

Modelling school catchments for segregation studies

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1. Introduction

A number of recent publications by members of the Centre For Market And Public Organisation (CMPO) have shown that some of the UK's 'non-white' ethnic groups – notably those with Indian, Pakistani and Bangladeshi backgrounds – are spatially clustered in particular locations, suggesting processes of residential segregation (Johnston et al., 2002a, 2002b). These ethnic groups are also shown to be concentrated in certain schools (Burgess and Wilson, 2005; Burgess et al., 2005; Johnston et al., 2004, 2005), with ethnic separations across schools being at least as great as that across neighbourhoods (Johnston et al., 2007).

Empirical evidence such as these led Trevor Phillips, Chair of the (British) Commission for Racial Equality to warn in a speech (Phillips, 2005) that Britain is 'sleepwalking to segregation': "[there are some] white communities so fixated by the belief that their every ill is caused by their Asian neighbours that they withdraw their children wholesale from local schools." He later continued that, "the passion being spent on arguments about whether we need more or fewer faith schools is, in my view, misspent. We really need to worry about whether we are heading for USA-style semi-voluntary segregation in the mainstream system."

In fact, the evidence that Phillips cited is not longitudinal and therefore cannot support a notion that segregation is becoming more pronounced in the UK (a more longitudinal study is an area of on-going research within CMPO). Nevertheless, there is still a concern that the sorts of choice offered within a state-subsided education market (as suggested by the UK Government's recent White Paper, subtitled 'More choice for parents and pupils': HM Government, 2005), might lead to the sort of conclusion that Renzulli and Evans (2005, p.413) do in regard to quasi-autonomous but state-funded charter schools within the US: "charter schools provide a public school option for white flight without the drawbacks of residential mobility."

Two problems in assessing whether an element of (constrained) choice leads to increased segregation vis-à-vis neighbourhoods in the UK are, first, that the causal process is hard to prove and, secondly, the more geographical problem of how to make the comparison: specifically, which school to compare with where. Papers such as Harris et al. (forthcoming) compare characteristics of schools against measures of the ethnic

composition of neighbourhoods in which the pupils reside. So, the ethnic composition of a school is compared against the ethnic composition of the census zones containing one or more of the school's pupils. Alternatively, the composition of the school could be compared against the composition of some geographical zone (e.g. electoral ward), within which the school is situated. The issue is whether the two are really comparable: if the school is a magnet, do the definitions of neighbourhood really reflect the areas from which pupils are attracted? If not, then how might this 'mismatch' impact on measures that suggest fairly subtle increases in ethnic segregation from neighbourhoods to schools?

In this paper we focus on the geographical problem of defining the catchment areas of state funded schools and using these to consider segregation. Our study region is Birmingham: England's 'second city', with a population of 977,087 residents (390,792 households) recorded in the 2001 Census. It has been chosen as the study region because, as the local government website states, 'the Census confirms Birmingham as a diverse City, with residents from a wide range of ethnic and religious backgrounds' (www.birmingham.gov.uk). Although schools do not have fixed catchments, and parents can express a preference as to which school their child attends, ultimately each school has only a certain number of places available and, if oversubscribed, will operate selection criteria (for example, offering places to siblings and giving priority to those who live closest). Faith schools – those supported by religious groups – may also adopt selective practices as, of course, do single gender schools. The admissions criteria for each (non-private) secondary school in Birmingham are documented at www.bgfl.org/services/admissions.

Our argument is that the 'core catchment' areas of schools are knowable simply by looking at the geographical patterns of addresses of those attending the schools. The addresses are available to us from the Pupil Level Annual School Census returns (PLASC), released for research by the Department for Education and Skills (DfES). The PLASC data also contain the ethnicity of each student – recorded by staff at the pupil's enrolment but open to parental alteration.

2. Modelling school catchments

2.1 Definition

Here a 'core catchment' is defined as the area containing 50% of the pupils attending the school, the delimitation of which reflects the geography of the study region and the locations from which the school draws its pupils. There is no assumption that the school is at the centre or even necessarily within its core catchment area.

