Evidence Based Library and Information Practice

Connecting Music and Place: Exploring Library Collection Data Using Geo-visualizations

Carolyn Doi

Volume 12, Number 2, 2017

URI: https://id.erudit.org/iderudit/1105410ar
DOI: https://doi.org/10.18438/B86078

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Publisher(s)

University of Alberta Library

ISSN

1715-720X (digital)

Explore this journal

Cite this article

Doi, C. (2017). Connecting Music and Place: Exploring Library Collection Data Using Geo-visualizations. *Evidence Based Library and Information Practice*, *12*(2), 36–52. https://doi.org/10.18438/B86078

Article abstract

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Methods – Data was harvested from MARC metadata found in the library catalogue for a special collection of Saskatchewan music at the University of Saskatchewan. Microsoft Excel and OpenRefine were used to screen, clean, and enhance the dataset. Data was imported into ArcGIS software, where it was plotted using a geo-visualization showing location and concentrations of musical activity by large ensembles within the province. The geo-visualization also allows users to filter results based on the ensemble type (band, orchestra, or choir).

Results – The geo-visualization shows that albums from large community ensembles appear across the province, in cities and towns of all sizes. The ensembles are concentrated in the southern portion of the province and there is a correlation between population density and ensemble location. Choral ensembles are more prevalent than bands and orchestras, and appear more widely across the province, whereas bands and orchestras are concentrated around larger centres.

Conclusions – Library catalogue data contains unique information for research based on special collections, though additional cleaning is needed. Using geospatial visualizations to navigate collections allows for more intuitive searching by location, and allow users to compare facets. While not appropriate for all kinds of searching, maps are useful for browsing and for location-based searches. Information is displayed in a visual way that allows users to explore and connect with other platforms for more information.

Evidence Based Library and Information Practice

Research Article

Connecting Music and Place: Exploring Library Collection Data Using Geo-visualizations

Carolyn Doi
Music & Education Librarian
University Library
University of Saskatchewan
Saskatoon, Saskatchewan, Canada
Email: carolyn.doi@usask.ca

Received: 23 Jan. 2017 **Accepted**: 26 Mar. 2017

Abstract

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Introduction

Local music collections are a type of library collection composed of music or musical materials that are representative of an identified place or location. Previous approaches for searching library or archival holdings of local music in online environments has primarily involved use of public access catalogues, finding aids, or digital asset management systems. These approaches to searching are useful for text-based queries, but may hinder understanding of the connection to place, which is the unique and defining aspect of local music. This paper illustrates the potential for analysis of local music materials using a geo-visualization tool based on a case study of large ensemble sound recordings from a local music collection at the University of Saskatchewan. Results are presented and analyzed using a map developed on the ArcGIS platform. This approach uses identification by ensemble location and categorization by ensemble type, plotted using clusters and points on a topographic map.

The dataset used for this research was built from library catalogue records of sound recordings in the Saskatchewan Music Collection (SMC), a historical local music collection at the University Library, University of Saskatchewan. The collection aims to preserve the musical heritage of the province through collection of local music materials, containing representative items from the early 1900s to the current day. Items meet collection criteria when they are considered local by demonstrating a connection to an artist, composer, music label, or topic relating to places within the Canadian province of Saskatchewan.

This is a growing collection that, as of January 2017, contains 3202 items, the majority (90.9%) of which are sound recordings. These items are physically held in the Education & Music Library at the University of Saskatchewan, and are fully catalogued and findable in the Library catalogue under the series title "Saskatchewan Music Collection." Approximately a third of the SMC has been digitized and is available online through Sask History Online (SHO), an initiative that aims to bring together digital collections from galleries, archives, museums, and libraries within the province (http://saskhistoryonline.ca/). SHO is built on the Islandora platform, an open-source software framework for digital asset management (https://islandora.ca/).

Project Background

An overview of the origins of this project will help to contextualize the analysis presented in this paper. The music represented in the Saskatchewan Music Collection is not limited by format or genre, aiming to preserve and make available music pertaining to all aspects of the province's history. One of the defining features of this musical history is a prevalence of music from community-based large ensembles, which have often been established by and connected to community organizations such as schools, service clubs, churches, or arts organizations.

