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GPS tracking of some Northern Ireland students – patterns of shared and separated space: divided we stand?

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Northern Ireland is a fundamentally divided society and there is evidence of the two main communities there, Protestant and Catholic, leading essentially separate lives. These divisions are reflected in the largely segregated residential patterns for the communities and in the separate schooling that most of them experience. This paper examines these divisions and the young people's perceptions of their impact. Global positioning system (GPS) tracking devices are used to explore the patterns of movement of some young people and the effectiveness of this method of recording spatial mobility is examined. These devices seem, only recently, to be becoming a technology that Geography teachers would consider using in their classrooms and in the field to support learning and to develop an interest in GPS and other spatial technologies. It is argued that there are many potential uses of the devices by Geography teachers.

Keywords: GPS; education; Northern Ireland; sectarianism; segregation; technology; tracking

The Community Relations Council¹ (CRC) in Northern Ireland, established in 1990, has the remit to promote better community relations between the Protestant and Catholic communities and to develop more recognition of cultural diversity (Community Relations Council, 2011). The continued existence of the CRC is a recognition of the continued divisions, which exist in Northern Ireland, a part of the UK, which has just emerged from a prolonged period of ethno-sectarian violence, known colloquially as The Troubles.

The signing of the Belfast/Good Friday Agreement in 1998 promised the beginning of a new era in Northern Ireland. As part of the process of emerging from the conflict, the Northern Ireland government published a policy paper *A Shared Future* (OFMDFM, 2005). This explicitly committed the government to promote shared education in a society that had long had a divided education system. A number of targets were established which included 'demonstrably promoting sharing in all levels of education' and 'developing opportunities for shared and inter-cultural education at all levels – nursery, primary, secondary and tertiary' (op. cit., p. 24). While elements of the policy document have been criticised (Graham & Nash, 2006), the targets remain in place.

This paper aims to examine divisions in Northern Ireland, as manifested through the movements of school children. In doing so, it seeks to shed light on sectarian division and some of the challenges of that for education in Northern Ireland. It will also examine how certain technologies can be used to track these movements and will reflect on the potential of such technologies to support and enrich geography education.

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Segregation in Northern Ireland society

Segregation of residential space along ethno-sectarian lines in Northern Ireland has long been noted and much analysed. The divisions in Northern Ireland are multifaceted and complex but, for the purposes of this paper, they have been reduced to the terms Catholic and Protestant. It has been suggested that much of the residential segregation which exists in the north of Ireland was established during the plantation of Ulster in the seventeenth century (Robinson, 1982) and has changed little since then. Boal's seminal study into differences in shopping and other activity patterns in the area between the Falls and the Shankill in Belfast was published over 40 years ago. He noted 'two very distinctive territories' (Boal, 1969, p. 49) and that the different religious or ethno-sectarian groups largely did not enter the territory of the other group. Boal, in returning to the paper more recently, noted:

what emerged as a clearly defined discontinuity in the residential and social fabric of west Belfast was strongly registered perceptually by the residents themselves. (Boal, 2008, p. 330)

Teenager perceptions of space have been studied in Belfast more recently (Leonard & McKnight, 2010). They used a range of methods, surveying 442 teenagers drawn from Catholic and Protestant schools from across the city. The centre of Belfast was perceived as a shared space by their respondents and:

... over 90% of young people suggested that they felt safe using these places and regarded [city centre] locations as arenas where religion was not overly important. (op. cit., p. 27)

Additionally, 62% of the respondents expressed the view that Belfast was a city shared by Catholics and Protestants. Intercommunal conflict in Northern Ireland has largely ceased and political avenues to solve disputes have opened since the signing in 1998 of the Belfast/Good Friday agreement, which marked the official end of the conflict in Northern Ireland (Elliot, 2007). However, one quarter of those questioned by Leonard and McKnight emphasised the continued relevance of sectarianism for them. Leonard and McKnight cite Komarova's (2008) comment that there has been 'little transformative impact on the existing sectarian geography of Belfast and that the political agreement itself has been unable to affect any real transformation of the ethno-national division in society and politics' (op. cit., p. 11).

While much of the research into residential segregation has focused on Belfast, territoriality is not restricted to that city. Harris (1972, 1979) took an anthropologist's approach to a rural area in Northern Ireland, which she called Ballybeg. Cooperation is mutually beneficial in many agricultural communities and Harris found that there was considerable contact between the Protestants and Catholics. However, contact between the traditions did not extend to the formation of 'friendships', despite almost daily contact between individuals. Social groupings tended to be with people from the same religion, formed in childhood and continued into adulthood. She also found a dual system of provision of services. Catholics tended to use Catholic-owned businesses while Protestant-owned businesses served the needs of their community. Even where contact occurred, conversation was '... kept firmly to safe, non-contentious subjects, indeed to trivialities' (Harris, 1979, p. 46), in order to maintain friendly relations and to minimise the potential for disagreement or conflict. In consequence, Harris notes, individuals in each system remained almost completely ignorant of the views and beliefs of the other. The communities lived separately and, even when they met, there was little meaningful dialogue that would generate shared understanding.

