

Mapping Experience: Age and Indigeneity as Mediating Factors in Users' Experiences with the Algonquian Linguistic Atlas

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ABSTRACT

To understand how effectively digital maps of Indigenous languages engage a variety of audiences, a mixed-methods user study focused on the experiences of 23 Indigenous and non-Indigenous users aged under and over 30 from a Canadian university as they navigated an online Canadian Indigenous language atlas by completing a series of tasks. An evaluative component assessed the efficacy of the study itself in measuring such experiences. Indigenous participants found the atlas more relevant and useful and focused more on its linguistic content, while non-Indigenous participants focused on the layout and structure of the atlas's framework. Digital language atlases can better address Canadian Indigenous populations by emphasizing multimodal representations of linguistic content, with easily accessible links to additional resources from the communities represented. While the study did capture multiple dimensions of user experience, low Indigenous participation decreased the efficacy of comparative statistical analyses. Future research can improve Indigenous representation by focusing on recruitment methods that engage and are relevant to Indigenous populations.

Keywords: language education, digital atlas, map use, language revitalization, Indigenous languages, multimodal mapping

RÉSUMÉ

Pour comprendre avec quelle efficacité les cartes numériques des langues autochtones rejoignent divers publics, l'auteur mène, auprès d'utilisateurs, une étude faisant appel à une méthodologie mixte portant sur les expériences de navigation en ligne de 23 usagers autochtones et non autochtones, âgés de moins de 30 ans et de plus de 30 ans, recrutés dans une université canadienne et appelés à s'acquitter d'une série de tâches dans le cadre de la consultation d'un atlas de langues autochtones canadiennes. Un élément d'évaluation permet de jauger l'efficacité avec laquelle l'étude elle-même permet de mesurer ces expériences. Les participants autochtones ont jugé l'atlas plus pertinent et utile et se sont concentrés davantage sur son contenu linguistique, alors que les participants non autochtones se sont plus particulièrement intéressés au modèle et à la structure du cadre conceptuel de l'atlas. Les atlas linguistiques numériques permettent de mieux cerner les populations autochtones canadiennes en insistant sur les représentations multimodales du contenu linguistique et en proposant des liens facilement accessibles vers des ressources supplémentaires provenant des communautés représentées. Bien que l'étude circonscrive bel et bien les multiples dimensions des expériences des utilisateurs, la faible participation autochtone réduit l'efficacité des analyses statistiques comparatives. Il serait opportun, dans des recherches ultérieures, d'améliorer la représentation autochtone en mettant en œuvre des méthodes de recrutement persuasives, adaptées aux populations autochtones.

Mots clés : atlas numérique, cartographie multimodale, formation linguistique, langues autochtones, revitalisation linguistique, utilisation de cartes

Introduction

THE NECESSITY OF MAPS IN LANGUAGE EDUCATION

More than just a means of representing geographic spaces in formats palatable to viewers, maps are important resources in storing and transmitting inexhaustible arrays of

knowledge without the interference of text (Upton 2010) and can provide social empowerment due to their ability to communicate large amounts of information easily. When constructed well, maps can reflect *relationships* between the subjects and factors being explored, in essence contextualizing them (Ormeling 2010). Furthermore, Upton

(2010) states that language maps are important, as viewers often seem instinctively drawn to them, and in contrast to the case with other media of instruction, viewers feel that they have some immediate understanding of the information displayed. With the increasing sophistication of digital and Internet-based technologies, maps presented digitally are in the novel position of being able to convey information interactively in ways unthinkable with traditional print atlases: with audiovisual information, photo albums, interactive activities, and relevant Web links, to name a few options. In education, maps are powerful tools in teaching learners about the physical spaces they inhabit and the issues connected to those spaces. Learners can engage with, encode, and interpret visuospatial information (Bollman 2010) in ways they could not with text alone without making learning more demanding on their mental processes (Roberts, Parush, and Lindgaard 2005). Even a single map can communicate ideas of cultural and linguistic dispersion in ways that written texts cannot (Luebbering, Koliivas, and Prisley 2013), as learners can simultaneously view multiple aspects of the subject at hand. Educational theory suggests that learners learn more effectively in both formal and informal settings when actively engaged than when passively involved (Taylor 2005). As well as extending the modalities through which information can be presented, digital maps offer unique accessibility in the classroom, as they do not need to be physically acquired and cared for or replaced. Atlases can be presented through classroom projectors or interactive computer programmes or on mobile devices, allowing unprecedented accessibility in the classroom and the hands of learners.

