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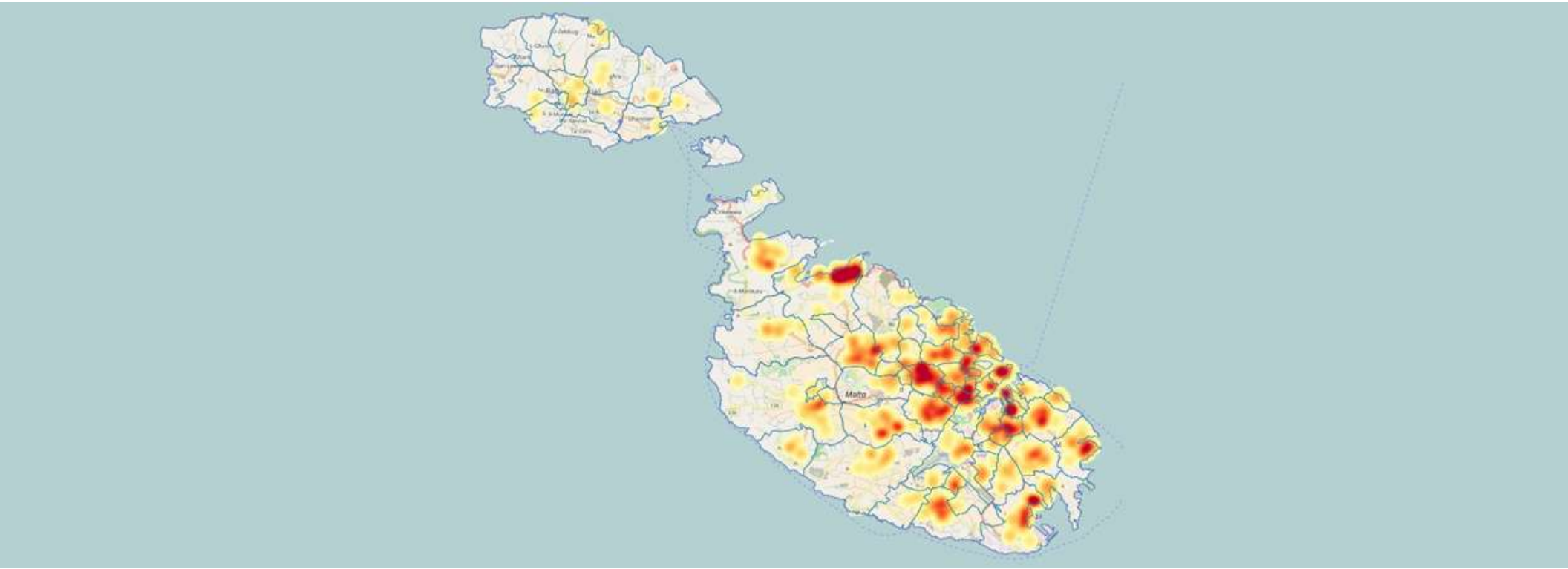
Criminal Domains and New societies:
Spatio-Temporal Approaches to the Mapping of Social Research

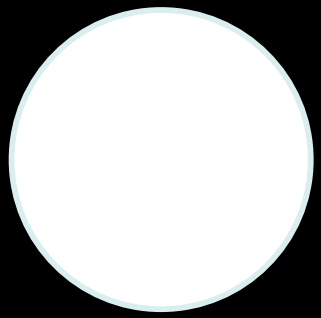
Public lecture in remembrance of Dr Jacqueline Azzopardi
06 November 2016



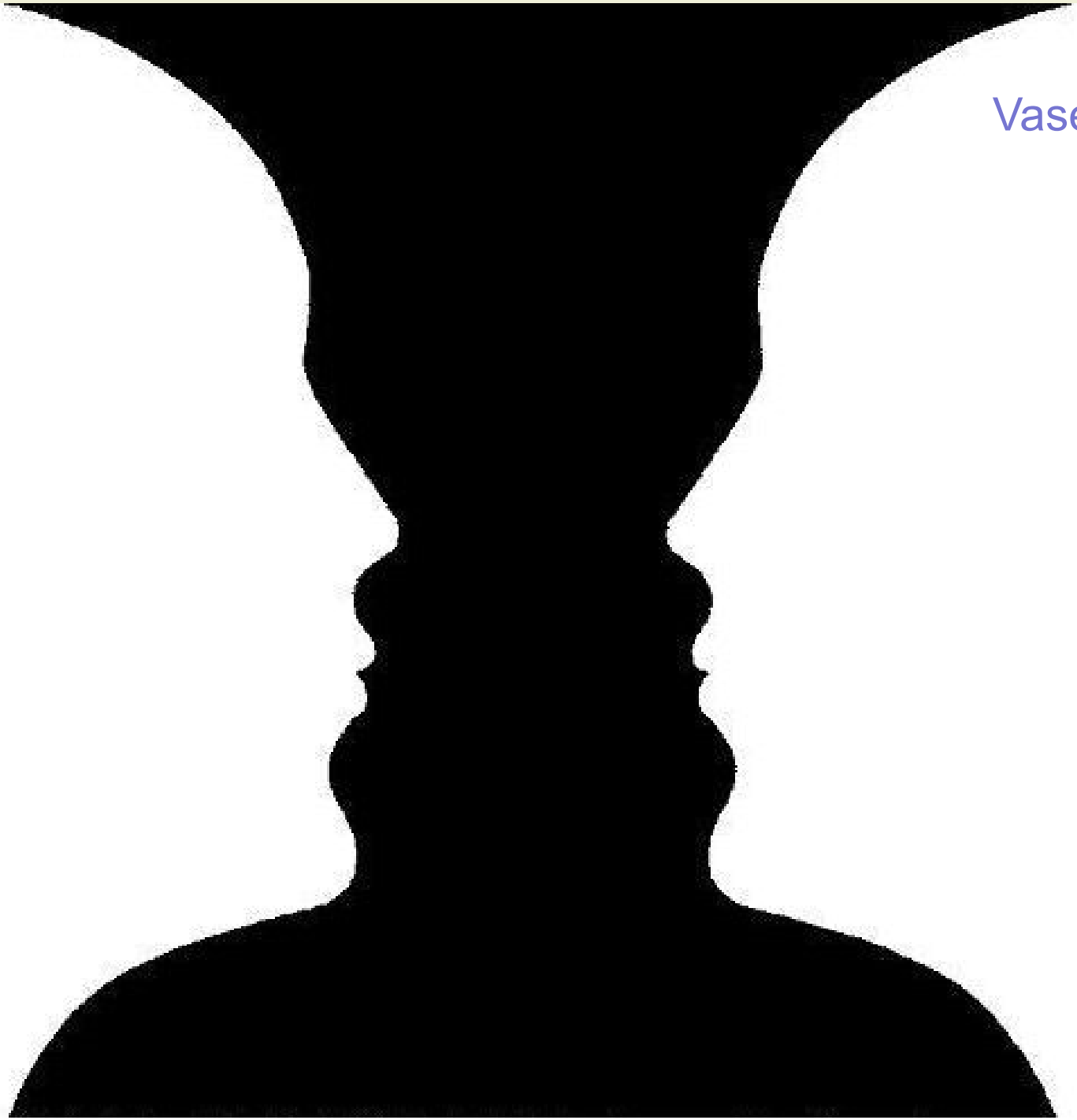
Prof Saviour Formosa
saviour.formosa@um.edu.mt

Found it?

Better?

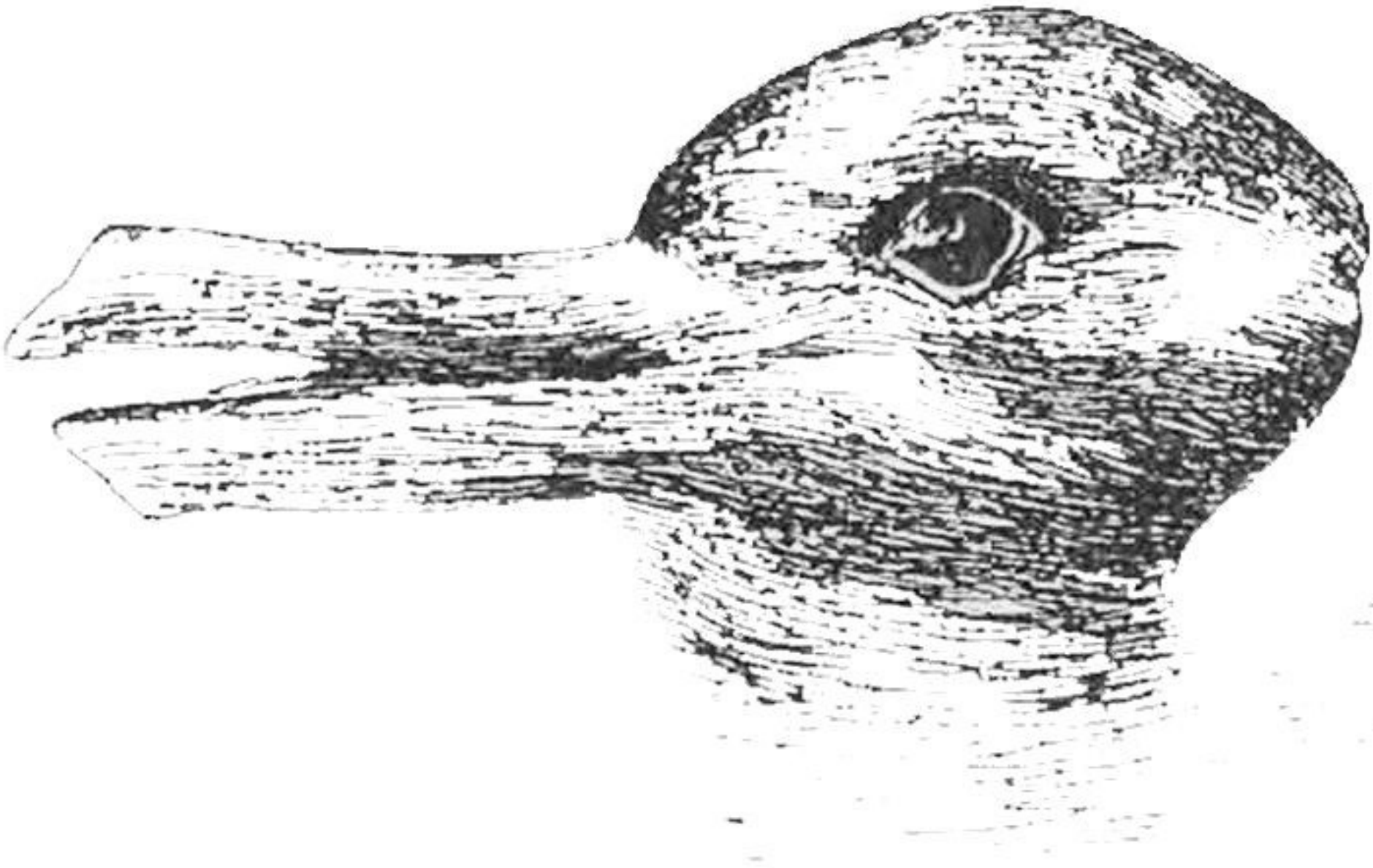


Visualisation



Vase or Faces?

Duck or Rabbit?

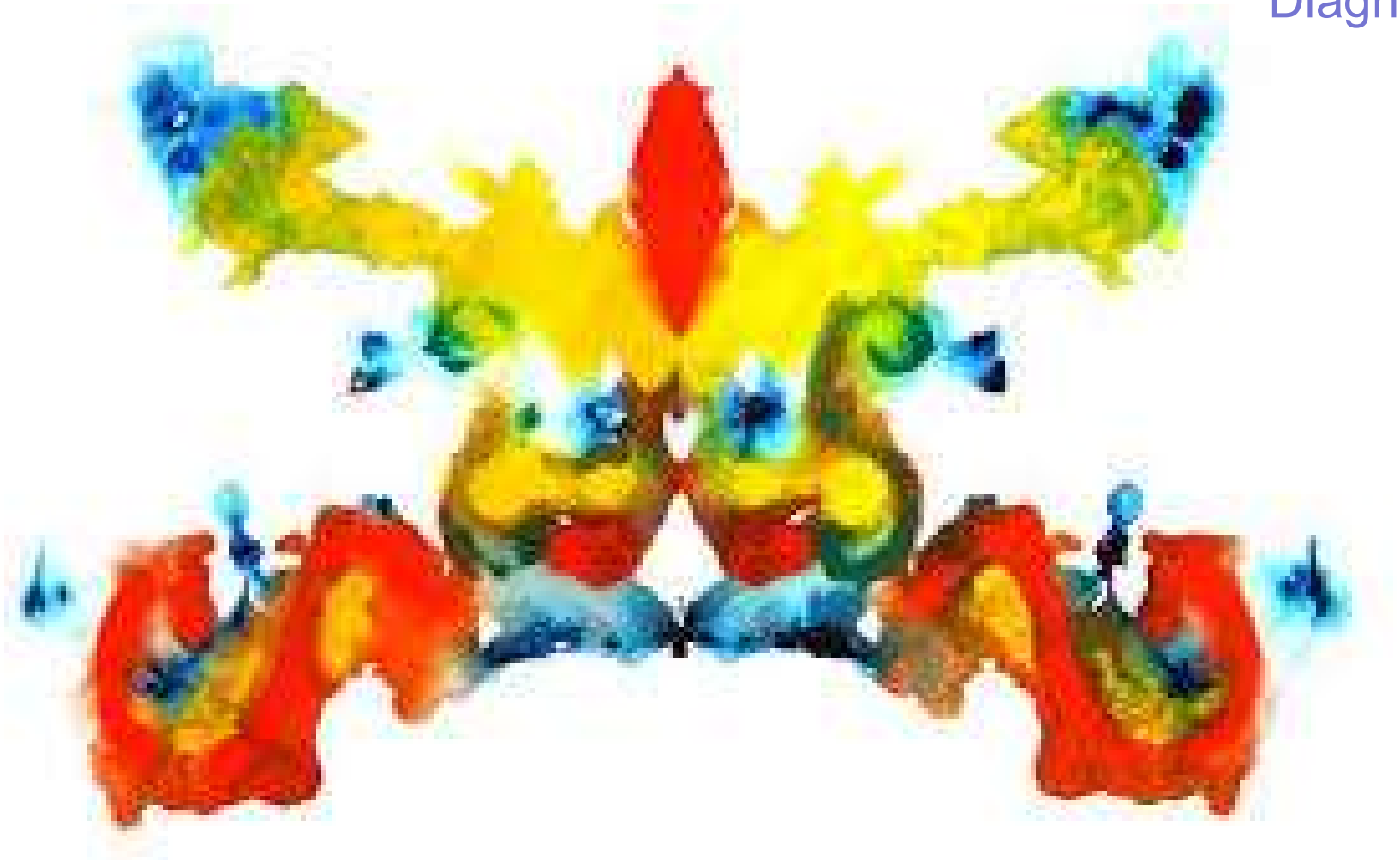


Visualisation

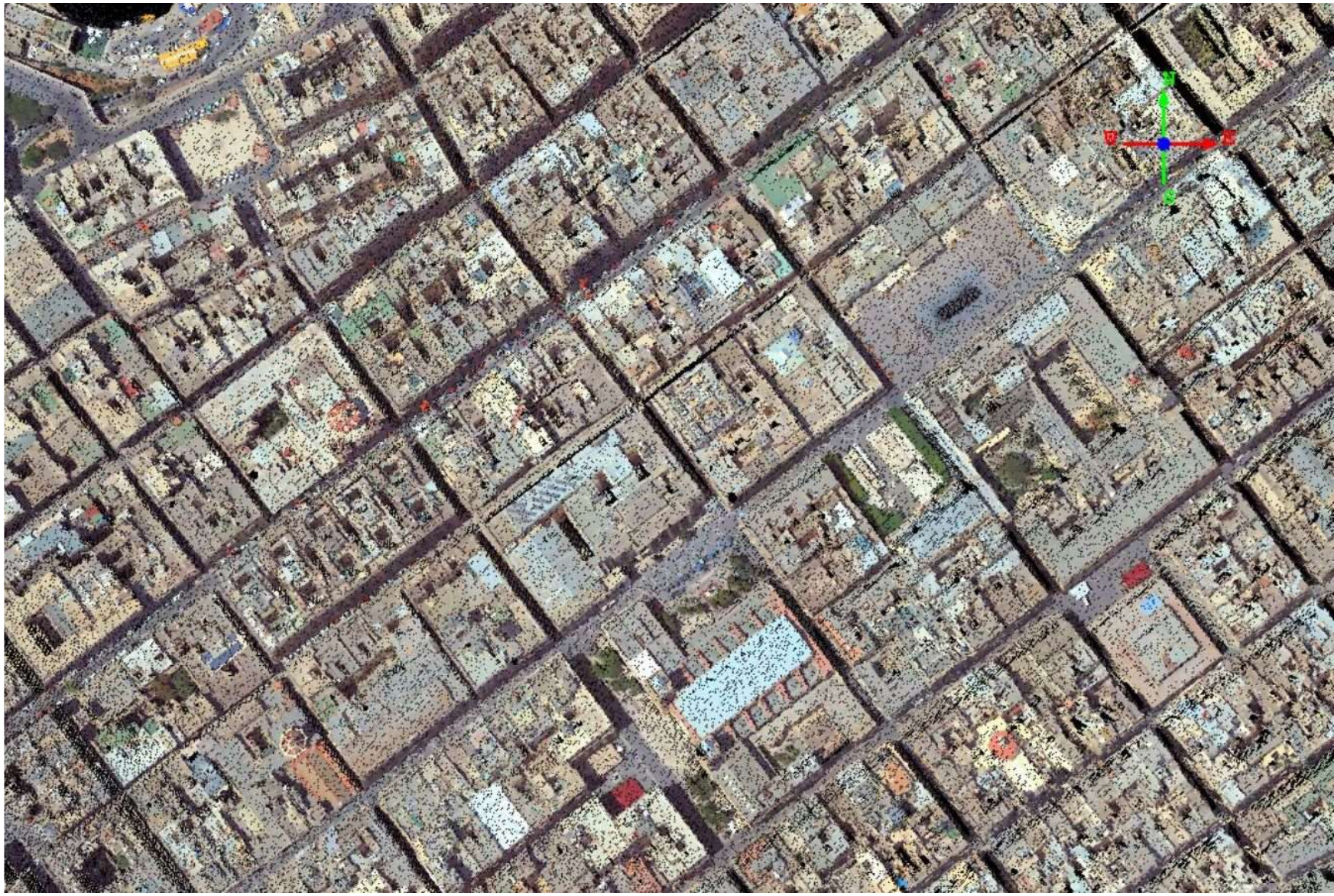
My Wife
My Mother in Law

Visualisation

The Rorschach Inkblot Diagnostic



Maps – Easy No?

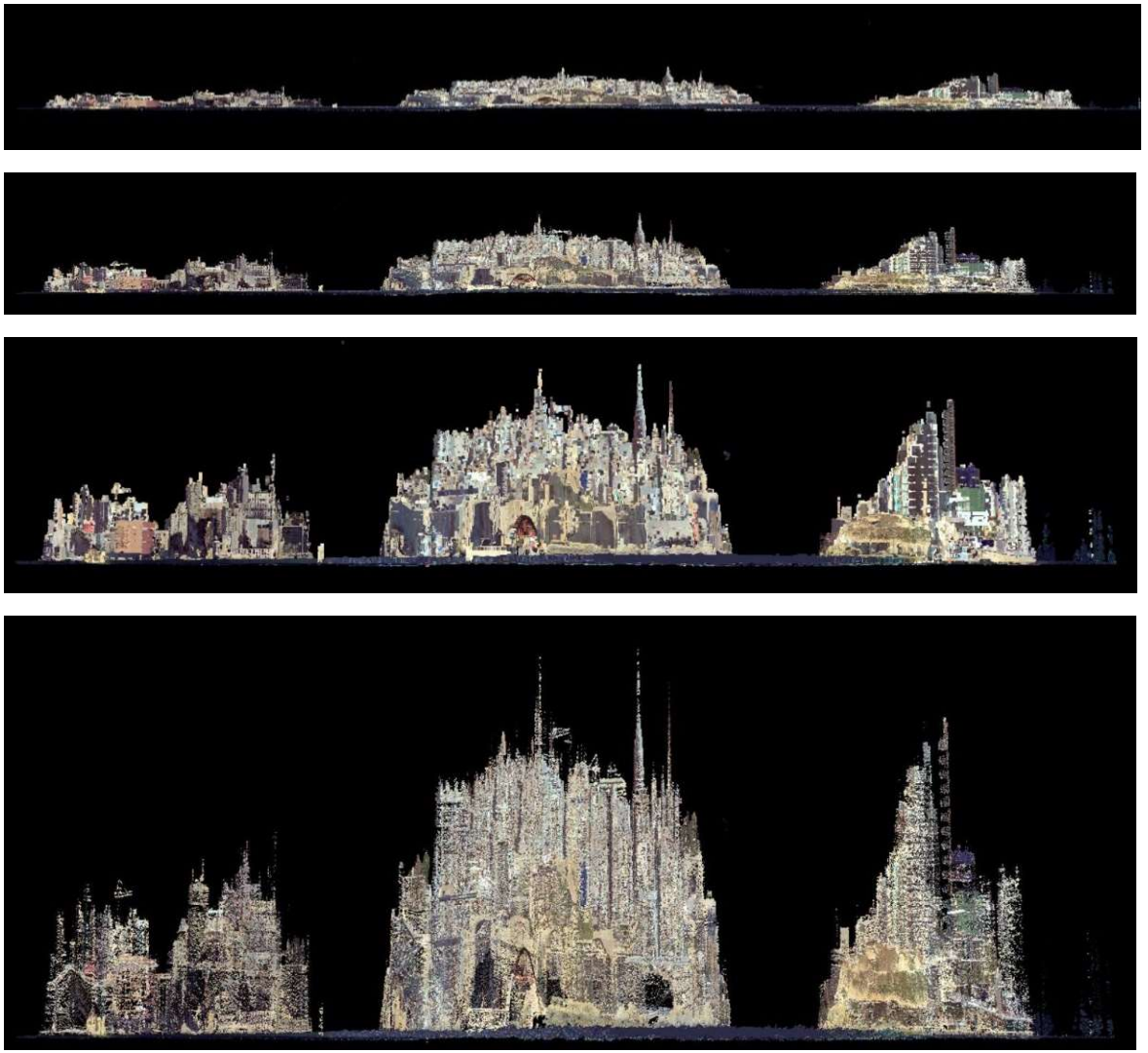


Maps – Easy No?

Visualization - Visualisation

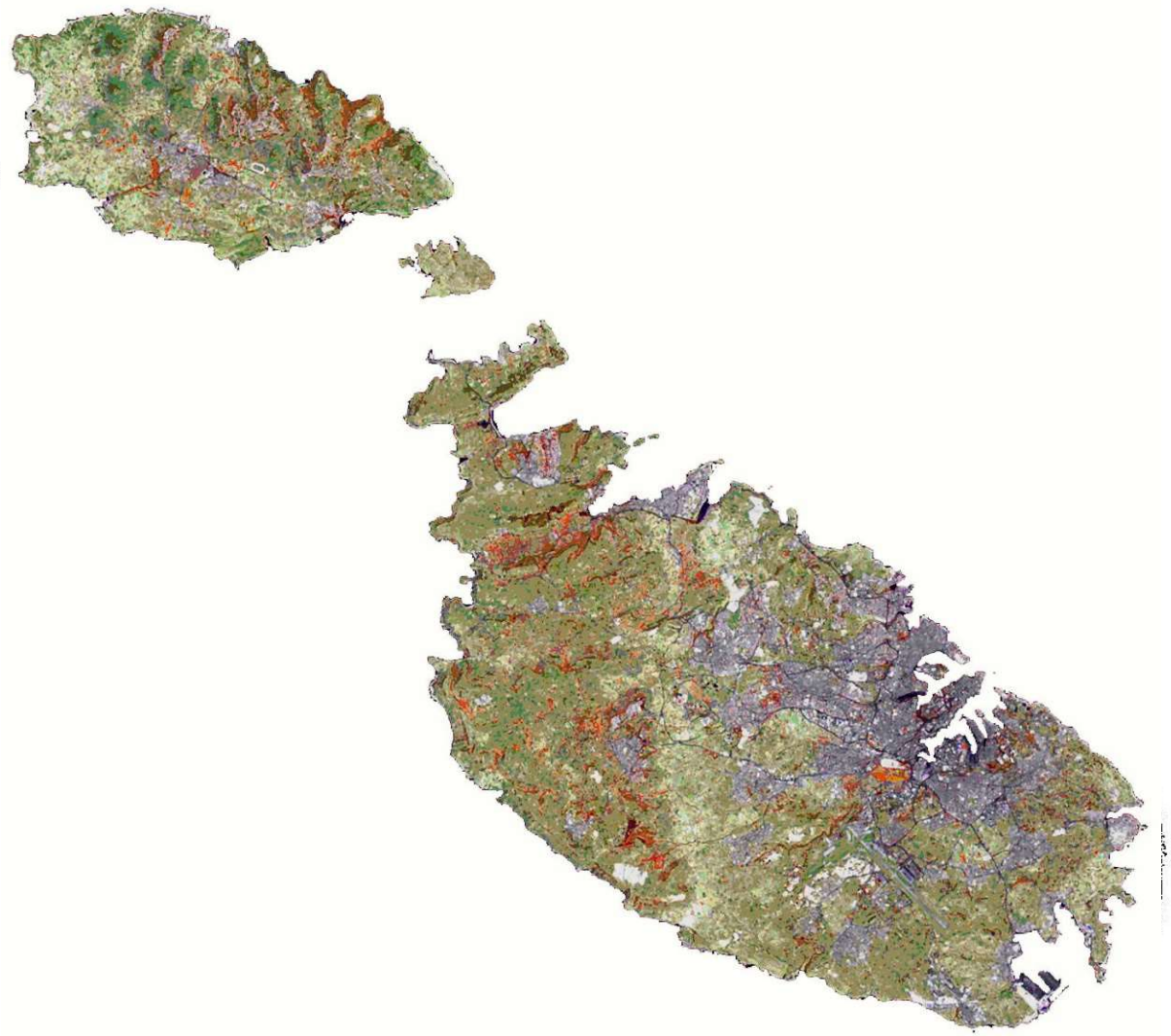
Z ⟹ **S**

Imagine the Valletta Grand Harbour Vista

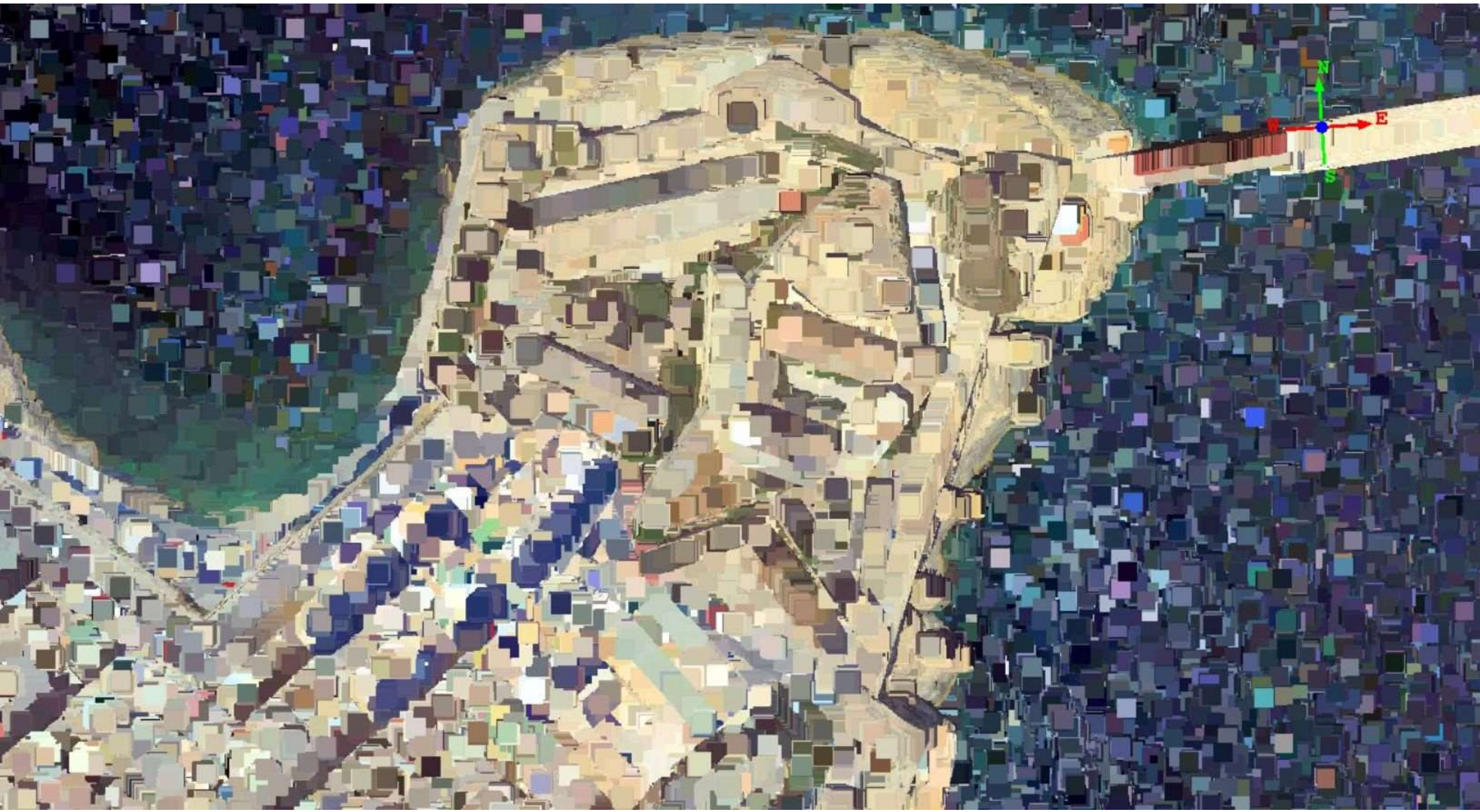


Visualisation – Sample Group

Imagine the Maltese Islands and locate Valletta



Setting the baselines for a virtual world



GIS Definition

"A geographical information system is a group of procedures that provide data input, storage and retrieval, mapping and spatial and attribute data to support the decision-making of the organisation" (Grimshaw, 1994)

The people factor is now the most important factor!

GIS - Geographical Information Systems
Geographic Information Systems

SIS - Spatial Information Systems

LIS - Land Information Systems

AM/FM - Automated Mapping/Facilities Management

Geomatics – used widely in Canada

Historical Issues:

Military	to	Physical/Urban	to	Environmental	to	Social
1960s	to	1980s-1990s	to	1990s-2000s	to	2000s

Theoretical and practical issues are spreading beyond mere use to incorporate the hard-scientific physical and earth sciences approach to the more complex fuzzy concepts identified by social-scientific theories.

Initiatives:

Push - Pull: Entities were being pushed by the availability of a mapping system and provision of base maps

> Global explosion of GIS and Spatial awareness as well as software availability made it all possible – on-line take-off

Pull - Push: Private organisations finally break through by creating their own data and then going for the mapping systems

Approaches:

Techno-Centric or Socio-Technic?

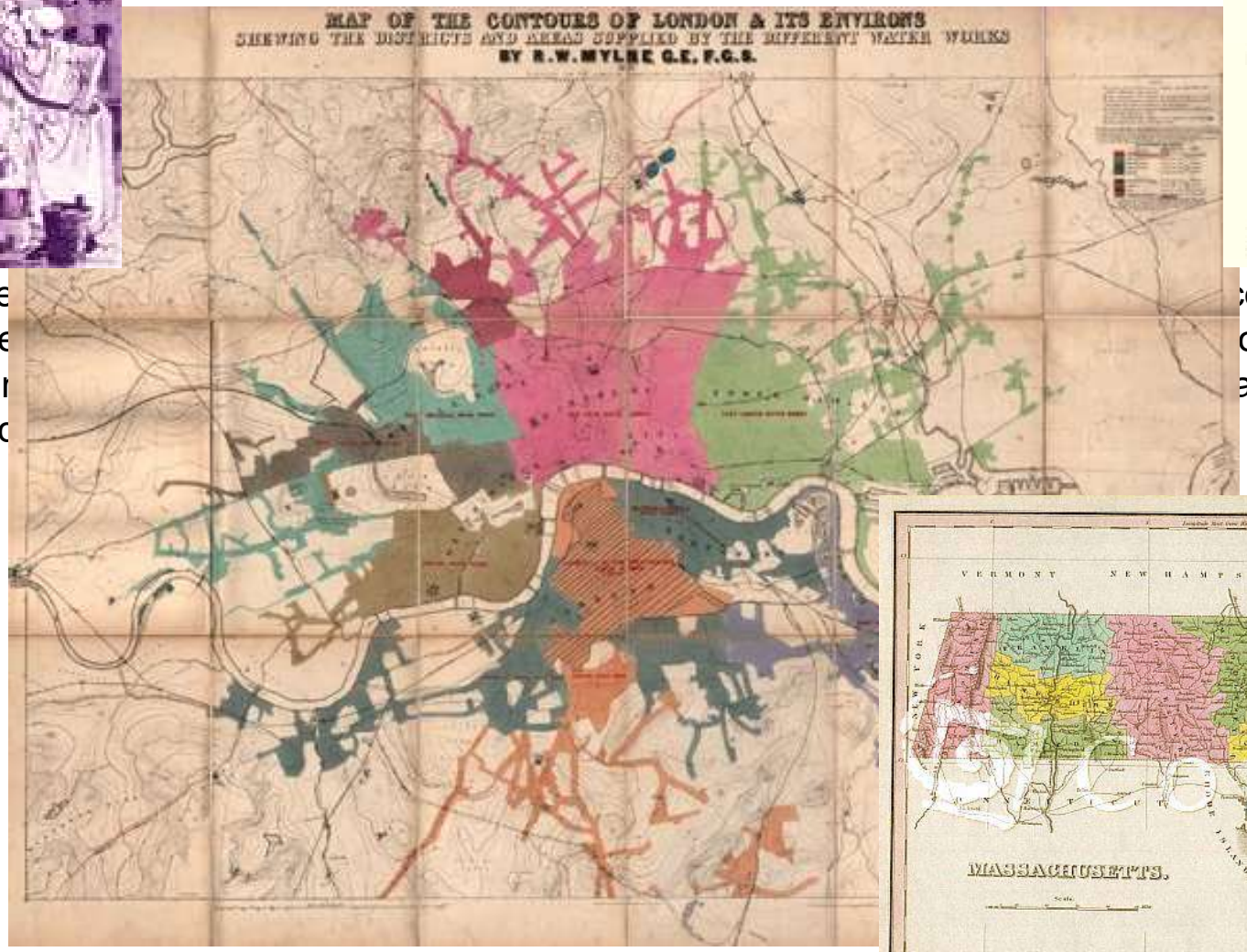
Should we just concentrate on Technology and its delivery
(ICT-based approach with users as the secondary 'potential' market)

or

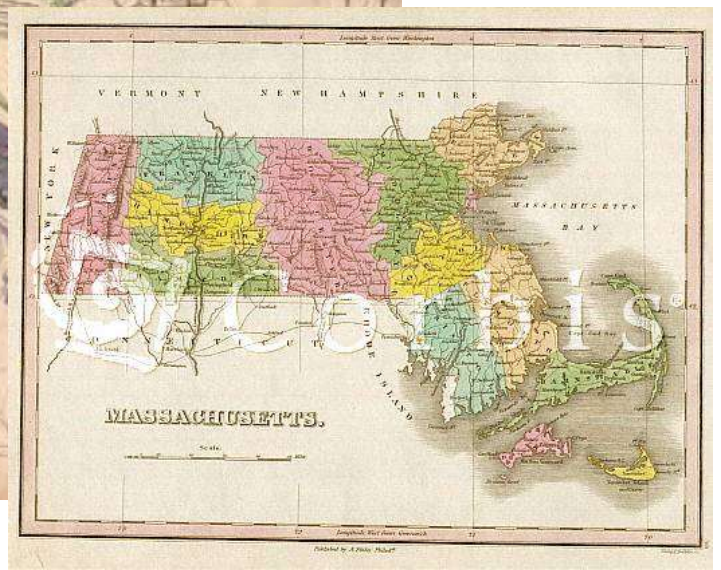
Should we concentrate on the Social implications of that technology
(Person-based approach with ICT as the 'conveying tool')

As people get more used to discrete and unobtrusive technology the move from techno-centric towards socio-technic will occur.

