Hi-end spatial information systems:
a case for mental health

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Population Density and Offender Density Rates
- Both have very high rates: more than 1000plus
- Rates between 101 to 1000
- Both have less than 100

Figure 2: Small Area statistical analysis for Islands of Malta (bottom) and Gozo-Comino (top right), based on rates of population and incidence density.
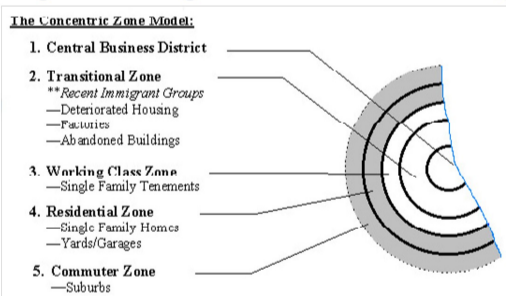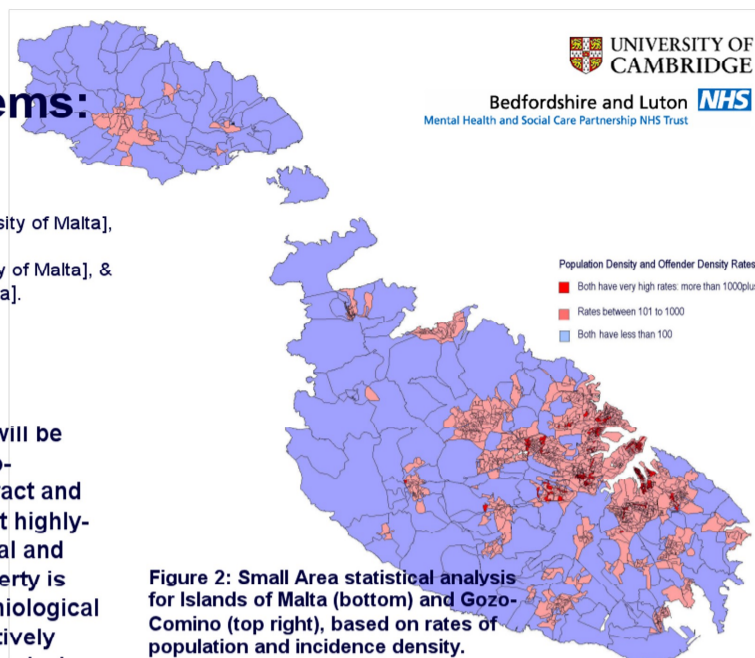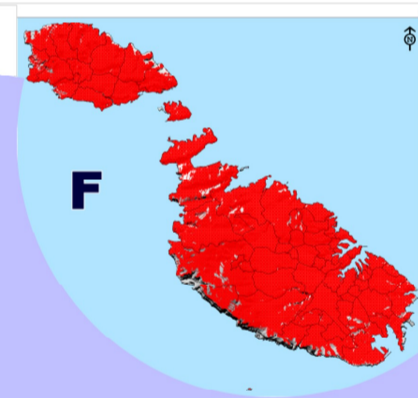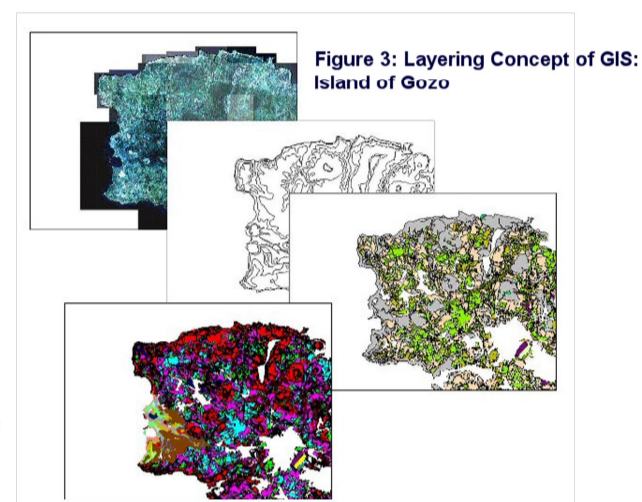
Introduction

This study description focuses on a discipline (crime) that is far removed from mental health in functionality, but the corresponding parameters show that the methodologies are essentially parallel and are based on a technology that is rarely employed in the medical sciences: spatial information system. Environmental criminology focuses its analysis on such parameters as remotely sensed data (satellites) and physical infrastructural features that influence the interactions between the discipline and the technology. There are issues to be learnt from environmental criminology which can be taken up by the mental health discipline.