As tools of power (Aporta and others 2014), convincingly produced maps allow their creators to dictate how their viewers experience reality, as they inspire confidence in their viewers (Caquard and Taylor 2005). Those who produce the maps become authorities in the subjects they are mapping and will often create the maps to further their own interests (Ormeling 2010). In colonial contexts, maps became tools of ownership, in which European groups assigned names and borders to newly conceived territories, hence “claiming” them (Aporta and others 2014; Ormeling 2010). The idea that languages, peoples, and places can be represented on maps in the first place is a product of European nationalism attempting to categorize languages into particular tribal, ethnic, and social groups (Mühlhäusler 2010). Colonialism provided a strong motive for the development of maps, as explorers and colonists attempted to understand and ultimately control the new places, ideas, and lands they encountered. When representing the dispersion of ethnic groups in a given area, the mapping authorities in place created new names for the peoples and languages being mapped, and their ethnic and linguistic boundaries were decided for them. The “reality” of Indigenous peoples in North America thus began to exist outside of themselves, and risked becoming in part the domain of European society.

As digital and information technologies have the perspectives and values of the society from which they came embedded in them (Dyson 2004), researchers such as Pannekoek (2001) argue that while digital technologies have the *potential* to work as a powerful tool in the empowerment and education of Indigenous communities, the reality is that they bombard these communities with English-language and Eurocentred media, which undermine Indigenous values and culture. Furthermore, Pannekoek (2001) posits that access to digital technologies has served to separate more affluent and middle-class Indigenous people from those with fewer resources. Because of this, the use of maps in North America has a troubled legacy as a tool for exerting control and power over others, but just as tools are actualized in the hands of those who use them, maps also have great potential for restoration and rehabilitation, provided they are used sensitively and appropriately.

In one direction, digital maps have a great potential in the mapping and intergenerational transmission of Indigenous traditional knowledge (TK). TK is described by Oguamanam (2011) as follows:

aspects of [. . .] self determination, human rights, culture, [. . .] lifestyles, and innumerable aspects of social processes that undergrid a people’s worldview. (p. 46)

This definition can be further extended to include unique understandings of “place and space” (as in Aporta and others 2014, 241) and language when applied to the context of map use in education. For more information on this definition and an account of other definitions in this article, see Appendix 1. Because digital maps can present information through the use of videos, photographs, and audiorecordings such as songs, stories, and spoken language samples, TK can be presented in ways that respect intergenerational legacies of oral traditions. The benefits of culturally appropriate and accessible maps in the empowerment of communities and their TK are twofold: atlases can act as a common space where members collect and contribute their own information and data as a form of *distributed cognition* (see Hutchins 1995) and as a “facilitator of learning among younger generations” (Aporta and others 2014, 242).

For many, however, computers, tablets, and smartphones are a source of confusion or apprehension due to unfamiliarity stemming from a variety of factors such as age, education level, socio-economic status, or perceived irrelevance. There is a knowledge gap between the older and younger generations, in which, having grown up immersed in digital technologies, younger generations can intuitively grasp how digital systems work more easily than their elder counterparts (Schnürer, Sieber, and Çöltekin 2015). When applied to TK, a paradox arises: on one hand, elders, who

possess a wealth of knowledge regarding the land, culture, and language, have at best a fraction of the digital experience younger generations have, who, on the other hand, possess at best a fraction of the TK elders have (Keith, Crockatt, and Hayes 2014). Remote areas such as much of northern Canada experience hindrances to connectivity such as low bandwidth, a lack of nearby retailers, and prohibitively high product shipping costs. A lack of access to the technologies creates an array of design challenges that require special consideration when working with these populations, such as ensuring that users are not overwhelmed with information, are able to intuitively grasp the atlas's layout and features, and do not get disoriented when using the software (Roberts, Parush, and Lindgaard 2005). Nevertheless, digital language atlases do have the potential to act as a valuable store of TK as an educational medium that can span Canada's vast geographical distances (Payne, Hayes, and Ellison 2014). As information can be displayed in a variety of more culturally appropriate multimedia alternatives to large bodies of text, users from a variety of backgrounds and ages have the potential to become engaged in ways never before imagined. Understanding how people fit into this system is thus paramount to understanding how successful the atlases are, and how they can be maximized as an educational resource.

USER STUDY

A user study will investigate how individuals experience a digital atlas that represents Indigenous languages across a geographic space. Though many digital atlases that map Indigenous knowledge and languages are now produced in partnership with Indigenous communities, I was unable to find any post-production assessments of how effective the atlases are when put into practice. This is particularly troubling because digital atlases require regular maintenance and funding to exist and remain active. If digital atlases contain inadequacies that interfere with learning or do not capture the interest of their viewers, they run the risk of becoming defunct or not satisfying funding criteria. Being able to investigate what makes atlases successful in terms of both information delivery and user experience is thus of great importance. The main objectives of the research conducted here are threefold:

- (1) to assess the success of an online linguistic atlas in effectively engaging users and providing them with information they deem as relevant and useful;
- (2) to understand how people interact with and experience Indigenous digital language mapping technologies and how personal factors such as age and the presence or absence of an Indigenous background may affect or mediate these experiences;
- (3) to better understand the strengths, limitations, and factors involved with conducting user studies on digital Indigenous atlas projects.

