British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

NERC Environmental Data Transformation at the British Geological Survey
Friday 23rd March 2012

Data Representation and Visualisation – Breaking Boundaries

Henry Holbrook, Simon Ward, Clive Cartwright
British Geological Survey

© NERC All rights reserved

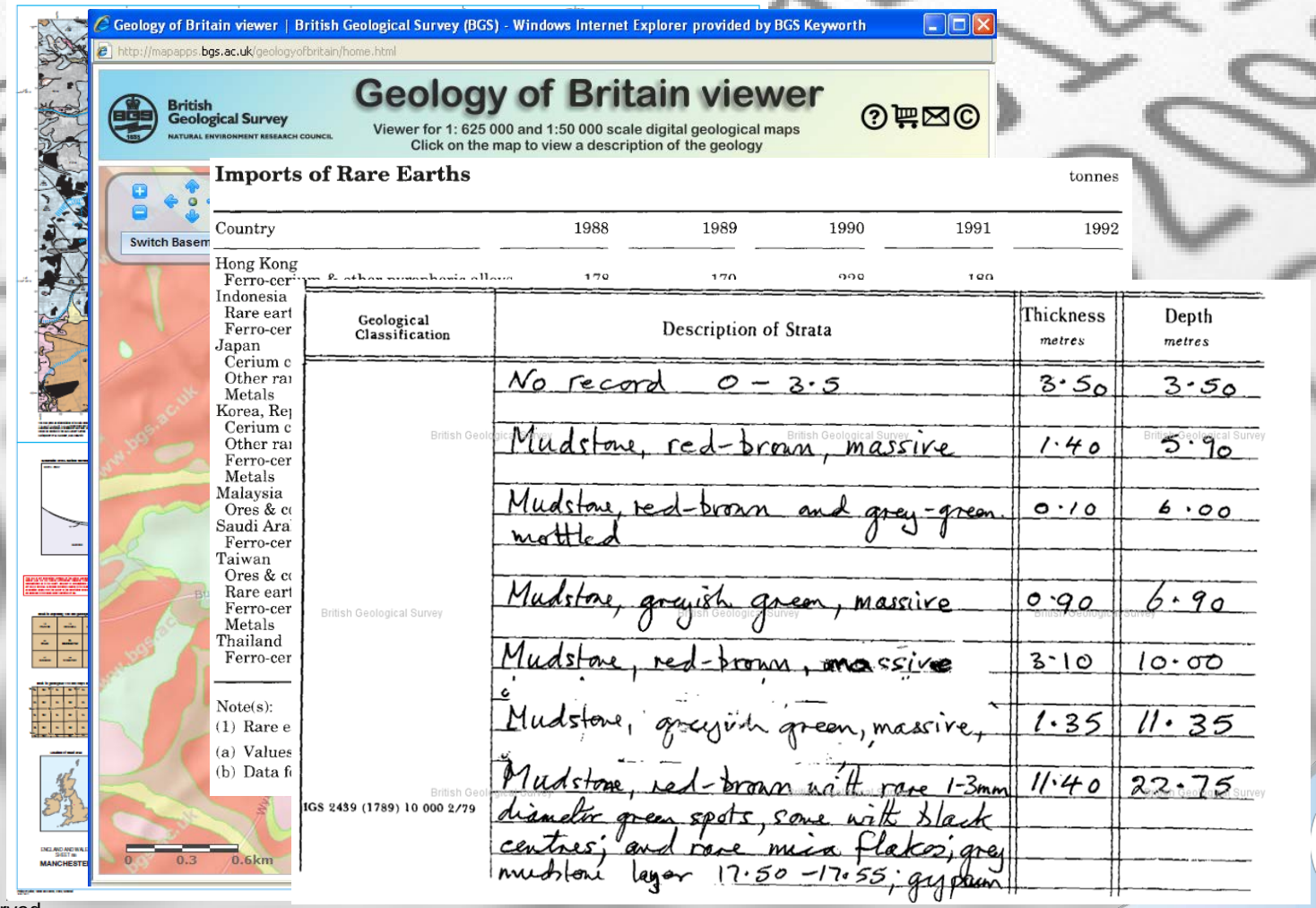
Schedule

- Data
- Introduction
- Who we are and what we do
- Infographics
- Cartograms
- What we've found
- Why breaking boundaries?
- Future
- Questions

© NERC All rights reserved

Data

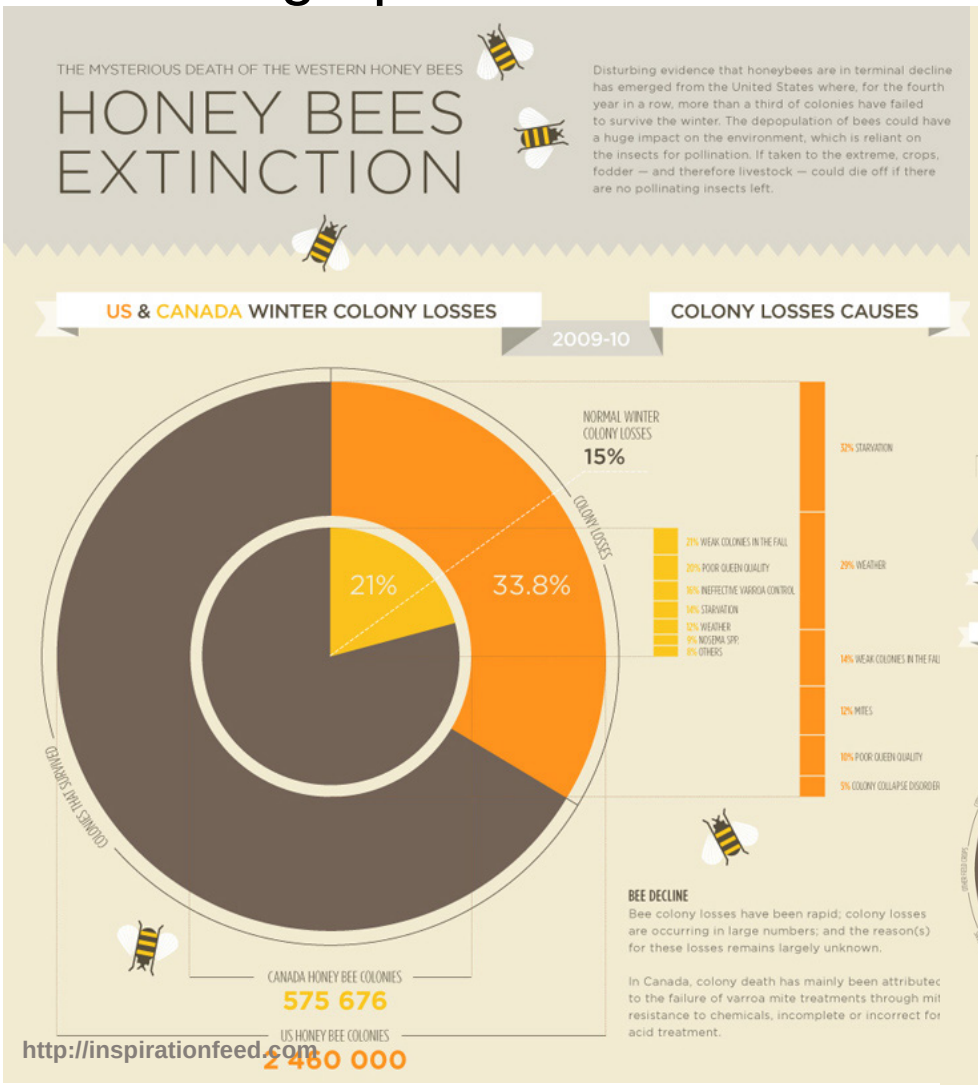
- Huge amount of data being created
- Different types of data

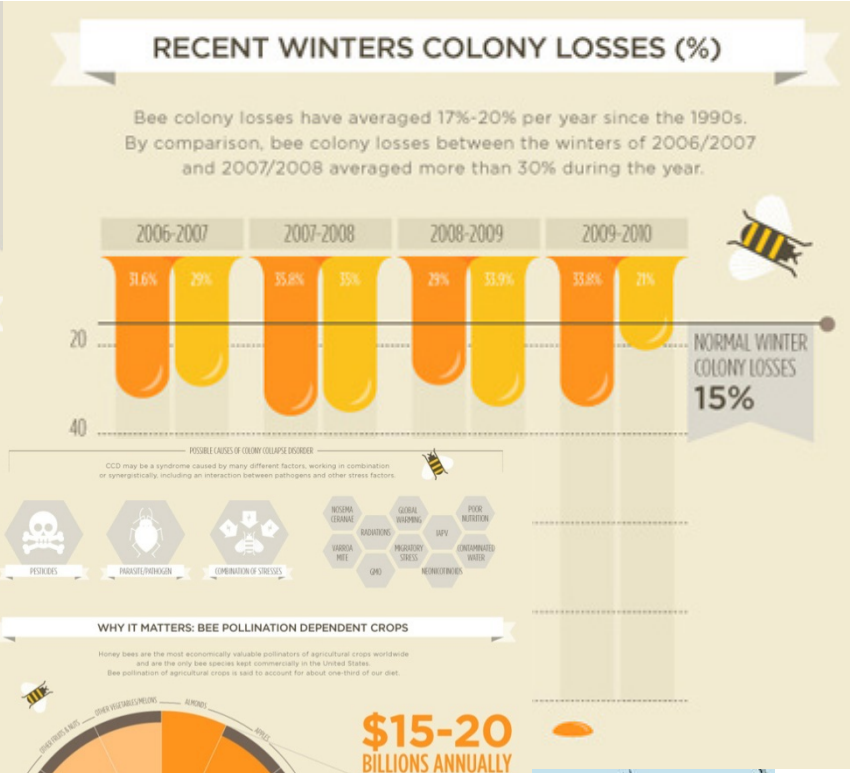


© NERC All rights reserved

Breaking boundaries with....

