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CURRENT ISSUES IN METHOD AND PRACTICE

Developing a geocollaboratory for Indigenous tourism research

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Collaboratories have been defined as virtual places where collaborative research can be undertaken. As part of the Aboriginal Tourism Network (ABORINET), a geocollaboratory was developed to support Indigenous tourism research. Indigenous communities are culturally distinct and remotely located and this presents geographic and sociocultural constraints when conducting research on issues affecting these communities. ABORINET's development focused on the specific goal of enabling collaboration between researchers and Indigenous peoples on issues related to Indigenous tourism planning and management, and the general issue of enabling the sharing of differing knowledge and management approaches among research and Indigenous communities. The purpose was to develop a multi-scale and multi-method data collection and analysis protocol for better understanding Indigenous tourism in a way that supports multi-site and longitudinal comparisons, for connecting Indigenous communities across the world, and for sharing the results in ways that are meaningful to stakeholders within and beyond Indigenous communities. This paper outlines the development of the geocollaboratory and describes the lessons learned with specific attention afforded the geographical nature of the collaboratory. Recommendations for mitigating challenges are proposed and future research opportunities are identified.

Keywords: collaboratory; geovisualisation; Indigenous communities; Internet-based research

1. Introduction

The purpose of this paper is to introduce the Aboriginal Tourism Network (ABORINET) geocollaboratory and explore its development and operationalisation for Indigenous tourism research. The ABORINET geocollaboratory is an Internet-based data collection method that facilitates collaboration among and between researchers and Indigenous people and the sharing of information across geographical and cultural boundaries. The focus of this paper is the operationalisation of the method as opposed to the information it yields. The contribution is a critical analysis of the operationalisation of the method and the challenges (and mitigation strategies) and benefits for researchers and research participants from Indigenous communities.

Indigenous tourism refers to tourism activities in which Indigenous people are directly involved either through control and/or by having their culture serve as the essence of the

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attraction (Butler & Hinch, 2007). It forms parts of a cluster of 'tourism alternatives' that are characterised by visitor experiences that are different from traditional mass tourism (Smith & Eadington, 1992). Indigenous communities practicing cultural norms that are different from dominant cultural traditions, and/or where the tourism experience is managed in such a way so as to reduce negative impacts on environments and cultures, are popular 'alternatives' that hold a competitive advantage in the tourism market (Sinclair, 2003). Since the 1980s, governments, researchers, and communities have been focusing on ways for Indigenous communities (i.e. a group of people who share a distinct cultural identity that has been shaped by their native geographic region, especially before the arrival of foreign or dominating culture) to attract tourists. Indigenous communities are thought to have a competitive tourism advantage based on their unique cultures and the environments in which they live. This advantage has the potential to attract tourists and by extension, raise capital, reduce poverty, and improve quality of life for the host communities (Butler & Hinch, 2007; Goodwin, 2007; Notzke, 2006).

As the interest in and complexity of managing the natural and cultural resources upon which Indigenous people and the tourist experience depends, researchers and Indigenous communities are increasingly recognising the benefits of knowledge mobilisation and dissemination. As technologies evolve, especially in regard to mass communication such as the Internet, it becomes possible to provide interconnectivity in and between the world's most remote areas where knowledge exchange was previously limited (Buhalis & Law, 2008). By way of their dispersed and isolated location, Indigenous tourism stakeholders have found the Internet to be a useful medium for increasing the visibility of their tourism enterprises, and until now, this has been its primary function (Weng, 2008). The availability of new Internet-based technologies, however, is providing opportunities for expanding the use of the Internet beyond tourism marketing to provide a medium through which to share traditional knowledge. Donovan (2007) examines the appropriateness of Internet technology for sharing traditional knowledge and concludes that there are significant pedagogical parallels between their respective characteristics. Internet frameworks support learning through experimentation, the development, and the use of group space, individualised investigations, and it is flexible enough to allow communications to be contextualised and adapted for specific outcomes. Aboriginal pedagogy is characterised by experiential learning, peer or group learning, space for individual investigation, and contextually based action research and/or participatory methods. For these reasons, Indigenous communities are finding the Internet to be an important new frontier for communicating with non-Indigenous people and for sharing traditional knowledge among Indigenous people. Today, Internet literacy and technology acceptance is increasing among Indigenous people (though it is important to acknowledge that this is not a homogenous trend across Indigenous communities). For researchers, the Internet presents unprecedented opportunities to develop meaningful relationships with communities, to engage in collaborative research, and to share the results with those that may benefit the most – Indigenous peoples (Blangy, 2010).