During an exhibit of SMC materials at the University Library in early 2015, it was the

albums of community bands, orchestras, and choirs connected with rural Saskatchewan towns and cities that especially engaged visitors. The album covers provided a unique gateway into stories and memories connected with the musical activities of these places. This experience prompted me to consider how the digitized albums from the SMC might be presented in a similar way, where one might have the opportunity to learn more about the connection between the music and geography of the province.

In the spring of 2016, the Engineering and GIS Librarian (Kristin Lee) and I (Carolyn Doi) launched a project to develop a geo-visualization using the local music collection data. The goals of this project were to create a dataset from the SMC catalogue data, and to present this dataset online for public use in a geo-visualization tool. I managed the musicological and music collection management aspects of the project, while Lee oversaw the aspects related to data management and map development. Staff in the Education & Music Library, Library Systems & IT, and the collections unit also offered additional support for the data collection, cleaning, and implementation of the map.

This paper shows the process for collecting the data, cleaning the data, and building the geo-visualization. This is followed by a presentation of findings based on the data analysis, conducted in late 2016.

Literature Review

History of Music in Saskatchewan

Saskatchewan is a prairie province located at the geographic centre of Canada. Settled in 1774 and then created in 1905, the musical life within the province has been defined in many ways by geography, climate, settlement, and industrial history. Its musical origins are tied to a diversity of contributors including: "military and police bands, church choirs, immigrant teachers, enthusiastic residents, and . . . many travelling groups of instrumentalists and singers who came by rail across the continent from the earliest days of settlement" (Swales, 2006b).

Literature on the history of artistic development of the province is sparse, often found primarily in encyclopedias, general histories of Canadian music, or in more anecdotal sources such as newspapers and reports. An early account of this history by Robert Solem, as summarized by Lewis, recounts the quick development in the early years of the province as especially vibrant:

> . . . a period of rapid growth accompanied by a spirit of musical optimism. By 1912 the city of Saskatoon, for example, could boast of four good bands, two good orchestras, a Conservatory of Music, and a Philharmonic Society. This society was established by a large and energetic group of music teachers (1973, p. 6).

The history of bands, orchestras, and choirs in the province has been documented intermittently, primarily through narrative summaries. Despite this, there is evidence that the province was flourishing with artistic activity.

Orchestras

Although fewer in number than other types of ensembles, Saskatchewan has maintained two notable orchestras since the early 1900s. The Regina Symphony Orchestra (RSO) was founded in 1908 and is known as one of Canada's oldest symphony orchestras. Originally known as the Regina Orchestral Society, its first concert was given on December 3, 1908, under the direction of its founder, L. Frank Laubach (Wall, 2006). Meanwhile, in 1927, 40 amateur members came together to form an early iteration of the Saskatoon Symphony Orchestra (SSO). The only symphony in the northern part of the province, the SSO is one of the only ensembles in the region that performs

major symphonic repertoire on a regular basis (Conway, 2006). The presence of these ensembles is significant since they act to encourage the overall health of the musical community. As "magnets for orchestral performers," who by extension "enrich the musical life of the community as soloists, as players in . . . other musical groups . . . and as music teachers" (Conway, 2012a).

Bands

Wasiak's paper "School Bands in Saskatchewan, Canada: A History" outlines the history of school band development in the province, including an overview of curricular development, repertoire, historical impacts, challenges, and teaching methods. He states that the implementation of band programs in the schools occurred "comparatively late" in the province and it was not until the 1950s that bands "gained a foothold in the province's schools" (2000, p. 113). Development was influenced both by "British bands, [which] were the prototypes for the first military, civilian, and (later) community bands in the province" and by "widespread and profound" American influences, which included teaching methods, repertoire, and expertise (p. 125).

Choirs and Choir Music

The development of the Saskatchewan Arts Board, choral societies, and arts festivals were influential in the development and support for the many community choirs, which were prominent in local churches, schools, and communities (Swales, 2006b). Church, school, and community choirs were at the core of the Saskatchewan music festivals in the early 1900s and were known for their large numbers of participants. "Many church choirs exceeded fifty members, and in the 1950s the Bishop's School for Choristers in the Diocese of Qu'Appelle had over 100 boys annually each summer" (Swales, 2006a). In the paper "What about Choral Art Music from the Prairies?," Morgan identifies five features of choral music from the prairies including: 1) the Christian church, 2) prairie landscapes, 3) secondary and post-secondary education, 4) the arrival of new immigrants, and 5) Aboriginal culture (n.d, p. 3). These themes, Morgan states, have had a profound influence on the history of choral music (and by extension, other musical genres) from the prairies, which is made up of a "rich artistic community that is well endowed with musicians who create and develop choral art" (p. 19).