The Algonquian Linguistic Atlas

The Algonquian language family is a large grouping of related languages that spans much of the North-American continent from Mi'kmaw in Nova Scotia, to Blackfoot (Siksiká) in Alberta (Goddard 1978). The Algonquian language family is not to be confused with the *Algonquin* language, which comprises a cluster of dialects of Ojibwe in the Ottawa River watershed and is part of the Algonquian language family. The atlas used in this study geographically represents a number of languages belonging to the Algonquian language family with individual points (or "dots") on a digital map of Canada (Junker and Stewart 2008). Produced by Junker (2005–17), the Algonquian Linguistic Atlas aims to

co-create an on-line, multimedia linguistic atlas of Algonquian languages [. . . which] allows [the Atlas] to offer many training opportunities for sound editing and linguistic description training to aboriginal students [and] create contacts between curriculum developers, language specialists and lexicographers of Algonquian languages, with a focus on on-line language resources and dictionaries. (From the "About the atlas" section, Junker 2005–17. For full credits, see <https://resources.atlas-ling.ca/about/>)

The atlas is presented online and uses satellite maps provided by Google Earth as a base for geographical representations, as seen in Figure 1. Language information is presented on the map using specific points that, when clicked on, display speaker recordings of specific words or phrases selected from a drop-down menu. Links to dictionaries, learning resources, and classroom activities are provided in the atlas, not only allowing users to explore samples of the languages themselves, but also providing the opportunity to learn more about them.

The atlas is in many ways exemplary, as it was created with involved and regular input from members of the linguistic communities it represents. However, no formal assessments focus on how the atlas is experienced by users since it became available to the public. Because the atlas is a product of collaboration with Indigenous communities and represents Indigenous knowledge primarily for these communities, it is of great importance that Indigenous perspectives and experiences be taken into consideration in every aspect of this study's design and implementation.

Users' Backgrounds as an Influential Factor in Their Experiences

Users of different ages differ in both their needs in and their approaches to using digital interfaces (Prensky 2001; Schnürer, Sieber, and Çöltekin 2015). Prensky (2001) uses the term "digital natives" to distinguish those who grew up surrounded by more contemporary technologies such as smartphones and the Internet from "digital immigrants,"

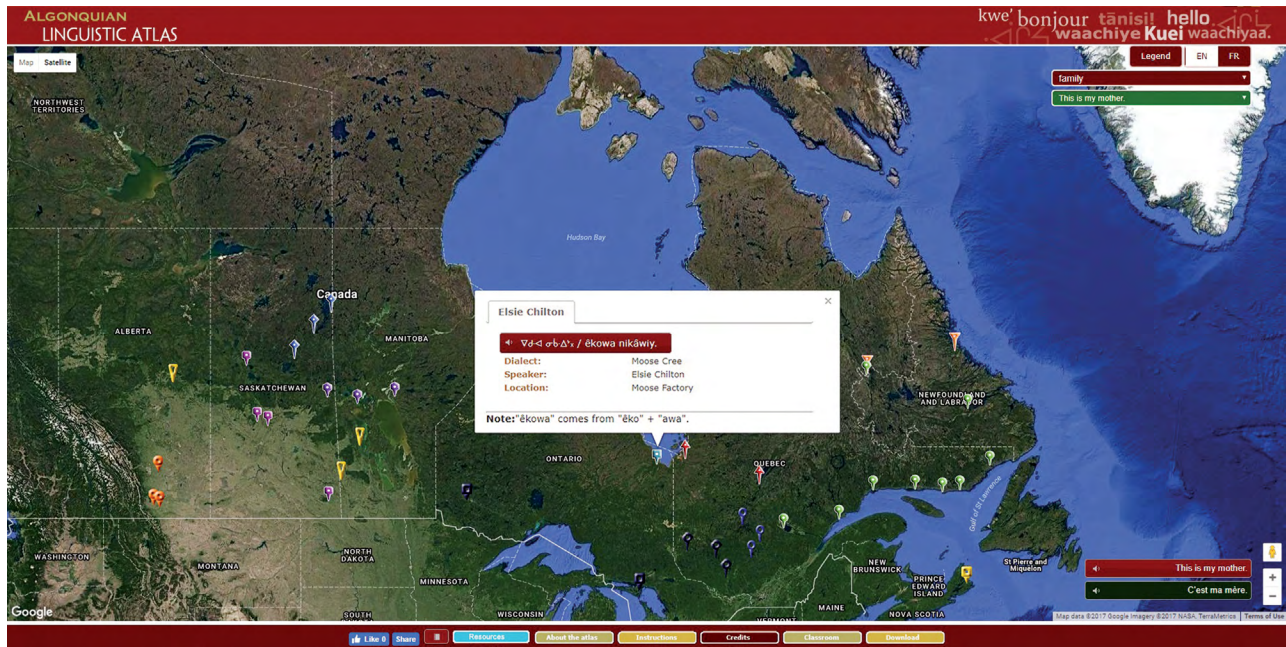


Figure 1. Screenshot of the main atlas page, with a speech sample selected
 Source: Map data © 2017 Google Imagery; © 2017 NASA, TerraMetrics.

who grew up before these technologies became available. As this study involves Indigenous contexts and languages, the term *digital generation* (DG) will be used instead of “digital natives,” and the term *mature* will be used for “digital immigrants.” In Schnürer, Sieber, and Çöltekin (2015), the DG includes those who were born after the year 1980, presumably when personal computers first became available. Here, the DG criterion will be changed to 1990 to reflect when the Internet first became publicly available, and personal computers, while already available to the public, became more accessible due to their decreasing cost and first true implementation of a graphical user interface (GUI; Reimer 2005).