2. Collaboratory

A collaboratory is traditionally defined as a centre without walls where researchers and research participants can interact, share information, data, and resources (Kouzes, Myers, & Wulf, 1996). A collaboratory is more than a simple repository; it is an elaborate collection of information and communications technology mediated by a networked organisational form that also includes social processes, collaboration techniques, formal and

informal communications, and agreement on norms, principles, values, and rules (Cogburn, 2003). When a collaboratory is developed in an Internet-based environment, technology allows teams to conduct research irrespective of the geographical or temporal distance among the researchers and participants (Craver & Gold, 2002). The primary focus of the initial Internet-based collaboratory effort has been on developing and implementing the networking technologies required to make remote connections possible and real-time data collection a reality (Kaur, Mann, Matossian, Muralidhar, & Parashar, 2001). Based on research experiences in the physical, social, health, and medical sciences (e.g. Craver & Gold, 2002; MacEachren et al., 2006; Pettit & Wu, 2008; Russell et al., 2001), the Internet has been found to support more effective and efficient work toward project objectives than traditional tools such as phone, email, and face-to-face meetings (Schleyer, Teasley, & Bhatnagar, 2005).

The development of collaboratory technology and tools continues to evolve (e.g. use of instant messaging, email, video conferencing, and wikis) while limited progress has been made towards applying and understanding the implications of the collaboratory concept. For example, MacEachren et al. (2006) argue that a geocollaboratory is a particularly useful tool for better understanding the human–environment relationship – the traditional geographical muse. Evolving spatial data exchange standards are aiding the development of spatial data portals allowing communities to make geographic information available to the general public or to share internally among dispersed communities as appropriate. This is developing at the same time as the increasing popularity of collaborative mapping for action research and the increasing availability and familiarity of researchers with Internet tools and mapping (Pulsifer, Hayes, Fiset, Taylor, 2008; Stewart, Jacobson, & Draper, 2008). The fusing of the collaboratory concept with geographical research tools such as Geographic Information Systems (GIS) and geovisualisation presents new and potentially valuable tools for approaching research questions through collaborative research.

It was within this context that a geocollaboratory for Indigenous tourism research was initiated. In general, Indigenous communities are culturally distinct and remotely located which presents significant geographic socio-cultural challenges when conducting research on Indigenous issues. To address the aforementioned, ABORINET development and operationalisation focuses on: (1) the specific goal of enabling collaboration between non-Indigenous researchers and Indigenous peoples on issues related to Indigenous tourism planning and management, and (2) the general issue of enabling the sharing of differing knowledge and management approaches (i.e. traditional ecological knowledge) among research and Indigenous communities. The primary objective of the project is to develop a multi-scale and multi-method data collection and analysis protocol for better understanding Indigenous tourism in a way that supports multi-site and longitudinal comparisons, for connecting Indigenous communities across the world, and for sharing the results in ways that are meaningful to tourism stakeholders within and beyond Indigenous communities.

3. Aboriginal Tourism Network

Blangy (2006) published *Le Guide des Destinations Indigènes* which includes 183 Indigenous tourism case studies (e.g. service providers – lodge, guides, restaurants) representing 60 countries. Language and accessibility limitations provided the impetus to develop an Internet-based portal for connecting the case study providers/communities and for sharing information with a broader audience. The portal was also perceived to be a means for community capacity-building, Indigenous tourism promotion (and a potential

economic boost), as well as an opportunity for research continuance. As the project developed beyond the initial goals, the geocollaboratory evolved. Development efforts focused on methods and tools to support four central activities. *First*, a website was created to support the asynchronous sharing of case study information. The SPIP content management system (CMS) was employed in the development of the initial website. *Second*, a Google Map interface was created and integrated so as to support the sharing of geospatial information and traditional knowledge. *Third*, an e-survey was developed to support data gathering activities, and *fourth*, a discussion forum was created to complement the aforementioned but with a specific goal of enabling knowledge exchange between Indigenous communities and relevant stakeholders.

3.1 *Content management system*

SPIP (http://www.spip.net) is an Internet CMS in which great importance is attached to collaborative work, multilingual environments, and simplicity of use for web authors. It is distributed under the General Public License so it can be used freely for any website, be it personal, co-operative, institutional, or commercial. SPIP allows the development and publishing of website content in a similar style to major newspaper websites where articles and news items are inserted in an expandable tree layout. There are many other CMSs available and we do not attempt to assess which would be appropriate in different situations but instead, focus on features that lend themselves well to the geocollaboratory. For those interested in CMS, http://www.opensourcecms.com allows one to survey and even pilot test most of the existing open source CMS solutions, allowing one to compare their strengths against individual project needs.

The SPIP interface is very user-friendly and this is the reason why it was judged to be a best-fit for this project. The researchers were able to quickly learn how to input and upload the case studies as SPIP articles, provide alternative translations, insert images, and update the data archive. The researchers could take advantage of a number of automated SPIP tasks including: multi-author management, code-less article layout, and easily modifiable website style, all of which free the participants to concentrate on effective information sharing rather than technical details. Content management is done online, so only a web browser is needed and minimal training is required. As the website was developed, care was taken to provide an intuitive and user-friendly interface for the research participants. This involved a combination of exploiting existing features of SPIP with custom modifications or extensions (based on consultations with case study participants). For example, ABORINET was set up to support both English and French language content, with other languages available where possible to foster cross-cultural communication.

