Digital Mapping

Lecture 3

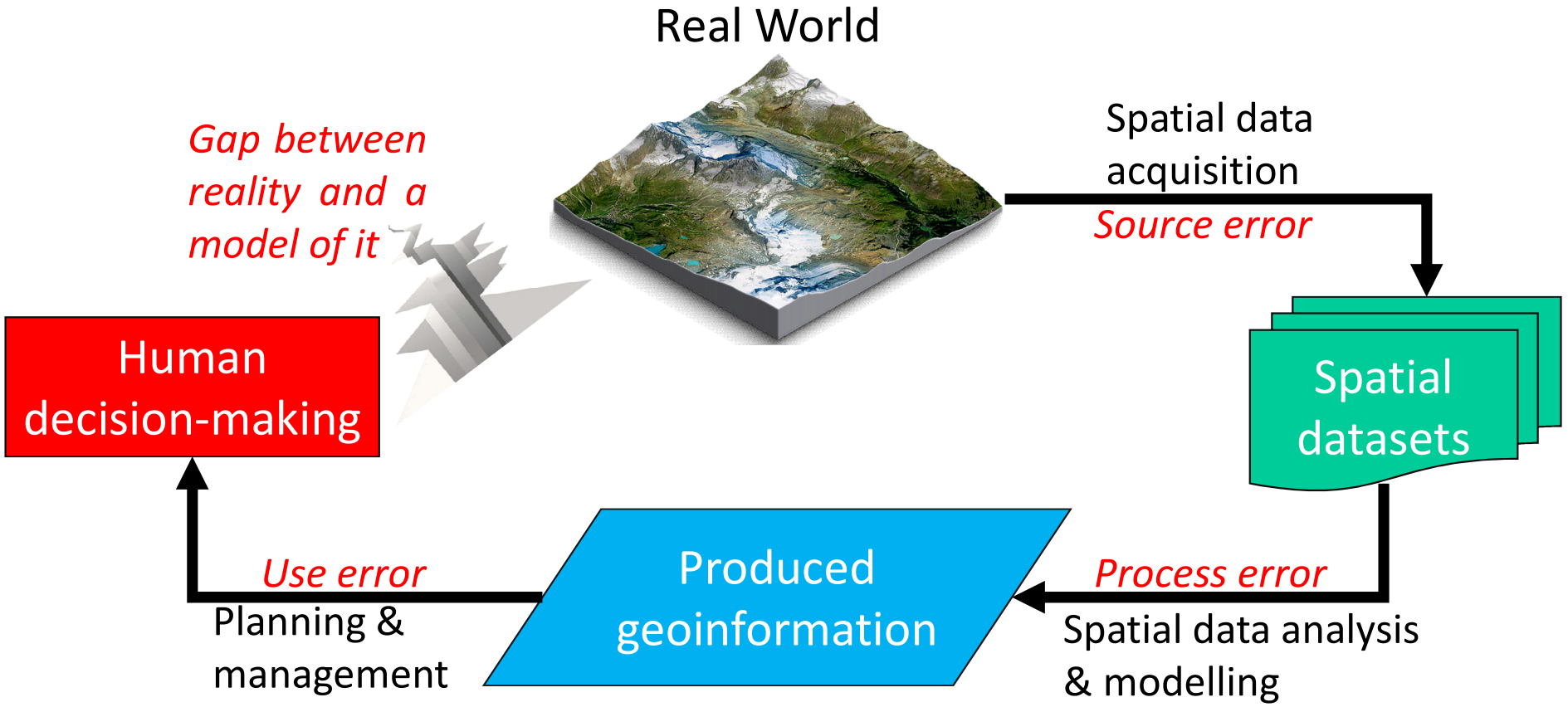
Outline

- Spatial data Acquisition
  - Methods: Primary and secondary data capture
  - Collection process
  - Digital sources

Spatial Data Acquisition

- Acquiring geographic data is an important *part of* and *factor in* any GIS and mapping effort.
- Data acquisition, by some estimates, typically consumes 60 to 80 percent of the time and money spent on any given project.
- Errors may be propagated and accrued at various stages of spatial data handling, including data acquisition.

