



GIS

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An Introduction To Geographical
information systems

Overview and background

- GIS has been available for many years, but they have only come into their own in the last 5 years
- It would be fair to say that this technology is becoming a buzz word in desk top systems solutions.
- Again it would be true to say , some of the influencing factors in its sudden surge in popularity is the fast declining costs of HW/SW that will support and run such systems.

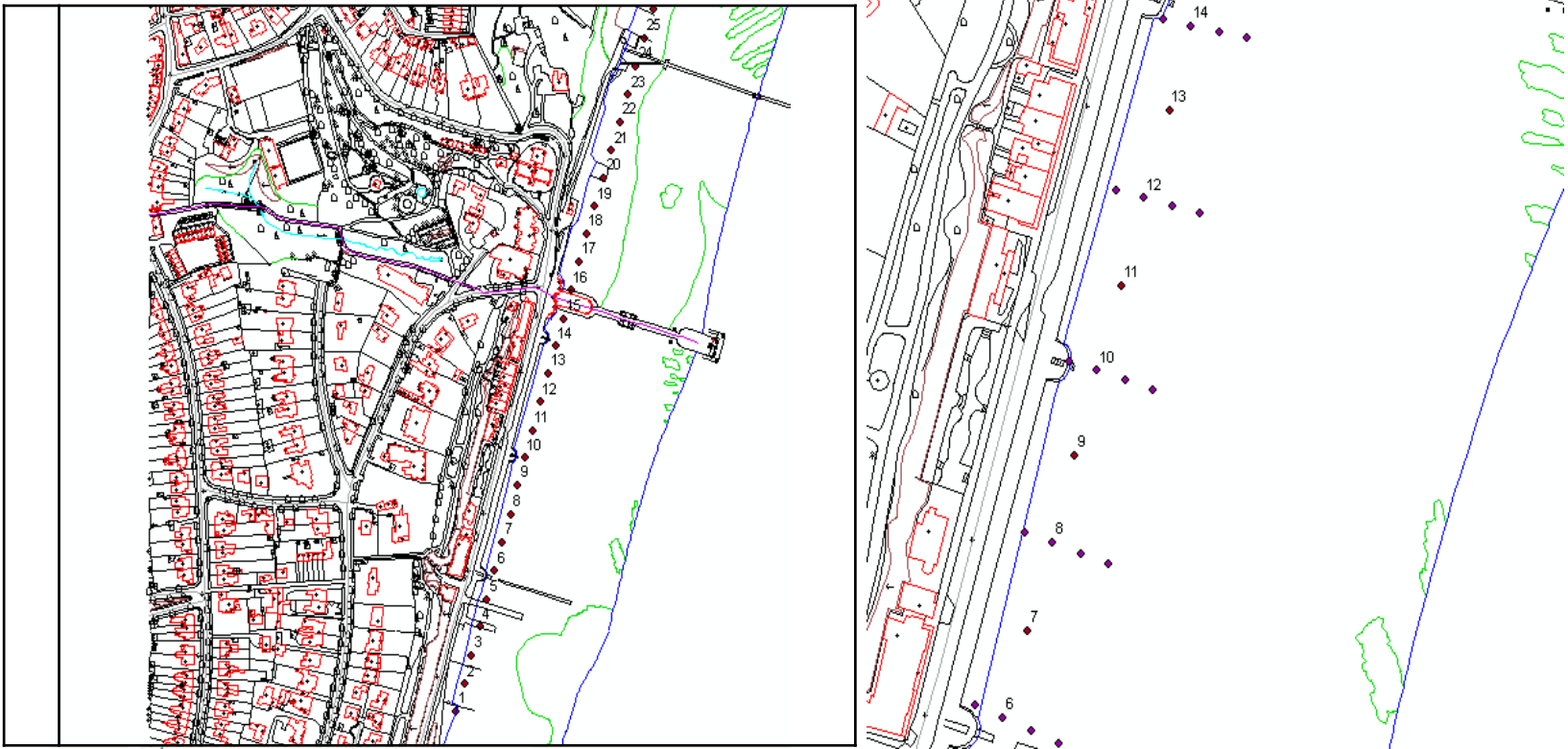
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- GIS has been technology led. Based on CAD/CAM systems, they required expensive, memory rich kit.
- The GIS market remains an immature one, potential customers are confused over the benefits.
- Two emerging themes have however increased the popularity of GIS :-
 - Data is collected containing a geographical / spatial reference
 - Rapid improvements in technology

How GIS Emerged

- Geographical information has been with us since man travelled and made map references.
- GIS has been developed out of a desire to replace manual cartography with a digital solution.
- The OS (ordnance survey) organisation of UK has converted their maps into digital format and over the last decade many of the original paper based maps are now available in digital formats plus many more useful map sets all available to us through DIGIMAP

