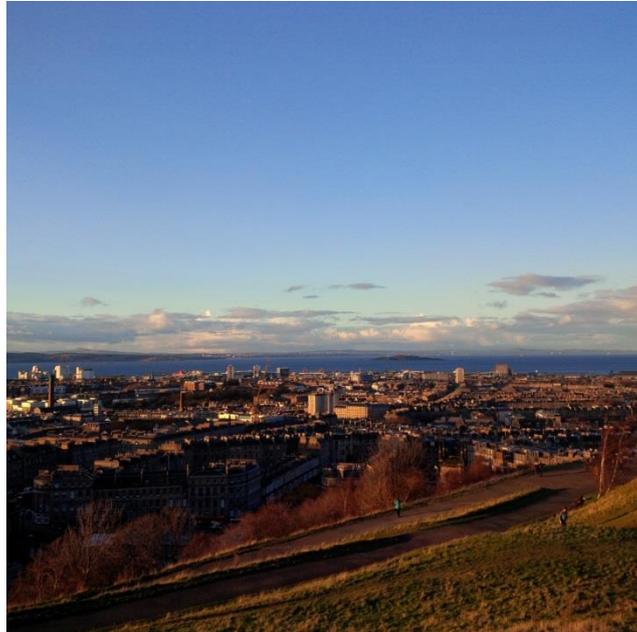


# Exploring online mapping applications for socio-economic data: their use and impact

## Workshop report



Jonathan Hopkins\* and Andrew Copus

Social, Economic and Geographical Sciences

The James Hutton Institute

\*: [jonathan.hopkins@hutton.ac.uk](mailto:jonathan.hopkins@hutton.ac.uk)



This workshop took place as part of the “Web-based mapping for open access – building capacity and exploring user preferences” project, funded by the Macaulay Development Trust. The workshop contributed to Work Package 1 of this work.



## Purpose of document and research aims

This document summarises the activities and discussions which took place at a workshop “Exploring online mapping applications for socio-economic data: their use and impact” which took place at the COSLA Conference Centre in Edinburgh on the 3<sup>rd</sup> October 2016. This workshop was held as part of the project “Web-based mapping for open access – building capacity and exploring user preferences”. The specific aim of the first work package of the project was to “...assess ways in which web mapping facilities can be made more accessible and useful to end users, and can deliver policy impact”. Additionally, during the workshop introduction, three key research questions were noted:

- How are online mapping applications for socio-economic data used by different groups?
- How can they be improved/made more effective?
- How can they be used to generate impact and influence action?

And two broader aims for the workshop event itself were recorded:

- Knowledge exchange, learning and discussion between professional end users, people involved in mapping tools, and researchers
- Open, informal and useful discussions

## Workshop organisation and timetable

The ‘end users’ of online mapping tools for socio-economic data have been recently described based on the professions of Twitter users who shared the UK-based DataShine and LuminoCity websites<sup>1</sup>, and five ‘key groups’ of users of the DataShine site have also been identified: the private, public and non-profit sectors, teaching staff, and members of the public<sup>2</sup>. From these insights, four groups of potential users of online mapping applications in Scotland, based on organisation type, were identified:

- Local government (including community planning, and those involved in LEADER Local Action Groups)
- Researchers, including mapping tool designers
- Scottish Government and Scottish Public bodies
- The third sector: including charities in relevant areas (e.g. poverty, transport).

Over summer 2016, potential speakers for the workshop were approached, and following an internet search, individuals within the four groups above who may be interested in the workshop issue were identified. Batches of invitations were distributed in July and August 2016 via email: people were invited to attend the workshop if they had used online mapping applications in any way during the course of their work. In some cases, these invitations were helpfully distributed by recipients to other staff within their organisations, so they reached staff not identified in the initial

<sup>1</sup> <https://citygeographics.org/2015/11/20/exploring-the-users-of-interactive-mapping-platforms/> (Accessed 4<sup>th</sup> October 2016)

<sup>2</sup> Page 681 of O’Brien, O. and Cheshire, J. (2015) Interactive mapping for large, open demographic data sets using familiar geographical features. *Journal of Maps*, 12 (4): 676-683.  
<http://dx.doi.org/10.1080/17445647.2015.1060183>

list. On the day, there were 25 attendees<sup>3</sup> (not including the two investigators), representing a broad cross-section of professional end users.