Schnürer, Sieber, and Çöltekin (2015) indicated that DG users have intuitions about digital technologies not observed in many mature users, due to the devices available to them from an early age. Giedd (2012) noted that adolescents spend approximately 11.5 hours a day engaged with some form of device (smart phone, tablet, etc.), readily use digital devices while engaged in other tasks, and access multiple devices at the same time. Though this may mean that DG users more easily process multiple sources of data coming from a digital atlas interface, an fMRI study by Just, Keller, and Cynkar (2008) indicated that the increased cognitive load associated with attempted multitasking may cause impairment in parts of the brain responsible for the processing of space.

For the purposes of this study, the term *Indigenous* refers to individuals with historical, social, and ancestral backgrounds that include ties to communities of peoples who inhabited

areas in what is now known as Canada prior to European colonization. This definition encompasses First Nations, Métis, and Inuit peoples, which is important to consider, as due to differing historical and legal considerations, Métis and Inuit peoples are on occasion not defined as Indigenous (for example, see Aporta and others 2014). As the atlas was created with the collaboration, assistance, and input of Indigenous peoples, represents Indigenous linguistic TK, and is primarily intended for Indigenous communities, user studies should ideally include Indigenous participants and their perspectives. At the same time, non-Indigenous users are also of interest, to gain more insight into how diverse other groups experience digital atlases.

Methods

RECRUITMENT AND PARTICIPANTS

A total of 23 participants completed the study, with the majority ($n = 20$) physically present in the intended laboratory settings. The remainder participated from a distance via an Internet connection ($n = 2$) or in their own spaces with the researcher present ($n = 1$). Table 1 categorizes participants according to *age* and *indigeneity*.

Indigenous DG participants (< 30 years of age) were recruited with a research poster in a campus Indigenous student centre, by an online version of the same poster attached to the centre’s regular digital newsletter service, and by the snowballing technique. Non-Indigenous DG participants were recruited by similar physical research posters placed throughout the university campus, and via

Table 1. Participants according to the study's variables of age and *indigeneity* ($N = 23$)

	<i>n</i>	
	Age (< 30 y)	Age (> 31 y)
Indigenous	2	1
Non-Indigenous	15	5

snowballing. Posters here only differed from those used with the Indigenous group in that potential recruits did not need to be Indigenous. Potential mature Indigenous participants were personally contacted by the researcher. Non-Indigenous participants above the age of 30 were also recruited in this manner, but also were recruited with the physical research poster and by snowballing.

PROCEDURE

If physically present in the researcher's office, participants were first provided with a gift card to a popular coffee shop. They then read a short description of the study and were prompted to ask the researcher for added clarification if necessary. Then participants signed a consent form that was subsequently also signed by the researcher. Following this briefing stage, participants began the study if they decided to stay:

- (1) Atlas navigation task: Participants navigated the atlas using a desktop computer in the researcher's office. The task did not take longer than 10 minutes on the average. Though they were permitted to informally explore the atlas's features for an indefinite amount of time, they were also required to complete 12 tasks in the form of questions on a worksheet to ensure that they encountered most of the basic features the atlas has to offer. Though participants' accuracy was not individually measured, participants' overall total accuracy was recorded to better understand how intuitive the atlas is to novice users and how effective the instructions were.
- (2) Questionnaire task: Upon completion of the atlas task, participants completed a questionnaire asking them to numerically rate their experiences using a Likert Scale (1–10) and to circle a response to a feature-related statement best reflecting their experiences, as shown in Table 2. This component of the questionnaire was produced as an adaptation of the usefulness, satisfaction, and ease of use (USE) questionnaire (Lund 2001). The USE questionnaire was selected because it is simple and straightforward to use while still testing subjective dimensions of user experiences, which tend to be overlooked in more conventional user studies (Lund 2001). A fourth dimension of *learning ease* was added to this questionnaire to focus on the process through which

Table 2. Example multiple-choice question paired with numerical rating values^a

The atlas was easy to use (circle one):				
Strongly disagree	Disagree	Neutral	Agree	Strongly agree
-2	-1	0	1	2

^a Numerical rating values were not shown in the actual questionnaire.

participants become familiar with the atlas software. For the purposes of this study, the questionnaire will thus be referred to as the USE(L). Though many user studies look at how successfully users perform various tasks on an interface in order to determine the interface's competency (for example, Laidlaw and others 2005), the primary objective here is to focus on the users themselves. The last three items were open-ended questions that prompted participants to describe what they liked about the atlas, what they did not like, and what could be improved. Though participants were given the option to leave any question they did not want to answer blank, all items were filled out on most of the questionnaires. The questionnaire did not ask for any personally identifying information, though participants were asked to disclose their age in years, any languages they were interested in or had exposure to, and where they learned about the study. Asking where they learned about the study and for their language interests was an indirect way of attempting to better understand participants' ethnic and cultural backgrounds, without explicitly asking participants to declare sensitive identifiable information.

