RGS innovative teaching grant resources - Investigating the geography of Crime,

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The purpose of these resources are to provide teachers and students with the information and skills required to be able to conduct a sophisticated investigation into UK crime patterns using GIS mapping techniques using primary and secondary data. An interactive online version of this resource is available here [http://arcg.is/1TZiyv](http://arcg.is/1TZiyv)

The resources will contain a number of useful web links and a series of online videos. It is intended that this will support sixth form students with conducting individual investigations or extended project qualifications. It is an ideal topic for allowing students to take a very individual slant. These resources will provide access to a range of skills, without being fully prescriptive about one route to enquiry, so allowing teachers and students to adapt these to local issues and original ideas.

While the resources are aimed at Key Stage 5 Geography research opportunities there are clearly a lot of aspects which could be used for a GCSE investigation or a Key Stage 3 scheme of work and study. They are also a useful overview of GIS skills and can be used by teachers or students to simply learn about GIS mapping techniques.

The study of crime is a suitable area for investigations for the new 2016 A level specifications as it links well to topics relating to changing places focusing on urban and rural issues. While crime patterns themselves may not be a requirement the specifications, there is an opportunity for students to explore their relationship to specific themes such as patterns of deprivation, urban decline, rebranding and regeneration initiatives. It is also an area where there is a wealth of freely accessible data which can be drawn upon alongside various types of primary data which the student can collect.

The richness of the data available, alongside the range of potential primary data collection, means that it should be possible to generate a large number of different titles and focuses for each student’s individual investigation, so allowing for large groups to all be conducting studies on this topic.

Advice for teachers

This resource is aimed to be useful to both teachers and students. No previous skills or knowledge of either the geography of crime or GIS are needed to undertake this work. The table below outlines for teachers how these resources could be organised into a series of lessons:

<table>
<thead>
<tr>
<th>Lesson stages</th>
<th>Approach and resources</th>
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<tbody>
<tr>
<td>1 – Introduction to the personal investigation</td>
<td>Introduce students to the concept of the personal investigation. Ask students to come up with a range of physical and human geography investigations which they could carry out. Get students to consider the steps involved in planning an investigation. Could present give small groups of students different titles for geographical investigations to develop an outline plan for and then present their ideas to the class.</td>
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<td>Step</td>
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<td>2 – Introduce the geography of crime</td>
<td>Introduce the idea of a geographical investigation into crime patterns. Discuss with students what patterns they might expect to find in their local area and possibly to come up with a range of possible types of titles. This can be compared to the list of titles provided in this resource. Show students some of the video clips about crime mapping. Students take some notes and also consider how the information could be useful for their investigation.</td>
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<td>3 – Background research work</td>
<td>Give the students some time to access the links to professional research into the geography of crime such as by UCL. They should use this to help develop an interesting theme and title. They should take notes for their project introduction.</td>
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<tr>
<td>4 – Looking at local crime data</td>
<td>Demonstrate the web sites with useful information with summary crime data (video tutorial 1). Let students use the interactive sites to start focusing down on their study area. They can use this to help finalise their study aims if they have not already done this. Then they can start collecting screenshots of key information and write notes about the initial findings from this.</td>
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<tr>
<td>5 – Planning the study</td>
<td>By this stage, or possibly earlier, students should be in a position to be able to start planning out the approach to their study. They would complete some kind of investigation planning table which gets them to outline their title and aims, synopsis of background research and theory, the methods they plan to use, any relevant risk assessment, the sources of data they would need, starting to think about how they would want to process and present the data. These plans could be presented to the class or discussed one on one with the teacher to ensure they will work.</td>
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<tr>
<td>6 – Gathering relevant crime data</td>
<td>Demonstrate the process of obtaining crime data and getting it prepared to input into a GIS package (video tutorial 2). Give student’s time to collect and start displaying their data in ArcGIS Online.</td>
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</table>
| 7 – Processing the crime data | Explain to students how to use the key functionality of ArcGIS Online and ways to visualise their data. Include how to create density and hot spot maps (video tutorial 3 and 4).
Get students to prepare their initial maps and to describe the distribution of crime of relevance to their study. Student should explain how they processed the data to create certain types of maps which enhanced visualising the patterns. |
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<tr>
<td>8 – Explaining the patterns</td>
<td>Explain to students how to add various types of secondary data to their GIS crime maps, such as deprivation patterns (video tutorial 5). You could explain about data enrichment also (video tutorial 6). Pupils to find relevant data to their study and start producing maps which effectively visualise any relationships between various variables. They write about what the patterns are showing and try to explain any relationships in the data.</td>
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</table>
| 9 – Gathering primary data | This stage may have occurred earlier, perhaps at the outset of the study. However it is possible that it would fit in well here, as primary data is now needed to develop some of the initial findings produced from secondary data sources. If relevant you would explain to students how to set up their data collection within ArcGIS online and possibly set up to use the Esri Collector app in the field (video tutorial 7 and 10).