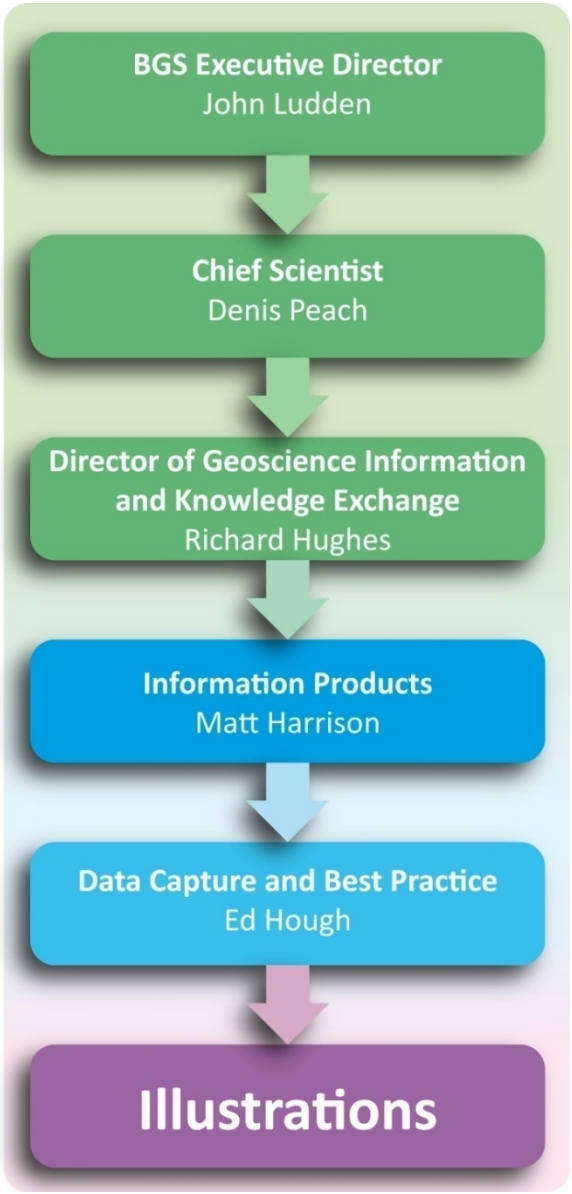
Infographics





© NERC All rights reserved

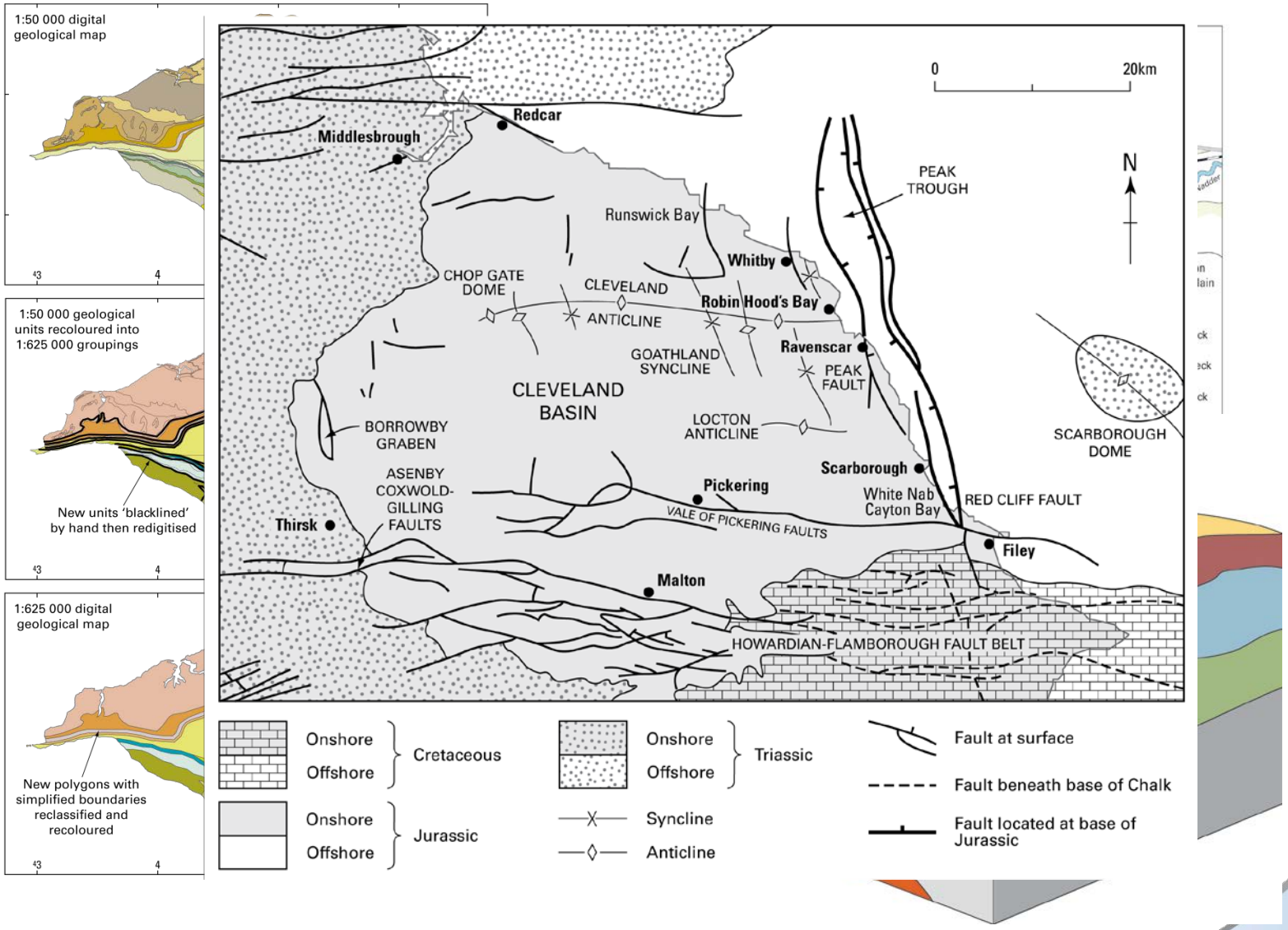
Who we are and what we do



- Producing illustrations for printed publications
- Wide spectrum of illustration types
- Set specification

