Tools for web-based GIS mapping of a "fuzzy" vernacular geography.

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Introduction

Every day, billions of people exist in a vernacular geography very different from that captured by standard geographical techniques. Millions of us "go uptown for the evening" or "go down the shops on Saturday", meaning particular geographical areas, but without a clear definition of where or what they are. We avoid "the rough end of town" late at night or park away from "high crime areas" without clear definitions of what these terms mean geographically, despite their links with our behaviour. Such vernacular geographical terms are a good thing: the use of metaphors like "the East End" or "the grim area down by the station" allows us to communicate geographical references that often include information on associated environmental, socio-economic, and architectural data, and they place us in a connected socio-linguistic community with shared understandings and, less fortunately, prejudices. These vernacular geographical terms are not simply communicative - they often represent psychogeographical areas in which we constrain our activities, and convey to members of our socio-linguistic community that this constraint should be added to their shared knowledge and acted upon. This private and shared vernacular geography influences billions of people every day, and yet, because of its difficult and subjective nature, it is hard to tie directly to objective data so we can use it to make policy or scientific decisions.

There has been a growing body of work in the last few years using fuzzy logic to define ambiguous geographical data (for a review, see Jacquez *et al.*, 2000). Ambiguous or fuzzy geographical boundaries can be used between areas when one or more of the following criteria are present…

1. Continuousness: when boundaries are difficult to define because the measurements of an entity produce a gradient.

2. Aggregation in the categorization of variables: where discrete boundaries actually represent the average location of a geographically varying set of continuous or discrete variables that are binned together for descriptive convenience (soil types, for example).

3. Averaging: where discrete boundaries are actually an average of time or scale varying geographical boundaries.

4. Ambiguity: where boundaries are tied to linguistic factors (for example, "high" crime areas).

Imagined areas that are casually (rather than scientifically) constructed by human beings tend to display all four of these criteria. When asked, for example, to outline and justify areas where they think crime levels are high, most people will draw on a slew of continuous and discrete variables at differing scales of detail, historical experiences, urban morphology and mythology, as well as introducing linguistic ambiguities. The resultant areas may be bound by prominent landscape features, usually for convenience, but are more often diffuse. The level at which an area is perceived to belong to a category like "high crime" often drops off over some distance, and the actual areas themselves internally often have more or less "high crime" zones.

Recording and Utilizing Vernacular Geographical Entities

Here we present three GIS tools aimed at recording and manipulating such fuzzy vernacular or perceived areas, using a web-based public participation study of the location of "high crime" areas in Leeds as an example.

The tools presented span the needs of a GIS system user, from input to output. They are…

1) A user input tool: specifically, the user is given a spray can tool, familiar from many image editing packages, with which they can define fuzzy areas on a map (Figure 1). The spray can is currently a dot-density can, rather than a continuous surface with increasing values. Attribute information can be attached to the fuzzy area.

2) A storage and weighting tool: this aggregates results from multiple users and also stores their individual areas and attributes.

3) A querying tool: this allows individuals to query aggregate datasets from multiple users, and displays the attribute information back to the users (Figure 1). The attributes are ranked on the basis of which users rated a particular point as most important (highest surrounding density of spots). That is, a point location is assessed as to which user-defined fuzzy set it has greatest membership of, and this set's attributes are displayed, followed by the second greatest membership etc.

In the study users defined fuzzy areas where they thought there were high crime levels, giving more weighting to some areas within their fuzzy boundaries than others (Figure 1). In addition, they could attach comments to their areas as attributes. They could then view a composite map combining all the areas perceived by the whole community of users, and view people's comments associated with specific locations.

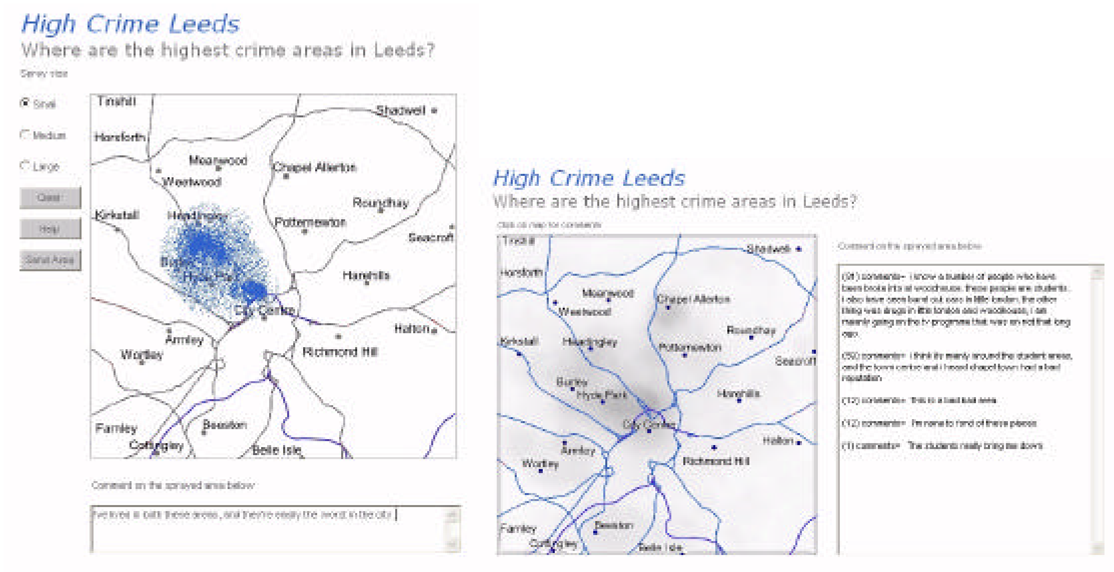

Figure 1: Left: user inputted area of perceived "high crime". Right: Output showing all user areas aggregated and ranked comments for one area.

