EXPLORING COMMUNITY PARTICIPATION USING THE GEOSPATIAL WEB: A CASE STUDY FROM THE CENTRAL OKANAGAN, BRITISH COLUMBIA

by

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A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF

THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF ARTS

in

THE COLLEGE OF GRADUATE STUDIES

(Interdisciplinary Studies)

THE UNIVERSITY OF BRITISH COLUMBIA

(Okanagan)

August 2012

Abstract

The idea that map-making by communities can lead to local change is well established. Through a collaborative case study involving a community-university partnership with a local food organization, I explored community participation in mapping using the Geospatial Web (Geoweb). Widespread public access to the infrastructure of the Internet and the growing use of web-based mapping tools by amateur citizens has led to great enthusiasm for the participatory potential offered by the Geoweb. To better understand this potential, our partnership developed a customized web-based participatory mapping tool named Geolive, which was then used during three participatory mapping sessions in varying contexts in British Columbia's Central Okanagan Regional District. Through Community-Based Research methods, I gathered information using interviews, survey questionnaires, participant observation, and participatory mapping on the Geoweb. As participants linked their knowledge to existing or new digital map features through geo-located community discussions, I examined their experiences and the types of participation that resulted. First, 63 university students participated together in-class. Then 54 public attendees joined us individually over two days at the local Farmer's Market. Finally, 45 students participated from home in dispersed locations. Results from each of the participatory mapping sessions varied with respect to the map contributions, to what the participants learned, and to their ratings of effectiveness. From these results, I identified three participation types that occurred with declining frequency, beginning with access, followed in some of these cases by engagement with the process, and then in fewer cases ending with a change in critical consciousness or awareness. The Geoweb supported discussion and gathering of place-based knowledge through a socially and procedurally differentiated process.

Preface

This thesis describes Community-Based Research that evolved from a collaborative partnership. Casey Hamilton as Co-investigator from the Interior Health Authority initiated the project and collaborated on the design, implementation and review of the project. Dr. Jon Corbett from UBC Okanagan led the research team as Principal Investigator and worked closely on all aspects of the research and on development of the mapping technologies at UBC. As Co-investigator, I participated in all collaborative aspects of the research including the focus groups, spatial technology and data development, interviews, and participatory mapping sessions. I completed the interviews and the analysis, and wrote this thesis.

Since much of this research was done in collaboration, the thesis refers to 'we' when the group is speaking and 'I' when it is my voice. This thesis is a collaborative result that builds upon the ideas, efforts and words of all contributors. It is, in fact, our combined story that is told through my own partial perspective. These chapters are my attempt to portray in my voice an account of the research that does some justice to all of the collaborators and participants in the case study, to whom I am most grateful.

Partial findings discussed in Chapter 4 of the thesis were previously published in the book chapter "You are where you eat: Developing an online tool for community food mapping", co-authored with Jon Corbett and Casey Hamilton, submitted July 2011, forthcoming in *Taking the Next Steps: Sustainability Planning, Participating and Public Policy in Rural Canada*, University of Alberta.

This research required the approval of the UBC Okanagan Behavioural Research Ethics Board under Certificate Number H08-02628.

Table of Contents

List of Tables

List of Figures

Acknowledgements

First, I would like to thank Jon Corbett for encouraging me to pursue interdisciplinary graduate studies and participatory research, and for sustaining the time consuming process of supervising the thesis while engaging with my endless questioning. I would also like to thank Lawrence Berg and Christine Schreyer as members of the supervisory committee for their valuable contribution of time to review the research and critically discuss the thesis. I want to extend my thanks to Carolyn Labun for expert assistance with scholarly writing and editorial.

I want to also acknowledge a few more specific contributions to this effort. Funding for the research was provided by a Research Interest Group grant from the UBC Okanagan Institute for Healthy Living and Chronic Disease Prevention. Funding was also provided by a grant from GEOmatics for Informed DEcisions (GEOIDE) which is supported by the Government of Canada through the Networks of Centres of Excellence programs. I also wish to thank Interior Health Authority for their support and provision of data.

Thanks to Nick Blackwell for computer support, and to the other researchers in Arts and Science 365b (the 'Grad Cave') for peer support and helpful advice. Thanks also to Casey Hamilton, and to all of the Central Okanagan community participants including the advisory committee members, the UBC Okanagan students and the public participants in Kelowna, whose contributions were the basis for the research.

Finally, thank you to my family, beginning with my parents who enabled me to pursue my education. Thanks to my grandmothers for teaching me to write. My children provided the inspiration and comic relief, and special thanks especially to my wife for supporting this thesis with remarkable patience and commitment, and for reading the rough draft.

Chapter 1: Introduction

> If images of our neighbourhoods, our communities, and our regions are made by others, then it is their future that will be imposed. But if maps are made by resident groups, individuals who have quality of life as a goal, then images of a very different nature predominate. (Aberley 1993)

The idea that map-making by communities can lead to local change is well established (Aberley 1993; Edney 1996; Harley 1988; Harley 1989). Using participatory mapping processes in which local people map their home lands and spaces (Corbett and Rambaldi 2009; Elwood 2002), the Geospatial Web (Geoweb) offers a model for participatory mapping on the Internet (Elwood 2011; Parker 2006). The *Geoweb* refers to the combination of geospatial information and the user interactivity of Web 2.0 (second generation World Wide Web) technologies to facilitate the online display and use of geo-located user data (Haklay, Singleton and Parker 2008). The term Geoweb includes web-based mapping software functionality (including examples like Google Earth, Google Maps, Microsoft's Bing Maps) and other web-based spatial technologies, such as geo-tagged search engines and photo sharing websites (Scharl and Tochtermann 2007).

The research presented in this thesis centers on the use of Geoweb technologies in a participatory mapping project involving a local food organization called the Central Okanagan Food Policy Council (COFPC), based in the Central Okanagan region in British Columbia, Canada. This collaborative community-university project—connected by the ideas of communities and organizations mapping relevant local issues—forms the foundation of this research. The Geoweb offers a new participatory mapping tool for communication and discussion of spatially bounded community priorities, which has led to diverse practices of sharing geographic information and local knowledge in the online public domain (Rambaldi

et al. 2006; Sui and DeLyser 2011; Tulloch 2008). However, the emergent Geoweb technology and a wide variance in the efficacy of previous participatory mapping projects (Corbett and Keller 2005; Craig, Harris and Weiner 2002; Elwood 2006a) have led to cautious speculation about the Geoweb as a tool for public engagement (Elwood 2008; Jankowski 2011; Kingston 2011). To explore the extent to which participation on the Geoweb can be an effective method of public engagement, we conducted a case study to engage the Central Okanagan community in a dialogue related to the local food system, and then examined participation from the perspective of different participants.

The goal of the COFPC was to use the Geoweb for participatory mapping of the local food system to promote local food awareness and to stimulate dialogue. Our goal as researchers was to support the COFPC in their objectives, and to study the participatory processes and outcomes that resulted through the project. In order to explore effective development and use of Geoweb technologies to support online participatory mapping, our study focused on two shared research objectives:

1. Development of a new web-based participatory mapping tool named Geolive, in collaboration with both the COFPC organization and members of the Central Okanagan community.
2. Investigating the experiences of participants while they used the new web-based participatory mapping tool, and examining the outcomes of the participatory process.

Using Community-Based Research, we collaboratively conceptualized, developed and implemented a new web-based participatory mapping tool to engage the local community in a local food dialogue. To better understand the potential effectiveness of the new tool to support public engagement in a map-based discussion, we then conducted three participatory mapping sessions in varying contexts. As participants linked their knowledge to existing or

new digital map features through geo-located community discussions, we explored both their experiences of using the new technology and the resulting food systems maps, to gain a more nuanced understanding of the participation types that resulted.

Use of the Geoweb for public engagement builds on numerous technical strengths and existing applications of this emerging technology. The development of the Geoweb has been closely associated with the unprecedented growth in the hardware and software capabilities of the Internet during the past fifteen years. The rapid increase in Internet capacity has prompted what Haklay, Singleton and Parker (2008) describe as a burgeoning use of the Internet to provide maps and other geographic information (p. 2011). Simple and attractive interfaces deliver both functions and information on the computer screen, allowing users to view location-specific information, and to interact with the system. A natural strength of the Geoweb is its ability to collect and publish volunteered digital content. Known as Volunteered Geographic Information (VGI) (Goodchild 2007), and referred to beyond the field of geography as crowd-sourcing (Howe 2006), the phenomenon of VGI involves citizens in a participatory process.

VGI provides a medium through which communities can express their local knowledge, leading to more context-dependant and more personally relevant representations of the world (Elwood, Schuurman and Wilson 2011). In this sense, VGI involving local knowledge such as discussions and comments is idiosyncratic. Like Internet blogs, VGI of this kind contains the subjective opinions of those that create it (Hall et al. 2010). Therefore, the quality of data provided through VGI remains a concern when authoritative and accurate information is needed. However, VGI also invites communities to fill gaps within the patchwork coverage of existing spatial databases by contributing their own local information (Goodchild 2007).

Recently, research has suggested that VGI is intrinsically valuable to communities and that it is often more relevant to community level issues than official government data (Elwood 2008; Hall et al. 2010). Scholars have begun to study the potential for the Geoweb to support a two-way flow of information between citizens and governing agencies, referring to this outcome as a *participatory Geoweb* (Johnson and Sieber 2011).

In this way, the Geoweb technology and philosophy aligns with the established values underlying participatory mapping and Participatory Geographic Information Systems (PGIS), where inclusive and easily accessed mapping tools are also preferred (Tulloch 2008). Past research involving PGIS found that spatial technologies can "simultaneously promote empowerment and marginalization of socially differentiated communities" (Craig, Harris and Weiner 2002, 4) and subsequent studies have focused on explanations of how and why this occurs in various contexts. Current research in these areas faces a new set of actors and variables even as it echoes familiar arguments.

This intersection of participatory mapping practices and VGI is a topic that motivates this thesis. While clear parallels do exist between the citizen production of VGI using the Geoweb and established participatory mapping methods like PGIS, the extent of this 'common ground' is still being examined. Increasingly, the Geoweb presents both a new theoretical discussion and a practical conduit to support participation. Models for participation on the Geoweb can take many forms, from citizens providing their local knowledge and opinions to leaders, through to online self-improvement strategies (Gilbert 2009) or web-based petitions that call for political or economic 'action' by individuals and communities. One such effort—to raise local food awareness among community members

using the Geoweb for mapping and dialogue—forms the motivation for the case study presented in this thesis.

Of the many contemporary social issues, the popular debate about food has gained ground in the imagination of citizens and leaders alike. Here, the word debate refers to an increasing public involvement in food-related social movements, often through local community organizations. Food policy advocates and agencies continue to urge individuals and communities to question the industrial agri-food products that now dominate our food system (Wakefield 2007). As one of the more serious questions facing wider society, it is notable that food issues and policies are now being taken up at the local scale. Citizens and individuals are being encouraged to participate locally in issues that are also becoming more relevant at the global scale (Aitken 2002; Lezberg 1999). Community organizations, local activists and policy makers have recognized the emerging opportunity to connect with the growing public interest in the issue of food (Guthman 2008; Wakefield 2007).

If we characterize the debates around food—such as where food comes from and whether it is healthy and sustainable—as a conversation, then it is fair to say that many 'voices' are speaking. Local governments and non-governmental organizations in North America and abroad are considering and supporting local food options, and are actively seeking mechanisms to engage the public in this topic (Seed 2011). Participatory mapping using the Geoweb offers a method for reflecting these voices and for discussing relevant issues through a participatory citizen-centred process (Corbett 2010). Maps can also facilitate a greater understanding of complex spatial relationships (Janelle and Goodchild 2011) such as food systems (Hamm and Bellows 2003). These factors motivate groups like the COFPC to use the Geoweb for communicating and engaging with local citizens.

The Geoweb has shifted the modes through which geographic information is both used and created. With a mobile device or personal computer, members of the public can volunteer their contributions by attaching them to digital geographic map coordinates (Scharl and Tochtermann 2007). The Geoweb offers great flexibility to participants, who can contribute at their convenience from home, in proximity to a specific location or physical subject, or while they are travelling (Elwood 2008). VGI can be aggregated to form a comprehensive body of knowledge (Haklay, Singleton and Parker 2008). At the same time, when used in a social environment, web-based mapping tools can allow for diverse opinions to be shared and thus may enable many-to-many communication (Wilson and Peterson 2002).

The extensive access and intuitive features of the Geoweb have led to claims that it is more equitable than other forms of costly and complex geographic information technologies. Previous access barriers such as financial cost and the need for specialized training are significantly reduced in the Geoweb model, in which the distance between the roles of contributor, producer, and consumer of geographic content has decreased (Haklay, Singleton and Parker 2008). Based on these factors discussed above, the Geoweb offers a promising new tool for public access to spatial knowledge and for community participation in map-making (Crampton 2009; Dunn 2007; Tulloch 2008).

However, organizations that decide to implement similar technologies and methods can benefit from better understanding the nature of what is mapped on the Geoweb. In a previous study within the context of participatory asset mapping, the information created during the process was examined as a key finding (Hall et al. 2010). Using a web-based mapping tool for the creation of locally relevant community asset features and related discussions, Hall et al. (2010) found it was an effective method for gathering place-based volunteered

knowledge. They conclude that the practise of participatory mapping using the Geoweb requires further investigation, with respect to both the technology and the efficacy of the public engagement.

To guide the use of spatial technologies for community-based purposes, Rambaldi et al. (2006) calls for a focus on the practices used during participatory mapping projects, which are critical to successful project outcomes. In his list of best practices, he identifies the main factors including: the style of facilitation, the method of interaction with participants and the tasks completed during the mapping sessions (Rambaldi et al. 2006). Due to the emergent nature of the Geoweb, best practices are still being defined. Practitioners of participatory mapping on the Geoweb would therefore benefit from detailed review of the mapping technology used, the volunteered map contributions, and the process followed during the mapping practise.

Researchers studying participatory processes involving the Geoweb are confronted with a fluid set of definitions, concepts and methods related to this emergent technology. For example, participation—defined as taking part or sharing in—is interpreted in varying ways that are relevant to this study. From “citizen power”(Arnstein 1969) to “citizen engagement” (Rocha 1997) to “citizens as sensors” (Goodchild 2007), participation has been expressed differently across disciplines, as well as by different projects and researchers. The term participation requires critical examination in the context of the Geoweb since it has been used in reference to many different activities and experiences in the past. Exploration of participation in this emerging context can contribute to an understanding of types of participation that occur and how community organizations and agencies might benefit from this new form of public engagement.

Research Questions

This study sets out to explore the broad question of how participating on the Geoweb engages the community in a dialogue related to the local food system. To better answer this question, I explore two specific research questions based on the experiences of participants involved in the Central Okanagan participatory Geoweb project. First, what shapes their view of these technologies and their experiences of using them? Secondly, does the involvement of the public in this manner constitute effective and meaningful public engagement?

This first chapter has introduced the premise and motivation for the research. In the next chapter, I review the relevant literature by describing previous studies and background concepts related to this case study. In Chapter 3, the research methodology in which we worked directly with the community organization and our public participants is described. In Chapter 4, I explain the research process and results including the Community-Based Research partnership, our Community Advisory Committee focus groups, and the development of a new web-based participatory mapping tool named Geolive. Chapter 4 also discusses how we used the new tool in three participatory mapping sessions, and then concludes with results from interviews with the project's Community Advisory Committee.

In Chapter 5, I provide a comparative analysis of the results from the three participatory mapping sessions using the Geolive participatory mapping tool. I use this analysis to explore some of the factors that shape participants' views of the new technology and their experiences of participating. In Chapter 6 I identify three participation types that were apparent from the case study, and then I conclude by discussing effective and meaningful public engagement, from both the perspectives of the participants and the facilitators.

Chapter 2: Literature Review

The sections in this chapter focus on the topics of food movements, participatory geographic information systems, and on the concept of community participation. First, I review the motivations for applying the Geoweb as a tool for communication, spatial learning, and social change in the local food movement. Next, I will discuss the significance of these issues within the broader context of participatory mapping and participatory geographic information systems. Then, I will explore relevant public participation studies and frameworks as they are described in the literature, including the concepts of effective and meaningful public participation. Finally, I review methods to assess community participation using the Geoweb by drawing links to past studies of participation involving participatory GIS. To begin, I provide a short history and description of the food movement.

2.1 The Global Food System and Local Food Movements

Depending on where one is situated in the global food system, food is at once a challenging yet sensuous topic that connects to both human well-being as well as many cherished and pleasurable experiences. Inequalities have been a driving force behind many calls to move the global food system toward greater transparency, sustainability and social justice (Lezberg 1999). Wakefield (2007) observes that "in Canada and around the world, issues related to the food system have become prominent among the concerns of individuals, groups, and organizations" (p. 331). She describes this collective as the *food movement*, "an alliance of disparate social actors mobilizing in resistance to various aspects of the dominant corporate–industrial food system" (Wakefield 2007, 331). The local food movement as a whole is often confused as being synonymous with one of the myriad groups and philosophies that work under it. The history of the food movement can be organized into three main approaches—

Hunger/Food Insecurity, Food Sustainability, and Health—which now work together with some degree of tension.

Hunger, interpreted as being synonymous with Food Insecurity, was the first front of the food movement effort in North America during the global economic crisis of the Great Depression. The League of Nations in the 1930s began to focus on persistent world hunger and malnutrition despite agricultural surpluses, which had given rise to the term "hunger in the midst of plenty" (Seed 2011, 33). The work of the League, which ended with World War II, is still credited with forging the first "World Food Movement" by commissioning and publishing research and reports that drew some of the first prominently published links between public health, agriculture and economic policy. During the war, the return to regulated economies saw policies directed squarely at increasing the food supply. Thus began the *productionist paradigm* in which "the assurance of worldwide food security hinges on increasing agricultural production in order to meet the future needs of burgeoning populations" (Lezberg 1999, 4). This was largely accomplished by industrializing food production systems through mechanization, introduction of mass produced synthetic fertilizers, seed technologies, and chemical pesticides (Wakefield 2007).

The 1962 publication or Rachel Carson's book *Silent Spring*, which revealed the health and environmental damage caused by pesticide use, is largely credited with launching the environmental sustainability movement. It was later in the 1990s following the rise of *neoliberalism* that *food sustainability* specifically joined the food movement agenda. During the 1980s, and moving into the 1990s, dominant politics in North America and most of the industrialized world shifted toward the ideology now referred to as neoliberalism, and with it the formula of economic re-structuring around global trade and free markets (Connell 2010).

Globalization is defined as "a process and a condition that involves the increasing interconnectedness of different parts of the world through common processes of economic, environmental, political and cultural change" (Knox et al. 2004, 18). Neoliberal globalization, though just one of the possible policy approaches to globality, has been the dominant form implemented.

At the same time, hunger has remained a problem, moving from the status of an 'emergency' through the 1990s (and the subsequent development of relief efforts including food banks) into the current realization that the problem has become systemic. It is unclear that the general public either understands the current food system, or that market efficiency has resulted in a healthy food supply accessible to all. *Health* has now become the third arm of the food movement.

As Lezberg (1999) notes, the three approaches to the food movement share many common ideas, but they also diverge on certain key points. For example, the hunger movement may prescribe access to low cost foods, even if the most competitive pricing is delivered through unsustainable production practices. This has led to a process of defining food-related issues in a way that tries to encompass both the anti-hunger and the environmental sustainability agendas that now work under this common social movement (Seed 2011). The motivation for a shared food movement may stem from a growing awareness that food issues are no longer an isolated issue within low income communities and undeveloped nations. Seed (2011) points to the widespread impact of food policies within North America and the rest of the developed world, which are:

> felt most deeply by the poor who suffer more hunger and ill health; further, they cannot overcome issues such as pesticide residue by purchasing more costly organic foods or choose more pricey, yet healthier restaurants over fast food. (Seed 2011, 32)

Seed goes one step further, arguing that hunger and health problems will reach further into the mainstream public if current anti-social government and corporate policies toward food continue (p. 32). Communicating the importance of these issues requires that organizations working within the food movement must engage the general public using shared terms of reference that the public will understand.

The food movement has recently moved toward a shared frame of reference using the concept of *community food security*, which exists "when all community residents obtain a safe, culturally acceptable, nutritionally adequate diet through a sustainable food system that maximizes community self-reliance and social justice" (Hamm and Bellows 2003, 40). However, the term may still lack the shared understandings needed for groups to collaborate effectively, since "the framing for the community food security approach, in its broad conceptualization, reaches out to many concerns and issue areas, but is deficient at articulating the linkages" (Lezberg 1999, 20). Subsequently, prescriptions to this problem have been framed in varied and sometimes contradictory ways. The hunger arm of the movement focuses on the social system while the health arm focuses on the food system and "elements of both frames are evident, while the integration between the two is tenuous" (Lezberg 1999, 17).

Community food security has been conceived by community food advocates at a time of sweeping government downsizing and has often been associated with bottom up policy (Hamm and Bellows 2003). If new policy initiatives are to come from civil society, the role of the state in this new form of governance remains cloudy (Guthman 2008; Seed 2011). Presently, neoliberal governments are continuing to push the model of a corporate, industrial

food system while also framing health and well-being as an individual issue of self-improvement (Huxley 2008; Larner 2009). This dichotomy is reflected by the current Canadian federal policy, which promotes "a profitable and innovative agriculture, agri-food and agri-based products industry that seizes opportunities in responding to market demands and contributes to the health and well-being of Canadians" (Government of Canada 2011). This statement suggests that both the agricultural industry and public health can be recognized in a common policy. Although this environment "cultivates an air of inevitability" (Connell 2010, 31), the effectiveness of these policies is contested. Guthman (2008) draws parallels between her work in the well-organized food movement in the American state of California and the extensive critique of neo-liberal urban planning policies by Marxist geographers, noting that if "cities are key sites to study neo-liberalism and resistance to it, the same could be said of food" (Guthman 2008, 1).

Wakefield's perspective is helpful in outlining the academic and grassroots food movement efforts that have worked alongside government healthy food programs, and which have become increasingly organized in recent years. As she explains:

> Access to sustainable, healthy food is increasingly seen as an environmental justice issue, and the connections between formerly disparate fields of engagement (eg between anti-poverty and environmental activism) are being made clear. Food activism, then, can make visible the normally opaque relationships between environmental and human devastation. Healthy food is a fundamental human need—as such, food can be a powerful tool for broad-based education and mobilization. (Wakefield 2007, 332)

Local examples can help to contextualize the issue of community food security in the Central Okanagan. Even in the Central Okanagan region where favourable climate, convenient fresh water supplies and fertile land might support more local food, production is declining alongside increasing rates of food bank usage (Kerstetter and Goldberg 2006). The existence

of local food insecurity within the working class is not well documented, and thus it may be surprising to learn that those reporting food insecurity in British Columbia are often employed while using food banks to feed their families (BC Ministry of Agriculture and Lands 2006). This parallels findings by Marxist geographers that suggest the benefits from participation in a capitalist system, such as disposable income and home ownership, do not accrue evenly to all citizens, who are stratified across differing social classes (Wyly et al. 2009). These food systems issues are particularly relevant locally, where outlying rural communities also lack transportation options and an economic base to support the viability of local food producers, processors and retailers. Many communities in the Okanagan are located in sparsely populated suburban or semi-rural areas with few options for public transit. This has the tendency to concentrate lower income residents without automobiles in particular areas that may offer transit but have poor access to local food options. Residents in outlying areas are required to drive automobiles since few local options for transit or local retailers exist, but they subsequently tend to drive to larger centralized retailers with more competitive pricing. At the same time, the problem is amplified by the fact that regional Central Okanagan housing prices remain among the highest in the nation, placing more financial pressure on local residents to economize on their food costs.

The premise of the mapping initiative described in this case study builds on the belief that citizen engagement using the Geoweb can increase community awareness and understanding of the complex, uneven global food system. Mapping on the participatory Geoweb offers a method for organizations to engage and educate the public, and perhaps to advance the local food movement.

2.2 Participatory Geographic Information Systems

In this section I will explain the background of the broader field of Participatory Geographic Information Systems. This description of participatory mapping tools, goals and practices helps to establish the significance of participatory mapping technologies as a tool to support community priorities.

Geographic Information Systems (GIS) refers to "an organized collection of hardware, software and geographic data that is designed to capture, store, update, manipulate and display spatially referenced information" (Knox et al. 2004, 26). GIS became the standard tool of professional cartographers and geo-statisticians during the 1990s. However, it has been criticized for its inability to accurately model social realities and has been framed as a reductionist technology with close ties to military applications (Rundstrom 1991; Rundstrom 1995; Smith 1992). In contrast to these technocratic uses of GIS, Elwood, Schuurman and Wilson urge critical geographers to place a greater focus on "*doing* GIS in critical contexts, extending calls for critical cartographic literacy" (Elwood, Schuurman and Wilson 2011, 91). The Participatory GIS movement responded to the critical call for academics and cartographers to assume ethical responsibility for the social implications resulting from their maps.