Another feature of SPIP is the separation it allows between the four user categories. Not all of the features and functions are available to everyone, allowing a balance between broad participation, delegation of responsibilities, and the protection of sensitive information. The *first* user type is the webmaster who is tasked with developing, formatting and publishing the entire process in terms of core features, page layout and style. They have access to every feature the site has to offer and they are capable of manipulating it to suit the research needs and evolving priorities. The *second* user type includes the editors who are responsible for approving research participant contributions as well as for organising the site contents (articles and sections). Editors can have responsibility over the whole site or specific sections and they can monitor site usage using the statistics tools built into SPIP. The *third* user type includes the research participants who contribute content to the geocollaboratory. Traditionally, the SPIP model requires the webmaster or editor to post content but we

adapted the model to reflect the collaborative objectives of the project; the content was co-created by the researchers and the research participants. Case studies originally presented in the *Le Guide des Destinations Indigènes* were uploaded by the researchers, and the research participants (original case study participants) were given author status so that they could update their case study and contribute a new content. The author profile pages were also created (anonymity is optional) so that visitors can read the author's profile, view a list of articles that the author has contributed, and access an email contact form. *Fourth*, visitors have access to information on Indigenous tourism and the research process. They may also request and receive secure login credentials in order to participate in discussions or to leave comments. Visitors may be encouraged to become more advanced contributors and in future, we hope to welcome new users capable and willing to add to the pool of information.

3.2 *Mapping*

The geocollaboratory includes an interactive Google Map that allows localisation of the individual communities to be presented in multiple dynamic views; each case study is accompanied by a local map, with a pin indicating the spatial setting of the Indigenous tourism community (Figure 1). To incorporate the map, the SPIP field called '#EXTRA' was used to attach custom information that was not initially linked to the main SPIP entities. This feature allows research participants to easily contribute geographic knowledge using relatively simple, well-known, and freely available software. Integration of e-survey data into the Google Maps display was a feature developed specifically for this project. Users can select a question from the survey and have the results displayed as coloured markers or pins, immediately visualising the distribution of answers given by each community. Also, pins marked with a central dot mean a free text comment has been added by the research participant; clicking on this pin displays this comment over the map.

3.3 *e-Survey*

Instead of using a survey software or service such as SurveyMonkey (http://www.surveymonkey.com), the e-survey was developed using customised programming called Quickpool. The customised programming meant that about 200 hours of programming effort from a suitably skilled partner had to be invested, but the payoff was complete control over the system's architecture, allowing us to concentrate on the project goal of 'real-time' presentation of the e-survey results in the map-based geocollaboratory. The goal of immediately presenting all results in the Google Map constrained the survey to closed-ended questions so that the pre-defined categories could be assigned symbology. This limitation has been mitigated to a degree by introducing the free-form comments option to each question, and having those comments accessible through the geocollaboratory.

3.4 *Discussion forum*

The need for a discussion forum was realised early in the project; however, it had a lower priority than the main site layout, mapping interface, and e-survey system, and has only recently been addressed. The SPIP system allowed the activation of a discussion forum at the bottom of each article and this feature was judged to be a valuable addition to the geocollaboratory as it allowed participants to comment and discuss the issues raised in each article. Access to the discussion forum was restricted to users with a registered account. This was done to: (1) limit discussion to authenticated research participants, (2)