First Use: Dr. Snow: 1854 Soho-London - Mapping of **Cho**



He was electe cond term his party, the Jeffe on districts in their favour i amed by his opponents and



The Data Context

Spine - City Of Dreams

Guide to the City treasures

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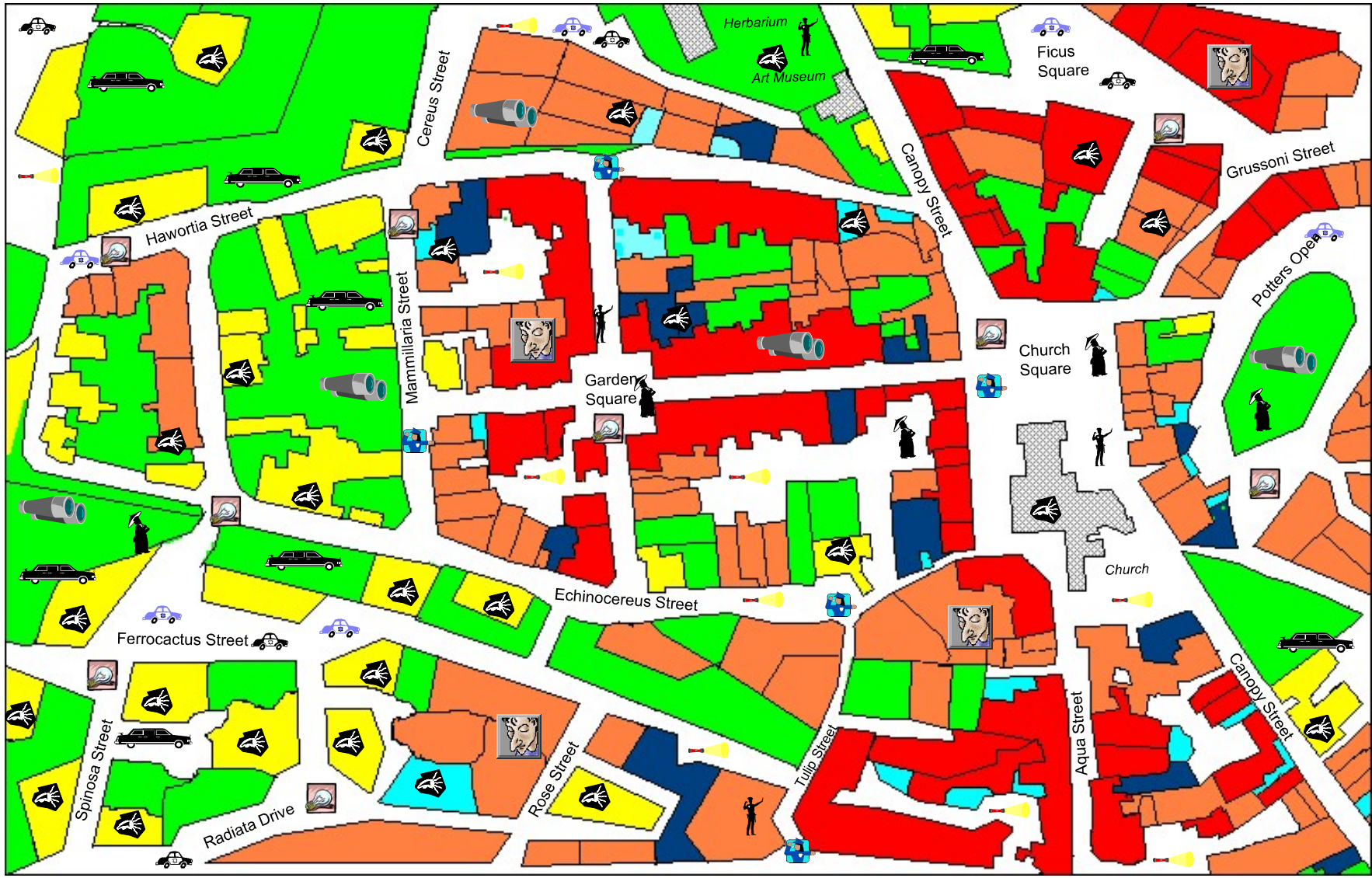
Property and Road Key

- Villa
- Terraced House
- Apartment
- Small Shop
- Supermarket
- Open Area/Garden
- Landmark Building
- Two-Way Street
- One-Way Street



Security and Target Key

- Traffic
- Illuminated Street
- Dark Street
- Police Foot Patrol - Daytime
- Police Mobile Patrol - Daytime
- Police Mobile Patrol - Night-time
- Neighbourhood Watch Effective range (by block)
- Burglar Alarm
- Other Burglar's Turf Effective range (by block)
- Expensive Vehicles
- Easy victims (elderly, etc)

The Information Dilemma
Tower of Babel or Valhalla?

Today we are facing a period unprecedented in history: information is available, it is easy to decipher and is accessible to all…

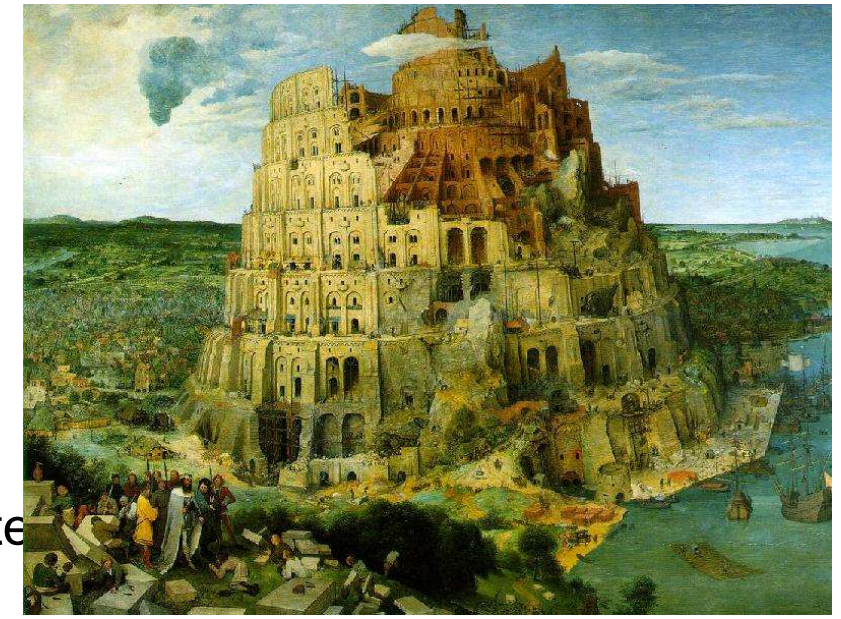
Or is it?

Are we going down the Babel way?

The most brilliant architects got together with the brightest inventions and plans..

But at the end there were too many languages and they couldn't communicate

That killed
the tower not the technology



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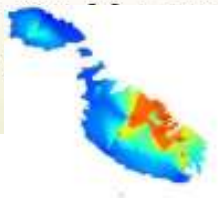

Specific Problems

- Data are sold and very expensive
- Data are extensively hoarded/ territoriality is very evident
- No referenced address point data exists - CdB will solve this
- Zip codes are not reliable
- Census data is overly protected (EAs need special permission from PM
- Most data available at Local Council Areas

Data Sources

- Dubious
- Metadata - few if any entities compile such
- Lineage recording does not exist
- Data are not current - Large scale spatial data is now dated – old currency
- Versioning is not employed

Solid definitions that stood the test of time

Data: data are information **coded** and structured for subsequent processing, generally by a computer system (British Computer Society, 1989)

Information: information **is the meaning given to data** by the way in which it is interpreted (British Computer Society, 1989)

Geographic Information: information which can be related **to specific locations** on the earth (UK Department of the Environment, 1987)

Spatial Referencing: the **means** by which information can be related to a specific position or location (Shand and Moore, 1989)

Is there a need to convert the Real to Virtual?

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- **Who** might use this information? Who are the players – end-users?
- **What** does the process entail? What 'outside of the box' options are there?
- **Where** can it be deployed? (economies of scale)
- **Why** should visualization be brought in?
- **When** would it be best to introduce spatial information?
- **How** can we employ visualisation for social change
- **Why Not**?

W6H

The Situation and the Thematic Reality

- A data dearth: most data is in analogue format
- Access and limitations/moratoria spread across the different entities
- Cleaning the data where available is done manually
- Spatial issues:
  - Projections and conversions of whole state has proven a 'nightmare' (EEA shift)
  - Geocoding is based on street centre points which does not allow for real locational analysis
  - Streets are non-networked
  - Address point database does not exist…
- However, major steps have been made to create an NSDI based on the requirements from the **INSPIRE Directive**, together with a pivot from the CLC activities, the **Aarhus Convention** and other data-related legislation such as that required for reporting to the EEA (European Environment Agency).

The Spatial Context

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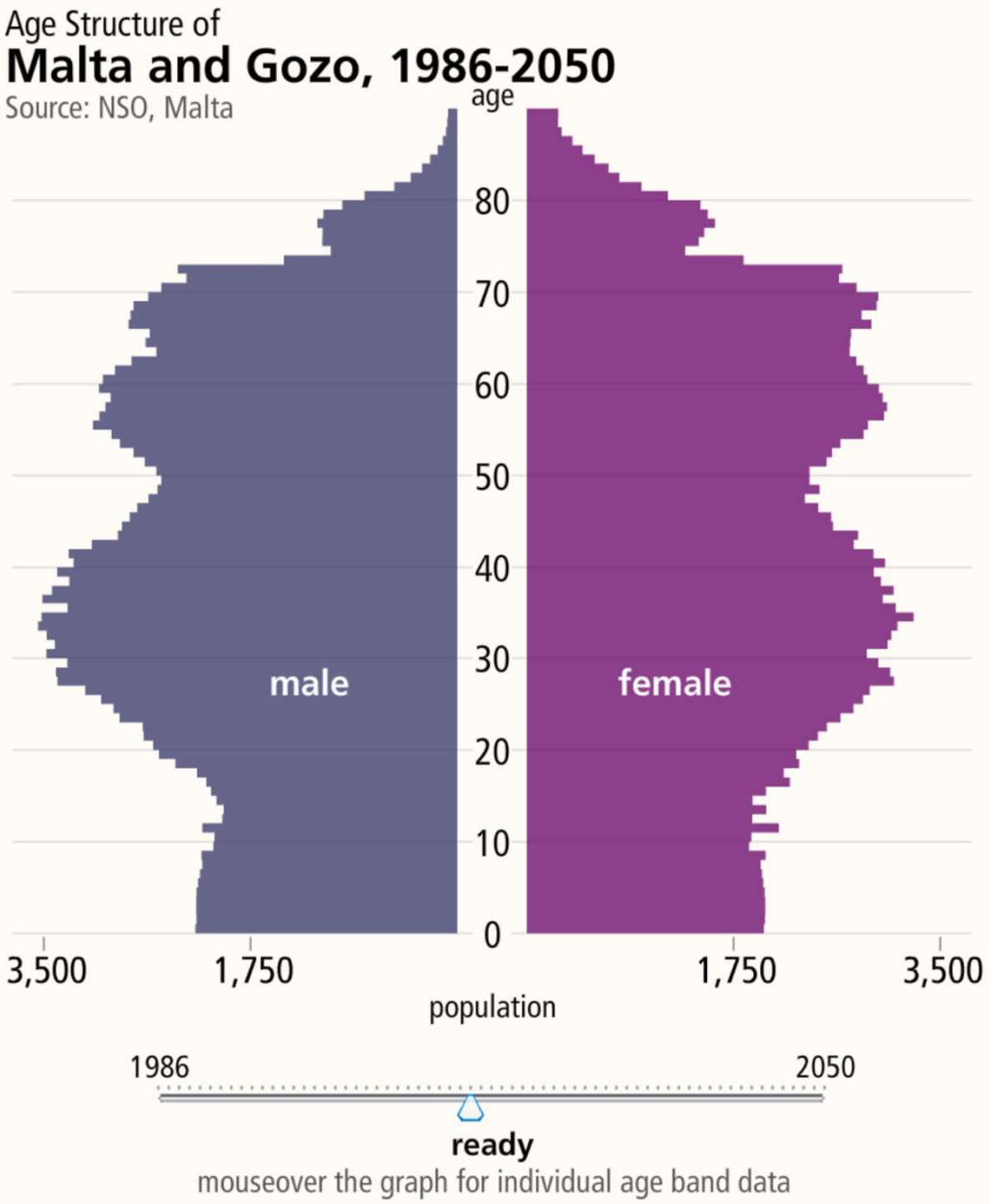
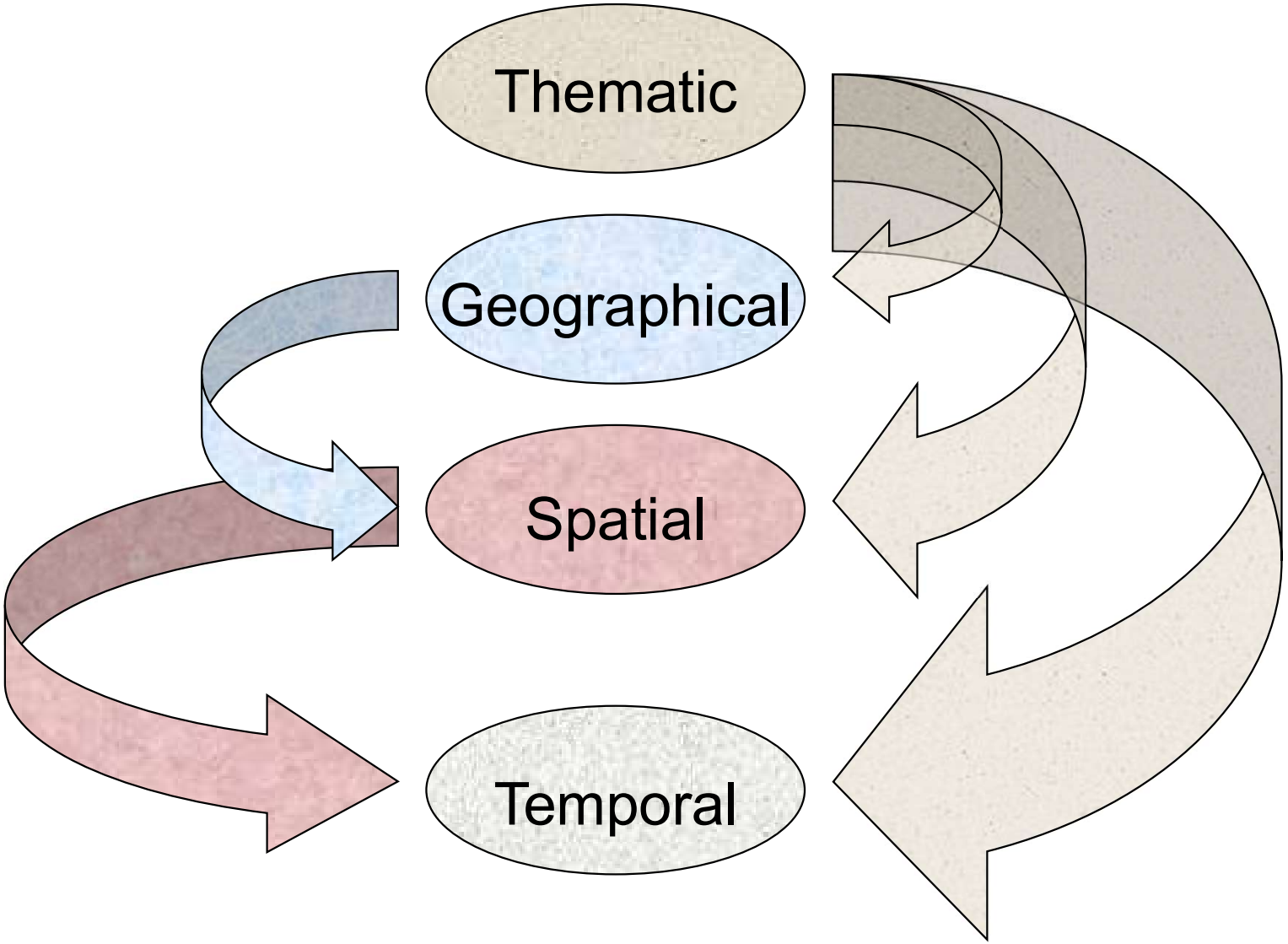
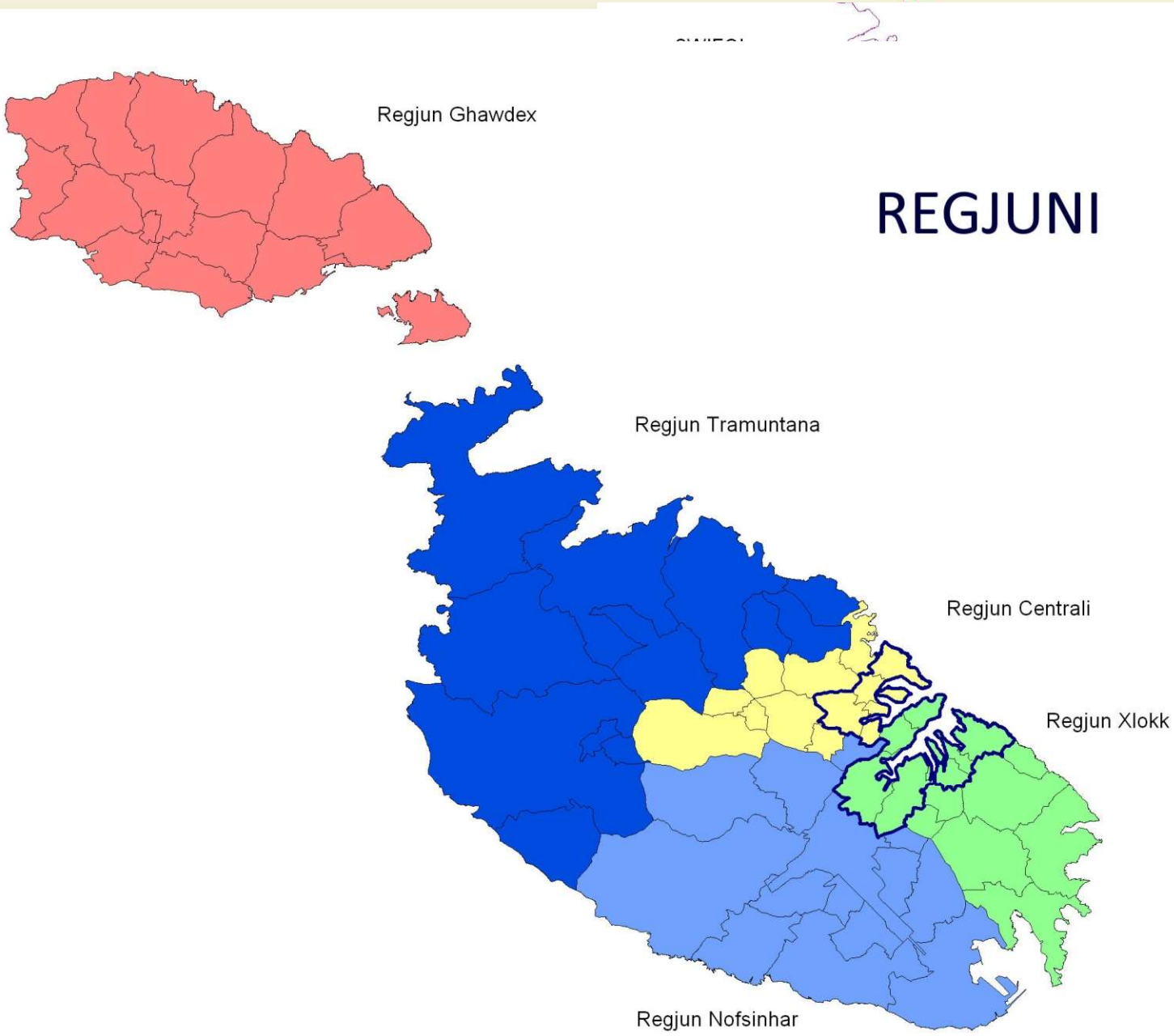
Animated Data: Population Pyramids



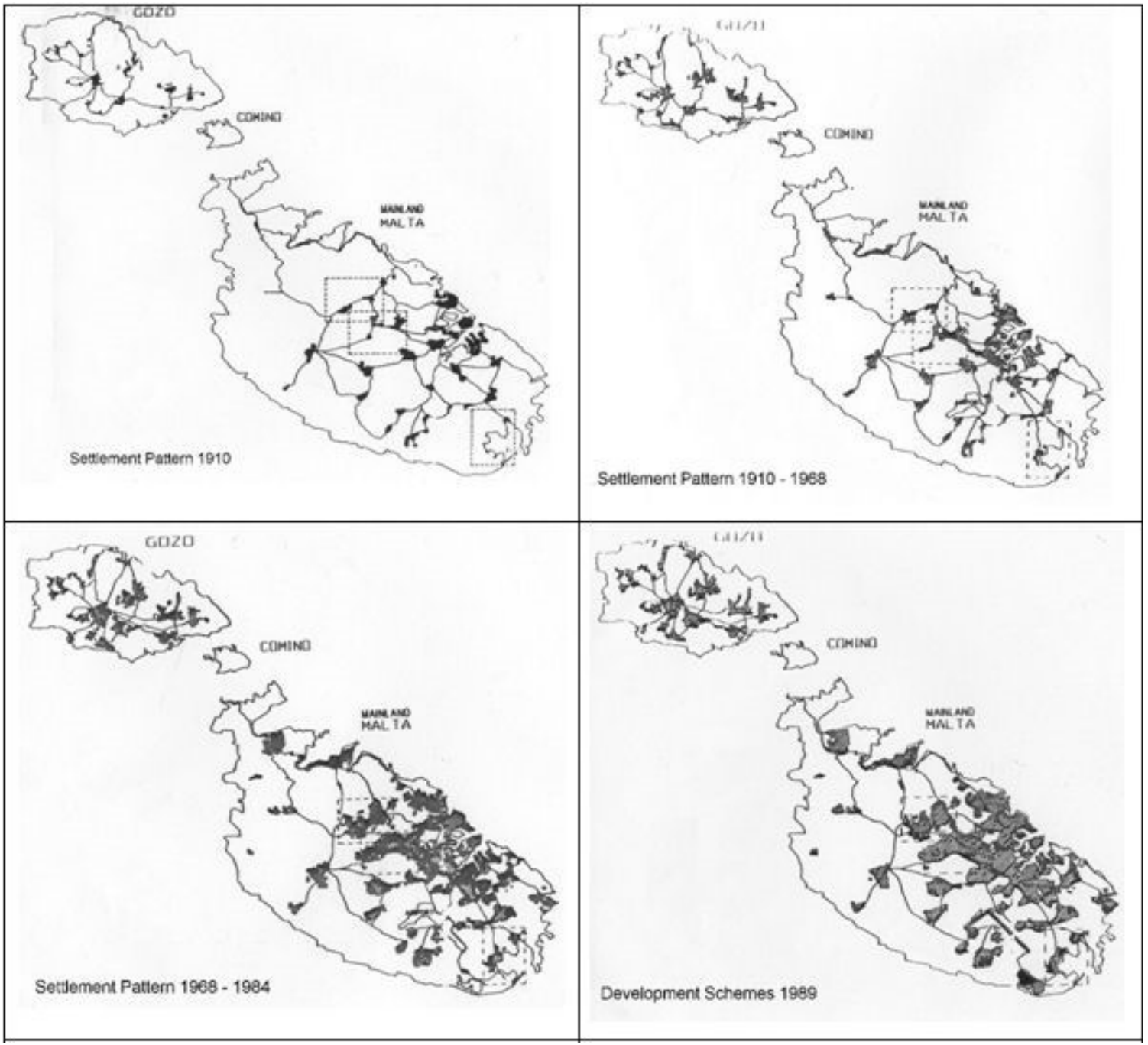
Analytical Constructs



Overlaying Nightmare? The Inflowence Dilemma



Development Sprawl: a historical approach



Offender Movements over Time: 1950s to 1990s

Figure 8.23a-d: 2NNH (Spatial Clustering) inter-decade change analysis 1950s – 1990s

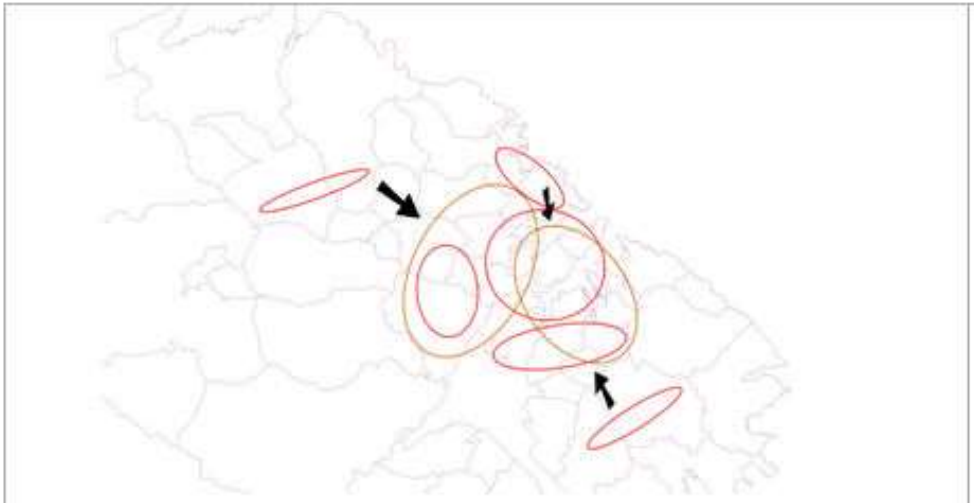


Figure 8.23a: 1950s – 1960s

Figure 8.23b: 1960s – 1970s

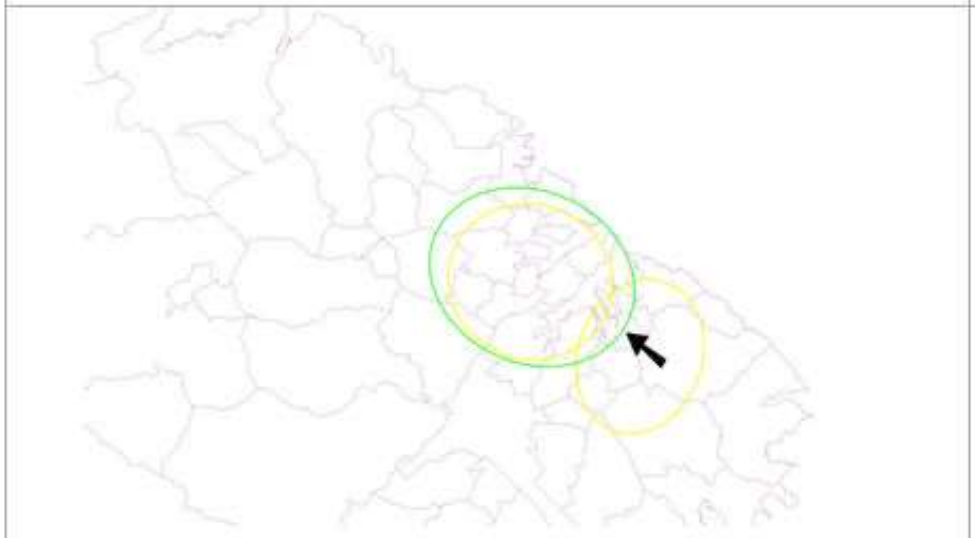


Figure 8.23c: 1970s – 1980s

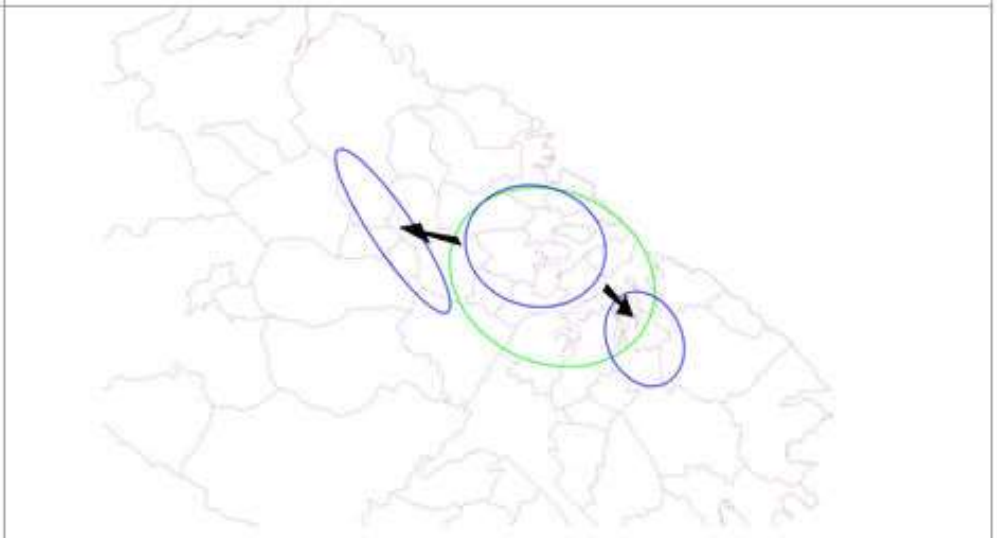
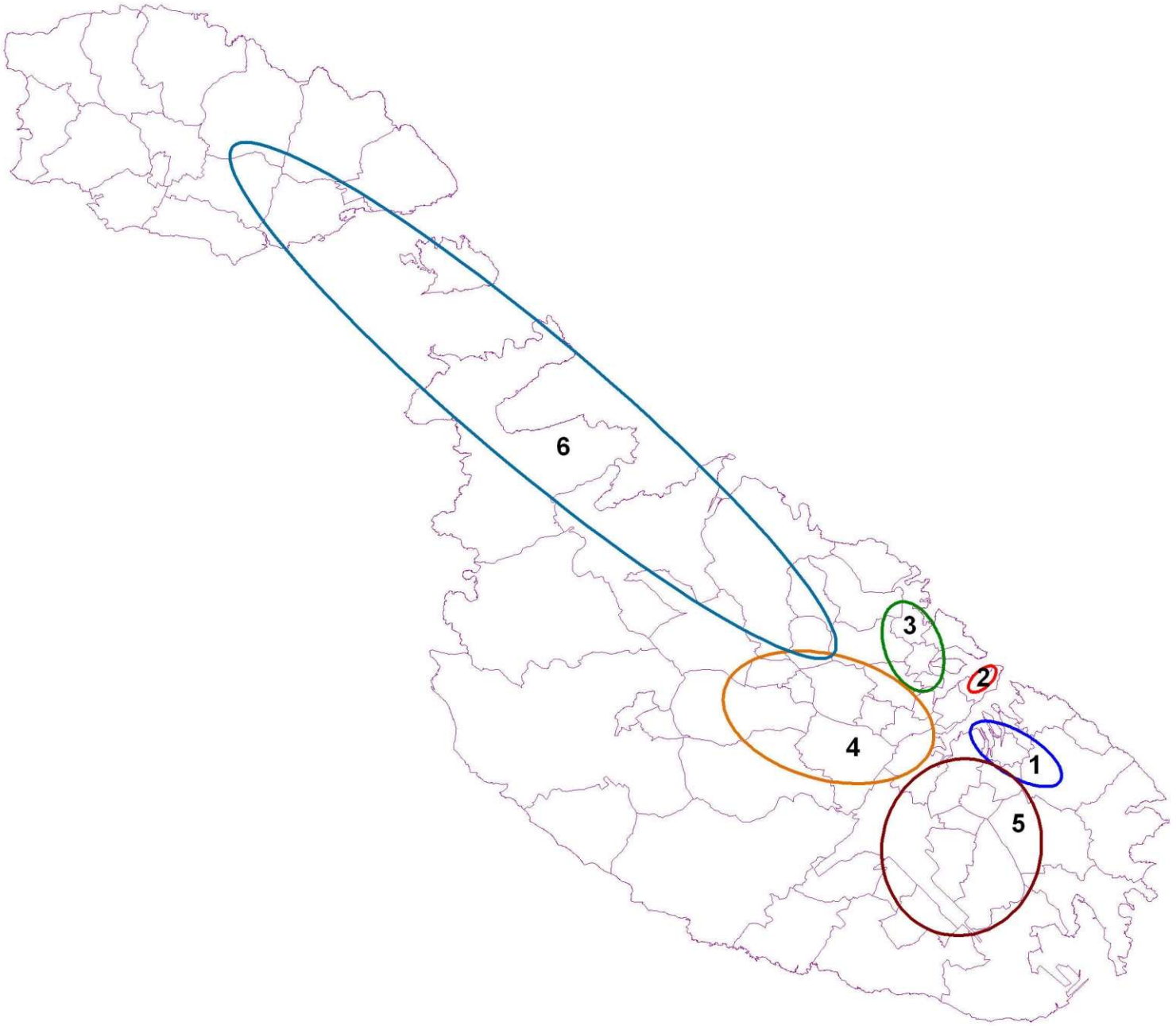