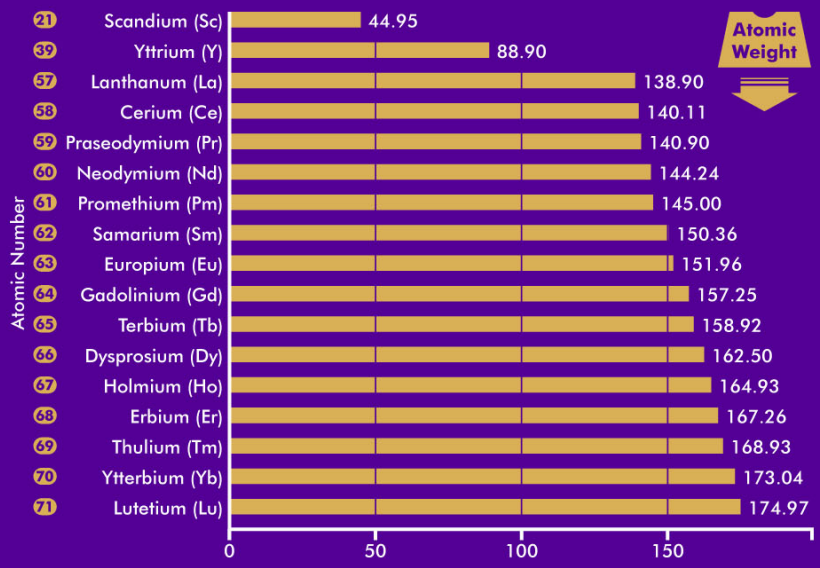
© NERC All rights reserved

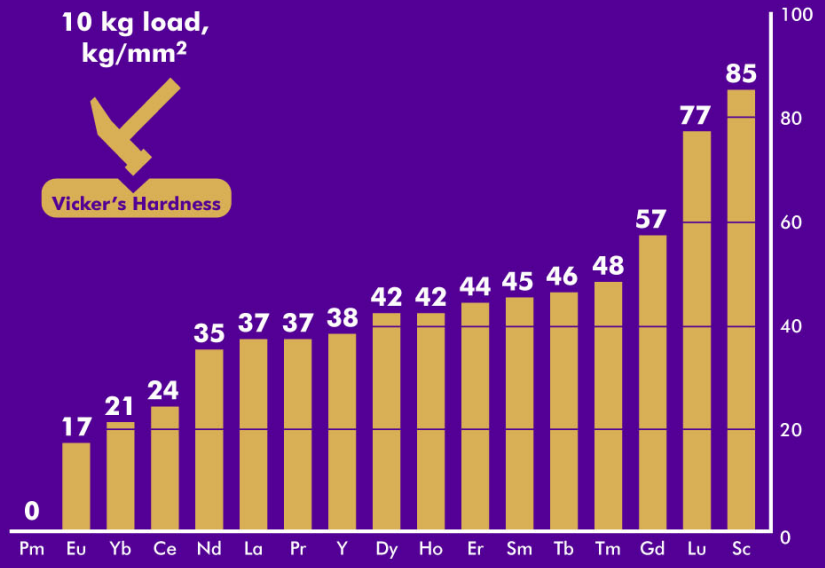
Who we are and what we do

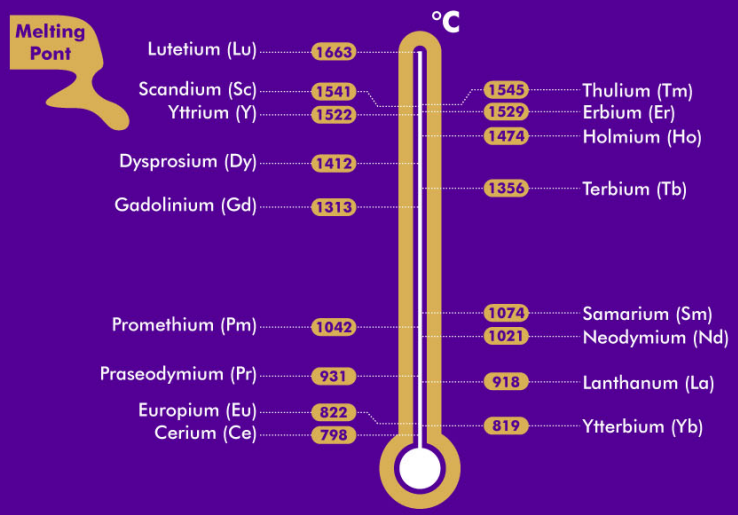


© NERC All rights reserved

Selected properties of the Rare Earth Elements.







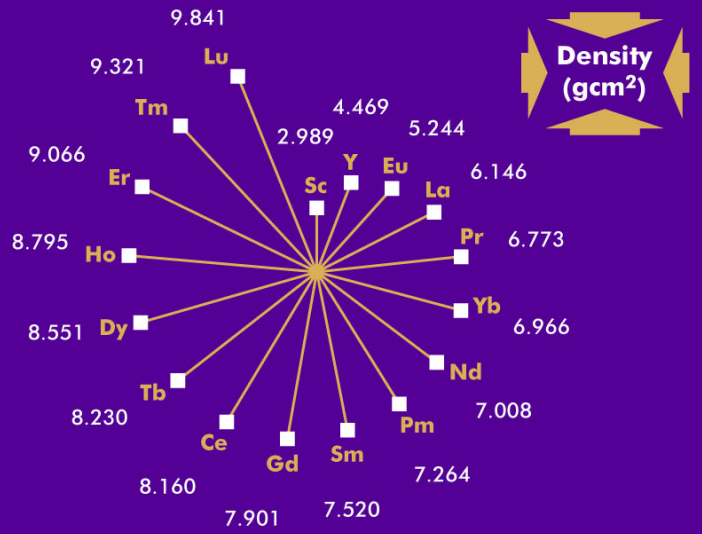


Table 1: Selected properties of the Rare Earth Elements (REE).
Compiled from Gupta and Krishnamurthy (2005)

© N

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

NERC Environmental Data Transformation at the British Geological Survey
Friday 23rd March 2012