The workshop was structured into three main sessions. The first two were based around a series of presentations (c. 15 minutes), leading to questions and discussion. The third session, entitled “Online map users’ experiences: what works and what doesn’t?” used activities and discussions to explore end user views on the quality and clarity of different types of map designs, and important features of online mapping applications from the viewpoint of end users. The session was also used to collect data through questionnaires on the use of geographical socio-economic data, and preferences for the design of maps and online mapping tools. At the start of the day, the project investigators provided a brief introduction and background information on research on socio-economic performance in Scotland, which led to the development of this research project. The workshop timetable is shown below.

<b>9:45 → 10:20</b>	<b>Coffee, tea, orange juice, biscuits available</b>
<b>10:20 → 10:25</b>	<b>Introduction, tour of the table and workshop background (I)</b> <b>Jonathan Hopkins</b> (The James Hutton Institute)
<b>10:25 → 10:35</b>	<b>Workshop background (II)</b> <b>Andrew Copus</b> (The James Hutton Institute; Nordregio): <u>“Mapping Rural Socio-Economic Performance (SEP)”</u>
<b>10:35 → 11:20</b>	<b>Online mapping applications and socio-economic research: what is available?</b> Format: 15 minute talks and discussion. Chair: Andrew Copus <b>Ryan Weber</b> (Senior Research Advisor, Nordregio): <u>“NORDMAP Nordic web-mapping tool: Lessons from developing an online mapping tool for socio-economic data”</u> <b>Gregor Boyd</b> : <u>“Statistics.gov.scot”</u>
<b>11:20 → 11:30</b>	<b>Break</b>
<b>11:30 → 13:00</b>	<b>Which maps generate impact?</b> Format: 15 minute talks and discussion. Chair: Andrew Copus <b>Shona Nicol</b> (Head of Geographic Information Science & Analysis Team (GI-SAT); Directorate for Digital, The Scottish Government): <u>“Maps that Generate Impact”</u> <b>Alistair Prior</b> (Head of Rural Communities Team, The Scottish Government): <u>“Use of socio-economic data to support funding of Local Development Strategies in Scotland”</u> <b>Mike Atkinson</b> (Research Officer – Highland Council; Muir of Ord (Tarradale) Community Council; Muir of Ord Hall and Facilities Company): <u>“Open data access supporting community driven change”</u>

<sup>3</sup> Based on signatures on the consent form.

	<b>Alastair Nicolson</b> (Highlands and Islands Enterprise): <u>“Fragile Areas in the Highlands and Islands”</u>
<b>13:00 → 14:15</b>	<b>Lunch</b>
<b>14:15 → 15:50</b>	<b>Online map users’ experiences: what works and what doesn’t?</b> Format: Audience-led discussion and activities. Facilitator: Jonathan Hopkins
<b>15:50 → 16:10</b>	<b>Break</b>
<b>16:10 → 16:30</b>	<b>Closing discussion. Lessons from the day. Workshop closed.</b>

## Workshop results: presentation summaries<sup>4</sup>

The first session of the workshop (‘Online mapping applications and socio-economic research: what is available?’) introduced two contrasting online platforms. **Ryan Weber** introduced the NORDMAP mapping tool<sup>5</sup>, which offers the ability to generate high quality, customisable maps of social and economic data across the Nordic countries. Ryan offered points of ‘key advice’ for developing mapping tools, which focused on the ability to show change over time, ensuring that the applications work, and are developed with users in mind, and creating a dynamic but simple interface. **Gregor Boyd** then summarised statistics.gov.scot<sup>6</sup>, a facility which provides Official Statistics for Scotland from a range of providers, contains a “metadata catalogue” of data available, and enables flexible downloads of data for different variables, geographical units and types of statistics, as well as basic mapping. Both speakers provided live demonstrations of these websites: notable within these were the ‘TimePlay’ function of NORDMAP (to show changes in indicators over time) and the exploration of data within statistics.gov.scot, including the use of the ‘Data cart’ to download data and how to produce simple maps.