Figure 8.23d: 1980s – 1990s

Offender clusters in 1990s



Offender Cluster Analysis

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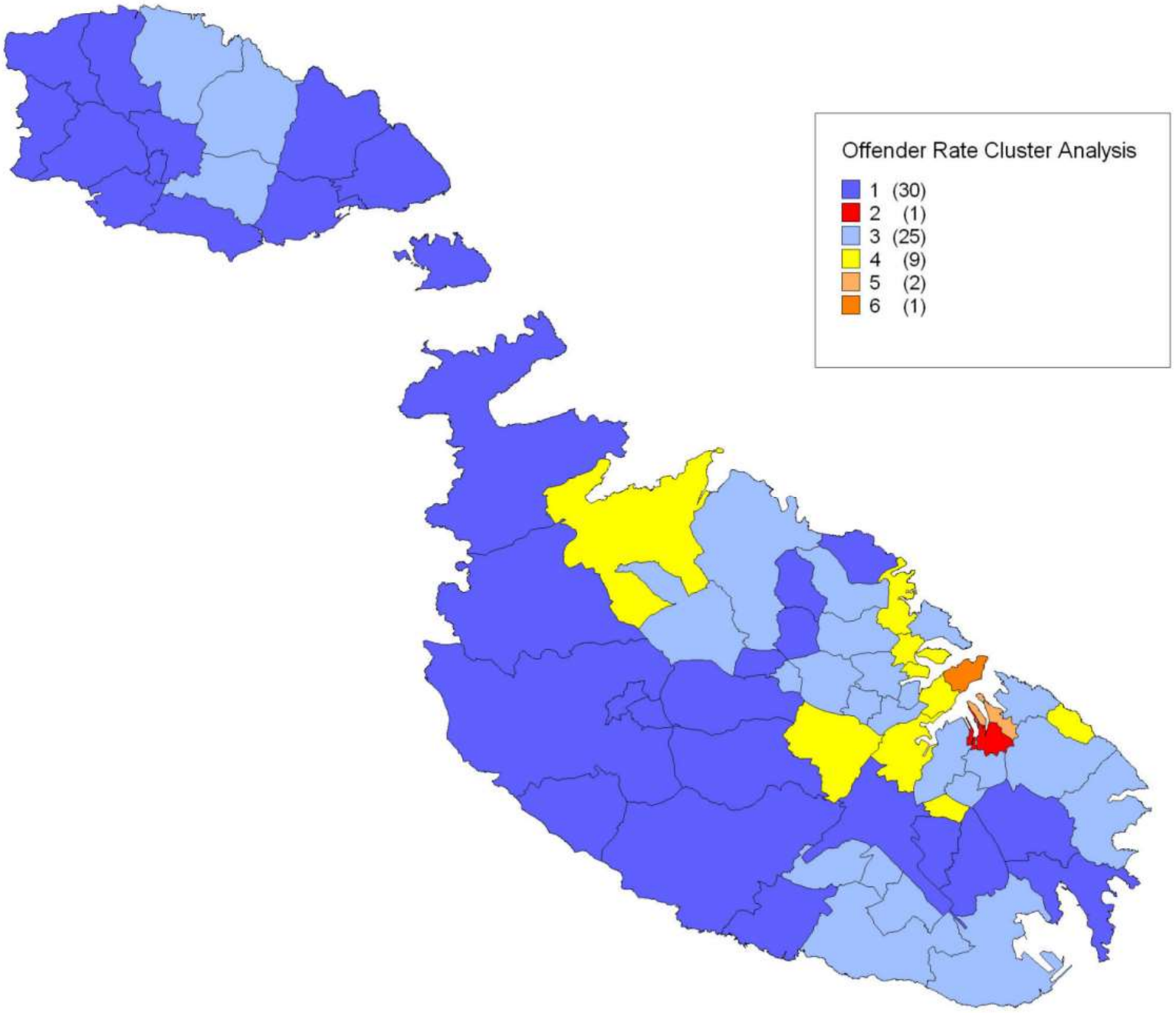
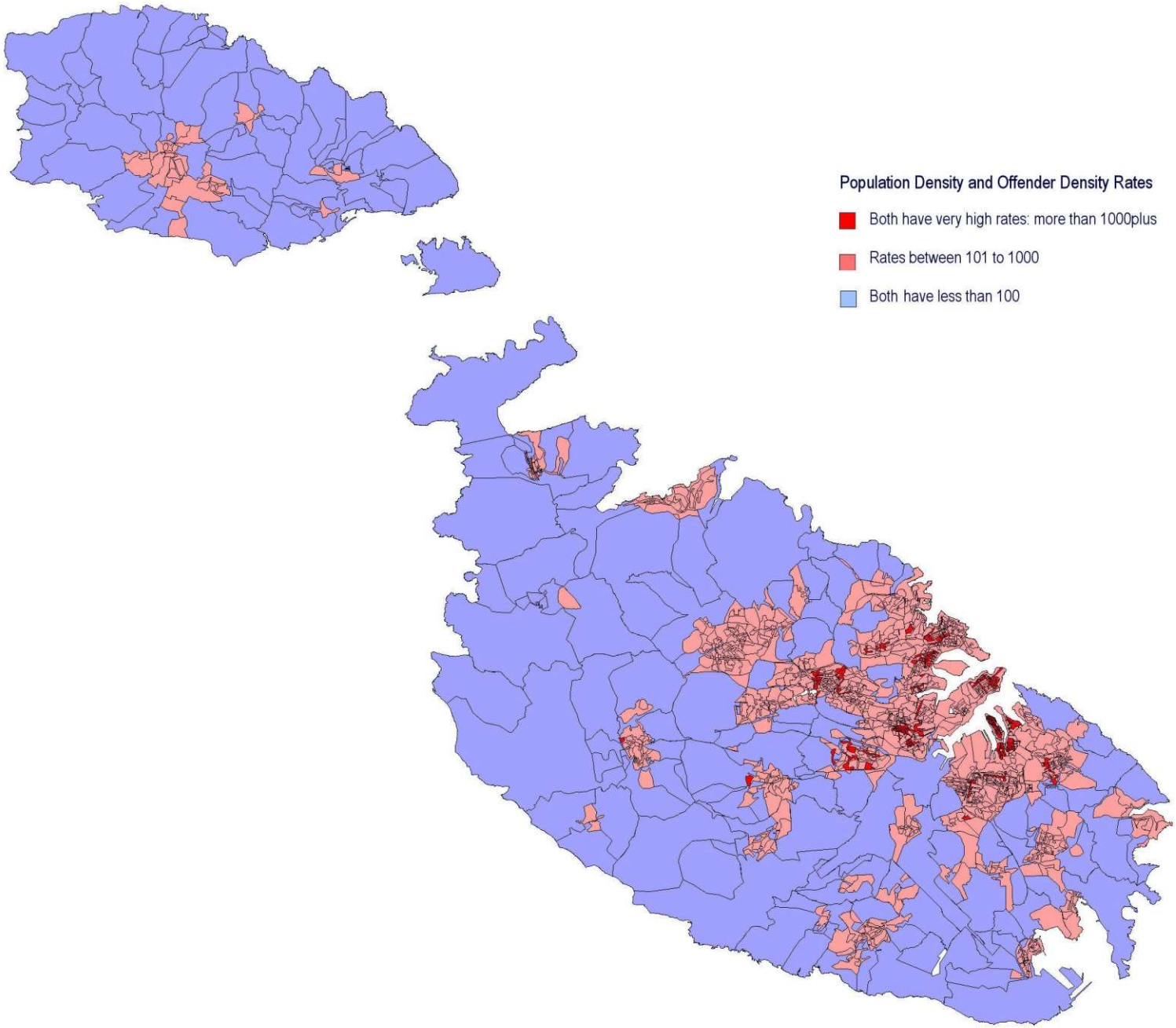
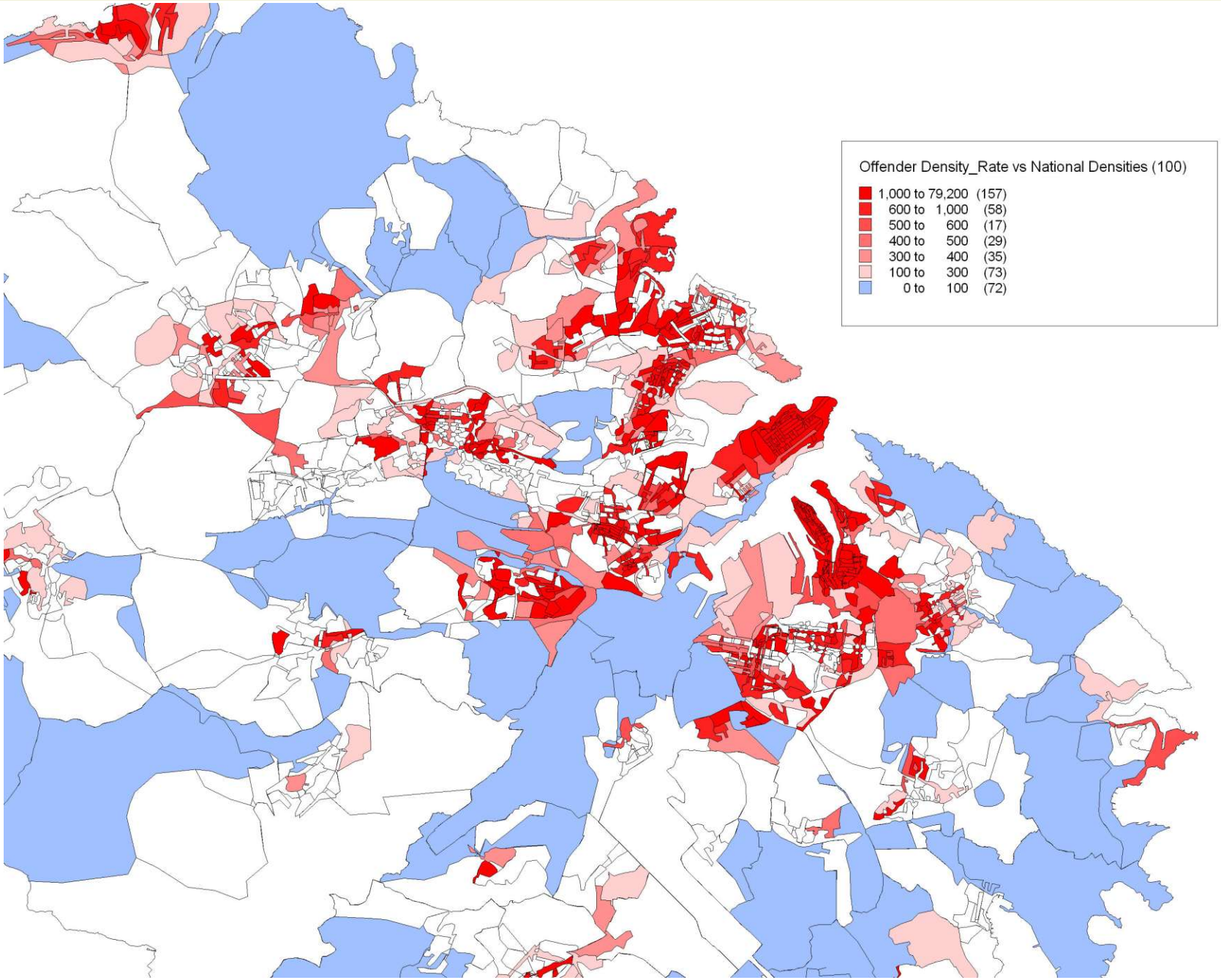


Offender densities by EAs: popdens-offender correlation

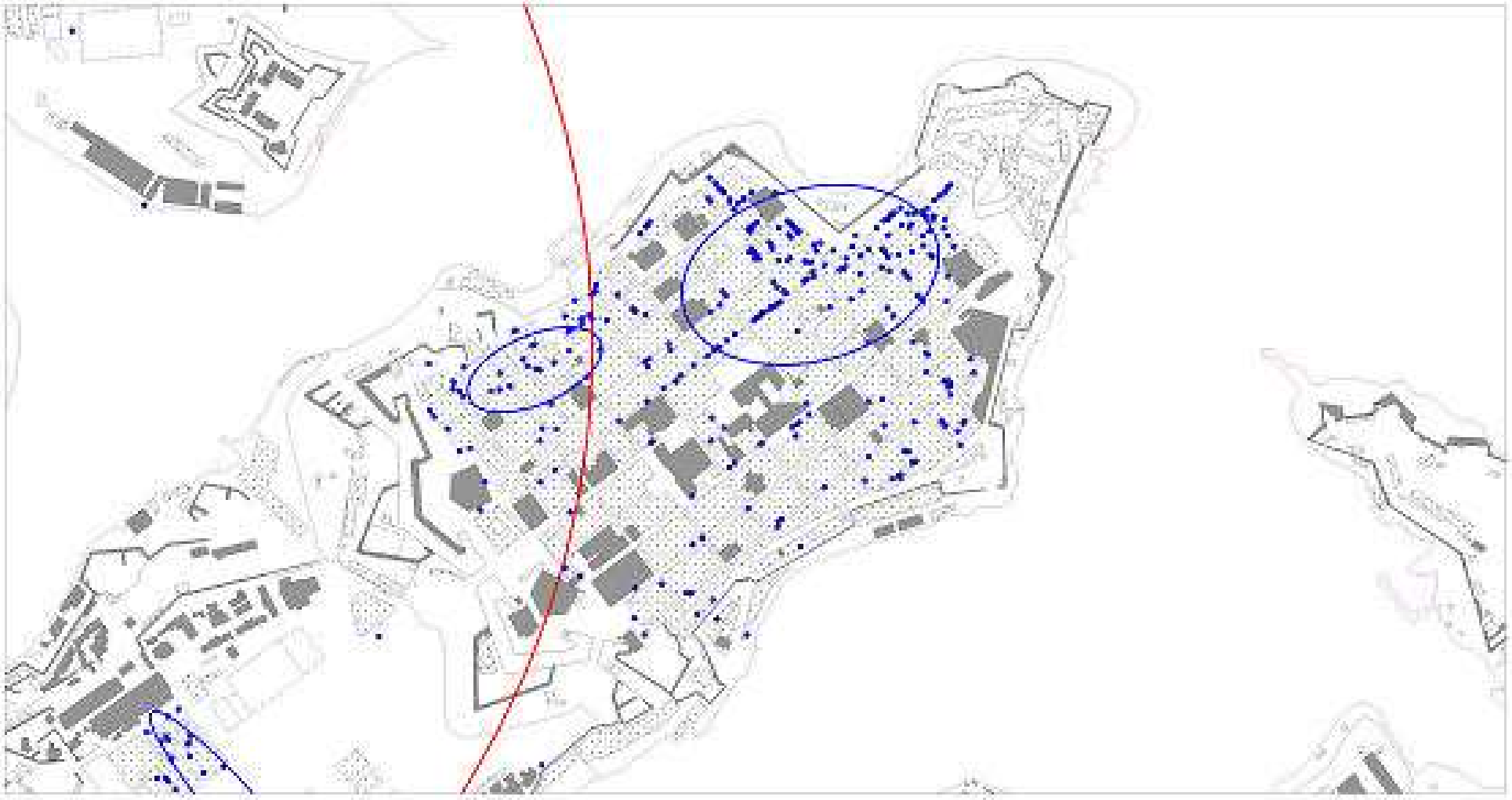


Offender densities vs National densities: EAs

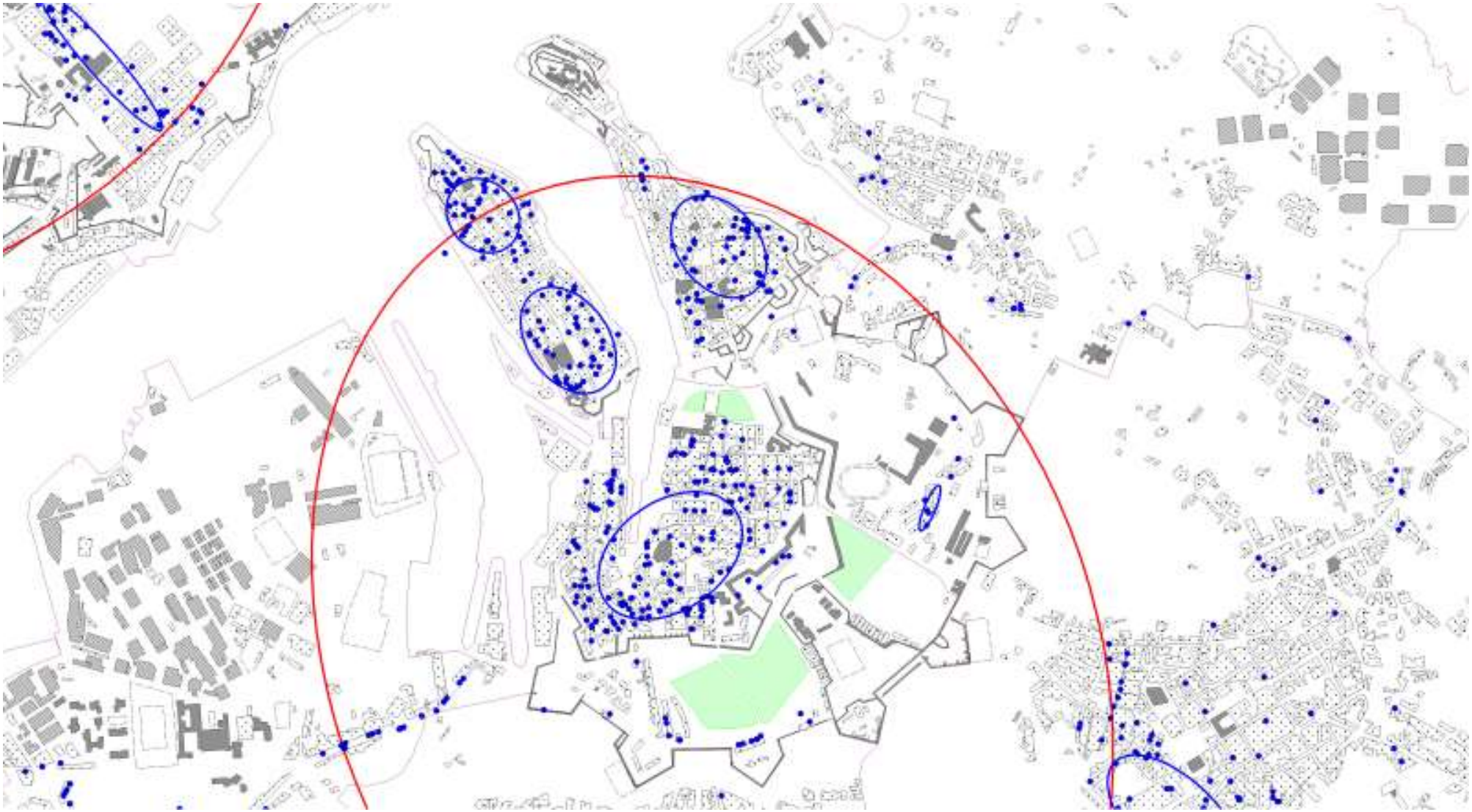


Offender hotspots: a spatio-statistical approach

Figure 8.26d: 1NNH (blue) and 2NNH (red) map showing the Valletta 1990s' hotspots

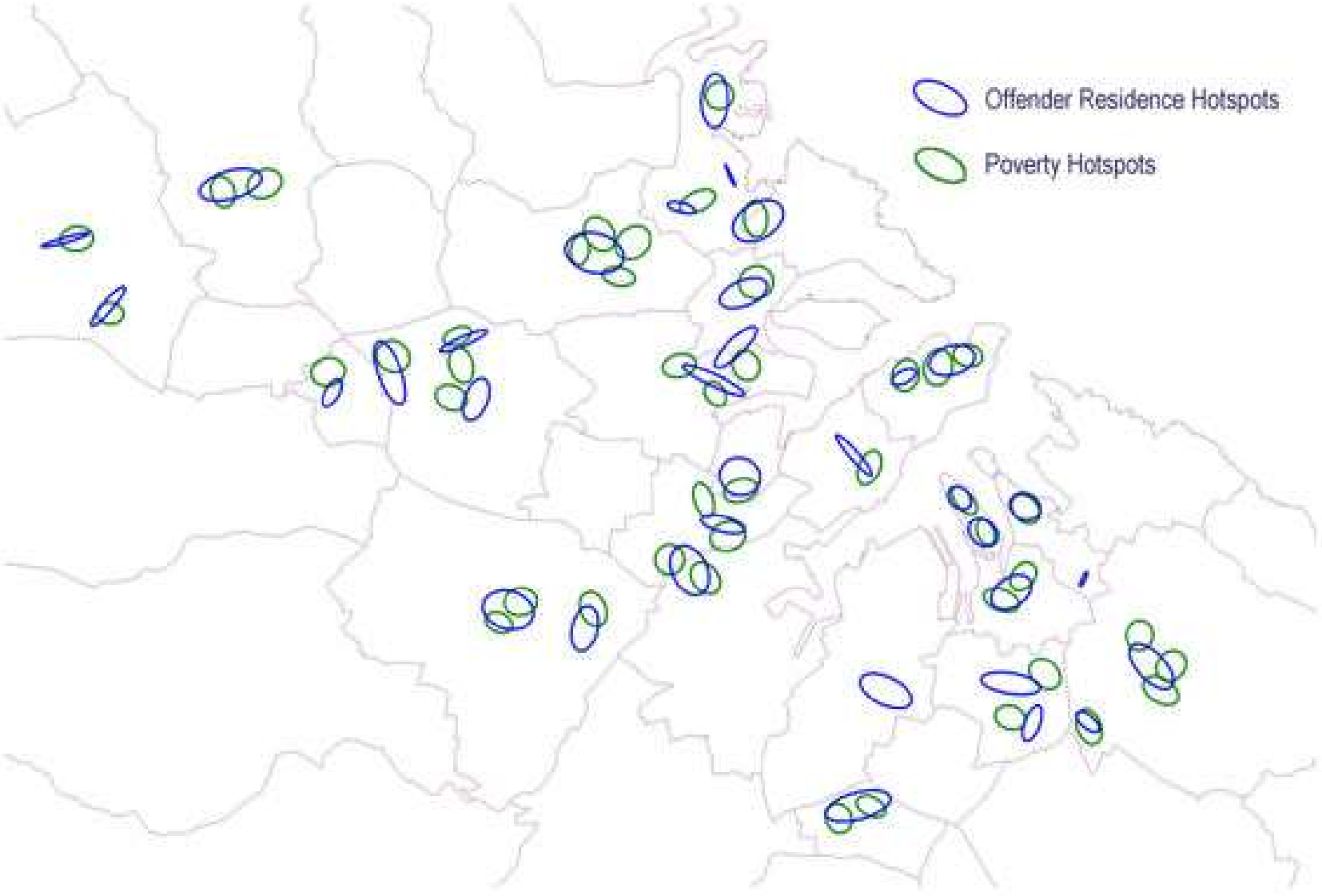


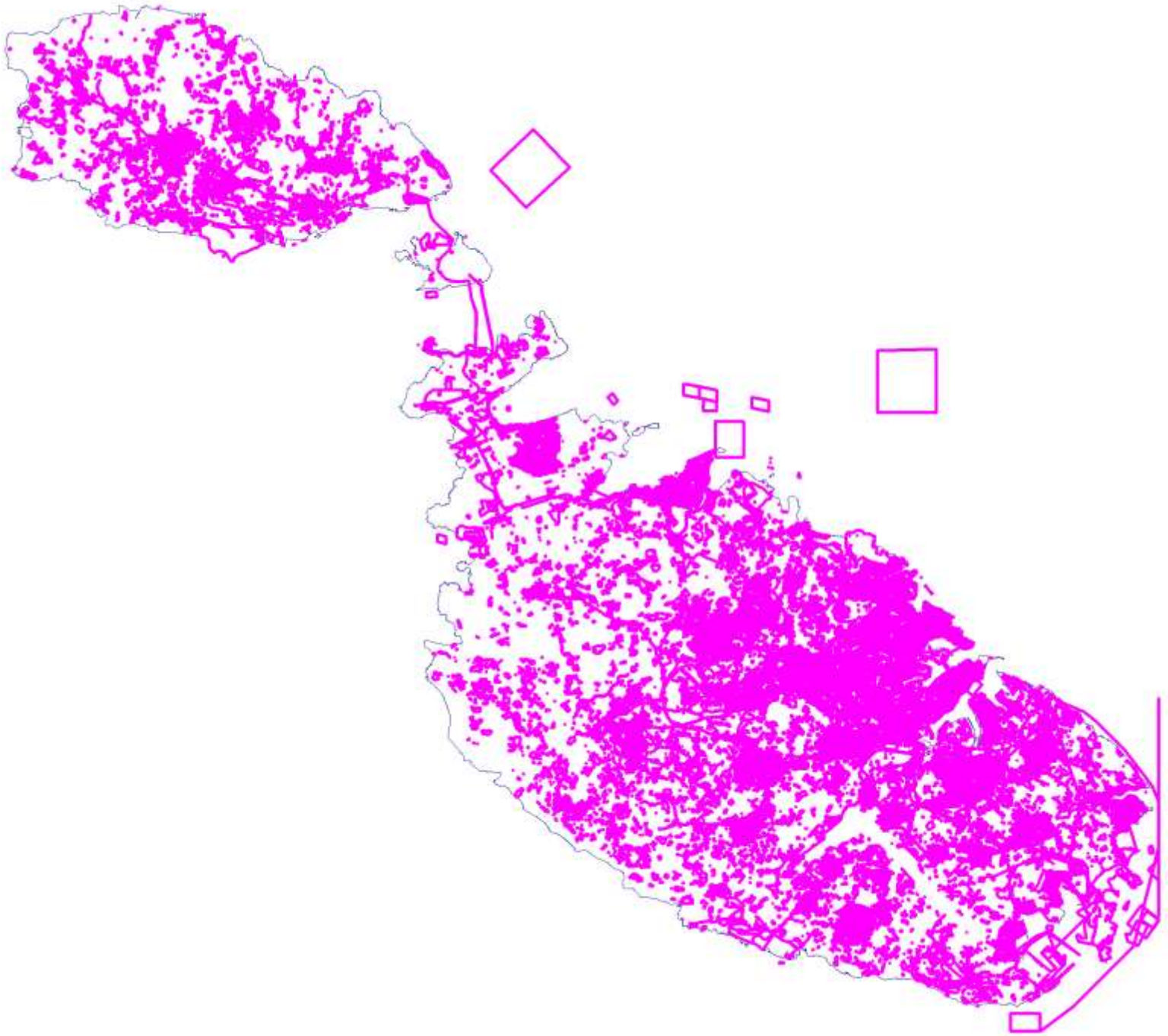
Offender hotspots: a spatio-statistical approach



Offender/poverty hotspots: a spatio-statistical approach

Figure 8.39: 1NNH hotspot analysis for offender residence and poverty





Development Planning: Enforcement Cases

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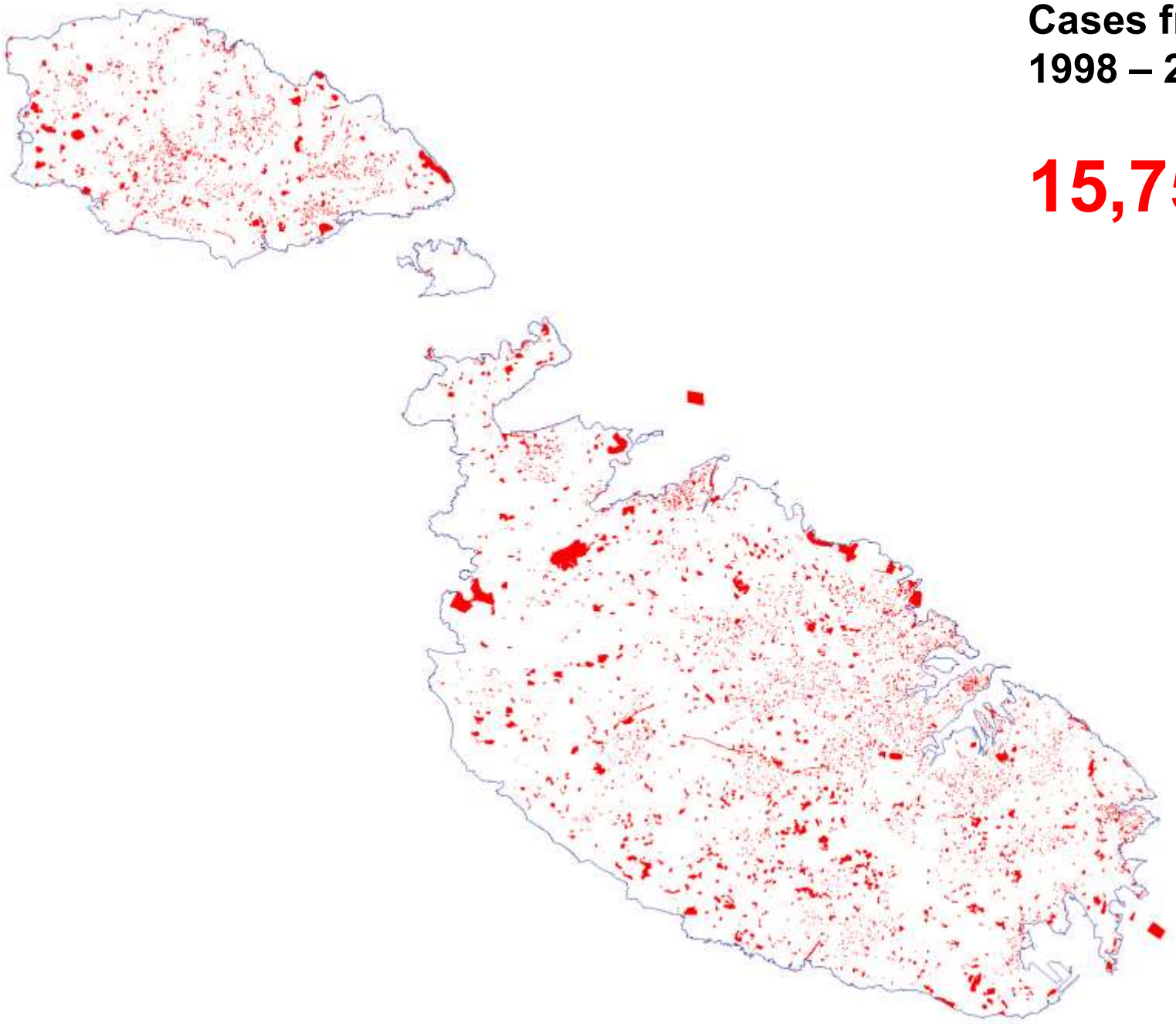
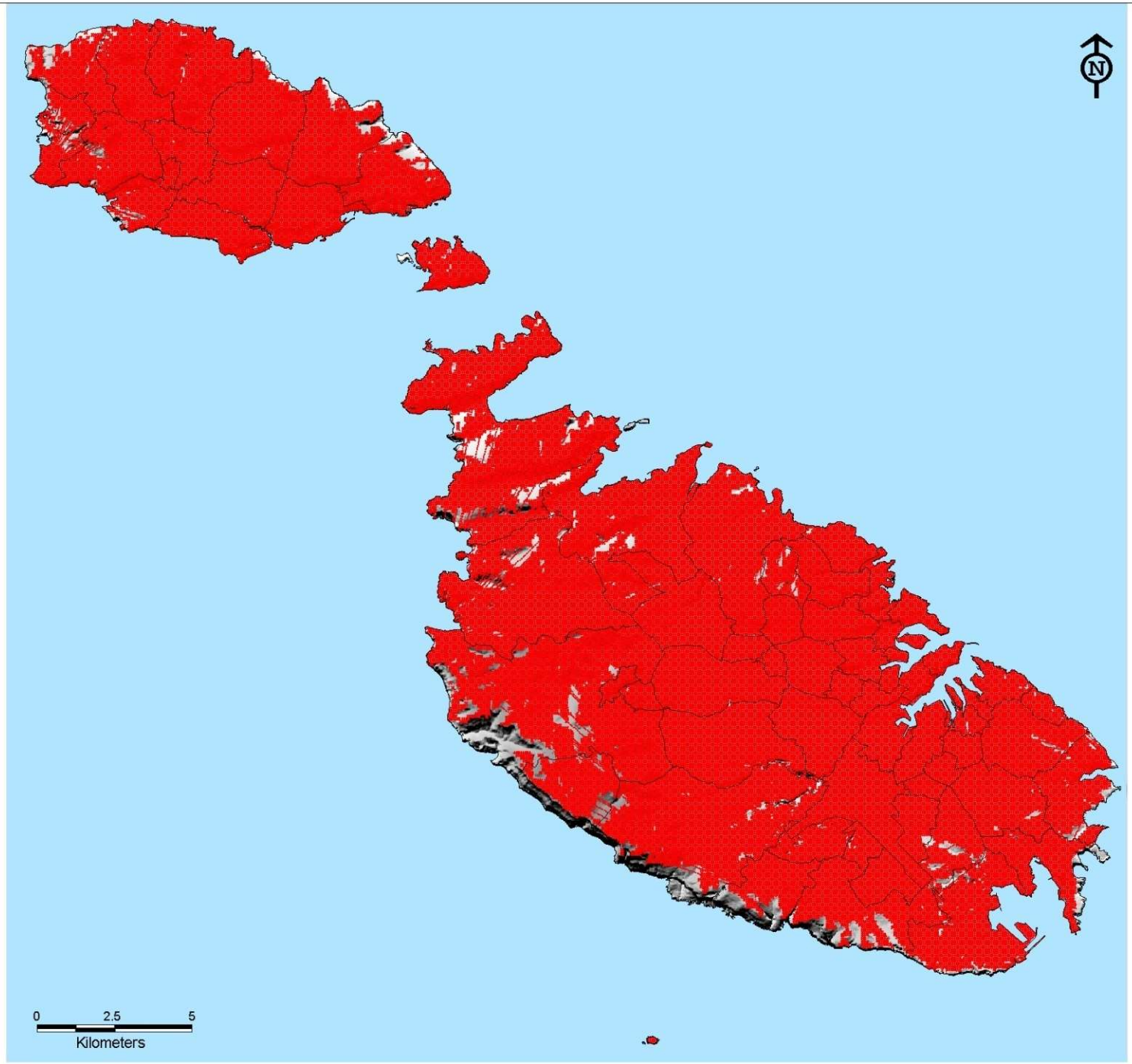
Cases from 1998 – 2006

15,750





State of the Environment Report
2005

MEPA

L-AWTORITA' TA' MALTA DWAR L-AMBJENT U L-IPPJANAR
MALTA ENVIRONMENT AND PLANNING AUTHORITY

Key

Area from which urban areas are visible

Area from which urban areas are NOT visible

Areas from which urban areas are visible

Scale : **as indicated**

Date : **March 2005**

INDICATIVE ONLY
Not to be used for direct interpretation.