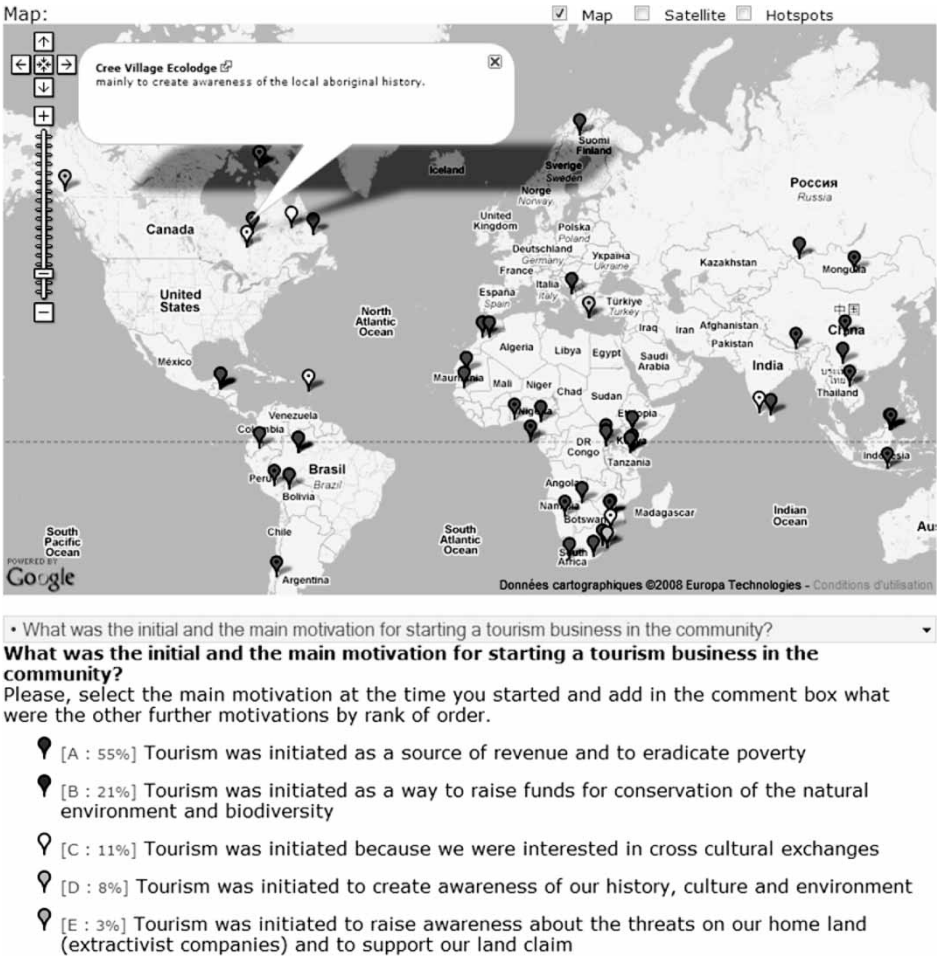

Figure 1. e-Survey integration with Google Maps, showing free text comment displayed by clicking the central dot in one of the coloured pin symbols [(c)2008 Google].

allow the geocollaboratory administrators to monitor and control the forum, (3) shield sensitive topics and participants, (4) and to encourage others to sign-up and contribute to the collaboratory.

4. Lessons learned

We found, as have others (e.g. Weng, 2008; Wright, 2005), that there is a wide range of tools that can assist with collaborative and participatory action research using the Internet, and the effort and skills involved in effectively using these tools varies widely. By extension, our work confirms that further evaluation is needed to better understand the opportunities and challenges associated with their use and the effects they may have on collaborative research. In this study, the challenges and the benefits came not just from the individual tools, but from the efforts of the webmaster who successfully integrated these tools into a single web site. ABORINET is currently producing varied results and our experiences have revealed a number of valuable lessons.

4.1 *Time and cost*

The development of the geocollaboratory was made possible by the enthusiasm, passion, and generous in-kind donations of the web programmer, research participants, and research assistants. It is difficult to estimate the total time invested by project members, but it has taken over 3 years so far. The web programmer invested at least an hour a day during active development periods, most of which was spent communicating with the primary investigator, customising SPIP, and implementing the e-survey system. The primary investigator spent approximately 3 months of full-time effort uploading, updating, and formatting the case studies and analysing and enhancing the functionality of the geocollaboratory. In addition to the time spent engaging and building trust relationships with Indigenous communities so as to recruit participants, significant time was also spent with Indigenous research participants to collaboratively design the e-survey. In the absence of in-kind donations and active engagement by all project stakeholders, the time and cost associated with geocollaboratory development and maintenance can be significant (MacEachren et al., 2006).

4.2 *Usability*

Initially, we had concerns that research participants might not have regular or reliable access to the Internet (as is often the case in Indigenous communities) and would thus not be able to participate. Instead, we did not find this to be an operational problem as participants who did not have private Internet access could gain access through alternative facilities nearby (e.g. Library facilities, Internet café) and were used to making these arrangements as a normal part of their business. However, it is possible that some individuals did not participate because they could not access the Internet. This unintentional 'exclusivity' is a limitation that must be acknowledged. Beyond Internet access, we identified that the user interface design is the most important feature of the geocollaboratory as it is the primary communication portal. Our choice to use an established CMS (SPIP) allowed us to build on the experiences of others who have used the system in other contexts and we noted that there was a range of user comfort and experience with the interface. Sometimes the discomfort manifested when participants became frustrated when their expectations about the interface did not match its execution. In certain circumstances, this involved response time of the web site – as the integration of different components temporarily slowed down responsiveness to user interaction. With other users, the mismatch between interface or designer expectations and those of the participants could be even more basic – for example, some participants did not realise that they were supposed to use the web site itself to fill out the surveys and post articles or comments in the discussion forum; instead sent their contributions by email. Clear and explicit instructions are recommended and the availability of technological support for the research participants is highly recommended by Donohoe (2011), who experienced similar usability challenges when developing a geocollaboratory for ecotourism research.