Spatial Data Acquisition



Spatial Data Acquisition:
Methods

- Generally, there are two main methods of acquiring spatial data including:
  - Direct observation/ Primary data capture
  - Indirect/ Secondary data capture
- The two methods can be further broken down into:
  - Collecting new data → Survey;
  - Converting/transforming legacy data → Maps/ records;
  - Sharing/exchanging data → Geoportals/ SDI; and
  - Purchasing data → Geoportals and mapping agencies

Spatial Data Acquisition:
Primary data capture

- A direct data acquisition methodology that is usually associated with some type of in-the-field or *in situ data collection* effort.
- Can be through:
  - Ground-based survey
  - Remote sensors aboard satellites or airplanes
- Data which is captured directly from the environment is known as *primary data.*

Spatial Data Acquisition:
Primary data capture

- From a data type perspective:
  - Primary *raster* data capture is via remote sensing observations.
  - Information is derived from measurements of the amount of EM radiation reflected, emitted, or scattered from objects.
  - Primary *vector* data capture is via classical survey (Chaining, EDM, total station, and GNSS) or non-scanning remote sensing e.g. LiDAR.

Q. What are the limitations of primary data capture via remote sensing when compared to ground survey methods?

Spatial Data Acquisition:
Secondary data capture

- An indirect methodology that utilizes existing geospatial data available in both digital and hard-copy formats.
- Any data which is not captured directly from the environment is known as secondary data and includes:
  - Data derived from existing paper maps
  - Data digitized from satellite imagery
  - Processed data purchased from data capture and dissemination firms/ agencies

Spatial Data Acquisition:
Secondary data capture

- From a data type perspective:
  - Secondary *raster* data capture is through scanning of hardcopy media using scanners
  - Secondary *vector* data capture is through:
    - Vectorization
    - Photogrammetry
    - COGO data entry

Q. Distinguish digitization, rasterization and vectorization.

Spatial Data Acquisition:
Primary & *Secondary data capture*

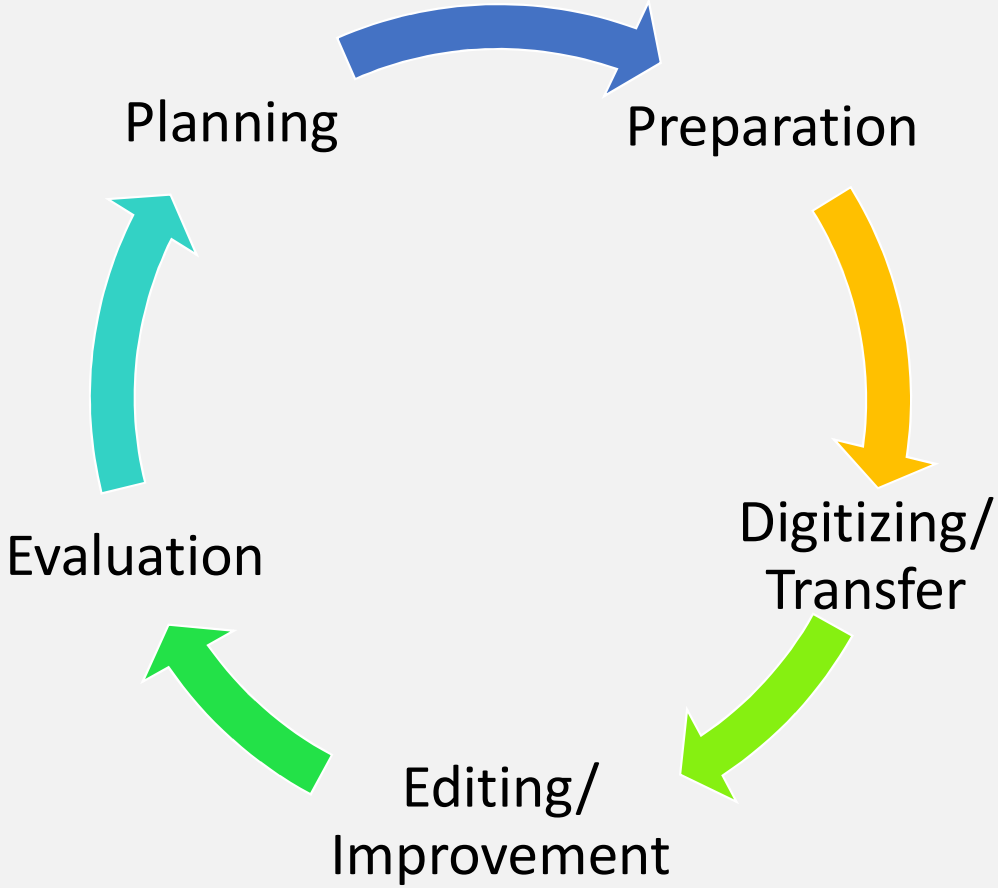
	Raster	Vector
Primary Data Capture	Digital remote sensing images	Total Station, GNSS Survey measurement
	Digital aerial photographs	Non-scanning remote sensing data e.g. LiDAR
Secondary Data Capture	Scanned maps	Vectorization
		Photogrammetry
		COGO data entry