Figure : 6.1

Offence NNA: spatial – Type by spread – Most effected

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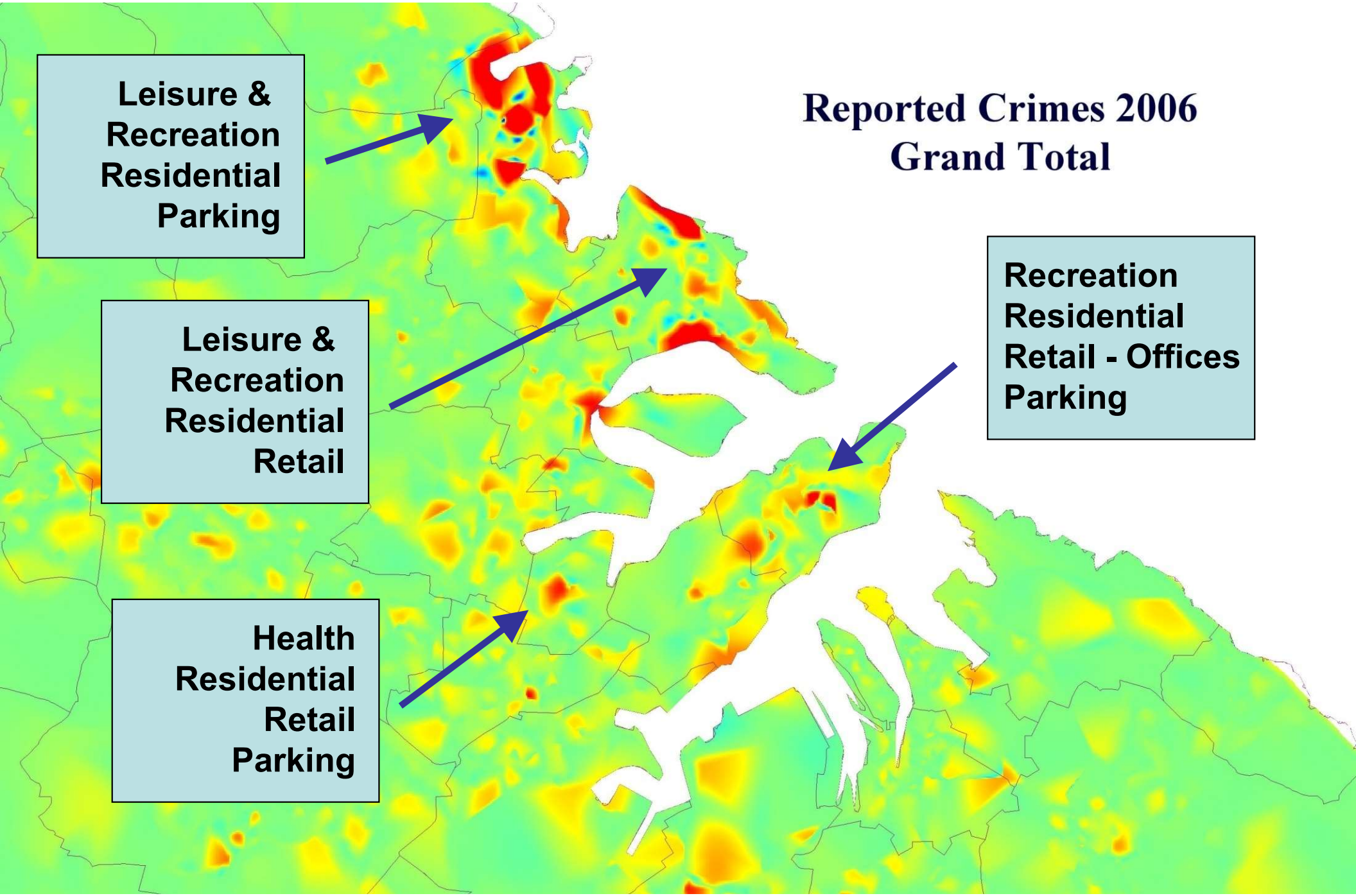
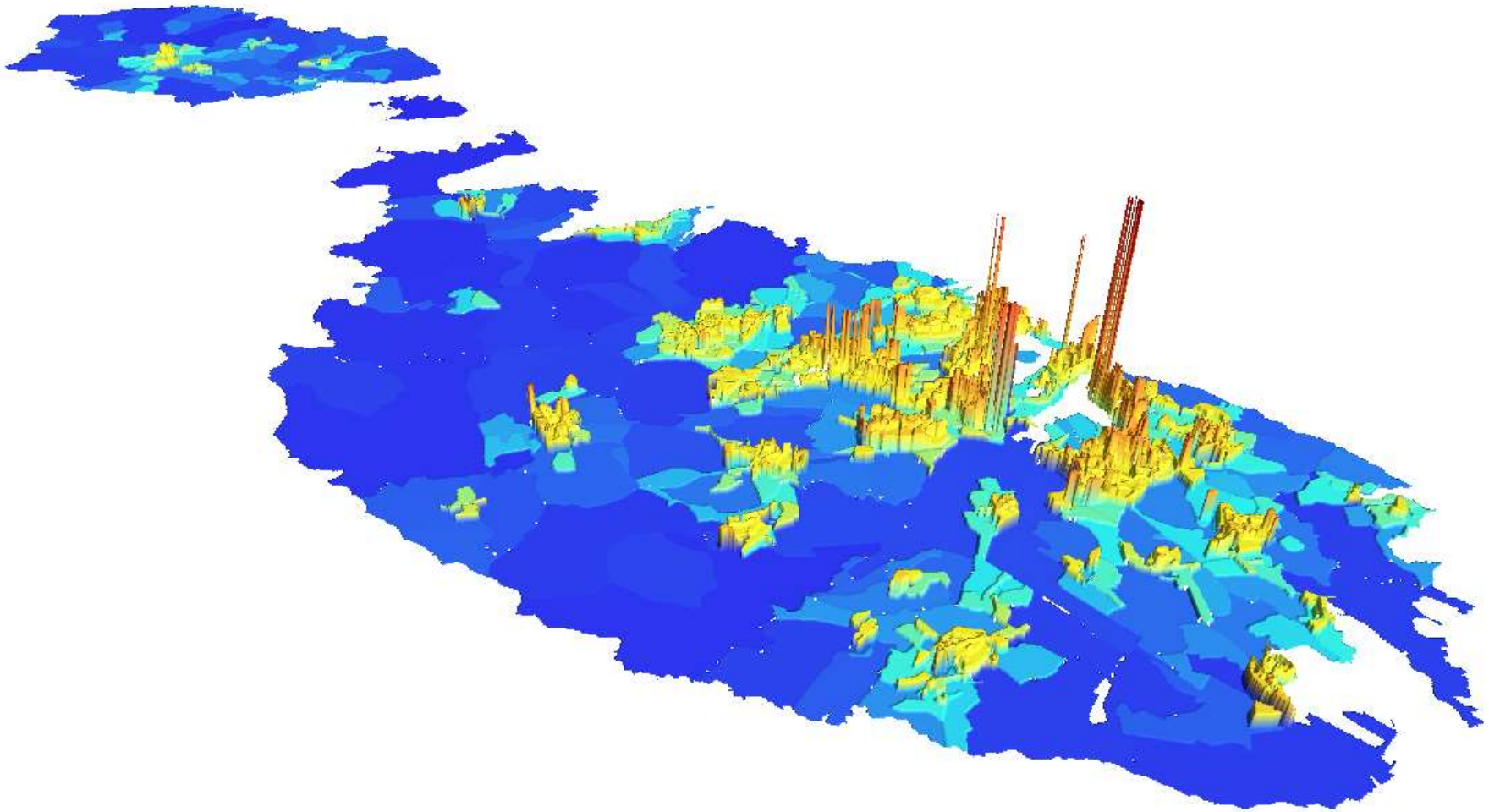
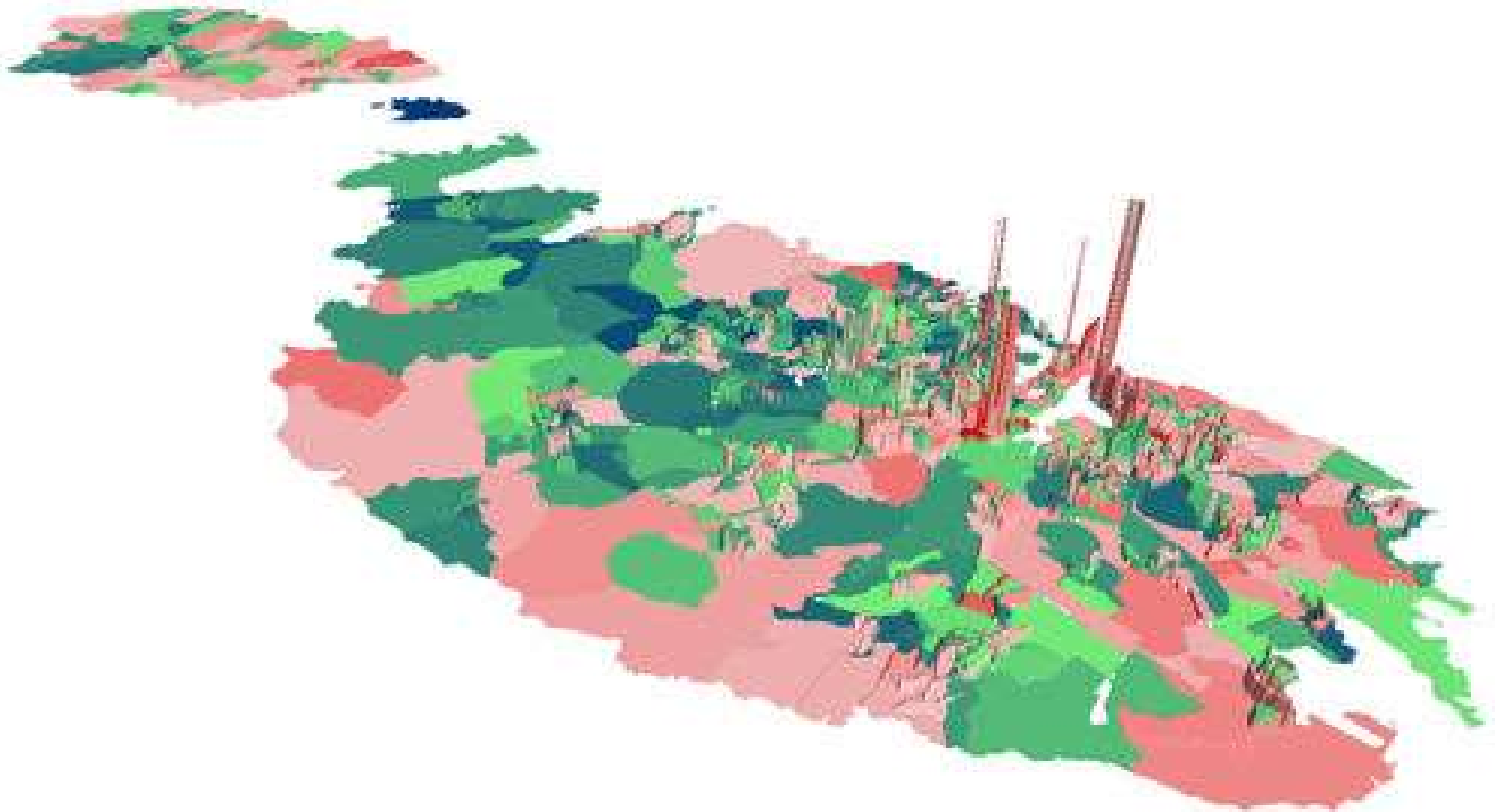


Demographic Landscapes: Population Density



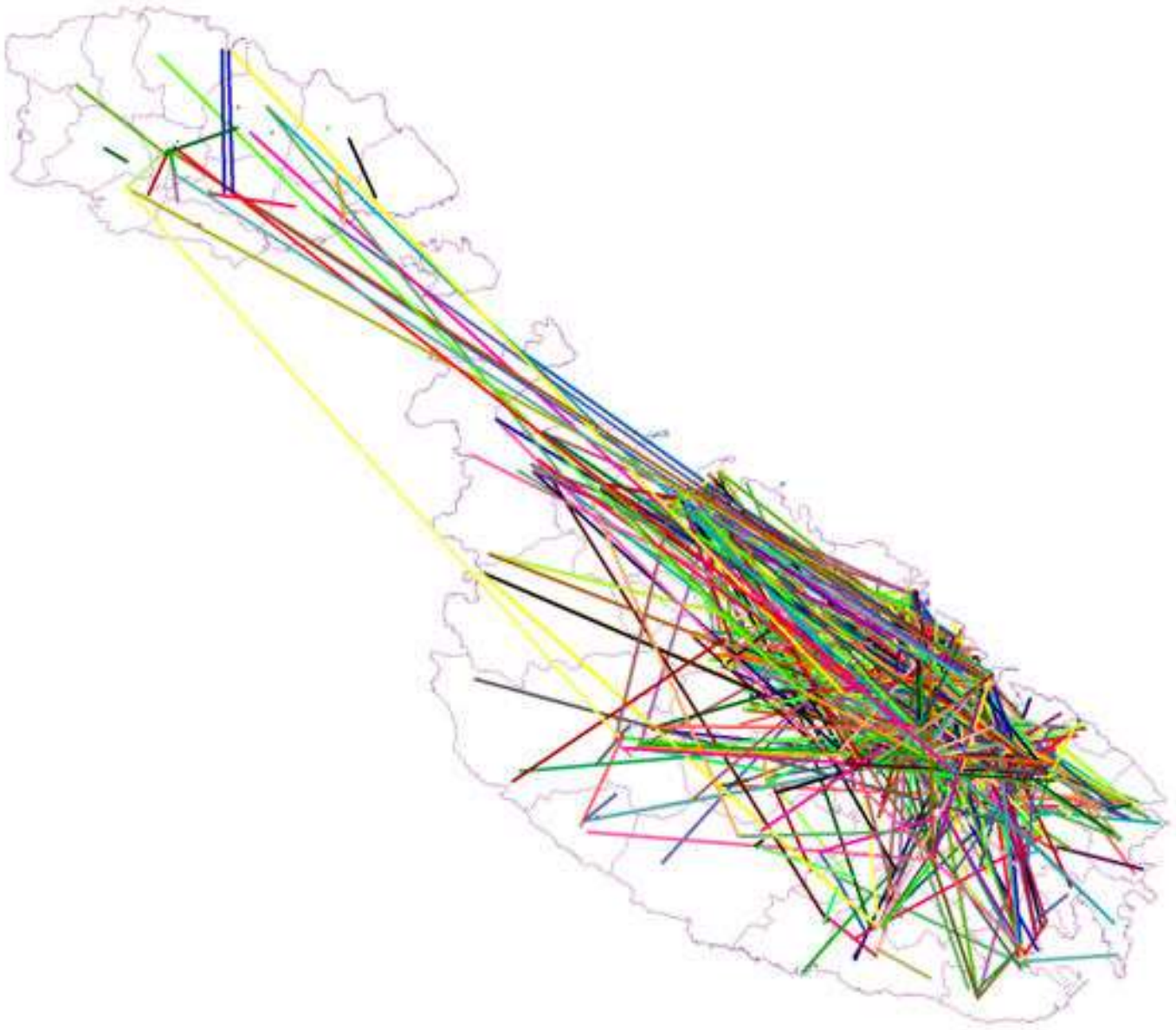
Poverty hotspots: a spatio-statistical approach

Figure 8.37: Risk of Poverty map draped over a population density map



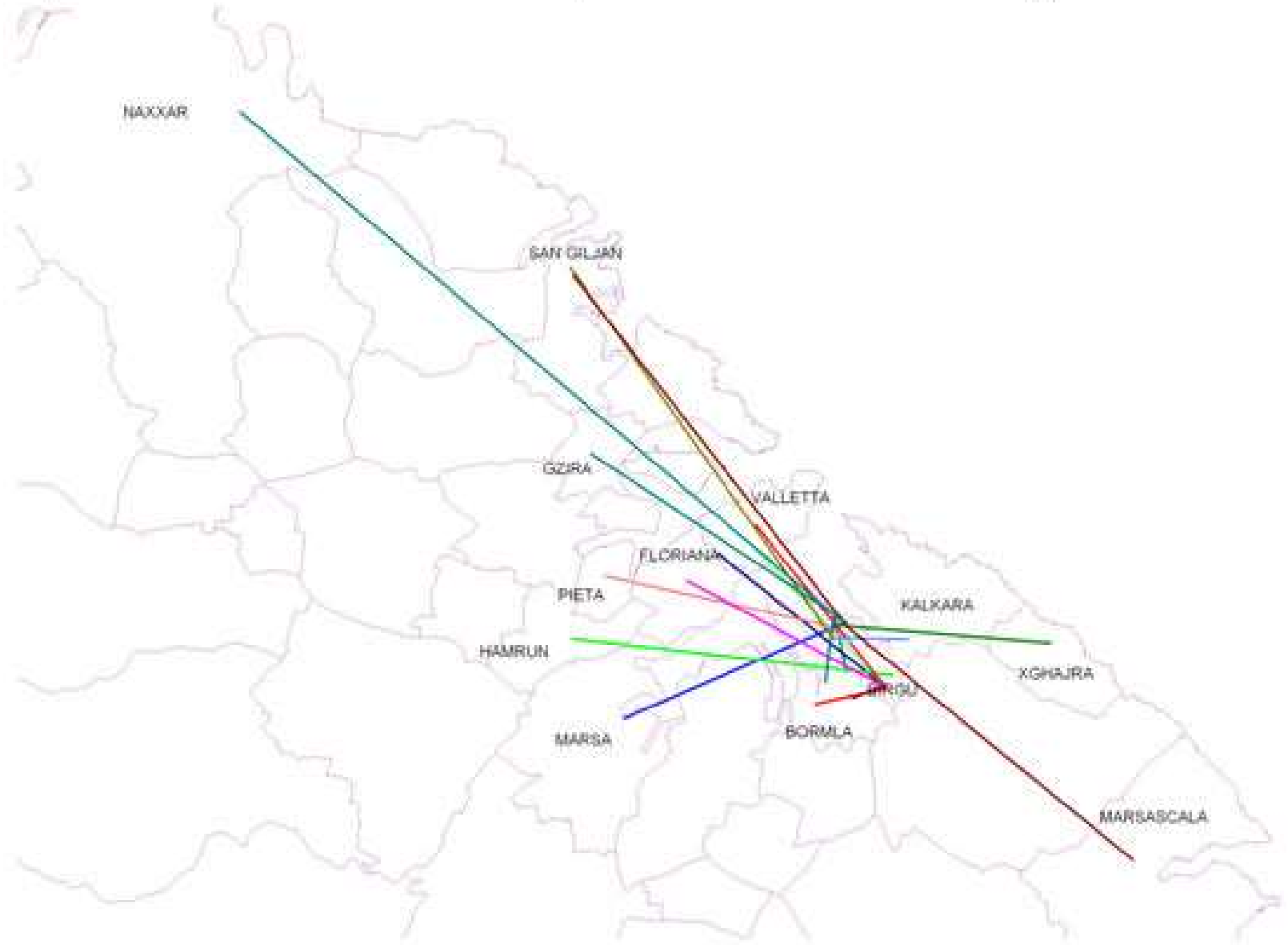
Offender journey : a spatio-statistical approach

Figure 8.49: The Maltese Islands Journey-to-Crime Web



Offender journey : a spatio-statistical approach

Figure 8.50: The Maltese Islands Journey-to-Crime Web: the case for Birgu



Offender journey: a spatio-statistical approach

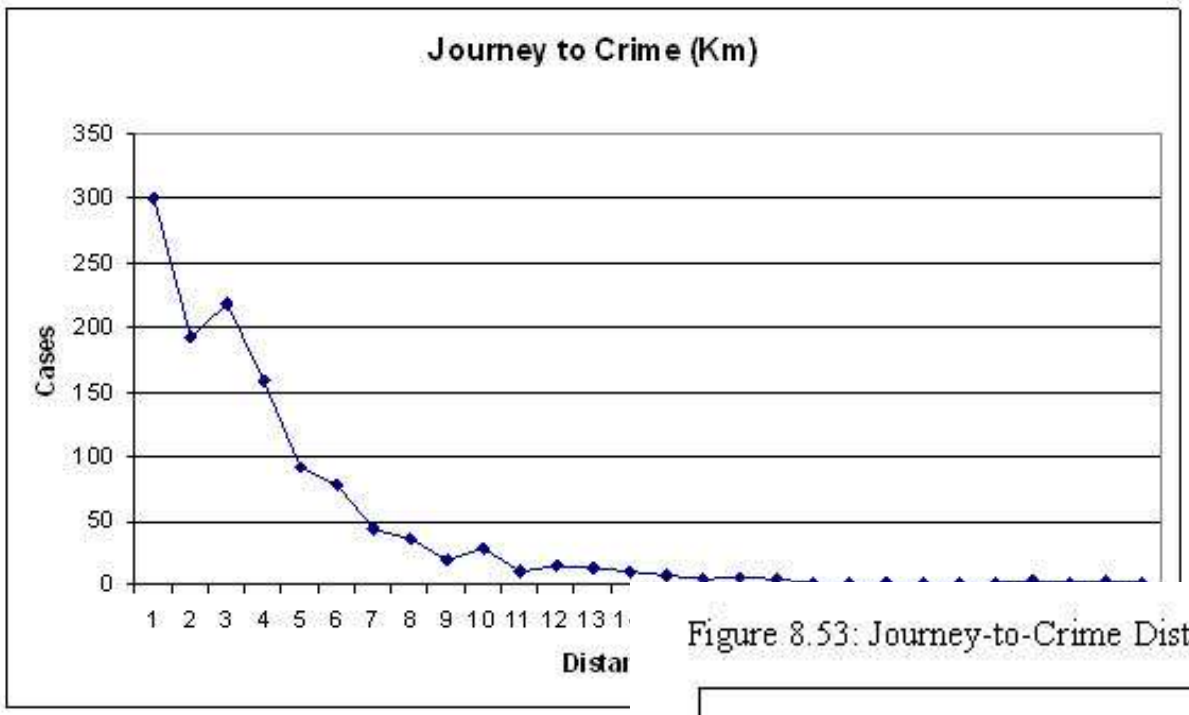
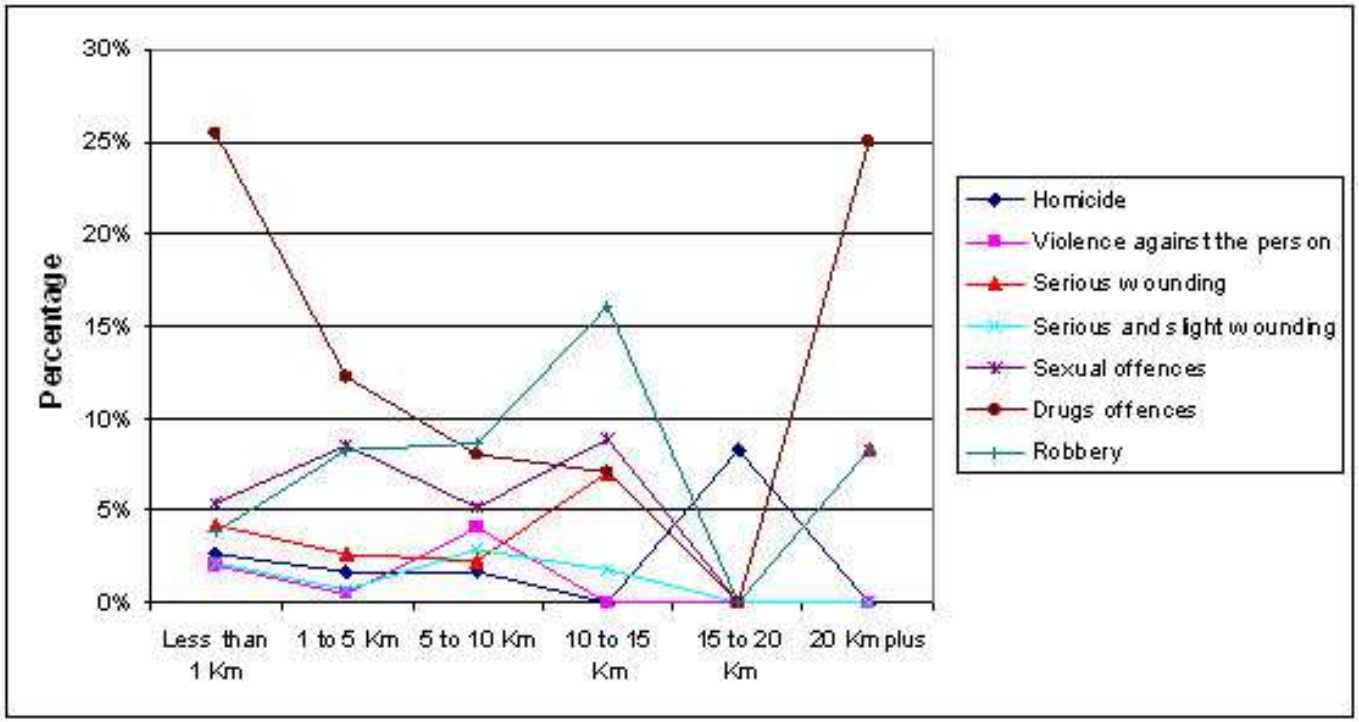
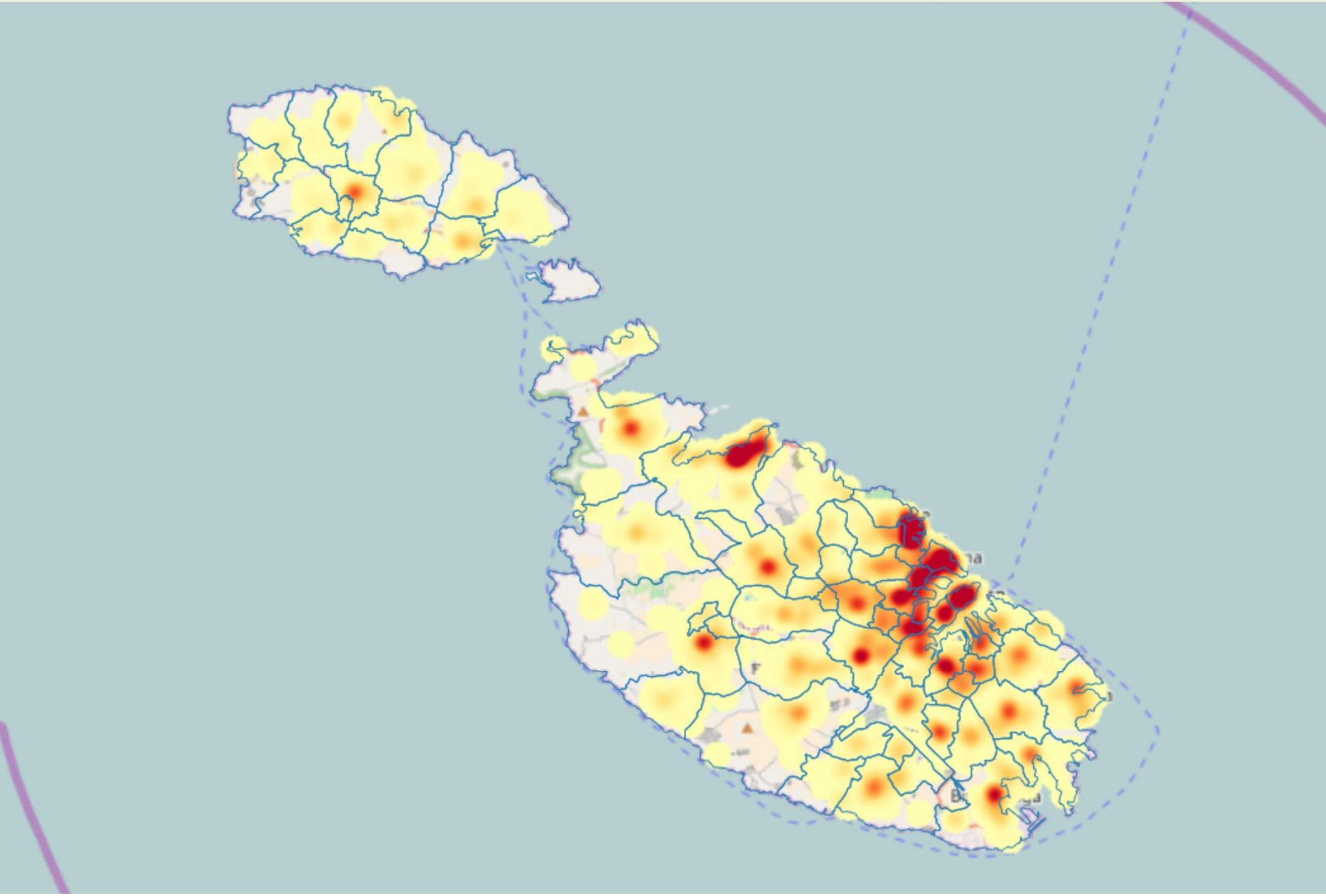


Figure 8.53: Journey-to-Crime Distance – Serious offences



Web Maps for public use: Crimemaps



Web Maps for public use: NSO stats

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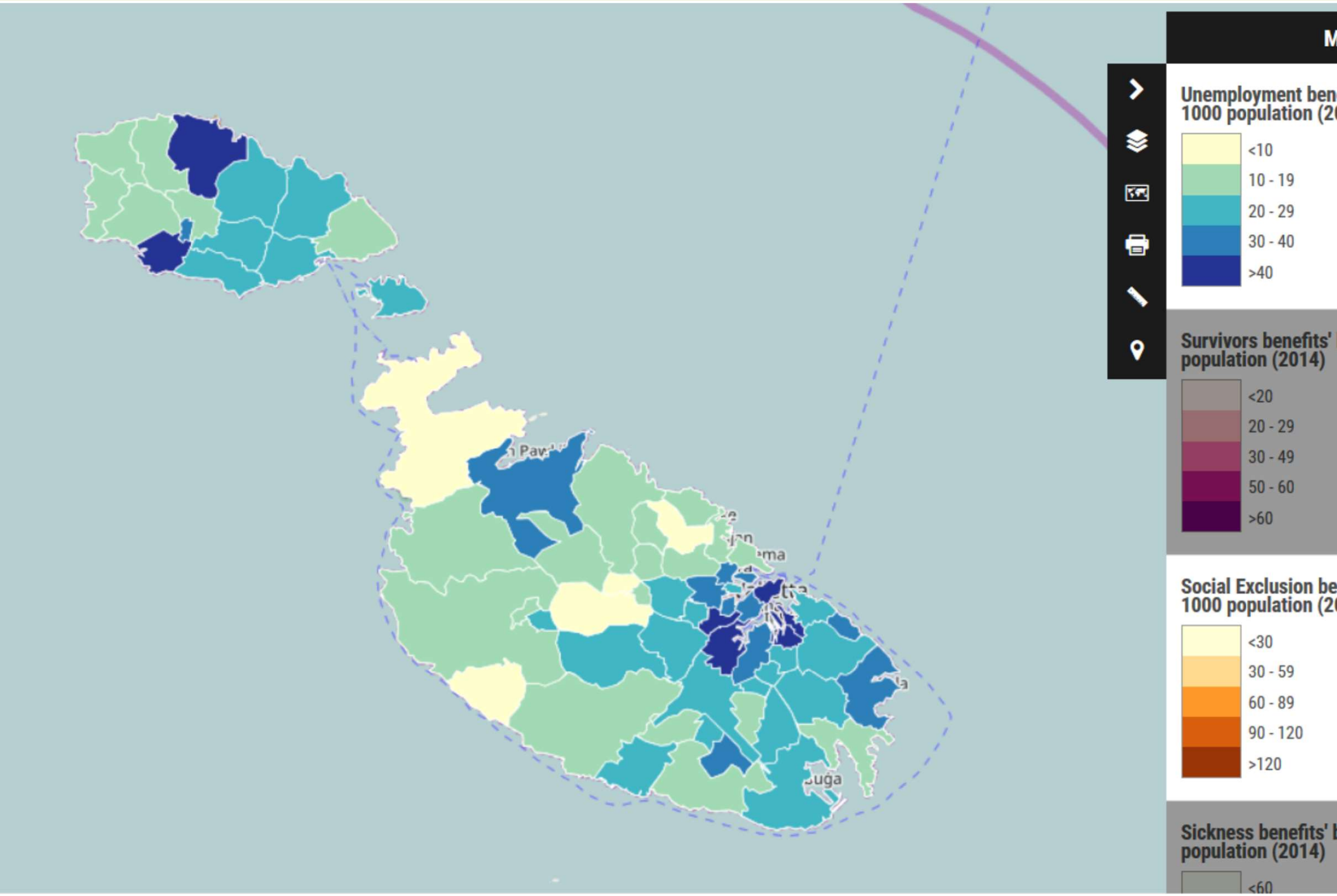


Crime Constructs: a modelling perspective

Crime Constructs: a planning perspective
Illegal development

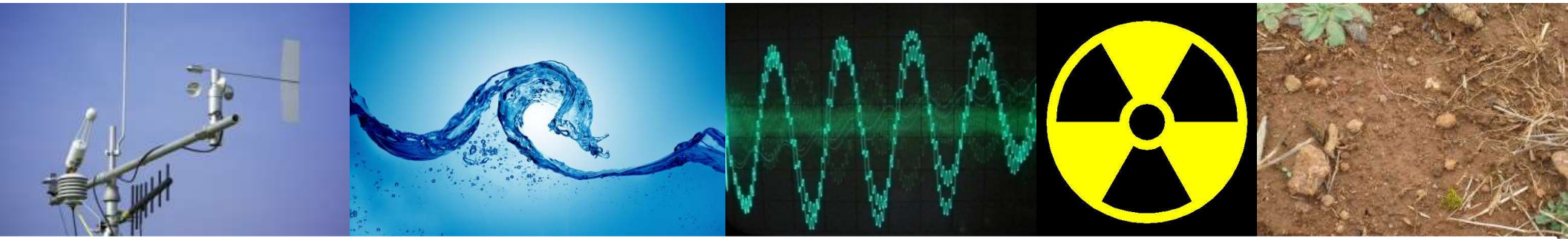
Crime Constructs: a temporal perspective
Shadow impact

Crime Constructs: a trigger perspective
Offender locations responsible for crimes psychologically induced by stress-triggered factors caused by prolonged sunlight deprivation

Visualising the Real before acquiring the Virtual

EUROPEAN REGIONAL DEVELOPMENT FUND
MALTA2007-2013

ERDF 156:
Developing National Environmental Monitoring Infrastructure and Capacity