There have been significant political developments in Northern Ireland in recent years, but Northern Ireland is still made up of fundamentally divided spaces (Hamilton, Hansson, Bell, & Toucas, 2008). Segregation and sectarianism are everyday realities for many Northern Ireland residents. Individual experiences of segregation and sectarianism differ and are impacted on by age, gender, social background and place of residence. Hamilton et al. note that these, and individual experiences, are used to construct 'mental maps' of the places in which individuals move which develop and change over time. These:

... are used to guide and structure personal routines and practices, and the mental maps are in turn reinforced and at times challenged by routine experiences. (op. cit., p. 144)

There is considerable evidence to suggest that these mental maps are important to individuals and can influence behaviour.

Some Catholic and Protestant areas of Belfast are divided by physical barriers, incongruously known as Peace Walls, now a magnet for tourists to the city. One of the largest, at Cupar Way, divides the very communities described by Boal in 1969 (Photograph 1).

Despite a dramatic decline in inter-communal violence, the numbers of physical barriers have been increasing over the last decade. The Belfast Interface Project mapped 41 'official' barriers that are built and maintained by the Northern Ireland Office (Jarman, 2005). In addition, they noted 'unofficial' barriers demarcating areas of North Belfast. In their most recent survey, they detail 99 barriers in the city in total (Belfast Interface Project, 2012), each influencing movements of people in those areas.

While physical divisions constrain movement of populations, in other settlements in Northern Ireland without Peace Walls, there are still barriers to movement. Bell, Jarman, and Harvey (2010) discuss contested space in Derry/Londonderry, Lurgan and Portadown.



Figure Photograph 1. Peace Wall at Cupar Way dividing residents of the Shankill and the Falls, Belfast.

Although these urban areas, unlike Belfast, have only a very small number, or a total absence, of walls and fences separating their inhabitants, there is still negligible mixing of the Protestant and Catholic communities. There exist non-physical barriers of the mind which:

... have real effects in constraining and shaping the behaviour and attitudes of both individuals and communities. (op. cit., p. 4).

Bell et al. also look at movements more widely than these three settlements. When examining segregation in the southern boundary counties of Northern Ireland, they note that:

many southern border Protestants continued and still continue to have a 'northward' orientation, be that for trade, shopping, education and schooling ... (op. cit., p. 35).

In even smaller settlements, Protestants and Catholics are still divided in terms of the space they use. The impact of segregation and sectarianism in two small County Tyrone settlements, Castleterg and Newtownstewart, was examined (Hamilton, Bell, & Hansson, 2005). Using methods such as in-depth interviews, mapping exercises requiring respondents to identify segregated areas and some other information-gathering activities, they found that segregation and sectarianism were part of everyday life for the residents. The respondents identified areas in which they might travel during the day but which would not be safe at night. This was particularly so for Castleterg, where a 'lack of meaningful interaction between the two main communities' was noted. The researchers highlighted a 'perception of a predominantly Catholic north end of the town and a predominantly Protestant south end of town' (op. cit., p. 37). As a consequence, the movement of individuals, particularly young males, is affected, with a resultant segregation of socialisation. As Catholics and Protestants are reluctant to enter the other groups' area to meet and to socialise, interaction is reduced.

In the full study, Hamilton et al. (2008) report on six areas of Northern Ireland. The methodologies employed included asking respondents to keep diaries detailing their movements. In most cases, this was dropped or replaced as a methodology, as it proved difficult for many of the respondents. There were a number of reasons for failure or reluctance to keep the diary. These included 'a lack of time and an inability to read and write' (op. cit., p. 15). Additionally, even in the few cases where respondents were able to keep and regularly update a diary of their movements, respondents found it difficult to maintain this over the study period. It would appear that mapping the respondents' movements using diaries can be problematic.

Segregation in Northern Ireland education

In addition to residential segregation, most of the population of Northern Ireland are also segregated when it comes to education, a division that has a long history. Ireland established a system of National Schools in the early 1830s, the first 'national' system of education in Europe. Initially non-denominational, pressures from church hierarchies meant that they became increasingly divided along religious grounds:

Thus, the state system of non-denominational education that was founded in 1831 had become, by 1900, a state system of denominational education. (Akenson, 1970, p. 389)

In practice, two kinds of schools emerged, Catholic and State, but de facto Protestant, schools. This divided education system persisted after the partition of the island of Ireland

and the genesis of Northern Ireland in 1921. Very few children were educated in schools where they would encounter children of other religious denominations. For example, in 1962, Barritt and Carter found that, 'as far as can be discovered', at least 98% of all Catholic children of primary school age attend Catholic schools (Barritt & Carter, 1972, p. 77). Twenty-five years later, Cairns notes that '... authorities in the field seem to agree that, whatever the precise level, segregation in education is almost total' (Cairns, 1987, p. 119). In 2001–2002, only 5% of the pupils in State schools were from the Catholic community and 1% of the pupils in Catholic schools were from the Protestant tradition (OFMDFM, 2005, p. 25).

