

# Local Knowledge Matters for Crowdsourcing Systems: Experience from Transferring an American Site to China

Fernando Torre<sup>1</sup>, Yanjie Liu<sup>1</sup>, Zhengjie Liu<sup>2</sup>, Loren Terveen<sup>1</sup>

<sup>1</sup>GroupLens Research, Department of Computer Science and Engineering  
University of Minnesota, Minneapolis, MN, USA  
{torre,yanjie,terveen}@cs.umn.edu

<sup>2</sup>Sino-European Usability Center, Dalian Maritime University, Dalian, China  
liuzhj@dlnu.edu.cn

## Abstract

We present the results of a preliminary cross-cultural study of Cyclopath, a geographic crowdsourcing system for cyclists. We created a Chinese version and tested it in lab with 40 cyclists in Dalian, China. We analyzed the data entered by users and found some significant differences compared to similar studies done in the US; this illustrates the need for local knowledge in crowdsourcing applications. From usage patterns and interview data, we observed that landmarks play a larger role for navigating the map and requesting routes; this suggests that integrating landmarks better into the Cyclopath UI could improve Chinese users' experience with the system. Finally, we found that concepts of authority and hierarchy may influence Chinese users' trust of peer-contributed content; this suggests that reputation mechanisms may help improve trust.

## Introduction

Picture Peter, a fictional cyclist in the Twin Cities, Minnesota, USA, giving instructions to his friend on how to bike to where they will meet for dinner. He gives directions such as "head south on Hennepin Ave" and "turn left at 12th street". He assures him that even though it is downtown, there are bike lanes to make his trip safer. He gives him the name of the restaurant and informs him of a bike rack just one block away from the restaurant where he can lock his bike.

Now picture Peng, a fictional cyclist in Dalian, China. Peng finds himself in a similar situation to Peter. He gives his friend directions such as "take Zhongshan Road towards Xinghai Park" and "turn right after Dongcai University". He reminds his friend to be careful of the hectic traffic and to be aware of the big hill near Dongcai University. The restaurant is a little hard to find, so they plan to meet at a nearby, recognizable park and walk together from there.

Cycling is one of the most common forms of exercise, recreation, and transport around the world. Yet the geographic, structural, and cultural characteristics of a location can significantly impact the cycling experience. So how do these differences in turn affect geographic crowdsourcing applications? What is their impact on the success of such

applications? In order to explore these questions further, we took Cyclopath, a geowiki for cyclists in the Twin Cities and created a Chinese version for cyclists in Dalian.

## Cyclopath

Cyclopath<sup>1</sup> is an editable map that provides route-finding services for cyclists. Users can edit road segments (blocks) and places of interest (points). They can also add tags and notes to both blocks and points. Additionally, users can rate the bikeability of blocks. These ratings are used by the route finder to compute bike-friendly routes. Users can further personalize their routes by specifying preferences for different tags. Furthermore, since Cyclopath is a wiki, users can monitor and revert any changes to the system.

## Twin Cities

The relatively flat Twin Cities metropolitan area covers about 8,000 km<sup>2</sup> and has a population of about 3.3 million people. Even though the winters are cold and cycling numbers drop during those months, it is still considered one of the most bike-friendly areas in the US<sup>2</sup>.

## Dalian

Located in the northeast of China, Dalian is a mountainous region covering an area of about 13,000 km<sup>2</sup> and with a population of almost 6.2 million people (3.6 million in urban areas). Although not as cold, it also experiences seasonal temperature differences that affect the cycling experience. Its infrastructure was changed in favor of cars, moving cyclists to the pedestrian space, making it a not very bike-friendly city. Dalian's different culture, geography, and infrastructure and its similar area, population, and seasonal changes make it an ideal city to compare with the Twin Cities.

## Research Questions

**RQ1. Contributed Content.** What type of content will users in Dalian contribute and how is it different from the content contributed by users in the Twin Cities? This will help us better understand the cultural, geographic, and infrastructure differences between the two cities.