Arising from participatory development theories, *Participatory GIS* (PGIS) "has its roots in Participatory Learning and Action (PLA) and in Participatory Rural Appraisal (PRA). It combines participatory mapping visualizations, spatial information technologies, spatial learning, communication and advocacy" (Rambaldi et al. 2006, 106). PGIS practices can involve the use of expert-driven mapping technologies, but control and access to local knowledge and culturally sensitive spatial data reflected in maps is transferred to the

communities that generated it (Rambaldi et al. 2006). Two fundamental themes remain at the core of PGIS practises. First, practitioners of these methods try to address the inequitable access to mapping technologies like GIS, and the past effects of this in society. Secondly, mapping of community priorities and local knowledge is directly relevant to the communities that created the information (Hall et al. 2010).

Participatory GIS uses geographic information technologies to build upon the tradition of community mapping. Community maps differ considerably from authoritative government maps in content, appearance and methodology. Community mapping is defined by an inclusive process of production (Aberley 1993) and by a product that represents, through its appearance, the agenda of the community. Finally, maps are made by communities directly (Lydon 2003), showing their places, names and information that is relevant and important to the community's needs (Corbett et al. 2006; Elwood 2006b; Parker 2006).

Through increasing capacity within communities, one of the greatest strengths of community mapping is that the mapping process itself can help build community cohesion (Alcorn 2000; Corbett and Keller 2005). Community maps can also serve as a focus for discussions that will help the community identify issues of concern and raise community awareness about local and regional issues. Community maps have enabled communities to lobby governments and authorities, as a tool with which to seek recognition and inclusion in governance and decision-making processes (Peluso 1995). Thus, community maps use participatory mapping methods as a form of political action that can lead to social change (Alcorn 2000).

Participatory GIS (PGIS) is often used interchangeably in the literature with the term *Public Participation GIS* (PPGIS), which tends to be viewed by academics and practitioners as a more 'top-down' method used primarily by governments in Western societies, often in urban

planning contexts (Kingston 2011; Sieber 2007). Laituri linked social and technological aspects in her definition as follows:

> PPGIS is the confluence of social activity (participatory activities, grassroots organizations, governmental decision making, the Internet) and technology (computers, hardware, software, digital information, the Internet) in specific places – grounded geographies. (Laituri 2003, 25)

PGIS shares more with community mapping methodologies, which should ideally originate from the needs and initiatives of the community. However, some scholars argue that this is just an issue of terminology, based on differing views toward "the issue of participation (who participates, why and for what purpose) and that in practise there is very little difference between PPGIS and PGIS" (Jankowski 2011, 348). Jankowski adds another term *web-based grassroots GIS* , a form of Participatory GIS that "relies on advances in 'Web 2.0' technologies enabling the creation of web mapping applications which are freely available to anyone with an Internet connection, a web browser and basic surfing skills" (Jankowski 2011, 348).

In North America, community organizations have used geographic information and spatial technologies for local development (Craig and Elwood 1998; Elwood 2002; Ghose 2007) through a variety of models for access and provision (Leitner et al. 2002). Using community GIS facilities or university spatial labs, desktop computer-based GIS (as opposed to web-based GIS) was provided to local groups to support neighbourhood revitalization (Elwood and Ghose 2001; Elwood 2006a), to produce maps and data to lobby governments for policy and service provision (Ghose 2007), and to identify local assets like parks, community gardens and public libraries (Elwood 2006a). As the Geoweb has become more established, the concept of mapping local assets and places of interest or concern has also been rapidly adapted for the Internet medium. One relevant example is the 'Green Map' initiative, in

which the interactive capabilities of Internet technologies and web browsers allows participants to interact with and add locational information to the maps online (Parker 2006). Photo sharing websites (for example Flickr and Picasa) allow the user to geo-tag photos and to produce maps of photo categories, enriching the dimensions of their social networking capabilities (Armstrong et al. 2011).

Specific online mapping tools known as argumentation maps were initially created for supporting community dialogue, based on theories of participatory mapping, user positionality and communications theory. *Argumentation maps* use specialized participatory mapping tools to "provide discussion contributions embedded at the feature locations where those contributions are relevant 'on the ground'"(Armstrong et al. 2011, 116). Rinner's (2001) work with the 'ARGOOMAP' technology helped to conceptualize and implement an online argumentation map, which "conceives of communication as several logical types of 'speech acts' that are part of a structured grammar defining certain rhetorical practices, such as 'answers' that respond to 'questions'"(Elwood 2011, 391). Using argumentation maps, speech acts like questions and answers can be attached to particular map-based features like points or regions. Wilson and Peterson (2002) encourage researchers using new technologies to focus on communication types like "one person-to-one (as in sending an email message), one-to-many (as in publishing a Webpage), and many-to-many (participating in a discussion forum)" (Wilson and Peterson 2002, 453), adding that the study of communication types will maintain relevance despite rapid obsolescence of underlying technologies. The Geoweb shifts the model for participation and communication on the Internet. The Internet was initially a primarily one-direction, top-down broadcasting medium that tended to be placeless

in the absence of locally relevant content. Both the Internet and the Geoweb now rely upon the two-way flow of interactive information between the users of the system.

Over the past ten years, advances in geospatial technologies have enabled untrained citizens to participate in the production of geographic information (Sui and DeLyser 2011). Rambaldi et al. (2006) describe an "unstoppable excitement about geo-referencing our human physical, biological and socio-cultural worlds and making the information accessible in the public domain" (Rambaldi et al. 2006, 107). Given the growing interest in using participatory Geoweb mapping tools for public participation, understanding their effectiveness is important to users and to society more broadly. In the next sections, the concept of participation is explored and considered within the context of this thesis research.

2.3 Designing Participatory Mapping Technologies

Pragmatic interest and a spirit of optimism in 'the web' are met with an increasing awareness of the inequalities that it can impose. The 'digital divide' is acknowledged in a number of academic disciplines and is seen to impact social justice on the Internet. The digital divide is a term referring to the "economical, ethical, gender, generational, technological, and other digital divisions… or distance [that] exist between those who do, and those who do not, go online" (Wilson 2008, 150). Laughey (2007) cautions that *techological determinism*, "the idea that media technologies in themselves determine social, political, economic and religious change—that they have a life of their own beyond the human beings that invent and use them—is far from convincing" (p. 33).

Haklay and Tobon (2003) note that participatory mapping technologies can be improved through a user-centred design approach during the software development process. The user-

centred design approach considers the concepts of usability, computer literacy and spatial literacy, which helps the system designer to both develop and assess new participatory mapping tools from the user's perspective. Using these concepts, system designers and collaborators can assess software design choices and examine the effectiveness of systems within the context of specific tasks and participant groups. These three themes explained below are salient to participatory mapping technologies based on the Geoweb, and thus are relevant to this study.

Usability can be defined as "the effectiveness of the interaction between humans and computer systems" (Haklay and Tobon 2003, 580). At the time of this research, the usability of relatively new online technologies like the Geospatial Web continues to be defined and evaluated by organizations and academic researchers (Kingston 2011). Development and implementation of Geoweb tools requires an understanding of their usability, which can guide system designers and facilitators during the design process. Haklay and Tobon argue that while "early research focused on the use of GIS by specialists who use the system to accomplish a specific work-related task, PPGIS settings usually call for an open-ended exploration in which users experiment with the GIS and examine various issues that relate to their community and their locality" (Haklay and Tobon 2003, 578). This distinction also applies within the context of the Geoweb in which the user may be performing either work-related tasks or more casual activities.

As PPGIS researchers learned during the early 2000s, public participation in GIS required particular computer skills. Laituri (2003) defines this concept as *computer literacy* which:

> means an understanding of keyboards, logging on and basic skills in pointing and clicking a mouse. A subset of computer literacy is Internet-literacy, which means an understanding of the virtual world created by computer software programs and the

> ability to navigate in cyberspace: operating systems, web browsers[1], search engines, key words and Web pages. (Laituri 2003, 23)

Research has linked the importance of computer literacy and internet literacy to both public access to spatial information and to effective public participation using spatial technologies (Carver et al. 2001; Laituri 2003; Smith and Craglia 2003). GIS specifically uses an extensive jargon, and assumes a special set of abilities including knowledge of cartography and database management. Although the usability of GIS technologies is greatly improved, operating them still requires specific technical knowledge which "presents major obstacles to non-expert users in terms of navigating an interface that embeds a language, world view and concepts that support the system's architecture rather than the user's work view" (Haklay and Tobon 2003, 577).

Spatial Literacy is assumed and required to some degree in most applications on the Geoweb. The concept of *spatial literacy* refers to a map reader's level of understanding of "the underlying grid imposed (coordinate systems), geodesy (datums and projections), geospatial science (spatial analysis) and digital information…that includes terms generally not part of the everyday lexicon" (Laituri 2003, 27). In this case study, several foundation concepts of spatial thinking are relevant including: location, distance, neighbourhood and region, networks, overlays, scale, spatial dependence and spatial heterogeneity (Janelle and Goodchild 2011). Spatial literacy supporting comprehension of map-based information is known to be a fundamental consideration in public participation applications involving GIS (Sui and Holt 2008) and is an important factor in this study in which maps published on the

[1] Current examples of popular web browsers include: Microsoft Internet Explorer (included with the purchase of the Windows personal computer operating system), and Mozilla's free, open source version named Firefox.

Geoweb are used as a basis for both facilitating and gathering voluntary geographic contributions.

The three concepts of usability, computer literacy, and spatial literacy are key considerations to both designers and practitioners of participatory GIS and participatory mapping on the Geoweb. In addition to these user-centred design concepts, the participatory processes and the outcomes involved must also be considered in terms of the participants. In other words, the way that participation is conceptualized, the methods of participation, and the results of the participatory process are all important considerations within the context of participatory mapping case studies. The purpose of the next section is to review a set of relevant concepts and frameworks of participation as they are described in the academic literature.

2.4 Participation

The term participation is widely used in human geography and urban planning in reference to "a multiplicity of experiences associated with power and control" (Tulloch 2008, 164). In development, participation refers to "the type and level of stakeholder or beneficiary involvement in development planning, projects and practices" (Hickey and Kothari 2009, 82). In urban planning, numerous models exist for conceptualizing, implementing and evaluating participatory projects. At its most basic, participation simply means the act of taking part, however it is viewed.

The concept of effective and meaningful public participation has a substantial literature that does not map exactly onto the context of the Geoweb. Effectiveness itself has varying definitions depending upon the intended purpose and the context involved. Often the term *effectiveness* refers to the impact programs have on solving identified problems within a

public administration or development context. Jankowski articulates a "notion of meaningful public participation …situated in the context of Habermas' theory of communicative rationality" (Jankowski 2011, 349). The central theme in this body of research is always a *deliberative-analytic process*, in which "public participation is a process that has defined objectives, a sequence of steps leading to the achievement of objectives, rules of participation, means of supporting the steps of the process, and measures (qualitative or quantitative) of gauging progress made toward achieving the objectives" (Jankowski 2011, 349). These objectives are set forth by participants, but the outcome is generally evaluated in terms of the decision at hand, and it is on this point that participatory mapping differs slightly: participatory mapping need not involve this formal deliberative-analytic process. Participatory mapping processes are often carried out for the benefit of the participants and so the participants must assess the effectiveness of participating.

Without a decision on which to base assessments, another model for determining effective participation is required. Setting public participation within government decision making processes usually leads to evaluations that can either be done from the perspective of the government or from that of participating citizens. However, the potential for citizens to be involved in government decision making processes revolves around a number of issues related to the degree of public involvement, the legitimacy, and the effectiveness of such efforts. Distinguishing different participation types helps us to better understand what constitutes effective participation in various contexts and recognizes the fact that participation is not a universal concept.

The Ladder of Participation—modeling citizen participation upon a climbing ladder of graded levels from most to least participatory—has often been modified and extended as a

spatial metaphor for understanding participatory processes. Sherry Arnstein's original 1960s version is one of the best known and discussed frameworks for conceptualizing public participation in the urban planning literature (Arnstein 1969). The ladder metaphor here describes a spectrum of eight varying levels of meaningful public involvement as the level of citizen power to determine the process increases. Beginning with forms of nonparticipation, then progressing to forms of tokenism and finally reaching the top level of citizen control, Arnstein's ladder concept has been extensively applied and adapted in public participation studies (see Appendix A for examples).

Ladders of participation are based on examining different types of processes, outcomes and types of engagement. The interpretation of these ladders and the steps they describe is the most important aspect to understand, since this determines the context and the type of participatory practices that can be analyzed. For example, in a recent book chapter, Haklay (2012) proposes another typology for citizen science projects in which citizens volunteering in scientific data collection do not have the technical skill required to take full control of the project. The 'gap' on the ladder is then between expert scientists running the projects and the public participants who often require the help of these professionals for interpretation and understanding of the overall research. Thus, the ladder metaphor in citizen science carries a different interpretation than in urban planning, since many citizen science projects target participation on the lower rungs (Haklay 2012). This interpretation is relevant to other expert led fields like Participatory GIS, in which the public would not be willing or able to lead or even conduct some parts of the work (Kingston 2011).

Outcomes of public participation can be effective in ways that are not always as clear. Andrews and Turner (2006) explore the proposition that "effective engagement can involve

making discriminating decisions about how to participate, as well as action *per se*" (p. 380). In other words, they refer to effective public engagement (a term that is often used in reference to participation) as a process of personal reflection on the issue of how to best participate. The process of personal reflection, often referred to as *reflexivity*, is an intended result of many participatory and community-based projects.

As this review has discussed, participation is not a universal term. Instead, it is a differentiated process that has many observed types and that is characterized by many possible outcomes. Participatory processes are often evaluated reflectively at three temporal stages corresponding to the period of initial public engagement, followed by the short-term outcomes and finally the long-term outcomes (Ramasubramanian 2011). This is a helpful place to begin since it emphasizes the fact that participatory processes such as participatory mapping are undertaken with intent to achieve a specific goal, but the exact nature of each project and its impact cannot be known until after the project is completed. Although 'outcome' does not necessarily imply 'change', this model implies an intended action or decision that will result from these mapping activities as a long-term outcome.

2.5 Types of Participation on the Geoweb

The most basic type of participation discussed in the literature involves simple *access* to resources. Past research has often focused on the fact that many participatory projects involve a top down provision of software, data, services and expertise in which participation takes the form of attendance and viewing, but without any physical or cognitive action by the participants (Elwood 2011; Haklay 2012; Laituri 2003; Sieber 2007). Using desktop-based and web-based mapping software, agencies in government and non-governmental organizations often release maps and spatial information as well as other types of data

without any method for interaction by the viewing member of the public. On the Geoweb, resources provided to the public can include maps, images, charts and statistics at the neighbourhood, regional or other scales (Parker 2006; Kingston 2011) as well as access to online software programs and data storage (Armstrong et al. 2011). This level of participation is described by Tulloch (2003) as a situation characterized primarily by access to data, as often occurs in federal environment impact assessments. Active participation through citizen involvement in decision making is limited in these models, despite large amounts of data provision (p. 57). On the Geoweb, access to information might be the end result of a project and this constitutes a valuable resource but at the lowest level of participation (Kingston 2011; Tulloch 2008). Rowe and Frewer's typology of public engagement mechanisms (2005) refers to this as public communication of information by a sponsoring agency or organization to the public representatives. Participation through access only maintains a singular direction of information provided by publisher to the community in a one-to-many flow of communication (Wilson and Peterson 2002).

The second type of participation examined in this study is cognitive and physical *engagement* in the mapping process. Physically, the participant's engagement is observed as a data contribution. Engagement in the case study by participating in the mapping exercises and the use of the Geoweb maps required cognitive ability unlike some crowd-sourcing activities that can involve little cognitive input by participants. This type of participation is closely related to the concept of volunteered geographic information (Goodchild 2007) but also to theories of active pedagogy in which participation requires cognitive engagement (Baum, MacDougall and Smith 2006).

Community food mapping that seeks to inform others can then be seen as an implicit action agenda, in which "human consciousness brings a reflection on material reality whereby critical reflection is already action" (Baum, MacDougall and Smith 2006, 856). Theories supporting inquiry for social change arose from work with oppressed peoples in the 'Third World', including the work of Brazilian educator Paulo Freire and others in Latin America, Africa and Asia (Minkler 2000; Rocha 1997). This work focused on "co-learning and action based on critical reflection" (Minkler 2000) and became central to participatory action and learning approaches (Corbett 2010). Participatory action approaches are now often used in North American policy and advocacy settings such as community health and development (Baum, MacDougall and Smith 2006; Minkler 2000). Freire suggested engaging in learning through everyday life, while at the same time applying formal academic knowledge. Applying his theories to participatory mapping offers a method for public education, leading to awareness of alternatives and the possibility for personal transformation as a result (Baum, MacDougall and Smith 2006, 856). Commonly used in urban planning applications involving public comment and discussion tools (Hall et al. 2010; Kingston 2011), this engagement model is also used in many community asset mapping websites (Parker 2006) and other applications based on voluntary geo-located contributions (Haklay, Singleton and Parker 2008).

The engagement level of participation represents the difference between participating directly in creating the maps themselves versus viewing spatial information only. Recalling Rowe and Frewer's typology of public engagement mechanisms, a similar type is identified based on the flow of information from the public back to the sponsoring agency, which they refer to as public consultation (Rowe and Frewer 2005). A bottom-up flow of knowledge supports

participatory mapping and PGIS activities on the Internet, since these fields also embrace the benefits of co-learning and self-reflection. This type of participation brings the added benefit of including community perspectives in the project.

Finally, *change* is characterized by evidence of participants' critical consciousness and reflexivity as a result of access and engagement using the Geoweb. In other words, the intent of engagement and change are the same. However, as recognized by Arnstein and other participation scholars, the intent of engagement does not always translate to change. Engagement is characterized by physical and cognitive engagement in the project, primarily through a one way flow of information, but without evidence of actual change. Ideally, participation using the Geoweb can enable a type of socio-political empowerment at the individual scale, perhaps then leading to a form of community empowerment (Corbett and Keller 2005).

Rocha (1997) highlights two core elements of the developmental participation process: "(1) critical reflection by the community and members-of-community (individuals) rethinking their relationship to structures of power and (2) collective action upon these structures" (p. 38). Individuals and communities will progress through the developmental participation process at different rates, based on their varying needs and interactions (Rocha 1997). In the context of the Geoweb, change occurs when individuals gain access to information, community resources or new avenues for collaboration allowing them to understand and act upon their individual situations. This is what Rowe and Frewer's typology refers to as 'public participation' since it involves a two-way flow of information between sponsors and the public. Individuals are not only informed, but their knowledge is also included in the decision making process (Rowe and Frewer 2005).

The three types of participation 1) access, 2) engagement, and 3) change can be considered on several levels. In the literature reviewed above, these terms are associated with a variety of processes and outcomes. In Participatory GIS and other participatory mapping fields, the three terms refer to numerous mapping practices and equally varied outcomes. In the case study to follow, the participation outcomes will be identified and discussed using these three types. Exploring the identifying characteristics and the variables or factors influencing participation on the Geoweb is a focus of this thesis.

In the following chapters, I will describe a collaborative case study related to the Central Okanagan food movement in which a team of university researchers developed and tested an innovative, web-based participatory mapping tool called Geolive, in partnership with a community organization. Using Geolive as a research tool, we facilitated a large number of geo-located community discussions about local food systems. As participants gained access to the new Geolive web-based participatory mapping tool and learned to contribute their own geographic information, we gained key insights into participant experiences and the effectiveness of the participatory process.

Chapter 3: Research Approach

This chapter describes the research approach that we followed, including the research design and our methods of data collection and analysis. Participatory approaches are increasingly used by scholars and communities as flexible and inter-disciplinary methods for addressing complex social and environmental issues and questions (Kindon 2009). In her section of the book *GIS and Society*, Elwood (2011) identifies multiple positions that participation has occupied within methodologies and substantive elements of past research. As she states, participation can be used in research designs, as an object of inquiry, or as a desired outcome. This methodology chapter explains how all three participatory approaches are used in this case study.

3.1 Participatory Action Research Methodology

Participatory Action Research is the combination of two earlier research traditions based on Action Research (Lewin 1946) and Participatory Research (Hall 1975). More than thirty years after scholars such as Freire used Participatory Action Research to educate and empower illiterate students in South America, these methods continue to gain acceptance. *Participatory Action Research* in North America has become an overarching term referring to research practices involving co-learning with an emphasis on community participation and translating knowledge to education, action, and change. This case study used a *Community-Based Research* methodology, which is a widely used academic form of Participatory Action Research in which "communities define projects and invite university staff/students to collaborate to achieve some social change outcome, under the leadership and guidance of a local institution" (Kindon and Elwood 2009, 22). Within the participatory framework, we used a series of interdisciplinary research methods as I will discuss later in the chapter.

In this study we explored the collaborative design and assessment of participation in a participatory Geoweb project, and asked how it engaged the local community through online dialogue. The project was conceived and initiated by the Central Okanagan Food Policy Council (COFPC) in partnership with the Centre for Social, Spatial and Economic Justice (CSSEJ) in the Community, Culture and Global Studies department at the University of British Columbia (UBC) Okanagan campus. Funding to initiate the project was provided through a grant from the Institute for Healthy Living and Chronic Disease Prevention, which supports research linking communities with the university to focus on capacity building and knowledge creation that benefits individuals, families and communities. The COFPC is a new organization formed in 2009 and they were actively seeking opportunities for collaboration.

This *Community-Based Research* partnership allowed all the project partners to work together toward a research objective defined by the COFPC (Kindon and Elwood 2009). Our research design was guided by two principle goals. First, an action component was aimed at software development and testing, in order to produce a new customized version of the Geolive participatory mapping tool in collaboration with the CSSEJ lab, the local COFPC organization, and members of the Central Okanagan community. Secondly, the theoretical component focused on understanding the experiences of participants using the new participatory mapping tool, which allowed us to identify relevant variables and to determine the overall effectiveness of the process. These goals required us to collaboratively conceptualize, develop and implement the new participatory mapping tool to engage the local community in a local food dialogue. This action agenda also provided the context, motivation, and data to support answering the research questions. To develop the new web-

based participatory mapping tool, we used methods from G*eographic Information Science* (GIScience), the "science behind GIS" (Kavouras and Kokla 2011, 46).

As recently as 2001, studies by Wong and Chua found that "designing appropriate data methodologies for studying participation in web-mediated GIS activities is challenging because of the often asynchronous nature of participants' contributions, difficulty in identifying precisely who is participating, and an often-limited capacity to create face-to-face forums with these participants for research purposes" (Elwood, 2011, 394). For this reason, a Community-Based Research case study was appropriate for providing the opportunity to collaboratively develop the web-based participatory mapping tool. Our active involvement in the research practise allowed us to both observe and facilitate the participatory mapping on the Geolive website. This approach enabled us to better understand the participants themselves through both observational and survey methods and through their volunteered geographic information. In order to support voluntary participation in the project, we tried to access groups that might find relevance in the research through a presumed interest in local food or in the Geoweb. The research design and methods that we used to accomplish this objective are summarized in the remainder of this chapter.

3.2 Central Okanagan Case Study Design

Project collaborators defined the study area to be the Central Okanagan Regional District of British Columbia. The district centres on the City of Kelowna, one of Canada's fastest growing communities, but the region also includes the three distinctly more rural communities of Peachland, West Kelowna and Lake Country. This region is famous for a lifestyle of wine, alpine skiing and the pursuit of endless summer on and around the shores of Okanagan Lake. In the Central Okanagan, rural areas exist alongside densely populated

neighbourhoods and even urbanized areas remain interspersed with plots of agricultural land. The combined population of the region is approximately 250,000. Although the study area encompasses numerous smaller physical communities, we define community for the purpose of the research as all residents in the Central Okanagan region.

Our participatory case study combined "the cyclical, iterative processes of action research…with the traditional processes of case study research" (Reilly 2009, 659). Case study research supports both qualitative methods (Cope 2010) and empiricism using quantitative methods (Hesse-Biber and Leavy 2010); both were used in this study. Generally, a positivistic approach is not appropriate in the context of participatory research. In addition to our action agenda involving the participatory mapping tool development, we needed to understand the perspectives of the participants as they used the tool and afterward. The case study approach allowed us to explore the contextual influences on participation (Cope 2010) using "a set of mixed methods of data collection and analysis in order to bring out viewpoints of multiple participants in the study" (Hardwick 2009, 441). The evidence gathered through these methods supported our exploration of the experiences of participants and of the influences on the participatory process.