OS Landline of Penarth early digitised maps of the coastline



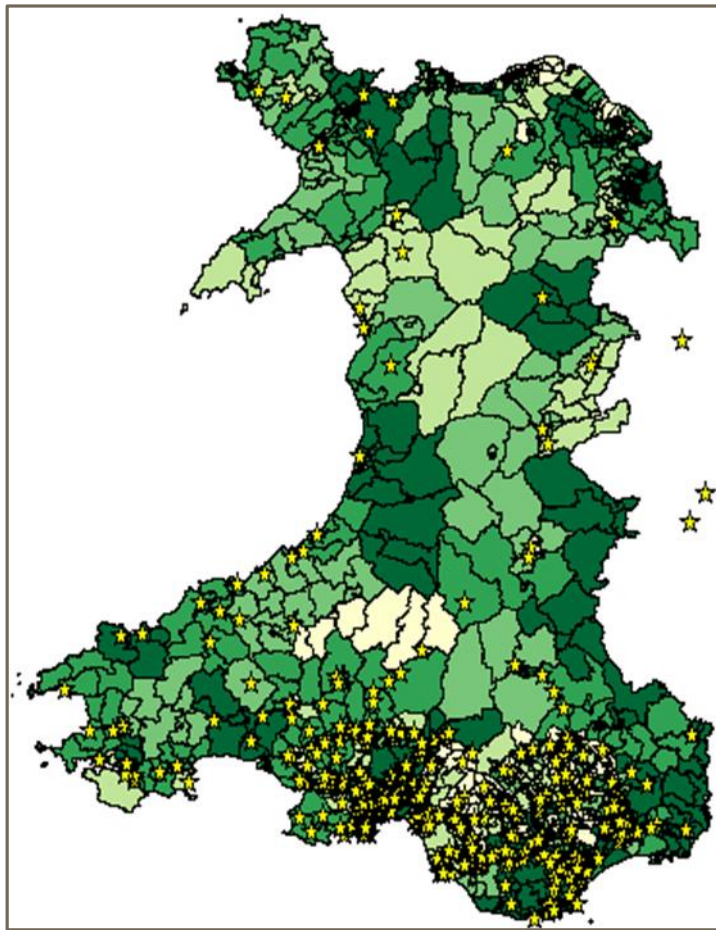
GIS Defined

- The literature offers some differing definition but here are some suggestions :-
 - **A business tool developed for the effective handling of spatial references**
 - **A set of tools for collecting storing referencing at will, transforming and displaying spatial data from the real world for a set of purposes.**
 - **A GIS is an information technology tool that can manage, analyse and report on data. The data can encompass applications from many disciplines, business, legal, social, environmental plus many more. The common theme is that all the data is spatially referenced.**

So what is a GIS

- A computer system that can handle and use databases of information that describes things i.e.. object or places on the earth's surface.
- Elements that occupy space and have a spacial reference.
- GIS offers the user a model of geographical reality
- To explain:
 - an aspatial query :
 - **How many students are on the B.Ac Env COns computing course at SMU.**
 - a spatial query :
 - **How many students travel to the M.Sc Env Cons course daily, form a distance greater than 20 miles.**

Students in UWTSO



Applicant_Data_2016_2017_Wa

★ Point

wales_Isoa_2011 Legend

Region

HHold is not deprived in any dimens

1,490 to 2,990 (83)

1,290 to 1,490 (79)

1,150 to 1,290 (82)

950 to 1,150 (82)

440 to 950 (84)

What question can be expect a GIS to answer

- Where are particular features found ?
- What geographical patterns exist?
- Where have changes occurred over a given period ?
- Where do certain conditions apply?
- What will the spatial implication be if an organisation takes certain actions?

Understanding how we perceive

- Understanding how we perceive size, depth, brightness and colour is crucial to the design of effective visual graphics system.
- Humans are able to perceive height and depth. We are able to perceive the height and depth of any object from any distance. The object may look smaller, but our perception of the size remains constant.
- By looking at a scene, we can comprehend the overall depth – objects covered by another object in our visual path we perceive to be in the background.

Why Are GIS
systems
Good at

analysing
vast amounts
of Data?