2.1 How is the core catchment delimited?

There is an infinite number of ways of delimiting a school catchment area. The starting point used here is knowledge of the (x, y) postcode grid reference for each of the pupils attending a school, permitting the median x and the median y point per school to be determined. Conceptually, a small rectangle is then positioned at the median centre and

then allowed to grow-out at each iteration of the algorithm in either of the N, NE, E, SE, S, SW, W or NW directions, continuing until it contains 50% (or other) of the pupils. The direction of growth at each iteration is decided by the maximum gain – the direction returning the highest ratio of pupils per unit area grown. This implies two criteria for the catchments: that they be compact but also that they reflect the actual geographies of the schools' recruitments. The algorithm is implemented in the statistical/computing language 'R', finally using its 'chull' function to compute the convex hull of the set of points defining each school catchment for the purpose of visualizing their area boundaries.

3. Preliminary results

Figure 1 shows (shaded) the modelled core catchment for one secondary school in Birmingham and also (not shaded) the thirteen other secondary schools with catchments overlapping the first. It is evident that there is already considerable movement (implying choice) within the school system (Harris et al., forthcoming, suggests that in 2002 only 25% of pupils attended their nearest secondary school in Birmingham; see also Parsons et al., 2000). Unsurprisingly, for all state-funded secondary schools in Birmingham, the ten with the largest catchment areas are in some way selective (by gender or by faith) – Table 1.

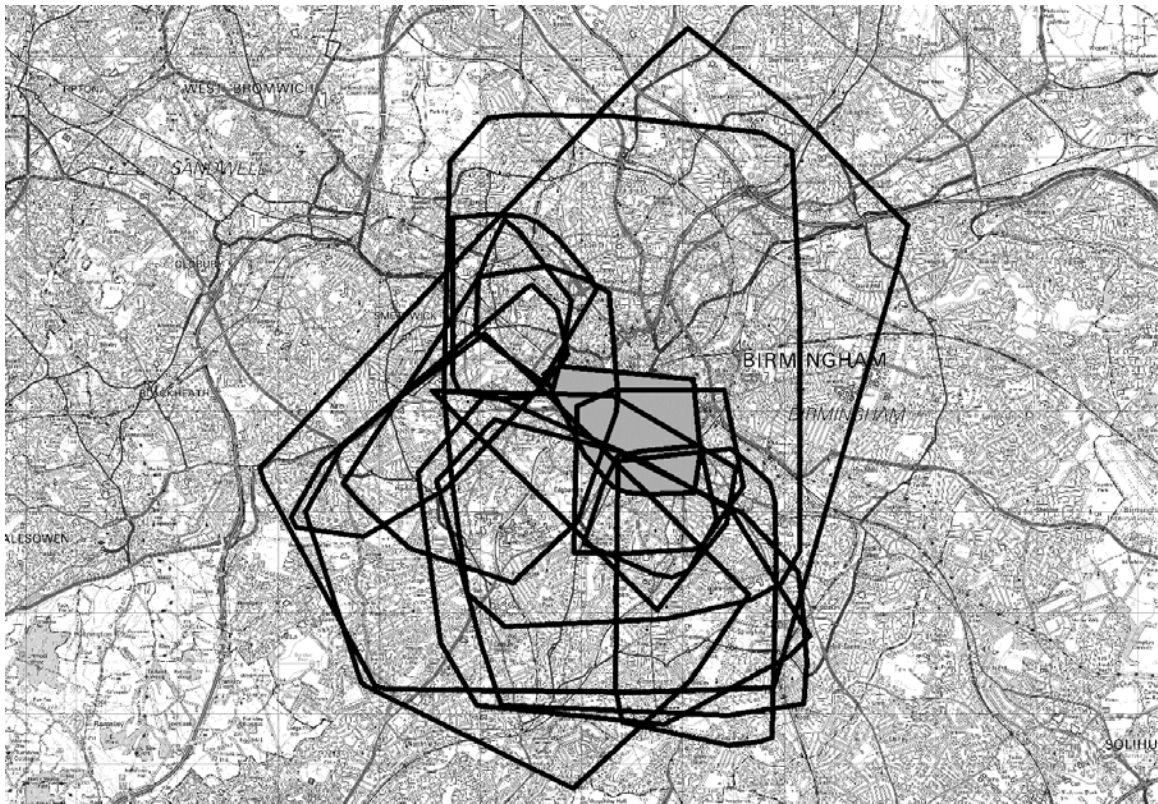


Figure 1. The core catchment area of a comprehensive school in Birmingham (shaded) and the catchments of thirteen other schools that overlap the first.