Geo-visualizations and Digital Libraries

Within the realm of computer science, there has been extensive literature on the topic of geo-visualizations as they relate to digital libraries. One of the earliest and most widely cited pieces of literature introducing the concept of data visualization comes from Ahlberg and Shneiderman's chapter titled "Visual Information Seeking: Tight Coupling of Dynamic Query Filters with Starfield Displays" from 1993, which discusses the new concepts of "visual information seeking" applications and methods. The authors pose several principles unique to visual search such as: "dynamic query filters [that] are rapidly adjusted with sliders, buttons, etc.," "starfield display . . . result sets [that] are continuously available and support viewing of hundreds or thousands of items," and "tight coupling . . . query components [that] are interrelated in ways that preserve display invariants and support progressive refinement" (pp. 313-14). These principles set the foundation for many of the visualization case studies being implemented today.

The literature on using geo-visualizations to understand music collections has focused on personal libraries (Leitich & Topf, 2007; Torrens, Hertzog, & Arcos, 2004) or commercial applications (Pampalk, Rauber, & Merkl, 2002). The literature on data visualizations for use in cultural heritage institutions has been less saturated, though it is growing in recent years. Much of this research comes in the form of case studies that focus on how visualizations can: assist librarians in collection assessment

activities (Kilb & Jansen, 2016; Lowery, 2011), facilitate user understandings of print library collections (Finch & Flenner, 2016), or improve access to digital collections (Deal, 2014; Shiri, 2008; Hoek & Mayr, 2014).

Music collections have often presented challenges for libraries and archives when it comes to information retrieval and organization. Typically, music collections are represented with textual metadata and searchable using text queries, though these are not ideal for browsing and serendipitous searching. As Deal identifies, "browsing features, if they are offered, are often limited to a list of metadata vocabulary terms or a search that displays the entire contents of a collection, one page of 10-20 items at a time" (2014, p. 15). Additionally, finding a way to manage non-textual information such as sound files or images has posed challenges in the library systems environment. Speaking specifically on the topic of ethnomusicological collections, Magas and Proutskova identify both metadata and content management as challenging areas in the design of music collection information retrieval, especially in relation to the audio content (2013, p. 152).

Benefits are found when visualizations are used to engage with spatial representations of data. It is this interaction that has an "important role in sense-making activities involving space. It allows users to restructure and modify a space's content according to their perceptual and cognitive needs. For example, interaction with the geographic space may support understanding of differences among various types of locations and their associations with collections." (Buchel & Sedig, 2014, para. 3). While literature on geo-visualizations of music collections in academic settings is limited, there are many examples of projects within academic, commercial, and public domains that serve as examples of the potential for such work. Notable examples include maps representing locations of music library collections (González Ribot, 2015; Ward, 2015), maps documenting musical events in time such as the *Travelling through Time with Sounds* project (Europeana, n.d.), and maps created to link users with items from a music collection, such as the *Smithsonian Folkways Holiday Music Map* (2013).

Aims

This project had two identified aims:

1) to understand the number, location, and concentration of community-based large ensembles in Saskatchewan and
2) to enable location-based searching and browsing of the Saskatchewan Music Collection.

These aims support a longer-term goal to increase the visibility of the Saskatchewan Music Collection and to increase visibility of Saskatchewan music by making it more accessible to the public and scholarly community.

Methods

Data Collection and Screening

MARC catalogue records from the Saskatchewan Music Collection were used as the basis for analysis in this project. The catalogue data was exported in a .csv file format and initially contained records for all items from the SMC (3202 items). Screening criteria were established to narrow the dataset. Items were included if they met the following screening conditions:

1) Sound recordings in any format.
2) Recordings by large ensembles that were in an identifiable place (city or town) in Saskatchewan. Large ensembles were defined as musical groups that self-identified as choirs (including children's choirs, church choirs, and community choirs), bands (including concert bands, wind bands, and pipe bands), or orchestras

(symphony orchestras, string orchestras, and fiddle orchestras).