From Hardwick's (2009) list of mixed and overlapping qualitative and quantitative data sources, we used the following four methods to collect data during the course of the case study: interviews[2], survey questionnaires, participant observation, and participatory mapping. The summary of our research process is provided in Table 3.1 which organizes the

[2] Several types were used including both individual and group discussion formats.

major events used in the research methodology in the chronological sequence in which they occurred.

Table 3.1 Sequence of research methods, results and timeline.

Event	Methods	Result	Date
Community-Based Research partnership with Co-investigators	Participant Observation	Partnership	Jan to Apr, 2010
Focus group meetings with Community Advisory Committee	Focus Group Discussion	Research direction	Apr and Aug, 2010
Geolive participatory mapping tool developed at UBC	Participant Observation & GIScience	Mapping tool	July to Sept, 2010
1: UBCO In-class Mapping Session	Participatory Mapping* & Survey Questionnaire	Student participant perspectives	Nov 2010
Followup semi-structured interviews with In-class participants	Semi-structured Interview	Validated survey questions, in-depth perspectives	Mar 2011
2: Kelowna Farmer's Market Mapping Sessions	Participatory Mapping* & Survey Questionnaire	Public participant perspectives	July & Oct, 2011
3: UBCO At-home Mapping Session	Participatory Mapping* & Survey Questionnaire	Student participant perspectives	Nov 2011
Follow-up interviews with Community Advisory Committee	Unstructured Interview	Community Advisory Committee perspectives	Dec 2011
Analysis and writing	Analysis	Thesis	Jan to Apr, 2012

***For specific details of the three varying methods used during these three participatory mapping sessions, please refer to Table 3.2 in section 3.3 below, under the heading "Three Participatory Mapping Sessions Using Geolive".**

In the next section, I describe the research design in more detail by expanding upon the events and methods as they are presented in Table 3.1.

3.3 Research Methods Used

Community-Based Research Partnership

The project team was formed in late December 2009 and combined two investigators from UBC Okanagan and one that jointly represented both the Interior Health Authority (IHA) and the COFPC. IHA is one of the six Health Authorities in the province of British Columbia, and this organization actively supported the research in a number of ways described later in this chapter. The proposal for funding was centered on the use of Geoweb mapping technologies. Our IHA/COFPC co-investigator was interested in using a 'social determinants of health' lens, and also supported the use of Geoweb mapping as a way to increase public awareness of community food security while building capacity within the COFPC itself. My own background in GIS software systems and community engagement led to my supporting the decision to develop technology during the research process. All three members of the group were interested in providing a participatory food mapping tool as an ongoing resource to the community. Although the research team did not focus on supporting political action involving the community, we agreed on a Community-Based Research model in an attempt to engage public dialogue using these novel approaches.

I used p*articipant observation* where I was present and "watching and noting phenomena as they occur" (Kearns 2010: 242) and at times actively involved in the process. I was a participant observer in the meetings with the co-investigators. This involved active participation where I engaged in discussions, directed the topic occasionally and inserted my opinions into the process. I was both a co-facilitator and direct observer of the focus group discussions and the three participatory mapping sessions, and so I do not refer to these activities as participant observation.

The decision to include myself in the research design arose at the outset of the project by embedding the case study in Community-Based Research. The strength of this approach was my dual role as both researcher and GIS practitioner. My perspective as the interface designer is described in the research as suggested by Warren (2011), who calls for studies of those who practise and maintain mapping technologies. I provided my own perspective as practitioner, researcher and participant. However, there were obvious drawbacks to my presence in these engagements. It would be impossible to separate my impact on the results from the final reporting of the research. To account for this influence, I provide this detailed description of the research process. Reflexivity, through my own personal reflection on my position and many roles in the project, has been a key aspect of this participatory research.

Based on findings over the course of the study, the final analysis and subsequent writing has largely been a reflexive exercise, after the project was completed. Evidence was collected during the two year period of field work. Emails, printed communications and researcher field notes resulted in extensive texts; over 650 email messages were filed for the project over the two years of the study.

Focus Group Discussions with Community Advisory Committee

Using the concept of a core advisory committee drawn from the urban planning literature, the project partners recruited a Community Advisory Committee of six community food leaders. The Community Advisory Committee was invited to join the three co-investigators during two meetings that can be described as focus group discussions or focus group interviews. A *focus group interview* "involves a small group of people discussing a topic or issue defined by a researcher" (Cameron 2010, 152). A structured component during which Community Advisory Committee members responded to the same question was then followed by an

unstructured component that allowed for an open group discussion. I describe both the detailed process followed during these focus groups and the results in Chapter 4. Aimed at forging a shared understanding of the project in support of community collaboration, these meetings were organized around the themes of the local food movement and participatory mapping on the Geoweb. The Geolive web-based participatory mapping tool was then adapted and implemented based on the priorities and principles identified in these meetings.

Geolive Web-based Participatory Mapping Tool

Geolive is a web-based participatory mapping tool developed at University of British Columbia Okanagan; it combines Google Maps and Joomla! an open source content management system. The application allows users to create and share their own spatial information using a single dynamic map-based interface (see Figure 3.1).

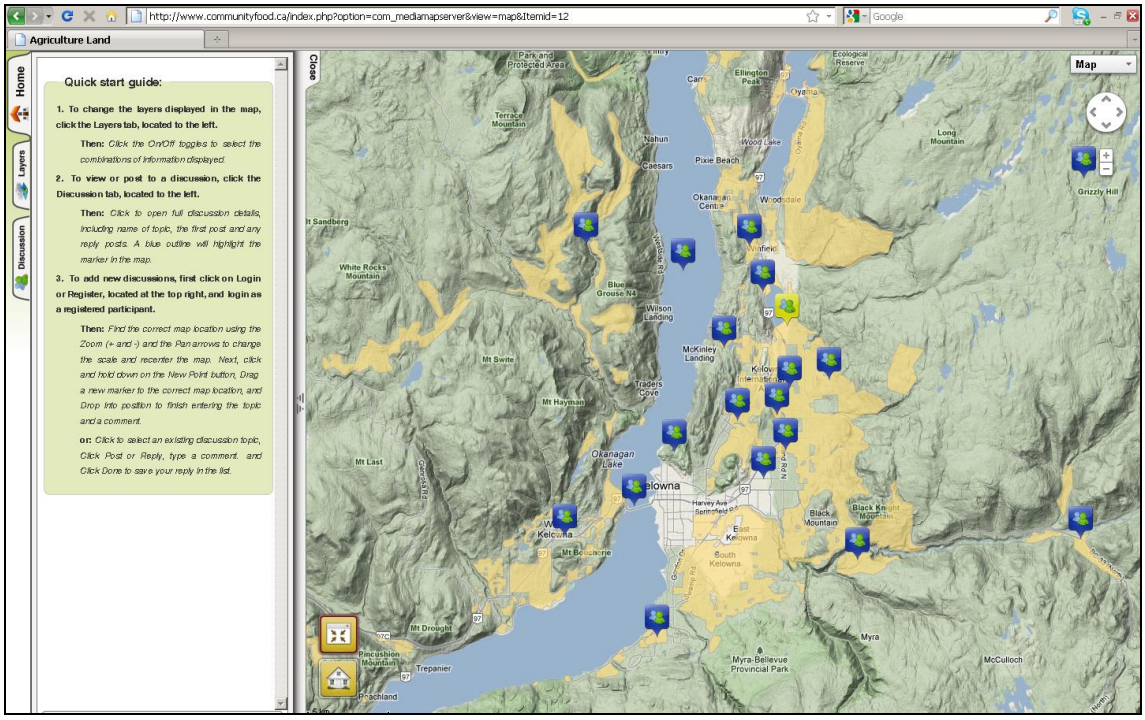

Figure 3.1 The user interface of the Geolive web-based participatory mapping tool

Geolive enables registered users to place information markers onto a map, turn different data layers on and off as well as take part in ‘instant messenger’ type discussions (see Figure 3.2 and 3.3 below).

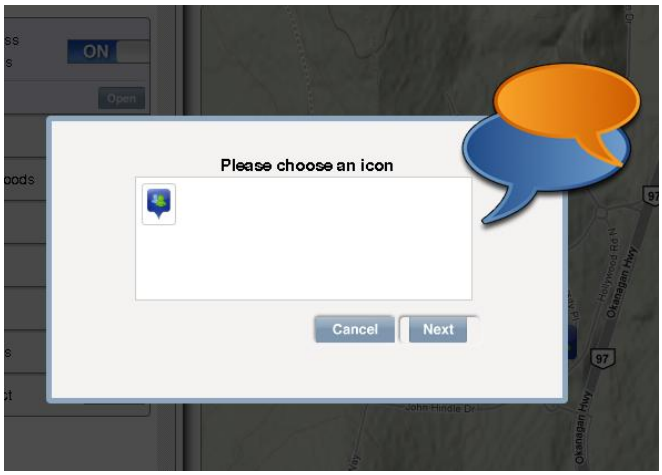

Figure 3.2 Participants follow guided steps to add new map discussions and replies

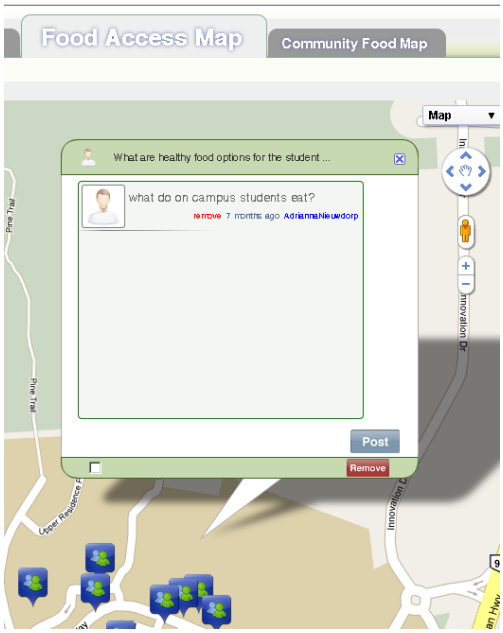

Figure 3.3 Geo-located discussions can be searched and selected

The original goal for Geolive was to create an interactive mapping application that could support multiple simultaneous contributors using open-sourced software platforms. While there are numerous requirements for web-based participatory mapping applications, we focused on the design and development of a tool to best support the active participation of users in the contribution of location-based content. The COFPC shared our goal to engage Central Okanagan citizens in the issue of local food systems, and thus community participation was one of the main desired outcomes of the mapping initiative in this study.

The detailed design of the Geolive participatory mapping tool emerged from the collaboration with the COFPC and through a user-centred design approach. Haklay and Tobon's work with white, middle class public participants (referred to in the paper as typical 'active publics') in the United Kingdom provides a helpful template for research involving development of participatory mapping technologies using public participants. Their framework for user-centred design is well suited to interdisciplinary settings since "knowledge of both the users and the work they need to accomplish, as well as about the technology is required to meet this approach to systems design" (Haklay and Tobon 2003, 579). Chapter 4 describes the spatial information obtained for the research and the development process of the Geolive participatory mapping tool used for this research. Through a close collaboration with the lead CSSEJ programmer, I was responsible for the design and support of the website. I worked with participants and collaborators to determine the direction of design requirements. I relayed this information to the Principal Investigator and to the lead programmer, who then managed and implemented the design specifications. I tested and configured the systems for public use, developed and managed the maps and spatial data, and designed parts of the user interface. Geolive is a modular system with a

large capacity for customization within a set of existing core features and components. Organizations can begin from the same core functionality but then customized components can be implemented according to their needs in terms of participatory processes, data and users.

Three Participatory Mapping Sessions Using Geolive

I developed a survey questionnaire and a participant recruiting strategy for the purpose of assessing meaningful participation in the participatory mapping sessions. Survey questionnaires are used for gaining "insights into relevant social trends, processes, values, attitudes and interpretations" (McGuirk and O'Neill 2010, 192). We used surveys as a practical method for assessing several attributes, behaviours, attitudes and beliefs of participants in the case study. All individuals that participated in the case study went on to complete a questionnaire after using the site. Though questionnaires cannot provide the depth of information gained through other qualitative interviewing methods (McGuirk and O'Neill 2010, 215), they were effective for exploring broad patterns within groups and were easily deployed in the larger group settings when time with participants was limited.

We used a mixed methods survey questionnaire that consisted of open ended questions, rankings using Likert scales, qualitative ratings like "Effective or Very Effective" and measures like "Monthly, Weekly, Daily". The survey was designed to collect both quantitative and qualitative data on the following variables:

1. Participant's existing attitudes, behaviours and beliefs involving web-based technology.
2. Participant's experiences during engagement including: perceptions of usability of the participatory mapping tool, and strengths and weaknesses of the system.
3. Learning outcomes from the mapping session and whether it was perceived as effective.
4. Basic demographic information on participant attributes like age and place of residence.

Responses to this survey questionnaire were collected in the context of three individual structured participatory mapping sessions using the Geolive participatory mapping tool which are explained in Table 3.2. Through the process detailed in Chapter 4, each mapping session was held in a varying context of diminishing facilitation by researchers. We modified the survey instrument following the first deployment in November 2010, and subsequent to follow-up interviews conducted with a sub-sample of the original group. We used the refined survey again in July and October 2011 at the Kelowna Farmer's Market mapping session, and again in November 2011 during the UBCO 'At-home' mapping session. See Appendix B for copies of the revised survey questionnaire used in this study.

Table 3.2 Three structured participatory mapping sessions using Geolive.

UBCO In-class, Nov. 2010	**Kelowna Farmers Market, July and October 2011**	**UBCO At-home, Nov. 2011**
-element of co-learning -synchronous -shared location and setting -in depth specific steps to complete through a specified method of offering input -exercise to set a definite context and discussion topic	-participatory mapping - asynchronous -shared location and setting -one-on-one engagement with hands on demonstration and mapping exercise -use of the technology varied, and was not assured	-fully web-mediated -asynchronous -distributed location -no facilitator present and no training, just the help screens on the Geolive website -technology was the only means of participation

First Mapping Session: UBCO In-class 2010

To assess usability of the online participatory mapping tool and inform the theoretical research agenda around effective and meaningful participation, we invited 100 students registered in a university first-year geography course to voluntarily participate. Of these, 63 students volunteered to take part and simultaneously completed an 'In-class' one hour mapping session in which we facilitated a structured exercise using the online participatory

mapping tool. Participants completed a survey questionnaire during the participatory mapping session.

Follow-up Semi-structured Interviews with UBCO In-class Participants

To further explore the dimensions of the participants' engagement through the project, a subset of students was identified from the UBCO In-class participants. Six students were identified through completed surveys (those with no questions skipped or left blank and with contact details provided) that reflected interested and informed attitudes and beliefs about the In-class mapping session. In other words, our method was to first select students that appeared to have engaged and learned something from the process, and then to explore these perspectives through in-depth semi-structured interviews. One goal of the interviews was to assess whether the survey questionnaire responses had accurately indicated participant engagement, while another was to assess the extent of this over a longer term (in this case three months after the UBCO In-class exercise). We also wanted to understand the extent to which their engagement seemed based upon their participation in the mapping session rather than other existing factors (such as a prior engagement with the local food movement). I used semi-structured interviews with the three participants that agreed to take part, in order to gain in-depth responses to our specific questions while also allowing spontaneous conversations to emerge. This semi-structured interview form was "organized around ordered but flexible questioning" (Dunn 2010, 110). Probe questions varied slightly, and evolved from the specific content of each interview. A copy of the interview questions is included in Appendix B. I conducted the interviews in the Principal Investigator's office in the Center for Social Spatial and Economic Justice at UBC Okanagan, which lasted from 60 to 90 minutes each.

The interviews were video-recorded and partially transcribed afterward based on key themes. All interview material was kept confidential and stored in secure UBC facilities and computer servers. Video consent was included on the statement of informed consent for the Community Food project, and a separate consent was also signed for the production of a research video about the study. Participants had the option to appear on camera, to record only on audio or to not record at all. All three participants gave consent to appear on video, but it was agreed that any direct quotes taken from the video would be published anonymously. Furthermore, portions selected for release in video form were reviewed by participants to gain prior approval before any public release of the material. However, I expect that video recording of these interviews impacted the type of responses given, in which participants may have shaped their answer around the possible future loss of anonymity. The interview results helped us to refine the survey instrument for subsequent mapping sessions and to improve the Geolive participatory mapping tool.

Second Mapping Session: Kelowna Farmer's Market 2011

To expand our understanding of the participatory mapping process through a different group of participants, we organized a second mapping session in a public market setting. 54 participants at the local farmer's market were involved on two different days in the summer and fall of 2011. Using convenience sampling, participants who stopped at our UBC mapping tent and agreed to receive a short demonstration were then offered the option to participate hands-on and contribute to the online map. Regardless of whether they agreed to contribute to the map, they were then invited to complete a survey questionnaire. 20 participants that received demonstrations over the two days also agreed to complete surveys.

Third Mapping Session: UBCO At-home 2011

The final group that we invited to participate in the mapping was another section of new students taking the same geography course, one year later. We recruited these students using an email from the course instructor. The email offered a participation grade in exchange for the student contributing to the online map through a simple procedure to add three new markers and three replies to existing markers. 45 students participated and completed online survey questionnaires. Information gathered during these three participatory mapping sessions supported our understanding of the participatory mapping tool usability and the experiences of the participants.

One of the main goals for this case study was to use the Geolive participatory mapping tool as a medium to collect volunteered geo-located information from participants. This local knowledge was a resource to be developed and shared with the community. Allowing participants to contribute in their own words was an important motivation for the design and use of the new Geolive tool. The Geolive participatory mapping website, referred to within the project as 'Community Food', was published online during and after the project and all contributions became immediately visible and accessible in the public domain.

Map markers, contributed by participants using the participatory mapping tool, were analyzed to determine clusters, topics of the discussions in close proximity to one another, and whether certain locations tended to promote more reply posts (ie. conversation) than average. In order to track website usage systematically, Google Analytics software was used to track website usage statistics from January 2011 onward. As described on the product's web page, "Google Analytics is the enterprise-class web analytics solution that gives you rich insights into your website traffic and marketing effectiveness" (Google 2012). The tool

includes online charting of daily users of the site, whether they were new or returning users, how long they remained on the site, how many pages were viewed during the visit and their country and region of origin (or the origin of the server computer for their web service provider).

The combination of survey results, participant observations and the volunteered geographic information created using the Geolive participatory mapping tool supported my understanding of the case study through numerous perspectives and data sources.

Follow-up Semi-structured Interviews with Community Advisory Committee

After a full revolution of the Participatory Action Research cycle, the final research method returned to the same participants that helped to plan and conduct the study. Using an unstructured style in which the questions were "almost entirely determined by the informants responses" (Dunn 2010, 111), I interviewed four of the six Community Advisory Committee members. To complete the Community-Based Research, I asked the advisory about their perceptions of the project and the short term outcomes that resulted. I also asked the committee to speculate about possible longer term outcomes.

The four interviews were audio recorded. One recording was incomplete and another was inaudible. Using both detailed interview notes taken during these two interviews and the interview guide as a reference, I partially transcribed these two interviews. The two audio recorded interviews were fully transcribed using 'Express Dictate' software. Both co-investigators were also interviewed in a similar format; only one of these interviews was audio recorded and then fully transcribed. The principal investigator's perspective appears

instead as entries in the field notes and email communications and through high level decisions reflected in the research and technology design.

3.4 Data Analysis

Three concurrent activities guided my approach to analyzing the substantial volumes of data generated through this research. Starting with data reduction to simplify and summarize the raw data, followed by data display to present the reduced data from which highlights and conclusions are drawn, my analysis finishes with conclusion drawing to note regularities and themes in the data (Miles and Huberman 1999: 10). I used two basic methods of data analysis within this interactive model. To interpret the results of the open-ended survey questions and the interviews, I used *qualitative content analysis* to code simple themes originating from the literature, from the data and from my own experiences (Baxter 2009). Coding methods were refined during the participatory research process and also emerged from the data inductively (Cope 2010). In some cases, I also interpreted data using more than one coding strategy to search for relevant patterns and themes in a more holistic way (Bradshaw and Stratford 2010). I use *descriptive statistics* and *charts* to summarize and present the quantitative data, and to compare participant experiences within and between mapping sessions (Lee 2009).

For the purpose of this study, participation is defined narrowly as the process and results of involving collaborators and members of the public in this participatory Geoweb research project. Recent literature in the field of PGIS and other critical GIS traditions tries to redress an apparent inflation of the term 'participation' by clarifying types, purposes, and evaluative methods. To contribute to this effort, I propose a spectrum to analyze participation in this case study that is drawn from the literature review. To understand how participating on the Geoweb engages the community in food-related dialogue, I describe three types of

participation in the case study. I identify the three different types of participation that were apparent in the case study as follows: 1) those that gained access to the technology (access), 2) those that engaged in the online dialogue (engagement), and 3) those that demonstrated a change in critical consciousness (change).

The simple three part structure that I use is based on the concept underlying the ladders of participation, which sees participation as a differentiated process. While there is some similarity to Arnstein's Ladder of Participation, there is also a substantial difference. First, because participants in online participatory mapping activities are invited, the resulting types of participation should not be linked to value judgments. Rather, they serve as a way to identify and characterize types of participation that are observed in the case study.

I describe these participation types 1) access, 2) engagement, and 3) change with the assumption that they are not discrete or static; instead I assume they are overlapping and fluid (Sundberg 2004).

3.5 Validity and Rigour

To improve the validity and rigour of this case study, we checked our evidence using "multiple sources, methods, investigators and theories" (Bradshaw and Stratford 2010: 77). Using multiple sources of mixed and overlapping qualitative and quantitative evidence addressed the research question from more than one community perspective and using more than one research method (Denzin 2010; Hardwick 2009). This mixed methods design allowed data from one method to inform the results gained from the other types of methods. Three co-investigators worked together to conceptualize, conduct and analyze the research, using a set of inter-disciplinary theories to complement the work. Themes that frame the

analysis and discussion of this case study are drawn from the literature and from the case study data itself.

We identified participants for this case study using purposive sampling in which unique characteristics of participants were the basis for their selection, since “emphasis is usually on an analysis of meanings in specific contexts” (Bradshaw and Stratford 2010, 76). In this case, participants were selected either as key informants to the Community Advisory Committee process, or they were selected to take part in the participatory mapping sessions. Participants on the Community Advisory Committee were chosen by investigators to provide a diversity of perspectives on the topic of local food mapping by drawing from varying local interests and varying geographic parts of the study area. The participants in the three participatory mapping sessions met the criterion of enrollment in a specific first year university course, or they conveniently stopped into our booth at the Farmer's Market. Including diverse community perspectives within our Community Advisory Committee helped to broaden our understandings of local food issues and priorities, and to establish a network of community support for the project. By including two different groups of students and a group of community members in the participatory mapping sessions, we reduced the bias from a single participant group based just at the university. Comparing the results of the three participatory mapping sessions provided a controlled method for examining the contextual influences on the participatory process.

Both the survey questionnaire and the Geolive participatory mapping tool were updated and improved slightly following the first participatory mapping session. Semi-structured interviews with the subset of participants from the first student group provided more in-depth

information explaining their survey responses, which then helped us to validate and refine the survey questionnaire itself as well as the Geolive technology.

A more detailed account of the research process is included with the initial results in Chapter 4, which provides the rich description needed to understand both the methods used and the results themselves[3]. Rich description of this case study may also allow other researchers to apply some of the methods and variables identified in this exploratory study in other geographies and research designs. Then in Chapter 5, I use a graphical approach to summarize and compare the findings from the three participatory mapping sessions.

This analysis reveals some of the characteristics of participation using web-based mapping tools, volunteered geospatial information and "new spatial media" (Elwood, Schuurman and Wilson 2011, 101). As I discuss in the proceeding chapters, despite challenges there were also numerous benefits to choosing collaborative mapping methodologies for studying participation.

[3] A more detailed description of the research process is included with the results presented in Chapter 4 to help the reader understand how these results may have varied as the context and participants also changed.

Chapter 4: Research Process

In this chapter, I present a detailed account of the research process and the results of the case study. I will describe the Community-Based Research process that guided the development and implementation of the Geolive web-based participatory mapping tool used to support the research. Results are drawn from participant and direct observations and transcripts from the two focus group interviews with the Community Advisory Committee, and from field notes taken during the development process. I will also explain the Community Food participatory mapping website that we developed, including the spatial information and the discussion mapping concept as implemented. The chapter concludes with the findings from the three participatory mapping sessions in which we tested the participatory mapping tool and collected data in support of the research questions. This chapter provides the foundation for addressing the first research question which set out to explore the experiences of participants involved in the participatory Geoweb project.

4.1 Community Based Research Partnership

The research team began the project with the intent to develop a participatory mapping tool that would facilitate and encourage dialogue about local food. Beginning in January 2010, the three co-investigators met weekly to discuss development of the mapping technology, which also progressed alongside this collaborative research planning.