4.3 *Architectural literacy*

Current Internet technology encourages collaboration and interactive applications, which lend themselves well to participatory action research. There is a trend towards open access and there are many tools or web services with published Application Programming Interfaces so that developers are given the technical tools to implement exactly the kinds of

integrations we sought in this project. Although more tools aimed at non-technical users are becoming available, geocollaboratory development still requires a significant level of architectural literacy – a good knowledge of web standards as well as programming skills. Successful customised and integrated solutions are more likely if the project is designed as collaboration between research and technical expertise. This presents noteworthy constraints in terms of training, resources, time, and costs. Having said that, there are individual examples of web technologies that can be integrated with relative ease, given some basic familiarity with web publishing and this trend seems likely to continue. Google Maps is a representative example and it has been adopted, with our support (resources, training, support), by many of the research participants for their own tourism enterprise websites.

4.4 *Geovisualisation*

Data visualisation using the Google Maps interface, although relatively simple cartographically, has been one of the most appreciated features of the project. Participants have repeatedly provided feedback indicating they were very interested in seeing the visual representation of their replies as they fit within those from other communities. They specifically appreciate the medium of the symbolised map, as opposed to traditional text-based research dissemination methods such as tables, raw data, or scientific reports. Our experiences parallel the success of using visually oriented participant action research tools reported elsewhere in the literature. For example, Chevalier and Buckles (2008) used collaborative inquiry and social engagement techniques to study the Cree communities of James Bay, Canada, and these Indigenous communities specifically noted the importance of the visual and map-based approaches. Blangy, McGinley, and Lemelin (2010) also used visual mapping techniques to study Indigenous communities in the Canadian Arctic and report that Internet-based mapping is a valuable and complimentary tool for collaborative research in Indigenous communities where non-traditional methods and tools facilitate communication. While cross-cultural GIS for land-use planning and the concept of space remain a relatively new research frontier beyond the boundaries of the geographical discipline, GIS maps are increasingly being used by Indigenous People to draw their land boundaries and to manage their resources (Turk, 2007). The promise and potential of Internet-based geographic mapping technology for collaborative research concerning Indigenous communities is noteworthy.

Despite the advantages and opportunities associated with using geovisualisation tools, the Google Maps API does have limitations. While it is convenient, feature-rich, and free to use, it cannot always be considered a truly free (as in liberty) mapping solution. The license restrictions (http://code.google.com/intl/fr/apis/maps/terms.html) associated with its use mean that one cannot modify the map or publish the information without limits, and this may be too restrictive for some projects. On the other hand, an open initiative known as Openstreetmaps (http://www.openstreetmap.org) aims to collaboratively build a free open world-wide map, using anyone's individual input (most often GPS tracks of people performing systematic ground surveys), as well as commercial maps donated to the project and government data with compatible licensing. Software companies like http://www.cloudmap.com provide programming interfaces to take advantage of Openstreetmaps data with a degree of customisation that mapping services like Google Maps or Yahoo! Maps currently do not provide. Such an API could be used in the development of a geocollaboratory, particularly for areas of the world not well covered by Google data.

4.5 *Participatory engagement*

Although the CMS interface creates the opportunity for research participants to login and edit their information or add new content, most of the participants were wary of this 'power', and many preferred to send their updates by email, to be entered by the research team. This negated some of the advantages of the CMS system, but this is expected to dissipate with time and increased experience with the interface. In the future, we need to develop very clear instructions for accessing and contributing to the geocollaboratory and by extension, explicit explanation that the site is intended to be the community site and not a space 'belonging' to the primary investigator. Otherwise, part of the participatory nature of the research is diminished or lost. To sustain the geocollaboratory requires a sustained investment from the research team to interact with participants during active data gathering.

Similarly, initial work with the discussion forum has shown that while it opens many possibilities for rich interaction, we have found that most of the information transfer has been one way, and improving this situation likely requires more up-front communication from the research team. The primary investigator posted the e-survey results in the discussion forum in the hopes that the research participants or other visitors would comment on the results, but this has only happened when prompted. This experience suggests that a specific call for moderated discussion may be needed. We have also considered that our initial portrayal of the envisioned user community may have been too restrictive. The notion that people should sign up to the site in order to contribute specific expertise and materials may create a barrier, because it is perceived as a large commitment. A new model of more open membership may help attract a wider user base, which could evolve its own subset of users who eventually make meaningful contributions according to their own interests. However, this presents additional research considerations related to control, representation, and power that must be carefully considered before designing and managing an open access geocollaboratory.