The second session of the workshop was on the theme of the use of maps to achieve impact and positive action. **Shona Nicol** provided an overview of two main areas where geographic information systems (GIS) were important to the Scottish Government: “key spatial data of national importance” (e.g. the development of the Data Zone geography, the Urban-Rural Classification and calculating access to services for use within the Scottish Index of Multiple Deprivation (SIMD)<sup>7</sup>); and “key policy led analysis” (including work on a Population Dispersion Index in Dumfries and Galloway, patient transport for treatment, assessing public subsidies related to transport, and a ‘heat map’ for Scotland). Next, **Alistair Prior** explained the allocation of European Union funding under the LEADER programme<sup>8</sup> for the 2014-2020 period, with funding distributed to local action groups in Scotland partly based on the population affected by poor socio-economic performance (as defined by the SEP Index produced by The James Hutton Institute). This method was presented as a contrast with the

<sup>4</sup> A research project website will be developed, this will include presentations (if approval is given for reproduction) and other resources

<sup>5</sup> <http://www.nordmap.se/> (Accessed 5<sup>th</sup> October 2016)

<sup>6</sup> <http://statistics.gov.scot/> (Accessed 5<sup>th</sup> October 2016)

<sup>7</sup> <http://www.gov.scot/Topics/Statistics/SIMD> (Accessed 5th October 2016)

<sup>8</sup> See <https://www.ruralnetwork.scot/funding/leader> (Accessed 5th October 2016)

previous method for allocating funding in the 2007-2013 period, which had several issues. Alistair also raised the difficulty of reconciling Data Zone-based information with other areas: a theme noted throughout the day.

The following talks provided a Highlands-based perspective. **Mike Atkinson** gave a talk as a Community Councillor from Muir of Ord, and described the need for communities to access and use spatial social and economic data to support applications for development funding. Mike described 'real world problems' including the lack of 'fit' between Data Zones and more meaningful units such as 'communities', and the difficulties in arriving at a satisfactory population figure for his community: the conclusion being that open data should be readily accessible to those with different skill levels. **Alastair Nicolson** outlined the methods used by Highlands and Islands Enterprise (HIE) to define 'Fragile Areas' and 'Employment Action Areas'; the former being prioritised for support by HIE. The methodology for calculating Fragile Areas was described, incorporating 'key indicators', supplementary indicators and consultations. The mapping presented showed that Fragile Areas were spread across the remoter areas of the Highlands and Islands, with Employment Action Areas associated with economically deprived areas of Argyll and Bute and areas where employment could be threatened in future.

## Online map users' experiences: what works and what doesn't?

The afternoon session included activities designed to capture the views and preferences of end users for the design of maps and online mapping applications. At the start of the session, workshop participants were shown examples of three map types.

- Choropleth maps, where areas are shaded different colours, depending on the data values shown<sup>9</sup>. This is arguably the 'standard' map style for displaying socio-economic data.
- 'DataShine'<sup>10</sup> type maps, as used within online mapping available for the Scottish Index of Multiple Deprivation, 2016<sup>11</sup>. These maps only show data for areas of buildings or urban areas, rather than for whole regions as on standard choropleth maps.
- Cartograms, where the areas of different regions are distorted in proportion to their population<sup>12</sup>.

Following this, a questionnaire was given to participants to complete, which included three questions on a) how clear participants found choropleth maps for communicating socio-economic data, and b) how effective 'DataShine' maps and cartograms were for clearly communicating socio-economic data, in comparison with choropleth maps. Participants were then split into three groups and asked to feed back their responses to these questions onto three 'grids' (using stickers) to produce an aggregate view of the opinions of all participants<sup>13,14</sup>. These showed that:

<sup>9</sup> See [https://en.wikipedia.org/wiki/Choropleth\\_map](https://en.wikipedia.org/wiki/Choropleth_map) (Accessed 5th October 2016)

