* (the range agents use to search their social network for potential partners) was varied from 1 to 3, with ten runs performed for each of the values, resulting in 30 runs per scenario. Each run had a length of 10 years (120 ticks) and an initial population of 1000 agents.

Figure 1 shows the results for the original model; figure 2 the results for our extended version, measured against 2011 rates of inter-ethnic partnership. As is clearly visible in figure 1, the original model is already quite well attuned to the scenarios with low homogeneity (left column), while underestimating the actual inter-ethnic marriage rate in the scenarios with a high homogeneity (right column). At first glance, the same holds true for the extended model (see figure 2), whose results for the scenarios with high homogeneity seem to match those of the original model. This is due to those areas having much smaller migration flows than the more ethnically diverse areas Bradford and Newham; their populations being thus hardly influenced by people moving to and from the area. This could be a consequence of the small population size, or could also indicate that other processes may be at play when choosing to marry an out-group member in more homogenous areas.

In the more diverse areas, on the other hand, migration has a marked influence, visible in the much broader range and the higher over-estimation of model-predicted inter-ethnic marriage rates.

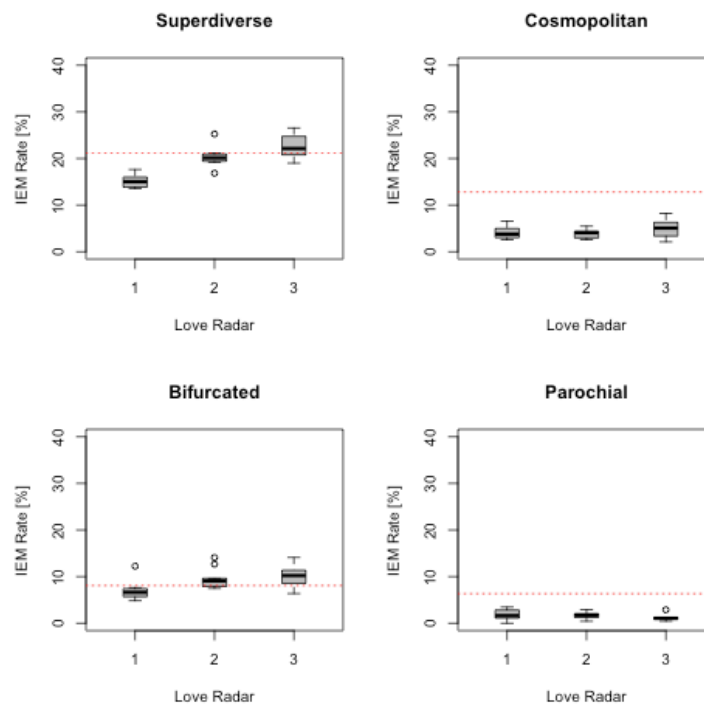


Figure 1: Proportion of interethnic marriages in the four different scenarios (original model). Three different values for the parameter ‘love radar’ are explored. The dotted line indicates the 2011 Census figure for the given scenario.

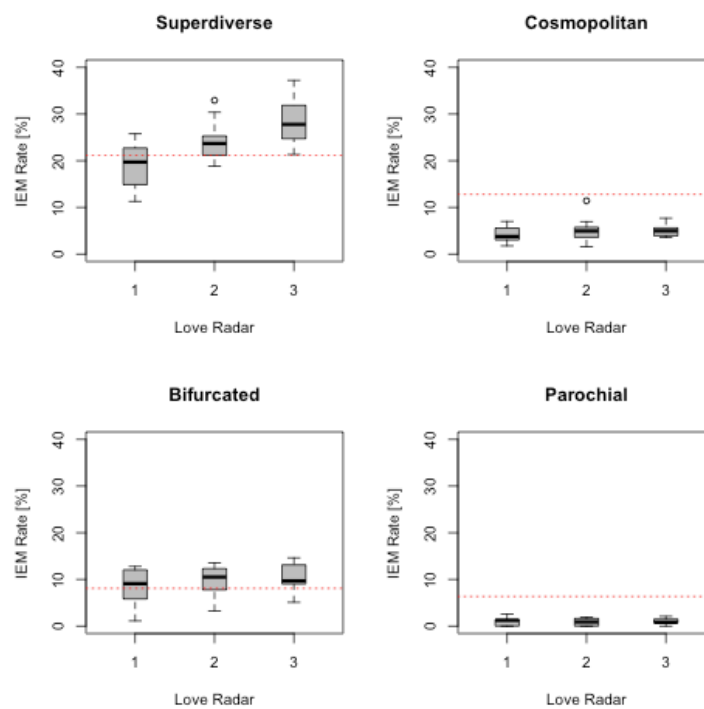


Figure 2: Interethnic marriage rates for the four different scenarios obtained with the extended model (including migration). As before, three different values for the parameter ‘love radar’ are explored.

Conclusion and Outlook

The preliminary results from our extended model demonstrate that migration – and thus a population changing over time – can play a vital role in the formation of inter-ethnic partnerships. When inflow and outflow rates for the different ethnic groups exceed a certain threshold, the impact of migration on the composition of the population cannot be neglected in a model of inter-ethnic marriage. Even though first attempts at validation indicate that applying the migration rates obtained from the 2001 Census as constant over the whole simulation period does not comply with the situation in reality, incorporating migration into an empirically-driven agent-based model of inter-ethnic marriage is a step in the right direction.

As updated data on migration flows per ethnic group on the level of the Local Authorities in the UK have just become available [17], we will adapt our model to allow for changing migration rates and repeat the simulations reported here.

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