The situation has changed a little since 1981, as another sector has slowly emerged: integrated schools. These schools have the aim of educating Catholics and Protestants together. In 2011, there were 61 integrated schools, of which 20 were post primary (the term used in Northern Ireland for secondary or high schools). This is a growing sector in terms of school and learner numbers, particularly when set against a backdrop of falling rolls and school closures. However, these 61 integrated schools still form a small proportion of the total of 1219 schools.

The largely segregated nature of education in Northern Ireland is a product of its divided history. Some commentators are beginning to examine the role that education can play in facilitating reconciliation between communities (Magill, Smith, & Hamber, 2009; Smith, 2011). The particular challenges of teaching, particularly Geography, in such a divided society have also been examined (Clarke, 2006). She comments on the:

... myriad everyday, low-key sectarian occurrences which are a feature of school-based education in Northern Ireland ... symptomatic of the contested landscape. (op. cit., p. 89)

Graham and Nash discuss the micro-geographies affecting the Northern Ireland population, including school children, in which '... exclusive territories ... essentially function as alternative worlds, each ... demarcated with parallel cultural, social and educational structures' (op. cit., 2006). It is in these alternative worlds that this study is located.

Methodology

Six post primary schools in Northern Ireland were involved in this pilot. Two of these were integrated schools, two were located in a suburb of Belfast and two in a large settlement outside Belfast. The respondents were 16- to 17-year-old students at those schools.

There are three components of the study. The movement of 36 students were tracked over 7 days using satellite-enabled, global positioning system (GPS)-enabled tracking devices, a questionnaire was applied to 72 students in the schools involved in the project and structured interviews were carried out with two teachers. We will take each of these in turn.

(1) Learner questionnaires

All the students taking part in the tracking also completed questionnaires which examined the students' experience and perceptions of segregation. There were insufficient tracking devices to supply all of the students from each school, but those who did not take part in the tracking were given the same questionnaire. As a result, further 36 students from the schools completed questionnaires, providing 72 participants in all.

(2) Technology

The evidence would suggest that the Protestant and Catholic communities in Northern Ireland often occupy very different spaces, attend different schools and may have very distinctive travel patterns, particularly on a micro-scale. Relying on the completion of a diary to monitor those travel patterns is problematic as respondents would have to remember to complete it regularly and record their movements accurately. There may also be problems related to literacy levels and ensuring that the task is completed during the study (Hamilton et al., 2008). However, there are technologies which may provide movement data more easily and lessen the requirement for active user input, potentially reducing the likelihood of respondent apathy and increasing the accuracy of the results.

There is much in the literature regarding the use of Information and Communication Technology in the Geography classroom (Yeung, 2010), and particularly in integrating Geographical Information Systems (GIS) (Beeson, 2006; Papadimitriou, 2010; Wheeler, Gordon-Brown, Peterson, & Ward, 2010). The potential for GPS tracking devices in the Geography classroom seems to be less well developed. There are some examples of GPS trackers being used in education to track users (Schonfelder, Axhausen, Antille, & Bierlaire, 2002; Wolf, 2000) and others in which the devices have sensors fitted which measure changes in the environment or in the users' bio signs to gather additional information (Kanjo et al., 2007). While such sensors might provide an interesting development, in this pilot only the movement of the subjects was studied. The data of the movements of the individuals who have carried the device are exported as shape files, a geospatial vector data format used for displaying data in GIS software. In this study, 36 students volunteered to have their movements tracked; each was supplied with a portable GPS device that they then activated and carried with them for 7 days.

The data from the GPS tracking devices were extracted and each of the student's movements was plotted for every day on which the device was carried. Sample points were plotted, sufficient to see the route taken without overloading the viewer with information. These were then plotted onto base mapping and the viewer could select one of the six schools involved, select one of the students and see the movement for each day of the week. Subsequent processing provided data aggregated by all the students on all of the days on which mapping took place and it is two images derived from those data which will form the basis for later discussion.

(3) Teacher interviews and learner feedback on the tracking exercise

Structured interviews were carried out with two of the teachers involved in the project. These were both Heads of Geography in their respective schools and it was their Advanced Level Geography classes that had been involved in the study by completing questionnaires and, in some cases, by taking part in the tracking exercise. Students from one of the schools were also interviewed, providing information on the tracking process. The students from the other school were on holiday and so were unavailable for interview.

Ethical approval was required for this research; there are particular ethical issues regarding the tracking of the personal movements of young people. In this pilot, great care was taken to explain the project and its aims to the respondents, to work with teachers in the participating schools and to seek the full permission of students and their parents. It was vital that mapping the movements of the young people would be done in such a way so as to allow neither individuals nor precise home locations to be identified, and great care was taken throughout this pilot to ensure that that was the case.