The first three months of the research was an exhilarating but at times frustrating period that required us to learn the ‘different languages’ spoken by different members of our research team. Interdisciplinary research often brings together researchers from quite different backgrounds. Disciplinary divides posed initial challenges since field specific vocabulary had

to be negotiated, learned and embedded within the process of collaboration. The disciplinary diversity within the research team led to tensions but concomitantly provided a space for innovation.

A principle theme of these early meetings with the research team involved action on the issue of local food awareness. “What can we do?” seemed to be a question that surfaced repeatedly (rather than the question, “What can we learn?” which might be predicted in typical research initiatives). This focus on action guided the project team throughout the research process (Kindon 2010), and provides another reason why Participatory Action Research was an appropriate choice for the project. Participatory Action Research decisions are often guided by the practicalities of field work, and within our research, plans were subject to change as the project direction unfolded. As priorities shifted, a successful case for specific research objectives outside the community’s immediate goals had to be developed and often the research design was adapted to accommodate emergent challenges and opportunities (Kindon and Elwood 2009). As we negotiated the research agenda, finding a balance between academic requirements and the needs of the community members became a key element of the collaborative research process.

4.2 Community Advisory Committee

Our Community Advisory Committee used a ‘core advisory’ concept that is well established in urban planning (Jankowski 2011; Ramasubramanian 2011), in which members are either elected or appointed to represent specific communities or sectors of society within a particular process. It is commonly used in Participatory Action Research projects (Kindon 2010) and other collaborative projects such as ours that seek to engage a large number of public participants, of which only a small sample is available during the design stages. We

balanced the possible benefit of including more sectors and representative members with pragmatism and the challenges of coordinating with larger groups. Community Advisory Committee members were chosen to have experience and knowledge to offer the project.

We recruited volunteer members from local governments, health authorities, local producers, non-governmental organizations and academia for their inside perspective on theory, policy and practises of local food production, processing and retailing, as outlined in Table 4.1.

Table 4.1 Community Advisory Committee participants and Co-investigators by sector

Sector	Co-investigator	Community Advisory Committee*
Municipal government		2 – City of Kelowna and District of Lake Country Lake
Academic	2 – UBC Okanagan	1 – UBC Okanagan
Local organic producer		1 – Lake Country
Non-governmental organization	1 – COFPC and IHA	1 – COFPC / Community Gardens
Public health		1 – IHA

***While some committee members represented more than one sector, they are assigned according to the role they were representing in relation to the study and the context in which they were recruited.**

We then invited the six Community Advisory Committee members[4] to attend two focus group sessions, in April and August, 2010, with the three co-investigators. IHA provided a letter of support endorsing the direction of the research. An IHA research ethics approval obtained in parallel with ours from the UBC Behavioural Research Ethics Review Board allowed participation by the IHA food security manager, and by our COFPC co-investigator, who was also employed as a community nutritionist at IHA during the period of the study.

[4] The names of the Community Advisory Committee are not published here because we did not obtain the prior consent of the individuals representing the organizations outlined in Table 4.1 to release this information.

4.3 Focus Groups with Community Advisory Committee

We held the first meeting with our Community Advisory Committee on April 21, 2010. Our purpose was to introduce the project, elicit group input and explore potential support for the project. The meeting was held in the meeting room of the CSSEJ, and was attended by all nine committee members and investigators. As suggested in participatory mapping and PGIS methodologies (Rambaldi et al. 2006), we did not present any mapping tools or technology during the introduction of the project or during the first section of the focus group meeting, even though it was to be a key aspect of the research. Although it was important that the technology was introduced during this meeting, it is also important that participatory mapping projects allow for alternate methods of participation. We obtained permission to audio record the session, and used the recording to transcribe the key points discussed.

The first focus group meeting was designed to gather feedback on the Community Advisory Committee perspectives related to the issue of local food. It was also our hope to explore plans for developing and implementing the new participatory mapping tool. The COFPC had originally become interested in the Geoweb to produce a local food map and to facilitate community dialogue on local food issues. We began the meeting with a short introduction to the project, followed by an 'idea cloud' exercise that asked the group to individually write down what they felt to be the key elements of the local food system. The written results of this exercise were collected and presented to the group to stimulate a follow-up discussion. The input gathered during this focus group meeting provided the initial direction for our project plan. Our review of the audio recordings and field notes from the meeting revealed that the group had interest in numerous aspects of the food system. As reviewed in Chapter 2, the food movement represents a number of 'arms' or frames of reference that work under a

shared label but not always a shared understanding of issues and prescriptions to problems. The Community Advisory Committee's priorities reflected all prominent frames that constitute the local food movement, including local hunger, environmental sustainability (Lezberg 1999; Wakefield 2007) and public health (Seed 2011). While this diversity of views complicated our efforts to define a clear mapping project with a singular purpose, it reflected the realities of mapping a complicated social, environmental and economic system. The Community Advisory Committee members emphasized the following shared priorities: access to local food, urban food deserts (areas with inadequate access), agricultural land awareness, and local food pricing. In addition to defining food systems categories, the Community Advisory Committee identified and discussed these more general issues:

1. The length of time required for mapping, and the technical accuracy of VGI data;
2. Authoritative GIS data was needed as a starting point for the map, upon which public VGI contributions could then be layered;
3. A participatory component was needed for allowing qualitative data on sense of place and user perspectives.

The Community Advisory Committee identified their concerns regarding local food, and suggested a course of action. At the same time, the research objectives shifted in a subtle but critical way. Rather than a consumer engagement model focused on specific products or solutions, the committee pointed toward a participatory engagement model promoting awareness of the issues. In order to accommodate the committee's vision for the project, we decided that software development was needed to expand the discussion-related functions, which was both a great opportunity for the project but also a complex undertaking. The development and functionality of the Geolive participatory mapping is discussed in more detail in the next section.

The advisory committee was invited to a second focus group meeting on August 11, 2010. Two committee members could not attend the meeting, as one was on leave and the other was out of the country during that period. Between April and August, 2010, researchers had made significant changes to the Geolive mapping technology, based on the feedback from the first focus group interview.

The second focus group meeting in August lasted two hours and was conducted in the same location at UBC Okanagan using the same format as the first meeting. Our intent during this focus group meeting was to develop the Community Advisory Committee's understanding of the project, to the greatest extent possible in a short period of time. We also wanted to gain further feedback on the direction of the project and the mapping. The Community Advisory Committee offered their final input on the plan, before we agreed to proceed with development and testing of the new participatory mapping tool. Following the focus group meetings with the Community Advisory Committee, Geolive was developed by the research team at the CSSEJ to support our collaborative vision.

4.4 Developing the Geolive Participatory Mapping Tool

The combination of a social networking platform with a participatory mapping interface seemed to meet the requirement for mapping local dialogue. At the same time, a substantial database of local food locations was identified by IHA data technicians following a request by researchers for food-related data within the IHA system, as discussed next.

The content of the data used to populate the spatial information layers published online was initially obtained from two sources. First, we obtained a GIS database of polygons from the Agricultural Land Reserve Commission delineating the current areas protected by provincial zoning for agricultural use. This data was available for download by the public on the

commission's website, but in a proprietary format (ESRI shapefile). The data was converted to .kml format and published on the Agricultural Land Map layer of the mapping website.

Through our data sharing agreement with the IHA, we then obtained our second data set showing addresses and locations of public health inspection certificates. These IHA inspections were required for businesses to sell or serve food, or to process or produce food for sale in the Central Okanagan Regional District. The public health inspection data did not include sites that shipped products out of the province of British Columbia, which were inspected by the Canadian Food Inspection Agency and recorded in that database. The IHA data was already publicly available as text listings, but not in a form that could be geo-located on a map.

ArcGIS software was used to view three overlapping IHA categories of original data that were provided as follows: Food Store/Retail, Food Service and Food Other. The categories were analyzed and then re-coded to include the following: Fast Food, Restaurants, Grocery Stores, Convenience Foods, Other Food Stores, Local Producers and Other Food (which was not published). The new categories were designed to highlight types in the food system, the sources of production or distribution and the spatial density of specific types. Data was uploaded to the Geolive mapping website in ".kml" format, which included a marker identifying each location, the type of food establishment, the name of the business and the street address. Using the Community Food participatory mapping website, each layer of 'Food Access' information could then be viewed by the public and turned on or off separately, thus giving the user control over the combinations of data to be displayed on Geolive. Simple 'point and click' controls allowed participants with relatively modest technical skills to use the tool. Figures 4.1 and 4.2 depict the two maps that were used during

demonstrations to illustrate contrasts between access to convenience and fast foods versus local production.

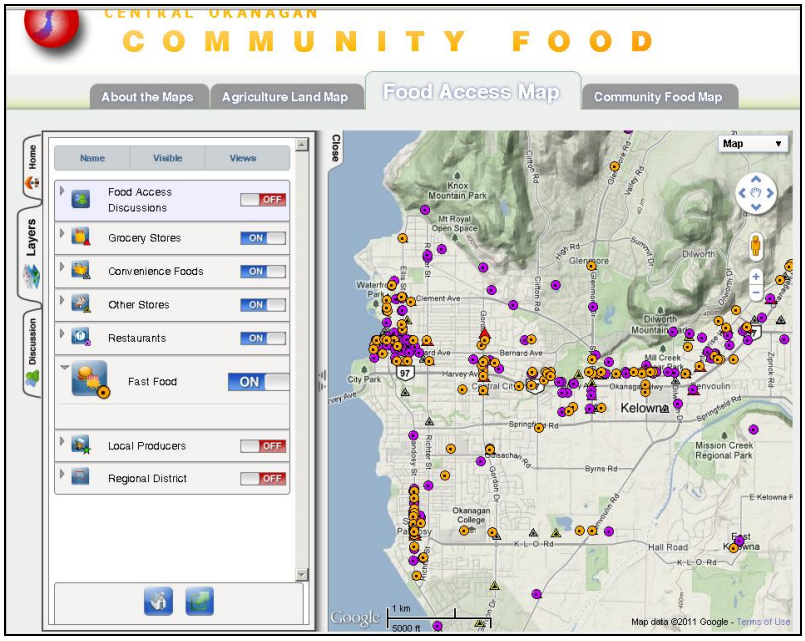

Figure 4.1 'Food System' spatial data layers on the participatory mapping website

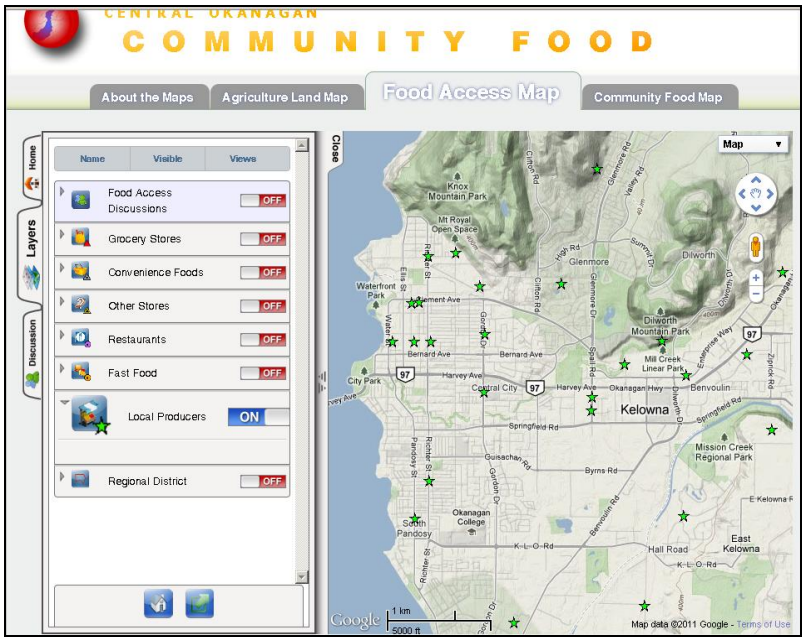

Figure 4.2 'Local Food' spatial data layer on the participatory mapping website

Since development of Geoweb applications is still an emerging field of research, the appearance and functionality of the web-based participatory mapping tool drew from the existing collaborative and participatory GIS literature to inform the theory and methods used (Ellul et al. 2009; Haklay, Singleton and Parker 2008; Kingston 2011; Parker 2006).

Unlike some other Geoweb-based discussion tools, the Geolive discussion mapping component was not implemented with a threaded structure. New discussions were added at the top of the date sorted list, with options for users to resort the list by other criteria. Each argument was assigned a unique location, and several could co-exist in one place on the map. Each 'discussion' in the list could open into a folder with a 'topic' and a list of 'posts' replied by public contributors.

In his framework for designing and evaluating collaborative GIS technologies, Jankowski provides a design cube defining three dimensions of inter-related decisions involved with designing public participation systems: small to large group size, synchronous to asynchronous setting, and simple to complex technology (Jankowski 2011, 353). Since Geolive was designed to support participation by small or large and synchronous or asynchronous groups, it was decided that the third design element needed to be more controlled. That is, the complexity of the tool was reduced to the minimum level deemed possible by researchers in order to simplify the process of participating for non-expert users.

By building upon established websites and computer software, we relied upon our user's existing computer literacy and familiarity with popular features and general concepts. There is already awareness by Internet users of the overall structure and operation of established Geoweb technologies like Google Maps (Meng and Malczewski 2009). A Google Maps-inspired interface was implemented, along with simple features designed adjacent to the map

canvas supporting the discussion mapping technology (see Figures 4.1 and 4.2). Participants were able to view and react to discussions posted by other participants, which informed their experience and their own contributions. This map was made publicly available online.

4.5 Three Participatory Mapping Sessions Using Geolive

Four techniques described in Haklay and Tobon's (2003) paper on user-centred design provide a useful structure for presenting the research process and results from each of the three mapping sessions in the case study, which shared many of the key elements and goals. The four techniques used are:

1. Facilitation is described, including any use of 'chauffeurs' to operate the mapping software on behalf of the participants.
2. Use of tasks to obtain information about users' performance and attitudes toward the system.
3. Description of researchers' observations of the process.
4. Collection of data describing the user's experiences while using the system. (Haklay and Tobon 2003)

I used these four steps to structure my analysis of the process and results for each of the three participatory mapping sessions. For each of the three participatory mapping sessions completed in this study as described below, the detailed process and results are presented under the headings 'Facilitation', 'Tasks Completed by Users', 'Observation', 'Data from User Survey Questionnaires', and 'Analysis of Map Discussions'. The data that I used to analyze the mapping sessions was drawn from observations, photographs of mapping session participants, contributed data from the online maps and results from the survey questionnaires.

4.5.1 First Mapping Session: UBCO In-class November 2010

An In-class focus session was held on November 16, 2010 to assess usability of the online participatory mapping tool and inform the theoretical research agenda around effective and meaningful participation. 100 students enrolled in UBCO Geography 129 were approached verbally in-class and by subsequent email from the course instructor, and 63 of these students simultaneously participated in the one hour optional in-class mapping session.

Facilitation

Researchers facilitated a structured exercise using the Geolive participatory mapping tool on the Community Food website. Each of the three co-investigators was present and facilitated one of the three sections (see Figure 4.3). While one facilitated, the other two co-investigators were circulating among participants assisting and responding to inquiries.

Figure 4.3 Facilitator introduces project at UBCO In-class mapping session, Nov. 2010

Tasks Completed by Users

After explaining the purpose and goals for the session, consent forms were signed by everyone, and an introduction to the technology and the general concept was given by researchers. Participants were asked to complete a set of specific mapping tasks using the Geolive participatory mapping tool, and then to complete a survey questionnaire divided into three sections corresponding to each set of tasks. The first section of the survey helped to determine a baseline of the participant's computer literacy, their approach to sharing information online and demographic variables, and was completed prior to using the Geolive. The students were then taken through a hands on demonstration of the Geolive participatory mapping tool, completed using their own laptop computers that they had been instructed to bring. Those without a computer were asked to share in groups of two.

The students were then asked to complete a series of tasks and exercises. Task 1 allowed participants to use the web-based participatory mapping tool and to gain familiarity with basic functions. By navigating to one agricultural area, followed by one area of densely urbanized food distribution sites, the students could experiment with visualizing differing combinations of data. Task 2 built upon this and asked the user to open and reply to an existing discussion post (see Figure 4.4). Users then were asked to switch to the 'Food Access' map for the remainder of the session. Task 3 asked the user to complete a physical task to find and record the ID code of the map marker for their most frequented food store or restaurant.

This allowed students to gain experience with Geolive, including the use of the navigation tools, the map layer controls, contextual information in the GIS food mapping layers, and the Google base maps. Students then completed the second section of the survey, which asked

them to describe and evaluate their experience with using Geolive, and to record the results of their search for a food location marker. A second set of mapping exercises was then completed which involved more independent work by the participants. Task 4 was intended to create an online dialogue among participants using the Food Access map (see Figure 4.4). Students were asked to create one new discussion marker, and to reply to at least one other student's discussion.

The third section of the survey asked the user to consider what they learned from the map themes and topics, as well as about their experiences with the food-related information generally. At the conclusion of the session, students were welcome to leave when they had completed their contributions and the final portion of the survey questionnaire.

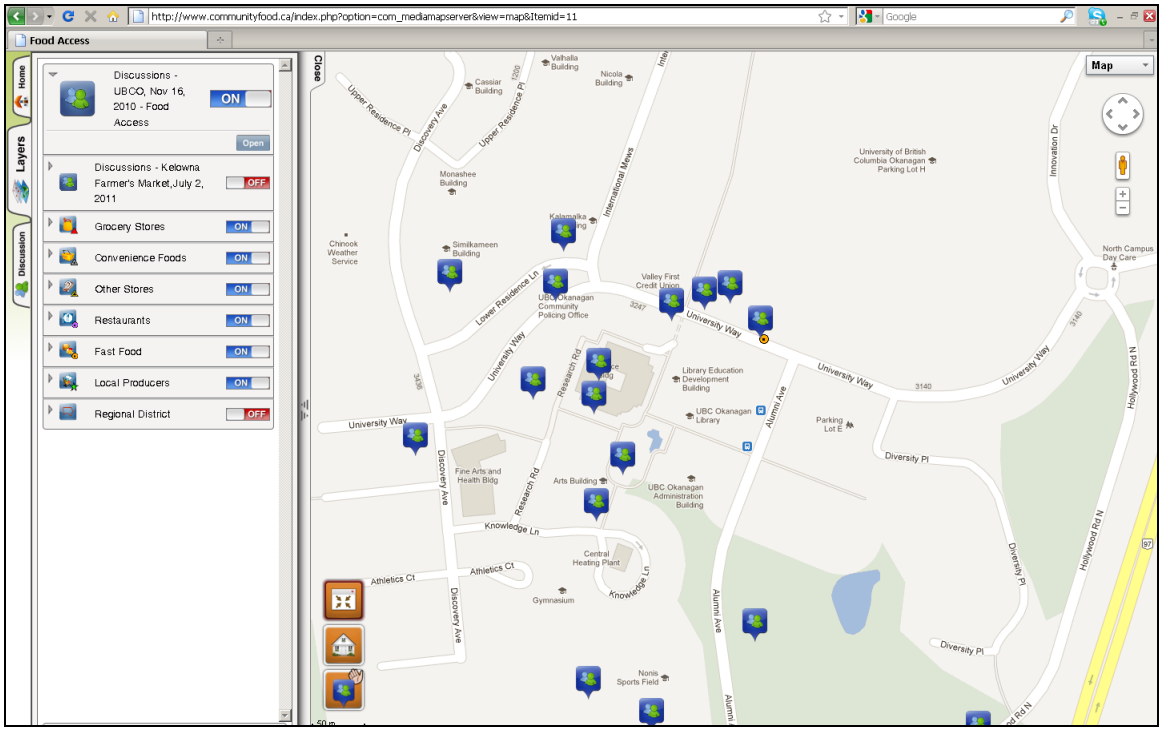

Figure 4.4 Geoweb discussions on the Food Access map near the UBCO campus

Observation

Most students in university now use laptop computers, and the wireless Internet throughout the university campus is equipped to handle large volumes of simultaneous access. The appearance of the participatory mapping tool and the spatial information on the maps was individually conceived on each student's laptop computer. In other words, the individual perceptions of space—or the students' sense of the real places and the information represented on the maps—varied slightly with each student's brand of computer system.

Variations in computer system configurations did impact some users. One student using a laptop with a Spanish language operating system was unable to display some of the website graphics. Other students had older browser software that caused display problems on some of the mapping screens. Researchers were able to assist these users to work past most issues and noted that the majority of the users were able to access the system without significant software errors or other performance issues. The website was programmed to accept students' existing Facebook profiles to login to the Community Food participatory mapping website. Most of the students were able to take advantage of this feature, thus avoiding the need to create a new account specifically for the in-class mapping session; a majority successfully logged in and began adding data to the system within ten minutes. Students without an existing Facebook account were asked to create a new account to log-in through the Community Food participatory mapping website itself. Figure 4.5 shows participants completing the In-class mapping exercise.

During the mapping exercise, we observed several students locating discussion markers on the screen above the facilitator. These students began posting replies before even receiving instructions from the investigators. These replies appeared in 'real-time' on the projector

screen before the entire class. This irreverent introduction did confirm the possibility for the tool to function at a basic level without instruction. We were able to extend the participants' familiarity with the Google maps functionality and many students were able to start using the tool before any detailed explanation. Without directions on the 'topic of conversation' and time to select an appropriate map location, these initial contributions lacked substance and relevance, yet they confirmed that the tool was relatively easy to use for this group of participants, as designers had hoped. The contributions changed as students were asked to sign in and join the structured mapping and discussion exercises.

Figure 4.5 Participants engage in the UBCO In-class mapping session, Nov. 2010

Data from User Survey Questionnaires

Participants completed a survey questionnaire assessing attitudes and behaviours toward technology and mapping, and beliefs about what was learned through the exercise. Using paper surveys initially, the data was entered into the 'Survey Monkey' web-based survey

application which allowed us to effectively compare with the results from the other two participatory mapping sessions. We also downloaded the map discussion database from the Geolive server. Texts from both the open-ended survey questions and the map discussions were coded and analyzed using Microsoft Excel spreadsheet software. These findings are presented in Chapter 5.

Overall, the mapping session was considered a success by both researchers, and 87% of participants rated the tool effective or very effective for discussing information presented on the map. 26 of the students gave open ended feedback on how to improve system usability, website appearance or maps and information. 31 students provided partial follow-up contact information at the end of the survey.

Participants noted that the strengths of the participatory mapping tool included “ease of use”, “its clarity”, or “quick access to food source information.” Interesting or unique strengths identified by participants included: “Multi-user input”, “Google maps makes it easy to use”, “see the types of food surrounding you”, and “participate in discussions.” Weaknesses of the participatory mapping tool often referred to specific software compatibility problems or errors that the user encountered on their laptop computers. Whenever a function problem was encountered, it was often reported as a response to the question on weaknesses. Specific weaknesses repeatedly described software glitches such as “Only works on advanced forms of browsers” or often reported issues with map data such as “Still data missing, anyone can add data”, and “Layers too broad. Not enough background.”

Asked what would encourage their future use of the website, participants often referred to improved information on products and low prices. Examples like “Which places have the best quality and price” or “more information on restaurants ie. type of food” were common

themes noted. Deterrents to future use were often reported in terms of lack of interest or concerns over accuracy of the data and the privacy of their own personal information.

Learning outcomes reported qualitatively through open ended responses were more challenging to understand. Through simple descriptive qualitative coding, I identified commonly used words and phrases within the responses. I used spreadsheet software to sort, filter, search and colour code individual responses, and then noted a number of frequently used terms. For example, when asked "What have you learned from this exercise about agricultural issues in the Central Okanagan region?" 36 responses to the question included the words or phrases 'agriculture', 'agricultural' or 'ALR (Agriculture Land Reserve)'. When asked "What have you learned from this exercise about food systems in the Central Okanagan region?" 32 of the respondents used one of the words or phrases 'food', 'food system' or 'food security'. Two responses used the word local. 12 students reported land in their response toward agricultural issues, while just three students used the word land in their answer based on food systems; students appeared to link land to the concept of agriculture more than to food or the food system.

Another method for coding emerged from the responses themselves. Through a more functional interpretation, I coded the responses by their relevance to the subject of local food as presented during each mapping session respectively.

To understand the distinctions, I have provided a set of quoted examples that demonstrates each of the themes from these open ended responses related to learning outcomes. First, many responses expressed concerns or negative perceptions toward the use of agricultural land, such as:

> "I learned that urban area is encroaching on ALR."

"ALR protects land to be continued to farm."
"Land for growing food is limited."
"ALR land is being used for Kelowna's golf courses."

Another group learned about the composition of the local food system and the balance between fast food restaurants, grocery stores and local production. Examples include:

"lots of easily accessed fast food."
"vast amounts of fast food compared to grocery stores and even restaurants."
"That there are more fast food places than local food producers."