What are the issues at stake?

Mental health 'incidences' are essentially tied to a spatial location: those parameters emanating from other than purely physiological and psychological triggers. The issue of spatio-temporal social interaction which identifies locational constructs such as patient's residence, everyday interactions and the resultant impacts of the neighbourhood fabric calls for a holistic approach in understanding health issues. This reality is why aetiology in mental health is described as bio-psycho-social. Recent observations suggest that serious mental illness [including Schizophrenia, Depressive psychosis and bipolar disorder] is more prevalent in inner cities. However, little explanation has thus far been offered as to what inner city socio-structural factors might induce the development of psychosis. The use of a variable such as mental health serves as an indicator of collective social well-being both in the social and health aspects. Various studies have investigated the use of hi-end systems to investigate the degree of relative deprivation and the degree of cohesion in a society, which essentially can be a cause of disorganization as well as impact on mental well-being (Townsend et al (1988); Hirschfield et al (1997); Kawachi et al (1997); Ellaway et al (1998); Kawachi et al (1999); Craglia et al (2000) and Ellul (2003).

Figure 1: Chicago School Model

The Concentric Zone Model:
1. Central Business District
2. Transitional Zone
   **Recent Immigrant Groups*
   —Deteriorated Housing
   —Factories
   —Abandoned Buildings
3. Working Class Zone
   —Single Family Tenements
4. Residential Zone
   —Single Family Homes
   —Yards/Garages
5. Commuter Zone
   —Suburbs

Source: http://www.csiss.org/classics/content/66

Based on an innovative Maltese spatio-temporal criminology study by Formosa (2007) that bridges the gap between urban-planning and socio-economic parameters, this study aims to further investigate the use of high-end geographical information systems (GIS) to serve as a tool for mental health epidemiological specialists (Helms, 2002). The Malta Study investigated routine-activity theory and opportunity theory, as based on the Chicago School Environmental Criminology model that investigated disorganization as based on successive spatial rings around cities (Figure 1).

The Crime Study

For this purpose, the original criminology study data will be used to demonstrate the method, which depicts spatio-temporal aspects based on where offenders live, interact and commit crime. The 50-year analysis' findings highlight highly-specific local-offender social situations with residential and poverty clustering. A feature of the system is that poverty is demonstrated by the use of government social/epidemiological data, which when analyzed produced maps of cumulatively higher and lower poverty risk (Figure 2). Residential analysis show a preference for the harbour region where offenders live in areas characterised by poverty that have disproportionate offender concentrations when compared to their shrinking population concentration.

The Mental Health Study

The review of Malta's crime within a social and landuse structure lead to a CRISOLA model which can be investigated within the mental health scenario particularly with reference to patient's residence location, social cohesion, the impacts of spatial planning on well-being (clustering and distance), inner city impacts on social parameters and the issue of hotspots in relation to the daily/seasonal/temporal patients' interactions.

This study shall investigate mental health epidemiology in the island of Gozo; taking into account the overlaying possibilities for incidence-reporting bias posited by the demographic, socio-economic, affluence and insularity factors (Figure 3). The intention is to map variables such as diagnosis and family history in correlation with the already established social factors, so as to identify correlation strengths with the social variables (Figure 4). The researchers will attempt to run a parallel London-area comparative study.

Figure 3: Layering Concept of GIS: Island of Gozo

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Note: The Malta Research team to include Maria Attard and David Borda

F

E

D

Marina
Bus Stop
Traffic Lights
Retail

St. Luke's Hospital
Detox
Bus Terminus
Parking Space

Housing Estate
Political Party HQs
Schools
Sports & Retail

A

B

C

Figure 4: Approaches to spatial analysis

The CRISOLA Model enables incidence analysis based on a theme (crime, health, activity) can be employed for diverse scenarios that link crime (and mental health) parameters to social variables and structural variables:

A) spatial information as extracted from remotely sensed imagery (Landsat image of Malta and the conurbation)
B) point mapping (geocoding and georeferencing) each incidence
C) spatial statistical analysis resulting in clusters at different scales and overlaid on social and landuse clusters
D) hotspot outputs identify 'hot-cold' incidence areas where inclusion of the social and landuse parameters helps identify sources of inquest
E) transposing the data to a 3D model enables visualisation of datasets as against 'causes' such as tall-building shadow impact on mental health
F) viewshed analysis to urban 'congested' areas results

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