4.6 *e-Survey data collection*

Incomplete, invalid, and biased responses are representative examples of the e-survey limitations discussed in the literature (Schmidt, 1997). In our case, we had to deal with incomplete surveys and had to resend the survey link with a more personal and customised message to have the e-survey completed in full. However, e-surveys also have numerous advantages and we observed many of those through the development stages of this project. Internet-based surveys have the potential to save time and money for survey administration (personnel not needed to ask the questions, record the responses, no postage involved, etc.) and data analysis (the reduced need for data translation and codification which are also key points for error propagation when recorded manually) (Donohoe, 2011). If the results are posted online, they can be made permanently accessible to the research participants and to a large population of individuals and can provide participants with customised feedback (Schmidt, 1997). Having immediate, visual, and user-friendly data access is highly appreciated by Indigenous communities who have been heavily researched in the past without receiving any feedback, or having to wait for several months before the researchers report back (Blangy, 2010; Stewart, 2009). The possibility of having instant feedback about the respondent's individual results and to have a global overview of other respondents' contributions increases participants' motivation and ownership, which is likely to encourage more accurate and thoughtful responses (Schmidt, 1997). We are hoping that as the project matures, that we will be able to assess the accuracy of Schmidt's statement.

Table 1. Geocollaboratory challenges and mitigation measures.

Challenge		Mitigation measure
Internet infrastructure	Access, connectedness, bandwidth, literacy, and degree of comfort with technology are bounding factors	Select user-friendly software interfaces that support bandwidth restrictions Consider providing support to those with limited access, connectedness, or comfort (training, case incentive, etc.)
Cost	Custom collaboratories come at a potentially high cost (time and resources)	Build collaboratories using existing technology and infrastructure Use free software and services wherever possible
Technological literacy	Technical skills are variable in groups and the need for technical assistance and training may be high for both researchers and research participants	Level of technical training associated with the adoption and maintenance of each tool must be considered before use Ability to provide support and training must be assessed against the time and resources available
Collaboratory engagement	Unclear expectations and instructions, lack of transparency, and sense of ownership, may result in lack of trust, reciprocity and ultimately research failure	Invest in human skills (e.g. such as community engagement, partnership and networking, reliable communications) that enable trust-building between research and researched communities Ensure technology facilitated social capital development rather than simply a research end

4.7 *Security, privacy, ethics, and confidentiality*

In using an online, real-time forum to publish research, critical reflection and care needs to be afforded, given the exposure that is being promoted. For the researcher, the public release of data means that anyone can use the data for any purpose. There are licensing models available to request that appropriate credit be given for the research (e.g. see http://creativecommons.org/), but researchers still need to be comfortable with the fact that if data are available immediately, others could conceivably publish results before the research team. Privacy, ownership, and other ethical concerns common to most social science research take on new implications in this forum and context, and models and standards need to evolve accordingly. For example, many Indigenous groups have cultural restrictions on the use of names and images, and cultural sensitivity should be reflected in the database arrangements. In the ABORINET case, participants have content control and ownership rights over their contributions but we learned that they also wanted to control what was made publicly available. In response, we implemented password protection schemes to ensure restricted access to select information (as requested by the research participants) and we have made anonymity an option for participant contributors.

Internet-based collaboration also impacts the researchers' ability and responsibility to care for the geocollaboratory and the data contained therein. While a local backup solution has been implemented, the research team is working to develop a much-needed plan for the long-term data archive. We are far from unique in this limitation, though, as efforts to consider archiving needs in Internet-based multimedia and cartographic projects are relatively rare, and not well supported by central archiving facilities (e.g. Lauriault, Taylor,

& Pulsifer, 2008). The new possibilities for social science research provided by Web 2.0 and other Internet-based technologies are numerous, but given the relative youth of their application, there remains much to be learned about their limitations as well as the ethical standards for their use. Benfield (2006) reminds researchers that guidelines have not yet been developed and that collectively our experiences must be shared and a code of ethics for Internet-based research should be developed.

Based on the aforementioned experiences and observations, and complimenting the work of Craver and Gold (2002), a set of Internet-based geocollaboratory challenges are presented (Table 1). To further assist others engaged or considering engagement in collaboratory research of this nature, pragmatic mitigation measures are proposed. Craver and Gold (2002, p. 508) remind us that 'Ultimately it is the human skills for collaboration rather than the technical excellence of the infrastructure that signals the potential for success'. Successful virtual teams are built on the same principles of successful teams – trust, reciprocity, and dense social networks. Internet-based collaboratories are a process of social capital development, and this should be the primary focus and objective when developing an Internet-based collaboratory. The technology is simply a tool for facilitating the process – one that requires that critical and informed design decisions be made and that the architectural development and maintenance of the geocollaboratory be purposefully focused on facilitating a successful collaborative research process.

5. Conclusions

As previously noted, antecedent efforts have focused on the development and implementation of networking technologies so as to make real-time data collection and sharing possible. Our research has focused on extending the collaboratory concept into the social sciences and specifically to the geographic study of Indigenous communities and tourism. Based on our experiences, the key challenges have been: (1) developing a set of technological tools to facilitate collaborative research between and among Indigenous communities around the world; (2) developing geographic representation in maps and other forms to improve knowledge transfer (and integrate data into the maps at low cost); and (3) capitalising on the lessons learned to improve the geocollaboratory and to move towards project success.