The human processor

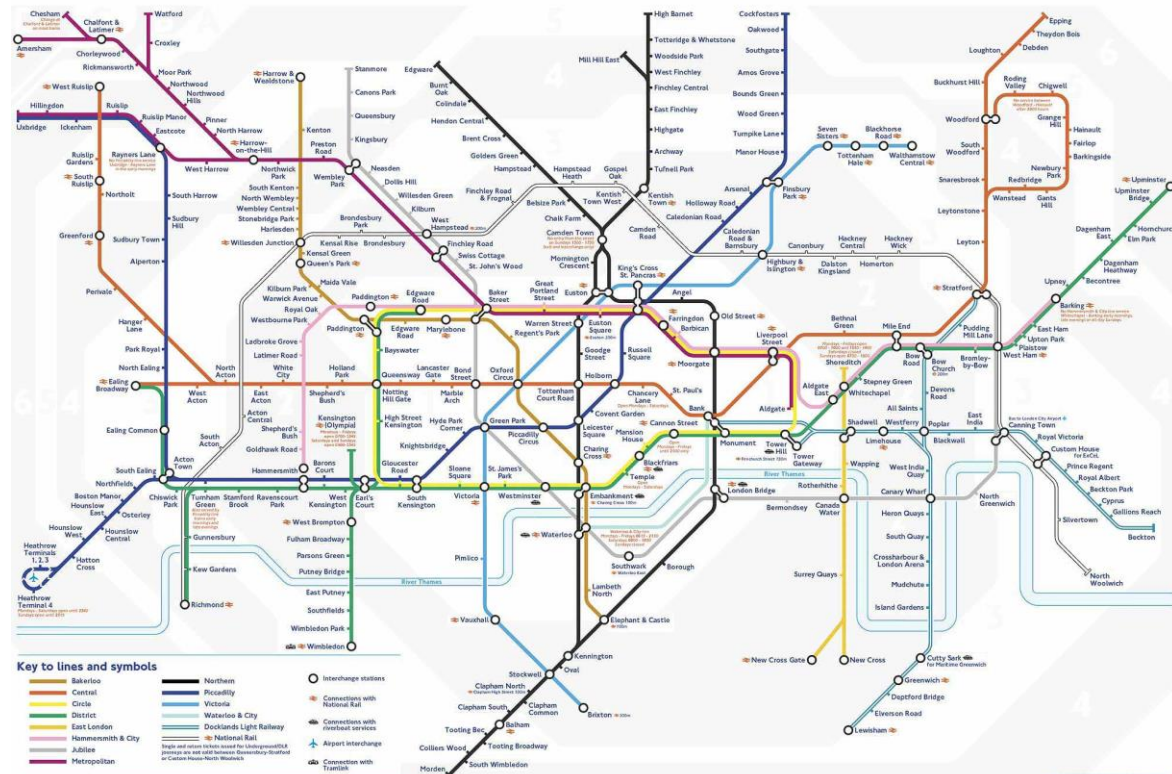
- The human processor comprises of three sub-systems: the perceptual system, handling sensory information from the outside world; the motor system, which controls the actions; and the cognitive system, which provides the necessary processing to connect the two. (Card, Morgan, Newell)
- Humans interact with the outside world via information being received and sent i.e. Input / Output.
- In an interaction with the computer, the user receives information via output channels.

Visualisation

- The term visualisation was first made popular around 1987. There was a growing interest in the study of techniques for display behaviour.
- Def: A mental Image - to imagine or remember as if actually seen
- we can see that it is an activity which a human being engages in, and that it is a cognitive activity
- In terms of computer graphics there is a much more specific and overcomplicated definition:
 - “The technical display of visualisation concerns itself with the display behaviour – making complex states of behaviour comprehensible to the human eye.”
- “A solution searching for a problem”
- Visualisation encompasses the generation, manipulation and comprehension of the products of vision.

Information Visualisation

- There are many situations in which data is available, in very large quantities, and where some human insight into the data is required.
- Here is an example



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- Sight of the map usually results in the viewer forming some understanding - though not a completely memorised image - of the underground railway routes and their regular and interchange stations.
- Typically, attention will be focus on the planned journey.
- The route may be memorised by the colour and direction of the line(s) involved.
- Thus, a relevant portion of the underground system has been visualised and the resulting internal model - whatever its form - can be accessed during the journey to ensure arrival at the correct destination.
- This internal model is sometimes called a cognitive map.

Scientific visualisation

- This is a related and somewhat overlapping field.
- It primarily relates to, and represents visually a physical 'thing' such as a mountain range over which clouds are flowing or a girder in which stress is of interest.
- A study of football statistics does not require an image of a football, however demonstrating flow in a pipe is usually best displayed in the context of the pipe itself.

What is Geovisualisation?

- Clearly the ability to visually analyse data is fundamental to geographic display. The graphical display of spatial data helps towards recognition of patterns.
- computer graphics that allows for the rapid display of vast volumes of data, and the processes provided by GIS help us analyse data sets that we could not achieve manually.
- This places GIS in the field of ViSC visual science
- Geovisualisation implies the use of visual geospatial displays to explore data and through that exploration to generate hypotheses, develop problem solutions and construct knowledge.

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- ◉ Within a Geovisualisation environment, a map is used to help the user to stimulate their “visual thinking”.
- ◉ A map as a visual analysis tool should give insight to spatial patterns and trends. Within a visual environment such as a computer based map data can be manipulated beyond the traditional norms.

3D

- Geovisualisation encompasses the realm of 3D representation. Providing the ability to model our natural environment and, for example, analyse coastal phenomenon. Technology such as LiDAR is helping to collect data that can be translated via a GIS to give excellent visual and Virtual Reality (VR) type views of spatial data

Penarth in 3D