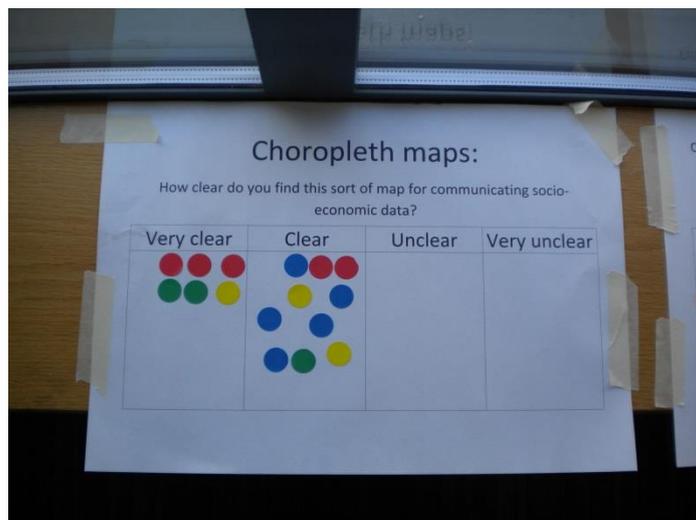
<sup>10</sup> An online mapping application (<http://datashine.org.uk/>). Reference: O'Brien, O. and Cheshire, J. (2016) Interactive mapping for large, open demographic data sets using familiar geographical features. *Journal of Maps*, 12 (4): 676-683. <http://dx.doi.org/10.1080/17445647.2015.1060183>

<sup>11</sup> <http://simd.scot> (Accessed 5<sup>th</sup> October 2016)

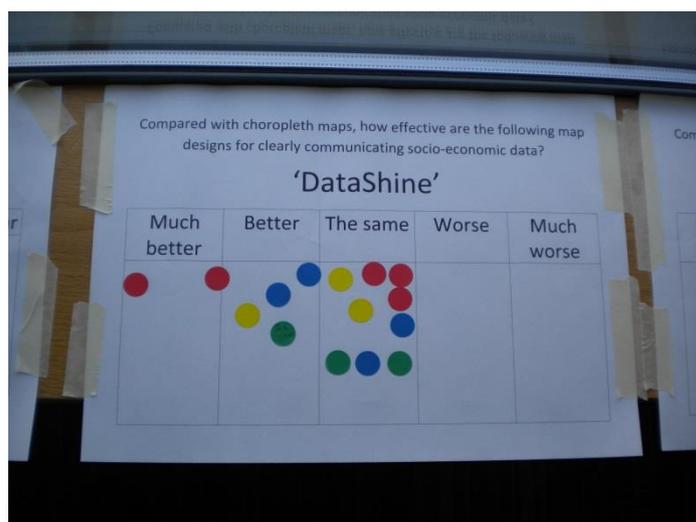
<sup>12</sup> See <https://en.wikipedia.org/wiki/Cartogram> (Accessed 5th October 2016)

<sup>13</sup> Note that figures provided on the questionnaires themselves were very similar to the results of the 'sticker' exercise.

- Choropleth maps were viewed positively. All respondents thought that choropleth maps were either 'clear' or 'very clear' for the communication of socio-economic data.



- 'DataShine' type maps were also viewed positively: most respondents thought that they were as effective as choropleth maps for clearly communicating data, and six out of fifteen respondents thought they were more effective.



- Overall, cartograms were more negatively judged, with most participants viewing them as worse than choropleth maps.

<sup>14</sup> Note that the sticker colours related to the organisation type of workshop participants.



nationwide public sector group pointed out that these maps coloured all buildings, including non-households<sup>16</sup>.

- The ability of end users to understand cartograms was linked to some of the advantages and disadvantages identified. The local government group noted that these maps were "most meaningful" with the caveat "if you understand them & metric used", and the same group recognised that they were "least familiar to (the) public". Other similar disadvantages were noted by other groups ("requires more understanding e.g. geographies of population", "can be confusing - need to see next to original areas?") and cartograms were also perceived as "hard to navigate" and that it was "difficult to infer statistics" from these maps. Advantages of cartograms noted included their effectiveness for impact ("can have impact/put across particular message", "emphasises how small & marginal some areas are").

The questionnaire completed by participants was used to summarise the participants' preferences for the design of maps and online mapping tools for socio-economic data, particularly related to interaction<sup>17</sup> with these applications and their usability<sup>18</sup>. 18 participants filled this questionnaire in: while this is a small sample compared with those of other surveys, it provides a very useful summary of end user views.