- (3) Post-questionnaire semi-structured interview: Following the questionnaire, the researcher interviewed several participants to obtain a more detailed account of their experiences. The researcher first read the questions aloud and then wrote down the participant's oral responses underneath each question. Interviewees were randomly selected from the pool of non-Indigenous participants who completed the other sections of the study, but each Indigenous participant was interviewed due to smaller groups and to place an emphasis on Indigenous perspectives. The interview questions, while similar to those in the questionnaire, were more broad and open-ended and asked participants what they thought of the potential for language atlases to be of benefit to learners in the classroom and other educational settings. Unless participants decided to spend extra time exploring the atlas' extended features, the study, including the interview, did not take more than half an hour per individual.

MEASURES

Participant responses were measured quantitatively in the form of rating scales and a 1–10 rating scale of overall satisfaction. Experience was measured qualitatively in the form of answers to the open-ended questions in the questionnaire and subsequent interview questions. Results were placed in a Microsoft Excel file, which contained all relevant information according to each participant. Written responses to open-ended and interview questions were summarized into single-word codes expressing their main themes. The coding process consisted of deriving themes from each participant sorted by both age and Indigeneity and analysing the two most frequently occurring theme codes for each group. Any concerns voiced by participants related to the atlas were noted, to add detail to their experiential accounts and to better understand their learning processes. Finally, the researcher recorded his own experiences during the experimental process and important information to take into account when interpreting the results.

Results and Discussion

STATISTICAL INTERPRETATIONS OF THE QUESTIONNAIRE DATA

Questionnaire ratings were analysed in response to the first objective of this study, which was to assess the success of a specific digital language atlas in effectively engaging users. Because the numerical component of the questionnaire tested users' experiences through one type of scale only, descriptive statistics composed the majority of the analyses. Due to unbalanced participant groups, all participants' ratings were collapsed to obtain a global measure of how the atlas was experienced.

Overall, participants enjoyed the atlas and found it engaging, and rated their total experience as 8.3 out of 10. [Figure 2](#) shows participants' combined ratings for each of the four dimensions found in the questionnaire.

User Satisfaction and *Learning Ease* was the most positively rated dimension from the USE(L) questionnaire.

As the atlas was designed to be a user-centred way of geographically and audio-visually representing languages and showcasing related Indigenous language projects, it does not come as a surprise that user satisfaction is relatively high. As participant ratings were different between *Learning Ease* and *Ease of Use* dimensions, it can be argued that adding the dimension that focuses on the process of learning itself is appropriate and increases the scope of [Lund's \(2001\)](#) USE questionnaire. The *Usefulness* dimension was the least positively rated, as many participants felt that the material was not relevant to their own lives. This may be due in part to the majority of participants having a non-Indigenous background, which could act as a factor in determining how relevant they felt Indigenous languages were to their own lives.

Cronbach's alpha was used to assess how internally consistent each of the questionnaire's dimensions was across participants. The Usefulness scale consisted of four items ($\alpha = 0.58$), the Satisfaction scale consisted of six items ($\alpha = 0.8$), as did the Ease-of-use scale ($\alpha = 0.65$), and the Learning Ease scale consisted of five items ($\alpha = 0.71$). However, the average across all the dimensions ($\alpha = 0.69$) was lower than the entire questionnaire's internal consistency score ($\alpha = 0.87$), indicating that the measures of internal consistency were strongly influenced by the number of items taken into account.

SHORT-ANSWER RESPONSES AND SEMI-STRUCTURED INTERVIEW

Qualitative data were obtained from three short-answer questions at the end of the questionnaire, from post-questionnaire interview responses, and from comments and observations made by the researcher during the trials themselves. In [Table 3](#), Indigenous participants primarily focused on content-related aspects of the atlas (such as presence and delivery of languages), whereas non-Indigenous participants in [Table 4](#) tended to focus on structure-related aspects (such as the layout and icons). However, mature