Discussion

1. Learner questionnaire data

Most participants were 16 years old, with the remainder 17 years old. Forty percent viewed themselves as Protestant and 54% Catholic. A question on national identity showed that the largest group viewed themselves as Irish (44%), closely followed by British (36%). The majority of those identifying themselves as Northern Irish were Protestants. However, there were nuances in the responses. Some (5%) saw themselves as both Catholic and British and 3% as Protestant and Irish. Fourteen percent of the respondents said that they were Catholic and Northern Irish. Respondents were also asked how they perceived the area in which they lived, with the largest number perceiving the area in which they lived, as ‘mostly Protestant’ (35%). In all, 70% of the answers given identified their areas as either mostly Protestant or mostly Catholic, with only 30% identifying their areas as ‘mixed’. The largest number of people who perceived their area as ‘mixed’ was Catholic.

In terms of travel to school, the largest number of participants used buses (38%); this was followed by those who got a lift in a car (21%) and those who made their way to school on foot (21%). In all, 83% claimed access to a car.

Respondents were presented with a range of statements relating to segregation and territoriality and they were asked whether they agreed or not.

There are two main areas of interest in Table 1. Those questions relating to identity, community and sectarianism would suggest a perception of high levels of segregation, albeit with considerable change in recent years; presumably, this suggests a perception that segregation has reduced. While there is some evidence of issues to do with mobility, some places, particularly shopping areas, are increasingly neutral urban spaces. This would seem to corroborate findings in other surveys (Leonard & McKnight, 2010).

Answers to more open questions in the survey relating to issues of identity, community and sectarianism appear to converge on the issue of segregation. There is an apparent awareness among the respondents of the impact and legacy of the conflict on the current perceptions of community and identity. This seems to inform the current nature of segregation that many of the young people appear to experience, or are aware of, as reflected in the following answers:

Table 1. Views on segregation and territoriality.

Statement	Agree	Disagree	Unsure
Segregation is an issue in everyday life	45	55	0
Segregation impacts upon all people but with differing levels and intensities	94	6	0
Segregation is a continuing legacy of the troubles	80	20	0
Levels of segregation have changed in recent years	90	10	0
Living in a small community highlights identity and religion: people tend to know ‘who and what’ you are	95	5	0
Wearing school uniforms in public places can create problems for young people	90	7	3
Shopping environments are increasingly neutral	98	2	0
Asserting community (i.e. religious) identity can undermine social cohesion	88	4	8
Denying opportunities to display community identity can erode a sense of belonging	82	9	9

Yes, people are affected at different levels depending on your location of home and activities etc. Older people feel more segregated and this has a knock-on effect on us.

... many families pass on sectarian views to the younger generation, meaning they too are impacted ... Children now take on views of parents and therefore the division continues.

This is indicative of a sense of a 'transmission' of trauma between the generations, particularly when we consider the age of those participating in the study. They would have been between 3 and 4 years old when the 1998 Belfast/Good Friday Agreement was signed. The legacy of The Troubles appears to impact acutely in these young people's lives in a contemporary context.

However, these views were countered by those respondents who view the current social climate in their areas in different or perhaps more positive terms:

... some people let segregation and divisions affect them, others just get on with life ... it is getting better, more people are getting over it.

... people now are not as strict as in who you are allowed to know. There is more encouragement to integrate both religions, especially within school.

... there's much less violence then a few years ago.

This is related throughout the questionnaires to issues of sectarianism. There is a consensus in the answers that sectarianism, or aspects of it, informs the segregation experienced by the respondents, or their awareness of segregation. This reflects the statistical data collected in relation to the students' perceptions of the communal composition of the areas in which they live. This is also represented by perceptions of community identity in relation to the schools the students attend, as well as their feelings of being identified by the school uniforms they wear. The following statements articulate this viewpoint:

... Nowadays you don't ask 'are you Catholic or Protestant', you ask 'what school did you go to?' ... When wearing your uniform people can instantly tell if you are Catholic or Protestant. This will mean you cannot enter certain areas of town.

... people are still bitter and a uniform can tell you what religion you are and the opposite religion may not like that.

It was clear from the responses that urban and rural respondents had different views in relation to school uniform. Both rural and urban respondents alluded to the issue of school uniforms and the potential for threatened or actual violence. However, it was much more prevalent as an issue for urban-based students. Students from urban-based schools stated the following:

Definitely, because people will know you're Catholic or Protestant and can get you in fights.

Yes, because you can wear a [school name] uniform, walk into a Catholic area and get beat up.

This reveals the very real experience of segregation and sectarianism for school pupils, the perceived communal affiliation of segregated educational institutions in Northern Ireland and the potential impact that this might have on mobility.

