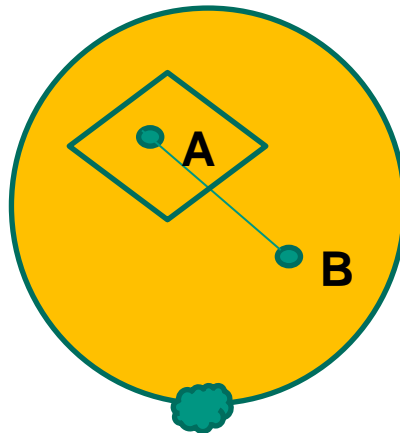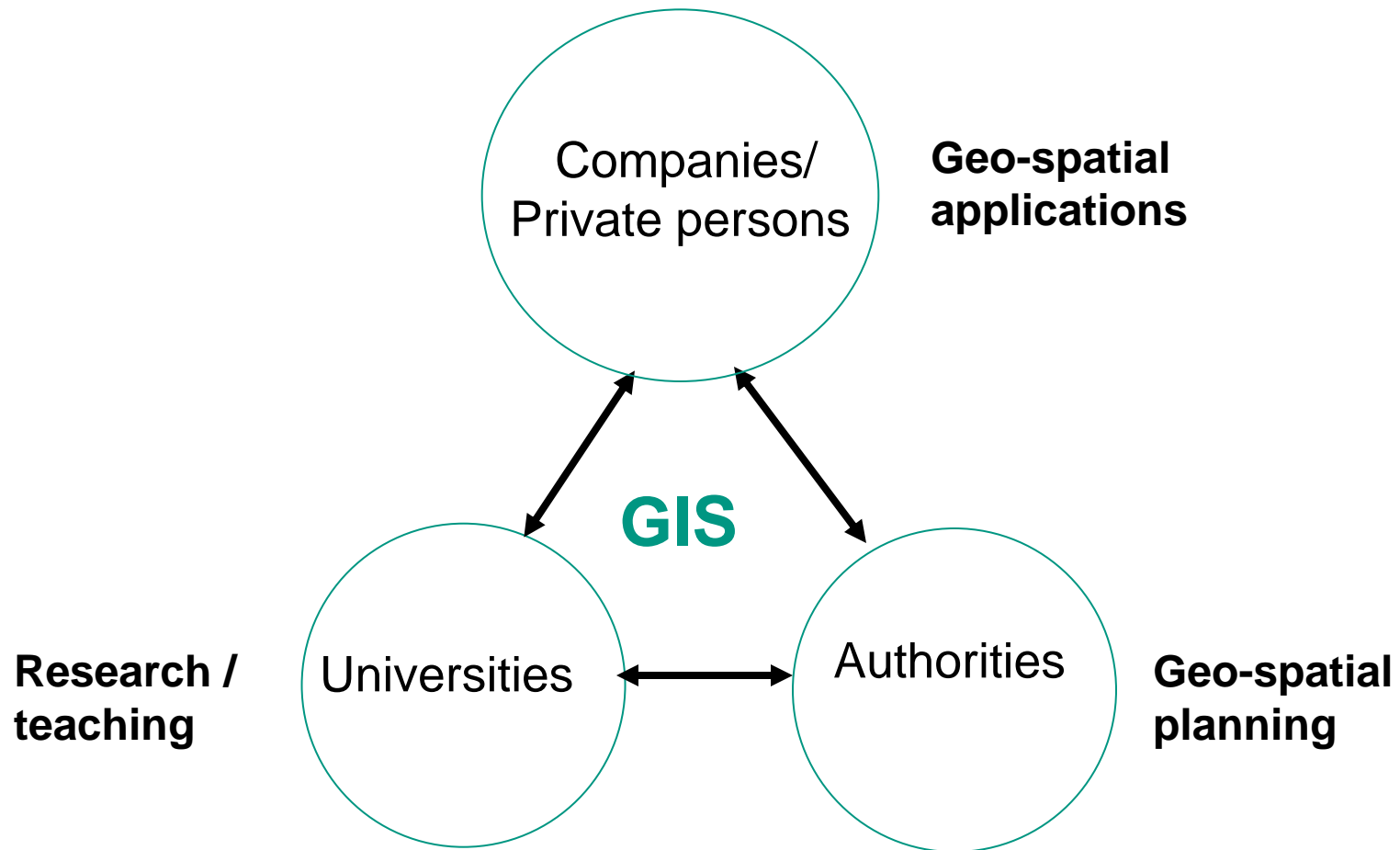# Basics of GIS reviewed