- Firstly, end users were clearly comfortable with using these applications: eight respondents favoured a moderate level of interaction, while nine favoured either high or very high interaction (n = 17).
- Participants were asked to rate the importance of a range of ways that they can interact with online mapping applications for socio-economic data (giving a score of one (no importance) to five (essential)). Simple average scores (shown on Figure 1) show that the ability to navigate the map was seen as highly important (mean importance rating = 4.8), with the ability to display summary statistics (4.1) perceived to be the next most important feature. The ability to change the intervals of the data 'categories' displayed (to suggested intervals: 3.7, to exact intervals: 3.3) were also seen as important, abilities to change map colour schemes were felt to be slightly less important.

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<sup>16</sup> This issue was acknowledged by researchers involved in the 'DataShine' mapping, who note that "...it would be possible to provide a more nuanced impression of the built form by removing non-residential buildings" (O'Brien and Cheshire, 2016: 678).

<sup>17</sup> Relevant descriptions of human interaction with maps described by McEachren (1994: 6-7) and Roth (2013: 63-64). (references: MacEachren, A.M. (1994) Visualization in Modern Cartography: Setting the Agenda. In MacEachren, A.M. and Taylor, D.R.F. (eds) Visualization in Modern Cartography. Pergamon, 374pp: 1-12. Roth, R.E. (2013) Interactive maps: What we know and what we need to know. Journal of Spatial Information Science, 6, 59-115. doi: 10.5311/JOSIS.2013.6.105)

<sup>18</sup> Several of the types of interaction and usage, and the 1-5 (no importance to essential) scale, described in the following section were based on those used by Roth et al. (2014) (reference: Roth, R.E., Donohue, R.G., Sack, C.M., Wallace, T.R., Buckingham, T.M.A. (2014) A Process for Keeping Pace with Evolving Web Mapping Technologies. Cartographic Perspectives, 78: 25-52. <http://dx.doi.org/10.14714/CP78.1273>)

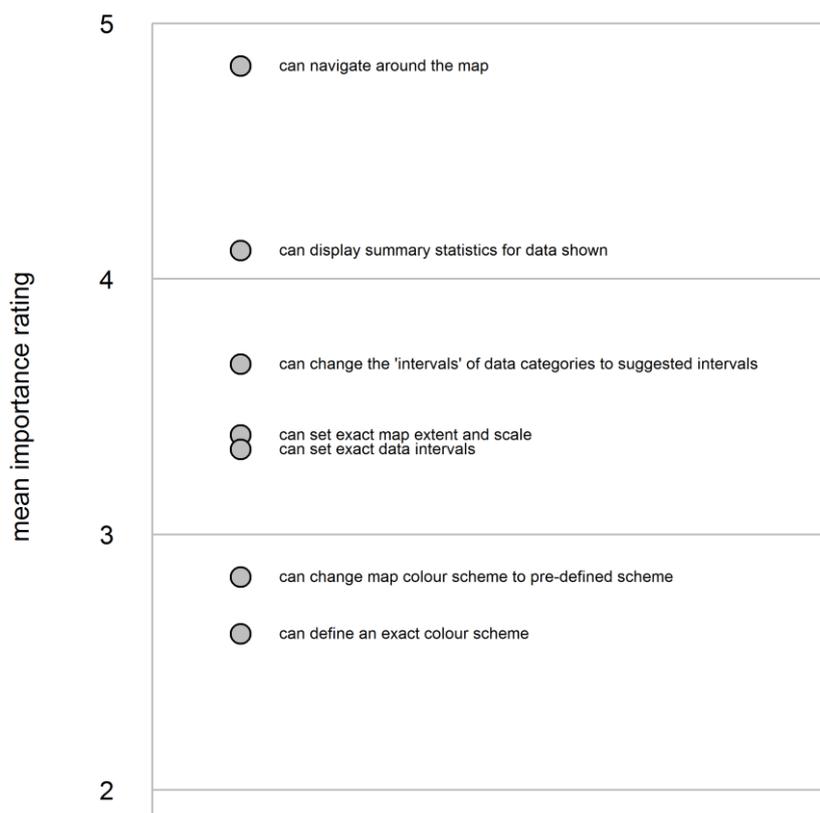


Figure 1: The importance of 'interactivity' aspects of online mapping applications, according to workshop participants. Individual ratings were given from 1 (no importance) to 5 (essential). The 'mean importance rating' can therefore range from 1 to 5.