Students need to plan out the detail of their primary data collection methodology and prepare all recording sheets and equipment. They need to consider any relevant risks and modify their approach as needed. |
| 10 – Analysing links and relationships | Explain some of the relevant GIS tools for looking at the spatial patterns between the data sets. This may include counting crime occurrences within certain areas or within a distance of some influencing factor. You can also show how to export merged data back into a spreadsheet for further graphical and statistical analysis (video tutorial 8 and 9).
Give students time and support to complete their study analysis tasks. |
Possible titles

There are a wide range of studies which can be conducted into the geography of Crime. Firstly different students looking at the same area can each focus on a different type of crime. In addition similar studies could be done but using different locations by each student, such as different parts of a town. In addition there is the opportunity to look at the data from a temporal as well as spatial perspective, such as seasonal variations in different months or changes over different years. Here are some examples of the types of titles which could be generated:

- How and why do patterns of a certain type of crime vary across an urban area?
- How and why do patterns of a certain type of crime vary seasonally in one area?
- Explain the variations in fear of crime in different areas
- How do perceptions of crime levels compare to actual crime patterns in an area?
- How effective have specific policing measures been in reducing crime in an area?
- Can crime vulnerability ratings for areas explain the patterns of crimes?
- What is the influence of urban design on the patterns of crime in an area?
- To what extent can levels of economic deprivation explain hotspots of anti-social behaviour?
- What impact has a regeneration project had on crime levels?
- What impact has gentrification and social changes had on crime patterns in an area?
- How does studentification affect the crime levels in an area?
- Why are certain streets more prone to vehicle thefts?
- Why are certain streets more prone to muggings?
- To what extent does dereliction and urban decline create crime hotspots?

The list above is just a staring prompt. Clearly there are many different investigation themes. All can be based in any area across the UK using the data shown in this resource. It should also be interesting research for students to carry out, as they will be genuinely conducting new research in their local area into an important issues that effects everyone.

The enquiry approach.
Students will need to demonstrate skills across the whole enquiry approach. Here is an overview of how an investigation into the geography of crime, as explained in this resource, will support this approach.


### Enquiry questions

<table>
<thead>
<tr>
<th>Planning – what is the geographical enquiry process?</th>
<th>Geographical skills</th>
<th>Approaching a study of crime</th>
</tr>
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<tbody>
<tr>
<td>Prepare to investigate a geographical question in the field; make and justify decisions on the task including data collection methods</td>
<td>Use the links to background research, articles and videos relating to the geography of crime. Use Part 1 of the video tutorials to start looking at data for your location. Use this to help form a focus for your personal investigation. Start to plan out the approach to your investigation.</td>
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| Data collection – how is data and information (evidence) collected? | Acquire primary and secondary data / information pertinent to the research question using quantitative and qualitative methods and primary and secondary data / information | Use the video tutorials parts 1, 2, 5 and 6 to help gather secondary data on crime and also on social and economic factors. See the section on primary data for ideas on data you can collect to add to the study. Use video tutorials part 7, 9 and 10 for explanation of how to link your primary data to the GIS maps. |