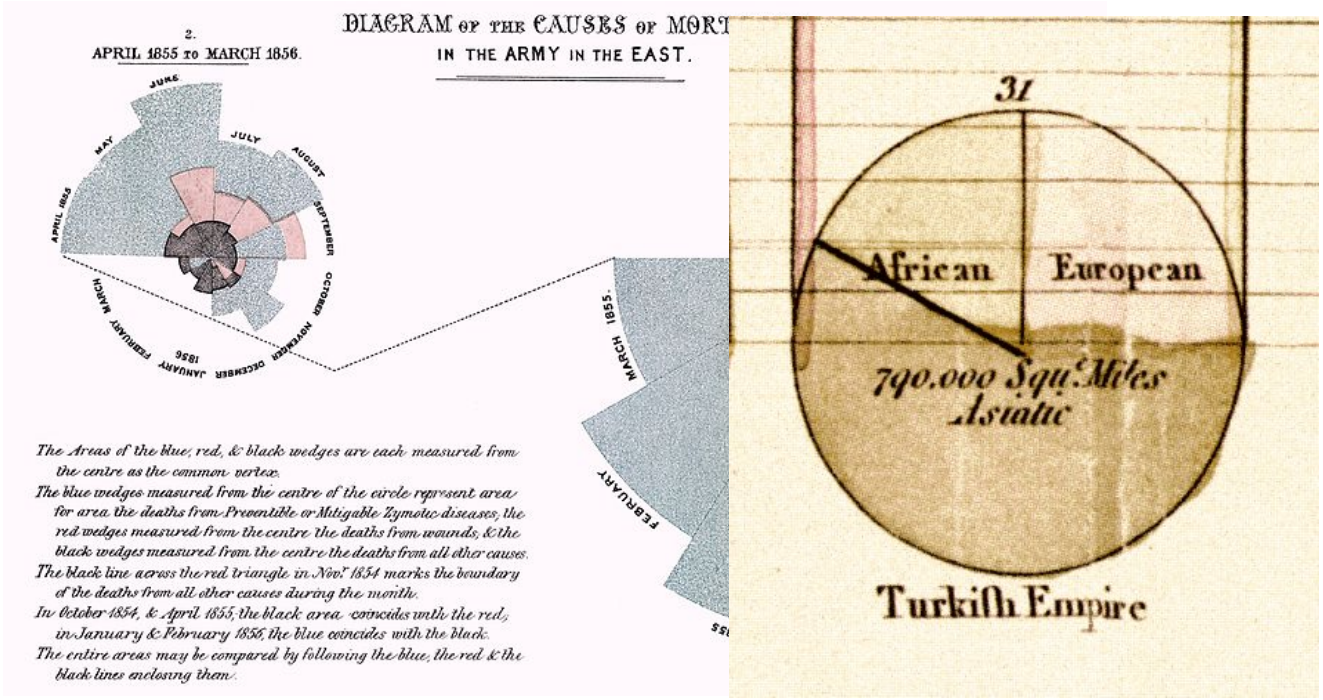
Infographics

Simon Ward

© NERC All rights reserved

The Concept

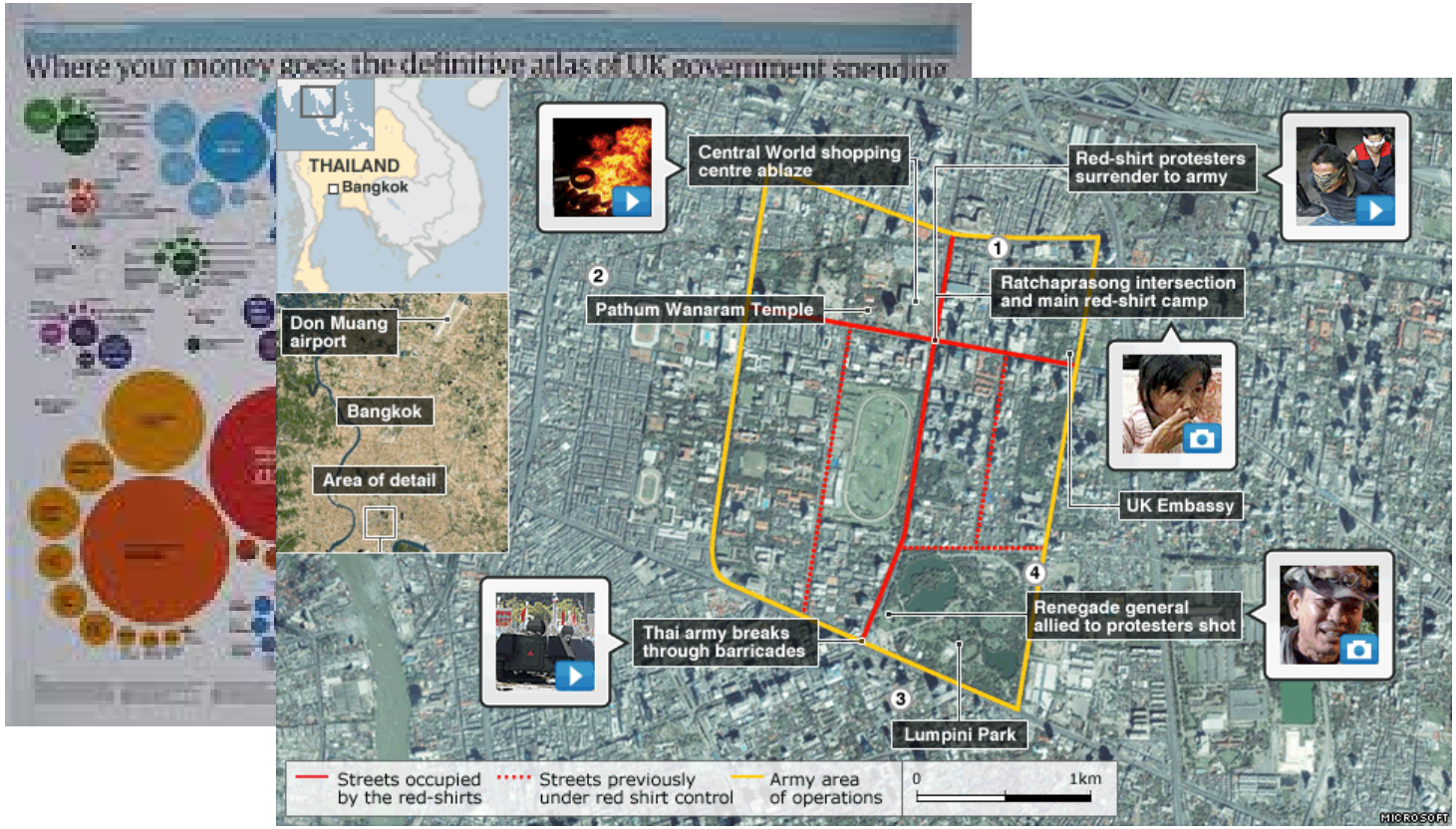
- To represent statistical data and information in a graphical context
- To act as ‘visual shorthand’, allowing data to be absorbed in one process
- Earliest infographics date back nearly 10,000 years – Cave paintings and Napoleon’s nautical diagrams



© NERC All rights reserved

The Concept

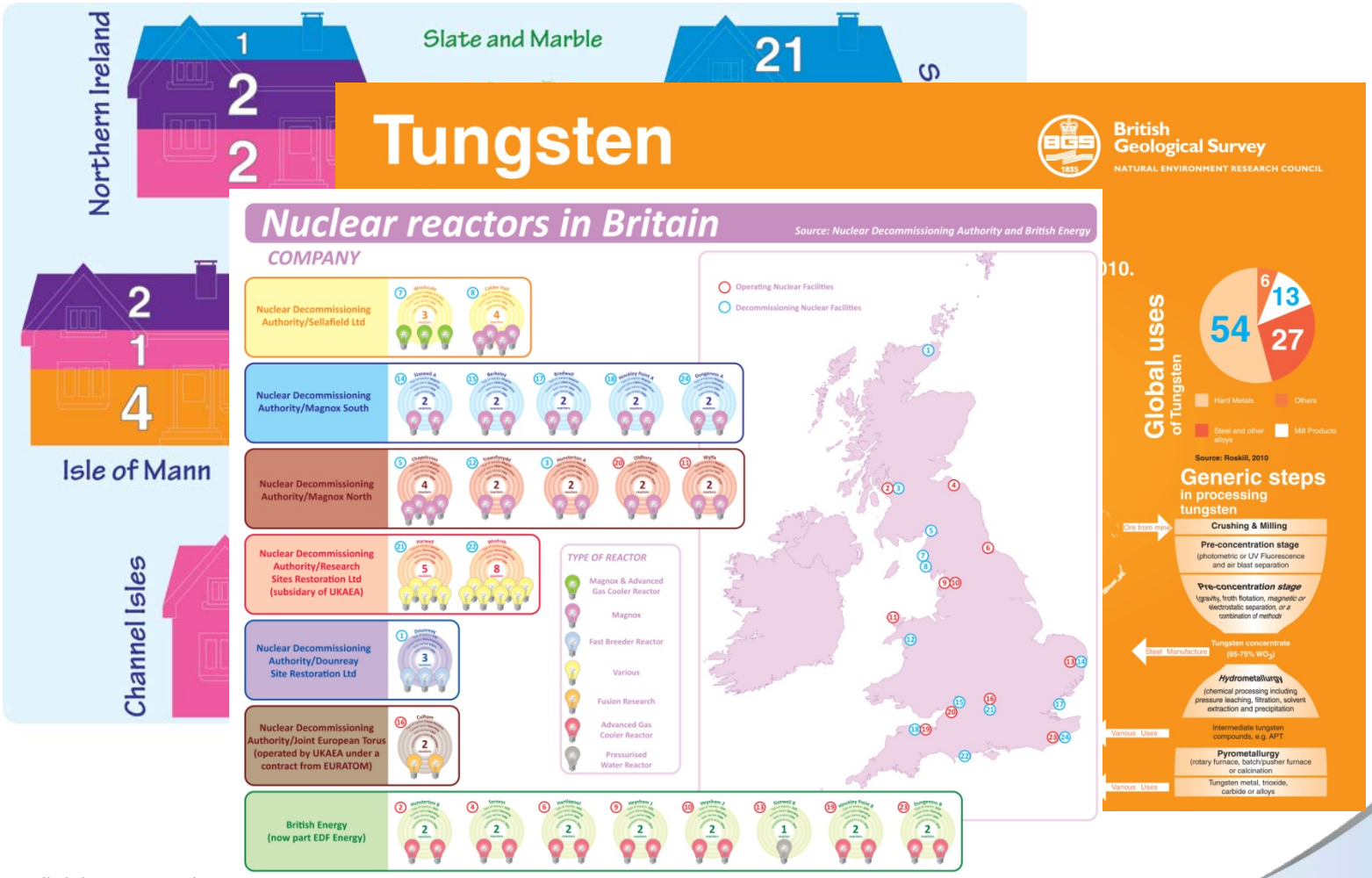
- Emphasis on accurate representation of the data
- Infographics are commonly used within the media



© NERC All rights reserved

When they are good…

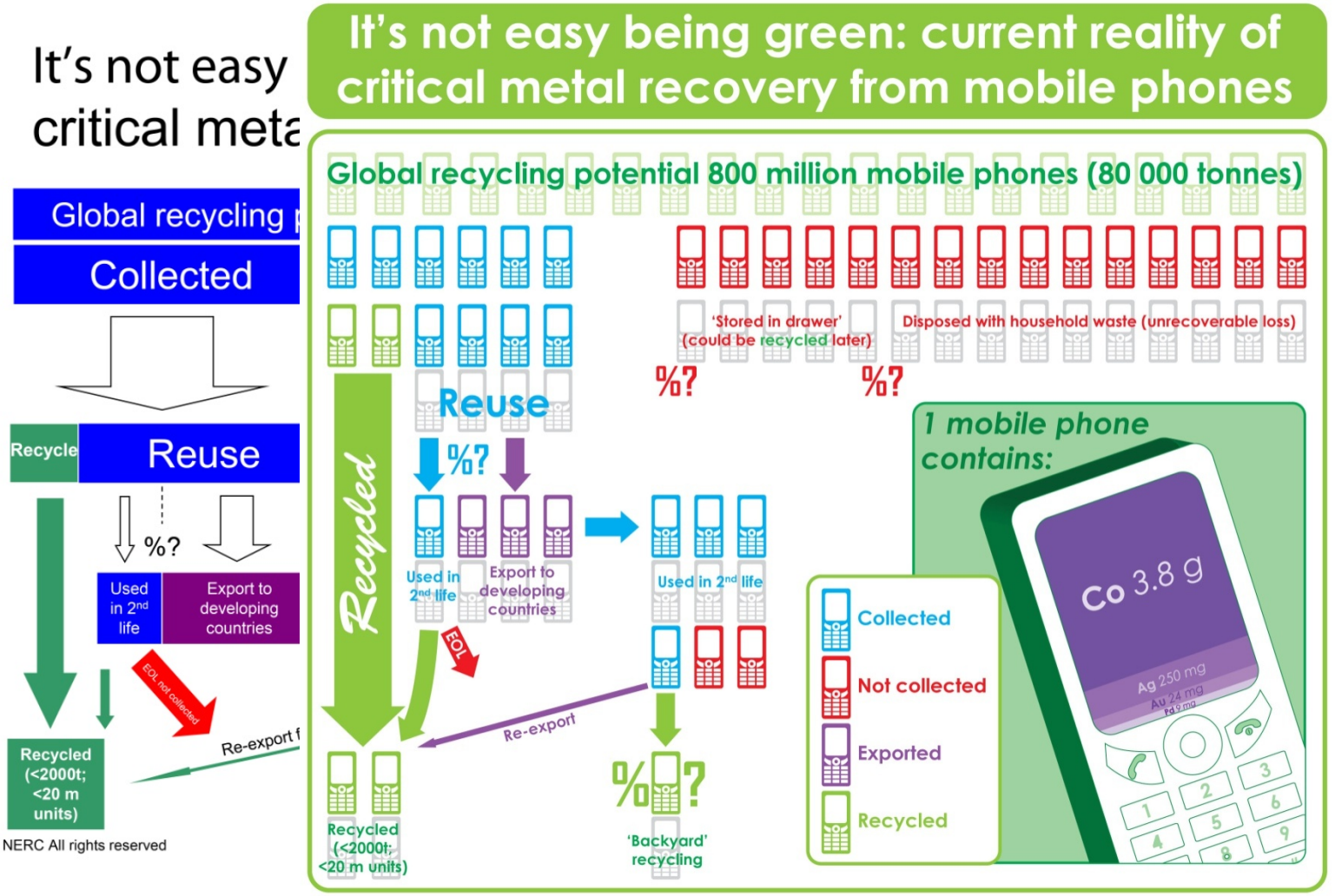
- Infographics can be tailored to a variety of target audiences, while still allowing instant recognition of data



