Geographical Social Production: Lessons from Cyclopath

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ABSTRACT
Geographical Social Production (GSP) is a recent phenomenon created by the confluence of geographical and the open content philosophies. In this position paper, we report a few lessons we learned through our experience and research with one such GSP system, Cyclopath, a route-finding geowiki for bicyclists. We believe these lessons would help drive critical thinking about how to make GSP systems better and more efficient.

Author Keywords
social production; geographical social production; geowiki; geography; HCI.

ACM Classification Keywords
H.5.m. Information Interfaces and Presentation (e.g. HCI): Miscellaneous

General Terms
Human Factors; Design.

INTRODUCTION
Social production communities are those in which large numbers of people freely collaborate on tasks and produce common goods. With the advent of the Internet, this phenomenon has reached new heights and has revolutionized the way content creation in the world works today. For example, Wikipedia, has over ten million articles, and Yahoo! Answers has received over a billion answers.

Geographical Social Production (GSP) is a more recent phenomenon created by the merging of open content philosophies and geographic content—Google Maps and its peers have made easy-to-use and high-quality maps available to anyone with a web browser, and their associated APIs have supported several products that involve users submitting location-bound information. GSP thrives at the unique boundary between Geography and Human-Computer Interaction (HCI) and offers tremendous potential for interdisciplinary innovation.

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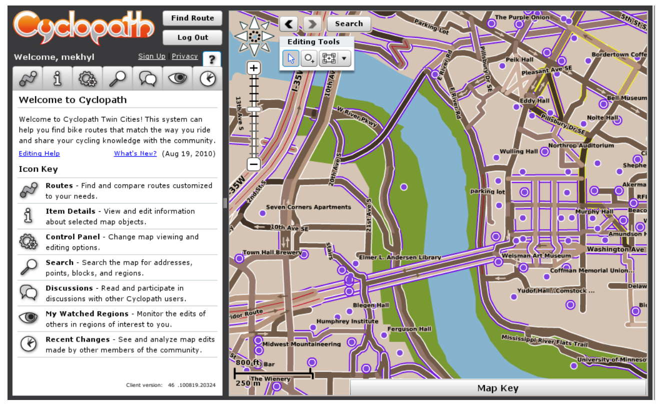

Figure 1. Cyclopath: `cyclopath.org`

This position paper focuses on one such GSP system: Cyclopath. Cyclopath (Figure 1) is an online geographic wiki that offers route-finding services for cyclists in the metropolitan area of Minneapolis-St. Paul, Minnesota, USA. Like any wiki, users contribute information to Cyclopath in sets of edits called revisions. When a user makes the desired edits in the Cyclopath interface (e.g. add a point) and clicks "Save Changes", they are saved as a single revision associated with the username of the user (if the user is logged in), IP address and a time-stamp. All revisions are publicly visible and revertible (via the Recent Changes list).

Each revision may contain edits to points, blocks, regions, notes and tags. Blocks (roads and trails) are useful for route-finding, points help define route endpoints, tags enable more customized route requests (e.g., a route that is more *scenic*, but less *bumpy*), and notes supplement blocks included in a route with subjective information useful for evaluating the route (e.g., "icy during the winter").

Our analyses have found that user work has had a positive effect on route finding in Cyclopath—user input has decreased the length of the average route by 1 km since Cyclopath went live [3] in the Summer of 2008.

FACILITATING GEOGRAPHICAL SOCIAL PRODUCTION
The process of social production of geographical data is more complex than that of textual data due to the inherent complexity of the data being gathered. For example, contributing to Cyclopath's road network involves not only using the graphical editing tools to add the road segments on to the map, but also setting their attributes correctly and connecting them

appropriately to the rest of the network. However, in our research and experience with Cyclopath, we have found success with several techniques that can help elicit more GSP and focus it in areas where needed.

