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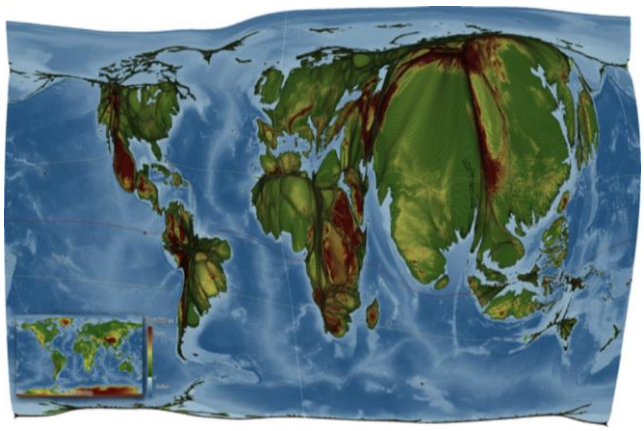
Mapping the 'anthropocene'

Geographer Dr Benjamin Hennig FRGS, of the University of Sheffield writes, explaining how new types of mapping are helping to explain the rapidly changing environment of the world.

The effects of humans on the global environment are perceived to be so significant by some scientists that they argue the onset of industrialisation (in the eighteenth century) has been a major driving force in environmental change on a par with the forces of nature. It is this rapid impact that has led some geologists to unofficially name (but not, as yet, officially recognise) this recent period of the earth's history (from around 1760-onwards) as the *Anthropocene* (roughly translating as the era – or epoch – shaped considerably through the actions of humanity).



Gridded population cartogram displaying the topography of the world in relation to the population distribution

Geographers have helped analyse, and increase our understanding of, the complex relationship between the physical and human environment, regularly using maps and visualisations to help shape our view of the world. Graphical displays have a long history in translating the complexity of our environment into understandable visual representation, with maps the most common way of representing the geography of our world, showing us how to get from A to B, and much more besides.

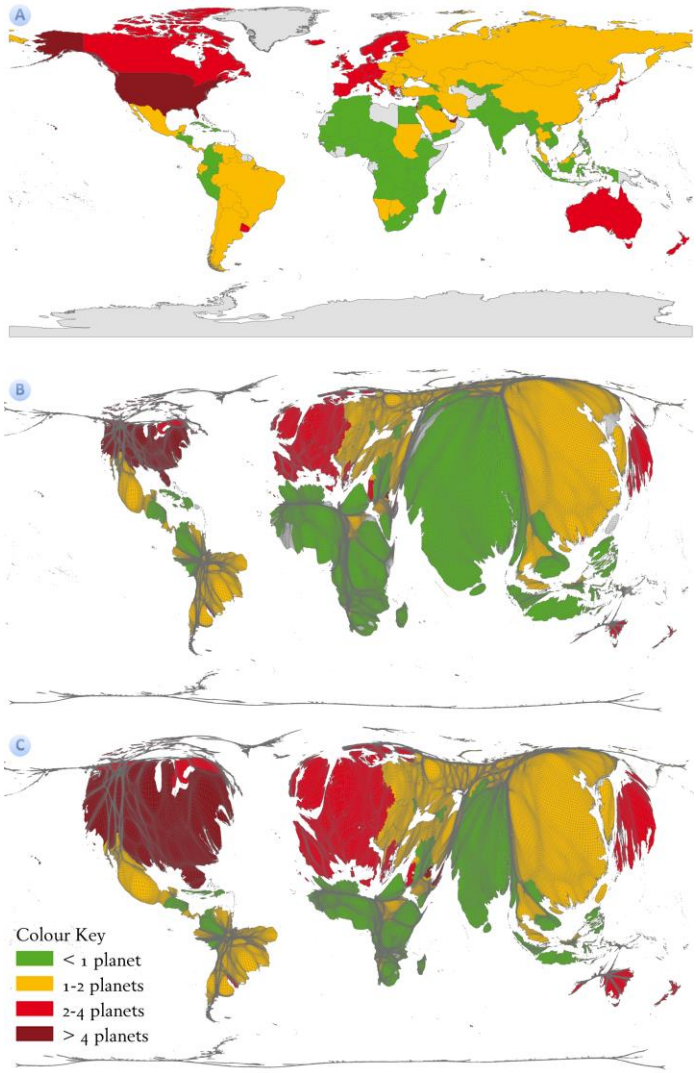
Although the traditional concept of a map is currently being challenged and revised in digital formats (for example, through the in car Sat-Nav) these still rely upon the underlying and traditional techniques of mapping, invented to discover unknown places and explore our physical environment, and do not have the capabilities needed to help us better understand the complex human-environment relationships of the *Anthropocene*.