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GEODETIC INSTITUTE, DEPARTMENT OF CIVIL ENGINEERING, GEO AND ENVIRONMENTAL SCIENCES, CHAIR IN GEOINFORMATICS
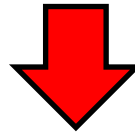
Different views on GIS

From „GIS" to „GIS"

GIS:

„**G**eographical **I**nformation **S**ystem"

since 1963
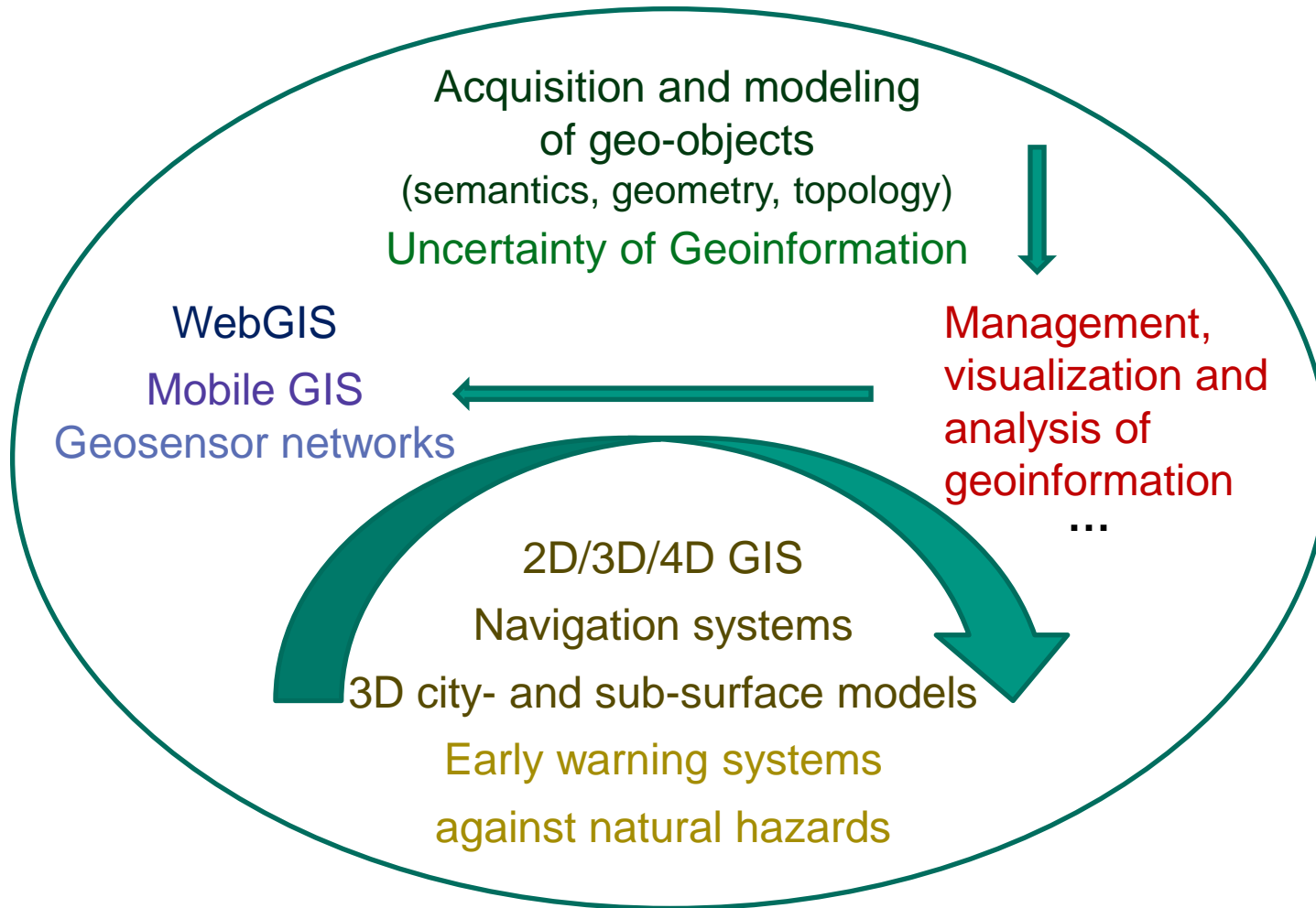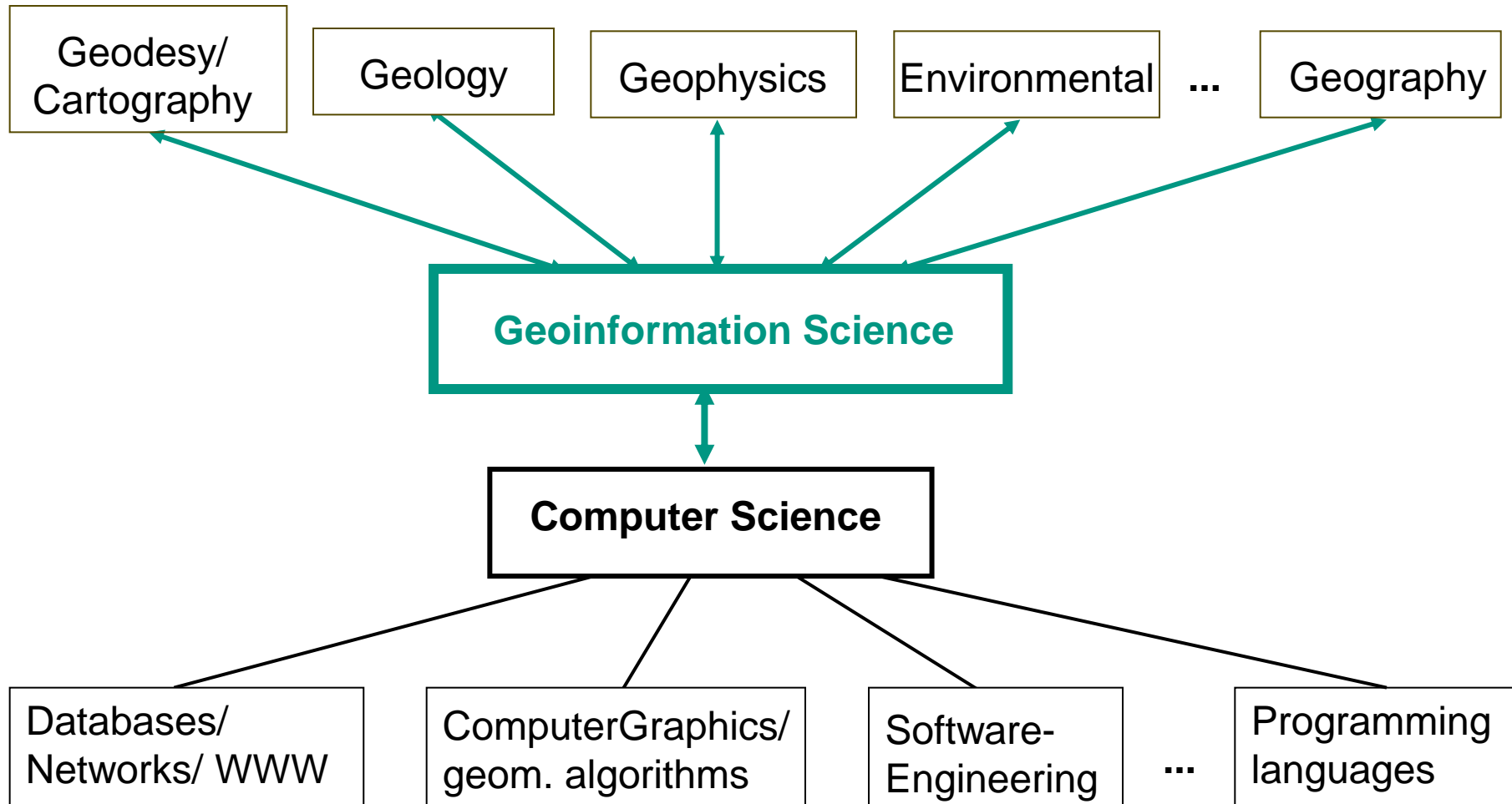(Roger Tomlinson, Canada)