Direct input. A straightforward way of facilitating GSP is by direct data input. We found that visually highlighting areas where work is needed elicited more social production than not doing so [3]. Additionally, we found that directing users' attention to areas more familiar to them resulted in more GSP when the work involved required local knowledge, such as rating the bikeability of a road segment. We speculate that this is because rating a road requires familiarity, but repairing connectivity at an intersection does not: users can examine aerial photos to make such contributions.

Matching GPS data. The proliferation of GPS-enabled devices in recent times provides an excellent source of information on where users ride. We implemented an Android application for Cyclopath with the aim to study how GPS traces can help facilitate GSP. We extended an Hidden Markov Model-based map-matching algorithm to handle missing road segments. We tested our algorithm using Cyclopath map data and GPS traces obtained from real-world usage of the mobile version of Cyclopath. We found that even for conservative cutoff distance values, our algorithm still found a significant amount of missing data per set of GPS traces [5].

Harnessing route feedback. When one requests a route on Cyclopath (or any other system), one has a tendency to develop an evaluation about the obtained route. We analyzed 488 instances of private route evaluation through manual coding using crowd-sourcing on Amazon Mechanical Turk. We found that 24% instances contained positive evaluations about roads/areas whereas 48% contained negative evaluations. Combined, 57% contained either a positive or a negative evaluation. These could potentially be translated into bikeability ratings. We also found that 51% instances contained some objective information about roads, their surroundings or about vehicles on them—potential candidates for translation into notes or tags. Finally, 39% instances contained descriptions of alternative routes. These descriptions may help us improve Cyclopath's route-finding algorithm as well as indicate road segments users like/dislike.

INTER-DISCIPLINARY BENEFITS

Unlike Open Streep Map, Cyclopath did not start out as a blank map: Its database was initialized with the best existing geographic datasets available to us – road and bicycle facility datasets provided by the Minnesota Department of Transportation. As a result, Cyclopath was able to provide route-finding services from the day it went live. This is a clear instance of Geography benefitting HCI.

Cyclopath also experiences the otherwise: HCI benefitting Geography. The recent years have seen the development of several map-based, citizen science applications that have been useful for planning purposes. For example, FixMyStreet (`fixmystreet.com`) and SeeClickFix (`seeclickfix.com`) empower citizens to report potholes and local issues from their neighborhood on a map so that the city authorities' attention can be directed towards them.

We designed a novel bicycling route analysis tool built on top of Cyclopath. It empowers transportation planners to analyze cycling routes and connectivity in the transporation network by tapping into the local knowledge of citizens through an easy-to-use web interface. Using this tool, planners can perform tasks such as bikeability gap analyis and alternatives analysis that help them decide where to focus their bike facility development efforts [1].

Route analysis on Cyclopath gets its distictive advantage over other, similar, planning tools due to the underlying geowiki architecture. First, Cyclopath's transportation network is maintained by citizen cyclists who often add shortcuts such as parking lots (segments valuable to cyclists, but not found on traditional maps that are designed for motor vehicles) to the map. Second, user-gathered bikeability ratings make for more personalized route-finding [4]. Together, these factors make route analysis more accurate and closer to the ground reality. Finally, user-gathered notes help in understanding the results of route analysis tasks and in understanding why users like or dislike certain road segments.

PRIVACY CONCERNS

Due to the geographic nature of Cyclopath activity, privacy could be a concern. In most systems, selecting "where" to view or edit means choosing a *topic* of interest, but in Cyclopath, it means choosing an *area*. The relationship between editing and viewing is unusual because editing is public behavior but viewing is private. Therefore, to the extent that viewing and editing are correlated, users' private activity may be inferred.

To see if viewing and editing activity are related, we looked at the association between users' viewport coverage—the fraction of a user's viewports that are intersected by *any* object modified by that user—and the number of revisions made by that user. We found that viewport coverage increases with the number of revisions and approaches completeness for the most prolific editors [2]. In other words, the more users edit, the more they are revealing about their private viewing activity. Follow-up studies with users are needed to investigate how sensitive they consider their viewing activity to be.

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