Items were excluded if they met the following criteria:

1) Sound recordings containing reductions of choir, band, or orchestra music but not performed by a large grouping of musicians (e.g., a quartet playing string orchestra parts).
2) Ensembles that were not associated with a place within the province. For example, a group might be based in another province, but have recorded the music in Saskatchewan.
3) Items that had not been digitized and uploaded to the Islandora digital asset repository system at the University of Saskatchewan.

The screening was conducted by applying filters using the "find" feature in Microsoft Excel for bands, orchestras, choirs, and related subject terms. No date filters were applied, as all eras were of interest. After the screening process, 119 results remained.

Data Cleaning

The dataset was cleaned first using Microsoft Excel and then using OpenRefine software. When the data was first received, each record contained 113 fields. The empty fields were removed (many were empty MARC fields) as were any fields determined to be irrelevant to this project (e.g., the MARC field 90 containing the library call number). MARC field numbers were then translated to natural language headings. At this point in the process, a field containing the ensemble location was added. In some cases, this information was found in the dataset, album cover, or liner notes, but when the information was not clearly indicated, additional research was done to identify the location of the ensemble.

In the second phase of cleaning, the dataset was imported into OpenRefine, an open source application that can be used for data cleanup processes (http://openrefine.org/). Most of this stage of cleaning involved adding new fields and standardizing the language within the records. Standard OpenRefine commands such as "find and replace," "slice," "chomp," and "trim" were employed to standardize language and organize data. Information on how to apply these commands in OpenRefine was aided by use of the OpenRefine GitHub wiki page (Wicentowski, 2015). Records were enhanced by adding new fields and a unique identifier for each record. The ensemble categories (choir, band, or orchestra) were added, and in cases where an album included more than one type of ensemble, multiple categories were applied. Three types of URLs were added to each record: a link to the item record in the University Library catalogue, a link to the digital album in the Islandora repository, and a link to the location of the cover image of the album located on the Islandora server.

Existing information in the records also needed to be standardized, because of variations in the catalogue language practices. The information in the 300 field (description) was used to add a new format field in the record added to indicate the type of sound recording (formats included 33⅓ rpm, 45 rpm, 78 rpm, and compact disc). The information found in the 260 field (publication) was extracted to identify a place of publication. Place names needed to be standardized, as variations in cataloguing practices have resulted in the same types of information being represented in multiple ways. For example, the name "Saskatchewan" appears in a variety of ways, including "SK," "Sask," and "Saskatchewan." Using OpenRefine facet filters and reconciling category function was useful in grouping variations of the same word for editing. Using the "cluster" feature allows the user to group information that might be related and the "merge" option provides an easy way to reconcile some of the values.

Table 1
Comparison of Terminology Allowed in RDA 3.4.1.3 Extent ("300 $a," Yale University)

RDA 3.3.1.3	Alternative: Common Usage	AACR2
audio disc	CD or compact disc	sound disc
audiocassette	cassette or cassette tape	sound cassette
audio cartridge	MiniDisc	sound disc cartridge

Subject headings found in the 650 field were cleaned using the OpenRefine "slice" function to remove unnecessary characters, words, and duplication. For example, "|aChoruses with band|zSaskatchewan|aBand music|zSaskatchewan" was updated to "Choruses with band; Band music" in the final dataset. In this case, the word "Saskatchewan" was removed because it is assumed all items in the dataset are from Saskatchewan. Semi-colons were added instead of pipes, in order to clean the appearance of this information in the public-facing map.

Based on the location of the ensemble, latitude and longitude fields were added to the dataset. This was done using the Google Geocoding API, a service that converts addresses into geographic coordinates that can then be used to place markers on a map (Google Developers, 2017). Instructions for how to translate addresses to latitude and longitude data were located in the OpenRefine GitHub wiki (Moscovitz, 2015). The finalized dataset was published through the University of Alberta DataVerse project (Doi & Lee, 2017b).

Challenges

Using library catalogue metadata to build the dataset had both advantages and disadvantages. Even though using tools such as OpenRefine simplified the process, it still took considerable time and several members of staff to clean and finalize the dataset. Since the MARC catalogue records had been created by a variety of means, including outsourced copy cataloguing and internal original cataloguing, the initial dataset was inconsistent. This was particularly apparent in the way that musical formats are described in the MARC records. This information is usually found in the 300 field for physical description, though standards for the type of information to include in this field varies from AACR2 (Anglo-American Cataloguing Rules, 2nd edition) to RDA (Resource Description and Access). These may include extent, duration, sound characteristics, dimensions, content type, media type, and carrier type (Yale University Library, n.d.a). This information is not always included consistently, and when it is, variant forms of spelling or terminology may be used. RDA 3.4.1.3 allows use of either an authorized term from the list at 3.3.1.3, or, as an alternative, a term in common usage (see Table 1).