- Similarly, participants were asked to show the importance of certain aspects of online mapping application usage, giving a one to five rating as above. Averages are shown on Figure 2. The ability to use the online mapping application on several internet browsers (mean importance rating = 4.5), the easy reproducibility of data with few copyright restrictions (4.4) and similar reuse of maps (4.3) were seen as most important, with the ability to download maps as high quality images (4.1) and the inclusion of a data download facility (4.1) also scoring highly. Applications being aware of user location received a much lower rating in terms of importance (mean = 2.3), and surveyed end users did not regard the use of open source technology as particularly important (3.3) in comparison to other characteristics noted above.

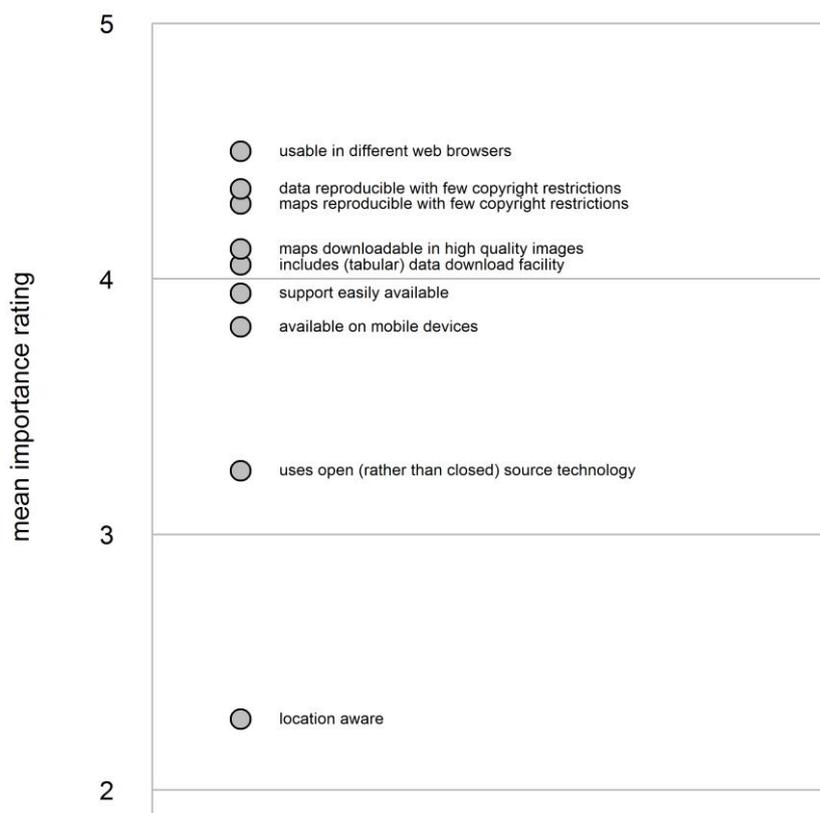


Figure 2: The importance of different aspects of online mapping application use, according to workshop participants. Individual ratings were given from 1 (no importance) to 5 (essential). The 'mean importance rating' can therefore range from 1 to 5.

In addition to preferences described above, further insights into the ways that workshop participants used geographical socio-economic data were collected within another questionnaire. In light of the issues raised above, responses to selected questions are summarised below.

- Participants were asked to identify the geographical areas which they used for their work with socio-economic data, from a provided list of geographical units. Participants noted whether these units were used 'Frequently' (used once a week or more often), 'Occasionally' or 'Never'. Figures show that local authority areas and Data Zones were the most widely used geographical area (Table 1): these were the only units to be used 'frequently' by over half of the participants who responded to this question. While these two types of area are commonly used for analysis and the reporting of statistics, participants had experience of using a range of other geographical units, especially urban-rural classifications, intermediate zones, settlements/localities and postcode units.