<sup>1</sup><http://cyclopath.org>

<sup>2</sup><http://www.bicycling.com/news/featured-stories/1-bike-city-minneapolis>



Figure 1: Chinese version of Cyclopath UI

**RQ2. Usage Patterns.** Are there any differences in usage patterns, such as when browsing the map or requesting routes? Significant differences when interacting with the system could suggest design changes that need to be made to better support Chinese users.

**RQ3. Authority and Trust.** Is there any evidence of the role of authority in the system and how it affects trust? The hierarchical and collectivistic nature of Chinese culture may affect users' trust of peer-produced content and may lead to a desire for greater authority, crucial issues for crowdsourcing applications.

## Methods

To prepare Cyclopath for Dalian, we translated over 800 English phrases in the Cyclopath UI and populated the road network with map data imported from Open Street Map. Given that this was an experimental study, some features such as elevation data and aerial images, were not included. Figure 1 shows a screenshot of the final interface.

We conducted user studies of about one hour with 40 cyclists in Dalian. The studies were conducted in Chinese by a Chinese member of the research team while an American researcher watched from a separate observation room.

User studies consisted of a set of interview questions and tasks. We began with some ice-breaker questions about a recent cycling trip, followed by questions related to riding behavior, their involvement in the local cycling community, and their experiences with online communities.

This set of initial interview questions was followed by the tasks portion of the study, where we asked subjects to: 1) enter 4 points on the map, 2) request a route of their choice, 3) enter 4 tags and 4 notes for blocks and/or points, and 4) rate the bikeability of at least 10 blocks, on a 5-point scale ranging from *Impassable* to *Excellent*. All data entered was made visible to subsequent participants.

After completing these tasks, users were asked a set of questions about their experience with Cyclopath, motivations to use the system, potential benefits gained from us-

ing the system, anonymous use of the system, and trust of information contributed by others.

We recruited participants with the help of local bike clubs. Subjects were 18 or older and had cycled at least three hours or 20km during the year preceding the study. Participants were compensated in cash for their time.

Half of the 40 subjects were students. 36 subjects were men and 4 were women. 12 subjects had more than 5 years of experience cycling in Dalian. When asked about why they cycled, 38 said they did so for recreation purposes, 22 said they cycled for training, and 16 selected commuting as one of their reasons.

## RQ1. Contributed Content

Subjects in our study entered a total of 168 points, 98 tags on blocks, 81 tags on points, 83 notes on blocks, and 78 notes on points. We manually coded this data and compared it to the results of previous US studies (Priedhorsky and Terveen 2008; Torre and others 2010). The following were the key factors we found that affected the types of data contributed:

**Geography.** Given that Dalian is a mountainous region, as opposed to the generally flat Twin Cities, many more notes on blocks were descriptions about slope (22.5% of all block notes). Additionally, 18.1% of all notes on blocks related to scenery. This is in part due to Dalian's many mountain and sea views. For many of our subjects, whose primary purpose for cycling was recreation, thinking about which routes would be most enjoyable often led them to think about geographical features and sceneries.

**Culture.** As an example, Dalian subjects did not enter points related to arts (compared to 10.9% for US users). This may be in part because of a noticeable subculture in the US of people who value both arts and eco-friendly activities such as cycling. However, it was not uncommon to find points related to culturally popular places such as Karaoke venues.

**Landmarks.** What serves as useful landmarks in Dalian is different than in the US. For example, Dalian users entered fewer points related to food (16.8% vs. 36.4%). Restaurants in Dalian tend to be numerous, but with similar offerings and small in size. This makes it harder to remember restaurant names and makes them less useful as landmarks. In contrast, subjects entered more community resources (43.1% vs. 17.1%), such as hospitals and schools, presumably because they served as useful landmarks.

**Cycling infrastructure.** While the amount of cycling-related data entered by users was similar to the US studies, the type of content was often different, reflecting the different cycling infrastructures of both cities. For example, there were no mentions of bike lanes in Dalian, even though that is one of the most popular tags in the US system. Bike racks, which accounted for 12.7% of all notes on points in the previous US study, also went unmentioned in Dalian. Bike racks are harder to come by in Dalian, so cyclists might be used to other alternatives for securing their bicycles.

