Visualisation of Digital Landscapes as a Potential Instrument for Visual Landscape Resource Management in the Maltese Islands

International Conference
ECOLOGICAL LANDSCAPE MODELLING and MANAGEMENT FOR MEDITERRANEAN ISLANDS
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Dr. Saviour Formosa
Mr. Stephen Conchin
saviour.formosa@um.edu.mt
FOREGROUND OR BACKGROUND?
GI just for techno-centrics?

Which tools aid Scientists and Decision Makers?

Where

What
When
Why
Who
How

It is not a simple matter to ‘push’ non-technic agencies to visualise the impact of spatial information

How can we integrate these tools to enable informed decision-making without risking?

Pieter Bruegel, Sr, Tower of Babel KhM

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Methods: Periodic Table of Visualisation

• Lengler and Eppler (2007) - visualisation methods which they adventurously called the Periodic Table of Visualization Methods.

• Termed the Visual Literacy Project.

• Lengler et al (2007) split the methods into six visualization categories based on what they called the Data, Information, Concept, Strategy, Metaphor and Compound approach (DICSMC).

http://www.visual-literacy.org/index.html

<table>
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<th>Data Visualization</th>
<th>Data in schematic form</th>
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<td>Information Visualization</td>
<td>Data transformed to an image</td>
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<td>Concept Visualization</td>
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<td>Metaphor Visualization</td>
<td>Structuring information</td>
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<td>Compound Visualization</td>
<td>Combining different methods</td>
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Pointing towards the DIKA approach
A PERIODIC TABLE OF VISUALIZATION METHODS

DATA MAP
Cancer Mortality Rates by County (Age-adjusted 1970 US Population)
Lung, Trachea, Bronchus, and Pleura: White Males, 1970-94

US = 69.40/100,000
91.86-150.47 (highest 10%)
83.81-91.03
78.30-80.16
73.80-75.15
69.45-73.79
65.16-69.40
60.65-65.14
55.04-60.74
50.41-55.00
45.12-50.40
40.87-45.12
36.54-40.87
32.21-36.54
27.88-32.21
23.55-27.88
19.22-23.55
14.89-19.22
10.56-14.89
6.23-10.56
1.90-6.23

Version 1.5
Mapping Tools in Overview

CRISOLA Model

Natural Environment
ex ecology

Social Environment
ex geodemographics

Physical Environment
ex landuse/landcover
Natural & Physical Landscapes
Demographic Landscapes: Population Density
Social Landscapes: Unemployment Rates
Is it a simple case of 1 variable?
Review the Landscape Topic Paper 2004
Zooming In: The State of Play

Population: 413,000  
(Demographic Review, 2009)

Households: 140,000  
(Census, 2005)

Land area: 316 Km²  
(MEPA, 2008)

Land cover: 27% - 85 Km²  
(MEPA, 2005)

Dwellings: 192,000  
(Census, 2005)

Vacant Dwellings: 53,000  
(Census, 2005)
GIS: A Maltese Time Line

1985
- NMA

1990
- Land Registry
- Planning Authority
- Common Database
- Transport Authority

1995
- Local Councils
- Melita Cable
- EneMalta
- Water Services Corp.
- Roads
- Agriculture Survey
- NSO

2000
- MEPA
- Resources Authority
- MapServer
- GIS Lab Univ
- Local Plans
- Planning Policy
- EIA
- Public Access to Information
- Environmental Reporting
- Environmental Acquis
- IACS
- Fisheries Zones
- EU Accession Process

2005
- ISD
- Google
- Aarhus
- ERDF 156
- INSPIRE

2010
- Digital Mapping/Data collection
- Application of GIS

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Base Mapping in Public Agencies

- Mapping available at National Level – Source MEPA

  - Large Scale Mapping
    - 1:2,500 basemaps
    - 1:1,000 basemaps

  - Small Scale Mapping
    - 1:25,000 basemaps
    - 1:50,000 basemaps
    - Orthophoto Map – Malta & Gozo (1:25,000)
Base Mapping

- **Software platforms available in Malta**
  - ArcGIS
  - MapInfo
  - AutoCAD
  - Various Opensource tools
  - Other ad hoc as per project requirements

- **Georeferencing System**
  - Local Co-ordinate system - UTM Stripped (Universal Transverse Mercator ED50)
GIS Deployment in Malta

Off the Shelf GIS Desktop packages
- Data creation and analysis.