Despite the concerns articulated about real or perceived threat of violence triggered by school uniforms providing visual clues to ethno-sectarian affiliation, students claim that this had little bearing on how they order their movements to and from school. This is perhaps because the dominant mode of travel, car or bus, insulates the young person from the community through which he or she travels. In the case of cars, there will be little or no opportunity to engage with the community. School buses are generally mixed so there is a potential for inter-communal discourse, although it is unclear to what extent this happens. Movement during free time as reported in the questionnaire, most often without school uniform clues to identity, appears to be less oriented around segregation and more preoccupied with spaces that are considered 'shared', such as shopping centres and cinemas.

The following statements support this:

... it has nothing to do with 'territory' at all.

... there are no problems inside the shops as everyone only really cares about themselves.

I believe they are neutral and have people from either religion attending. I don't think people mind shopping in mixed areas, I don't.

There appears to be a very notable distinction between areas which are considered to be 'off limits' to particular communities and areas open to all, or considered to be 'shared' space, which are generally commercial areas. One participant commented:

You can wear school uniform there and no one cares. It's a place where everyone can go and relax and forget all the segregation that is apparent in other areas.

Another elaborated on this by simply stating:

I don't think about these things as I walk through a shopping centre.

Many of the activities in which these students are involved are conducted within the realm of commercial spaces. For example, 69% cite shopping, 64% the cinema and 53% cite 'hanging out' in the town/city centre. Therefore, while much commentary has been made about the limited mobility and movement of the students as a result of their particular background, as well as the perceived communal affiliation of their schools, little concern is given to these issues in the context of commercial spaces of the various areas of Northern Ireland included in this pilot. While this may be an apparently positive step in terms of how these groups of young people engage on 'shared' and non-segregated basis in their spare time, there remains an awareness of the nature of the issues surrounding 'community' for them when they return to the often highly segregated areas in which they live. Hence, issues of identity and its expression pervade the discussion of community cohesion and movement among the respondents.

A range of views were expressed on issues of displays of community identity. Some of the young people agreed with it as a necessary element for community cohesion within defined areas/groups:

... everyone has a right to show their beliefs and be involved in their culture.

If we don't allow people to be themselves in their own environment or someone else's, we are stopping them from being themselves. This is quite sad. If you have to hide who you are in some areas you live in then there is no hope for the world.

It's not fair to stop people celebrating their identity.

However, there were many responses that equate expressions of identity with an awareness of the impact on other communities in terms of the offence it may cause:

... it can be seen as rude / imposing or disrespectful. Putting their identity in different peoples' faces ... If you display your identity in an insensitive way you may cause problems.

for example flying flags and painting pavements [can undermine social cohesion].

... wearing football tops which show your religion may divide the community further.

There was also a recognition of the impact of these issues on the occurrence of sectarian violence or the threat of it:

Painting footpaths and having parades can cause fights in some areas.

... things such as band parades (the different traditions have a history of musical bands who march through their communities, particularly strong in the Protestant community) and GAA (the Gaelic Athletic Association – an organisation that promotes Gaelic, often perceived as Catholic, sporting activities) matches can somewhat 're-open wounds' and flare up tension again.

It was clear that many of the young people were well aware that expressions of identity, community or culture in a given space are often shaped by the reaction of the 'other' community. The respondents also display an awareness of the impact of expressions of identity on social cohesion and ultimately how there can be both positive and negative connotations of cultural or community identity in Northern Ireland.

Both the quantitative and qualitative results of the survey appear not to fully align at certain points, particularly on the issue of segregation. Only 26% of the respondents stated that segregation was an issue in everyday life for them. However, overall, the questionnaire suggests that segregation has a much bigger role to play in the lives of these young people than is perhaps initially suggested. This suggests that the causalities and impact of segregation are more nuanced than some of these questions were able to accommodate. Any lack of awareness of the impact of segregation at a basic level may also suggest that it is an increasingly normative feature of how the respondents view and order their social world. That is not to say that there are not exceptions (such as much of the students' spare time being spent in 'shared' commercial spaces), but that the vast majority of their movement and mobility is informed by an 'us and them' construct, and much of these students' time, including, for most, the school day, is spent with others they perceive to be from 'their own' community.

2. Mapping of GPS data

A study of the GPS data from all six schools is beyond the scope of this paper and a specific case study of one settlement has been developed instead, Armagh. This is a relatively small