© NERC All rights reserved

When they're good…

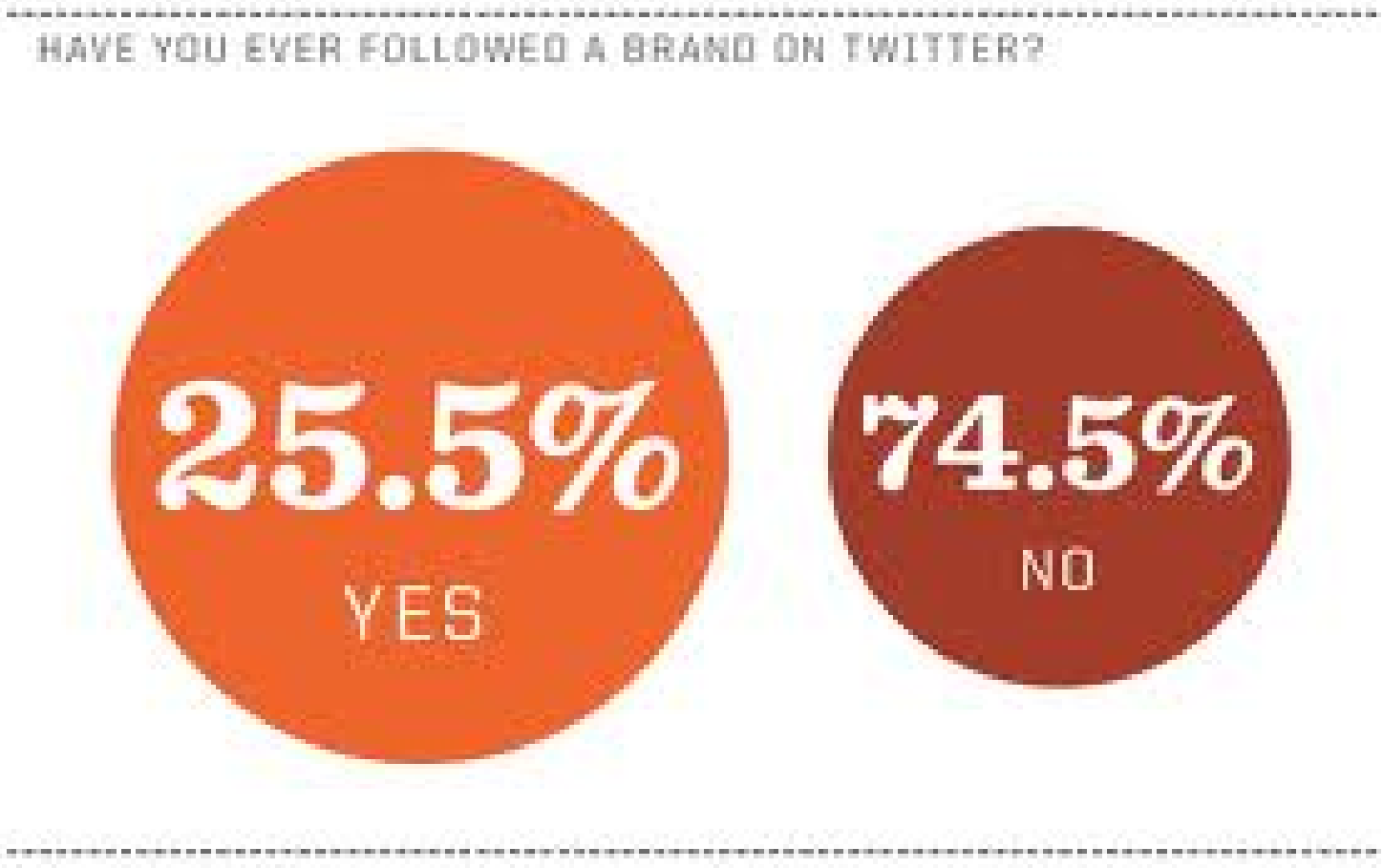
- Perfect for use in presentations



© NERC All rights reserved

But when they're bad…

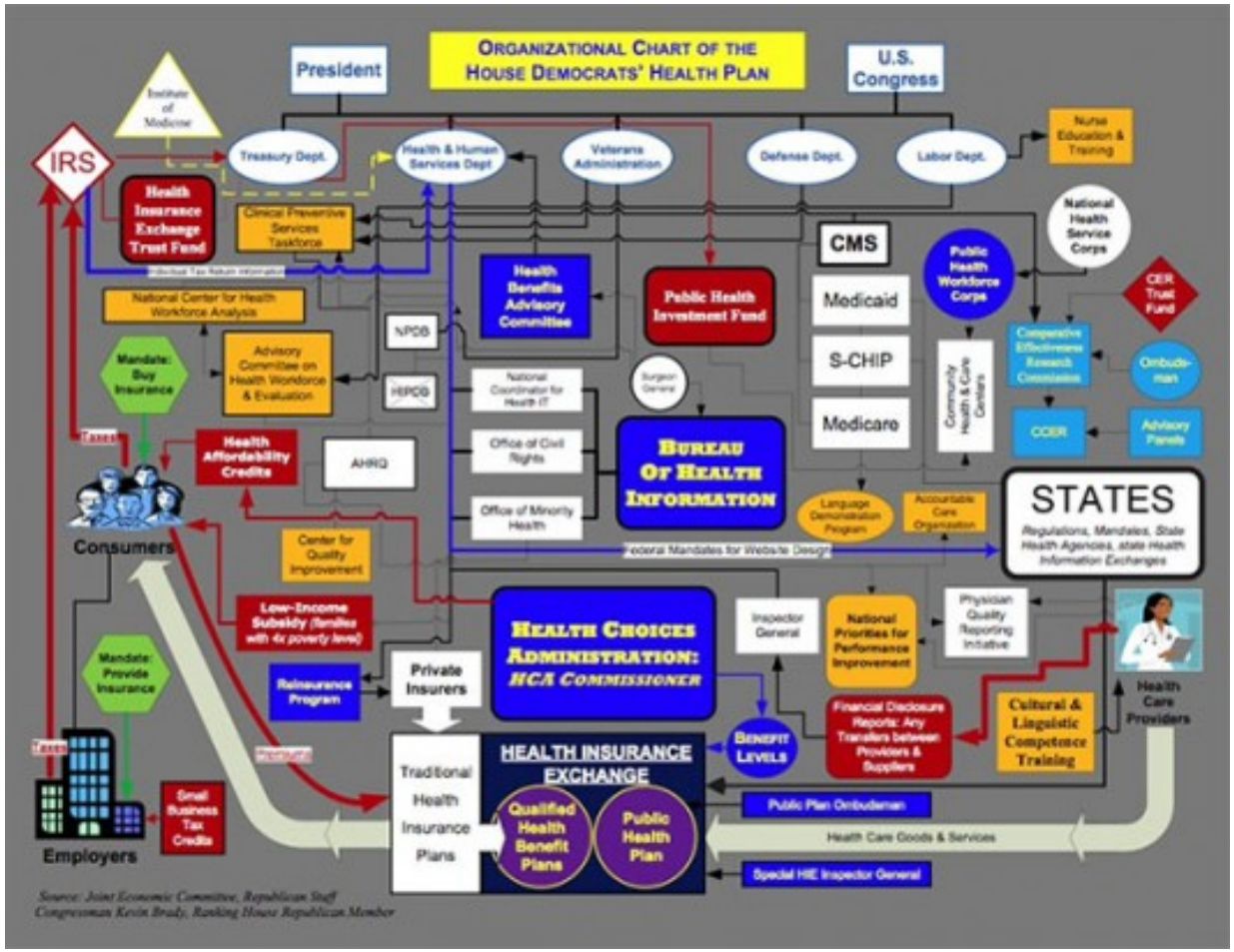
- Poor infographics can misrepresent or 'skew' the data



© NERC All rights reserved

But when they're bad…

- The effect of the graphic can be lost if too much information is included



© NERC All rights reserved

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

NERC Environmental Data Transformation at the British Geological Survey
Friday 23rd March 2012

Cartograms

Clive Cartwright

© NERC All rights reserved

What is a Cartogram?

© NERC All rights reserved
© NERC All rights reserved

A cartogram is a distorted display of attribute weighted regions or units housed within a *'best-fit'* spatial context.