Customised routines and GIS applications
- Decision tools to integrate with organisational business process such as online servers, socio-economic analytical tools

Web Tools
- Server-based Map Server available on the Internet – MEPA since 2000
- Census 1995 – imagemap / GIS-Client – NSO
- Crime-maps – 2007 - CrimeMalta
GIS Applications and Outputs

GIS Viewer - General

Map Server - MEPA

Bathing Water Quality – Health Dept. / EEA

Air Quality - MEPA

E-apps - MEPA

Best e-business solution for 2007 by the Computer Society of Malta
Special achievement in GIS 2006 by ESRI
ePractice.eu Good Practice Label for 2007
National/Local Business Processes

- Planning Applications and Enforcements
- Heritage: Cartruts study – Restoration Unit
- Scheduling and Protected sites
- Mapping of policies
- Environmental Management & Monitoring
- Street furniture
- Utilities infrastructure

International

- European Environment Agency data – env is available at [http://cdr.eionet.europa.eu/mt](http://cdr.eionet.europa.eu/mt) including:
  - CORINE land cover data
  - NATURA 2000 sites
  - Marine habitats data
  - Common Database on Designated Areas

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• Importance of GIS tools is evident throughout

• GIS deployment based on 2D flat outputs

• Need to exploit the 3D visualisation realm

• Numerous 3D tools available both as Off-the-shelf packages and open source

• Adding dimensions (3rd – height data, 4th – time) increases the combination of data available for decision-making
3D visualisation process – The PAST

Primary software used:
- Mapinfo Professional supported by Vertical Mapper

- Terrain modeling
- Viewshed analysis
- Line-of-site analysis
- Ortho-photo draping onto DTM
Visualisation case studies: a progressive approach
Latest Innovations and Future Tools
Example of GIS use
Example of GIS use

St. Paul’s Build
3D Elevation Coastal Inundation at 0, 0.5 and 1m sea level rise
San Pawl il-Bahar – 0m
• Based on unpublished MSc Dissertation (Conchin, 2005)

• Building of 3D visualisation model for St. Paul’s Bay / Qawra area investigating a tall building project proposal as an example

• 3 different outputs from 3 different software combinations
Case study phase I

Software used: Mapinfo Professional supported by Vertical Mapper
Case study phase II

Software used: ESRI ARCGIS 9 (Arcscene) with 3D Analyst and Spatial Analyst extensions
Software used: ESRI ARCVIEW 3.3 with 3D Analyst, Spatial Analyst and Multigen Paradigm SiteBuilder 3D extensions
Socio-Physical Models: The Conchin et al case study

Crime Constructs: a modelling perspective
Offence constructs: The Conchin et al case study - extended

Crime Constructs: a planning perspective
Illegal development
Offence constructs: The Conchin et al case study - extended

Crime Constructs: a temporal perspective
Shadow impact
Offence constructs: The Conchin et al case study - extended

Crime Constructs: a trigger perspective
Offender locations responsible for crimes psychologically induced by stress-triggered factors caused by prolonged sunlight deprivation
THE NEXT STEP FOR VISUALISATION IN THE MALTESE ISLANDS

WHERE SHALL WE GO FROM HERE?
Developing National Environmental Monitoring Infrastructure and Capacity

Structural Funds Project under the Operational Programme I Priority Axis 6

ERDF 156
Some Outputs

(1) Air Strategy and Data Acquisition
(2) Water Strategy and Baseline Study
(3) Noise and Radiation Strategy
(4) Chemicals in Soil Strategy
(5) Full LIDAR Scan: Terrestrial and Bathymetric
(6) Ground truthing for sea substrate type
(7) Oblique aerial imagery & satellite imagery
(8) Online information service
(9) Online mapservice - SEIS
(10) Statistical backing for experts – inc. spatial stats
(11) ALL Data is to be disseminated for FREE
The Area under Study

Maltese Islands coast inclusive of 1 nautical mile boundary from the baseline coastline
The Tools to enhance Visualisation

(1) LIDAR Scan: Terrestrial
   (Topographic Light Detection and Ranging (LiDAR))
   Digital Surface Model (DSM) and Digital Terrain Model (DTM)

(2) LIDAR Scan: Bathymetric

(3) Bathymetric Scan: Acoustic
   (interferometer swath and side scan sonar)
   Digital Surface Model and an acoustic information map of sea bed

(4) Oblique aerial imagery & orthophotos

(5) Satellite imagery

(6) Remote GPS Cameras (Remote capture GPS receiver)

(7) 3D scanner

(8) GIS Handhelds

(9) Global Navigation Satellite System Station and geodetic receivers
The Area under Study: 2007 - 2013
Visualisation: an exciting future!
Thank You