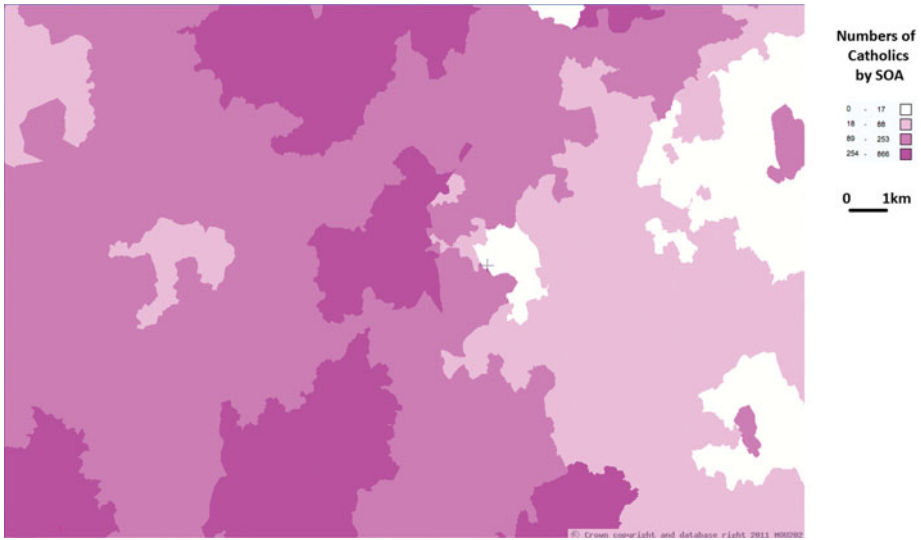


Figure 1. Catholics by SOA.

settlement with just 14,590 people in the south of Northern Ireland, located close to the border with the Republic of Ireland. Dominated by two large cathedrals, it is a place of significance to both Catholics and Protestants, with a long ecclesiastical tradition.

Like many parts of Northern Ireland, the area in and around Armagh is not homogeneous in terms of religion. Figures 1 and 2 show mapping of data taken from the Northern Ireland Census for 2001, the most recently available at the time of writing, with Armagh being located in the centre of each map. Considerable variations in the distribution can be seen. The mapping is based on SOAs (super output areas) (NISRA, n.d.). These are a new geography developed by Northern Ireland Statistics and Research Agency (NISRA) to improve the reporting of small area statistics from the census and other sources. The SOAs

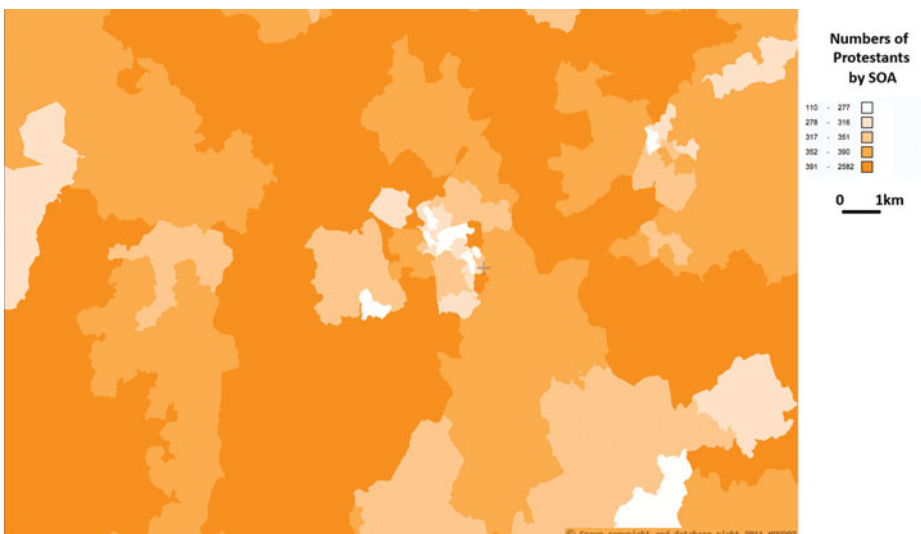


Figure 2. Protestants by SOA.