Often called *"Value-by-area maps"*

(Kreveld and Speckmann, 2006)

© NERC All rights reserved

The process places the integrity of the areal unit (shape, area and topology), subservient to its associated attributes.

Emphasis moves away from accurately rendering spatial topology and projections, to one of featuring the aggregated unit attributes.

© NERC All rights reserved
© NERC All rights reserved

It is generally understood that there are two types of cartogram:
Non-contiguous and Contiguous.

(Tobler, 2004; Keim, et al., 2005)

Although it can been agued that Dorling's Circular Cartograms should be placed in a separate class.

(Kreveld and Speckmann, 2006)

© NERC All rights reserved
© NERC All rights reserved

Non-contiguous cartograms often focus on preserving unit shape over topology.

Contiguous cartograms maintain topological relationships at the expense of the shape.

© NERC All rights reserved

Often quoted as a third type is the '**Dorling's circle cartograms**'.

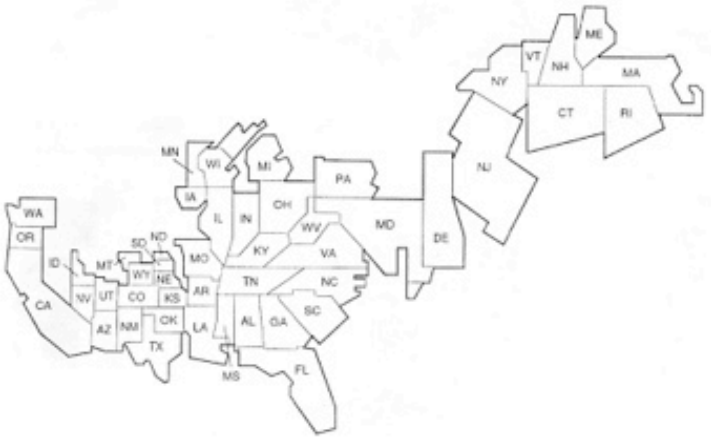
(Kreveld and Speckmann, 2004)

Attributed centroid circles are subjected to a gravity model, designed to both repel any overlapping circles and maintain a *best-fit* outcome for their original spatial position.

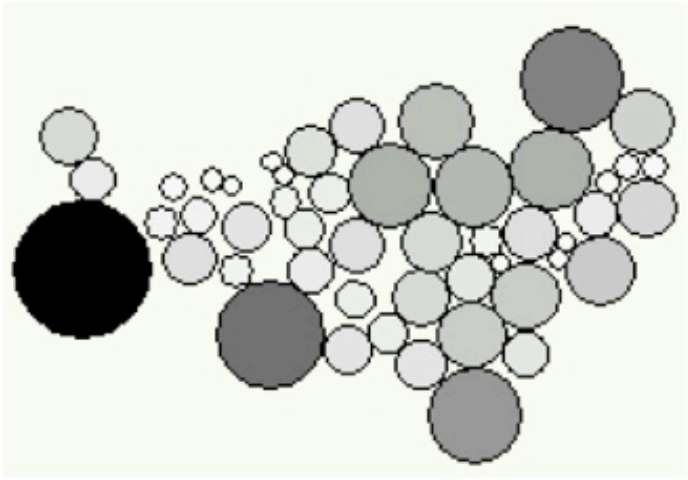
(Dorling, 1996)

© NERC All rights reserved

(a) Non-Continuous Cartogram



(b) Non-Contiguous Cartogram



(c) Circluar Cartogram

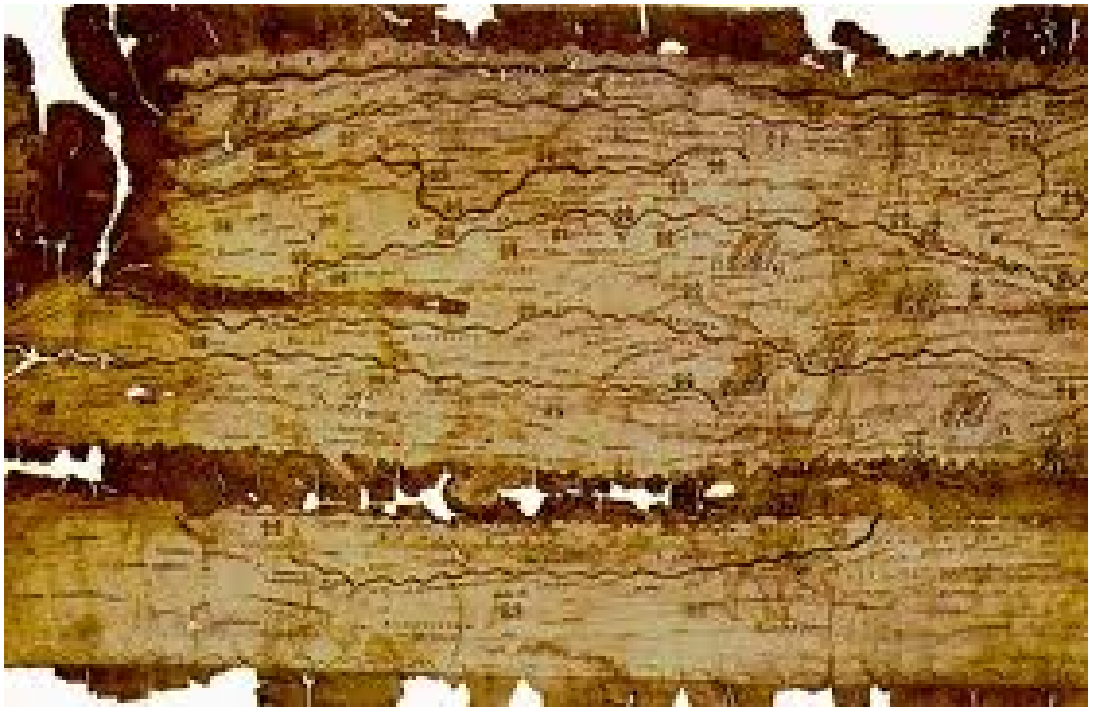
(d) Continuous Cartogram

(Source: Keim, et al., 2005)

© NERC All rights reserved

How long have they been around?

© NERC All rights reserved



The Tabula Peutingeriana *map of the Roman Empire* ~ 330AD

(Source: Keim, et al., 2005)

However, there is no statistical areal unit element to the creation of this map.

© NERC All rights reserved

Earliest reference to the term ‘Cartogram’ was by Minard in 1851.

(Tobler, 2004)

Levasseur’s cartogram of Europe showing countries proportional to area, after Funkhouser 1870.

(Tobler, 2004)

© NERC All rights reserved

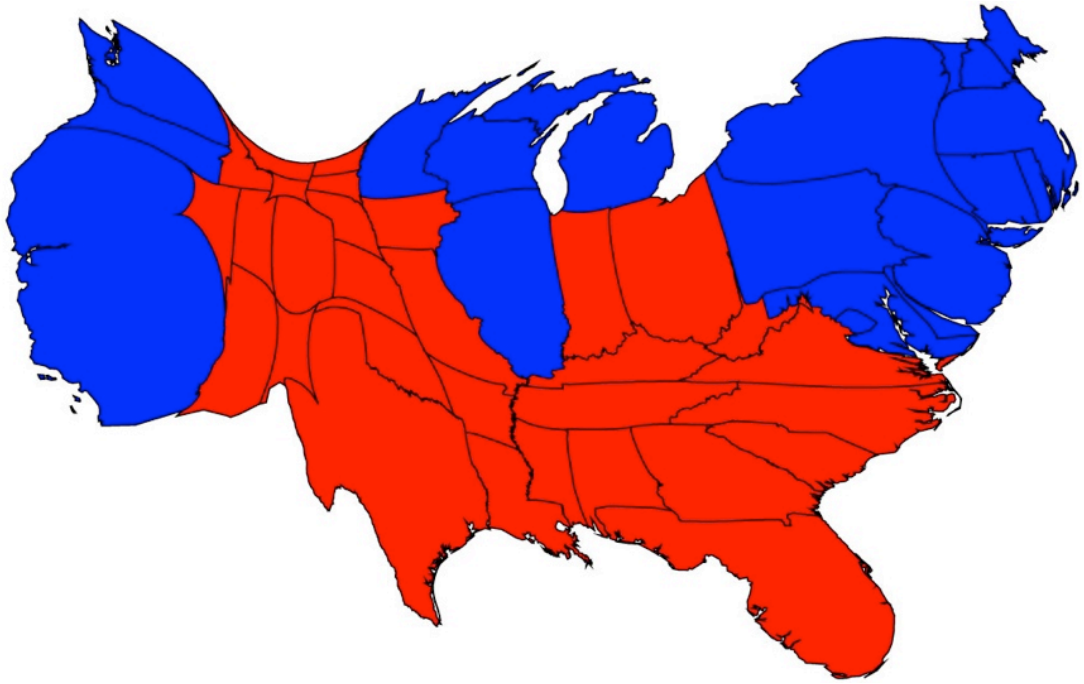
The first signs of cartogram algorithms were published as early as 1961 and by 1973, computer generated models.