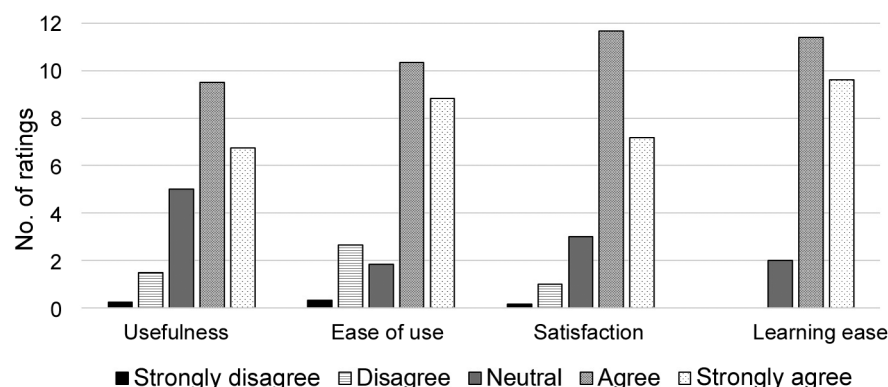


Figure 2. Collapsed ratings of the Atlas according to the four questionnaire dimensions

Table 3. Indigenous participants' coded short-answer responses by frequency

Questions	Mature Indigenous responses ^a	DG Indigenous responses
What did you like about the atlas?	Spoken media	Provides knowledge ¹ Spoken media ²
What didn't you like about the atlas?	Unclear components	Unclear components ¹ Few languages ²
What could be improved?	More languages ¹ More links ²	More phrases ¹ More languages ²

^a Single codes denote the absence of a second code, due to only one type of response being present.

and DG participants did not differ greatly in terms of what they liked and disliked about the atlas.

Participants' Backgrounds and Their Experiences with the Atlas

Indigenous participants' open-ended interview responses are emphasized due to their limited participation and subsequent representation thus far in this study. For an account of Indigenous participants' responses, see Appendix 2.

Indigenous participants tended to concentrate more on the content-related aspects of the Atlas, such as the presence, distribution, and delivery (audio or text) of language samples. Conversely, non-Indigenous participants tended to focus more on structural aspects of the Atlas, such as the placement of lists, menu items, or the legend. This may be the result of the subject matter's perceived relevance: Indigenous language information is likely more relevant to Indigenous participants in some way than to non-Indigenous participants. To further understand if relevance could have an effect, a follow-up measure of relevance in Figure 3 illustrates Indigenous and non-Indigenous participants' separately averaged total ratings on the *Usefulness* dimension. Using the average total ratings produces a magnitude reading of how strongly each participant group felt about the atlas's relevance.

Because the above figure is based on the combined ratings of unevenly sized groups, it serves as an exploratory illustration of how the relevance of the atlas's materials could explain the rationale behind which aspects of the atlas Indigenous and non-Indigenous participants chose to focus on. Indigenous participants had primarily positive experiences with the software, but remarked that the atlas still had a long way to go in including more languages and expanding the number of words and phrases available for translation. Indigenous participants appreciated multimedia aspects such as audio recordings, but also said that the atlas and similar projects ought to include more contextual

Table 4. Non-Indigenous participants' coded short-answer responses by frequency

Questions	Mature non-Indigenous responses	DG non-Indigenous responses
What did you like about the atlas?	Clear ¹ Visually appealing ²	Multimedia ¹ Provides knowledge ²
What didn't you like about the atlas?	Confusing icons ¹ Small area ²	Unclear components ¹ Confusing icons ²
What could be improved?	More multimedia ¹ More phrases ²	Clearer multimedia ¹ More languages ²

information to provide users with an understanding of why language samples occur where they do, and take the forms that they do. Any additional links should ideally be made to Indigenously owned sources that are in turn able to benefit in some way from the inclusion of their information in the atlas.

The amount of language-related information available in the atlas is directly dependent on how much information is volunteered from the communities themselves. As a result, any lack of representation in the atlas does not stem from a lack of recognition, but instead a lack of contact with a specific community. Though the atlas has been published online for some time, it is still very much a process undergoing continual development whereby more features and languages are added when information becomes available.

Participants' Ages and Their Experiences with the Atlas

There did not appear to be any meaningful qualitative differences between DG and mature participants' experiential accounts. Neither age group appeared to focus more on one aspect of the atlas than the other, and they had similar comments and concerns. It is worth noting that as participants in both age groups were recruited primarily from post-secondary institutional settings, both likely regularly engage with a variety of digital technologies for work purposes on a daily basis. To better understand how age might affect atlas experiences, future research should also focus on developing a representative sample of participants from outside post-secondary settings.

An unintended observation from the atlas task was that many DG participants engaged with other digital devices while performing atlas tasks, which was not observed in the mature group. Though one possibility could be that DG participants were less engaged with the atlas, a general lack of difference between the richness of DG and mature participants' open-ended responses regarding their experiences indicates that DG participants were focused

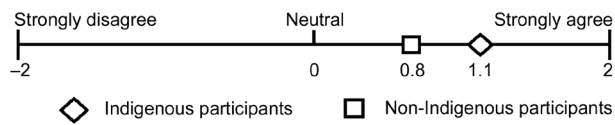


Figure 3. How highly participants rated the Atlas on the Usefulness dimension

on the tasks at hand, and wished to contribute meaningful responses. However, Giedd (2012) states that the use of multiple devices at a given time is an important characteristic of members of the DG, which may reflect underlying cognitive differences in how digital devices are approached (Prensky 2001). In this way, perhaps DG and mature participants had similar experiences of the atlas, but approached the tasks differently. Any future research ought to take this into consideration. In both age groups, the atlas was rated by participants as either very clear or unclear, meaning that there were likely additional personal factors not accounted for in this study that determined how clear the atlas's layout appeared to users.