Type of school		Gender	Faith	Admissions policy
Voluntary aided	Secondary	Girls	Christian	Selective
Voluntary aided	Secondary	Girls	Roman Catholic	Comprehensive
Voluntary aided	Secondary	Mixed	Christian	Selective
Community	Secondary	Girls	Does Not Apply	Selective
Voluntary aided	Secondary	Boys	None	Selective
Voluntary aided	Secondary	Girls	Christian	Selective
Voluntary aided	Secondary	Boys	Christian	Selective
Voluntary aided	Secondary	Boys	Christian	Selective
Voluntary aided	Secondary	Boys	None	Selective
Voluntary aided	Secondary	Mixed	Roman Catholic	Comprehensive

Table 1. Some characteristics of the ten schools with the largest core catchment areas in Birmingham

3.1 Comparing the ethnic composition of catchment areas and schools

Having defined the core catchment areas of schools it is possible to use the PLASC data to calculate (a) the proportion of *all* pupils living within a catchment who are of a particular ethnic group, and then (b) compare it with the proportion when calculated for only those pupils within the catchment who attend the school. The result of (a) defines an expected proportion of an ethnic group to be found within a school, whilst the result of (b) defines the observed proportion. Comparing the two permits a direct answer to the question ‘does the ethnic composition of a school reflect the ethnic composition of the neighborhoods from which it draws pupils?’

For the 78 Birmingham secondary schools, the expected and observed proportions of white pupils are similar, although there are clearly schools attracting more white pupils than expected – Figure 2. There are also schools attracting more Pakistani pupils than expected – Figure 3.

4. Conclusions

In this short paper we have not considered why it is that any ethnic group may seek to educate their children in schools where that ethnic group is well represented; we have not modelled any aspects of the schools (such as their size, GCSE performance, curricula, etc.) which might explain any apparent processes of segregation; and nor have we considered any characteristics of the pupils themselves (e.g. their levels of material or social advantage) – other than their residential location. (See, instead, the reference list for examples of more explanatory modelling).

Here we have been focused on the more technical but geographical question of defining the core catchments of schools, enabling us to see whether the populations of schools reflect the populations of the areas from which they draw pupils, or whether there might be an ‘ethnic dimension’ to who attends where. The research is, at this stage, incomplete: we have not, for example, offered a sensitivity analysis to consider the effect of changing

the definition of core catchments from the 50% of pupils threshold. Nevertheless, it hopefully still gives a flavour of the benefit of using explicitly spatial analyses informed by geocomputational thinking to inform substantive areas of policy-relevant debate.