GIS:

„**G**eographical **I**nformation **S**cience"

since 1992
(Michael Goodchild, USA)

since 1990 „Spatial
Information Science"
(Goodchild, USA)

Geoinformation Science

Acquisition and modeling
of geo-objects
(semantics, geometry, topology)

Uncertainty of Geoinformation

WebGIS

Mobile GIS

Geosensor networks

Management,
visualization and
analysis of
geoinformation
...

2D/3D/4D GIS

Navigation systems

3D city- and sub-surface models

Early warning systems

against natural hazards

Geoinformation Science

Geodesy/ Cartography	Geology	Geophysics	Environmental	...	Geography

Geoinformation Science

Computer Science

Databases/ Networks/ WWW	ComputerGraphics/ geom. algorithms	Software- Engineering	...	Programming languages

GIS workflow

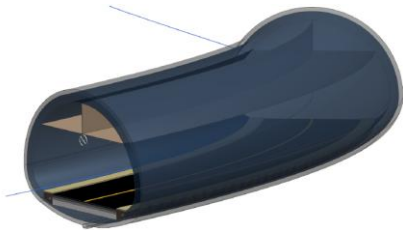Geo-data acquisition

⬇

Geo-data modeling

⬇

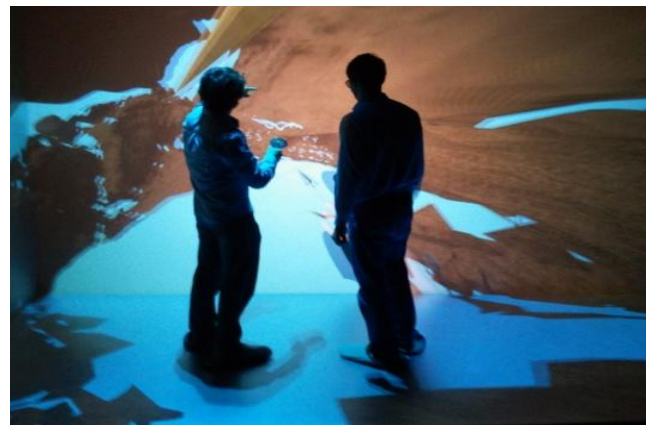Geo-data management

⬇

Geo-data analysis

⬇

Geo-data visualization

„Centre" of GIS

"The common element of all GIS applications in various disciplines is the **spatial reference.** This arises depending on the question of the user, however, is very different. ... " (Ralf Bill, in German)

„Centre" of GIS: Spatial reference

"... In surveying the (direct) **spatial reference** is given by specifying two or three dimensional coordinates or equivalent design requirements, where a defined reference system and a primary metric is defined.

Furthermore, these data include information as to their accuracy or uncertainty relations. ... "

(Ralf Bill, in German)

Geoinformation

"**Geoinformation** can be considered as a resource (land, labour, capital). But it is also a commodity that can be bought and sold.

It provides for a nation a similar infrastructure as the transport network or healthcare. Without this infrastructure, the social system would not work.
Geographic Information is a commodity which deployed, managed and must be kept up to date. ... "

(Ralf Bill, in German)

Geo-data

> **Geo-data** "are information about objects, terrain and infrastructure at the surface, with a spatial reference as an essential element.
> They describe the individual features of the landscape.
> Spatial data can be linked to each other via the spatial reference, so new information can be derived in particular with the use of GIS functionalities. ... "

(Ralf Bill, in German)

On and with geo-data, queries,
analyzes and evaluations for certain issues can be executed.