Q. In the context of the various spatial data types, what are the spatial data preparation considerations?

Spatial Data Acquisition:
Collection Process

- Planning involves establishing user requirements, garnering resources, and developing a project plan.
- Preparation involves obtaining data, redrafting poor –quality map sources, editing scanned map images, removing noise, and setting up appropriate GIS hardware and software systems to accept data.
- Digitizing and transfer are the stages where the majority of the effort in mapping and GIS is expended.
- Editing and improvement covers many techniques designed to validate data, as well as correct errors and improve quality.
- Evaluation is the process of identifying project successes and failures.

Spatial Data Acquisition:
Collection Process



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Spatial Data Acquisition:
Digital Sources

- Metadata is data about data.
- Geospatial metadata commonly document geographic digital data resources and geospatial resources.
- **Metadata record:** An information file that captures the basic characteristics of a geographic data or information resource, and represents the *who, what, when, where, why* and *how* of the geodata or resource.

Spatial Data Acquisition:
Digital Sources

Who	• Created the data? • Manages the data?
Where	• Is the study area? • Can the data be accessed?
What	• Is the data content? • Is the source data used?
How	• Was the data created? • Is the data distributed?
When	• Is the time period of the content? • Was the data created?
Why	• Was the data created? • Are the missing values?

Recap:
The Nature of Geographic Data

- Attribute Accuracy/ Thematic accuracy:
  - Sources of attribute error:
    - Blunders
    - Inappropriate model
  - There are two types of attribute accuracy relating to the type of data/ measurement scale:
    - Labelling accuracy - for nominal or categorical data e.g. land cover classes, road classes
    - Numerical accuracy – for numerical data e.g. soil pollutant concentrations, height of trees
  - Evaluation of attribute accuracy/ accuracy assessment depends on the data type.