STRENGTHS AND LIMITATIONS OF THE USER STUDY

The guiding questions used to aid participants in exploring the atlas were measured for accuracy to assess how uniform their experiences were; a relatively high score would indicate that participants were on the average able to successfully explore the variety of features, which would reflect a greater likelihood that participants had all viewed the same material. Overall, participants answered 10.5 out of 12 (88%) questions correctly, meaning that while the tasks could still be made clearer, the guiding questions asked were clear for the majority of participants.

Because I used a mixed-methods approach to gather both quantitative user ratings and qualitative accounts of users' experiences, a wide range of different information could be obtained regarding how such atlas software can be experienced by a number of groups with differing perspectives and backgrounds. Participants offered no complaints to me during the atlas task, and a high percentage of accurate responses in the guiding questions component indicated that the general layout of the atlas was easy to grasp, and that participants received a relatively uniform experience. The efficacy of the 5-point rating scale used in the questionnaire requires further investigation in future studies of this kind, as 5- and 7-point scales tend to produce slightly higher average scores than would be achieved with a 10-point scale (Dawes 2012), and reveal less information (D.R.F. Taylor, personal communication, 29 March 2017). Though Cronbach's alpha was used as a direct measure of the questionnaire's internal consistency and thus an indirect measure of reliability, the entire alpha score was very different from each dimension's score, meaning that the measure was affected by the number of items as much as

if not more than the consistency itself, which is a concern mentioned in Sijtsma (2009).

The short-answer questions at the end of the questionnaire were received well and yielded important experiential information, but the post-questionnaire interview questions were too open-ended, and participants either had trouble providing detailed responses or did not find the questions relevant. The benefit of writing down oral responses is that greater anonymity can be ensured than with voice recordings, while still capturing participants' messages. However, this method does sacrifice some of the detail that would otherwise be preserved in audio or video recordings. Further refinement of questions or a change in interview techniques (such as using focus groups) is thus important to improving the interview component.

Differences between specific Indigenous communities are not specified in this study, and proficiency in an Indigenous language was not a requirement. Given a larger number of Indigenous participants, separating user experiences into meaningful results by these differences would become more feasible. The small participant number is explainable in the case of Indigenous participants above the age of 30, as the potential recruits tended to live outside the Ottawa area and were unable or too busy to attend sessions physically or via Skype. However, a markedly lower Indigenous DG participation comes as a surprise, as the most recruitment methods were employed with this population. According to the cultural liaison for the campus Indigenous student centre, the research invitations were received well and met with enthusiasm, but only two attempts at contacting the researcher were made. It is possible that the incentive for participation was not sufficiently high to engage often time-constrained Indigenous students, who on average face greater internal and external pressures than non-Indigenous populations, such as family care, financial difficulties, or being the first in the family to pursue an advanced degree (Asmar, Page, and Radloff 2011). Investigation into reasons for lower Indigenous DG participation in user studies such as this is important, and deserves a separate study of its own alongside the development of more appropriate and engaging recruitment methods for Indigenous populations in all generations.

Conclusion

A mixed-methods user study focused on the experiences of Indigenous and non-Indigenous users as they navigated the Algonquian Linguistic Atlas. By their completing a series of tasks, answering questions related to those tasks, and participating in a semi-structured interview, an experiential account of the Atlas' ability to convey useful and relevant information was obtained. By additionally focusing on how this methodology was able to obtain such experiential accounts in the first place, this investigation also functioned as an important first step in developing

appropriate and informative evaluations of language atlas software.

While Indigenous and non-Indigenous participants of all ages enjoyed using the atlas, Indigenous participants found the atlas more relevant and useful and focused more on the content, while non-Indigenous participants focused on the layout and structure. Though there were negligible differences between DG and mature students' experiences (likely due to both groups coming from academic settings), DG participants were observed to *use* the atlas differently by engaging with multiple devices during the task. Indigenous participants reported enjoying the atlas experience, but advised that projects mapping Indigenous languages and knowledge should provide a greater contextual background and strive to benefit the Indigenous communities they map. To increase the efficacy of user studies of Indigenous language atlases, more detailed rating scales and more precise interview techniques should be used to

better capture users' opinions and experiential accounts. More appropriate recruitment methods in a greater variety of locations would improve sample sizes, reinforcing statistical assessments of the numerical results.

To successfully teach Indigenous members of younger generations, digital atlases need to focus on making their content accessible and appealing, while also ensuring that it is relevant to the community. The study confirms that multimedia approaches work well to engaging both learners from societies with oral traditions and those who are accustomed to multiple modalities in their devices. Developers, educators, and researchers should strive to create learning interfaces that are interactive and engage learners' ears, eyes, mouths, and fingers while also working on multiple types of devices such as smartphones, computers, and tablets. In this way, traditional knowledge can remain a crucial and integral aspect of Indigenous lives in a world of rapidly changing technologies and identities.