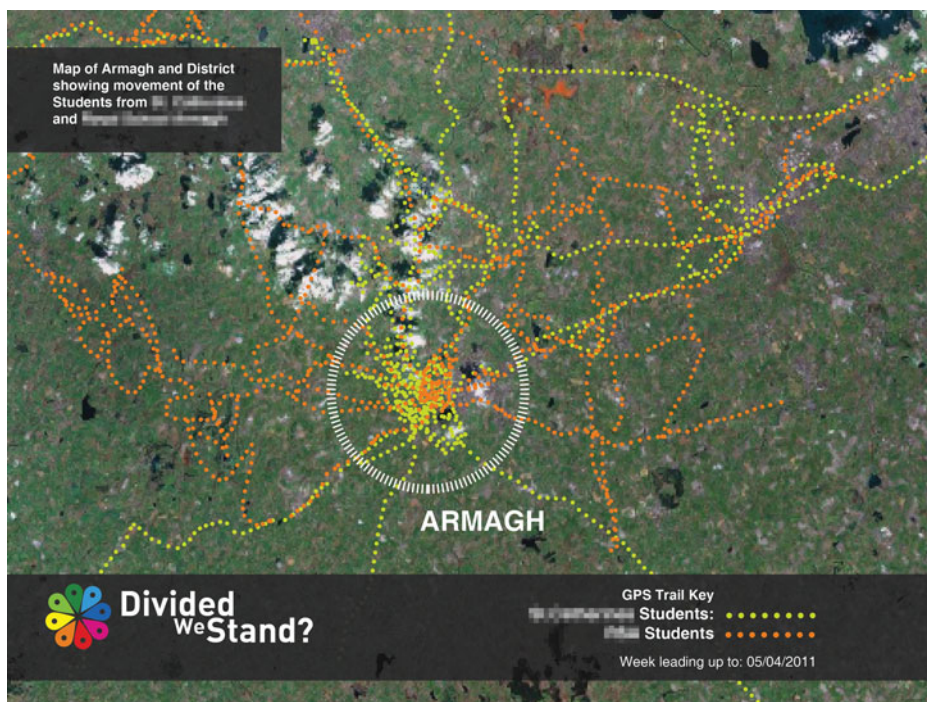


Figure 3. Movements in the countryside around Armagh.

vary from a lower population of 1300 up to an upper limit of 2800, with the target size being a population of 2000.

In some of the SOAs in Figure 1, both in the settlement and in surrounding rural areas, the number of Catholics is less than 12, suggesting a very high level of segregation. Similarly, Figure 2 shows that, in some areas in and around Armagh, the numbers of Protestants in some areas are less than 277, again a small proportion of the total population of an SOA. It is likely that both maps mask even more pronounced segregation in the area as SOAs are merely statistical disaggregations of electoral wards, taking no account of residential segregation within and across wards. Poole and Doherty (1996), in their classification of settlements in Northern Ireland, identify Armagh as 'highly segregated', alongside Belfast, Derry, Lurgan and Portadown.

In all, 12 students from two schools in Armagh were involved in the tracking. Six were from a school which describes itself as Catholic, while the others were from a school which, while de jure open to all denominations, is de facto largely Protestant. The 12 students used the tracking devices for 7 days and the data were then extracted and plotted. Two compound images are to be examined here.

The students from the Catholic school have had their aggregate movements plotted in light green (Figure 3). They seem somewhat less mobile than the Protestant students, whose movements have been plotted in orange. While there are trails to the north and the northeast of the city, most of the overall movement seems concentrated in the city itself. There is less activity to the south of the city by both sets of students, but what activity there is seems predominantly to be by the Catholic students.

Some of these contrasts may represent differences in residence between the two groups, but it is likely that there are also some differences in social interaction being reflected here.



Figure 4. Movements within Armagh.

Some visits may be kinship related and this may help to reinforce different patterns. It had been noted that one of the most common activities in which the students were involved was ‘hanging out in friends’ houses’ and if friendship groups are based on ethno-sectarian grounds, this may suggest segregation in visits. Additionally, while hardly definitive given the small sample size, the predominance in southward movement from Armagh by Catholic students would support a suggestion that Protestants have a northward orientation for shopping and trade compared to Catholics (Bell et al., 2010, p. 35).

It might be expected that more microscale movements within the city itself would show fewer differences. In fact, differences are still apparent (Figure 4). While some of the main concentration of movements may be disregarded, as they show attendance at the two schools or attendance at one of Armagh’s cathedrals, the other movements within the settlement suggest some differences. Many of the major arterial routes seem to be used by both groups, but there are parts of the settlement which seem to be dominated by movements of one of the two groups. As some of these are within the centre of the city, it would seem that certain areas of the city centre are not such shared spaces as might have been anticipated (Leonard & McKnight, 2010). Nevertheless, much of the map shows space that is shared.

More work would need to be done to investigate whether these spaces are shared but with minimal contact. Driving on the same piece of road in separate vehicles does not indicate contact. Even parking in the same car parks or shopping in the same shops does not indicate this, although it may indicate progression from that described by Harris (1972, 1979) in her smaller rural settlement. While we do not have the data here to support this, it might be that the larger shops of this settlement, usually multinational chains, are not seen to have the same community allegiances as the small family-owned village shops of Harris’ survey. Starbucks is neither Protestant nor Catholic.

The mobility patterns were shared with the students after they were processed. The respondents had to recollect journeys that they had taken, and they often reported that they had forgotten them and it was seeing the trace on the map which brought back a memory of the trip. The use of this technology may be more accurate than asking respondents to report movements, such as in a diary format, as those techniques may not be fully representative of the movements undertaken. However, more work would need to be done to examine more closely the accuracy and user responses to each type of data gathering.

3. Teacher interviews and student feedback on tracking

Both teachers involved in the interviews were experienced teachers of Geography. Neither reported problems in using the tracking devices themselves, nor were there any difficulties concerning student use. Student enjoyment of the task and their interest in the results were reported by the teachers from both schools. One teacher commented:

... the students loved it. They loved seeing the results and we spent a while talking through who went where and why.

The students reflected this in their responses too. Typical of the comments was:

I enjoyed seeing where I went on an average week.

Others felt that:

The best part was being involved in something bigger.