**Discussion** We found that users in Dalian have a significant amount of cycling-related knowledge to contribute. But there were many cases where the type of data contributed

was quite different from that in the US. For example, marking bike racks was not as important for cyclists as specifying properties of road and trail segments like slope and scenery. These differences highlight the utility of crowdsourcing systems such as Cyclopath, where local knowledge is leveraged to provide users with information and insights that are relevant to them. Attempting to control or limit the type of information that users can contribute could hinder the capture of knowledge concerning geography, culture, and infrastructure required to meet user needs.

## RQ2. Usage Patterns

As we conducted our studies, we observed an interesting pattern in the users' interactions with Cyclopath and answers to interview questions: *landmarks* played a major role for navigation and route finding.

One of the first signs of these patterns was that when asked to add points of interest, most users would go for the same well-known landmarks. Afterwards, they would tend to add new points around that landmark. Users expressed the importance of landmarks for finding (or adding) other nearby landmarks:

*"There are no landmarks. I have to zoom in enough to see the small characters on the points. But in Baidu Map, I can see the name on those landmarks even when it is in low zoom level. For example, if I want to add a point near Dalian Maritime University (DLMU), I'm used to finding DLMU first."*

*"If there is no other point around the point I want to add, it will be a little difficult for me. Because sometimes I can't remember the name of the blocks but can remember the bus stop signs near it and some landmarks."*

The second sign was the low use of addresses for requesting routes. Most users didn't know the addresses of their desired destinations and so preferred to route to nearby recognizable landmarks. In order to better facilitate this, we actually switched the order of the tasks so that users could add points first, whereas the original script had users asking for routes first. Users expressed to us the utility of landmarks when getting directions and finding new routes:

*"Adding points is important. The map is currently not very full of points. When I go out if I can't find landmarks I can't find my way."*

*"If I want to ride on a brand new route, I will check the map to find some landmarks before I start off."*

**Discussion** Navigation patterns have been found to vary from location to location depending on the cultural, geographic, and infrastructural properties of the place. These patterns can even vary within the same country (Li and Zhang 2009). Dalian cyclists' use of landmarks is evidence of infrastructural and geographic differences between Dalian and the Twin Cities. The smaller amount of grid-like road networks in Dalian, which is often a result of roads going along mountains, rivers, and similar large obstacles, results in a need for more navigation aids.

The use of landmarks in Dalian has important design implications for Cyclopath. First, cyclists use landmarks to orient their exploration of the map; however, in the current UI, when the map is zoomed out, main roads, bodies of water, and green spaces are shown – but no landmarks. Therefore, modifying the display to make some landmarks always visible, especially when zoomed out, would be useful. Second, landmarks should be used when showing computed routes, both displayed as part of the route visualization on the map and included in step-by-step text instructions, e.g., "Turn right after Xinghai Square".

## RQ3. Authority and Trust

Researchers have often studied the cultural differences between how Chinese and Americans use collaborative systems. Culturally-influenced views regarding areas such as authority can greatly influence user experience of a system (Liao and others 2010).

Hofstede's culture model, which categorized cultures based on five dimensions (Hofstede 2001), is frequently used to help explain cross-cultural differences. The dimensions *Individualism* and *Power Distance* seem particularly relevant to the subject of authority and trust in an open content system like Cyclopath. Individualism refers to the degree to which a culture emphasizes an individual's reliance on the self. Collectivistic cultures such as China might be more motivated to contribute to crowdsourcing applications for the benefit of the community (or by social pressure), but may also avoid contributing for fear of disrupting the harmony of the group. Power distance refers to the extent to which less powerful people in a society accept inequality of power and consider it normal. Users from hierarchical societies might have different expectations of the role of authority in such systems.