The original MARC record includes a place of publication, but this information was not always consistently formatted. In some cases, this is because publication information on sound recordings has not been regulated in the same way as monographs; in other cases this is because some sound recordings were produced independently by the artist, resulting in inconsistent formatting on the albums.

While these challenges with the catalogue data slowed our processes, it was by reducing the size of the dataset that the project remained manageable. The same work might be more

challenging with a larger or more diverse set of records.

Data Visualization

The dataset was exported into .csv file format and imported into ArcGIS, a mapping and analytics platform that provides "contextual tools for mapping and spatial reasoning . . . to explore data and share location-based insights" (ESRI, n.d.). ArcGIS was chosen in part because there is internal support for the platform at the University of Saskatchewan, and more importantly because it provided a stable platform on which to present the data to meet the research aims for this project. For this project, we implemented two instances of ArcGIS: a privately managed project where data can be imported and visualization aspects can be managed, and a public facing map developed using the Web App Building provided by ArcGIS (Doi & Lee, 2017b).

The records in the dataset are plotted on the map per ensemble location. This is defined as the place(s) where the ensemble was or is primarily located or with which it is associated. In some instances, an ensemble is associated with more than one location and appears more than once on the map. The map contains several layers, which can be switched on or off by the user. All ensembles can be displayed on the map using the "all ensembles – location points" layer, which pinpoints the locations (see Figure 1).

Using the "all ensembles – location clusters" layer displays the same information using a heat map, where concentration of ensembles is defined by variations in the colour (see Figure 2).

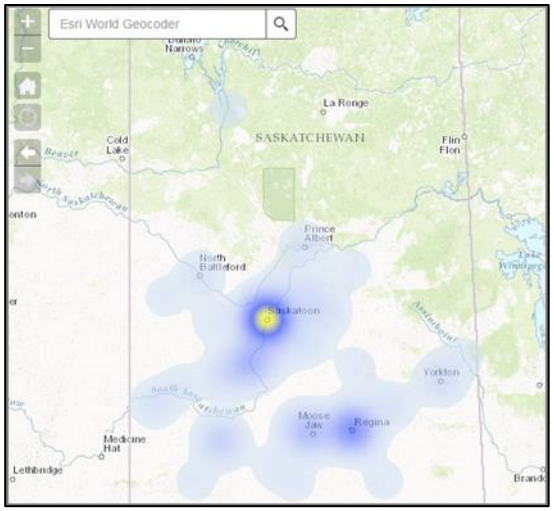

Figure 1
All ensembles – location clusters layer enabled.

Information about the ensembles can also be displayed by ensemble type, by switching the orchestra, choir, or band layers, which displays the representation of each using coloured pins (see Figure 3).

More detailed information about each album can be displayed by clicking on specific locations to reveal an information box or by opening an attribute table below the map. The displayed fields include album title, ensemble name, ensemble location, format, publication location, publication date, latitude and longitude coordinates, a URL linking to the catalogue record, a URL linking to the digitized album, and an image of the front cover. If more than one ensemble exists at the same coordinate, this is indicated in the upper portion of the information box. A search box is present in the mapping interface, which allows users to search by location (e.g., Saskatoon, Prince Albert, or others) or place (e.g., University of Saskatchewan, Kinsmen Hall, or others).