The originality of the work discussed here is the integration and combination of several features in one CMS-managed web site for collaborative research purposes: case study articles, Google Maps, e-surveys, and a discussion forum. The combination of these tools sets up a potentially rich, interactive research environment that parallels developments in the wider Web 2.0 world. These broader trends meant that the options for developing the geocollaboratory were varied and the potential for developing future interactive and dynamic web sites will likely continue to diversify and improve. Our experience using these tools for Indigenous tourism research confirms MacEachren et al.'s (2006) conclusion that having a suite of tools, rather than a one-size-fits-all solution, allows the research team to tailor the collaboratory to meet the research goals and objectives, to address the specific research context and/or requirements, and ultimately be successful. Like MacEachren et al. (2006), we have found that the development of tools and methods for global-scale research requires an iterative process of implementing, assessing, and refining the collaboratory's architecture. Although several of the tools developed in the early stages of the research produced mixed results, the lessons learned served to inform the enhancement of the geocollaboratory and this process remains ongoing.

ABORINET is a long-term project that is in the early operational phase. However, successful outcomes are now manifesting for a variety of stakeholders. For the global community of scholars, ABORINET case studies are informing graduate student research and supporting pedagogical activities such as lectures and field excursions. For Indigenous people, the case studies, discussions and other ABORINET resources are providing guidance for business development activities. Individuals, communities, and organisations are also making and maintaining contact with each other for support, guidance, and more. For the research team, ABORINET continues to grow and provide a central portal through which to conduct global-scale research. There are many difficulties that will need to be overcome, but we are confident that our reflexive approach will facilitate the identification and mitigation of issues as they arise (e.g. technical challenges, integration of new technology, security, and privacy, inclusivity). As ABORINET evolves, the research team continues to seek partners and participants who are interested in contributing to and benefiting from the project. The effort to disseminate findings and outcomes with stakeholders is a resolute priority.

Critical reflection on the research process and its associated goals, ethics, methods, tools, and outcomes is also a sustained priority for the research team. In future, it is our ambition to better understand the effectiveness of the collaboratory for sharing traditional knowledge among and between Indigenous communities, for marketing Indigenous tourism experiences, for knowledge dissemination among the scientific community, and for education and training. Specifically, we would like to address questions that have arisen in the early operational phase of the project: What is the motivation to contribute to ABORINET? Are participants satisfied with their experience? Whose voices are heard and whose are not (power, representation)? How does ABORINET contribute to the enhancement and/or sustainability of Indigenous tourism? To answer these questions and others, the research participants will be consulted about their experiences, contributions, motivations, and desired outcomes so that we can enhance the tools, engage more participants, and continue to deliver positive and meaningful outcomes for stakeholders.

Finally, is important to note that ABORINET is a geographic collaboratory because it emphasises traditional geographic representation in the form of maps and images and because of the fundamentally geographic problems it is addressing – understanding the human–environment relationship across cultures and landscapes, specifically Indigenous peoples and tourism. ABORINET uses low-cost, readily available technologies to facilitate participant engagement as well as to support the integration of geographically referenced data and knowledge. The ‘spatial’ distinguishes our approach from other approaches to scientific collaboration and it complements the work of MacEachren et al. (2006) and Pettit and Wu (2008) who are contributing geographical perspectives to this evolving research frontier. Despite the elements that in hindsight we would improve if given the opportunity to start again, this project has not only demonstrated the potential of integrating Internet-based technologies with maps and surveys for participatory and collaborative tourism research, it has produced a working global-scale geocollaboratory that will be the foundation for present and future Indigenous tourism research. We hope that other interdisciplinary, collaborative teams in tourism and other fields will see the potential in this kind of approach, and an evolving community will share best practices. Finally (and perhaps most noteworthy), the geocollaboratory is providing a portal through which Indigenous voices are being heard, traditional knowledge is being shared, and Indigenous tourism is being discussed, developed, planned, and promoted for the betterment of Indigenous communities. These themes and others are to be explored in future publications.

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References

Benfield, J. (2006). Internet-based data collection: Promises and realities. *Journal of Research Practice*, *2*(2), Article D1.

Blangy, S. (2006). *Le Guide des Destinations Indigènes. Indigène Editions*. France: Montpellier.

Blangy, S. (2010). *Co-construire le tourisme autochtone par la recherché-action participative et les Technologies de l'Information et de la Communication* (Unpublished doctoral thesis, Université Paul Valéry – Montpellier III, France).

Blangy, S., McGinley, R., & Lemelin, R.H. (2010). Recherche-action participative et collaborative autochtone: Peut-elle améliorer l'engagement communautaire dans les projets touristiques? *Téoros*, *29–1,* 69–80.

Buhalis, D., & Law, R. (2008). Progress in information technology and tourism management; 20 years on and 10 years after the Internet – the state of eTourism research. *Tourism Management*, *29,* 609–623.

Butler, R., & Hinch, T. (2007). *Tourism and Indigenous peoples: Issues and implications*. Oxford: BH Elsevier.