Geo-data

We can distinguish between the following geo-data:

- **Nature describing geo-data**
  - Geo-data that describe natural states and processes on the Earth's surface, such as the results of human planning, hydrological, geological, atmospheric, geological data
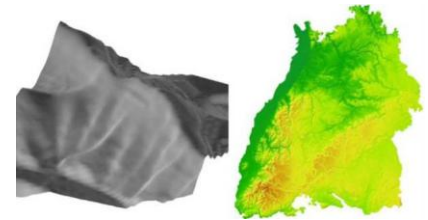
- **Artefact describing geo-data**
  - Geo-data that describe demographic, geography and transportation, economic and market conditions
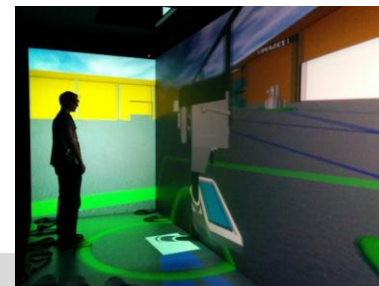
An example for nature descriptive data

DTM – Digital terrain model

> "DTM describes the digital representation of the terrain surface by spatial coordinate triple of a set of surface points (vertices), eg in the form of triangle meshes or grids.
>
> DTM is a database for the elevational description of the site. ... "

$$\text{„2.5D"} \quad : \quad h = f(x, y)$$

Source (in German): Ralf Bill http://www.geoinformatik.uni-rostock.de/einzel.asp?ID=984408921
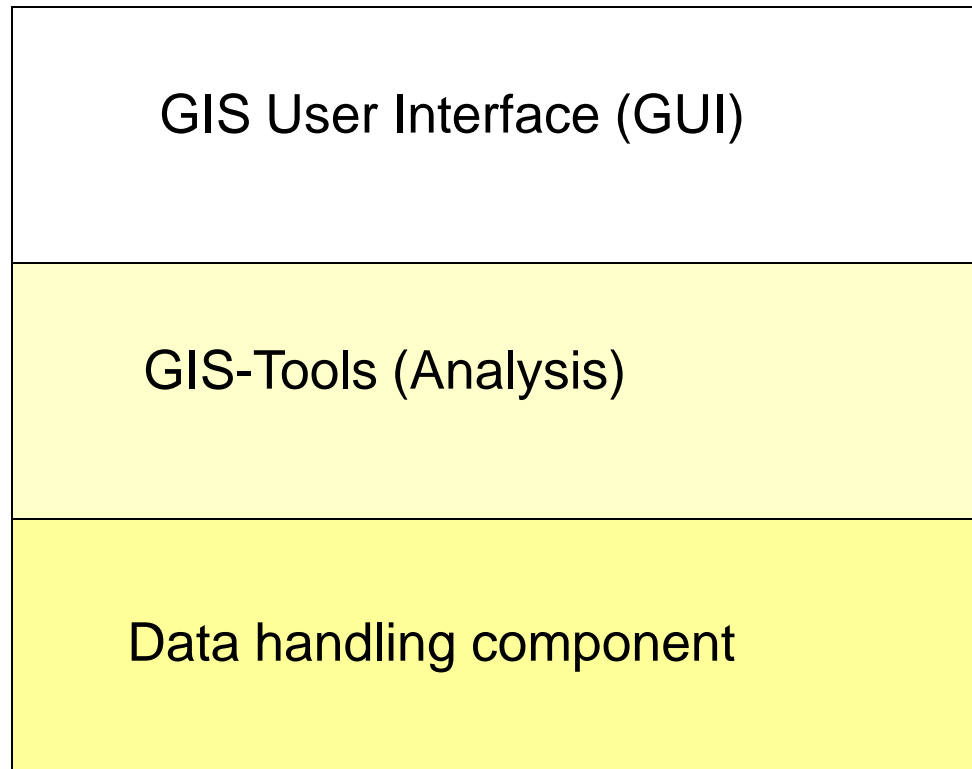
„Closing the circle":

Back to GIS – Geographical Information System

"A **Geographical Information System** is a computer-based system that consists of hardware, software, data and applications.