Appendix 1: Glossary of Terms as Used in This Paper

Term	Definition
The Algonquian language family	A grouping of related Indigenous languages spread over much of Canada and parts of the United States. Examples of Algonquian languages include Cree, Ojibwe, Innu, Algonquin, and Naskapi.
Age	One of two main variables focused on in this study. Refers to chronological age in years.
Atlas	A framework through which maps are presented.
Cognitive load	The total amount of mental effort an individual experiences when problem solving or performing a specific task. Demanding tasks have a high cognitive load, meaning that they require more of an individual's attention and concentration.
Community	A self-designated grouping of people who share a common heritage but may be physically separated over large distances (e.g., individuals with ties to the Algonquins of Kitigan Zibi).
Cybercartography	A distinctive critical map-based approach that provides a framework for dealing with complex social, political, and economic phenomena.
Device	A physical electronic object that allows individuals to connect to the Internet, or related software. Often refers to smartphones, computers, or tablets.
Digital generation (DG)	Those who are 30 years of age or younger, who are more likely to have grown up with a digital device such as a personal computer, laptop, smartphone, mobile phone, and/or Internet connection in their household.
Distributed cognition	A theory that as opposed to being strictly within an individual, knowledge is instead a shared process, in which multiple individuals share their unique knowledges between each other and in tools, objects, and artefacts, resulting in a greater understanding than one individual could ever be capable of (Hutchins 1995).
Elder	Individuals in Indigenous societies who, among other things, have a wealth of information regarding the culture, customs, language, and knowledge of the community. Elders do not necessarily need to be <i>elderly</i> , but inversely most elderly community members are considered as <i>elders</i> .

Appendix 1: Glossary of Terms as Used in This Paper (Continued)

Graphical user interface (GUI)	The visually oriented layout most people encounter on their digital devices. GUIs typically use icons, visual menus, and animations in order to convey information, such as the Windows, Linux, or Macintosh platforms. This sort of interface allows non-programmers to interact with digital devices more easily.
Indigenous	Refers here to First Nations, Inuit, or Métis persons' cultural backgrounds, languages, viewpoints, or knowledge.
Map	Graphic models of parts of (or phenomena related to) a physical area produced to scale for decision-making purposes, and graphical representations of relationships between concepts, ideas, or knowledge. They are often (but not always) contained in an atlas.
Mature participant	Participants 31 years of age or older, who are less likely to have grown up surrounded by digital technologies such as the Internet or personal computers.
Recruits	Those who have the potential to be included in the study but have not yet participated.
Traditional knowledge (TK)	Indigenous people's understandings and experience of their surroundings and lives, as mediated through their worldview. This is manifested in aspects such as human rights, language, culture, institutions, and social processes.
User	An individual who is directly interacting with a digital language atlas or map. (On occasion used interchangeably with <i>viewer</i> .)
Viewer	An individual who either is reading a paper map, or is exposed to a digital map, but is not necessarily actively interacting with its interfaces.

Appendix 2: Response to Interview Questions by Indigenous Participants

- (1) Tell me about your experience using the atlas. What did you think?

The fact that there was an audio component was a great feature of the atlas, as it allowed me to hear how the words actually sound, as opposed to just written. However, I didn't know there was a zoom function or that you could change the words that appear until I played around the mouse and found them by accident. These should be made more apparent. (Mature Indigenous participant)

I like how many different communities are represented on this map with different language samples, so that you can hear how they change over a large space. I know that there are many [Indigenous] communities around [own community], but I don't see any speakers from there. It would be nice to see more samples on the map. (DG Indigenous participant)

- (2) Do you think the atlas was a good way of representing different languages?

Yes, but there should also be greater consideration to what defines a language in the first place, and how it's different from a dialect. The atlas's stance on this should be made clear somewhere in the atlas itself. (Mature Indigenous participant)

It was a neat way of showing how languages change depending on where you are. It's probably not the best substitute for face-to-face learning though. (DG Indigenous participant)

- (3) Do you feel the atlas taught you some new things?

The atlas would be a great resource for learning some more words from my own language, as well as learning what the same words would look like in other areas. (Mature Indigenous participant).

- (4) Was there something the atlas didn't do well, or could have done better?

There could have been more links sections to other language resources, which should be local and indigenously owned. The atlas should also be constructed in such a way as to establish more relations with local communities. (Mature Indigenous participant)

- (5) How useful do you think atlases could be in language education?

This atlas could be really helpful in language education, so long as it is implemented in a culturally sensitive way. Also, the atlas should take into account more contextual information. As an example, Whapmagoostui Cree speakers speak a much older dialect than in other areas, as it has been the least changed by colonialism, but this isn't mentioned directly in the atlas. (Mature Indigenous participant).

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