Operational Programme I – Cohesion Policy 2007-2013
Investing in Competitiveness for a Better Quality of Life
Project part-financed by the European Union
European Regional Development Fund (ERDF)
Co-financing rate: 85% EU funds; 15% National Funds

Investing in your future

Information Resources

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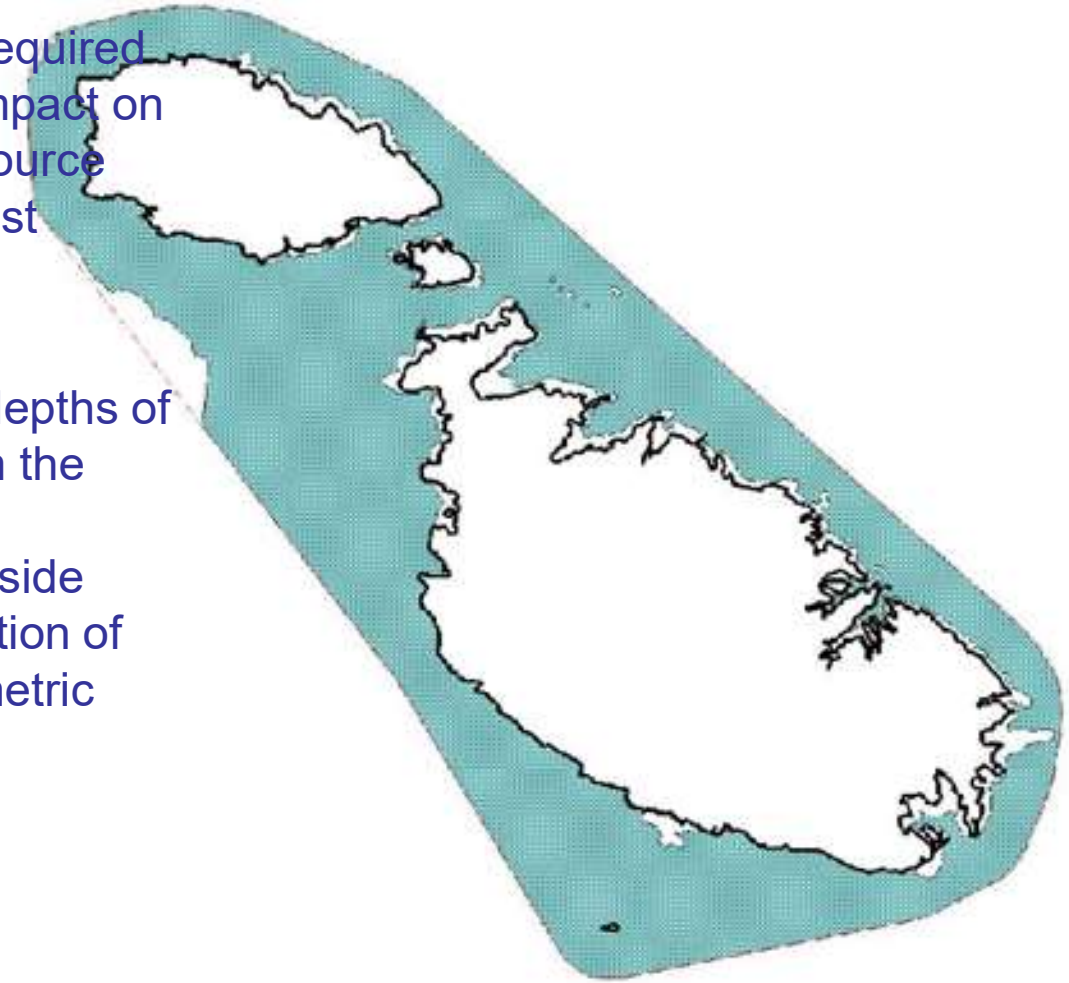
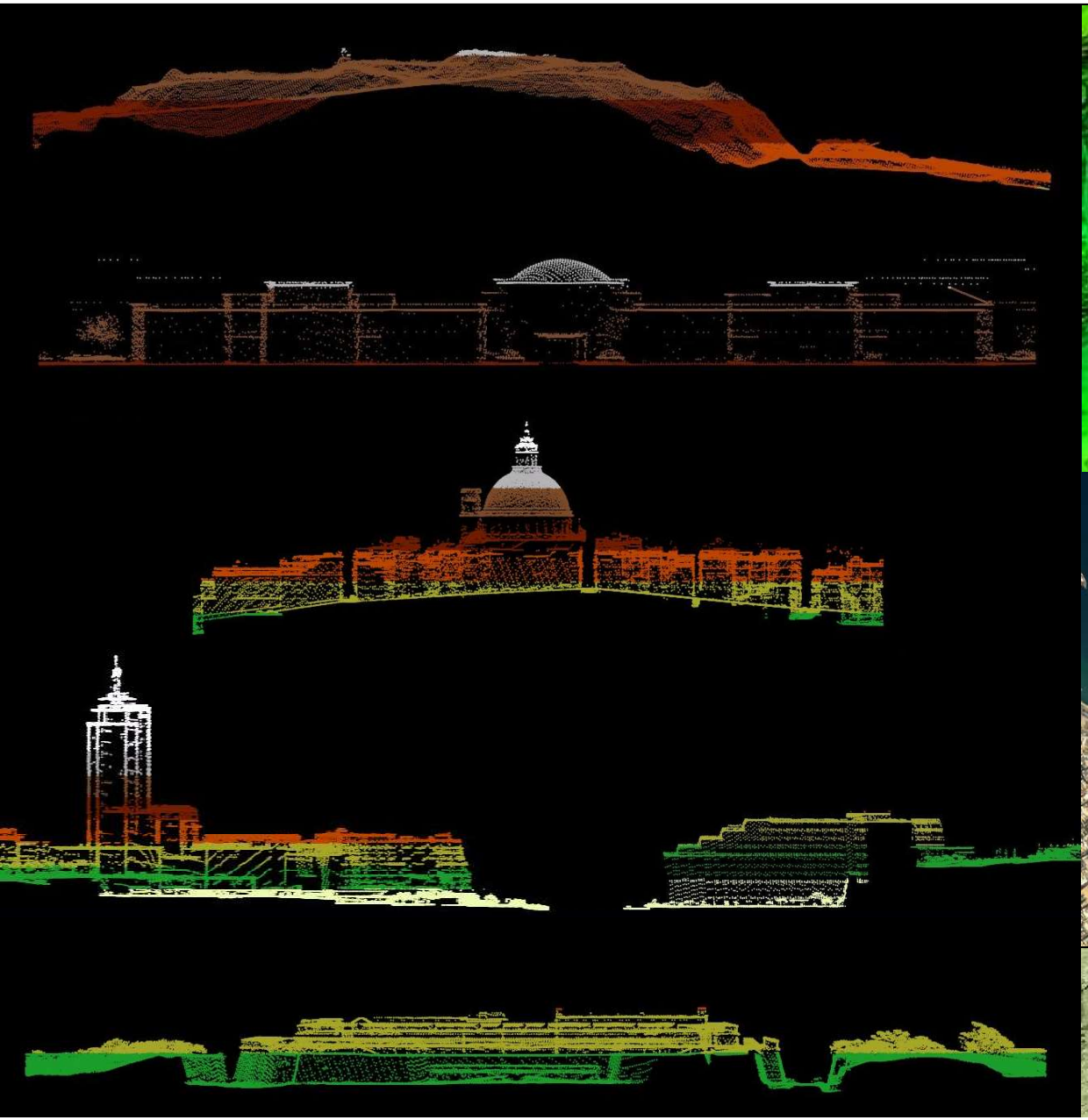
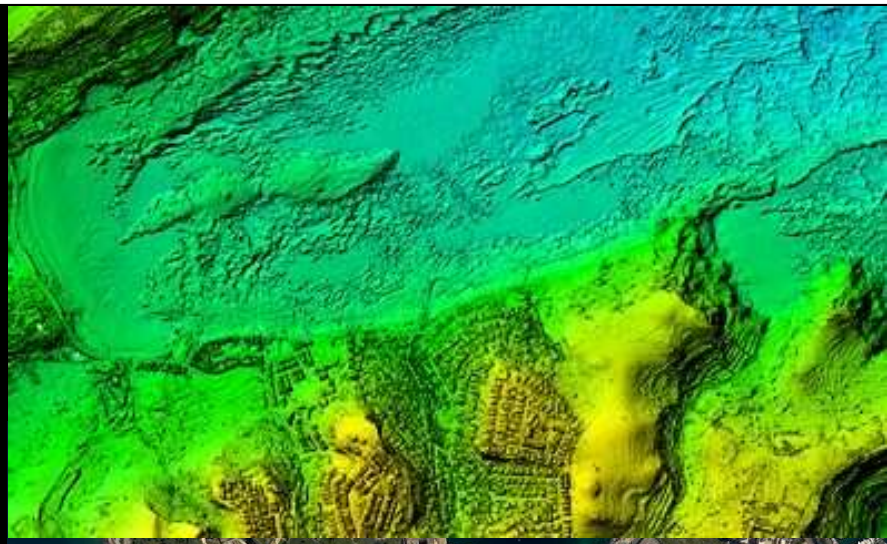
- Deliveries included a terrestrial LIDAR Scan (Topographic Light Detection and Ranging (LiDAR)) which resulted in a baseline map for the Maltese Islands infrastructure and landcover/landuse analysis which is required for the monitoring of structures that impact on noise levels, enforcement issues, resource monitoring and risk prediction, amongst others.

- Bathymetric LIDAR aerial survey for depths of 0 m to 15m within 1 nautical mile from the Maltese coastline and a ship-based bathymetric scan employing acoustic side scan sonar which will enable the creation of new nautical charts as well as bathymetric outputs that will help in marine spatial planning.



Visualisation





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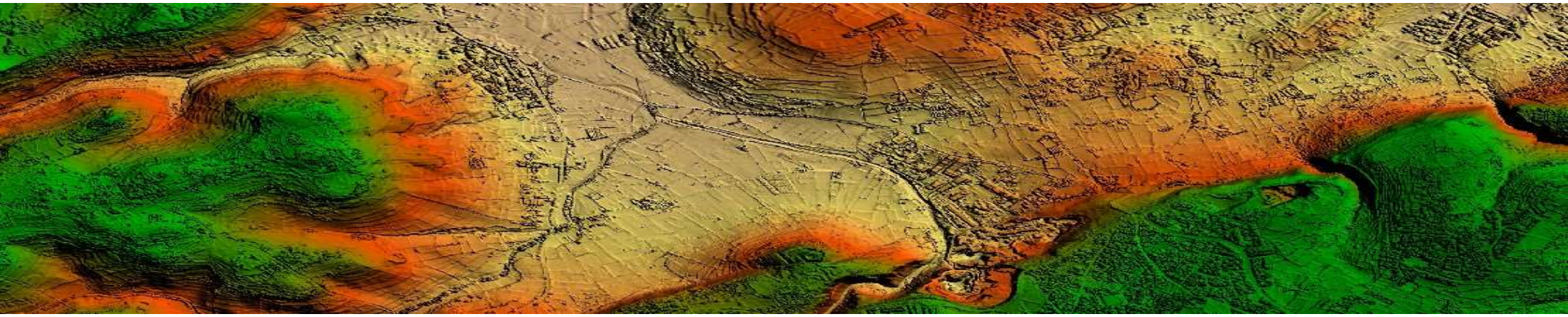
SIntegraM:
Spatial Integration for the Maltese Islands: Developing Integrated National Spatial Information Capacity



Operational Programme – Cohesion Policy 2014-2020
Investing in Competitiveness for a Better Quality of Life
Project part-financed by the European Union
European Regional Development Fund (ERDF)
Co-financing rate: 85% EU funds; 15% National Funds

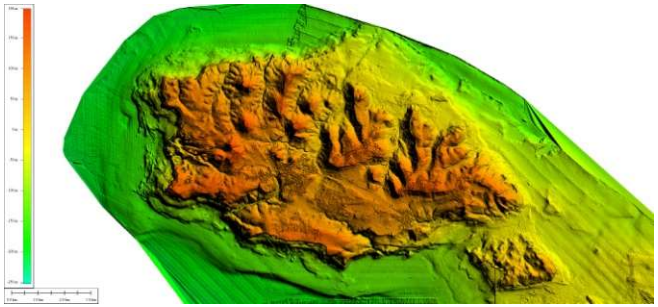
Investing in your future

The Scope: 5+1+2

- To develop a national spatial data infrastructure and capacity for Malta, with the focus on 5+1+2 main themes:
  - Developing a new Basemap for the Maltese Islands
  - Aligning all spatial data in a common projection (removing the current truncated data system)
  - Creating an online dissemination and analysis spatial information system
  - Building the necessary infrastructure to enable the entire data cycle (design-input-analysis-output-reporting)
  - Building the necessary infrastructure to future preparedness
  - Building human capacity in the spatial themes
  - Adhering to the INSPIRE Directive and relevant legislation
  - Creating a series of protocols that enable the free exchange of data and knowledge across the entities

Mediums to aid interaction

GIS



Virtualisation

Gaming

However, usage is very limited

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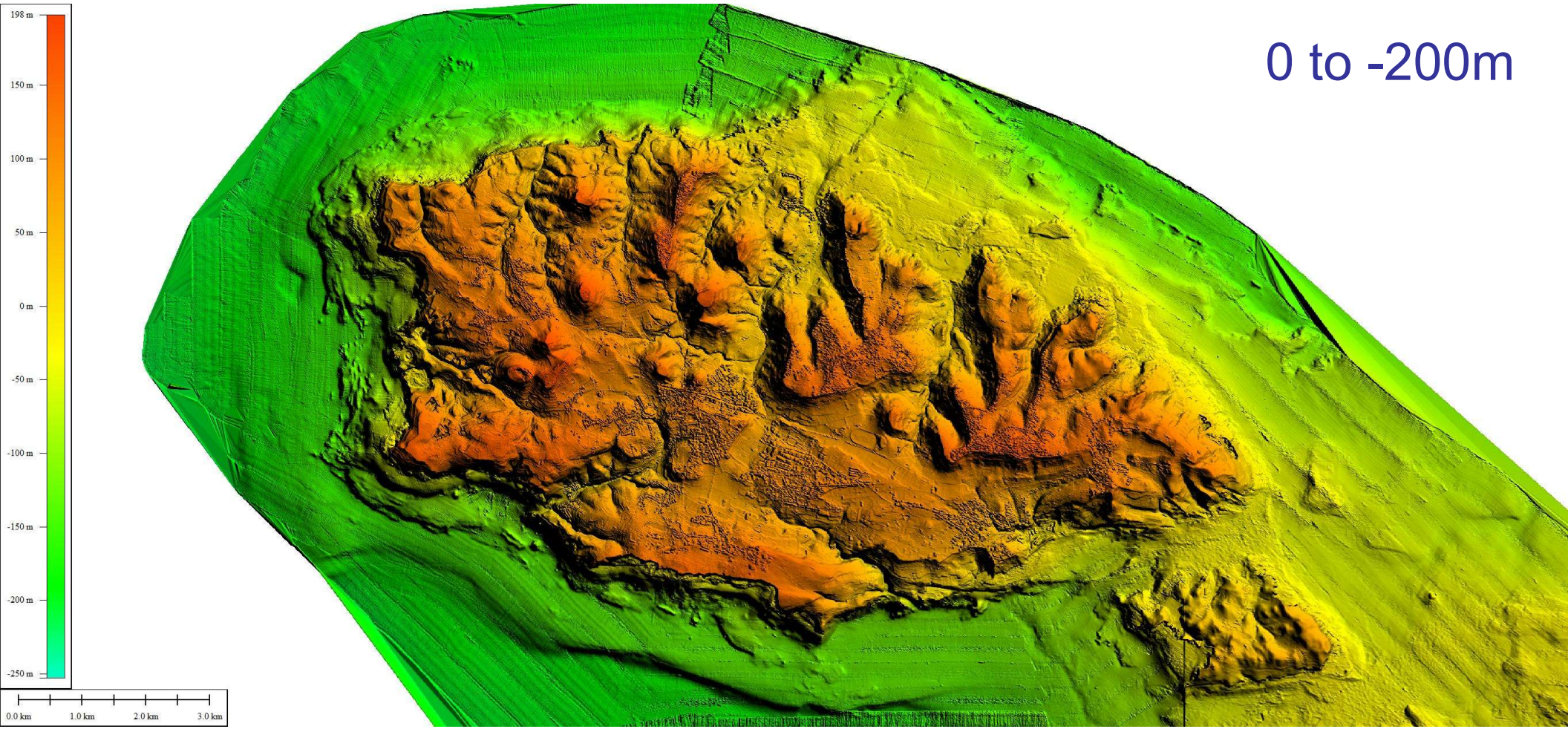
GIS



0 to -200m

However, usage is very limited

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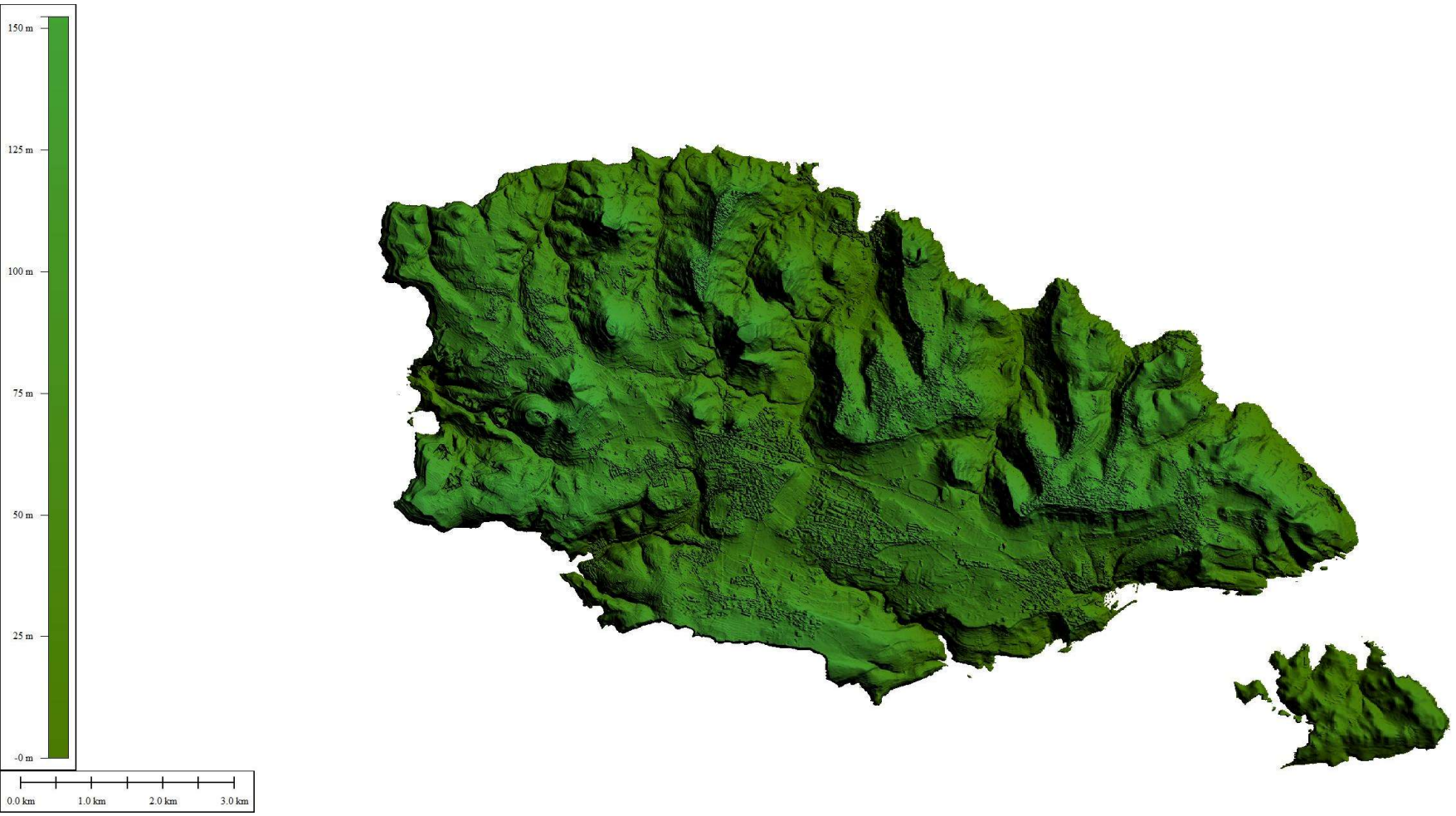
GIS



0m

However, usage is very limited

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GIS

-50m

However, usage is very limited

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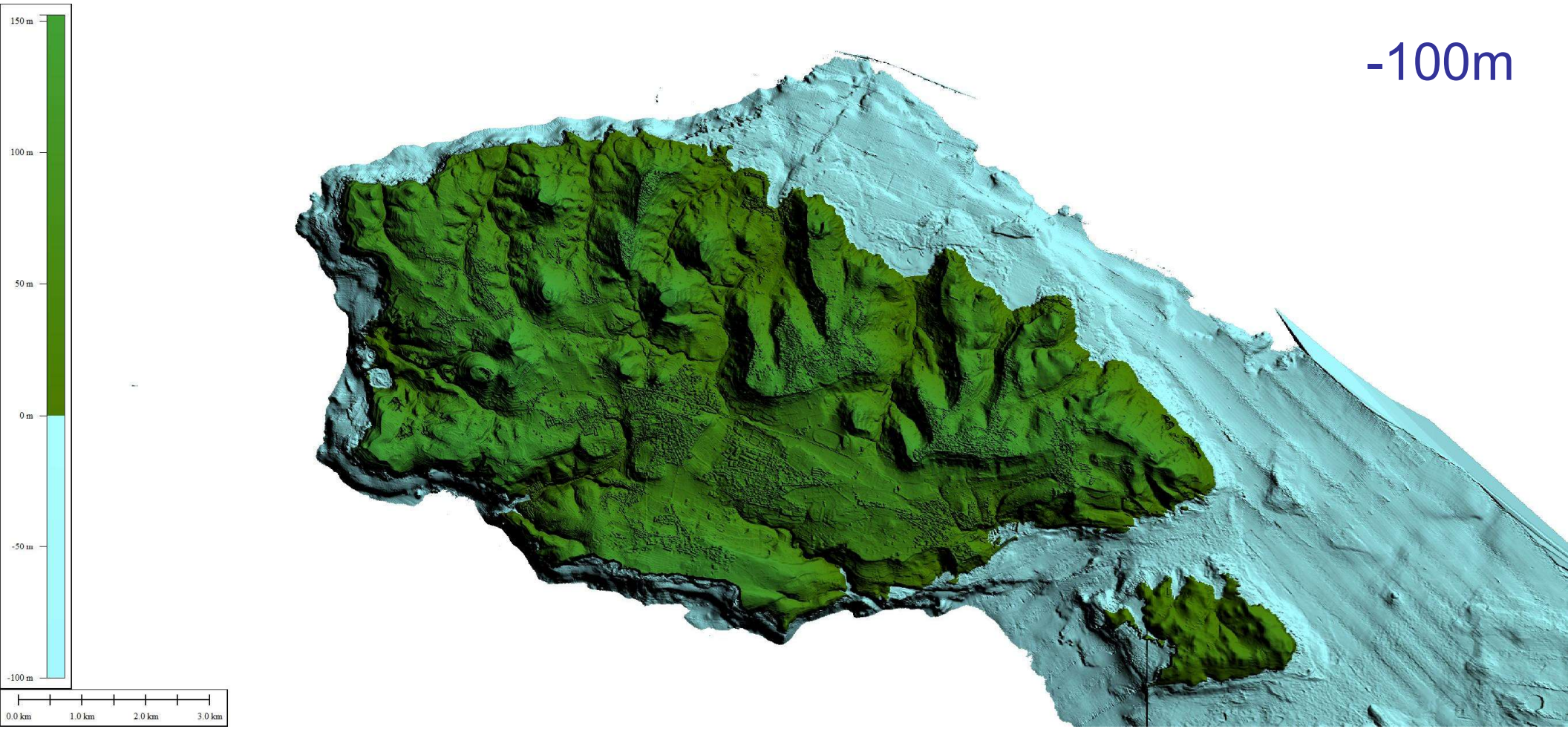
GIS

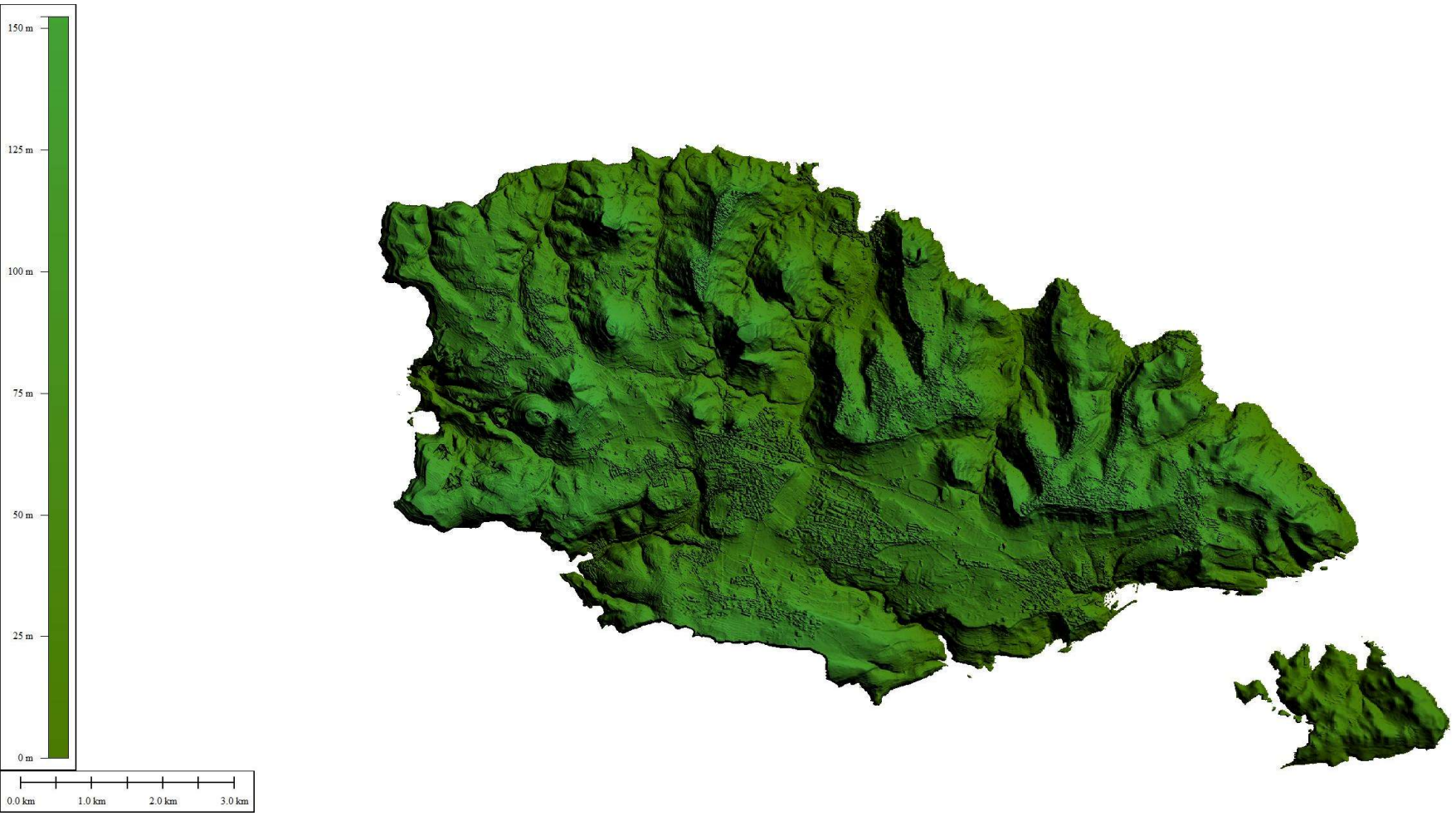
-100m



However, usage is very limited

GIS

0m



However, usage is very limited

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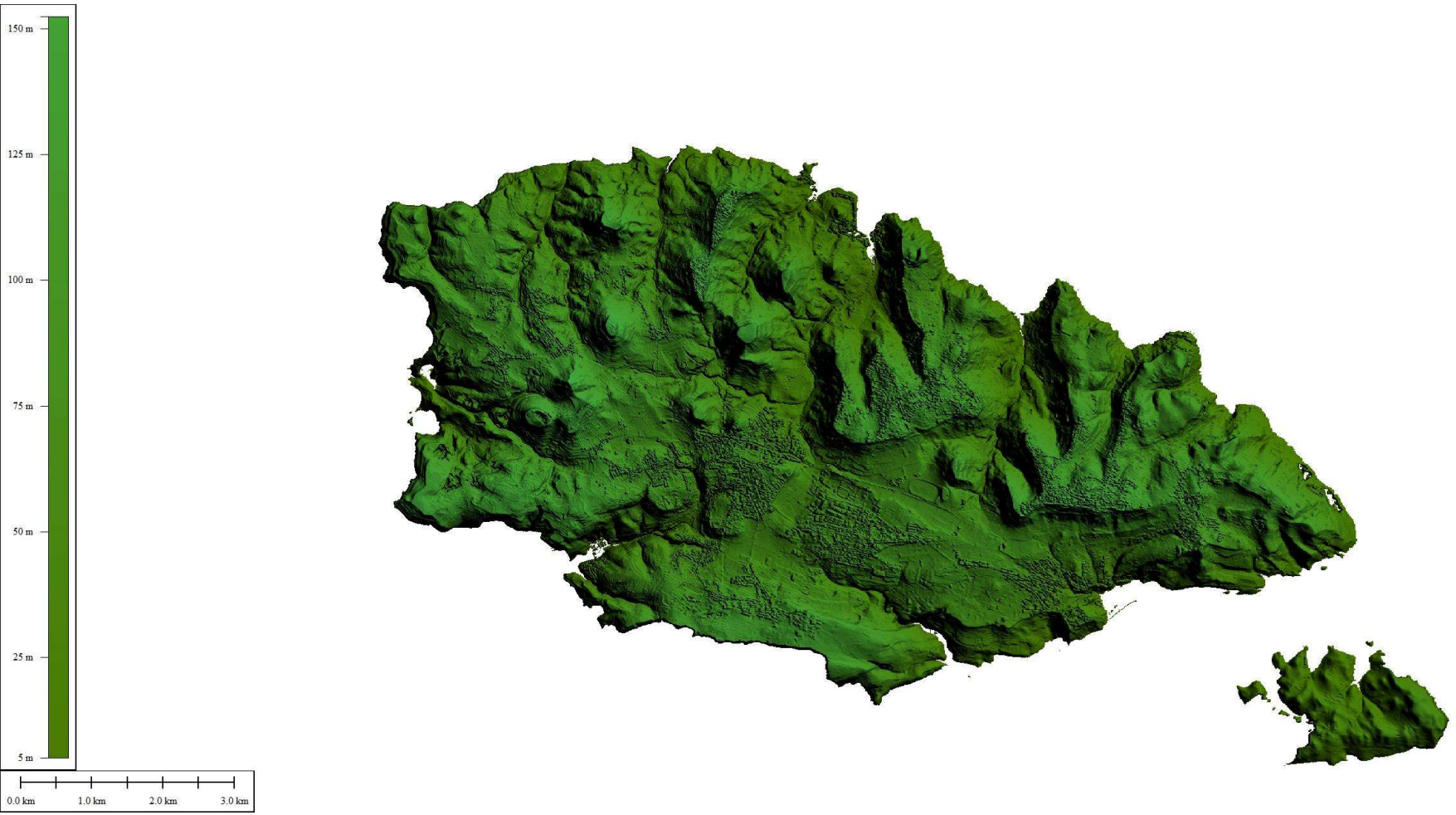
GIS

+5m



However, usage is very limited

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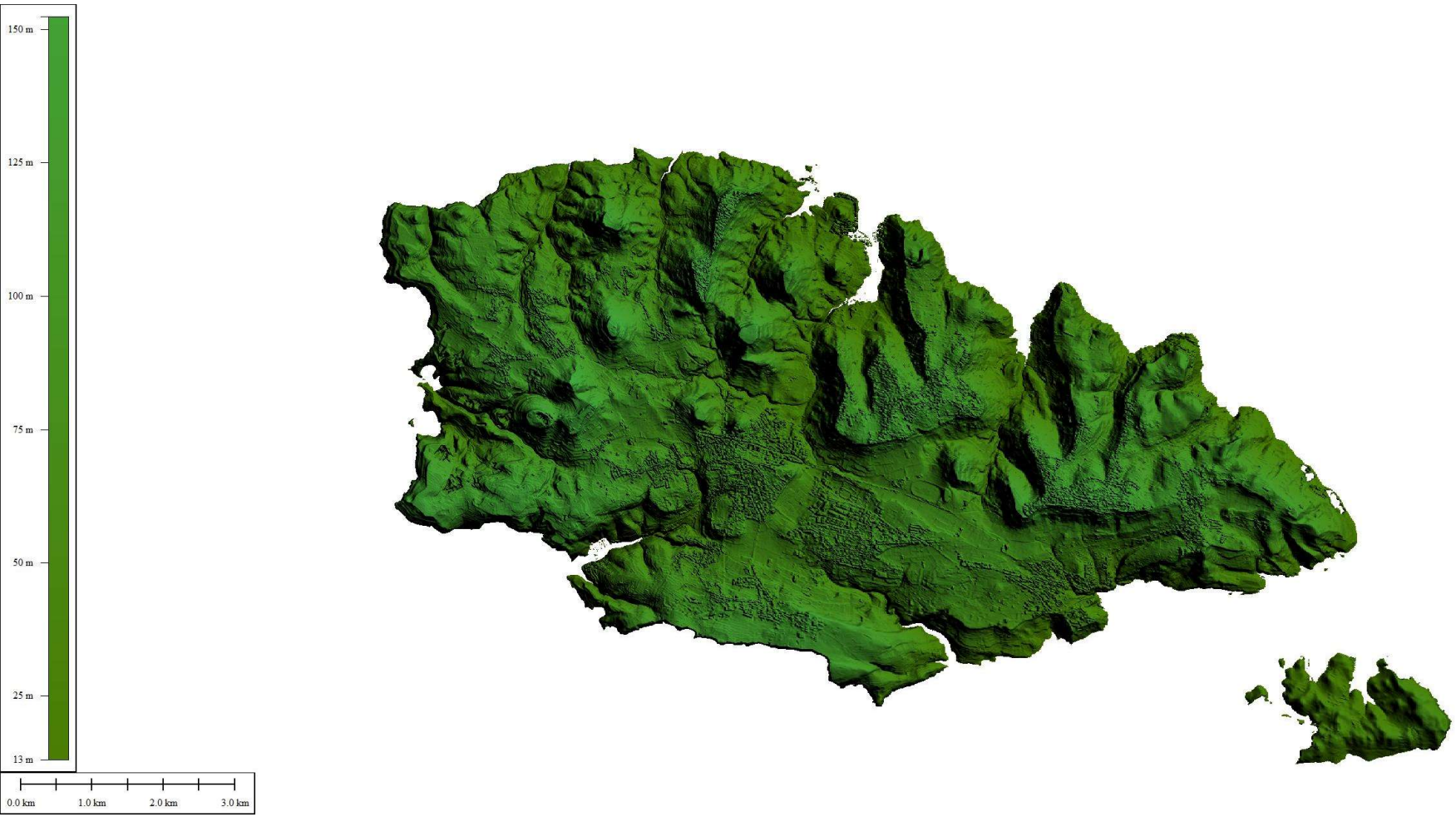
GIS

+13m



However, usage is very limited

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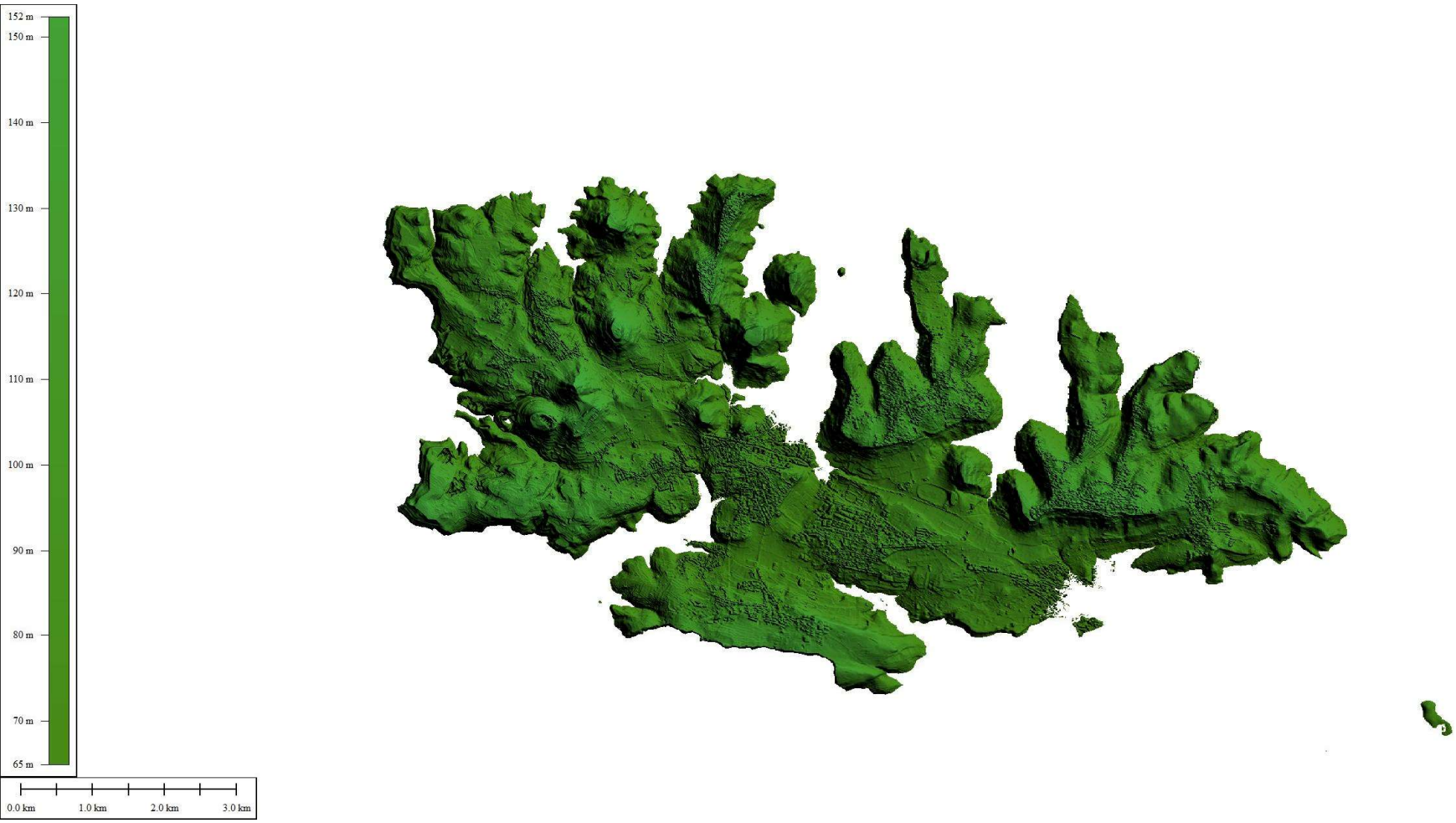
GIS

+70m



Breaking the Ice

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BBC | News | Sport | Weather | Capital | Future | Shop | TV

FUTURE

Home | Tech | Science | Health | Columns

DISCOVER: Stunning infographics >

PRESENTED BY DASSAULT SYSTEMES

FUTURE THINKING | 7 November 2013

Can games create an education fit for the future?