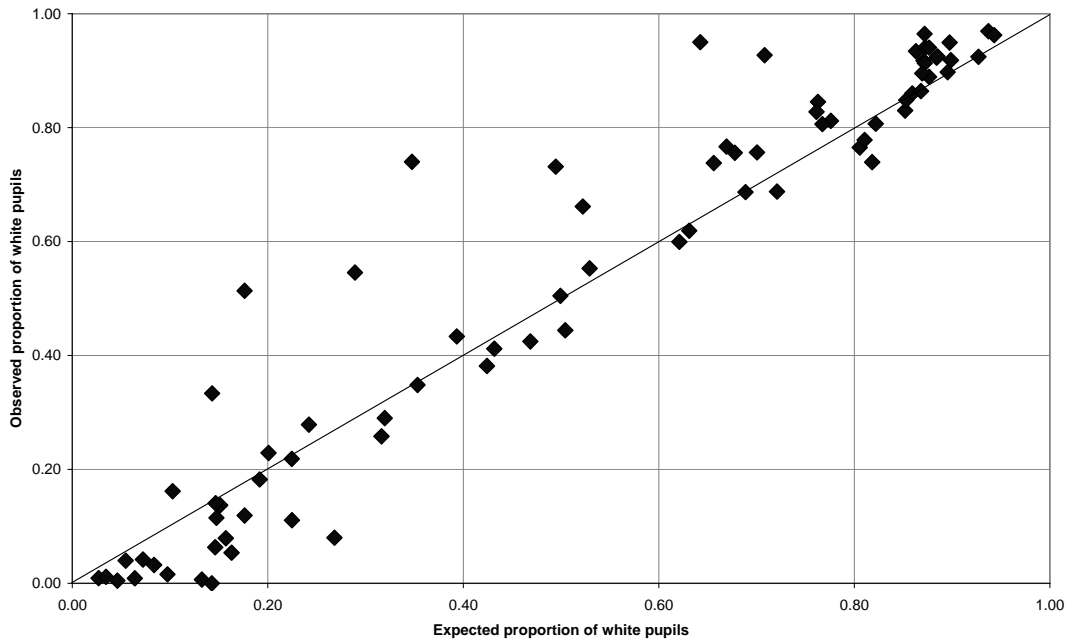


Figure 2. Expected and observed proportions of white pupils for the core catchments of Birmingham schools.

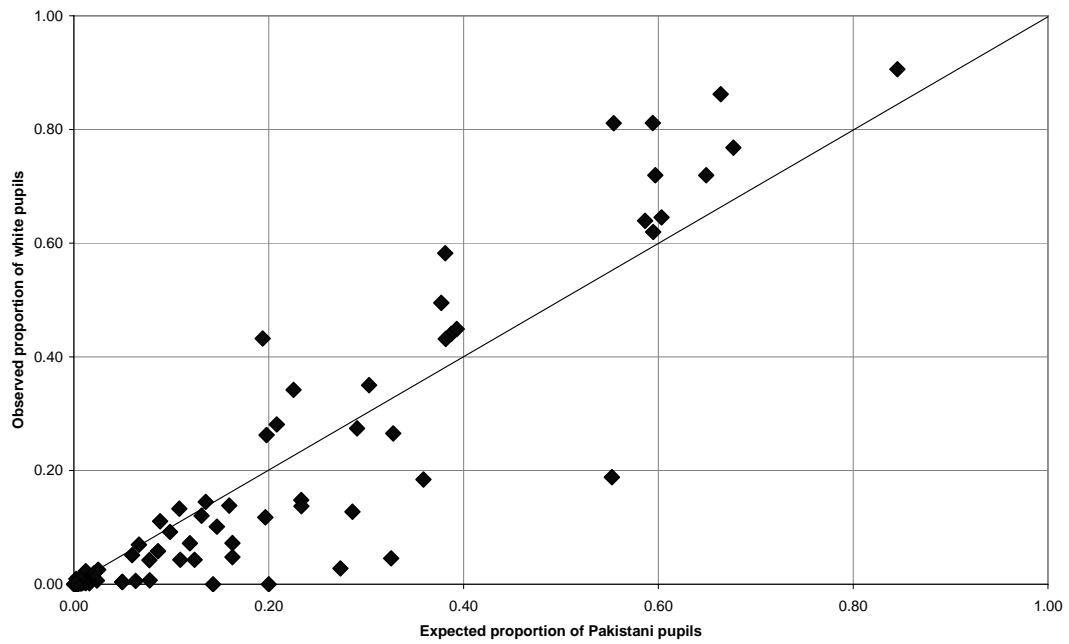


Figure 3. Expected and observed proportions of Pakistani pupils for the core catchments of Birmingham schools.

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Biography

Rich Harris is a lecturer in human geography at the School of Geographical Sciences, University of Bristol and a member of The Centre For Market And Public Organisation (a part of the recently formed Bristol Institute of Public Affairs). He claims to be immune to the 'Cameron effect'.