As the respondents were students of Geography, being involved in the pilot with their Geography teacher, they had been briefed about the ethno-sectarian element of the research and the comparison of the schools' data. Thus, they also had a great interest in what the results might show with regard to segregation and movement patterns. Typical comments included:

This experience made me more aware of segregated areas and areas where there is predominately more Protestant or Catholic.

and

It helped me realise and understand segregation of communities. It was easy to bring the subject of segregation alive by relating this information to Armagh.

The teachers readily saw the possibilities of using this technology to support their teaching of Geography. They identified possibilities of using GPS tracking to support the study of segregation and diversity, particularly at 'A' level, where it appears in the specification most often used in Northern Ireland – that produced by the Council for the Curriculum, Examinations and Assessment (CCEA) – Northern Ireland's examining and awarding body. They also pointed to possibilities of using it to contribute to the statistical analysis element required for Advanced Level Geography and also to support some of the population and settlement requirements of the Geography specification.

As well as specific curricular uses, it was thought to be a useful way to introduce younger students to GPS and GIS, a requirement for some parts of the CCEA specification. One of the teachers commented:

We displayed the map results on the walls, and other classes are very keen to try it out . . . the wall displays encouraged others to show an interest in the work. Within the Geography Department, the projected generated a great interest in GPS.

The other teacher returned to a core reason in this study for using this technology: exploring evidence of segregation and contrasts in how the local environment is used. He noted that the data generated would be of value to more than just Geography students and in supporting part of the curriculum:

Yes, there definitely is a place somewhere in the curriculum for this. But it would be of greater value to the local or central government. By completing this project, the results could be shown to governments for them to target areas where integration does not occur, [and] supply funds or investment to promote the area which would then encourage integration.

While this feedback is just from two individuals, it might suggest that there can be value in tracking personal movement of individuals and groups, as an element to support innovation in some areas of the curriculum in schools. A number of uses in the Geography curriculum have been suggested by the teachers, and there may be others, particularly when combined with environmental sensors.

There appear to be uses of this technology emerging in the classroom practice of Geography teachers. For instance, the GPS tracks can be used to help create living maps of the local area and examples of this are beginning to appear in some teaching resources (see Andrews, 2012 and the UK's Geographical Association's project, *Making My Place in the World*, n.d.). Geography students using this technology to help create maps would also seem to align with the work on adaptive cartography of Konečný and Staněk (2010), and others, with the learners being involved in the mapping process, helping to produce the maps that they and others can then use and analyse.

Results summary

There were three main aspects to this small scale pilot.

Divisions within Northern Ireland society were examined and the impact of these on the opinions and mobility of young people was identified. It was clear that divisions still exist and impact on these young people, although there was some evidence that these were less important for them than for earlier generations. While division and the consequences of that are apparent, shared space did exist, largely around shopping and entertainment venues.

GPS tracking devices were used to produce images of the mobility patterns of some young people. These appeared to work effectively in collecting this information, although it would be useful to directly compare this methodology with another, something not done in this study. The patterns produced seemed effective in engaging the interest of these young people and their teachers, providing mapping images which stimulated much debate. It raised awareness of the deep social divisions which remain in Northern Ireland society and which, without such technology, would be difficult to measure and challenging to describe so graphically. Catholics and Protestants showed some differences in their movements,

although the small numbers involved in this study preclude any definitive conclusions being drawn.

Uses for these devices in Geography classrooms were suggested by the teachers in this study and these were supported by some of the literature and the apparent emerging interest in the use of GPS tracking devices to support geographers in the classroom. They were seen to have potential in engaging learners with map creation, particularly if the resulting map supports the existing Geography curriculum, which maps of ethno-sectarian variation do in Northern Ireland. They may also have additional value in engaging learners and increasing their interest in cartography and the use of GPS technology to support this.

Conclusion

There are a number of ways in which this pilot could be extended and developed. An easier way to aggregate and disaggregate data would be useful. We might expect older and younger people to demonstrate very different geographies of how they use a central business district in a settlement, for example. Similarly, male and female movements might also differ. Comparing movements in the evenings to daytime movements might also be illuminating, particularly when gender is considered. And of course the ethno-sectarian geographies of many places in Northern Ireland could be explored in more detail.

The tracking data served to highlight to learners the potential differences of the 'worlds' inhabited by different groups within Northern Ireland society, whether those groups are based on gender, age or ethnic/religious affiliation, and the distance still to be travelled to achieve a truly Shared Future. While this could be demonstrated, for example, by means of individual stories, these 'live' maps of the movement of individuals and groups would seem to promise a greater impact.

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Note

1. The CRC commissioned the pilot with which this paper has been developed, with support from the Nerve Centre in Derry/Londonderry. The Nerve Centre has served as a focal point for young people in Northern Ireland, often working creatively with digital media. Also involved in the project was the Ulster Mediascapes group which has worked with schools in Northern Ireland since 2006, helping learners to create location-aware computing experiences.

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