With it geospatial data can be digitally recorded and edited, stored and reorganized, modeled, analyzed and presented in alphanumeric and graphic. ... "
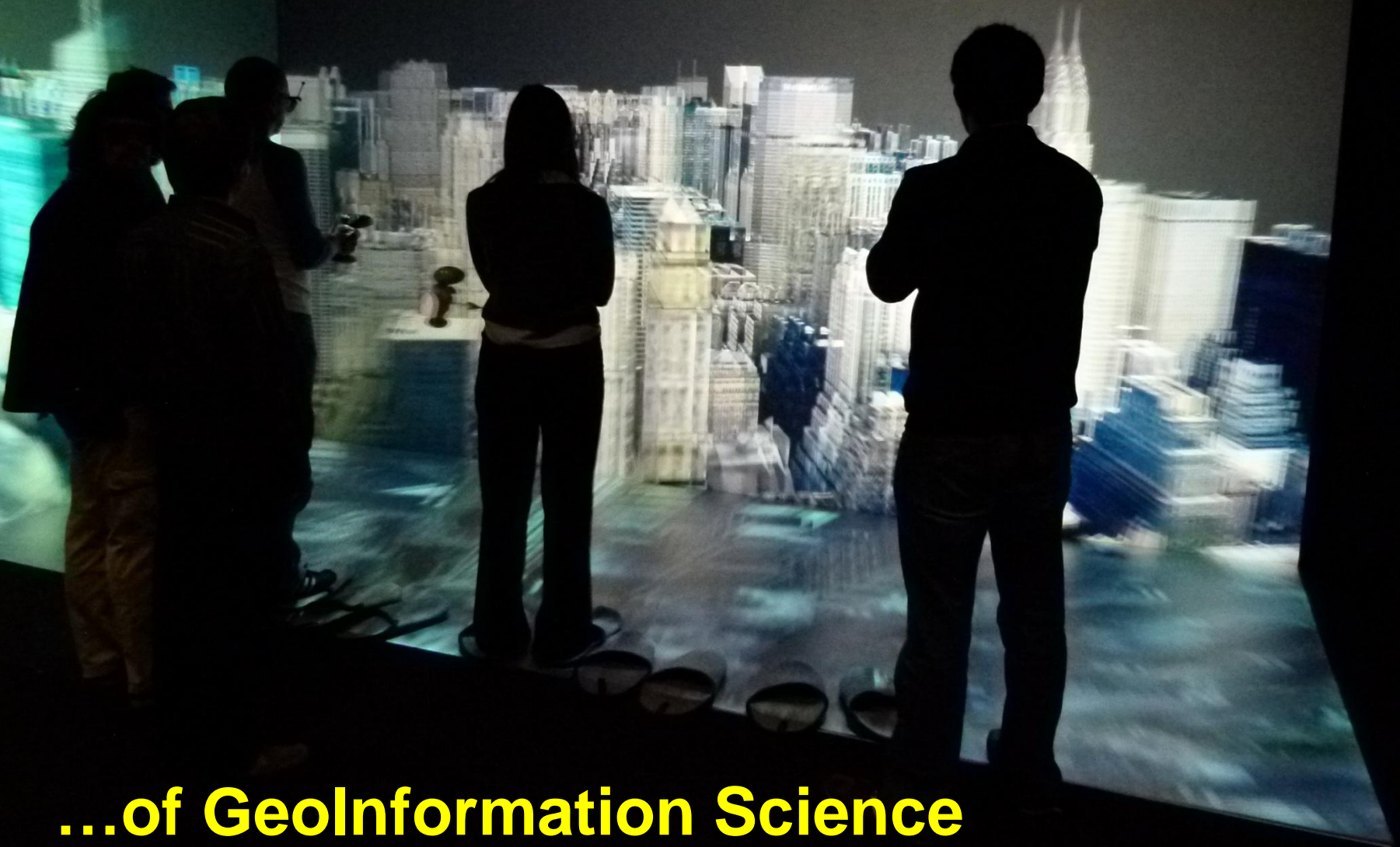
Quelle: Ralf Bill http://www.geoinformatik.uni-rostock.de/einzel.asp?ID=984408921

System architectures for GIS

Layers of a GIS architecture:

GIS User Interface (GUI)
GIS-Tools (Analysis)
Data handling component

Collaborating in innovative projects…

…of GeoInformation Science