(Dorling, 1996; Tobler, 2004)

© NERC All rights reserved

2004 revealed an extension tool for GIS desktop applications of the diffusion-based contiguous type cartogram, by Gastner and Newman.

(Gastner, et al., 2005; ESRI Inc., 2007)



© NERC All rights reserved

Where do we see cartograms?

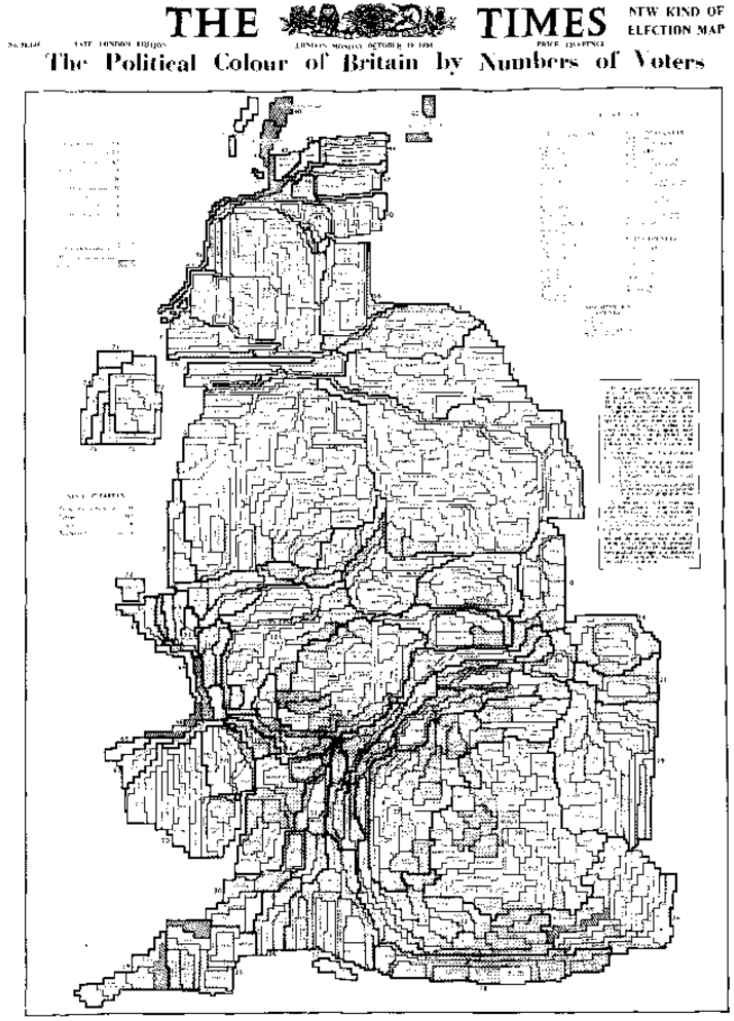
© NERC All rights reserved

Traditionally used in the Social Sciences.

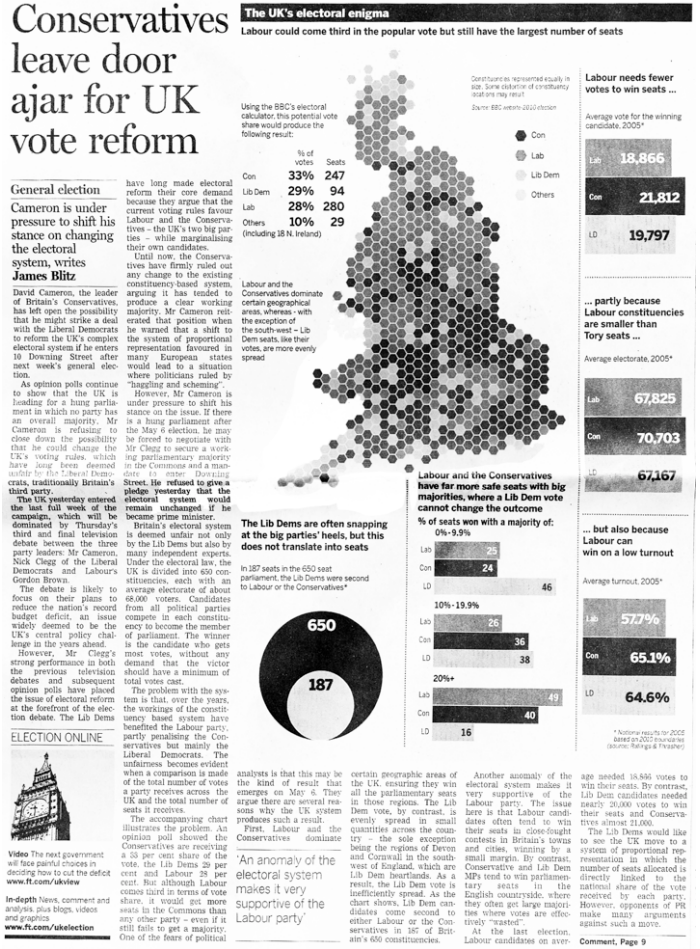
- Geography
- Economics
- Politics
- Archaeology
- Epidemiology
- *Newspapers*

© NERC All rights reserved

Political election results... the most public.



Physical Accretion Model. (Dorling, 1996)



© NERC All rights reserved

What are the advantages in using them?

© NERC All rights reserved

Cartograms reduce the effects of Modifiable Areal Unit Problem (MAUP).

(Openshaw and Aluanides, 2001)

Cartograms are choropleth maps and will experience all the problems associated with them.

Fothering and Rogerson (1993) placed the Modifiable Areal Unit Problem as first among eight issues that arise in spatial analysis.

(Jelinski and Wu, 1996)

© NERC All rights reserved

More effective and easier to understand.

Choropleth maps create a bias to larger areal units, regardless of the quantitative attribute value.

(Openshaw and Aluanides, 2001)

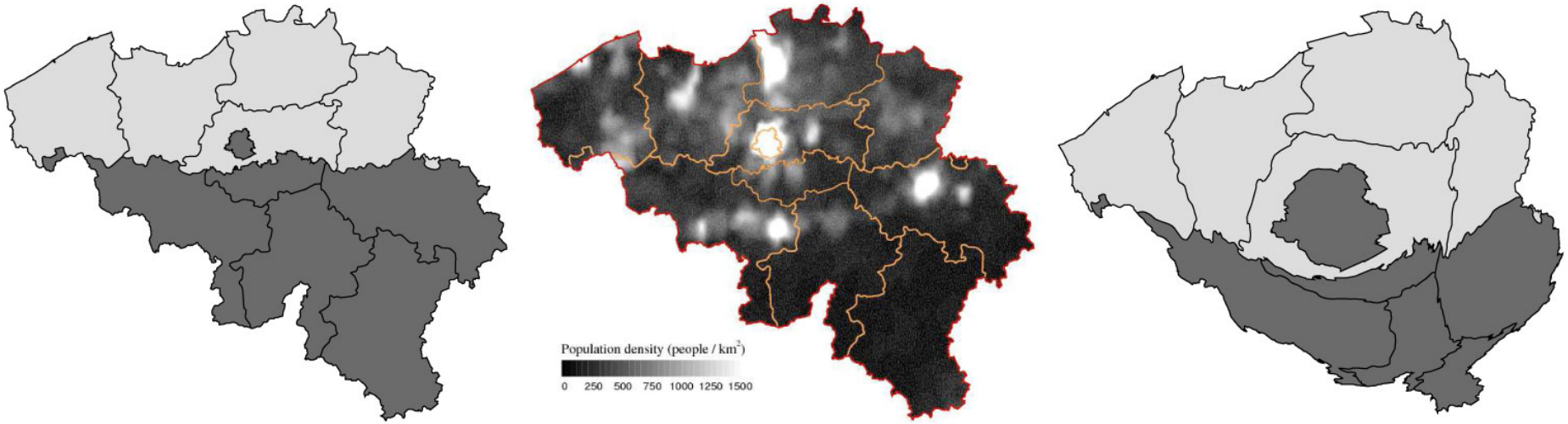
It has long been understood that the ability to understand shape out weighs both shade or colour, and one of the best methods to achieve this is to use circles.

(Dykes and Unwin, 1998; Dent, 1990)

© NERC All rights reserved

Linguistic distribution and population density in Belgium. Flemish north and Woolonian south.