A distinct group of responses related to the issue of food access for students on campus. For the students, the issue of food on campus seemed to be an intersection point, or a point of entry to the wider topic of food systems with which they could connect the concepts to their own experiences. Their responses included:

"We need a grocery store in UBCO."
"There are many more fast food options close to the university than grocery stores."
"I have realized how there is 0 access to healthy food for students living on residence at UBCO."

Many of the students referenced specific spatial concepts in their responses, indicative of spatial literacy among some of the group members, such as:

"It is centralized."
"Clustering around 97 and Rutland."
"some areas should have more variety of food stores with easy access."

A final set of responses referred not to food systems but to more general or combined issues:

"There is another useful source that doesn't just tell us where the restaurants are!"
"a lot of agricultural land has been used for golf courses."
"That Kelowna has a poor food policy compared to other cities in BC."

Analysis of Map Discussions

I examined the content of the conversations within the maps and discussion markers in two ways: first, by examining the number of responses per discussion, and then by visualizing

spatial clusters of markers. A cluster of conversations had developed around the map of the university campus area; a specific instruction during the in-class session was to think about food locations near 'their home', and a significant portion of the class lived in residence on campus. This group of discussions might be viewed as a type of conversation around a shared topic of interest. A shared understanding of the issues based on their common experiences on campus seemed to underscore the dialogue (see Figure 4.4 above for an image of the map discussions on the site of the UBC Okanagan campus).

The first participatory mapping session using Geolive, as explained above, informed minor changes to the mapping interface including the addition of a subject field to accompany the title on new discussion markers created on the map. Of the two map themes used during the mapping session, it seemed that the 'Agricultural Land' map received more in depth reflections that related to the agricultural land concepts discussed in class, and may have produced a more focused set of contributions overall. The 'Food Access' base maps presented complex quantitative dot density data, which required more spatial analysis and interpretation than the simple, monotone shaded polygon regions shown on the Agricultural Land map. Perhaps the more complex maps 'overwhelmed' viewers with data saturation and thus did not support enough understanding or engagement with the underlying concepts required for an in depth response. On the other hand, the real food locations on the food access map were well known to some of the participants, who based their contributions on anecdotes and comments from their own experiences. Using these preliminary findings, researchers aimed to better understand designing base map layers with appropriate levels of spatial complexity.

4.5.1.1 UBCO Follow-up Semi-structured Interviews

The surveys successfully recorded the experiences of participants in the mapping session. However, there is a limit on the depth of information provided on surveys that prevents "them from being used to explain action (since this requires us to understand people's intentions), the significance of action, and the connections between acts" (McGuirk and O'Neill 2010: 215). In order to further explore connections between survey responses and participants' beliefs and potential actions, semi-structured interviews were conducted with selected participants from the UBCO In-class Focus Session. Follow-up interviews in March 2011 helped us to refine the survey instrument and to validate our understanding of these survey responses through more in-depth participant perspectives.

Findings from these three interviews were extensive, as each interview had lasted 90 to 120 minutes. A picture of an informed, pre-engaged Geography student familiar with local food issues had emerged through the practise and analysis of these interviews. Coding was done initially in video form using commercial video editing software. I viewed each interview, and then began to divide the longer clips into short clips containing the answers to individual questions, before sorting the video clips by question and theme. In this way, a condensed video version of each interview was produced with around ten to fifteen minutes of footage per participant. Since each participant was asked the same questions, it was possible to align responses and then watch all three respond to the same question in turn, allowing for interesting comparisons. I also transcribed this video and quotes taken from the interview text are included below. The students are referred to anonymously as Student A, B and C. Student A is a white male in his early twenties, Student B is a white female in her early twenties, and Student C is a white middle aged female. When asked to recall their approach to food

awareness and food security, the participants referred to their position in the local food system, and how they related that to their experiences during the food mapping session:

> I was always kind of aware and tried to be as conscientious as I could be about where food came from, how it was produced and kind of the process of transporting that food, growing that food and everything like, but I am not from the Okanagan, so as soon as you move out of your area that you are familiar with you become unfamiliar with all the systems, right. So I tried to be engaged, but as it comes to moving to the Okanagan, I was completely un-engaged I guess? (Student A)
>
> I come from an agricultural town, so I think it's really important to know where your food comes from, but actually thinking of it in a sense of security? Not so much… (Student B)
>
> I think after four or five months, I am starting to see things a bit differently. We are looking at media telling us daily now that food security is going to be a big issue and we see it! I think in four or five months, we've seen a rise in food prices. (Student C)

Student B questions the terms of reference, which occurred in other instances as well. All three students had learned from the exercise, as stated in their survey responses from the in-class session. The following quotations demonstrate the breadth of their knowledge on the issues, but also their level of pre-existing awareness:

> That was weighed into where we wanted to live right. That had to be on our minds when we decided on where we were going to live because I know some friends who didn't think about that and it can be an hour on the bus, or it can be a 20 minute car ride, or in traffic it can be an hour drive… (Student A)
>
> No, I don't. For me specifically, I mean there are different opportunities and places I can go, especially in Kelowna, to have different options, but knowing where your food is coming from is difficult and finding affordable choices is also even more difficult. The Farmer's Market might be there, but that doesn't mean it's inexpensive. (Student B)
>
> We don't see the water is the problem. We don't see the water as the basis for all of this. Why we're here, why that food is here and the availability and the transportation. I mean you look at this valley and there is one road up and down through the valley, and so that's critical. Our transportation up and down the valley, how our food travels, how we access our water and how we use our water to grow our foods or access our foods—so it's just a bigger picture of it. (Student C)

All respondents had understood the issue presented, engaged critically and responded accordingly on the surveys. They remained engaged in the issue four months later, even

incorporating some of the perspectives discussed in-class within their day to day decisions. One of their principal learning outcomes related to perspectives of others, and how their own views were situated within the group. This is typical in community mapping where participants bring their own views to the fore but then learn others' views in the process. For example Student C adds:

> It was informative to me because I was able to see the project from their perspective. So, a different demographic, and what was important to them. Maybe there were a lot of students without an automobile or that had to work within totally different parameters for access to their food.

What also became clear was that these students were already engaged with these issues in their own lives prior to the mapping exercise. In that sense, the project appeared to connect with aspects of their own values and beliefs. In turn, an existing personal interest in the topic appeared to support their willingness to engage with the mapping exercise, and to offer their deliberate contributions on the map and on the survey questionnaires. The survey questionnaire had successfully gathered indicators of engagement and learning, and the interviews helped researchers to better understand how these responses related to participants' deeper understandings and perspectives.

It was not universal that the project frames of reference—defined around 'food security' and the 'food system mapping'—provided the common language needed to conduct a more inclusive conversation among all participants. This common language seemed to originate partly from the local knowledge of the individual participants, prior to any engagement with the mapping project. That existing knowledge base also appeared to be developed and enhanced during their participation in the mapping exercises in-class.

During the subsequent mapping session at the Farmer's Market, we anticipated just a few minutes out in public in which to communicate the purpose and process of the engagement. A number of steps were taken to simplify the process and the mapping interface. Two maps were reduced to one, and a set of help instructions was posted on the mapping interface itself. The demonstration tasks were refined to finish within 10 minutes. A number of survey questions were removed or slightly modified from the extensive in-class version, to produce a shorter survey for the public participants. Eight questions were removed from the original version used in-class to produce a final version with 14 mixed quantitative and qualitative questions. Five questions gathered qualitative evidence only regarding strengths and weaknesses of the website and what was learned during the mapping sessions. The remainder of the questions gathered primarily quantitative data through check boxes and rankings, with a space on most questions for open ended responses. A copy of the revised survey questionnaire is provided in Appendix B.

4.5.2 Second Mapping Session: Kelowna Farmer's Market 2011

We held the next participatory mapping session at the Kelowna Farmer's Market on July 2, 2011 and another on October 5, 2011. To assess usability and participation in a less structured public environment, 54 participants were shown a brief demonstration of the participatory mapping tool and project concept. Researchers engaged with 41 participants on July 2 and another 13 participants on October 5. Figure 4.6 shows a photograph taken on July 2 to depict the context of facilitation.

Facilitation

July 2, 2011: Researchers set up a tent, a computer with a large external monitor as well as posters with large prints of the map interface and layers controls. A UBC promotional banner

was placed at the tent entrance, and a sign was placed out in view of the passing foot traffic. My field notes from the day recall it was a typically warm, sunshine filled morning marked by large holiday weekend crowds at the market site. Market managers had indicated average attendance of over 1000 visitors to the market, held on a dedicated open lot in the central Kelowna area near the main highway and also adjacent to the area's largest indoor shopping mall. At times throughout the morning numerous public attendees lined the tent, some escaping the brilliant summer sun, others curious about our signs announcing "Community Food Mapping, Demonstration Today" or asking "Is there food everywhere?" and urging readers to "Join this month's conversation online". Engagement would often begin with questions about one of these items.

Figure 4.6 Kelowna Farmer's Market participants and facilitator, July 2011

While one of the co-investigators stood available to answer questions and to begin a demonstration of the project, the other co-investigator worked with participants at the computer terminal. The individual participant or group at the computer was given a five to ten minute hands on training session, where the researcher would act first as 'chauffeur', and then would pass the computer mouse to the community member, encouraging them to try the website and add new information. Following the demonstration and mapping, a consent form and survey questionnaire was provided (see Appendix B).

October 5, 2011: The second participatory mapping session at the Kelowna Farmer's Market in October followed the same method used in July. If July can be characterized as the peak season of the Farmer's Market—in which weather, attendance and local produce are at their best—then October was perhaps the opposite type of market day. The cool, rainy weather and 'last of the season' vegetables were enjoyed by a light weekday sprinkling of dedicated local shoppers. The same survey questionnaire was used on both days.

Results of 19 surveys from July have been amalgamated with responses from one survey from October. One other survey from October contained less than half completed responses, and was not used in the findings. Thus, twenty surveys were completed by participants that had sufficient experience with the website across the two days to support adequate understanding of the questions. These surveys were also completed initially on paper and then were transferred to the 'Survey Monkey' web-based survey application.

Other participants at the Farmer's Market provided rich and in-depth feedback, but did not choose to use the participatory mapping tool, or to engage with the online information itself for long enough to complete the survey questions. A short account of these conversations is provided below under 'Observation'.

Tasks Completed by Users

Community members were encouraged to use the mapping website themselves, steering the computer mouse and selecting markers and areas of interest on the map. All demonstrations were conducted using the Food Access map showing the location and density of types of food in the food system. Each demonstration would begin from visualizing just the grocery stores layer, then adding the fast food and restaurants layers. Only participants who watched a complete demonstration, in which at least one member of their group (if not the individual themselves) had used the participatory mapping tool hands-on, to view or contribute information, were invited to complete a questionnaire. The survey asked for their perceptions of using the participatory mapping tool, and so required that they were familiar with the process of reading and adding to the information on the map. About half of the participants that stopped at the tent arrived in pairs, with the remainder divided between individuals and larger groups of three or four.

Observation

In many respects, this event contributed some of the most in-depth and revealing findings. Participants reframed the questions in their own terms, reversing the relationship between researcher and 'researched'. In exchange for providing the information I had requested, one participant began a detailed and fascinating conversation about the research design. Asking if it was collaborative, she then went on to ask how I intended to write the thesis–as an individual or together with the group. We went on to discuss community based research, what one could learn from such a study, and how this related to her own research experiences. In another conversation, one of the market vendors concluded that the project lacked "sizzle". He went on to give his own rich account of the sensual experiences of

producing and cooking with fresh, vine-ripened, seasonal foods and the material appeal of timely information on local products. From this business and marketing perspective, the project was interpreted as overly 'academic' and laden with information. One of the contributors was at first reluctant to offer her input, as "there is already enough useless information on the Internet", and thus reminded researchers that interpretations vary around the utility of volunteered information. One local neighbourhood activist on that rainy October morning also was initially reluctant to enter information on the system, stating "I have already told them about this" (in reference to bus service requests for one of Kelowna's distant suburbs, popular with students and lower income families). She referred to comments she had provided during traditional community feedback sessions offered by the city planners, and her reluctance to renew this past struggle on new ground. Encouraged by researchers that this transportation and food system linkage was ideal for the research, the participant eventually agreed to add a map discussion when also assured that it could be accomplished anonymously. Past studies agreed that the Geoweb can offer an alternate method of participation in public processes for citizens unaccustomed to town hall meetings, which can be confrontational (Ramasubramanian 2011).

Data from User Survey Questionnaires

This second participatory mapping session using Geolive was also considered a success, as we gained first hand experience with public participants from the local community. Of those that were surveyed, 85.7% of respondents rated the tool effective or very effective for discussing information presented on the map. 17 respondents provided qualitative information on strengths or weakness of the mapping website, and 14 reported having learned something from the exercise. Some respondents gave contact information for

researchers to do follow-up interviews, but this information has not been used to further contact these participants since no further data or engagement was required for this group.

Learning outcomes on the qualitative survey questions were quite different among Farmer's Market participants than among the first student group. Of those at the Farmer's Market that reported learning outcomes, just four seemed at all related to the specific map-based issue around the access to food including:

> "Predominance of chain food sources, Relative obscurity of…healthier food sources."
> "There's great locations for local foods."
> "Over abundance of fast food in the area."

Most of the responses referred to learning something about the project more broadly, such as overall project motivation and goals:

> "Help is on the way!"
> "There is momentum and technology aligned to help the discussion."
> "That people are interested in the topic."

Clearly, the active use of the technology had mediated the process of participation, which in turn appeared to support greater understanding of place-based issues discussed on the maps.

Analysis of Map Discussions

This Farmer's Market group did not extensively contribute to the online map. Only seven unique discussion markers were created on July 2 and just one on October 5. Participation in the context of the Farmer's Market assumed a less structured nature. If we define participation narrowly by only examining data contributed to the map, then very little participation occurred. Most participants were happy to discuss the issues verbally, but they did not want to share information online. Overall, they were far less willing to base their dialogue around the spatial information on the map. However, to define participation in that

way seems to devalue the dozens of sincere and thoughtful verbal responses to our challenge of raising awareness around the local food movement.

4.5.3 Third Mapping Session: UBCO At-home 2011

The final mapping activity was designed to remove the facilitator from the context of participation, so that the website could be assessed without direct training as done previously. Returning to the same university geography course one year later in November 2011, a new group of students was invited to participate. 100 students were approached through an email from the course instructor using the course administration system. The course instructor offered a small bonus on the students' course participation grade in exchange for their time to collaborate on the project outside of regular class hours.

Facilitation

This final participatory mapping session helped to reveal the effect of removing the facilitator from the process of participation. This group of undergraduate geography students had been studying relevant topics in their course material. Thus, the group could be expected to have moderate knowledge on the issues combined with advanced computer and Internet skills. The survey for this mapping session was deployed online using the Survey Monkey web-based survey software.

Tasks Completed by Users

In the email message sent to recruit students, simple instructions asked them to join a map-based discussion related to their experiences of local food either on campus or in Kelowna. Following a brief description of the main functions and features of the website, participants were asked to "Drag and drop three new discussion markers onto a relevant point on the map

and add some text (or photos) related to experiences with food on the UBCO campus and in Kelowna, and then Contribute to three other discussions posted by another user[5]." Finally, we asked these student participants to complete the online survey.

Observation

Contact with this At-home group was coordinated with the Principal Investigator and course instructor. I had no direct contact with this group of students. A brief announcement of the opportunity to take part was given in-class by the Principal Investigator, but all involvement in this participatory mapping session occurred online using the Geoweb. The Survey Monkey system was used for deploying these surveys, which were completed by participants online. The statement of informed consent was appended at the top of the survey so that it was the first thing the participant read before they began. Completing the survey indicated informed consent to take part in the research.

Data from User Survey Questionnaires

Of the 100 students invited, 45 voluntarily completed the exercises and surveys, with most stating residence in the City of Kelowna. Interestingly, this group experienced a specific software error during the course of their engagement that significantly impacted the first users within this group who tried to complete the exercises. This software error complicated certain aspects of the analysis, but it also introduced an interesting set of emergent findings. A change in the underlying Facebook API integration meant that participants who logged in using their Facebook account (most of the group) were initially unable to add information to

[5] The Geolive participatory mapping tool provided users with an option to read more detailed instructions and support information as they began to use the website.

the map, having ‘view only’ capabilities instead. They could see all of the information and contextual material and add their own discussions, but they could not reply to other discussions. Those that logged in using the Joomla! website login module rather than through their existing Facebook account were unaffected and thus could complete the exercises fully. Notably, the error impacted only new Facebook login accounts, while those saved in the system already (such as those of researchers and programmers) were unaffected.

After the problem was noted and corrected, another email was sent out to the class, explaining the problem and asking that students return to the website to retry the exercise. Students were then invited to email their comments on what they had learned and how they could foresee the tool used in future, in the event they had already completed the survey during their first interaction with the site. 27 out of 44 survey respondents had completed the mapping exercises and surveys before the software was corrected. Of this 27, most could not add replies and thus were quite frustrated with their experience, or were simply confused about their inability to access some of the mapping functions. On one hand, this unexpected turn in the research introduced a variable that was difficult to control. On the other hand, it allowed researchers to examine in a controlled environment the effect of software problems or “bugs” on the participants. Without any other means of connection with the participants, these web-based users might have moved on to another use of their time, with little or nothing offered to the designers or managers in the way of reporting or feedback.

Obviously, the experience of the usability bug affected those that used the website prior to correction of the software errors. However, the average Likert rating given after fixing the problem was 3.4 out of 5, and this did not increase significantly from the value of 3.1 given by those that completed the exercise before the problem was resolved. Only 48% of total

respondents rated the tool effective or very effective for discussing information presented on the map. Again, the proportion grew slightly to 54% for the subgroup that participated after the bug fix, but still reflected a decreased satisfaction with the website compared with the previous two groups. Only 69% said they would revisit the communityfood.ca website, while 100% of those surveyed at the Farmer's Market had said they would revisit.

40 respondents gave qualitative information on strengths or weakness of the mapping website, and 39 out of 45 reported having learned something from the exercise. Again, several respondents gave contact information that was not used to further contact these participants. 14 students replied to the Principal Investigator specifically by email, as well as having completed survey questionnaires.

Despite their lower rating of their experience, this group provided some of the most comprehensive feedback on strengths and weaknesses of the 'Community Food' mapping website. They covered what seemed to be the widest range of issues, and gave short but focused and well articulated responses including:

> "The discussion feature is excellent, it helps to incorporate opinion into the map and give people a chance to voice their opinion."
> "Easily accessed and allows discussion based on location."
> "Good for sharing the experiences of the individuals. Provide awareness to the people in the community of the current issue with food."
> "Helps people connect with each other and interact with their environments in more profound ways."

Many of the weaknesses reported (16 out of 40) involved the usability bug mentioned above. For researchers, this survey mechanism helped to identify occurrences that prevented the user from accomplishing their goals, since there might not otherwise be any other way to capture this information. This also points to an important consideration with the study design, which

is the sensitivity of the user's experience and rating of the website to technical errors that occur with the system hardware or software. Other weaknesses reported did not mention usability issues, but instead discussed the concept overall:

> "people can provide biased information."
> "Information presented too simplistic. Requires a bit more detail to fully make it useful."

Learning outcomes on the qualitative survey questions were once again quite different for this group, who repeatedly referred to the issues discussed on the maps. Several responses referred to the social relevance of the information, and the alternatives it presented for understanding and challenging the food system, such as:

> "That we need to begin participating in the matter in order to create change ..."
> "The Okanagan has many local food options which more people should take advantage of."
> "We have a lot of local potential but it is in competition with cheaper and less healthy options."

Other specific themes within the responses included discussions around variety and selection such as "It's a great place to eat! Lots of choices" or dialogue around price and quality of local food including "Price and quality is an issue, seems that you have to search hard for a meal that is good but affordable." Another unique group of respondents learned about how their views were situated related to those of others in the group, examples of which include:

> "A lot of people around my age feel the same when it comes to spending money, location, and quantity vs. quality";
> "they are varied and each person has [their] own opinion and experience".

The initial question asked about the students' experiences on campus, and several respondents learned about that topic as demonstrated by these answers:

> "lots of resentment over the Aramark monopoly (basically) at UBCO and their ridiculous prices."

> "Food can be particularly problematic for students who have either limited money or mobility."
> "Food issues are not just limited to campus; it affects the rest of the community."

One of the most striking sets of responses used specific spatial concepts and thinking, which was also noted as a theme within the first group of students, but not within the Farmer's Market respondents. This seemed to strengthen the idea that spatial literacy combined with existing awareness of food system issues contributed to the students' ability to engage in a map-based dialogue using spatial thinking. Examples of these responses include:

> "It really pointed out the clustering of restaurants and grocery stores in one certain area of the city as well as the encroachment of city onto the agricultural land."
> "Food producers, distributors and retailers are located in specific locations in a food community [for] a reason."

Examination of the 14 email responses from the students shows even more in-depth responses around learning outcomes. One theme which emerged from these answers that was not as evident in earlier groups was the communications potential of the Geoweb medium. One participant noted "It has become apparent that many of the same issues I feel towards food prices, quality, and choices are the same issues felt across the campus. Primarily, that it is more expensive and limited choice for healthy options. I feel that this website can voice these issues to vendors, and make customer demands more well-known" (Email 13).

One email response was especially comprehensive, and exemplified the type of engagement with the material that researchers had aimed for:

> You can reach a lot by bus since almost everything is on the 97, however from what is available, there's a higher proportion of "junk"/fast food places than "real" restaurants. I also learned that there [are] community gardens in Kelowna, they're just downtown. Also, I learned that a lot of the food available is shipped from far away (based on the grocery stores listed - superstore, safeway, walmart) and not a lot is local - despite Kelowna/OK growing a lot. (Email 5).

This group, despite perceiving a less effective technological experience, provided rich feedback on what they had gained and how the participatory mapping tool contributed to these conclusions.

Analysis of Map Discussions

The students in this group developed a well populated online discussion map with over 100 unique discussions, despite initial challenges with the software. The students provided many examples of volunteered opinions, comments and ratings of their favourite local establishments. Of more than twenty map discussion created in the geographic area of downtown Kelowna, all referred to specific restaurants, stores and markets by offering advice to other students on deals, special products, experiences and reviews. The 'downtown' area was clearly associated with entertainment, while the area around the campus once again attracted interest from students in residence.

Around the area of the university campus, the dialogue assumed a more conversational nature. The participants posted questions to one another, and would answer each others queries. Several of these conversations received five or more replies from different students. In these on-campus conversations, students voiced political views, attitudes toward the food system on campus and expressed their understandings of the place in which the discussion was grounded. An exemplary discussion that developed on the site of the university campus demonstrates a shared understanding by the students of a particular map-based issue related to the food system. The map then allowed these understandings to be shared with members of the student community. The discussion title inquires "Should the university incorporate a mini-grocery store to save residence students the trip downtown?" Students replied as follows:

> i think this is a great idea however it would probably be owned by aramark which would drive up the prices (Post 1)
>
> I would LOOOVE one. UBCV I believe has one, and if they do, I believe, it's like a little Save-on. Which would be perfect. Like I'm pretty sure we don't need a full grocery store, but enough to make food would be lovely. (Post 2)
>
> It would be a good idea to bring in the mini grocery store to the Campus but I think the price is going to be quite high and eventually the students would prefer a long trip to the big chain supermarket looking for a better price. (Post 3)
>
> awesome idea. Maybe a student can start one up! Too time consuming to go down the 97 for grocery (Post 4)
>
> i definitely agree. the ubc van campus has a pharmacy and little store which make things way easier, especially to save the trouble of carrying a bunch of bag over bus trips! (Post 5)
>
> This would be a great thing if it could be done without Aramark's involvement. If they ran it the food there would be as overpriced as anywhere else on campus. So long as prices were reasonable it would see a huge amount of business. (Post 6)
>
> I would definitely like a locally owned, small grocery store on campus. Hopefully it would have local produce whenever possible. I think a store like that could do really well here and I think the students would be behind it if it also employed students. (Post 7)

To understand how this conversation differs from the other types of crowd-sourced 'data' observed on the maps, consider these titles and posts: "Excellent place to go for a breakfast or lunch. As well has live music on some weekend nights. The friendly staff make the experience enjoyable", or "Convenient location downtown and close to bus stops" or even "Walmart with a huge food section."

This study takes the view that all of the participants provided valid contributions to the research, and the intent is not to devalue certain contributions by exemplifying others. It is not assumed either that the study methodology warranted extensive feedback by all the participants. Participants that did not find an interest in the approach could not be expected to construct detailed answers beyond their level of engagement with the subject, despite

researchers' beliefs on the topic. The technology itself was in development throughout the course of the research and it may not have worked effectively at a level of performance expected by expert users of such technologies. What these examples serve to show instead are cases where participants demonstrated critical engagement and personal reflection on both the information presented, and on the larger issues raised during the research.