The study system captures those locations individuals, and the community in general, believe have the highest level of crime. These can then be compared with absolute crime levels to determine the answers to such questions as: “where do people have mis-perceptions as to the level of risk from crime” (Figure 2) or “what level of crime do people notice as ‘high’” (if the areas had matched), as well as allowing the users themselves to gain from reflections such as “how scared of crime are my neighbours” and “does anyone else feel the same way as me”. Initial analysis of user feedback suggests the system was well received by users (Figure 3) encouraging further trials comparing the ease of use explicitly with more traditional interfaces.

Further information can be found at http://www.ccg.leeds.ac.uk/democracy/

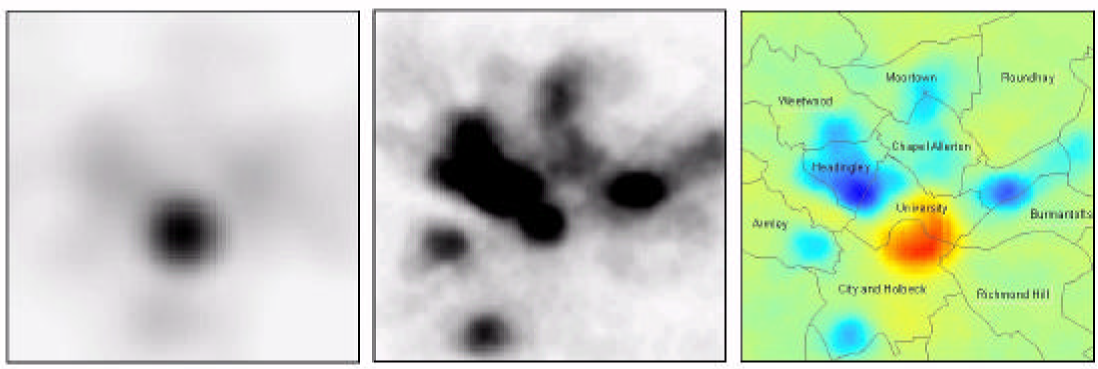

Figure 2 : Left: Total crime densities for Leeds for all crimes recorded in 2002. Darker areas are higher in crimes. The circular high is real and largely reflects the position of the inner ring road. Centre: Areas selected as “high crime” areas by users cumulated from August to September 2002. Darker areas are thought higher in crime. Right: Difference in perceived and real crimes, generated after stretching the highest perceived crime area levels to the highest real crime levels and the lowest perceived crime levels to the lowest crime levels. Red areas have higher crime than expected, blue areas lower. Wards are shown for reference.

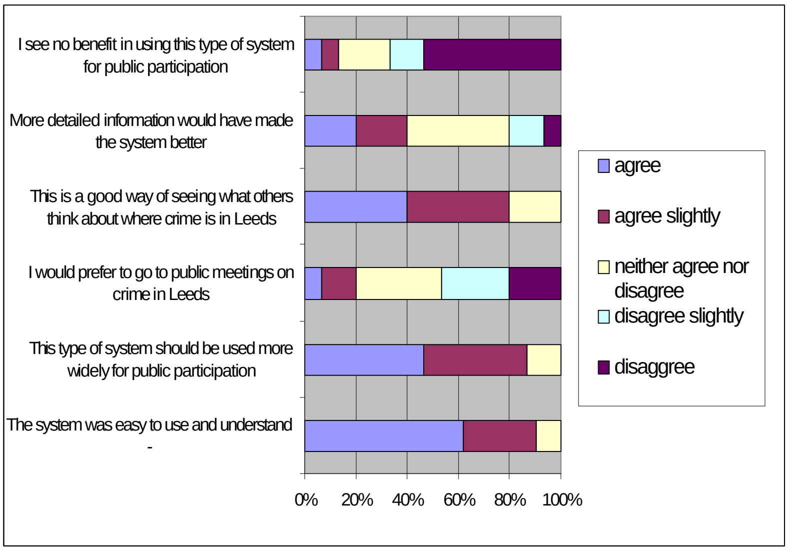

Figure 3: User feedback garnered by questionnaire at the end of system use.

References

Jacquez, G. M., Maruca, S., and Fortin, M.-J. (2000) From fields to objects: A review of geographic boundary analysis. *Journal of Geographical Systems*, 2(3), 221-241.

Biography

Tim Waters is currently research assistant in the Centre for Computational Geography at Leeds University, but is leaving to take up a position working on mapping crime for Bradford Council in a project aimed at integrating the community into the fight to reduce crime in the city. Dr Andrew Evans is a lecturer at the University of Leeds, and works, amongst other things, on systems for enhancing the democratic process through web-based GIS.