Given the traditional respect for authority and hierarchy in Chinese culture, we were interested in seeing how this affects users' trust within Cyclopath. Because more extensive and real-world usage of the system is required to truly dive into these issues, a direct comparison with the US site was not possible. Therefore, we focused on finding preliminary evidence of these factors during our interviews.

When thinking about online trust in this paper, we do not focus on how our site affects users' perception of trustworthiness about the site, but on how our system supports trustworthy behavior (Riegelsberger and others 2005). We are interested in knowing if users are willing to consume information contributed by other users. As in all situations where trust is required, there is a certain risk and uncertainty involved when doing so.

When asked whether they trusted content contributed by other users, only about a third of users (32.5%) in our study did. If we look only at subjects who were students, this increases to 45%, suggesting that there might be a higher tendency to trust contributed content among students, who are generally younger and more exposed to online content.

**Authority** Trustworthy behavior can be incentivized by the existence of authorities who supervise contributions and sanction behaviors that decrease trust. Comments from

a number of subjects touched on the theme of authority, specifically through a desire for content contributed by professionals and for administrators to play a role.

*“I’m worried about the limits of authority. An administrator should supervise the changes made by users.”*

*“I hope to have content written by both official organizations and the users.”*

**Reputation** Another mechanism that can motivate trustworthy behavior is reputation. As explained by Riegelsberger, reputation mechanisms require stable identities and the traceability of actions. Stable identities are supported in Cyclopath through usernames (although users are not forced to log in in order to contribute). Because Cyclopath is a wiki, all past contributions of any user can also be traced. Although not an explicit reputation measure, users’ work histories serve as reputation builders and evidence of past, trustworthy contributions.

Given that it is harder to establish reputation for anonymous users, we asked participants whether they trusted content contributed by anonymous users. Half of the users said they would trust content contributed by logged-in users more, but the reasons for this varied:

**Experience.** Some users correlated logging in with experience. To them users who have used the system for a long time will naturally decide to log in.

*“I trust logged-in users better because they have used the system longer.”*

**Accountability.** Some users felt that logging in gave users a sense of responsibility for their edits that anonymous users didn’t have.

*“I believe logged-in users more, because they can have a sense of responsibility ”*

**Community.** Anonymous usage affects the sense of community among users, something very important in a collectivistic country such as China.

*“I trust logged-in users more than anonymous users... When you communicate with a logged-in user, it is like you are communicating with a person. But when you communicate with an anonymous user, it feels like you are communicating with a computer.”*

**Discussion** So how can we motivate users to build trust? First, we need to help users trust peer-contributed content, especially by anonymous users. Second, we need to motivate users to log in so that their contributions are trusted more.

Techniques such as feedback, points, and ranks are good ways to not only motivate users to log in and use the system, but also increase other users’ trust. Making user rank and experience more transparent helps support the Chinese views on hierarchy and thereby improve trust. Users were already thinking about these potential solutions during our interviews:

*“I hope to have a function to rate on other user’s comments, just like on Taobao. We usually trust the seller who has a high prestige.”*

*“Just like forums, the system can provide some credits to motivate the users to post more content.”*

## Conclusion

**Result No.1** Even when the goal is similar (get cycling routes), the data entered and considered useful in geographic applications can vary by location.

Implication: This gives us insight into what is important to locals and reminds us of the importance of local knowledge for crowdsourcing applications and the dangers of limiting contributions too much.

**Result No.2** Landmarks play an important role for users in Dalian when browsing or navigating. Cyclopath should support this by making certain landmarks more visible on the main map and including landmarks in route directions.

Implication: Information that is more important to a specific group of users should be made more salient.

**Result No.3** Given that authority and hierarchy play an important role in Chinese culture, it was not surprising to find evidence of this in user reactions to Cyclopath. We should therefore consider implementing site features such as points and ranks that could help users establish reputation and trust.

Implication: When designing for different cultures, the importance of privacy and trust must be taken into account. This can affect whether the system requires users to log in, encourages them to do so or avoids it altogether. It can also lead to differences regarding how transparent to make user history and contributions in crowdsourcing systems.

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