<p>| Presentation and display – how is the collected data and information presented? | Process data / information using quantitative and qualitative methods | Part 3 of the video tutorials outlines the key principles of displaying your data, however all the tutorials contain elements of data presentation in map and graphical form. |</p>
<table>
<thead>
<tr>
<th>Enquiry questions</th>
<th>Geographical skills</th>
<th>Approaching a study of crime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis and interpretation of findings – how can the evidence be analysed?</td>
<td>Interpret and analyse data / information from primary sources, and, as relevant, secondary data / information; describe patterns, trends, relationships; apply knowledge and understanding of geographical concepts and processes to specific evidence collected</td>
<td>The video tutorials in parts 4, 8 and 9 focus on ways you can analyse and process your spatial data within the GIS application and also within a spreadsheet.</td>
</tr>
<tr>
<td>Conclusion – what conclusions can be drawn and how do these relate to the initial aim of the enquiry?</td>
<td>Synthesise findings to draw conclusions based on evidence</td>
<td>See the brief section with advice on conclusions.</td>
</tr>
<tr>
<td>Evaluation of the whole investigation – what evaluative techniques should be applied to the enquiry process?</td>
<td>Critically reflect on every stage of the whole investigation in order to appreciate the strengths and limitations of the primary and secondary data, links to original question; note strengths and limitations (accuracy, validity and reliability) and anomalies and / or errors or misuse of data; evaluate the methodology including, if relevant, sampling techniques; suggest improvements for further research</td>
<td>See the brief section with advice on evaluating your study.</td>
</tr>
</tbody>
</table>

**Background research links**

Any good geographical enquiry requires effective use of background reading to put the study in context and to learn from other research. It is often helpful to spend a bit of time researching around the topic before developing a focus for the investigation. I would then suggest looking at the links shown in part 1 of my video tutorial in order to start looking at your study area and see what issues seem to be potentially interesting. From this a clear focused title could be developed. The information from the other video tutorials will then help explain how to process the relevant data for your specific study focus and location.
A series of clips from the BBC related to mapping crime
http://www.bbc.co.uk/programmes/b00793ct/clips

Esri video explaining the role of GIS in analysing crime
https://www.youtube.com/watch?v=Oixk2Yj9nyM

Hampshire police explaining crime mapping website information
https://www.youtube.com/watch?v=7hS-e3EB9Hw

Channel 5 documentary on UK crime hotspots
https://www.youtube.com/watch?v=rhGAXUkwDco

USA police developing predictive crime software using GIS
https://www.youtube.com/watch?v=nvmjZtz-HK4 or the start of this BBC documentary on big data and predictive crime mapping
https://www.youtube.com/watch?v=XQgmWFsO4LM

UCL Department of security and crime science provides information on research work being conducted into crime http://www.ucl.ac.uk/scs. This page on geographical analysis of crime is particularly relevant http://www.ucl.ac.uk/scs/research-consultancy/geographical-analysis

The Jill Dando Institute at UCL conducts valuable research – this includes the vulnerable localities index http://www.ucl.ac.uk/jdibrief/analysis/Vulnerable-Localities-Index and Hot routes http://www.ucl.ac.uk/jdibrief/analysis/hot-routes and street robbery - http://www.ucl.ac.uk/jdibrief/crime/street-robbery

There are also issues linked to seasons and climate you could consider. This article looks at the links between climate and crime http://articles.latimes.com/2014/feb/19/science/la-sci-sn-climate-change-crime-20140219

**Potential primary data collection**

There are many resources and books which already explain the types of primary fieldwork which can be conducted to support an investigation into the patterns of crime. Here is a resource produced by the RGS with lots of good ideas http://www.rgs.org/NR/rdonlyres/9E65651B-2542-4E76-899A-8917A9499DDD/0/Crime.pdf

This resource is designed to complement a wide range of primary data which students may collect for their study. It explains how to bring primary data into ArcGIS Online to allow students to examine the links between their data and the crime patterns they are displaying. Key opportunities include:

- Conducting visual crime vulnerability assessments at contrasting locations based on a rating system.
- To plot locations of significant factors like CCTV cameras, street lighting, derelict land, late night businesses, etc.
- To conduct questionnaires into peoples’ views about fear of crime.
- To interview key groups like a crime analyst or local community police officer to get a deeper understanding of the factors which are contributing towards crime.
- Measurement of environmental factors which may have an influence, including noise levels, air pollution or weather.
Video tutorials on developing a geographical crime study