4.6 Follow-up Interviews with Community Advisory Committee Members

At the conclusion of the field work, I asked the Community Advisory Committee members to participate in un-structured one hour interviews at sites specified by the participants for their convenience. To begin, I guided each interviewee through a demonstration of the Community Food website to show the Geolive participatory mapping tool and discussions, before asking some of the questions from the interview guide (see Appendix C for a copy). Usually, only one or two questions from the guide were needed to initiate or maintain the flow of the conversation, and having the website open to view as we discussed naturally led to productive and relevant feedback. Interviews were audio recorded, allowing me to focus on the conversation, and later were transcribed. I have included quotations from these interviews to provide brief examples of their feedback, which are identified anonymously below as 'Committee A to F'.

The committee members expressed many of the same priorities for the project eighteen months later during the follow-up interviews as they had in the initial focus groups. In addition, each committee member indicated that the results of the online mapping provided insight into the views and knowledge of students and other community members. For example, one comment provided support for the discussion concept, adding that it would be prudent from an engagement perspective to "discuss what they are already talking about"

(Committee B) by connecting with existing social media outlets. When asked about how he felt the tool could be used to engage dialogue, committee member B suggested we go to where the participants are already, in terms of existing social media outlets on the Internet. His suggestion was to build discussions from what the public are already talking about, rather than trying to lead a new conversation.

Another member commented on the relevance of contributing information: "I'm not naïve enough to assume that policy change will come just from adding information onto the map—that requires organized political action" (Committee A). That member understood that the tool was just a platform for awareness and dialogue, but that long term change would require a more sustained and organized political effort. This was not to say committee member A was not engaged with the process, as he was in fact one of the most actively engaged committee participants. One committee member felt "It's still really relevant information. We'll use this information. I will come to this place to see what people have said, and probably use it do consultations" (Committee D). These interviews provided an opportunity to return to the original participants in the project and reflect on the collaboration.

This chapter has provided a description of the findings as the first part of the analysis of the Community-Based Research project. These finding have been presented to emphasize the context of participation and the experiences of the participants. They provide a highly contextualized set of information on which to build an analysis of the research questions. The data and partial analysis provided in the preceding chapter offers a basis for understanding the experiences of participants. This becomes important both in the next chapter and again in the final discussion chapter with respect to the specific research questions.

Chapter 5: Comparisons Across Participant Groups

In this chapter to follow, I will summarize and compare the data collected during the three participatory mapping sessions, as a way to analyze the experiences of participants involved in the Central Okanagan case study. The first research question asks what shapes participants' views of Geoweb technologies and their experiences of using them. Examining participants' existing views of relevant technologies and their experiences while using them provides a basis for exploring factors that could influence their willingness to use these technologies and their perceptions of effectiveness. I compared the three participatory mapping sessions as a way to better comprehend the effect that the context, the specific participants and the method of facilitation had on the results. Understanding similarities and differences between the three participatory mapping sessions provides a basis for considering what shaped the experiences of participants, their views toward using the Community Food Geolive participatory mapping tool, and their perspective toward how effective the process was. This analysis sets the stage for addressing the specific research questions, which are restated at the end of the chapter.

I will now summarize the main contextual elements that differed between the three participatory mapping sessions using the Geolive participatory mapping tool. Aside from the degree to which the technology mediated the participation in each engagement strategy, other substantial elements of the context varied between the three participatory mapping sessions. The first group used the participatory mapping tool for over an hour, the second group had about 10 minutes per person using the technology, and the third group was dispersed geographically and used the website for an unknown, though varying amount of time. As the facilitator's role diminished gradually during the second and then third mapping session, the

amount of additional context and guidance provided to the groups decreased. The participants' experiences then relied increasingly on the website, and on their existing knowledge and experiences. The participation setting varied widely, from the university to a busy public market to wherever individuals chose to access the Internet. There were also differences between the groups of users themselves, who represent differing social categories with respect to age and income level. Thus, the point of this analysis is not to establish causal links between factors, since so many things changed between one mapping session and the next. Rather, the goal is to note how these factors and variables move in comparison between the groups that participated in each of the three mapping sessions.

5.1 Participant Effectiveness Ratings and Willingness to Volunteer Information

To begin comparison of the three participatory mapping sessions, I emphasize two main contrasts between the experiences and learning outcomes of the participant groups above:

1. Difference in the effectiveness rating as the role of the facilitator is intentionally diminished.
2. Difference in willingness to volunteer information using the Geolive participatory mapping tool.

First, the At-home mapping session was rated less effective by the participants than the first two mapping sessions. These ratings reflect the varying context and practise of the research during each activity, and should not yet be attributed to any one factor. Figure 5.1 below shows the proportion of the group that rated the Geolive participatory mapping tool Effective or Very Effective for discussing information shown on the map. As shown by the bar graph in Figure 5.1, over 85% of the participants in each of the first two facilitated mapping sessions rated the Geolive participatory mapping tool Effective or better.

Recall for a moment that the most substantial contextual changes between the first two mapping sessions and the third were the removal of the facilitator, as well as the emergence of the usability problem for the At-home group. The drop in the effectiveness rating then measures the combined effect of these factors, in addition to other more minor contextual changes. As noted in the previous chapter, these ratings did not increase substantially for the sub-set of students at-home who used the site after the software error was corrected. Thus, removing in-person facilitation from the mapping process appears to be a significant factor in the participants' perceived effectiveness of the process. How this association between facilitation and effectiveness relates to other differences between the groups becomes the next subject of the analysis.

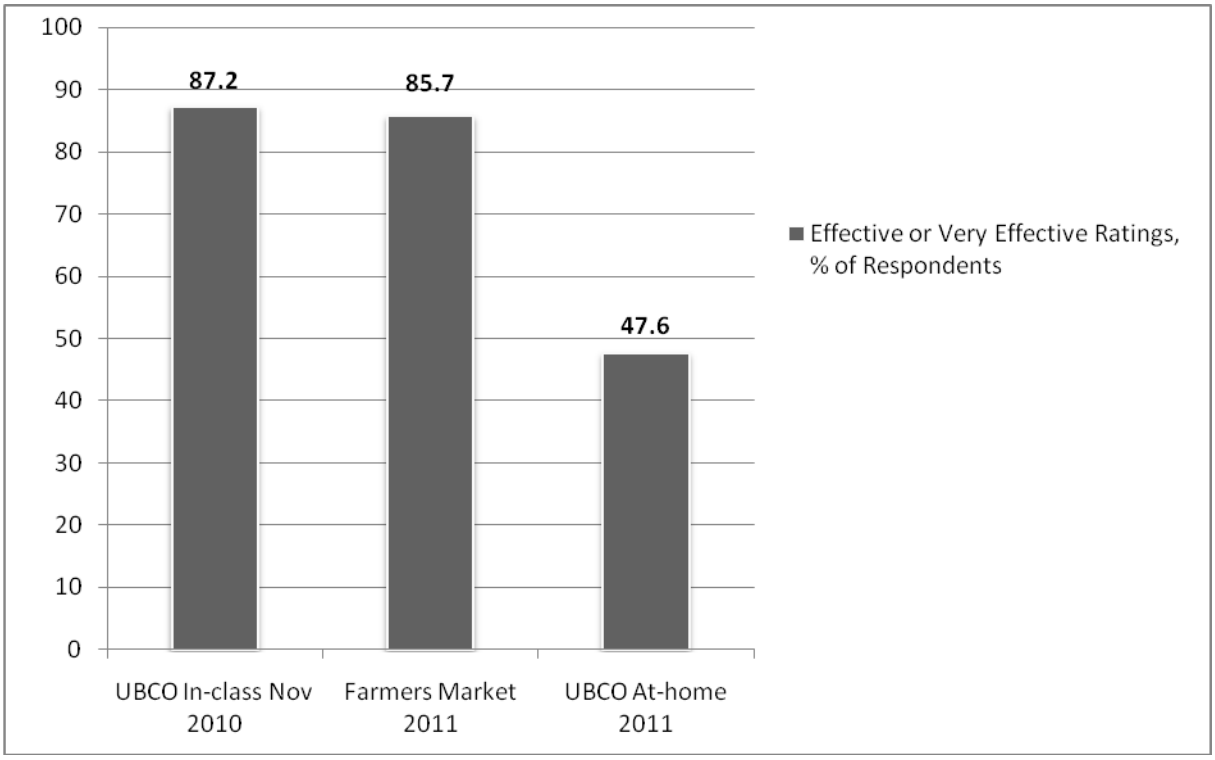

Figure 5.1 Effective or Very Effective Rating of participatory mapping tool, by group

The second substantial difference between the participant groups' experiences was the willingness of participants to volunteer their geo-located information using the Geolive participatory mapping tool. Both groups of students created substantial numbers of map discussions and replied to the discussions of others within the groups. The fact that these student mapping sessions were delivered as a part of a university course had some impact. Certainly, the students may have felt compelled to use the Geolive participatory mapping tool as a component of their studies although participation was not mandatory and not all of the enrolled students attended the mapping sessions. Nonetheless, the students did make greater use of the participatory mapping tool, with an average of two discussions created by each.

By contrast, the Farmer's Market group participated in viewing the information presented by the participatory mapping tool, but few were willing to actively use the tool to volunteer their own information. Less than a fifth of this group agreed to add information using the Geolive participatory mapping tool. At the Farmer's Market, participants valued the consumer information and the concept of greater food awareness, and yet most preferred not to participate actively online, opting instead for verbal engagement with facilitators.

We then noted that survey results from the question on learning outcomes also varied across the groups. The student groups that made greater use of the participatory mapping tool gave survey responses structured around the spatial concepts and map-based discussions. Viewing the spatial information only, as many participants at the Farmer's Market did, seemed to result in feedback structured by the general topic of the project, rather than by the map based-issues themselves. Responses on what was learned by the group that participated in the UBCO At-home mapping session repeatedly referred to the issues discussed on the maps. The use of the website to mediate the participant's experience clearly both impacted upon

their perceptions of what was learned and structured the content of their learning. Identifying these contrasts led to questions around what specific factors might be related.

The reluctance of some Farmer's Market participants to add their own information might be explained by the type of facilitation that we used. Many Farmer's Market participants accessed the information passively, while the researcher chauffeured the system on their behalf. Participant observation revealed that the group was clearly engaged with the issue and the topics on the map (and thus why they chose to shop at the Farmer's Market), but they did not want to directly contribute their views online specifically. We might theorize that they did not want to use the tool because of the context alone. Perhaps they were too busy shopping: however, that does not account for their willingness to remain and discuss the issues in-person, as noted through direct observation. For that group, their reluctance to use the tool actively seemed more related to them and to the technology itself. It is possible that they did not find a need to contribute information as they already felt engaged with local food issues. Despite the fact that only a few of the Farmers' Market participants actually added their own information, most gave positive ratings to the technology and perceived the participatory mapping tool to be effective for discussing issues presented on the maps. To better understand and interpret these findings, I continued the exploratory analysis in search of helpful evidence to identify possible explanations.

In the next section, the analysis moves to comparing factors that help to contextualize the groups of participants specifically. For this next section, I will draw upon themes from the literature review as they are relevant to the case study results including: usability, computer and Internet literacy, participant locality, existing approaches to sharing information online and spatial literacy.

5.2 Usability Ratings by Participants

Participants rated the following four aspects of the online mapping website: Appearance, Ease of Use, Navigation Tools and Map Layers. Moving from the first mapping session to the second and then third mapping sessions, the average rating by each group for each component is represented by the individual bars on the graph in Figure 5.2. Each group of participants appeared to have a consistent usability experience across the four aspects, meaning that each group tended to rate all components either higher or lower than the others.

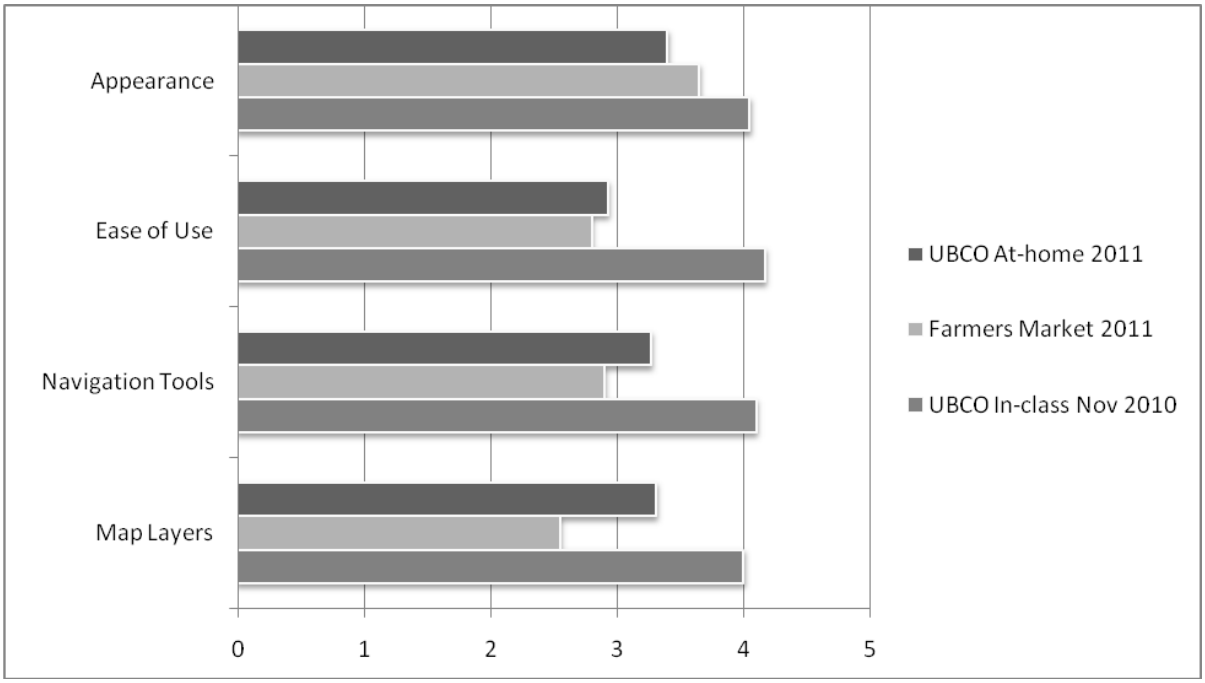

Figure 5.2 Average ratings of participatory mapping tool, by component and group

Usability of the Geolive participatory mapping tool was rated highest by the first group of UBCO In-class participants, while both the subsequent groups on average gave a lower overall rating. The lowest overall usability trend was noted for the Farmer's Market group. Each group's respective rankings of the usability aspects parallel the decreasing amount of time they spent using the system. It is possible that time with the system was one aspect of

the context and facilitation that had a specific effect on participant experiences and on the survey results. A full hour of engagement was used in the first mapping session, which was also rated highest. The students at home could participate at their pace, and website server logs show that the average visitor remained on the website for an average of over 10 minutes. Despite their experience with the software errors, the at-home participants still gave higher ratings of the technology. The Farmer's Market group actively operated the participatory mapping tool for only about five minutes on average, and also gave the lowest usability ratings. Verifying this hypothesis would require detailed study using a more controlled research design in order to understand the individual effect of factors like the level of facilitation, the context of participation and the amount of time spent using the system.

However, based on the analysis thus far, it is clear that both usability and effectiveness are related to the user's experience while using the system. Perceived usability seemed to mirror the participant's time spent using the system. Effectiveness seemed to stem more from the participant's perception of a successful outcome. Both perceived usability and effectiveness decreased with the level of in-person facilitation, as well as in the presence of technology glitches. Having illustrated some of the parallels between the context of participation, the mapping technology and the users' experiences, I now move to examining characteristics of the participant groups themselves.

5.3 Locality of Participants

The project was overwhelmingly drawn from a local sample of the population. Just four out of 162 participants surveyed were not residents of the Central Okanagan region. Over 80% of the total participants in the project were residents of Kelowna. The Farmer's Market drew a more 'representative' sample of the local community in the sense that participants were more

evenly distributed between the various local communities. The students were primarily residents of the City of Kelowna, and thus were representative of both the undergraduate university student population but also of local youth more generally. The Farmer's Market was the only mapping session that involved residents from outside the Okanagan. Researchers had hoped for a larger non-local group with which to compare local responses. Subtle differences were noted in the specific responses given by the four visiting participants, who did not tend to refer specifically to local features or issues, and obviously answered from a different perspective than local residents.

Another question added to the surveys for the second and third mapping sessions asked participants to identify 'home town', if this was other than where they were currently residing. Most of those surveyed stated they were originally from somewhere else. Only four participants were life-long residents of the local Okanagan (or had moved there before age five). Again, researchers had hoped for a larger group of distinctly local residents with which to compare the other groups. However, both the distinctly local and the distinctly non-local samples were very small. For the majority of the participants, there was a varying set of relationships to the local region. Many students were newly arrived in the area within the past year, while many others were more established local residents.

5.4 Participant Age and Approach to Relevant Technologies

The student groups were clearly drawn from a younger demographic sample than the Farmer's Market attendees. Average age for each group is given in Table 5.1. The average age of the university students was in the early twenties, while the average age of the Farmer's Market group was in the late forties. This corresponded with the groups' uses of online social media technologies as also shown in Table 5.1. The older Farmer's Market group indicated

significantly less use of these tools at just 60%, while over 90% of both student groups used the same technologies.

Interestingly, online maps based on the Geoweb were used by all groups. Also interesting was the change in the response rate around use of online maps corresponding with the change in the question text between the first and second survey, as noted in the caption for Table 5.1.

Table 5.1 Average participant age and use of relevant technologies, by group.

	Average age	Used online social media	Used online maps
UBCO In-class Nov 2010	**20**	**95%**	**6.3% ***
Farmers Market 2011	**49**	**60%**	**95%**
UBCO At-home Nov 2011	**21**	**91.1%**	**97.7%**

***The question asked on the first survey was "Do you contribute to online maps"? The question text "contribute to" was changed to "use" on later versions of the survey, with results shown above.**

The passage of a year of time may have affected the reported use of rapidly expanding Geoweb technologies. However it is also possible that the main difference in the response rate results from changing the question from the concept of access to that of contributing.

Thus, the Farmer's Market group was less likely to use online social media, but equally likely to use online maps. To better understand differences between the groups' ages and use of the Internet, I compared additional data across the groups. As shown by the bar graph in Figure 5.3, the groups also shared information on the Internet differently. All groups were comfortable posting text online, while the two student groups almost mirrored one another's responses. Noting this close relationship between the two student groups on the graph in Figure 5.3 confirms that the Farmer's Market group was less likely to contribute photos and videos than the students.

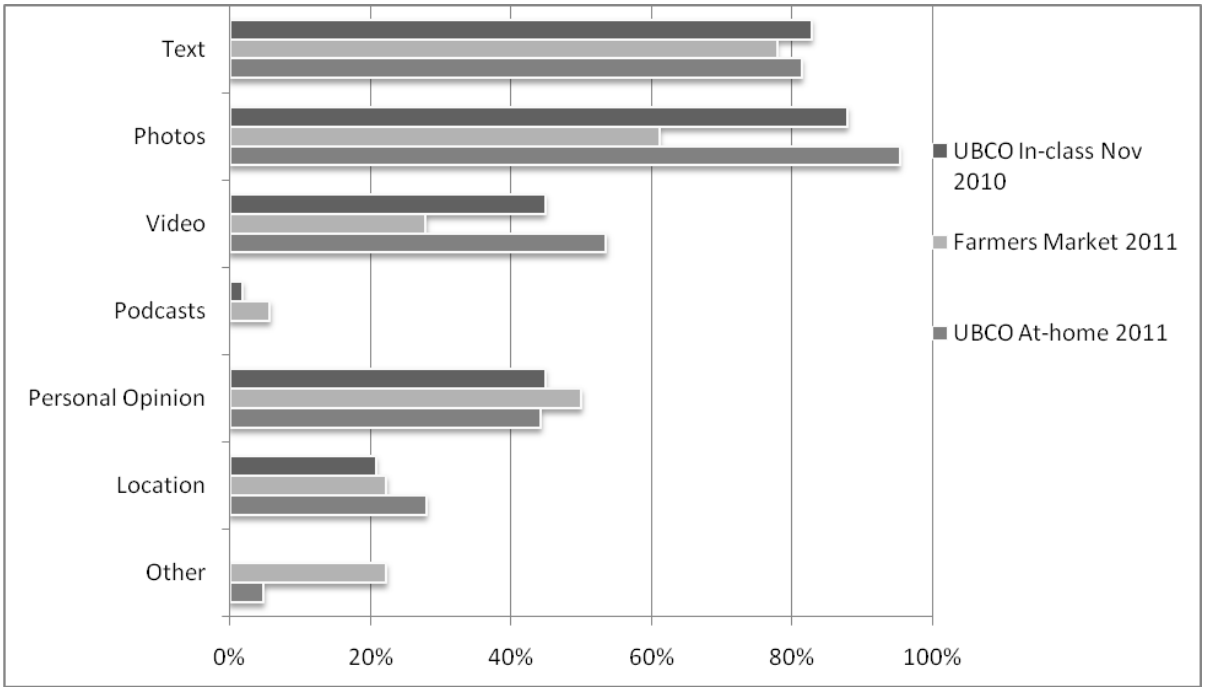

Figure 5.3 Types of information shared on the Internet, by percentage of group

To clarify relationships between group approaches to posting information online, I converted the results of participants' stated frequencies into yearly data. This involved estimating the number of days associated with their responses. For example, I converted 'Daily' responses to a value of 365, one for each day. 'Never' responses were converted to zeros, while 'Monthly' responses were assigned a value of 12. I assigned a value of 48 to the 'Weekly' responses, and 'Less than once a month' received a value of 1. This method had the effect of emphasizing the extreme values of 'Never' and 'Daily', but I argue that this is appropriate since these behaviours are the ones of most interest to our case study. I charted the weighted averages of these quantified survey responses as annual instances per person, which then enabled me to rank the approaches by implied order of preference. The results of the ranking are shown in Table 5.2 which lists the order of the approaches, with the most frequently used listed at the top of the chart, followed by the second highest ranked approach within each

group and so on. The numerical values for the number of days per year calculated for each approach to posting is also provided in Table 5.2. These values provide a basic measure of how participants share information online, both by examining first the order of the approaches and then the number of times per year for approaches of specific interest. This analysis reveals distinct rankings between the three groups, as well as significant differences in the frequency of their online sharing behaviours. The students ranked entertainment as a preferred approach, assigning it to the third and first position respectively. By contrast, entertainment was both a lower priority and a less frequent activity among the Farmer's Market group who assigned it to the fifth position. By contrast, political action was a low priority for the students in their approaches to posting online, while the Farmer's Market group ranked political action as their third priority. All groups ranked work or study as both a high priority and a frequent approach to posting online.

Table 5.2 Ranking and frequency of approaches to posting information on the Internet

Rank	UBCO In-Class 2010	*	Farmer's Market 2011	*	UBCO At-home 2011	*
1	for work or study	45.5	personal information	60.9	for entertainment	102.2
2	personal information	44.3	for work or study	37.6	personal information	55.6
3	for entertainment	37.8	for political action	26.4	for work or study	35.5
4	comments on media websites	35.8	comments on media websites	22.7	comments on media websites	27.7
5	anonymously	22.9	for entertainment	15.2	anonymously	16.1
6	other	21.4	anonymously	8.0	for political action	13.0
7	for political action	3.3	on maps	3.7	on maps	0.8

***Weighted average days per person per year.**

Posting of personal information was ranked highly by all groups, while anonymous sharing was not frequently used by any of them. All groups stated a significant frequency of posting comments on media websites. Posting on maps was almost never done by these groups, but more so by the Farmer's Market group. Other findings of note were that the Farmer's Market

as a group concentrated their online sharing around relatively serious use of the Internet. Most of their posts online involved work or study, with some use for political action and comments on media sites, and with a much lower frequency of the other behaviours.

One of the most notable contrasts was the increase in stated frequency of posting for entertainment by the UBCO At-home student participants. Of the three groups, students participating at-home in 2011 were far more likely to post personal information online for entertainment, with twice the average frequency of the top choice for the other two groups. The estimated frequency of the approaches to posting information on the Internet is shown by group in Figure 5.4. The bar chart vividly portrays the distinctions between the groups. The groups shared similar attitudes toward posting on the Internet, except with respect to posting for entertainment and posting for political action.