Geographical area	% who used 'Frequently'	% who used (at all)
<b>Local authorities</b>	<b>100.0</b>	100.0
<b>Data Zones</b>	<b>83.3</b>	100.0
<b>Urban-rural classification (any)</b>	<b>47.4</b>	84.2
<b>Postcode units</b>	<b>44.4</b>	77.8
<b>Intermediate geographies</b>	<b>44.4</b>	88.9
<b>Settlements or localities</b>	<b>38.9</b>	83.3
<b>Travel to work areas</b>	<b>26.3</b>	52.6
<b>Electoral wards</b>	<b>22.2</b>	72.2
<b>Scottish Parliamentary Constituencies</b>	<b>22.2</b>	61.1
<b>Census output areas</b>	<b>16.7</b>	83.3
<b>Highlands and Islands Enterprise</b>	<b>16.7</b>	27.8
<b>Island groups</b>	<b>16.7</b>	27.8
<b>National Parks</b>	<b>11.1</b>	50.0
<b>Protected areas (any type)</b>	<b>10.5</b>	42.1
<b>UK Parliamentary constituencies</b>	<b>5.6</b>	44.4
<b>Police Force Areas</b>	<b>5.6</b>	27.8
<b>Civil Parishes</b>	<b>5.6</b>	27.8
<b>Historic counties or historic districts</b>	<b>0.0</b>	16.7

*Table 1: Use of different geographical areas by workshop participants. Figures show percentages of respondents. Other geographical units provided by participants included community council boundaries, NUTS, housing market areas, grid level, Highlands and Islands Enterprise local areas and agricultural parishes.*

- Participants were also asked to note how frequently they carried out activities related to socio-economic data and mapping when at work<sup>19</sup>. Accessing or downloading geographical socio-economic data was a common activity among workshop participants (13 out of 19 respondents did this once a week or more often), and analysing this data was also a regular task (ten out of 19 respondents did this once a week or more often, 16 once a month or more often). For work with maps, there is a contrast between participants' regular access to pre-existing maps of socio-economic data (13/19 did at least once a week, 17 at least once a month) and the much less frequent creation of maps using online mapping applications (five out of 18 did this once a week, 11 once a month) and using GIS-like software (two out of 17 did this once a week or more often, eight at least once a month).
- In terms of the ways that maps of socio-economic data were used<sup>20</sup>, it is clear that they were used to accomplish several tasks. In terms of frequent use, the use of maps to present findings to other groups and summarise and clarify work were most commonly reported (Table 2). Maps were less commonly *frequently* used for data exploration and hypothesis testing. Participants were also asked about the specific tasks which they were hoping to accomplish when using maps of socio-economic data. Commonly cited tasks include those

<sup>19</sup> Time 'scale' based on that used in Roth et al. (2014): 31.

<sup>20</sup> The four "types of task" are derived from the four stages of research described in DiBiase (1990) (reference: DiBiase, D. (1990) Visualization in the Earth Sciences. Earth and Mineral Sciences, 59 (2): 13-18. Pennsylvania State University. Available at <http://www.geovista.psu.edu/publications/others/dibiase90/swoopy.html> (Accessed 19th October 2016). These stages are also described within Roth (2013: 68)

associated with communication and presentation of results, funding applications, and for informing policy groups.

Type of task	% who do 'Frequently'	% who do (at all)
<b>Data exploration</b>	31.6	94.7
<b>Hypothesis testing</b>	26.3	73.7
<b>Summarising/clarifying work to findings</b>	52.6	94.7
<b>Presenting findings</b>	52.6	100.0

*Table 2: How do workshop participants use maps? Figures show percentages of respondents.*

## Lessons from the day and key points

This section presents a summary of key issues which emerged from the workshop. It represents the reflections of the project investigators and also the views of some speakers and participants, and those of two participants (Scottish Government group, researchers group) who spoke briefly in the final session of the workshop.

- A recurring theme was **the lack of 'fit' between the Data Zone geography widely used to report on socio-economic statistics in Scotland, and units which are more meaningful to end users**, such as communities and localities. While some population data is available at much more 'fine grained' scales than Data Zones<sup>21</sup>, there are some disclosure constraints. Data on the use of different geographical units indicates that Data Zones are in widespread use, but based on presentations and discussions, they may not be satisfactory as a unit of analysis in all cases.
- **The different skill levels required to use different online platforms, and the demands this may place on some users.** Applications like NORDMAP enable the production of neat, attractive maps by a wide range of end users. By contrast, obtaining data from statistics.gov.scot and producing maps of 'NORDMAP quality' from this data will require greater technical ability and skill. The sites have very different purposes, and this does not indicate any criticism. Among workshop participants, there was evidence (in questionnaire responses) of widespread experience with downloading and analysing socio-economic data and using maps. However in the context of the trend to community based development, with communities making applications for funding and support themselves, just making data 'open' is not enough – it needs to be accessible and understandable for non-specialists.
- With regards to the development of mapping applications, there was some discussion over how these can 'add value' to datasets. There are possible problems in simply releasing raw data, as this can be misinterpreted, and **some thought should go into processing raw data into meaningful variables and indicators**. At the same time, interactive summary statistics, easily reproducible data and a data download facility are viewed by end users as important features of online mapping tools. However, discussions identified potential issues with gaining permission to share data and data protection. Although a very large (and expanding) volume of openly available and reusable socio-economic data exists, there is evidence that a