Chevalier, J., & Buckles, D. (2008). *SAS2. A guide to collaborative inquiry and social engagement*. Thousand Oaks, CA: IDRC, Sage Publications.

Cogburn, D. (2003). HCI in the so-called developing world: What's in it for everyone. *Interactions*, *10*(2), 80–87.

Craver, J., & Gold, R. (2002). Research collaboratories: Their potential for health research behavior researchers. *American Journal of Health Behavior*, *26*(6), 504–509.

Donohoe, H.M. (2011). Defining culturally sensitive ecotourism – a Delphi consensus. *Current Issues in Tourism*, *14*(1), 27–45.

Donovan, M. (2007). Can information communication technological tools be used to suit aboriginal learning pedagogies? In M. Dyson, & S. Grant (Eds.), *Information technology and Indigenous people* (p. 346). London: Information Science Publishing.

Goodwin, H. (2007). Indigenous tourism and poverty reduction. In R. Butler, & T. Hinch (Eds.), *Tourism and Indigenous peoples: Issues and implications* (pp. 84–94). Oxford: Butterworth–Heinemann.

Kaur, S., Mann, V., Matossian, V., Muralidhar, R., & Parashar, M. (2001). *Engineering a distributed computational collaboratory.* Proceedings of the 34th Annual Hawaii International Conference on System Science, (pp. 3612–3621), Maui, Hawaii.

Kouzes, R., Myers, J., & Wulf, W. (1996). Collaboratories: Doing science on the Internet. *IEEE Computer, 29*(8), 40–46.

Lauriault, T., Taylor, D., & Pulsifer, P. (2008). Will today's Internet maps be available tomorrow? How action research is leading to the preservation of the Cybercartographic Atlas of Antarctica. In M. Peterson (Ed.), *International perspectives on maps and the internet* (pp. 417–436). Berlin: Springer.

MacEachren, A., Pike, W., Yu, C., Brewer, I., Gahegan, M., Weaver, S., & Yarnal, B. (2006). Building a geocollaboratory: Supporting Human–Environment Regional Observation (HERO) collaborative science activities. *Computers, Environment, and Urban Systems*, *30,* 201–255.

Notzke, C. (2006). *The stranger, the native and the land: Perspectives on indigenous tourism*. Concord, ON: Captus Press.

Pettit, C., & Wu, Y. (2008). A virtual knowledge world for natural resource management. In C. Pettit, W. Cartwright, I. Bishop, K. Lowell, D. Pullar, & D. Duncan (Eds.), *Landscape analysis and visualisation: Spatial models for natural resource management* (pp. 533–550). Berlin: Springer-Verlag.

Pulsifer, P.L., Hayes, A. Fiset, J.P., & Taylor, D.R.F. (2008). An education and outreach atlas based on geographic infrastructure: Lessons learned from the development of an on-line polar atlas. *Geomatica*, *62*(2), 169–187.

Russell, M., Allen, G., Daues, G., Foster, I., Seidel, E., & Novotny J., von Laszewski, G. (2001). *The astrophysics simulation collaboratory: A science portal enabling community software development.* Proceedings of the 10th IEEE International Symposium on High Performance Distributed Computing (pp. 207–215), San Francisco, CA.

Schleyer, T., Teasley, S., & Bhatnagar, R. (2005). Comparative case study of two biomedical research collaboratories. *Journal of Medical Internet Research*, *7*(5), e53.

Schmidt, W. (1997). World-wide web survey research: Benefits, potential problems, and solutions. *Behavior Research Methods, Instruments & Computers*, *29*(29), 274–279.

Sinclair, D. (2003). Developing Indigenous tourism: Challenges for the Guainas. *International Journal of Contemporary Hospitality Management*, *15*(3), 140–146.

Smith, V., & Eadington, W.R. (1992). *Tourism alternatives*. Chichester: Wiley.

Stewart, E. (2009). Reporting back research findings: A case study of community-based tourism research in the Canadian North [Special issue on aboriginal tourism]. *Journal of Ecotourism*, *8*(2), 128–143.

Stewart, E., Jacobson, E., & Draper, D. (2008). Public Participation Geographic Information Systems (PPGIS): Challenges of implementation in Churchill, Manitoba. *The Canadian Geographer*, *52*(3), 351–366.

Turk, A. (2007). Representations of tribal boundaries of Australian indigenous peoples and the implication for geographic systems. In L. Dyson, M. Hendricks, & S. Grant (Eds.), *Information technology and indigenous people* (p. 346). Hershey, PA: INFOSCI.

Weng, T.S. (2008). *Using internet multimedia to promote local business: A case study of alshan*. 8th WSEAS International Conference on Multimedia Systems and Signal Processing, Hangzhou, China.

Wright, K.B. (2005). Researching Internet-based populations: Advantages and disadvantages of online survey research, online questionnaire authoring software packages, and web survey services. *Journal of Computer-Mediated Communication*, *10*(3), article 11.