Utilizing Volunteered Information for Infectious Disease Surveillance

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ABSTRACT

With the advent of Web 2.0, the public is becoming increasingly interested in spatial data exploration. The potential for Volunteered Geographic Information (VGI) to be adopted for passive disease surveillance and mediated through an enhanced relationship between researchers and non-scientists is of special interest to the authors. In particular, mobile devices and wireless communication permit the public to be more involved in research to a greater degree. Furthermore, the accuracy of these devices is rapidly improving, allowing the authors to address questions of uncertainty and error in data collections. Cooperation between researchers and the public integrates themes common to VGI and PGIS (Participatory Geographic Information), to bring about a new paradigm in GIScience. This paper outlines the prototype for a VGI system that incorporates the traditional role of researchers in spatial data analysis and exploration and the willingness of the public, through traditional PGIS, to be engaged in data collection for the purpose of surveillance of tsetse flies, the primary vector of African Trypanosomiasis. This system allows for two-way communication between researchers and the public for data collection, analysis, and the ultimate dissemination of results. Enhancing the role of the public to participate in these types of projects can improve both the efficacy of disease surveillance as well as stimulating greater interest in science.

Keywords: African Trypanosomiasis, Disease Surveillance, Geographic Information Science (GIS), Kenya, Spatial Databases, Volunteered Geographic Information (VGI)

INTRODUCTION

Recent publications surrounding Volunteered Geographic Information (VGI) broadly represent the belief among some in the academic community that non-scientists can be engaged in and benefit from spatial data analysis (Connors et al., 2011; Flanagan & Metzger, 2008; Goodchild, 2007a, 2010), a field previously reserved exclusively for academics. Focus on VGI represents a paradigm shift from viewing science as having a single authority (the scien-
tist) to a model where authority is relative and expressed contextually. Abundance, repetition, and the collective assessment of data (as well as the ability to correct) convey credibility to information that would not necessarily exist otherwise (Connors et al., 2011). In this sense, a non-scientist plays a role in validating data collected by others, and collectively assessing data quality (Craglia, 2007).

The concept of Web 2.0 incorporates bidirectional collaborations in which users collectively collate spatial data, stored in a central cloud repository and accessible by anyone for whatever purpose deemed worthy. The Web 2.0 paradigm is represented widely through web projects such as Wikimapia, OpenStreetMap, and even Google Earth. Within the context of these volunteered GISystems (VGIS), users contribute information to develop a collective knowledge base. Recent advances in mobile technology have furthered the applicability of Web 2.0 projects, enabling easier access to the information, and even allowing for novel uses of crowd-sourced information (Rosenberg, 2011).

Sui (2008) extends the paradigm to include “the wikification of GIS”, a notion which he defines as being the shift in perception that only people who are specifically trained to “do GIS” should interact with spatial data and perform analysis. It is upon this notion, specifically, that VGIS endeavors to enhance the role of the user in the collection and analysis of spatial data.

The use of volunteered information for disease surveillance draws upon themes in the participatory GIS (PGIS) literature in suggesting that GIS technologies can operate in concert with volunteered information and local knowledge (Boroushaki & Malczewski, 2010b; Connors et al., 2011; Elwood, 2010; Flanagin & Metzger, 2008). The key distinction between classical PGIS methods and VGIS involves the role of the scientist. We refer here to McCall’s (2005) discussion of good governance through improving dialogue, legitimizing and using local knowledge, the redistribution of resources access and rights, and new skills training in geospatial methods. These concepts support the idea that a PGIS or VGIS approach can contribute to the adoption of new technologies for disease surveillance.

**BACKGROUND**

**Traditional Paradigm**

The traditional paradigm in GIScience partitions individuals into experts versus non-experts. In an academic context, this treats scientists as the experts and citizens as non-experts. Under this traditional paradigm, public participation in the research process is hindered by a number of factors. Most importantly, the traditional roles of experts (scientists) versus the public leaves little room to consider alternative knowledge bases (i.e., local knowledge). Furthermore, there is limited opportunity for citizens to become informed, equal participants; thereby limiting the potential applicability of any results/understanding gleaned from the research process (Boroushaki & Malczewski, 2010a).

Under the traditional GIS model, technology and software are not readily accessible, requiring either a specific skill set or simply being priced beyond the consumer market. Therefore, citizens are relegated to operating as consumers of information exclusively, or as indirect producers, mediated by communication to researchers in small group projects. Their interaction with the data in this regard is strictly as a provider of information, not as producers of spatial data products. Finally, the traditional GIS model treats data validation as achieved largely through reputation (Flanagin & Metzger, 2008). Scientists and researchers are perceived as producers of reliable data due to past training in data collection and analysis. Furthermore, the peer review process adds credibility by requiring outside researchers to assess quality. Broadly though, data collected by researchers are assumed to be reputable because it is collected within the context of academic endeavors, and done by trained individuals. Information of this sort is generally accepted to be true until shown to be otherwise. With
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