<sup>21</sup> For instance, data for Output Areas is available at <http://www.scotlandscensus.gov.uk/ods-web/data-warehouse.html#bulkdatab> (Accessed 10<sup>th</sup> October 2016)

**legacy of legal/copyright issues and arrangements with third parties (e.g. licensing) exists in some areas to prevent data sharing.**

- End user views on types of map design showed that **choropleth and 'DataShine' type maps were viewed positively**, but a range of more subtle advantages and disadvantages for different types of map were identified during discussions. If maps of socio-economic data are produced (whether maps are produced in online applications, or by GIS users), it is clear that **the type of map needs to fit the characteristics of the data, the purpose of map production, and the map's likely audience**. As maps were commonly used by participants for the purposes of communication, presentation and illustration, **ensuring that created maps are of high aesthetic quality is important**.
- The day offered key insights for the researchers which will prove useful to the Social, Economic and Geographical Sciences group and The James Hutton Institute more broadly. Our research proposal noted the potential seed-corn impact of **"...an understanding of ways to improve knowledge exchange tools"**. Expanding on the points above, there is potential for The James Hutton Institute to add value to datasets and resources through **a) the development of well-designed indicators, aligned with areas of public and policy interest, for small geographical areas; and b) developing online applications to enable end users to generate high quality bespoke maps, potentially incorporating non-choropleth map designs, and geographical units other than Data Zones**. The high level of interest in maps and spatial analysis was very clear during the workshop, and ensuring that any future mapping applications developed by The James Hutton Institute are usable and beneficial for as many end users as possible is particularly important.

## Workshop feedback summary

Following the workshop, emails were sent to participants with an attached feedback form consisting of a series of statements (requiring a response from strongly agree to strongly disagree) and three opportunities for longer responses to questions. This feedback was positive: one comment noted that it was *"A well ran and organised event. All participants were (enthusiastic)"* and no responses to statements were 'Disagree' or 'Strongly disagree', which would have indicated negative views.

In response to the question **"What did you think could have been done to improve the workshop?"** respondents noted some issues related to the timing of lunch and breaks, and also that mixing the workshop groups (related to the afternoon session's activities) may have been interesting:

- *Possibly didn't need as long for lunch - but it did give some opportunity for wider networking. It might have been interesting to 'mix up' the membership of workshop groups, to hear different experiences.*
- *I found the lunch break really useful for networking, but would have preferred shorter tea/coffee breaks to give more time for discussion/questions etc.*
- *nothing much*

In response to the question **"What do you think was most enjoyable and/or useful about the workshop?"**, it is notable that presentations and learning/networking aspects of the workshop were mentioned relatively frequently, and were viewed particularly positively.

- *Presentations & different perspectives of participants*
- *Workshop activities made me think more deeply about the subject matter.*
- *There were several elements that I found useful and enjoyable, the presentations, the questionnaire workshop, the networking opportunities and I also learnt about the benefits and drawbacks of choropleth, dashboards and cartograms which I hadn't been aware of previously.*
- *the presentations and learning from others*
- *Presentations and contacts made from the day*

## **Acknowledgements**

The investigators would like to thank all workshop participants for providing their time to attend and contribute, and would particularly like to thank speakers for producing a series of excellent presentations. We also thank the staff at the COSLA Conference Centre for the venue and catering, reception staff at the James Hutton Institute (Craigiebuckler) for producing name badges, and acknowledge the Macaulay Development Trust for providing funding for this project. Graphs within this report were created using R<sup>22</sup>.

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<sup>22</sup> R Core Team (2016) R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. <https://www.R-project.org/>