Part 1 - Sources of useful data

This video outlines a few key websites with useful information for geographical studies of crime:

https://youtu.be/0DcyudEnPh0

Office of National Statistics crime trends

UK Crime Stats website http://www.ukcrimestats.com/Neighbourhood/1340

Part 2 - Getting GIS data

This video tutorial focuses on getting police data into ArcGIS Online mapping application. 
https://www.youtube.com/watch?v=RiZqMKCmpSM

UK Police Data web site http://data.police.uk/data/

Open a spreadsheet with the data and delete any data which is not needed and combine data from several months if you want a longer time frame
Add spreadsheet (CSV file format) data to ArcGIS Online using drag and drop or “add item” techniques

The data will now be ready to open within a map
Part 3 – Visualising your data

This video explores key ways you can filter and visualise the crime data in your map [https://www.youtube.com/watch?v=MG9iNGRXOg8&feature=youtu.be](https://www.youtube.com/watch?v=MG9iNGRXOg8&feature=youtu.be)

Filtering can help to display just certain parts of the data which you want to focus on. Crime types are very diverse and your study would probably look at a specific type of crime such as just vehicle crimes or anti-social behaviour.

Spatial patterns can be hard to see. In this data you may also find that there are many points overlapping each other. So you need to be able to visualise the patterns more effectively. One quick way to do this is to use the “Heat Map” display.
Part 4 - Hot spot analysis

This video looks at developing various statistical analysis of your crime data’s pattern using hot spots and density mapping [https://youtu.be/hnVRK8ol2Zk](https://youtu.be/hnVRK8ol2Zk).

This density map has calculated the number of crimes which are occurring per km² for the study area and produces a visually clear isoline map to display these concentrations.

You can also use the data analysis tools to perform a statistical analysis of your crime data patterns. This is called a hot spot analysis and identifies if clusters of crimes are statistically unusually high or low across your study area.
Part 5 – Explaining crime patterns

This video tutorial explains how you can easily find social and economic secondary data layers within ArcGIS Online to add to your map to compare with the crime patterns.  
https://youtu.be/p940qzbyzTc

Here is a freely available map of multiple deprivation levels from the UK. From this you can see if higher concentrations of certain crimes correspond with any of these deprivation indicators.

The table below shows the factors within the multiple deprivation index. This ranks every area in the UK where a score of 1 is the worst performing area on any measure and around 33,000 is the best area.

<table>
<thead>
<tr>
<th>Domain:</th>
<th>Sub-Domain:</th>
<th>Indicators relate to:</th>
<th>Number of Indicators:</th>
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<tbody>
<tr>
<td>Income (22.5%)</td>
<td>Affecting children</td>
<td>Income related benefits</td>
<td>6</td>
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<tr>
<td></td>
<td>Affecting Older People</td>
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<tr>
<td>Employment (22.5%)</td>
<td>n/a</td>
<td>Employment related benefits</td>
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<tr>
<td>Health &amp; Disability (13.5%)</td>
<td>n/a</td>
<td>Illness, admissions, disability, mental health</td>
<td>4</td>
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<tr>
<td>Education, Skills &amp; Training (13.5%)</td>
<td>Children/ Young People</td>
<td>Exam scores, absences, post 16 education</td>
<td>6</td>
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<tr>
<td></td>
<td>Skills</td>
<td>Low or no qualifications</td>
<td>1</td>
</tr>
<tr>
<td>Barriers to Housing and Services (9.3%)</td>
<td>Geographical barriers</td>
<td>Distances to key services</td>
<td>4</td>
</tr>
<tr>
<td>Crime (9.3%)</td>
<td>Wider Barriers</td>
<td>Overcrowding, homelessness, access to housing</td>
<td>3</td>
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<tr>
<td>Living Environment (9.3%)</td>
<td>n/a</td>
<td>Burglary, violence, theft, criminal damage</td>
<td>4</td>
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<td></td>
<td>Indoors</td>
<td>Poor condition housing, central heating</td>
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<tr>
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<td>Outdoors</td>
<td>Air quality, road accidents</td>
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This is a layer showing social and economic data for the UK including things like unemployment rates and percentage of student populations. Again look to see if there seem to be any factors which might explain the patterns of certain types of crime in your study area.
Part 6 - Data enrichment in ArcGIS online

This tutorial explains how you can access, within ArcGIS online, detailed social and economic data from any location specific to your fieldwork investigation needs. [https://youtu.be/-bixghf6RR8](https://youtu.be/-bixghf6RR8)

Here you can use an existing layer such as the deprivation ranking layer and use the data enrichment tool to add real income and age group data to each area.