Geographers' response to this problem has been to identify a need for new maps, developing new ways of mapping that use the computing powers of geographical information systems (GIS) to allow any geographic information from the human and physical environment of the world - issues as diverse as wealth, rainfall, or even the environmental conditions of the oceans – and how these are distributed across the world, to be illustrated in a visually interesting way.

The technique used to create these maps, known as 'gridded cartogram' transformation, works by morphing the recognisable shape of the world map so that the 'area' of the map represents not that of the actual land area but instead reflects the quantity of the dataset being presented. The technique applies something known as a 'density-equalising algorithm' to an underlying grid, ensuring the preservation of an accurate geographic reference to the real world.

One example, providing a clear demonstration of the capabilities of this technique, combines data on the world's population against the altitudes at which they live (a 'topographic' layer). The map created uses an 'equal-population' projection where every person on the planet gets the same amount of map-space. This allows an understanding of the distribution of people in relation to the elevations at which they live. The visual effect on the world map is dramatic: with very low population densities in mountainous areas such as the Himalayas in Asia, the Rocky Mountains in North America or the Andes in South America, many of the world's highest areas virtually disappear from the map. At the same time, the map highlights the high plateau of Mexico City and densely populated Ethiopian highlands as regions where high altitude has not restricted population.

This simple example just hints at how visualising geographical data in an interesting, and sometimes unusual, way can help to make the complexity of the world more understandable and the data more meaningful. An example demonstrating human impact on the world using this technique comes in a series of three maps showing 'ecological footprint' data. The 'ecological footprint' is a measure for the amount of resources being used – in total and per head of population – as a measure of the sustainability of a country's economy.



The ecological footprint describes the number of planets that were needed for a sustainable future if all people on the planet were using the same resources. It is expressed as x-planet living for a country. A: Shown on a conventional map, B: Shown on a gridded population cartogram, C: Shown as a gridded cartogram where each grid cell is resized according to its total ecological footprint

The first, a 'normal' world map, displays the ecological footprint categorisation (from sustainable to very unsustainable following a traffic light scheme from green to red) in the way it is most usually presented, with darker colours representing the bigger 'footprint' (and environmental impact) from more industrialised nations.

The second map, a gridded 'population cartogram', works in the same way as altitude in the previous example. Displaying the same 'ecological footprint' data against country population data, it shows that relatively few people globally are living very unsustainable lifestyles.

The third map shows the real extent of their impact, goes further still with the 'gridded cartogram' calculating the total hectares of ecological footprint that the people in each grid cell have (reflecting where most people live within a country, assuming people have a similar footprint within and across each country). This map therefore is a clear visual demonstration the high resource use, and unsustainable lifestyles, of relatively few people globally.

The use of cartograms like these will not solve all the challenges humanity faces, but a map can speak a thousand words and have a much bigger impact on people than a thousand complex charts and tables do.

The world in the *Anthropocene* may be a complex one, but it is one that geographers are finding ever better ways to explain.

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Rediscovering the world: Map transformations of Human and Physical Space
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A large number of examples from the work can be found on the views of the world website

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