Technology | Science & Environment | City | Education | Gaming

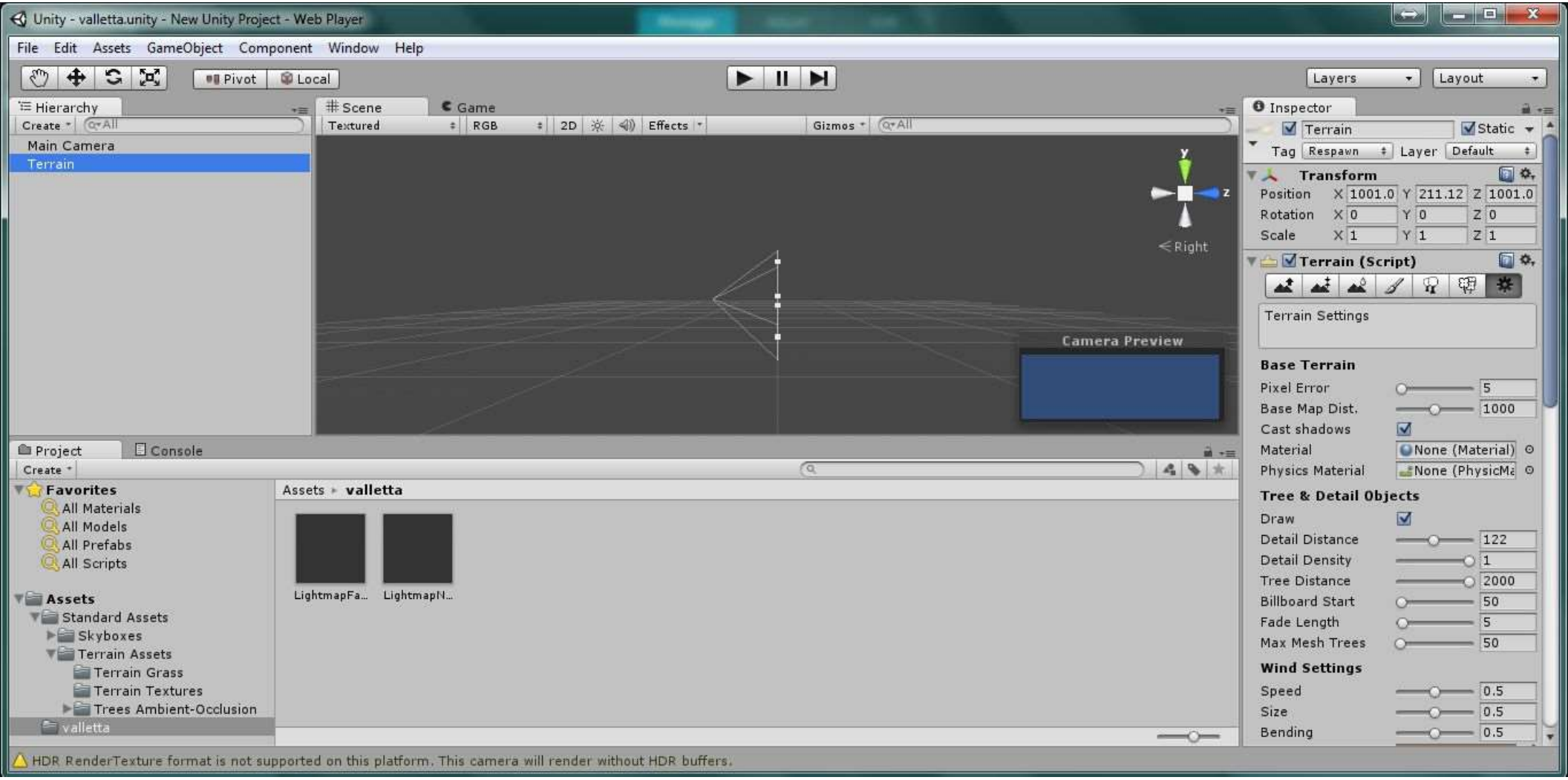
Share

Imagine a school where playing video games is encouraged during classes and may

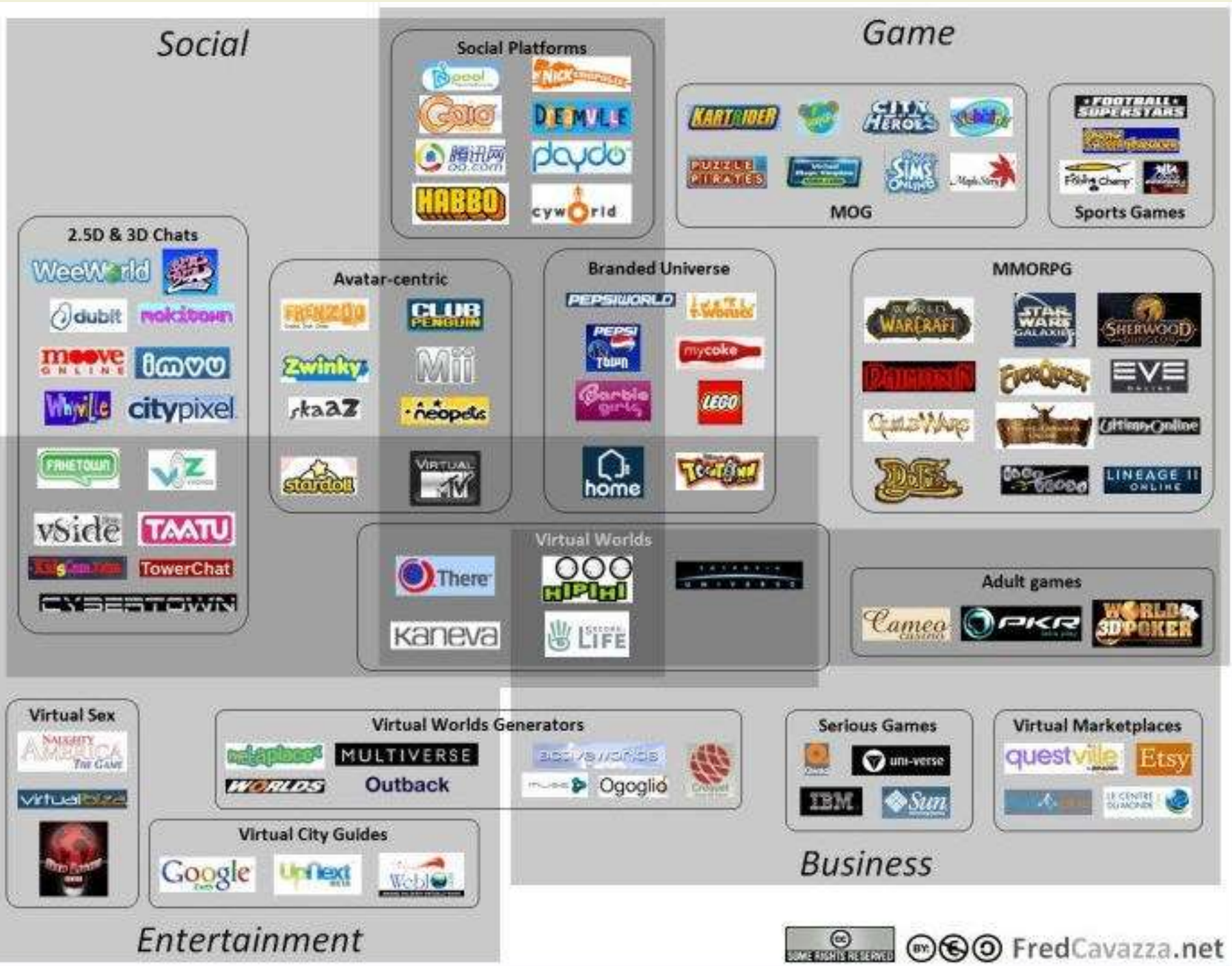
However, usage is very limited

SimCity

Unity3D


Unity - valletta.unity - New Unity Project - Web Player
File Edit Assets GameObject Component Window Help
Pivot Local
Layers Layout
Hierarchy
Create All
Main Camera
Terrain
Scene Game
Textured RGB 2D Effects Gizmos All
Right
Camera Preview
Inspector
Terrain Static
Tag Respawn Layer Default
Transform
Position X 1001.0 Y 211.12 Z 1001.0
Rotation X 0 Y 0 Z 0
Scale X 1 Y 1 Z 1
Terrain (Script)
Terrain Settings
Base Terrain
Pixel Error 5
Base Map Dist. 1000
Cast shadows
Material None (Material)
Physics Material None (PhysicMa
Tree & Detail Objects
Draw
Detail Distance 122
Detail Density 1
Tree Distance 2000
Billboard Start 50
Fade Length 5
Max Mesh Trees 50
Wind Settings
Speed 0.5
Size 0.5
Bending 0.5
Project Console
Create
Favorites
All Materials
All Models
All Prefabs
All Scripts
Assets
Standard Assets
Skyboxes
Terrain Assets
Terrain Grass
Terrain Textures
Trees Ambient-Occlusion
valletta
Assets ▸ valletta
LightmapFa...
LightmapN...
HDR RenderTexture format is not supported on this platform. This camera will render without HDR buffers.

Virtual Worlds



Then came MC

Case Study – Valletta

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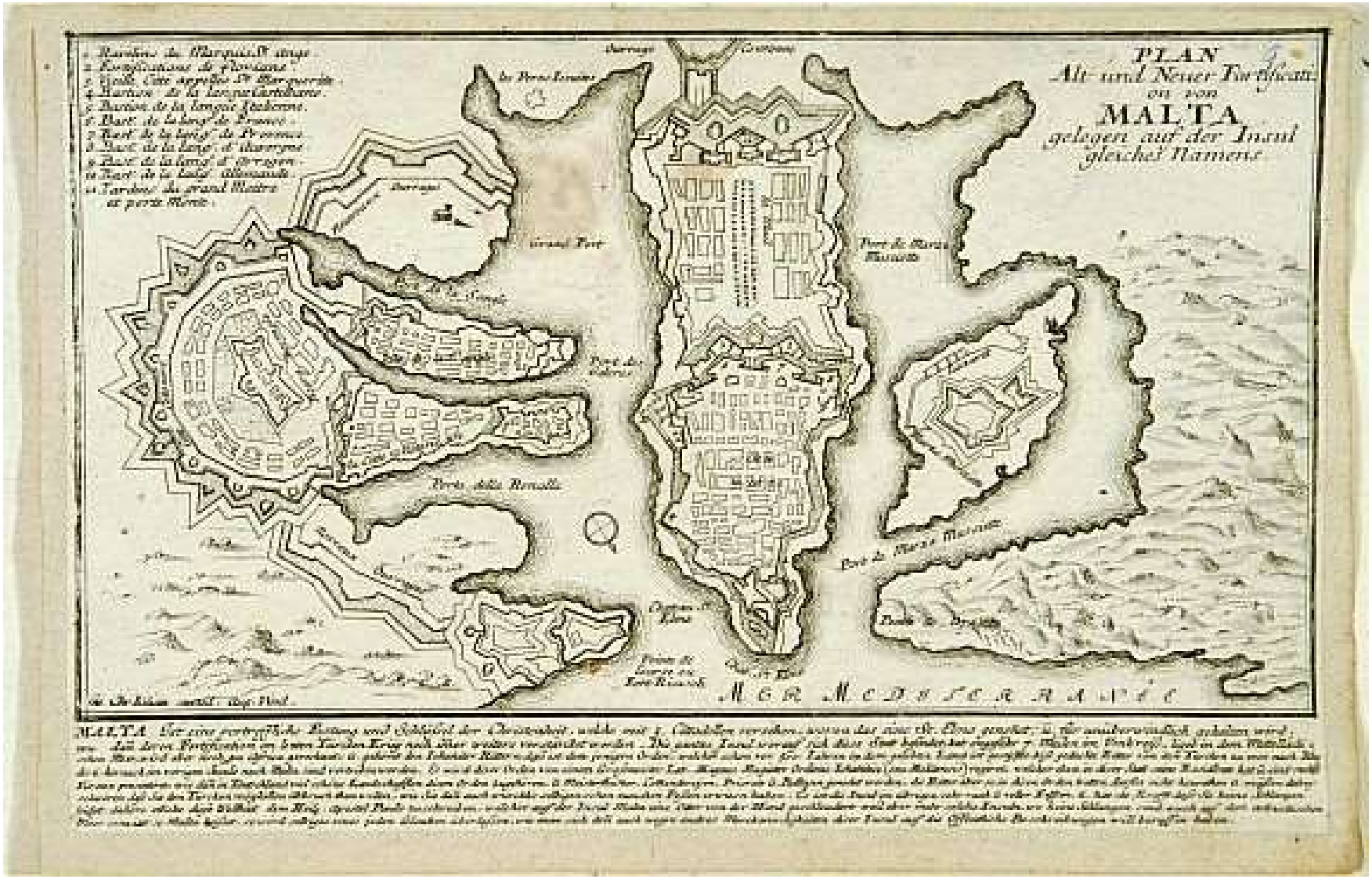

Title : Plan Alt und Neuer Fortificatizon von Malta gelegen auf der Insul gleiches Namens. [Valletta].
Map maker : KILIAN,G.C..
Date : Augsburg 1757.

Case Study – Valletta

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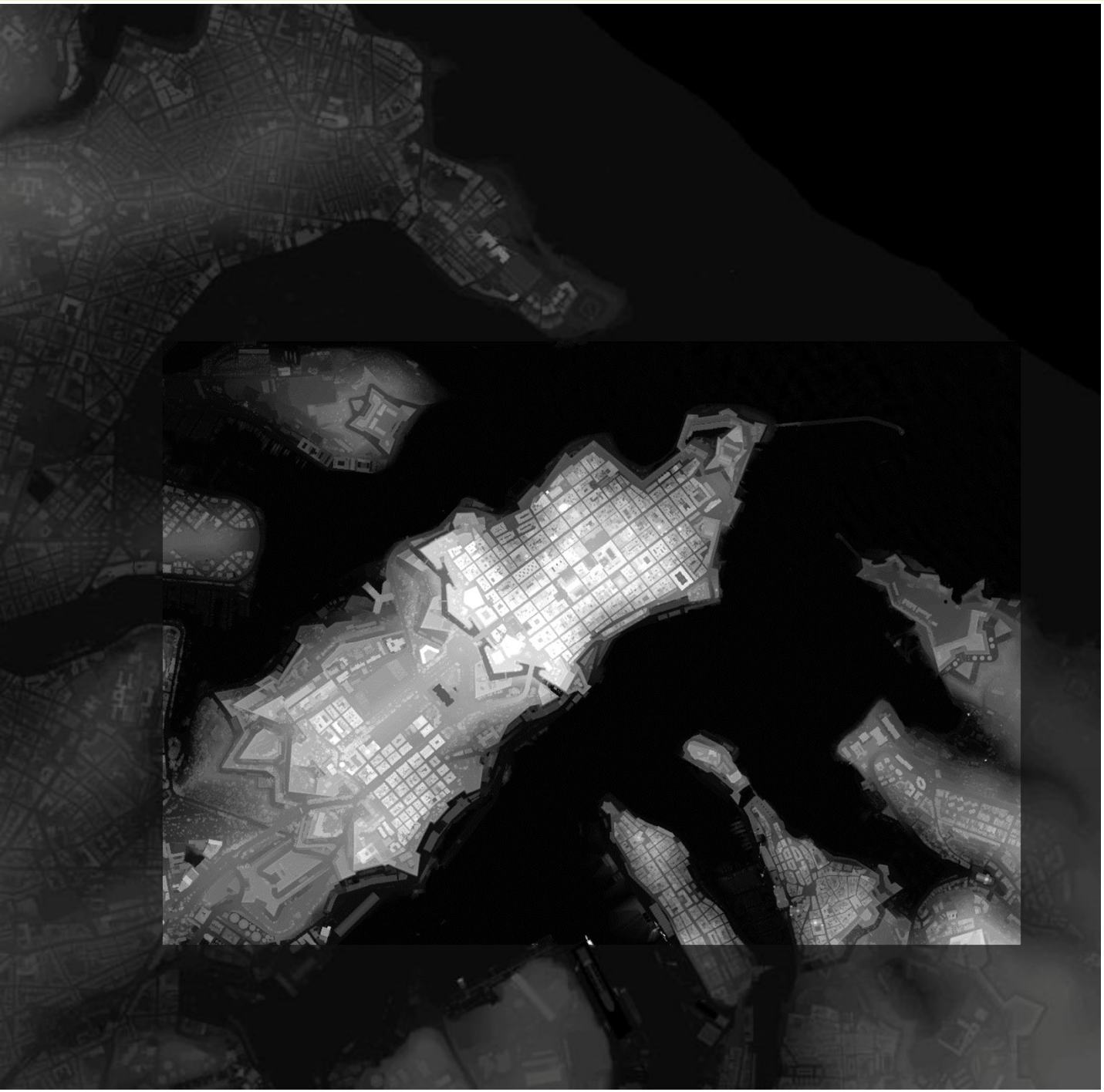


Employing base data

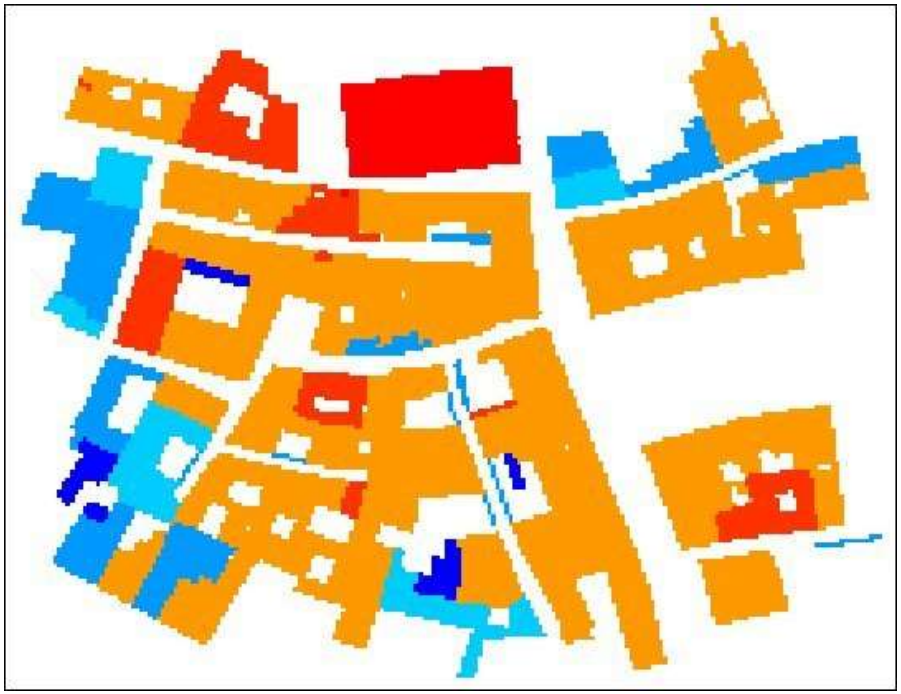
LiDAR

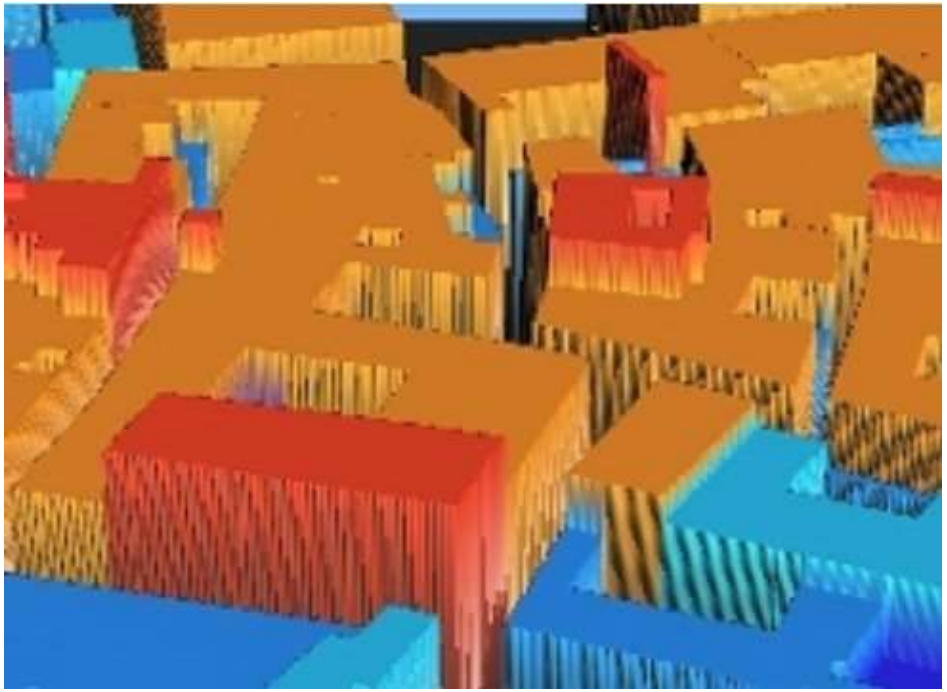
Light Detection and Ranging

DSM and DTM of the Islands

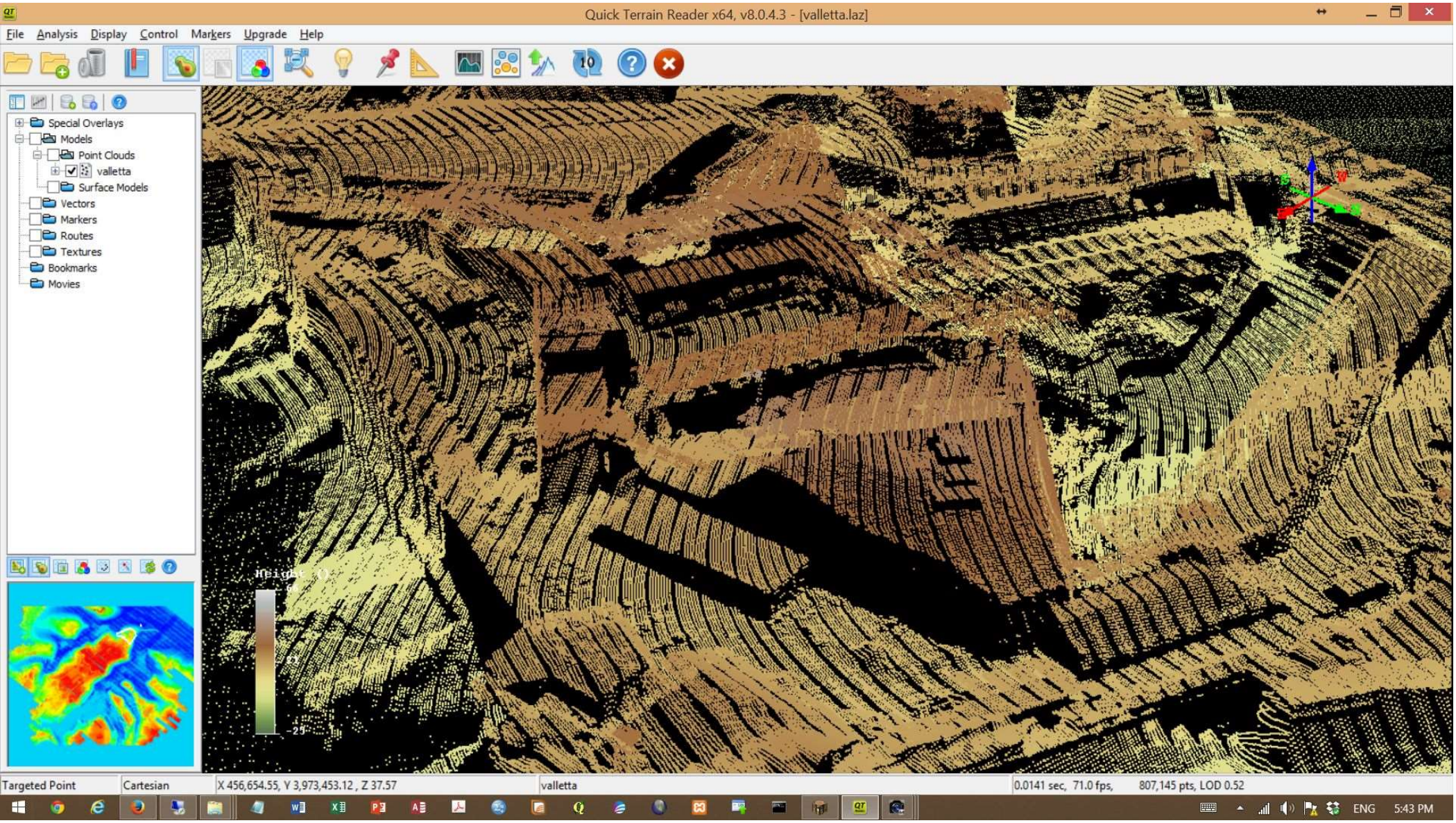
- average point density 4.3 Pts./m²
- height accuracy > 5 cm
- orthoimage mosaic with a resolution of 16 cm