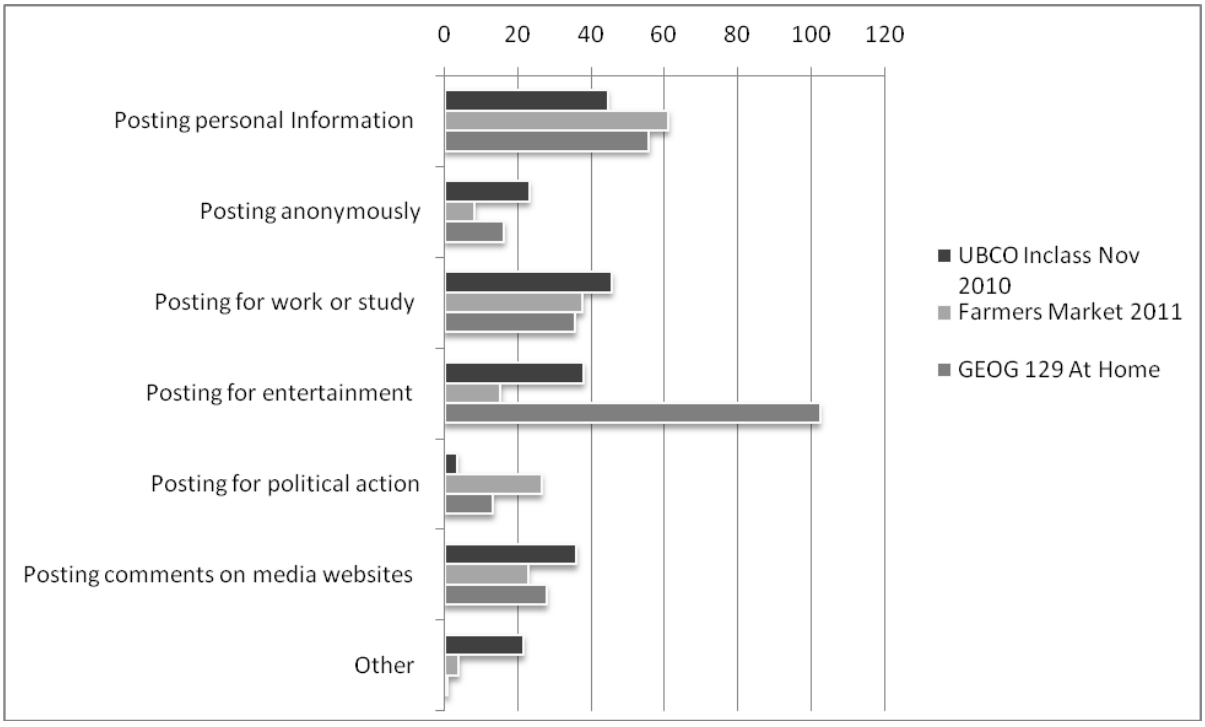

Figure 5.4 Average frequency of approaches to posting on the Internet

In summary, the findings presented above both describe the experiences of participants and provide a foundation from which to examine the research questions. In the next and final chapter, I discuss the results of the study under three types—1) access, 2) engagement and 3) change—as defined in the study methodology. The first research question set out to explore the experiences of participants in the participatory Geoweb project, asking what shapes their view of these technologies and their experiences of using them. The second research question asked if web-based participatory mapping was an effective or meaningful form of public engagement. In the next chapter, I will address the research questions more directly, using the results of the case study as presented above.

Chapter 6: Discussion

In order to better understand the types of participation that occurred within this study, I will now return to the terms access, engagement and change. I used these three terms earlier in Chapter 2 to explain three types of participation commonly discussed in the literature. I will now use these three terms to analyze the nature of participation and the range of participation types that were observed in this case study, and to guide the discussion of effective and meaningful participation. I will also examine factors that appeared to shape the experiences of participants and their views toward the process.

To determine the proportions of each type of participation in this study, we need to identify them using the case study data, as explained in the following section. Beginning with the most quantitative measure, website server traffic showed 880 visits by 526 unique visitors to the website over the one year period from January 1, 2011 to January 1, 2012. The use of the website over the year is shown by the graph in Figure 8.1. The large spike at the right indicates the traffic during the UBCO At-home mapping session.

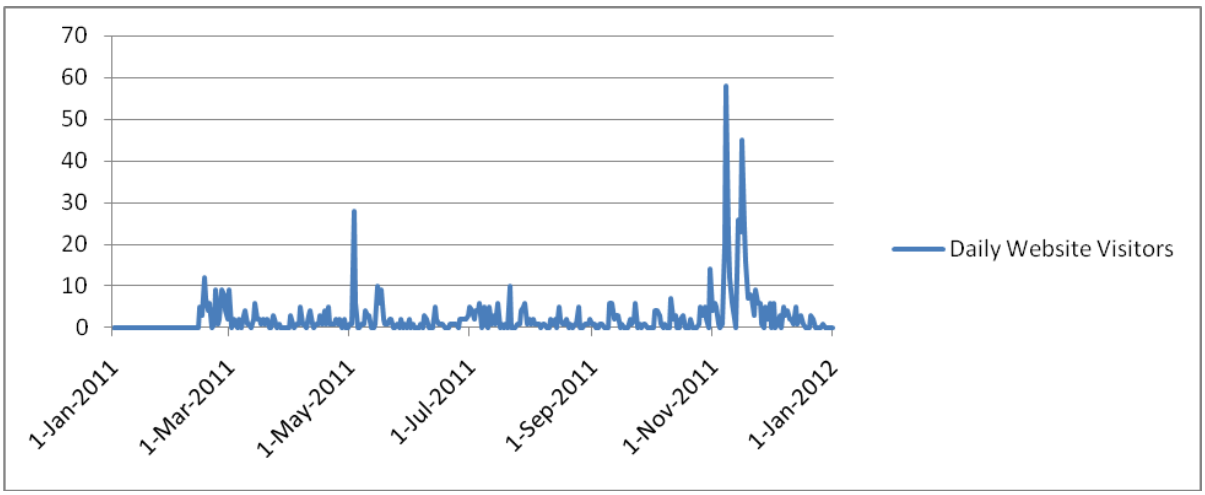

Figure 6.1 Geoweb mapping website server traffic, by date

However, server traffic statistics did not indicate whether participants had actually viewed the site or learned how it worked. To define a number that 'Attended the mapping session', we used the measure of participants that completed surveys following the mapping sessions. This provided a simple way to identify participants that had received access to both the participatory mapping tool and enough facilitation or direction to know basic functions. 100 UBCO In-class students, 54 Farmer's Market attendees and 100 UBCO At-home participants were approached and invited to participate. Of these, only 63, 20 and 45 respectively agreed to take part in both the online participatory mapping exercises, and the completion of a survey questionnaire. A total of 128 participants attended the three mapping participatory mapping sessions, which is defined to be 'access' in the case study as discussed in more detail in the following section. Moving along the continuum of possible participation types in the case study, the types become less clearly delineated.

If we identify the next type of participation as those that 'Engaged and completed the process', then each participatory mapping session involved a slightly different outcome. 63 students In-class at UBCO reported using each website component, including both the navigation tools and the map data layers. In addition, 12 participants at the Farmer's Market reported using each website component, while 38 out of 45 respondents from the At-home participants reported the same. A total of 113 participants reported using the website navigation tools or map layers after receiving either in-person demonstration and hands-on training or after using the website from home following online instructions.

Of this group who attended the three participatory mapping sessions, most but not all were successful in contributing their views online using the participatory mapping tool. Examining participants' belief about effectiveness provides another perspective on participation in the

study. Counting the number of participants that rated the participatory mapping tool as effective or very effective for discussing information presented on the map shows that 48 out of 63 participants from the UBCO In-class group shared this assessment. At the Farmer's Market, 12 participants found the tool effective or better, while the At-home group showed 20 students in those categories. By this measure, a total of 80 participants rated the tool as an effective method of engagement with the spatial information and the issues presented through the map media, which offers a measure for 'engagement' in the project.

Moving further along the continuum of participation types, the analysis now considers which participants demonstrated "Evidence of critical reflection on the issue", through the content of their contributions. By critical reflection I am referring back to the concept of reflexivity outlined in Chapter 2. Thus, conscious thought that can lead to awareness and the potential to support change are the indicator for identifying this type of map contribution, which is definitely the most difficult to delineate. We can first assess the number of participants that contributed what we thought to be relevant information, as a measure of participation. Coding of map discussions was completed using content analysis, and this allowed simple tallies of relevant and non-relevant map contributions to be produced. Irrelevant discussions were any that did not have a clear connection to the map or discussion context eg. 'test' or "12345". Relevant discussions were then divided into two groups corresponding to one for simple volunteered data and another for discussions that constituted dialogue. 'Data type' contributions were distinguished from those that were discursive, referring to ideas or concepts about the food system, or to personal reflections on these topics. Refer to Appendix C for the detailed method of calculating the total numbers of map discussions for each group.

During the UBCO In-class mapping session, 27 discussion markers referred to substantive issues or concepts. At the Farmer's Market, none of the participants contributed information that was substantive, with most consisting of just a word or two as the participants learned to use the new participatory mapping tool. The UBCO At-home mapping session provided 23 relatively substantive comments. Thus, across the three groups, a total of 50 unique map contributions demonstrated what we considered to be substantive map-based dialogue related to the food systems issues presented on the maps.

6.1 Identifying Participation in the Case Study

Many of the participants did consider their participation effective and meaningful, with results that also varied within the groups. Depending on how effectiveness was defined, I found that the number of participants for whom it was effective declined as the level of participation increased. Again, this does not place value on one form over the other, but just distinguishes participation such as viewing the site from participation by contributing information showing personal engagement with the issues. This last example speaks to a different level in the sense of involving more 'observable participation', even if those that only viewed the website felt equally empowered by the process. In parallel with findings from digital participation research involving public planning, there are likely at least two 'audiences' for these maps, one from a representative public and another internal audience drawn from the sponsoring agencies (Smith and Craglia 2003).

The public audience—in this case, the students or community members—may have learned worthwhile insights on the food system and on their own position within the system. Overall, the three groups demonstrated learning and greater understanding of the issues, and thus it could be concluded they found the experience meaningful. However, the level of engagement

demonstrated on the maps varied both between and within the groups of participants as noted. Some did not use the participatory mapping tools (and thus only had access) and of these, a smaller group engaged in a consumer dialogue or offered data for the map (engagement), while an even smaller group discussed the issues by relating the spatial information and views of others to their own experiences, as represented by their own map contributions (change). Generally, the groups overall seemed to find the experience effective, although with differences between the groups themselves as outlined in the comparative summary earlier.

For the internal audience including researchers, and perhaps public agencies or community organizations using Geoweb technologies, a different view of the assessment process might be taken. Success may be defined instead by the level of critical engagement or by specific data criteria. Obviously, a smaller group participated at these specific levels, as discussed in the findings of this research. Depending on the purpose of the project, the smaller proportion of active participants observed in this study may be considered insufficient. Overall, we were pleased with the contributions to this project and assumed the view that all levels of participation were valid, sincere and helpful to the goals of the research.

To link the types of participation identified in the case study with terms from the literature, I interpreted the findings using the Participatory GIS definition of participation. Participatory GIS and many participatory mapping approaches focus on critical engagement, co-learning and the greatest possible level of participation by all members of the community. Table 6.1 depicts the relationship of the case study data to the three terms access, engagement and change introduced in the literature review in Chapter 2.

Table 6.1 Case study participation data linked to participation types

Case Study Participation Data	Participation Type
Evidence of critical reflection	Change
Engaged and completed the process	Engagement
Attended the mapping session	Access

To end this chapter, I will discuss my interpretation of the three types, and the extent to which they are fluidly defined. My interpretation of the data is explained in the final section of the chapter using the headings Access, Engagement, and Change to guide the discussion.

First, a total of 128 participants attended the mapping session, based on the number that completed surveys. Using the figure for total participants that rated the participatory mapping tool as effective or better, 80 participants engaged or contributed to the process. Using their geo-located discussions as an indicator of critical reflection by participants, an estimated 50 participants in the study demonstrated evidence of changed perspective or reflexivity. Refer to Table A.2 in Appendix D for a summary of the total participants by group, date and participation types.

To understand how the participatory mapping on the Geoweb engaged the local community in a dialogue related to the local food system, it is useful to represent participation in the case study visually. This also helps us to understand how participation in this case study varied across the mapping sessions using the three types of participation to differentiate the process.

The graph in Figure 6.1 depicts the distribution of participation that we observed with respect to Access, Engagement, and Change. As shown by the volume based chart, the majority of participation in the case study (128 participants) occurred at the Access level, while a

diminishing proportion occurred at the Engagement (80 participants) and at the Change level (50 participants).

In the pyramid representation shown by Figure 6.1, the volume-based graph depicts the proportions of each participation type that occurred. Using this style of graph, there is an implied hierarchy between types, with Engagement above Access and Change above Engagement. The hierarchical representation also obscures the fact that these three types are not discrete. In other words, participants in the Change category are also assumed to be in the Engagement and Access category, which is not clearly shown by the pyramid diagram. A sequential relationship between the three participation types was defined by the methods of engagement in our study. We assumed for the purpose of this study that Access leads to Engagement which then leads to Change.

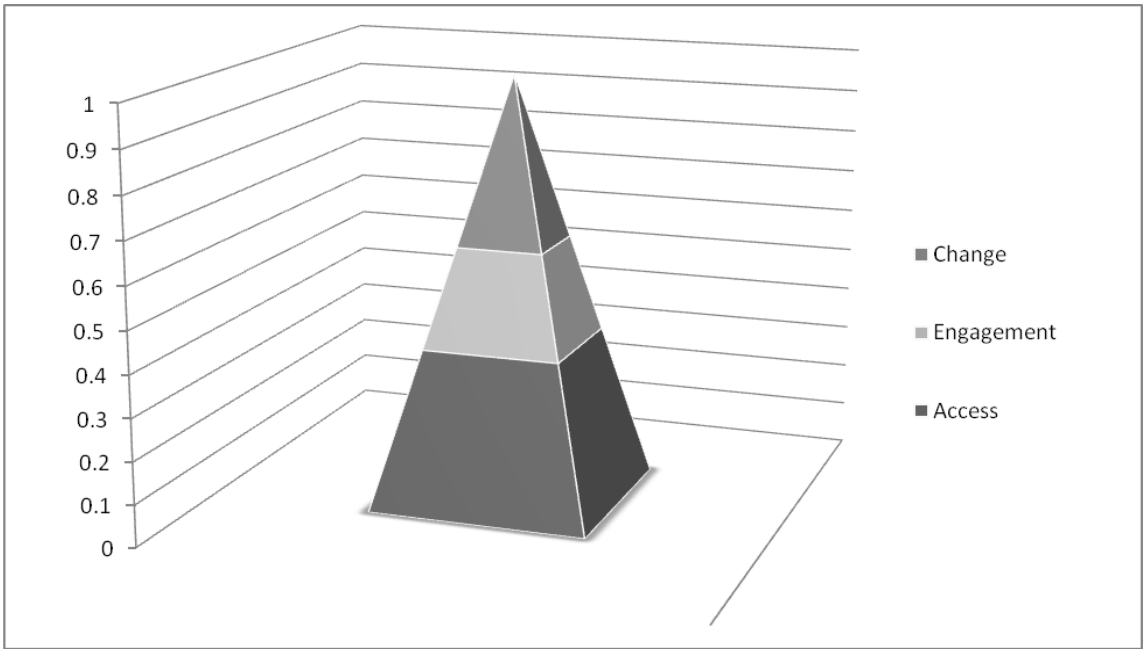

Figure 6.2 Pyramid of participation types in the case study

We focused on Engagement and Change as the motivating factors for our research. As discussed in the next section, analysis and interpretation could vary depending upon the exact definition of participation that is implemented, and upon the perspective of those assessing the outcomes. Another representation of participation in the study might use a non-hierarchical relationship to clarify that the groups are co-constituted. Whether participation is a strictly progressive and sequential process will also be discussed in the final section. Figure 6.2 shows the breakdown of participation using overlapping types shown by the Venn diagram.

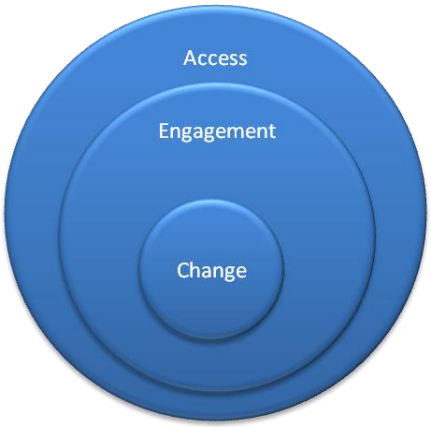

Figure 6.3 Venn diagram of participation types in the case study

6.2 Exploring Participation

In the graphs presented in Figures 6.1 and 6.2 above, participation has been portrayed as a multi-part process that occurred at varying levels within the group simultaneously. Not all participants experienced the same type of participation. Participation was found to be a process that occurred with declining frequency within the groups when analyzed along the spectrum of participation described by Access, Engagement, and Change. The pyramid presents participation in the case study as an uneven process that empowered groups and

individuals through what was referred to within GIS and community participation research as a socially differentiated process (Craig, Harris and Weiner 2002). I will now explore the case study process and outcomes in greater detail using the three participation types to frame the discussion.

6.2.1 Access

Using the participatory mapping perspective, participants' own views, priorities and perceptions are a focus of our research. Of the 162 community members and students who attended the mapping sessions, 128 participants gained access to the project based on survey results. Access by that definition was provided to students and members of the public through online information and an opportunity to volunteer their perspective. In this case, access had to be accepted, though it could have been defined otherwise. As Tulloch notes, it is common for government agencies to publish information online and then refer to this as public participation, regardless of whether the public accepts the information or actively takes part in the process (Tulloch 2008). By that definition, a much larger number participated in our case study, though on the lower rungs of both Arnstein's Ladder of Participation (Arnstein 1969) and Rocha's Ladder of Empowerment (Rocha 1997). In other words, if we defined participation as viewing of the website, then many more than 128 were included, but through a very low level of actual public involvement.

In participatory mapping and PGIS, an outside agency might have conducted the evaluation of the project, rather than the community themselves. However, best practices dictate that the terms of PGIS evaluations should include the communities affected to the greatest extent possible (Chambers 2006; Rambaldi et al. 2006). In urban planning applications, access may be measured online using website server traffic (Kingston 2011), and so that might have been

the preferred measure in such a context. In collaborative GIS, a more controlled method is preferred using tracking software that records each interaction of the user with the system both using the mouse and through an audio recording (Haklay and Tobon 2003). In this case study, the server tracking method did not provide statistics on specific functions and activities of the users and thus did not distinguish between viewing of the map online versus using the participatory mapping tool actively.

Access was affected by a number of factors including context of participation, age of participant group and the groups' existing motivations to use the technology. The older participants were less willing to use the participatory mapping tool, which constrained access as defined by the study. This may be related to computer literacy, which was lower among the older participants. Access was related also to the context in which they participated, which was equally significant. Returning here to the project goal of encouraging maximum participation, it is important to recall also "that constraining definitions of activism can serve to exclude those who prefer not to (or are unable to) engage in those activities considered 'real' activism (eg protests), and conceals the often gendered, classed, and racialized processes by which particular activities get constituted as more or less central" (Wakefield 2007, 338). Although the study defined online participation as the medium of access, and thus engagement, this should not devalue contributions of others left out of that definition.

6.2.2 Engagement

Participatory mapping and PGIS seek to engage the greatest possible participation by all community members, so that the process reflects their collective experiences (Corbett et al. 2006). Participants were offered access to the online mapping, provided with demonstrations and then encouraged to add information to the map through the online computer interface.

Again, determining effective engagement is best done from the community perspective. 80 participants surveyed rated their engagement with the participatory mapping tool as effective, which I associated with the engagement type of participation.

Using other definitions of participation could then allow for a different interpretation. Depending on the purpose of the study, participation to inform development policy might look to the map contributions and spatial information contributed, as an equal or higher priority to the survey information. Urban planning might prioritize the map based contributions and thus choose the number of map points and discussion posts, especially if the engagement process has no provision for face-to-face participation. This is a less constraining definition of participation in this study, since more than just 80 participants successfully contributed information. What is argued is that urban planning and also citizen science applications might actually be more stringent with respect to data quality and consistency of the content of voluntary contributions (Elwood, Schuurman and Wilson 2011; Goodchild 2007). Qualifying or validating the information volunteered would possibly lead to significant filtering of irrelevant or inaccurate data in such cases. What seems to be at issue here for community participation using the Geoweb is balancing the transparency and inclusiveness themes (Parker 2006) from PGIS and participatory mapping with the formal technical requirements of authoritative databases (Goodchild 2009). Engagement in this case study resulted in participation on the mid-rungs of Arnstein's ladder or on the lower rungs of the citizen science ladder.

Participation at this level may also be the most relevant to the world of VGI and new spatial media, in which participants may just want to post their personal content or share in a collaborative online creation (Tulloch 2008). Participation then becomes defined as the

simple act of uploading the information, without qualification placed on the value or integrity of the actual data itself. As demonstrated through applications like photo-sharing websites (examples are Flickr or Picasa), participation involves varying levels of sharing and interaction among contributors and participants (Armstrong et al. 2011).

Engagement was affected by usability of the mapping website; those reporting technical difficulties or challenges in understanding the functions of the participatory mapping tool also reported less engagement. The Farmer's Market participants did not contribute to the map as frequently, which again was related to the context in which they participated but also to the groups' other characteristics. Computer and Internet literacy seemed to affect the groups' motivations to use the spatial technologies themselves. As noted by numerous scholars, spatial technologies rely on skills and vocabulary that are distinct, and they can widen existing digital divides between experts and amateurs (Goodchild 2007).

Engagement was related to participants' existing approach to contributing online. Findings from the Farmer's Market participants showed that their motivation to share information online focused on work, study and political action. Past studies of actual contribution categories compared to stated motivations for contributing to Wikipedia found that all contributors stated a motivation to share based on 'ideology', but this was not correlated with actual contributions, leading the author to ask if "talk is cheap" (Nov 2007, 63). Older contributors to Wikipedia were also motivated by fun and self-enhancement to a greater extent than other groups. This suggests that although the ideology behind the food mapping project appeals to the older members of the local food movement at a conceptual level, this is not a primary motive that actually leads this group of volunteers to contribute online.

6.2.3 Change

Change was linked to community awareness and evidence of critical reflection that might lead to a change of perspective. While Access and Engagement could be linked directly to observable phenomena, reflexivity could not be measured or easily identified. Thus, I relied on interpreting which map discussions referred to substantive local food issues. This was chosen because it was a pragmatic and moderately inclusive method. As outlined above, other measures like survey responses or more constraining methods for coding the map discussion would lead to a very small number of participants in the Change category. For example, only 14 of the participants would have been chosen using qualitative survey responses.

It is possible that other definitions of Change might take a different view of the relevant findings. Urban planning applications would likely pre-define an objective or a framework within which to operate. This provides a model against which to check success (see for example Jankowski 2011), whether this is done in the short term during the project or in the longer term after time has passed to observe resulting changes from a policy or program (Ramasubramanian 2011). Depending on the specific measures used, the definition of Change could be more or less constraining. For example, urban planning applications are accustomed to moderating unstructured and even offensive material that is submitted through public comment websites to government agencies (Tulloch 2008). While the moderator may discard irrelevant or inappropriate material, these submissions may still be counted in the participation figures.

Within groups, the Farmer's Market participants had the lowest proportion of Change observed using these indicators. This is one potential limitation of engagement on the

Geoweb for groups that would plan to use this framework: the Farmer's Market participants did in fact engage and reflect, but they did not tend to use the Geoweb while doing so. Their views would not have been included otherwise had the project been strictly online.

This again points to the important role of context in this research, but also to an important finding of the study related to spatial literacy. The geography students demonstrated in their responses an understanding of numerous spatial concepts, which was required in order to understand the full range of information presented through the maps. Spatial literacy was not required for basic contribution of information using the intuitive interfaces of the Geoweb tools themselves. However, to gain an understanding of the information presented on the maps and to contribute thoughtful, relevant and accurately placed map discussions required spatial literacy. By this definition, effective and meaningful participation on the Geoweb requires significant spatial literacy.