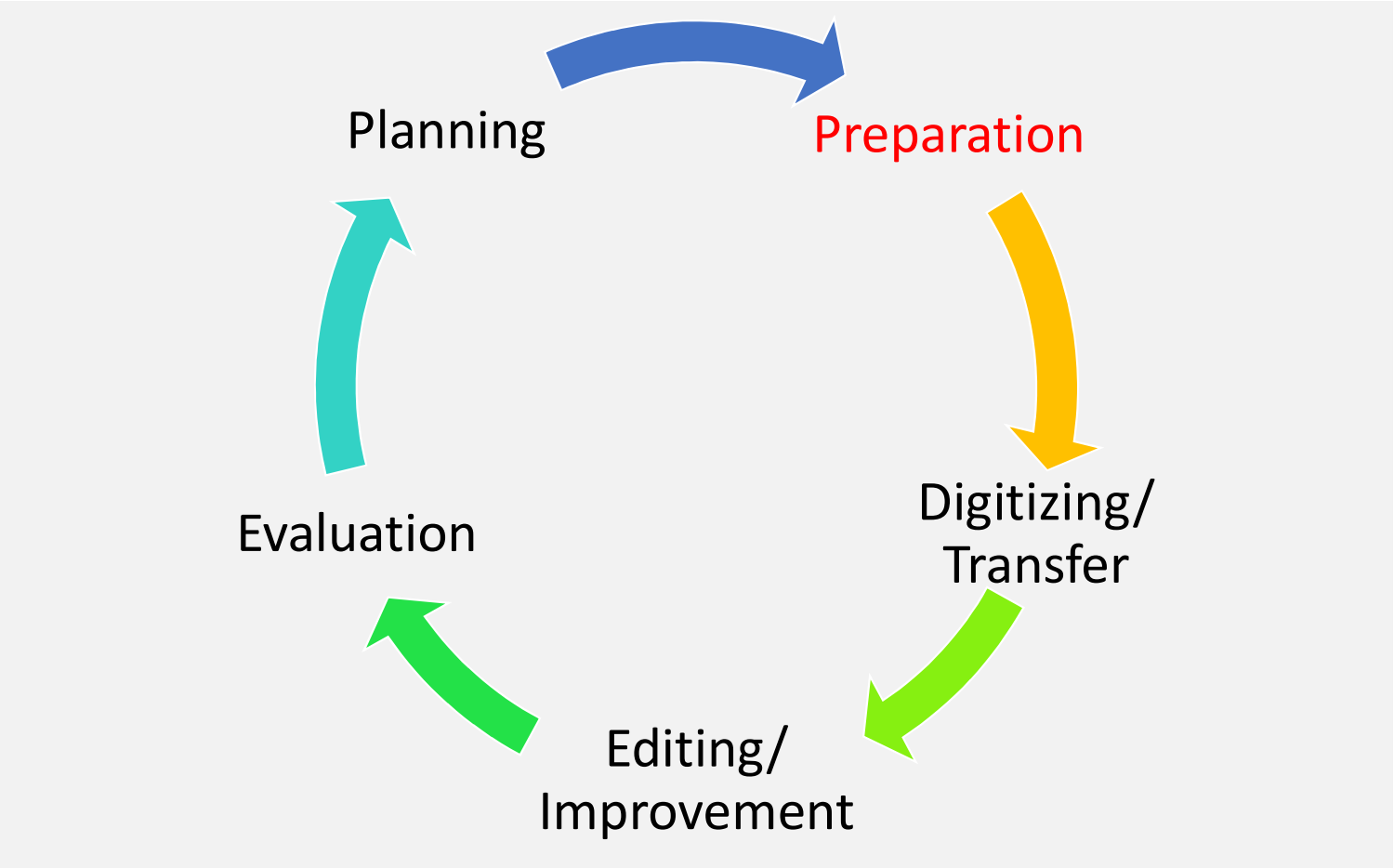
Spatial Data Acquisition:
Digital Sources

KEWI Water Test Results dataset

A	B	C	D	E	F	G	H	I	J	K	L	M	N
SAMPLE_NODATETYPE_OF_H2OCOUNTYTYPE_OF_ANALYSISPHALKALINITY_Mg/LCONDUCTIVITY?S/cmTotal_Dissolved_SolidsCOLOUROBJECTID													
7012/19/2012BoreholeMachakosFull Chemical Analysis8.952021670315													
7022/27/2012Borehole NairobiFull Chemical Analysis/Bacteriological Analysis8.91384052.516													
7032/27/2012NairobiFull Chemical Analysis/Bacteriological Analysis7.152295217													
7042/27/2012NairobiFull Chemical Analysis/Bacteriological Analysis6.982890218													
7052/27/2012BoreholeNairobiFull Chemical Analysis/Bacteriological Analysis7.81123932.519													
7073/1/2012BoreholeMogadishuFull Chemical Analysis7.7823627901729.8220													
7083/3/2012River CentralFull Chemical Analysis898325201.5121													
7093/5/2012BoreholeLokichoggioFull Chemical Analysis7.08256757469222													
7103/12/2012Tap + BoreholeMeruFull Chemical Analysis/Bacteriological Analysis8.5170493306223													
7113/12/2012DomesticMeruFull Chemical Analysis/Bacteriological Analysis8.046810464.5324													

Q. In the above example of digital spatial data acquired from a geoportal, what needs to be done to make it fit for mapping purposes?

Spatial Data Acquisition:
Digital Sources



Spatial Data Acquisition:
Geoportals

- The links below provide lists of geospatial data portals/ geoportals:
  - https://guides.lib.utexas.edu/gis/lists-of-gis-data-portals
  - https://data.opendatasoft.com/explore/dataset/open-data-sources%40public/table/?sort=code_en
  - https://github.com/awesomedata/awesome-public-datasets
  - https://africanews.space/here-are-some-open-access-geoportals-for-free-spatial-data-of-africa/
  - http://www.fao.org/geospatial/resources/data-portals/en/

References

- https://2012books.lardbucket.org/books/geographic-information-system-basics/s09-01-geographic-data-acquisition.html
- https://www.usgs.gov/products/data-and-tools/data-management/data-acquisition-methods