Research on the modelling of real world crimes and better understanding of crime ...

Psychology, Success

Although the advancement of computational methods and the abundance of data on web have enabled the feasibility of performing ‘ micro-scale’ crime simulation, the complexity of human society still remains as the prominent difficulty when modelling crimes in real world. This project will try to find the key to solve this difficulty based on the widely known fact that social interactions (Smith, 1984; Glaeser et al. , 1996; Bellair, 1997) and their spatial relations with built environment (Schweitzer et al. , 1999; Wilcox et al. , 2003) are both reflected in the form of criminal activity. We, humans, are simultaneously born into a geographic landscape and a Social Network (SN) which is a configuration of interpersonal relationship that individuals develop and maintain (Fischer, 1982). Each one of us conducts ‘ social behaviour’ with other people using the intertwined systems of the social network and the geographic landscape to grow the ‘ social connectedness’ which could be consisted of the various societal indices representing the complex components of human communities (e. g. social cohesion, capital, integration, psychological sense of community, and etc.).

It means that the ‘ human social behaviours’ to develop the social connectedness are affected by the reciprocal relationship between ‘ social’ (SN) and ‘ geo-spatial’ (geographic landscape) influences. In this sense, the both, social and geo-spatial influences should be fairly reflected in modelling a crime simulation to better understand the criminogenic factors in human society. Unfortunately, the human social behaviours have been failed to be thoroughly reflected or modelled in crime simulations due to the discordance in the structures between SN and GIS. The geo-spatial features in a GIS setting are difficult to associate with nodes (also known as agents or actors

representing humans in real world) and links (also known as edges representing relationship and interactions between nodes) of a SN structure since the SN features are not topologically integrated with the built environment. So, GIS has rarely become a part of the crime studies using Social Network Analysis (SNA), and vice versa. If a SN could successfully be analysed in a GIS setting as a new layer to distil the human social behaviour into a crime simulation model, it will help to understand how offenders or victims/guardians socialize, share information, form social groups and decide to move to the destination to commit crimes within the complex geographic landscape. In this sense, this research project aims to develop the method to include a SN (social behaviours through interpersonal relationships) as a new layer into a GIS setting to construct a micro-scale crime simulation model. Research Areas and MethodologiesThe targeted research areas as methodologies for this project can be divided into 3 categories: 1)SNA, 2)GIS, and 3)Agent-Based Model (ABM). The coupling medium to connect these 3 research areas above is ‘ Crime’. The integration between SN and GIS must be driven by crime theories to compensate their structural differences. The one of the concepts in environmental criminology, ‘ environmental backcloth’, and one of its theories, ‘ crime pattern theory’, are the logical backups for this project. Environmental backcloth is that the relationship between crime and its location has an uncountable number of elements (Brantingham and Brantingham, 1993).

The backcloth includes physical features such as street networks, buildings and land-use types and social elements that effect how residents or passers-

by respond to a crime event (Brantingham and Brantingham, 1993; 2008). ‘ Crime pattern theory’ also developed by Brantingham and Brantingham (1981; 1993) encompasses the two well-known crime theories, routine activity and rational choice. Crime pattern theory has attempted to explain the social (environmental) factors to provide comprehensive explanation of crime. It considers how the routes used to travel around a city influence knowledge of the environment, behaviour, and the spatio-temporal locations in which offenders are likely to commit crimes (Brantingham and Brantingham, 1981; 1984; 1993). ‘ SNA’ focuses on understanding the structure of interpersonal relationships in a network, and ‘ GIS’ uses spatial attributes in geographic landscapes. ‘ ABM’ can be an extensive setting as a pot to distil heterogenous social factors into a single dish by capturing the behaviours of individuals. In this sense, these three areas are chosen to be investigated as methodologies to embrace the logical backups. The fundamental step that must be preceded to conduct this project should be explained first: creating a synthetic population. This is the main reason why I request the data from CDRC. As aforementioned, the aim of this project is to develop a micro-scale crime simulation model using the social (environmental) factors drawn by integrating a SN as a layer into a GIS setting. All micro-simulation models ‘ must’ be fed up with individual-level data. Creating a ‘ virtual population’ based on 2 or 3% of given micro-scale population data (the process called, ‘ synthetic population’ or ‘ population reconstruction’ in other literature.) is mandatory to develop a simulation model. The initial plan was to create a synthetic population by myself through the comparison between Iterative Proportional Fitting (IPF) and

Iterative Proportional Updating (IPU). The creation of the realistic synthetic population is not the aim of this research project. It will be very helpful to initiate my research if CDRC can cooperate with me by offering the data. SNA models connections between individuals or groups with nodes (vertices, points, actors), and links (relationship, interactions) between them. It means that SNA is able to offer a systematic approach for investigating large amounts of data on individuals and their relationships.

The structure of such SNs can be studied which can give answers to specific group or individual behaviours using different measures. Due to this reason SNA has gained popularity in criminology to understand the essential condition for many serious criminal behaviours. SNA will be thoroughly conducted by reviewing the four characteristics of criminal networks (Sparrow, 1991) based on the socio-centric network approach which focuses on the quantification of ties between individuals within a defined group or domain (DeJordy and Halgin, 2008). GIS is a technological system that incorporates geo-spatial features with data in order to visualise, analyse, and assess the problems or events in real-world. Unfortunately, there are few examples of how to include SN as a layer in a GIS setting. Measuring the interpersonal relationships by distance between nodes used in SNA is a good way to explain the inextricable system of SN. This method, on the other hand, does not account for the structures of geo-located social groups or real-world events. It also fails to emphasise geographic landscape, city form, accessibility and the spatial configuration about real-world events. It also does not reflect how we, humans, interact with the built environment and the

obstacles we face in decision making process. In this sense, this project will try to spatialise (geo-locate; spatial join) the nodes of a SN in a GIS setting to make each node represent an individual or a group of people in a set of certain locations or areas. This ‘ spatialisation’ process will provide the possibility to understand the area where an individual frequents in a certain time frame, within a certain locale, or to perform a set of activities based on the analysis of social relationships in geographic space.

ABMs will be investigated to be utilised when it comes to the phase of modelling crime simulation. This modelling technique can be easily linked with GIS in the various fields of studies, because of the ABM’s ability to model the emergence of phenomena through the individual interactions of features in a GIS setting over space and time (Najlis and North, 2004). This ABM’s capability will give a better opportunity to understand the dynamics of crime patterns in complex system. This project will use this simulation outputs to generate new insights of, as mentioned above, how individuals socialize, share information, form social groups and decide to move to the destination to commit crimes within the complex geographic landscape.