Here you can just place points on the map and ask the data enrichment analysis tool to provide you with something like average income data for a distance you choose, such as 1km, from each point.
Part 7 – Adding primary data

In this tutorial you see how to set up a spreadsheet to add primary data you have collected in the field to your GIS map. https://www.youtube.com/watch?v=qE3VLgsjzus&feature=youtu.be

First by creating a spreadsheet with the data you want to collect and saving it as “CVS delimited” format

Then adding the data to ArcGIS Online using the “add” option within your contents or using drag and drop
Then you are ready to enter data directly into your map in the right locations.
Part 8 – Analysing spatial links

In this tutorial you will see how you can explore the links between two pieces of data on your map. For example if you added a layer of points showing businesses which were open late at night you could then count the number of drug related crimes within a distance of each one to see if a specific place could be encouraging criminal activity. [https://youtu.be/GhyT1mv2T9Q](https://youtu.be/GhyT1mv2T9Q)

This map shows the counts of total crimes within 75 metres of each late night business in central Bath.
Part 9 – Merging and exporting data

This tutorial shows you how to merge two separate layers. This is a useful way to combine and summarise data for certain areas. Then you can use this newly combined layer to export your whole data set to a spreadsheet. This will then allow you to analyse the relationships between factors such as levels of a type of crime and levels of unemployment across an area. This allows you to then conduct some complex statistical tests on your data such as Spearman’s Rank correlation.

https://youtu.be/f61TqBOPwvI

Here the deprivation layer is being merged with the crimes layer

The result now shows the total crimes in each of the deprivation layer areas.

This newly merged data layer can be exported as a “CSV” file
This can be opened in a spreadsheet programme

Then the data can be looked at using scatter graphs.
Statistical tests such as the strength of the correlation can be tested. Here are some online calculators which can be used [http://www.maccery.com/maths/](http://www.maccery.com/maths/) or [http://www.socscistatistics.com/tests/spearman/default2.aspx](http://www.socscistatistics.com/tests/spearman/default2.aspx)

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Part 10 – Using the Esri Collector App

This tutorial explains the process for setting up your data so that you can use the Esri Collector App to input data. You can even set this up for use in the field without any internet connection and then synchronise the data later. https://www.youtube.com/watch?v=pUgUkBt0I0

View of your maps which are set up to work within the collector app.

View of a map set up for offline data entry in the field within the collector app. This will be synched to update the map online when back in a WiFi zone.
Conclusions and evaluation

This is an important part at the end of an investigation. Drawing a conclusion involves making a list of brief points about what you consider to be the key findings in relation to your initial aims and hypothesis.

You could make some recommendations based on your study such as suggestions which may reduce the levels of crime in a certain area based on your findings.

There is lots to evaluate with a study of this nature. In your evaluation try to make comment on which parts of your results you are most confident with and which ones you are less certain about.

- Consider the various types of secondary data you have used. While it might look detailed and impressive there are lots of things to consider about it. Is the data from a good quality source? How old is the data? Does the crime data include all reported crimes? What data will it be missing and why? Is the data representative of the patterns for longer time scale than the month(s) you have used?
- How detailed are the areas in the deprivation and economic data maps? Do they help pick out the small scale/ street level factors which may influence the crimes?
- In your primary data you will probably find it easier to identify limitations such as your sample size, sampling strategy, equipment or techniques used.
- Does correlation equal causation – in other words say there is a link between crime levels and poverty can we say it is poverty causing the crime, or that criminal activity is attracted to the poorer areas, or that in fact there are other factors which have actually caused the pattern.
- Consider areas to extend your study through improving the data quality or by collecting new data.