Case Study – Valletta - precursors

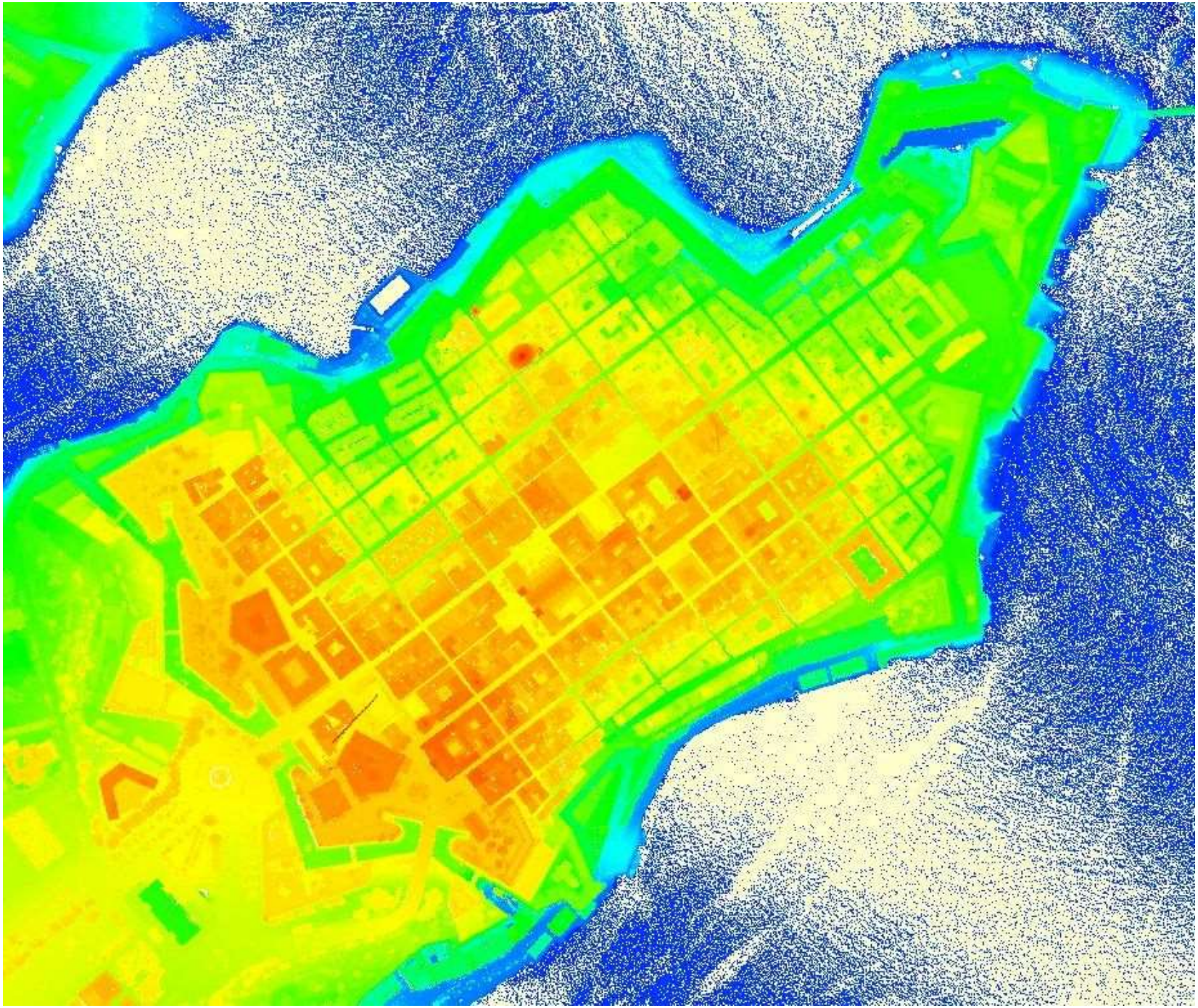




Case Study – Valletta – Captured Points

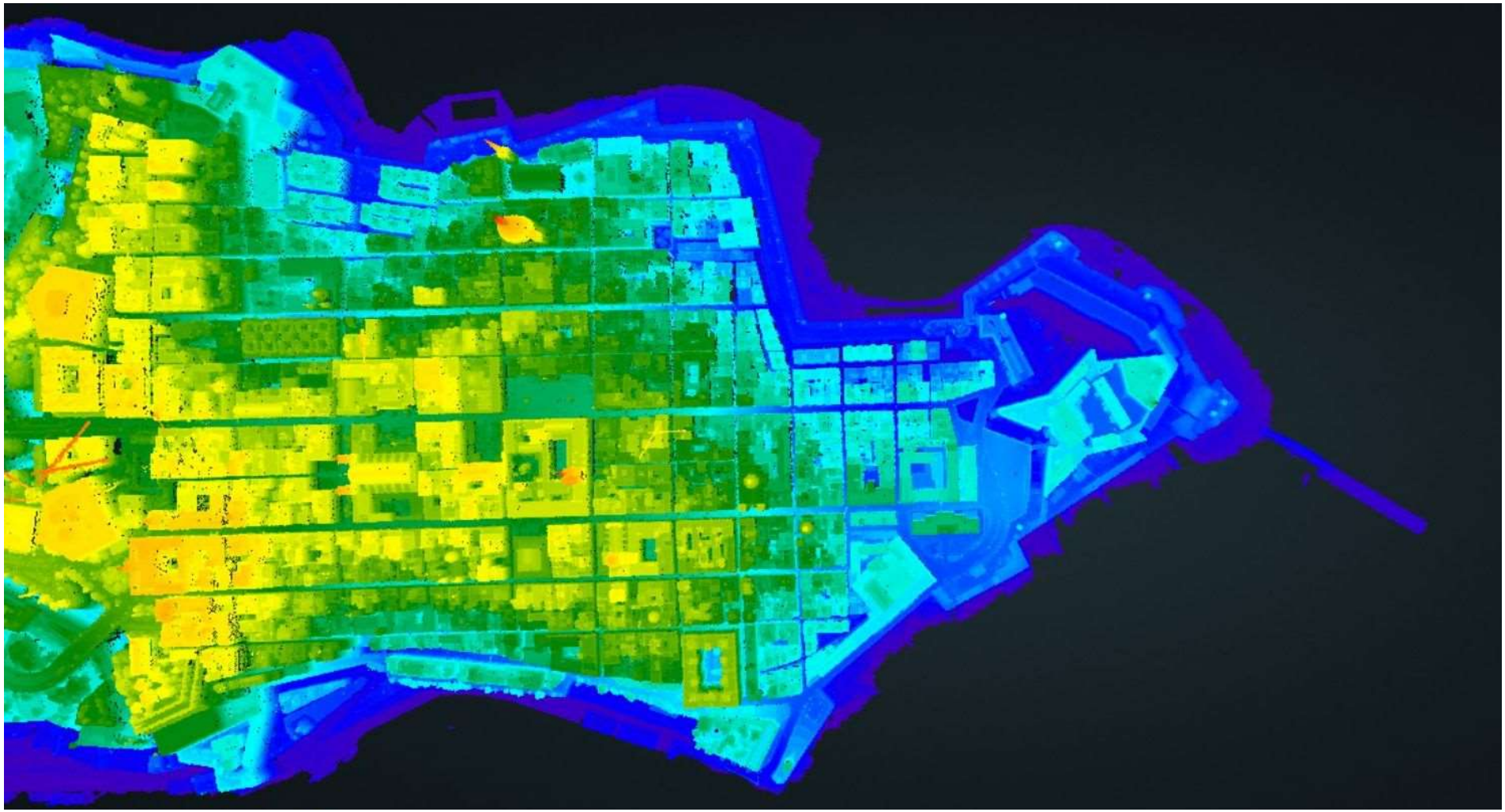


Case Study – Valletta - LiDAR

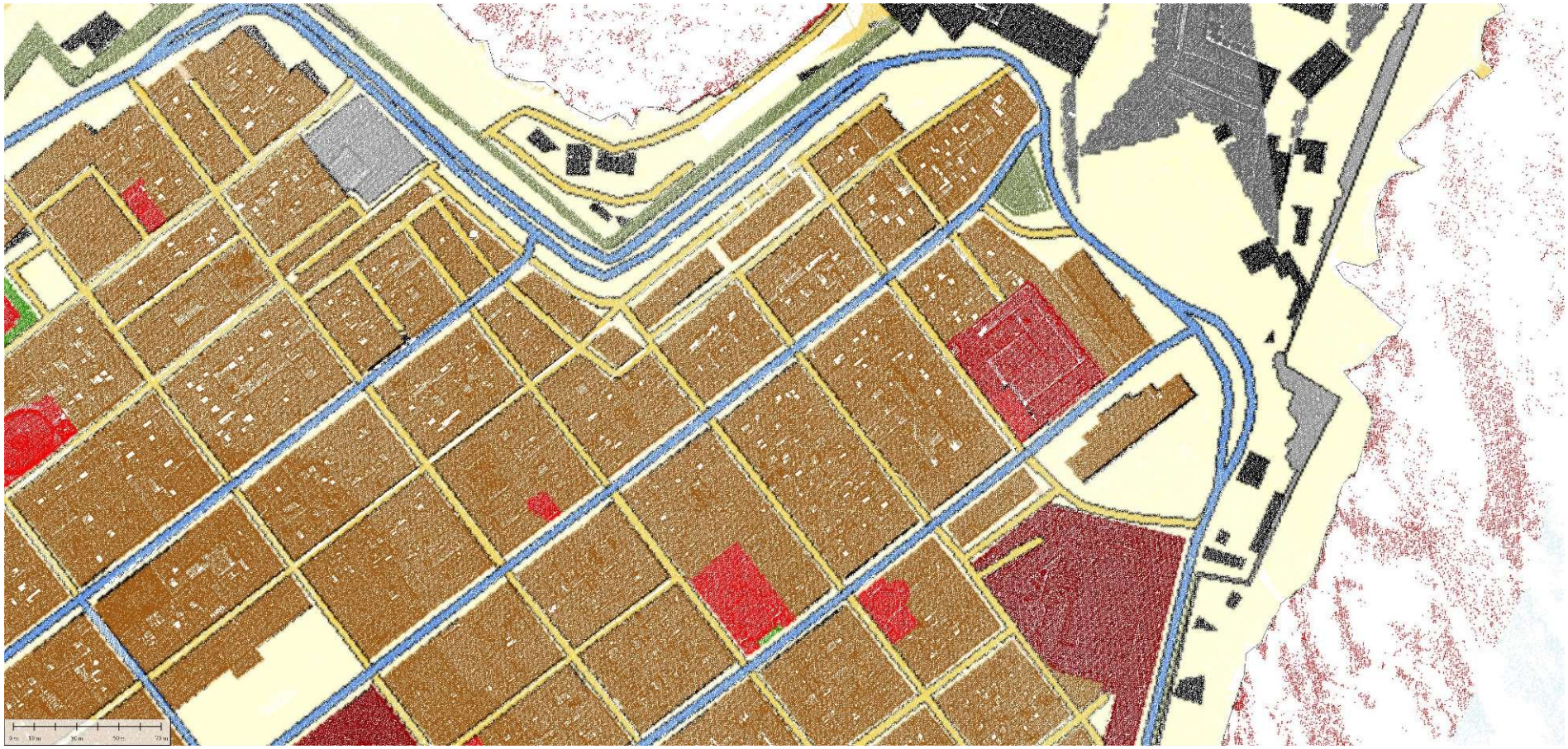


Case Study – Valletta - TIN

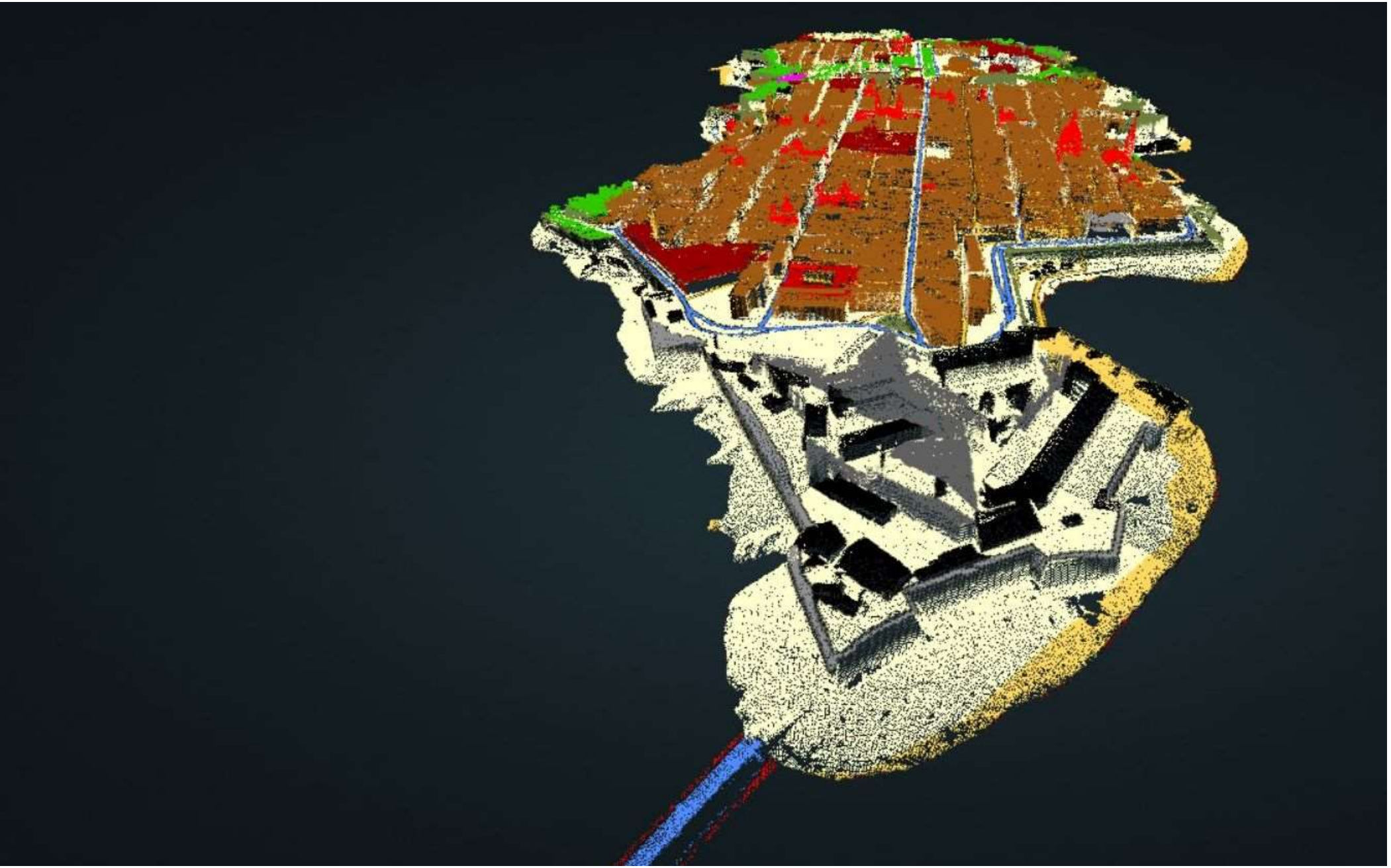
Case Study – Valletta – RGB Height



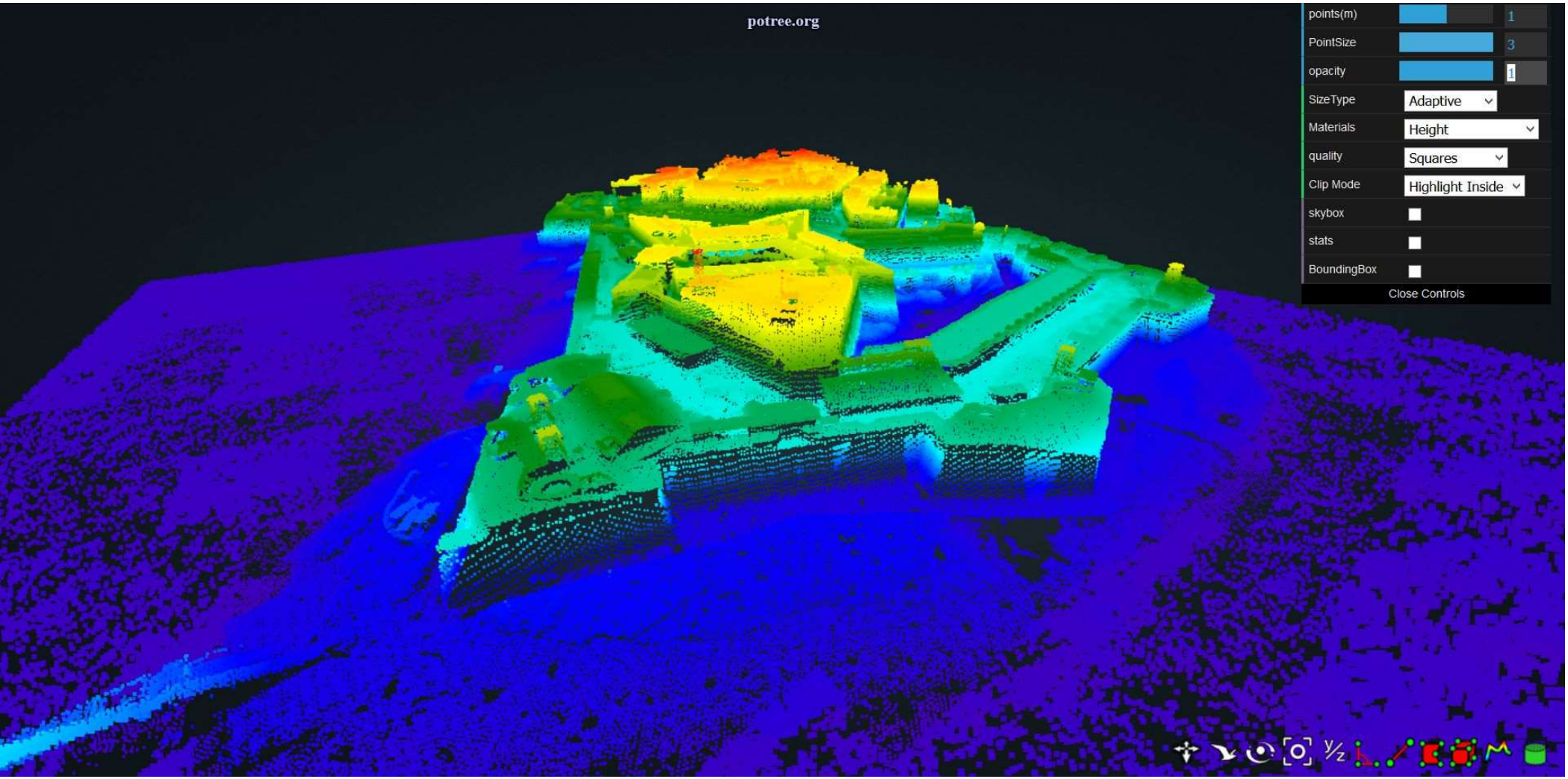
Case Study – Valletta – Thematic



Case Study – Valletta – RGB Height



Case Study – Valletta – St Elmo Heights



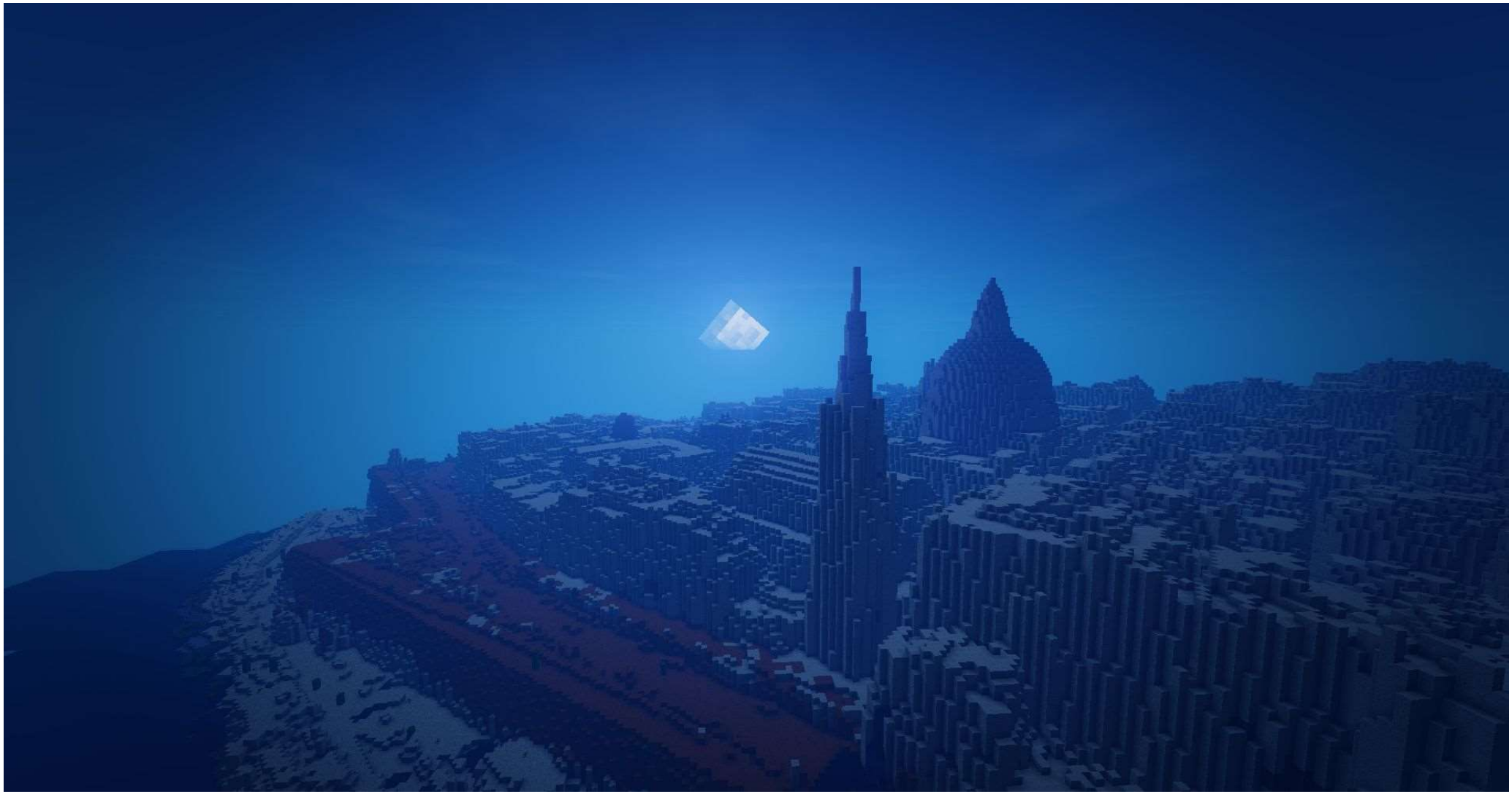
Case Study – Valletta – St Elmo RGB resized

Case Study – Valletta – Minecrafted

Case Study – Valletta – Minecrafted

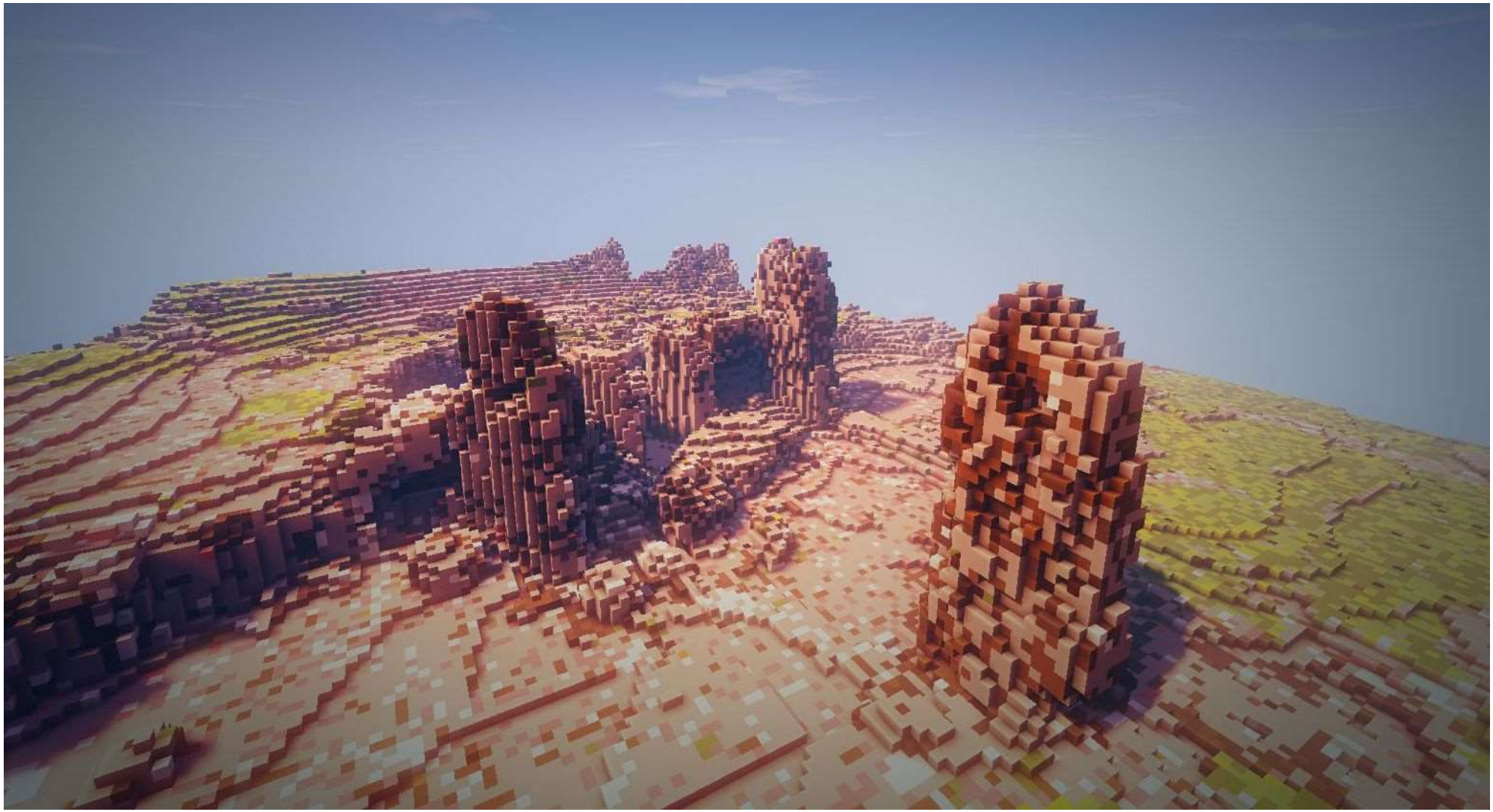
Case Study – Valletta – Minecrafted

Case Study – Valletta – Atmospherics



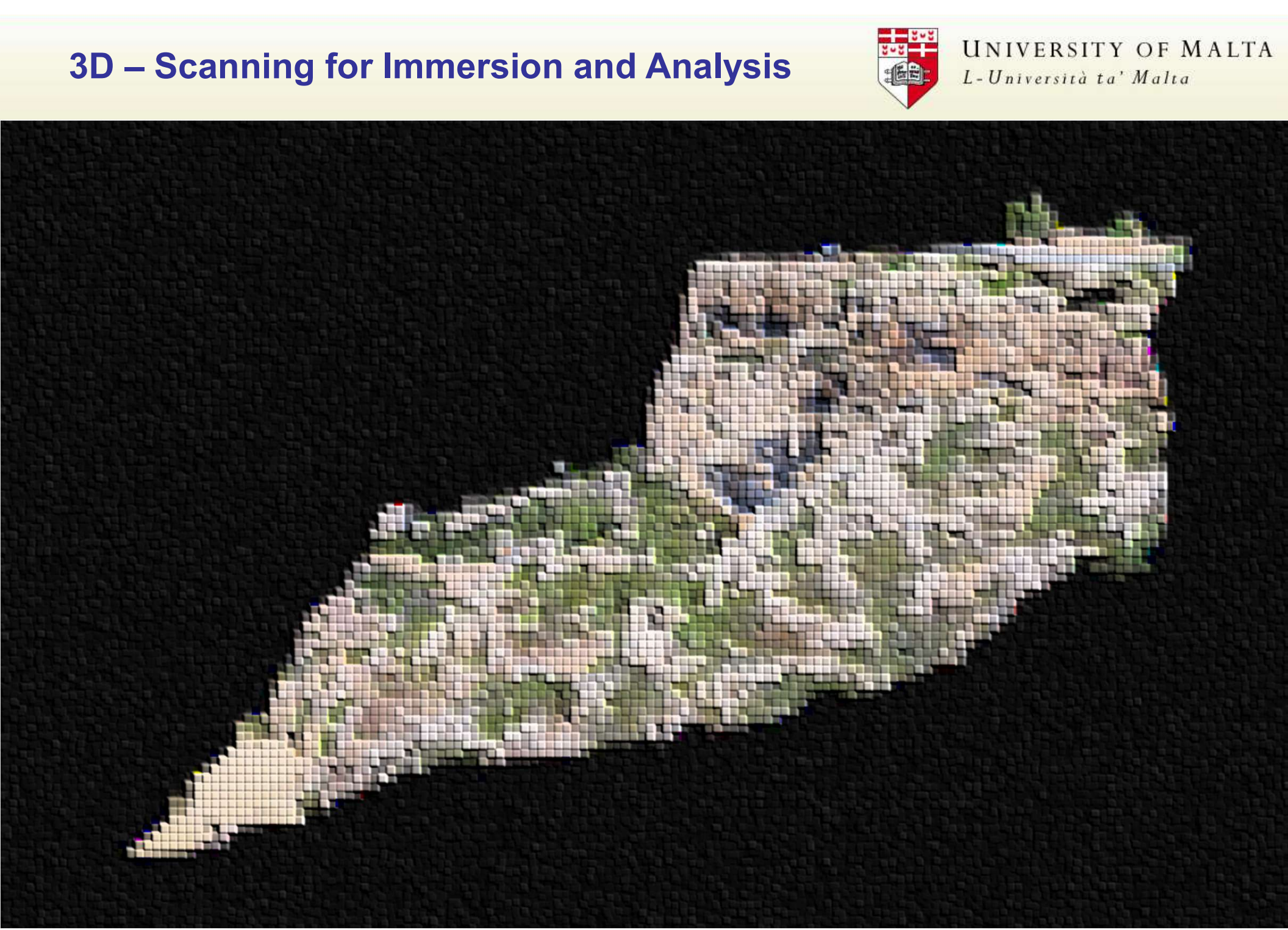
Case Study – Valletta – Minecrafted

Case Study – Skorba



Case Study – Immersion - Hypogeum

3D – Scanning for Immersion and Analysis



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3D – Scanning for Immersion and Analysis

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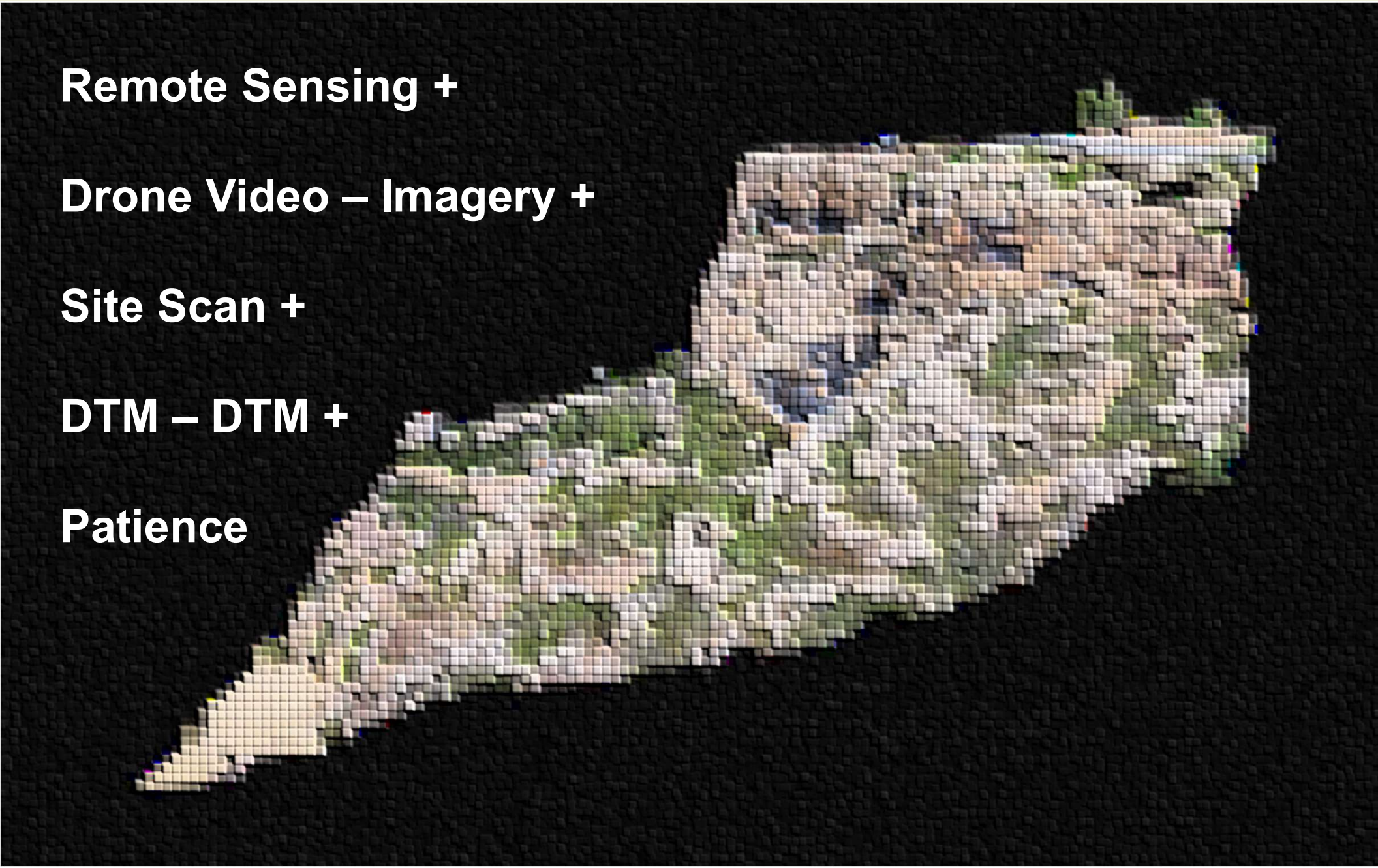
Remote Sensing +

Drone Video – Imagery +

Site Scan +

DTM – DTM +

Patience



3D – Scanning for Immersion and Analysis

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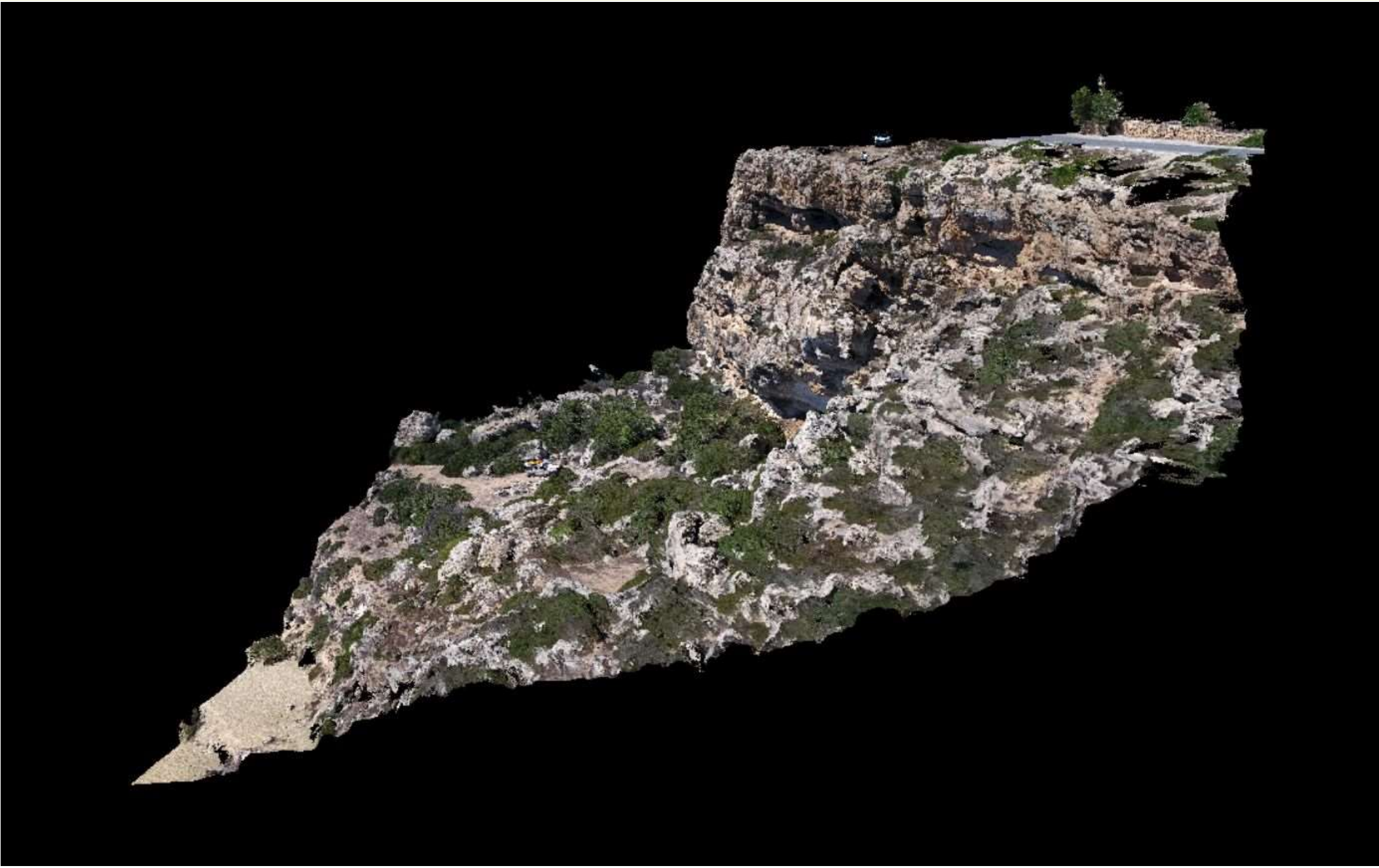