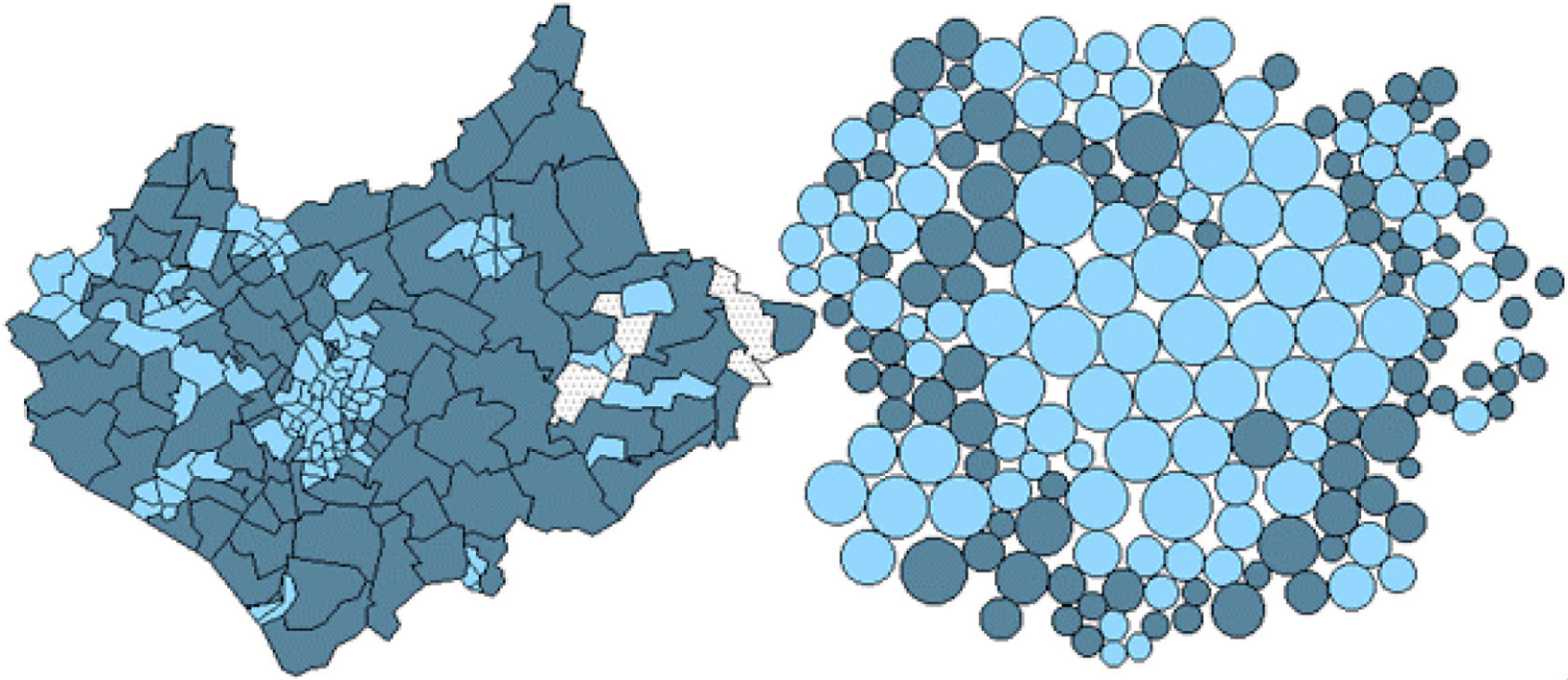
(Lekien and Leonard, 2009)



© NERC All rights reserved

Leicestershire wards with above and below median values for car ownership per capita, shown in dark and light colours respectively.

(Dykes and Unwin, 1998)



© NERC All rights reserved

Cartograms look impressive and have the ability to both ‘shock’ and communicate effectively.

This is why they’re frequently found in both atlases and newspapers.

© NERC All rights reserved

Can they be used in a geological context?

© NERC All rights reserved

Yes... as long as the data is quantitative and contained within discrete boundaries (areal units).

© NERC All rights reserved

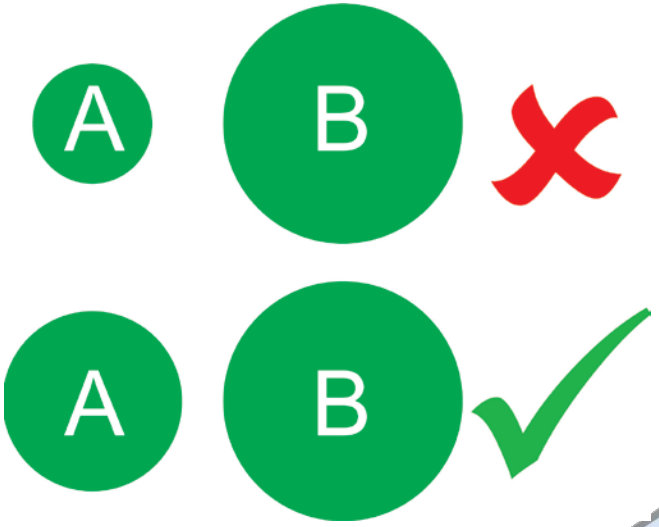
Examples:

- Minerals and metals.
- Location based services.
- Point data that can be aggregated.

© NERC All rights reserved

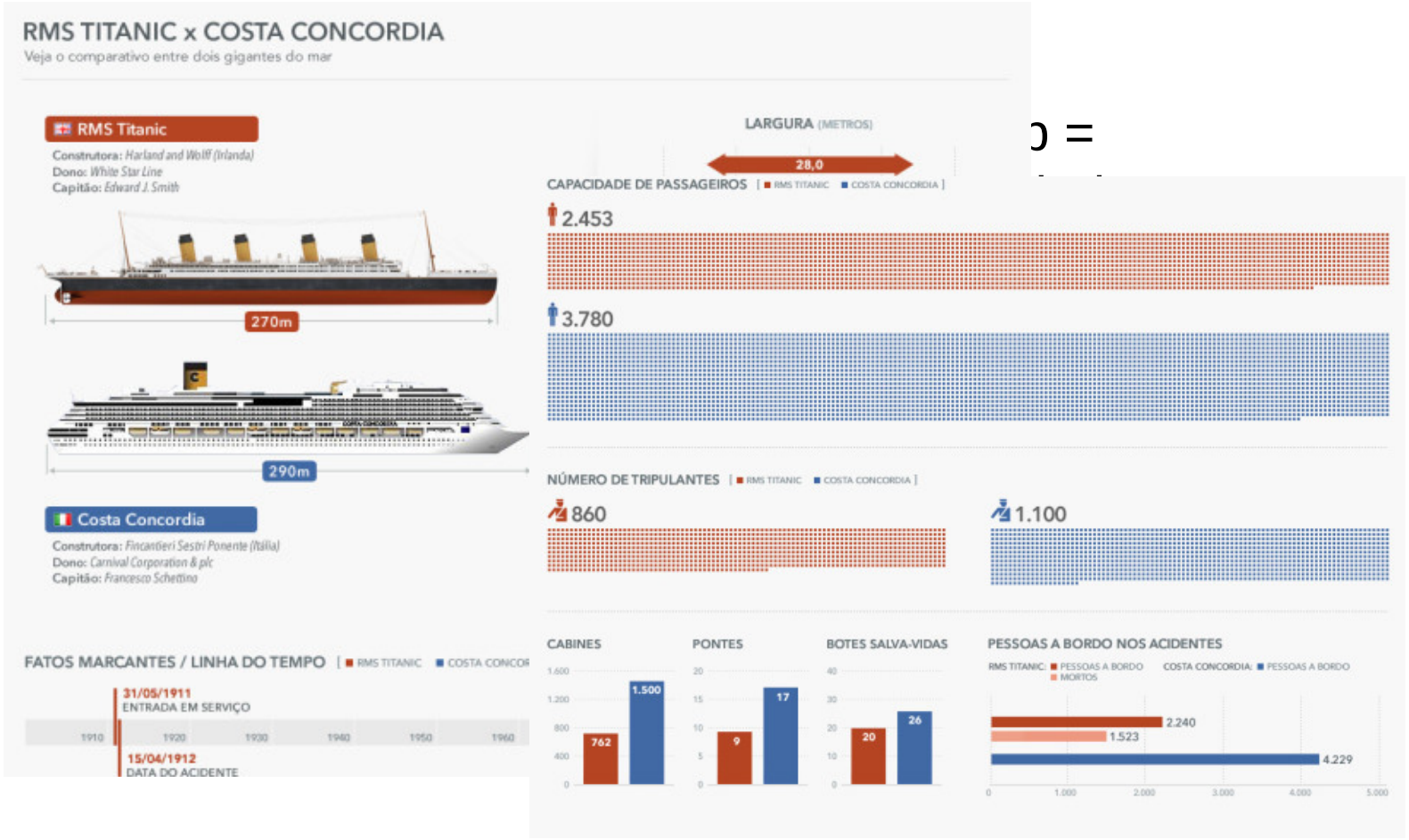
What we've found

- Data can be made more appealing
- Data needs to represent the truth and not be misleading
- We need to know what we are representing
- Data may need processing
- Important to get the message over in a glance
- Can get complicated!
- Is it appropriate?



© NERC All rights reserved

Why breaking boundaries?



www.coolinfographics.com

© NERC All rights reserved

Why breaking boundaries?

- o New delivery output
- o Increasing skills
- o Making data relevant
- o Increase Knowledge Exchange

© NERC All rights reserved

Future

- Create a portfolio of work
- Produce infographics and cartograms for projects during 2012/13
- Investigate other types of cartograms
- Animation

  'Some data sets are best represented as a moving image. As print publications move to e-readers, animated infographics will eventually become standard' – Economist online
- Methods of delivery
- Use of 'live' data

© NERC All rights reserved

Thank-you
Any questions?

© NERC All rights reserved