Change was also related to the willingness of participants to contribute online. In contrast to the Farmer's Market group, the younger student groups were motivated to share online for entertainment according to their survey responses. For those who mainly posted online for fun, there may have been a fundamental disconnect with the purpose of the website which, as noted during the Farmer's Market session, was decidedly academic and value-driven. As found during the semi-structured follow up interviews with students, those that demonstrated engagement already seemed pre-engaged with this topic. For others, not even the promise of participation bonus grades could entice them to participate. Another group attended and completed the steps as instructed during the mapping exercises, but did not seem to demonstrate evidence of a significant change of perspective. For these individuals, one

potential explanation was the lack of entertainment or fun that was anticipated. Wilson (2008) expresses some of the widely ranging views toward web-based interactions:

> Depending on participant purpose, online forums stage 'fun' or functional exchanges... Use of the web can swiftly alternate between considering it to be a wondrous toy or 'work tool,' focus for serendipitous surfing or seeking information relating to business and study… mediated virtual escape or material empowerment, cyberspace distraction or civil society development. (Wilson 2008, 151)

Participants in this group experienced a higher level of participation as demonstrated by their reflections on the map based issues. However, this outcome might still fall mid ladder using Arnstein's model. Change in this study operated at the individual locus of authority (Rocha 1997), but worked through a number of the potential empowerment processes described by Rocha's empowerment ladder. Mediated empowerment was potentially offered "to provide knowledge and information necessary for individual or community decision-making and action" (Rocha 1997, 36). In this study, it was implied that participants were contributing to a larger effort in support of the local food movement and the university research agenda, and thus the project may entail what Rocha (1997) refers to as Participation. Another reading is that empowerment was on the first rung of Rocha's ladder and limited to the individual which is useful to the individual but "may fall short when attempting to address social problems" (Rocha 1997, 35).

With no clear mechanism in this case study for participants' actions to scale up to the community or regional level (Corbett and Keller 2005), it was important to focus efforts on "individual problems that do not require alterations to systems, social relations, or structural changes (over which the individual has no control)" (Rocha 1997, 35). For example, Change in the form of individual awareness and subsequent action or participation in a community organization or even collective action based on awareness could all arise from the type of

individual empowerment that was facilitated in this study. While there is a substantial difference between individual awareness and collective action, it is possible that critical reflection then enables individuals to gain the knowledge needed to participate effectively in their own development and that of their communities. Awareness and critical consciousness of methods over the longer term are the principle goals of the developmental participation process that could enable social change.

6.3 Conclusions

As discussed at the beginning of the chapter, the Geolive participatory mapping tool was found to be a capable medium for sharing, accessing and engaging with detailed spatial information. Geolive also appeared to efficiently support the gathering of place-based knowledge. This occurred through a structured participation process that required a certain level of spatial literacy. Below, the following conclusions will be discussed: facilitation method, barriers to access, size of participating group, learning outcomes and motivation to participate

The context of participation was found to a significant factor in the motivation to use the technology, and one that affected the types of participants engaged and thus the outcomes. One key aspect of the varying context was the style of facilitation. Students were recruited through the university and thus do not represent public volunteers. They do accurately represent university geography students, and perhaps youth more generally. The setting and approach to recruiting participants led to widely varying types of contributions on the maps and the survey questionnaires. However, within the context of the university class room, the Geolive tool appeared to offer a rewarding experience to both the participants and the facilitators. The students were interested in the project and the participatory mapping tool,

and gave freely with their time to take part. However, the first group of In-class students benefited from over an hour of training and facilitated guidance, during which they learned to use the full functionality of the new participatory mapping tool.

The time spent by participants using the participatory mapping tool seemed to correlate with higher usability ratings. For the Farmer's Market participants, they were already engaged with the issue and were willing to discuss, but did not seem willing to contribute their views online. It is not clear if their reluctance reflected a personal belief that they were already sufficiently aware of the issues, or whether they were distracted by the bustling public location where they were introduced to the technology. The other possibility that arises from these findings suggests there may be reluctance by older participants to use web-based mapping tools generally and a possible need for continued research in this area.

The use of facilitators was explored across three varying levels of influence by researchers as intermediaries. In the first mapping session, facilitators dictated the process step by step and received a very complete set of concise and structured feedback related to the place based issues. By the third mapping session, participants used the technology at home without facilitation or instruction. While this third session was found to be the least effective by the participants themselves, the contributions from this group were some of the most in depth and reflexive. However, the participants' perception of effectiveness paralleled the decreasing level of facilitation across the three groups.

The physical access barriers to participation were minimized since researchers provided the hardware or made arrangements in advance to ensure computers were available. Internet access was challenging in the Farmer's Market, where wireless connectivity was the only choice. Access was unavailable at one point during the participatory mapping exercises,

which compromised the ability to contribute information to the maps and reminded researchers of the importance of having an offline alternative, should technology fail. Having access to the participants, dependent on their time and availability, is a precious resource that should never be wasted even if paper and pen becomes the only mapping tool available. However, these physical access issues will affect the wider public using this participatory mapping tool on the Geoweb. Connectivity and compatibility remain as key considerations.

The size of the participating group was varied from 100 simultaneously, to individuals one-on-one, to individuals dispersed and participating at different times. The group that participated simultaneously seemed to have the most enjoyable mapping experience as observed by researchers, and also as stated by their survey responses. The sense of watching posts in real time while participants responded was perhaps matched only when seeing an inquisitive interest in the eyes of community members as they contributed, or by the thrill of watching a map-based dialogue begin to develop between participants at home.

Many design factors were explored while aiming to minimize the constraining impacts of computer literacy and spatial literacy requirements, thus improving usability and ultimately participation. Computer and spatial literacy were less problematic for younger university geography students, but this did highlight potential concerns around use of the Geoweb generally. Using geographic visualizations as a basis for public policy can lead to misinterpretations, and subsequent policy decisions based on this incorrect analysis (Sui and Holt 2008). This implies a need to take responsibility for maps produced or presented to untrained publics and policy makers (Harley 1990).

Evidence of learning outcomes showed that the online mapping website helped to support participation, leading to structured and interesting map discussions. Results also showed that

engagement with the process also led to equally structured learning outcomes. By contrast, those that did not actively use the participatory mapping tool appeared to report less structured learning outcomes. Access to the spatial information and the Geoweb technology did not appear to support the same level of learning about the map based issues as active engagement and contribution to the process. The Geoweb promises the ability to reach new audiences for spatial knowledge, but this technology has a profound effect on the way spatial knowledge is learned and represented (Elwood 2011). Spatial knowledge inherently proposes a fixed representation of a place and actions based on that knowledge. At the same time, a substantial learning opportunity was provided by "facilitating the sharing of spatially referenced annotations [which] allows individuals to easily impart their perception of places to others" (Zook and Graham 2007, 1329). Participants emphasized learning about the perspectives of peers and others as a key aspect of learning during the participatory mapping sessions.

As introduced by Goodchild (2007) in his research task list involving VGI, the three factors authority, control and motivation were found to be relevant in this study. Authority and control over the process and the information were first emphasized by the Community Advisory Committee in terms of privacy, data quality, completeness and transparency. Participants in the mapping sessions expressed reluctance to post personal information in the absence of trust and protection of privacy. For younger participants, the concept of personal versus anonymous information seemed fluid and distinct from that of older participants.

Motivation was a concern of our community partner the COFPC as they balanced their organization's resources and decided on which tools best served their needs. During the research process, they often structured their research agenda around determining the

relevance and possible audience for the new participatory mapping tool. This focus on users and participants contributed to the Community-Based Research process and helped us to plan research activities.

In a public setting such as the Farmer's Market, participants expressed less motivation to use the technology unless it was adapted to meet their material needs. In other words, participants seemed eager to discuss the issues, but preferred in that context to interact through face-to-face dialogue.

Participants mainly lived in the local area, but many had previously moved from somewhere else. Visiting students expressed interest in learning about the local food system as outsiders. Kingston (2011) identifies numerous issues, with respect to similar PPGIS applications in the UK that were salient also in this study, including moderation of the contributions and qualifying legitimate data. This study also found, like Kingston, that a dichotomy exists between the 'active' citizen and the 'consumer' citizen (Andrews and Turner 2006), in which consumer expectations of modern technology and timely customer service can conflict with "a more participatory/deliberative process of engagement that is 'complex, costly and time-consuming'" (Kingston 2011, 376).

Whether the process and outcomes from this case study constituted effective and meaningful public engagement rests on the definition of participation used. Several types of participation occurred in this research and thus the definition affects the way that the results are identified, as well as their analysis and interpretation. As suggested by scholars presented in the literature survey, this study investigated participation from multiple perspectives, both inside and outside, expert and amateur as well as researcher, student and community participant. Characteristics of the context, the process and the participants were explored in depth

through the case study. Three types of participation were identified using three levels of effective participation from the academic literature, which showed a diminishing number of participants at each ascending level of participation. This suggests that public engagement using similar tools and processes may result in participation types along a similar spectrum.

6.4 Recommendations

Given the types of participation and the frequency of their occurrence in this research, there are implications for those interested in using these technologies to support public and community participation. Depending on both the definition of participation as well as the levels of access, engagement and change that are required, the Geoweb medium may hold potential or it may be seen as too exclusive. For example, if change was seen as the ideal outcome in this project, then less than a third participated, or fewer if more constraining definitions of participation are applied.

For organizations in the local food movement, the Geoweb offers the potential for a new participatory mapping technology that is accessible and usable by ordinary citizens. Discussion of local food issues was facilitated by the use of relevant spatial information on web-based maps, to which participants linked their local knowledge and contributions. However, as suggested by participatory mapping practitioners, projects using the Geoweb need to offer an alternate means of participation. For food movement organizations that seek to engage diverse communities and groups of citizens, the Geoweb has the potential to effectively reach and engage some groups of users, and particularly those who are computer literate, spatially literate and accustomed to web-based technologies. At the same time, the Geoweb technology appears to be less accessible to other groups, and may even distance or exclude those who are older, less computer literate and less familiar with existing web-based

technologies. For participants that actively engaged with the participatory mapping process using the Geolive technology, many appeared to gain a greater understanding of both the spatial issues and of other participants' views of these same issues. For food movement organizations, the information volunteered online appears to offer useful indicators of local knowledge, opinions and concerns related to local food that could inform ongoing policy and research. The Geoweb might offer a path to a shared understanding of local food issues.

Future research could build upon both these findings and on the design of the study. The active public in our study was drawn from a wider group that might be simply referred to as society, which is composed of numerous 'communities'. In this project, the 'public' was constructed as not only active (primarily white, middle class and educated) but also as being somewhat technologically adept. The project did not discriminate, but also did not actively engage those left out of the 'active public' as described. Future studies may find that participation can occur across social groups by using this new technology. However, the technology itself may drive some of the processes that tend to exclude these groups (Haklay 2012) as found in previous technology and modernity studies (Laughey 2007).

Also, the analysis was useful for exploration of variables, factors and definitions relevant to community participation on the Geoweb. However, researchers wanting to isolate certain parts of the process or certain factors or variables would need to modify this design accordingly. Using the same design, but studying one group across varying contexts would allow the effect of the participants themselves to be more controlled, thus improving analysis of the context itself.

One last refinement to the study methodology might involve collecting a more extensive set of sociological data. For example this study, like the Geoweb in general, assumed a universal

approach to race, gender, and class. However, it is known for instance, that fewer women than men contribute online in other social media environments, and yet women contribute online for longer (Nov 2007). As more women continue to access the web and to contribute online, we might expect that overall use of the Internet will increase substantially. Thus obvious differences exist between the participation of men and women on the Internet that should be explored through a dedicated method. However, a more nuanced theory of participation using the Geoweb had not yet been developed to address these factors.

Based on the conclusions and recommendations presented, this study suggests there is a great potential for using the Geoweb as a participatory mapping tool. The Geolive participatory mapping tool developed during the case study was successfully used to facilitate and gather the volunteered geo-located information of participants. The type of information gathered consisted of highly structured geo-located comments, discussions and anecdotes. As explained earlier, the type of participation that we observed was not uniform across the participants, but occurred instead through a socially and procedurally differentiated process.

As the Geoweb develops, the potential exists for participants and communities to share their locality and place-based knowledge in the public domain of the Internet through online maps. When we asked participants to use the Geoweb for a location-based discussion about local food, many accepted our offer. For some, their active participation on the Geoweb led to a greater awareness of their locale, and to the sharing of their contributions and personal reflections with other participants online. In the past, the Internet could be considered a placeless medium, prior to the ability for users to actively participate by adding information and interacting with the system. Through advances in the technology over the past ten years, participants on the Internet have now gained the ability to contribute their own local

knowledge. As our understanding of the world is increasingly determined by information that is created in far away places, this may challenge our ability to understand and critically engage with what we experience in our own communities. As we work toward local change, place and locality may be fundamental if we accept that "the only way to find a larger vision is to be somewhere in particular" (Haraway 1988, 590). The Geoweb carries our local knowledge to far reaches, but it also makes that knowledge visible to others in the local community as well, and so may serve to strengthen connections between communities and their local spaces.

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Appendices

Appendix A Models of Public Participation

The potential for citizen involvement in government decision making processes revolves around a number of issues with respect to the degree of public involvement and the legitimacy and effectiveness of such efforts. Arnstein's (1969) Ladder of Citizen Participation has been widely adapted as a conceptual model for participatory processes involving the public. From Weidemann and Femers' adaptation of Arnstein's framework, the participation ladder metaphor was used to frame the case studies published in the book *Community Participation and Geographic Information Systems* (Craig, Harris and Weiner 2002) in 2002 prior to the Geoweb.

Also similar to Arnstein's ladder model, work adapted from the Health Canada Policy Toolkit for Public Involvement in Decision-Making was published by the OECD in 2001 (Organisation for Economic Co-operation and Development). The OECD model describes a multi-level process with 'information' (both passive and active) at the bottom of the ladder, followed next by 'consultation' on the middle rungs, and with 'active participation' at the top level (OECD 2001). As a one-way relationship between citizens and authorities, examples of information in the OECD model might include public access to government records. Examples of consultation, a two-way relationship between government and the public, might include public opinion surveys. Active participation involves the highest level of public involvement through a "relation based on partnership" (OECD 2001, 23) between government and citizens, and examples of this ideal type could include citizen juries.

Kingston (2011) extends the OECD model to five increasing levels of public involvement by distinguishing top-down government-led processes from more participatory bottom-up citizen-led processes. Delineating two types of consultation at the second and third levels, and two types of active participation at the fourth and fifth level of the ladder, the top rung of Kingston's adaptation is characterized by "citizen-led active participation" (p. 365). Generally, participation ladders or typologies can be used to model and clarify participatory processes, in which top-down approaches often lead to outcomes "on the lower rungs of Arnstein's ladder and in types 1-3 in the OECD's typology" (Kingston 2011, 365). A spectrum of participation as discussed above highlights the power differentials involved with social processes like urban planning and participatory GIS, which can lead to widely varying participation experiences and outcomes.

Appendix B Research Instruments

B.1 UBCO Follow-up Semi-structured Interview Questions

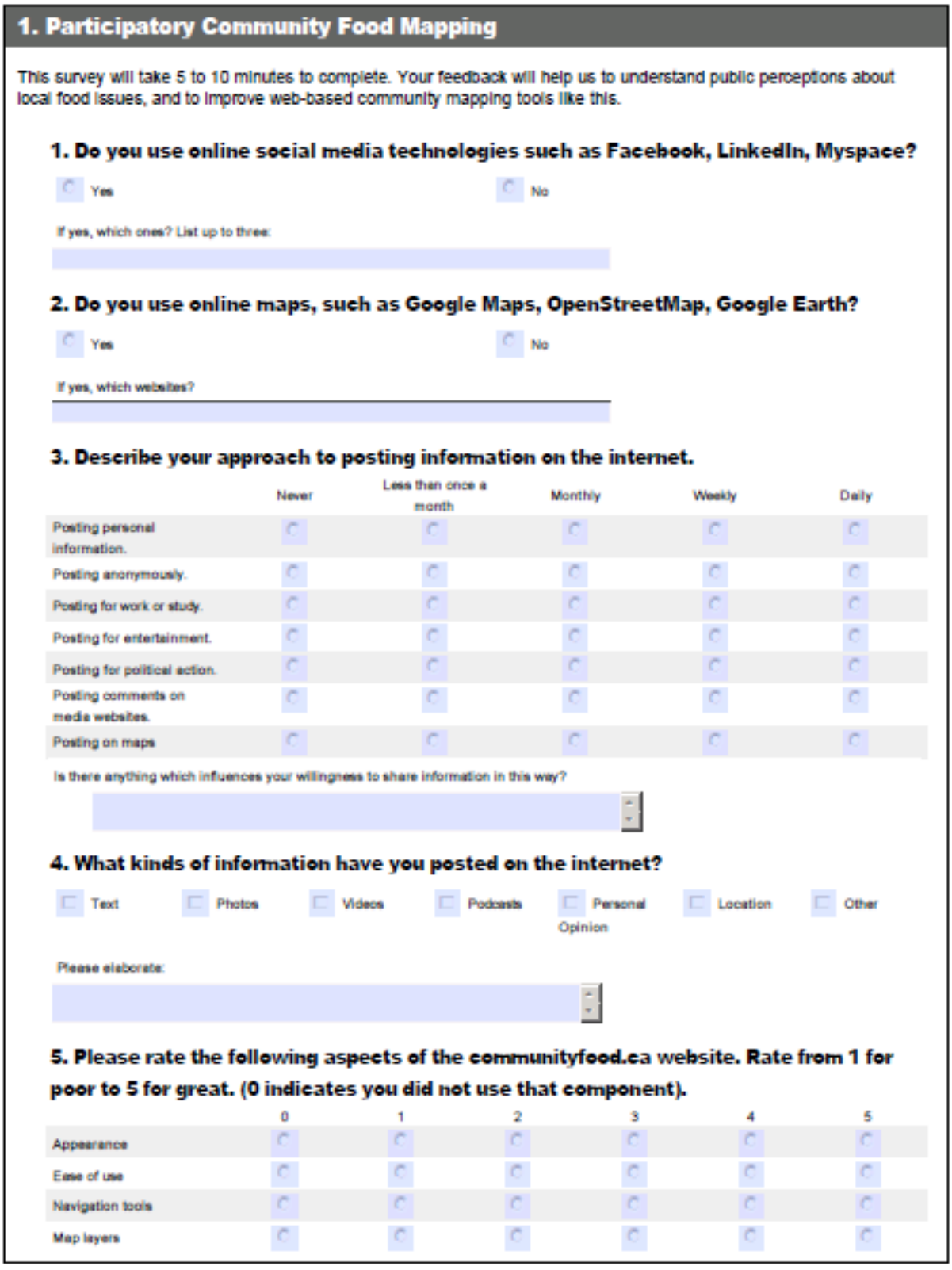
March 22, 2011

Setting for the interview: quiet location at UBCO.

Participants: selected from Nov 16, 2010 -- Geography 129 In-class Focus Session surveys.

1. How would you say you were engaged in the topic of food security before using the Community Food website? Did you think about where and how your food is produced? Can you give an example?
2. Do you feel you have sufficient choices of foods you enjoy that are affordable, healthy and sustainable? Can you describe?
3. Do you contribute to online maps? Why? Can you describe?
4. Do you contribute to online discussions? Why? Can you describe?
5. Did you learn about the topic of local food systems from the Community Food Inclass Focus Session? If yes-What do you feel you learned? If no-Can you think of a reason why you did not learn anything?
6. Did you find any of the discussions posted by others useful or informative? Can you describe the discussion?
7. Did you find any of the map layers to be useful or informative? Which ones?
8. What surprised you about community food systems in the Central Okanagan? Did anything you learned cause you to change your views? Can you explain?
9. What issue was best represented by the maps on the website? What issue was not well represented by the maps on the website? Can you explain?
10. How much did the lecture and mapping exercise help you understand the issue versus the map information itself? Why?
11. How did Community Food Inclass Focus Session impact your personal interest in the topic of food systems? Do you think you would use the Community Food website if it were not a course topic in your Geography class?
12. How would you compare online participation (for example, posting to communityfood.ca) to participation in person (for example, volunteering on the community mapping advisory committee)?
13. What do you wish you could have discussed that cannot be solicited from the data layers shown on the map?

B.2 Revised Survey Questionnaire, 2011



1. Participatory Community Food Mapping

This survey will take 5 to 10 minutes to complete. Your feedback will help us to understand public perceptions about local food issues, and to improve web-based community mapping tools like this.

1. Do you use online social media technologies such as Facebook, LinkedIn, Myspace?

Yes No

If yes, which ones? List up to three:

2. Do you use online maps, such as Google Maps, OpenStreetMap, Google Earth?

Yes No

If yes, which websites?

3. Describe your approach to posting information on the internet.

	Never	Less than once a month	Monthly	Weekly	Daily
Posting personal information.					
Posting anonymously.					
Posting for work or study.					
Posting for entertainment.					
Posting for political action.					
Posting comments on media websites.					
Posting on maps					

Is there anything which influences your willingness to share information in this way?

4. What kinds of information have you posted on the internet?

Text Photos Videos Podcasts Personal Opinion Location Other

Please elaborate:

5. Please rate the following aspects of the communityfood.ca website. Rate from 1 for poor to 5 for great. (0 indicates you did not use that component).

	0	1	2	3	4	5
Appearance						
Ease of use						
Navigation tools						
Map layers						

6. What are the strengths of the communityfood.ca website?

7. What are the weaknesses of the communityfood.ca website?

8. What have you learned from this exercise about local food issues in the Central Okanagan region?

9. What other food issues do you feel this tool could be used for?

10. Please rate the overall effectiveness of the online mapping tool for discussing information presented on the map?

	Ineffective	Not very effective	Somewhat effective	Effective	Very effective
Please check one.	○	○	○	○	○

11. Do you expect to revisit the communityfood.ca website?

○ Yes ○ No

Please suggest information we might add or ways we can improve communityfood.ca

12. What is your age?

13. What city or municipality do you currently live in?

○ Kelowna ○ Vernon ○ Lake Country ○ West Kelowna ○ Peachland ○ Other within Okanagan ○ Outside the Okanagan

Is this your home town? If not, where did you grow up?

14. May we contact you to request a short followup interview? If so, please provide your name, email address and telephone number.

Please contact co-investigator and project coordinator Shayne Wright at (250) 869-7248 or by email at shayne.w@telus.net if you have any questions. Any concerns about the project can be directed to the principal investigator Dr. Jon Corbett at (250) 807-9348 or by email at jon.corbett@ubc.ca

B.3 Community Advisory Committee Semi-structured Interview Questions

Setting for the interview: participant's office, lunch room or UBCO location of choice.

Participants: Community Food Advisory Committee Members.

Purpose of the interview:

a. Present the results of the project to the committee member, including the website and perhaps an overview of the research.
b. Explore the role/input/relationship of the member to the project as a whole, walking them through the process again.
c. Ask the committee member to speculate or theorize about how the project might be used in the future.

Make note of their approximate age, position with respect to the committee, and town of residence, as well as their home town if different.

1. In what ways were you able to participate in this (Community Food) project up until this point?
2. Do you contribute to online maps? Do you contribute to online discussions? Why? Can you describe? What affects your willingness to share information in this way?
3. What have you learned from this project about local food issues in the Central Okanagan region?
4. How would you compare online participation (for example, posting to communityfood.ca) to participation in person (for example, volunteering on the community mapping advisory committee)?
5. Based on your experience, what are the strengths of the Community Food project? The weaknesses?
6. Of the food system issues you emphasized in your advisory committee input, which if any do you see reflected in the project outcomes so far?
7. Can you suggest information we might add or ways we can improve the Community Food project?
8. How do you think this tool might be used to engage the public in food issues?
9. In what ways could you foresee this tool being used effectively for engaging public dialogue on local food issues?
10. How do you feel this tool can help you think about and discuss place-based issues?

Appendix C Method of Coding Map Discussions

Coding of map discussions in this case study was completed using content analysis. Relevant discussions were divided into two groups corresponding to one for simple volunteered data and another for discussions that constituted dialogue. 'Data type' contributions were distinguished from those that were discursive, referring to ideas or concepts about the food system, or personal reflections on these topics.

Of the 53 contributions that remained on the moderated version of the UBCO In-class food map, 26 were coded as data, in the sense that they offered pieces of data content or revisions to the underlying base layers of spatial information, rather than to substantive issues or concepts related to food systems. This leaves 27 in the substantive category. At the Farmer's Market, all seven participants added information that was relevant to the project but more of the data variety. Of the UBCO At-home group contributions, 49 of 100 map discussions by this group were considered more like data or field observations that did not relate specifically to the wider issue of food systems. Thus, of 160 map discussions created, 82 were coded in the data-type group, leaving 78 discussions that referred to the critical awareness and social change concepts motivating the project.

To arrive at a figure that represents participants, we could assume roughly the same proportion of critically engaged students as discussions (51/100 * 45 students= 23). In other words, we assume that a corresponding half of the students in the At-home group experienced critical engagement. This results in an estimated total of just 27+23= 50 total participants over the three groups that demonstrated evidence of reflexivity and critical reflection through their place-based discussions of food-related issues.

Appendix D Participants by Group and Participation Type

Table A.1 Participants by group, date, total number and participation types observed.

Name of Participant Group	Date	Total Number	Access	Engagement	Change
Community Advisory Committee	Apr. 21 and Aug. 11, 2010	6	-	-	-
UBCO In-class	Nov. 16, 2010	63	63	48	27
Kelowna Farmer's Market	July 2, 2011 & Oct. 5, 2011	54	20	12	0
UBCO At-home	Nov. 2011	45	45	20	23