3D – Scanning for Immersion and Analysis

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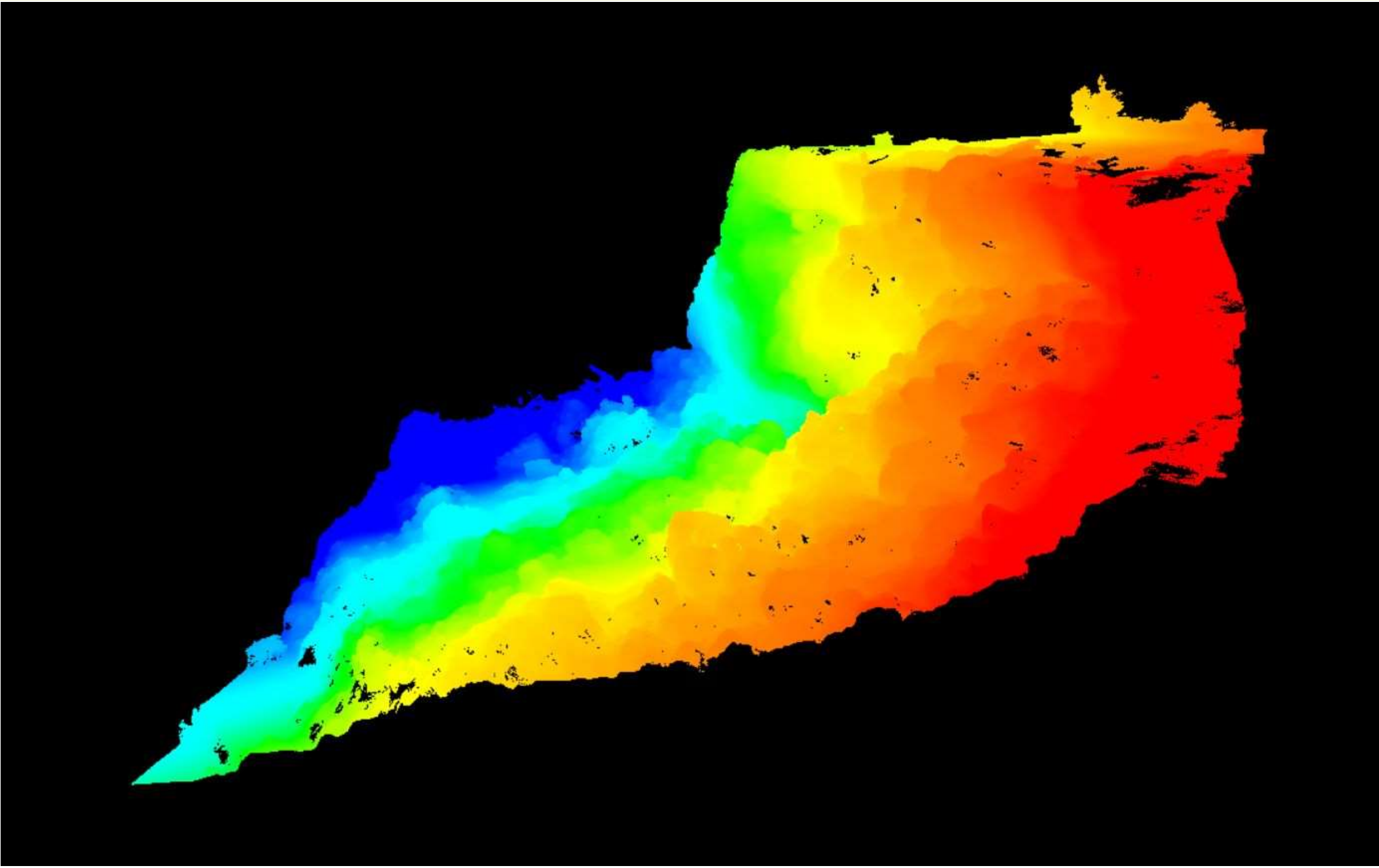

3D – Scanning for Immersion and Analysis

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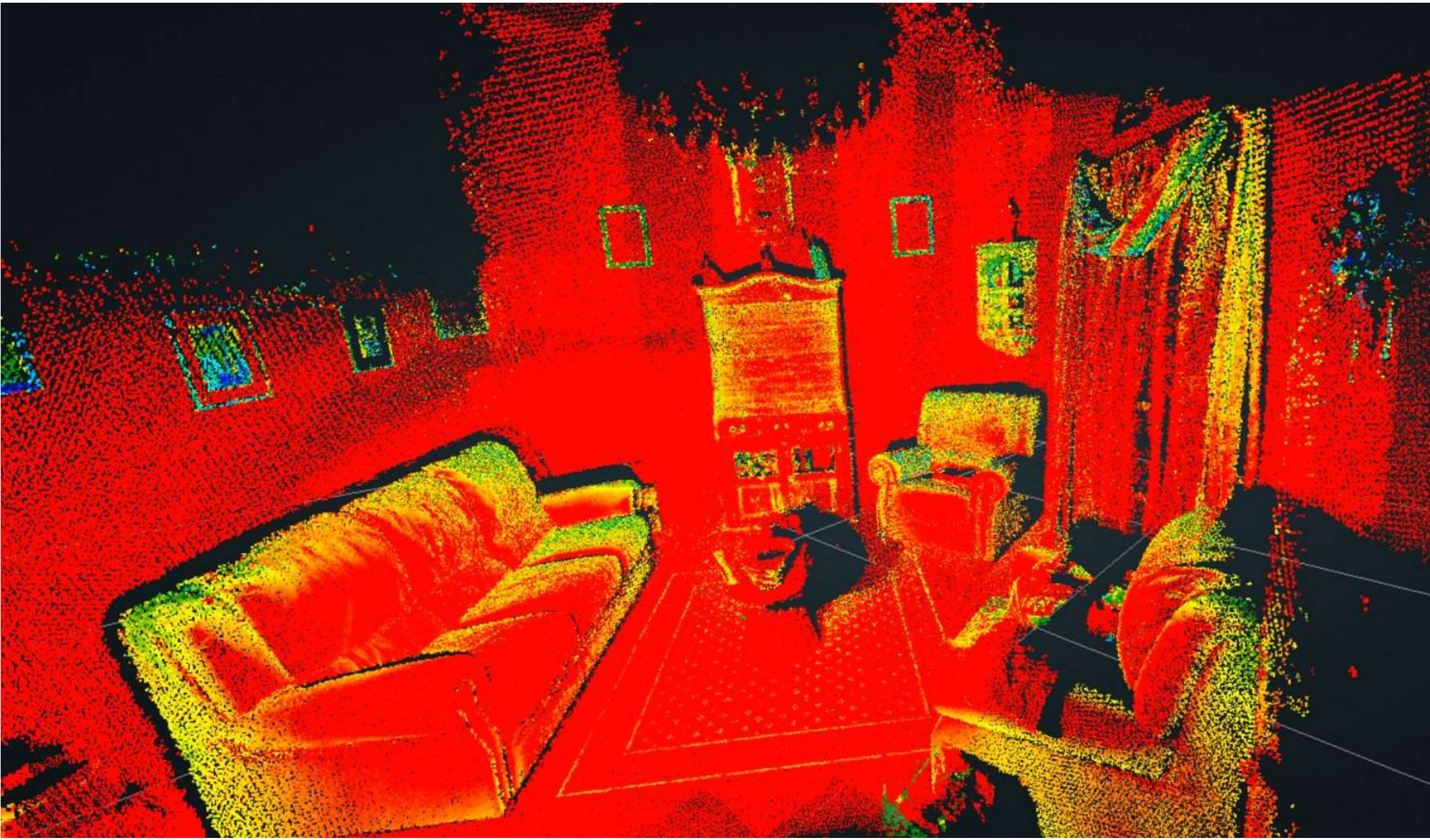

3D – Scanning for Immersion and Analysis

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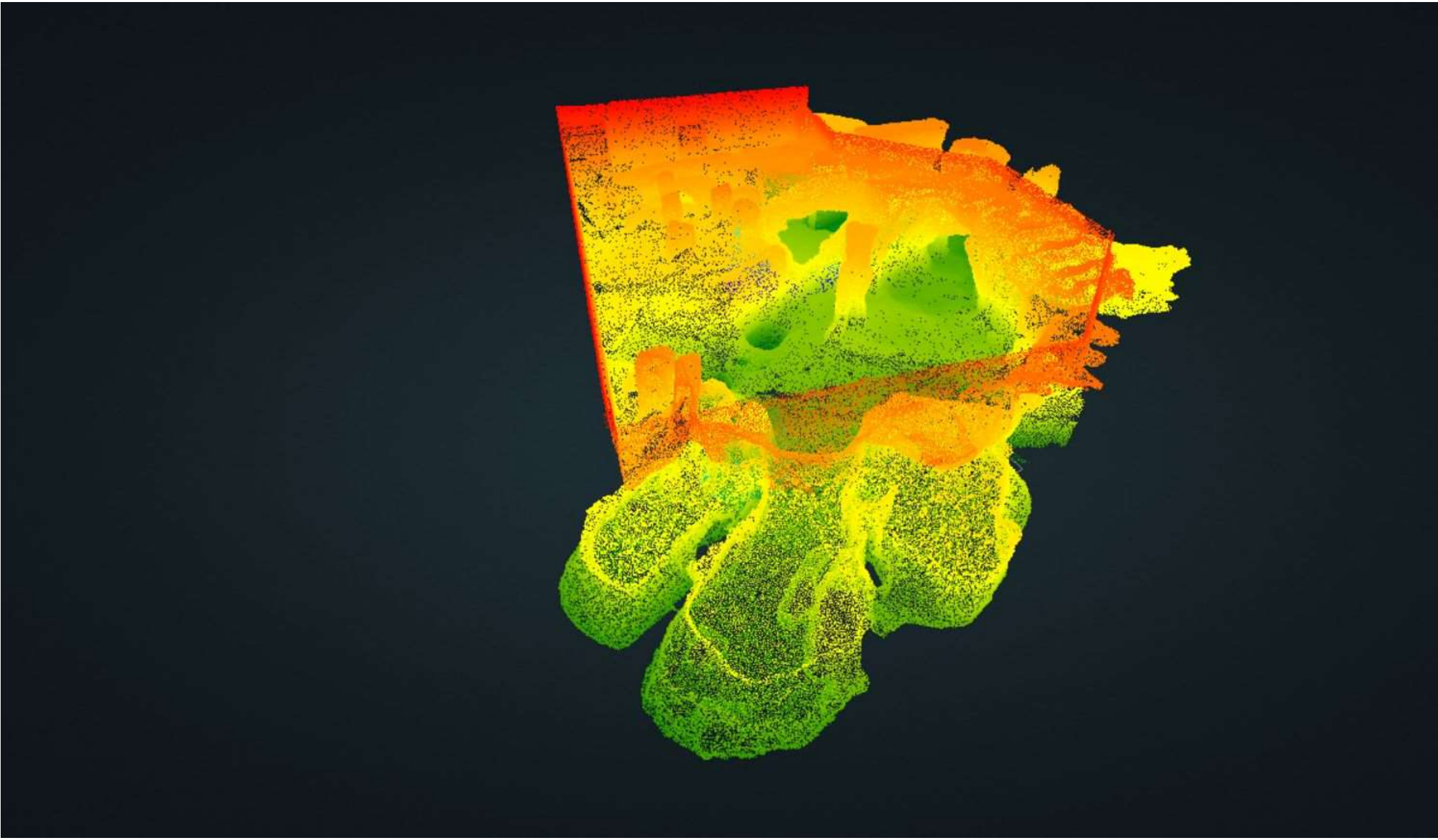
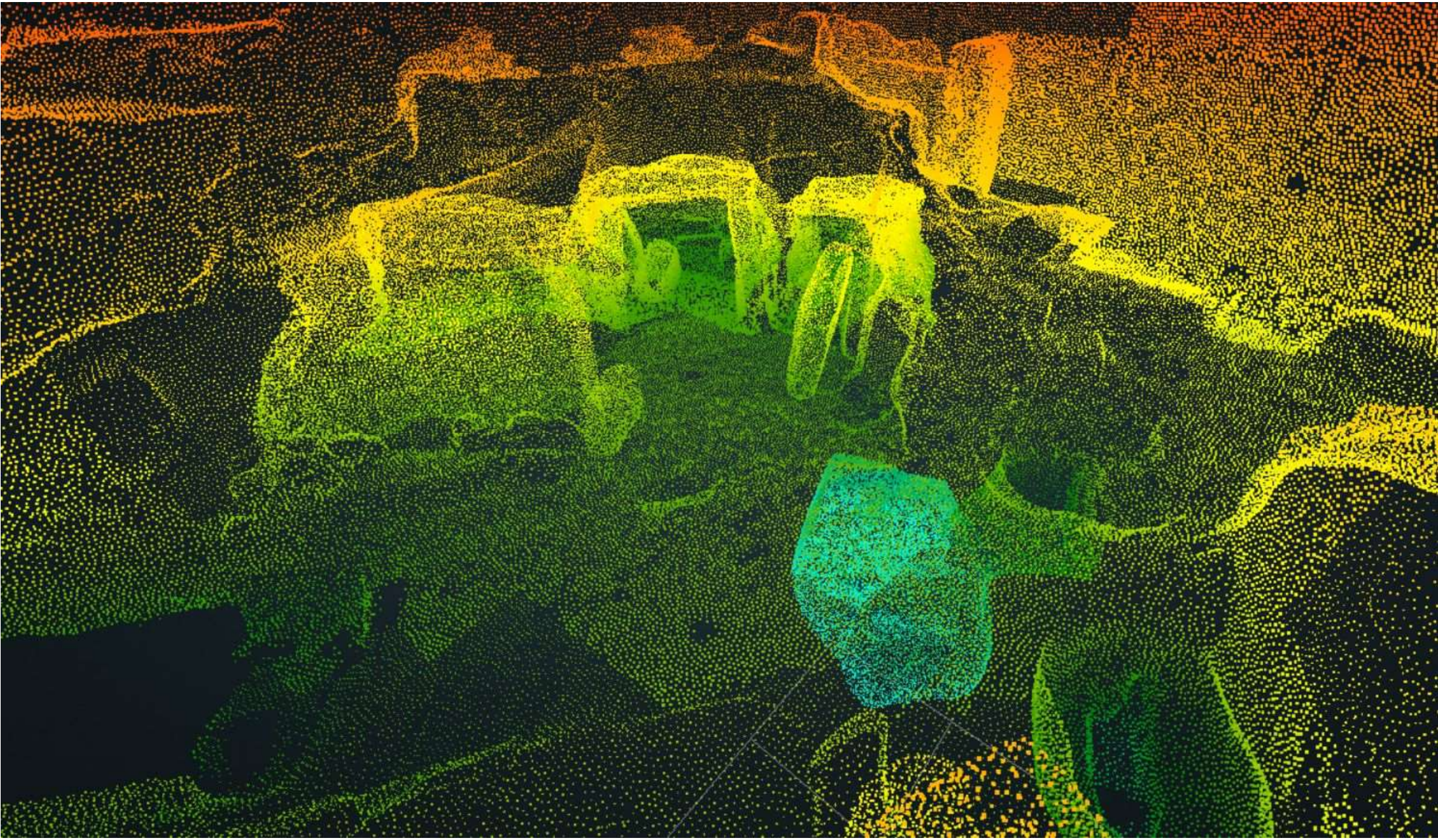
3D – Scanning for Immersion and Analysis



3D – Scanning for Immersion and Analysis



3D – Recreating Crime Scenes

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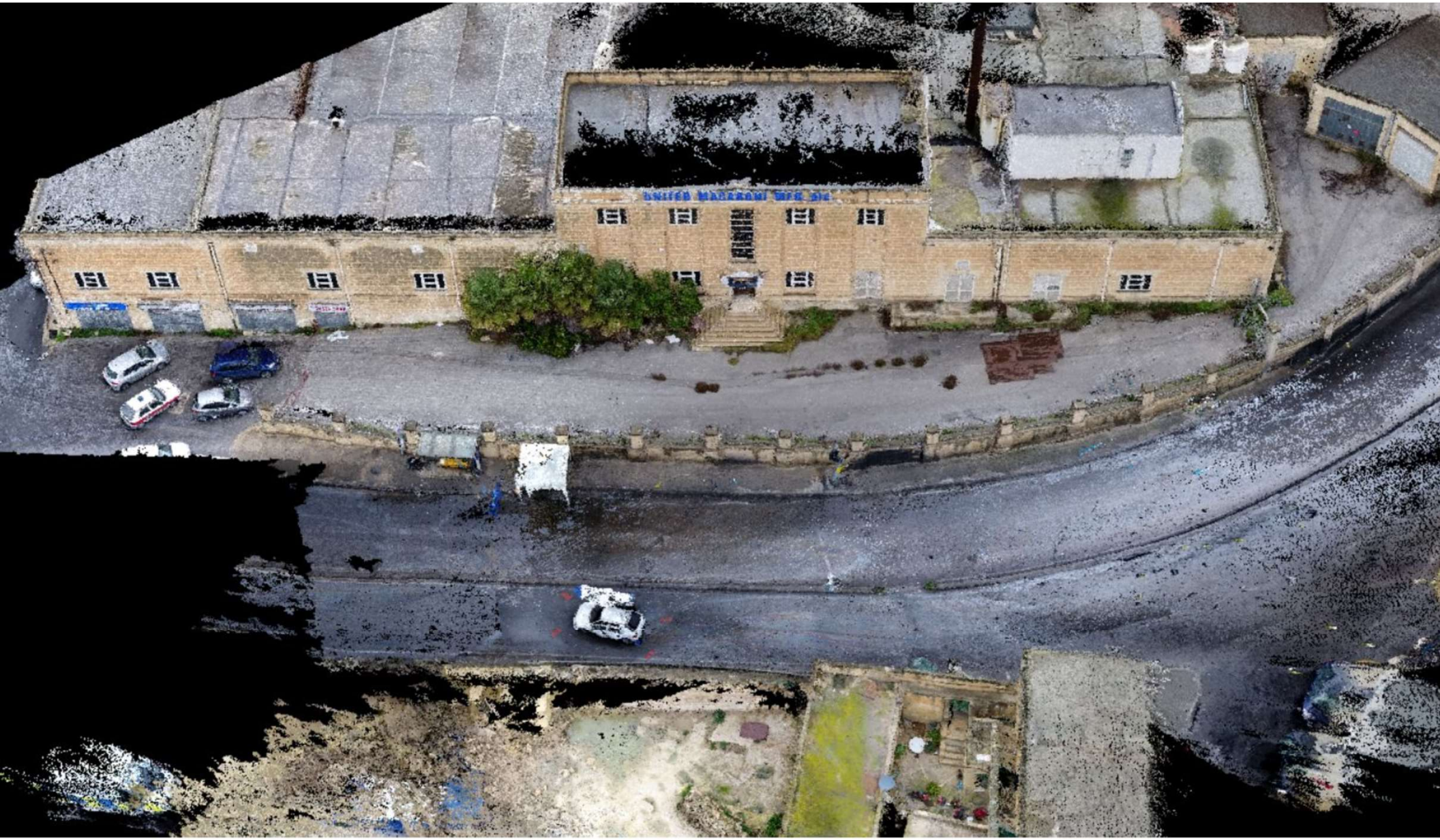
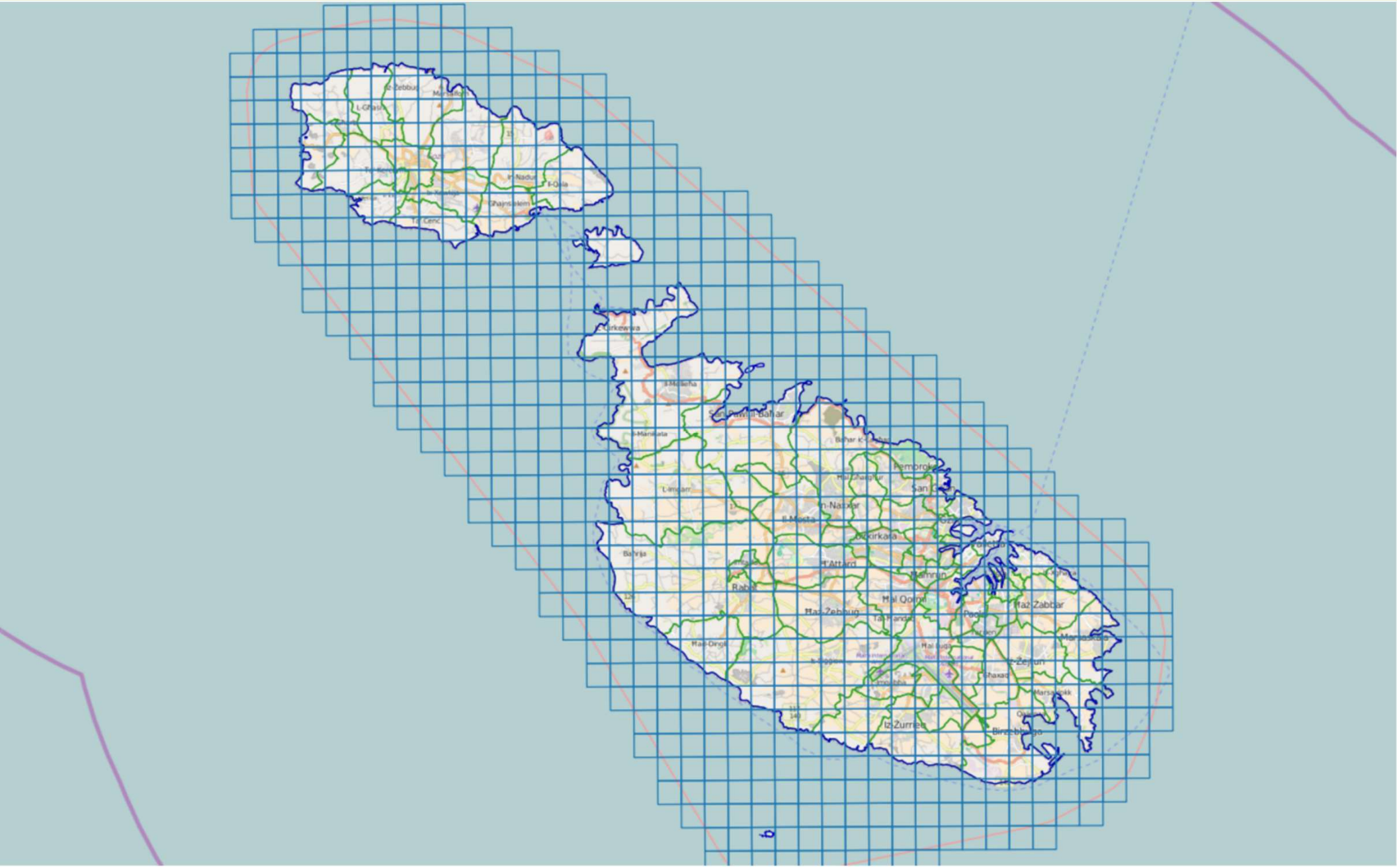
3D – Recreating Crime Scenes



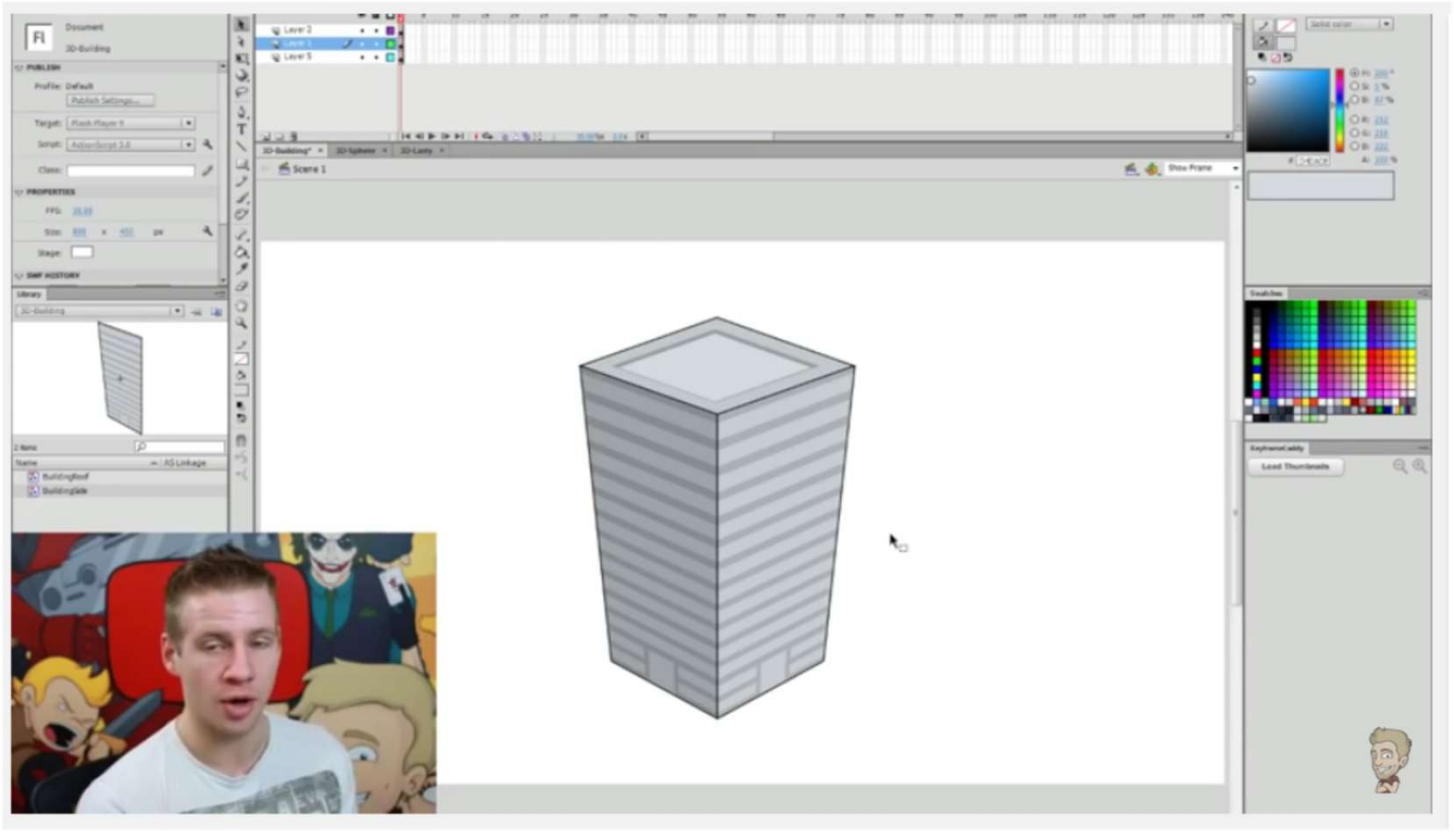
3D – Recreating Real Worlds

CloudIsle



Realms

Pseudo Reality



https://www.youtube.com/watch?v=x7g80j68bUc

Solid Reality or fake?

https://www.youtube.com/watch?v=_VhojvhhPng

Virtual Reality

https://www.youtube.com/watch?v=i4Zt3JZejbg

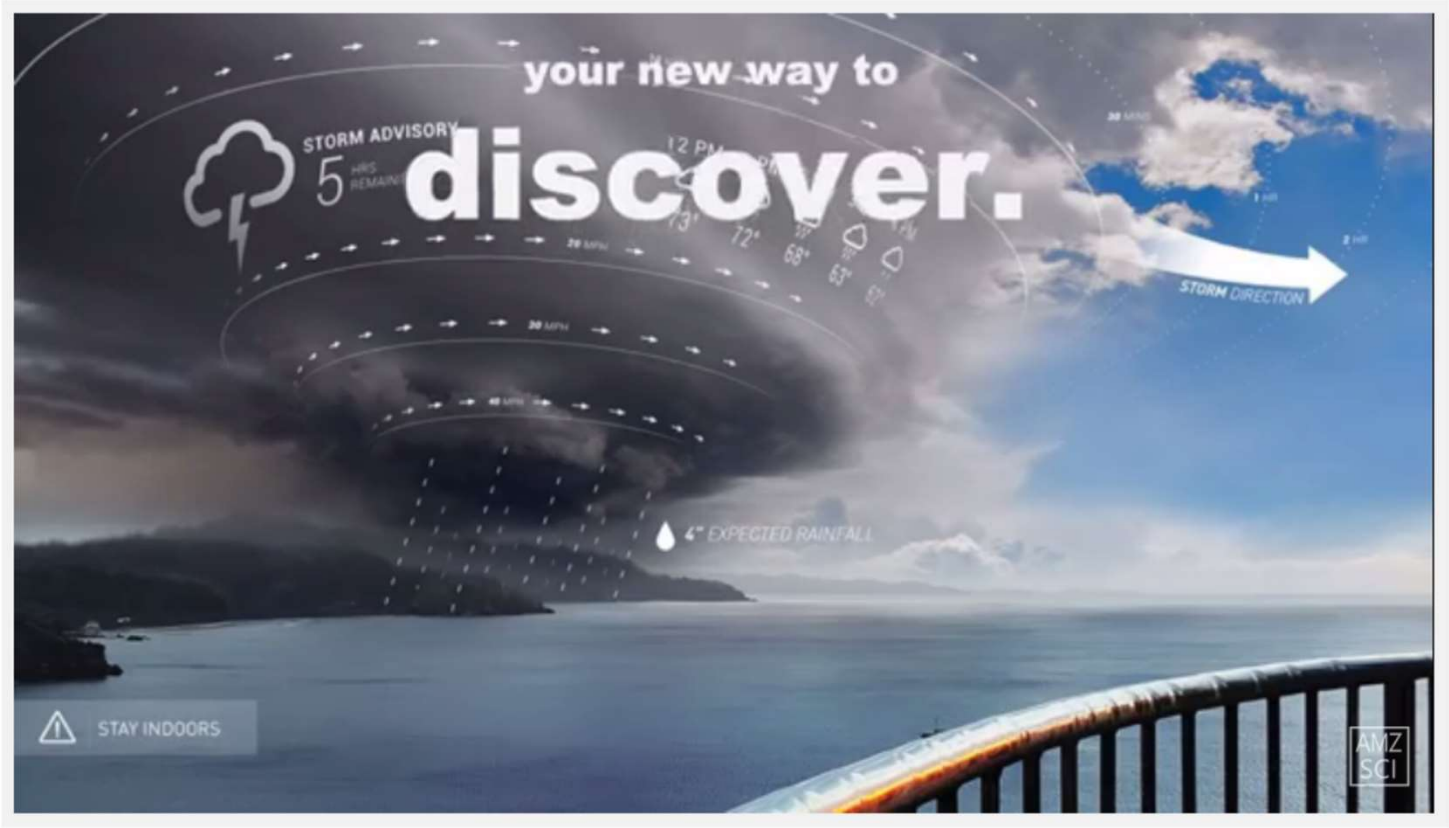
Augmented Reality

https://www.youtube.com/watch?v=hvAer3EhCe4

Place this one

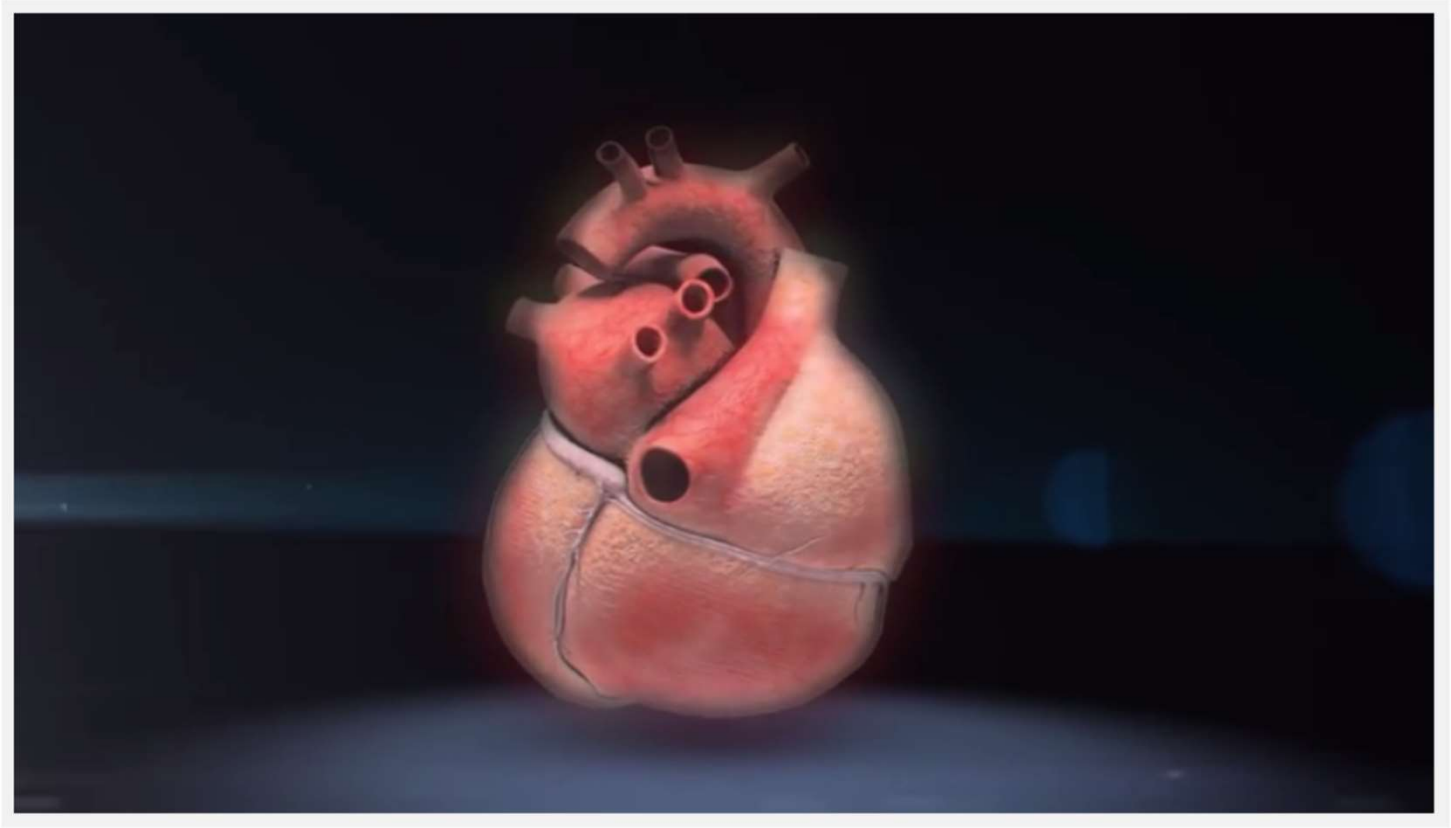
https://www.youtube.com/watch?v=WrHUZ-wKMcM

Magic Leap



https://www.youtube.com/watch?v=tSoSofLenSs

Holography



https://www.youtube.com/watch?v=AIj2xEd_z78

Tangible Media

https://www.youtube.com/watch?v=IvtfD_rJ2hE

Ultrasound Haptic Shapes

https://www.youtube.com/watch?v=kaoO5cY1aHk

Scenarios

- Period Virtual Worlds
- Fantastic city generation
- Immersive environments
- Teaching through walk-abouts
- Archaeological surveying (Marine and Terrestrial)
- Sea level Rise
- Inundation and flood zones
- Socio-Cultural
- Enforcement – change analysis
- Post-Disaster Management

Thank You

Prof. Saviour Formosa

saviour.formosa@um.edu.mt