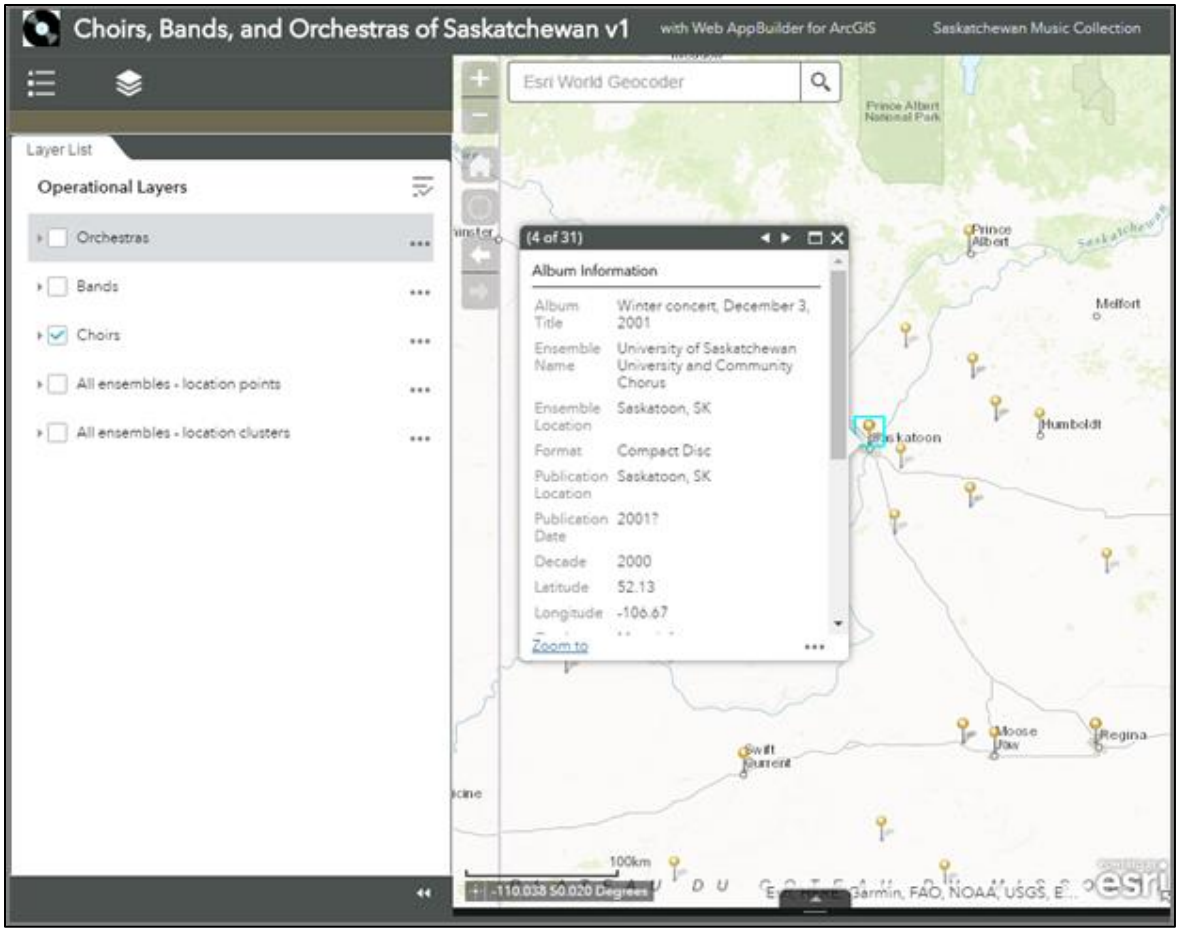

Figure 2
Choirs layer enabled and information box.

Results

Concentrations of Musical Activity

Comparison of data from the ArcGIS World Population Estimate map and the SMC heat map reveals a direct correlation between the number of albums produced and the size of a town or city (ESRI, 2016). The area measurement tool was used to determine the reach and concentration of the plotted musical recordings, showing that almost all the recordings are in the southern half of the province. This accounts for approximately 202,063 square kilometers (34.35%) of the total 588,239.21 square kilometers occupied by the province (Statistics Canada, 2015).

These findings also show clusters around larger centres in the province, such as Saskatoon and Regina, demonstrating a connection between city size and number of ensembles (see Table 2).

Enabling layers within the ArcGIS map shows the location of ensembles filtered by ensemble type. These findings show that choirs make up the largest percentage of ensemble recordings within the province, representing 77.31% of the total albums. Bands make up the second largest percentage, representing 21.85%, and orchestras make up the lowest, representing 0.07%. In some of these cases, an album might contain music from more than one ensemble type, explaining the higher total number of ensemble representations overall than the total number of albums included in the dataset. When

Table 2
Saskatchewan Populations Compared with Number of Albums per Location

City name	City size (2011 census) (Statistics Canada, "Saskatchewan Population Report")	Number of albums per location
Saskatoon	222,189	41
Regina	193,100	18
Moose Jaw	33,274	5
Outlook	2,204	9
Swift Current	15,503	5

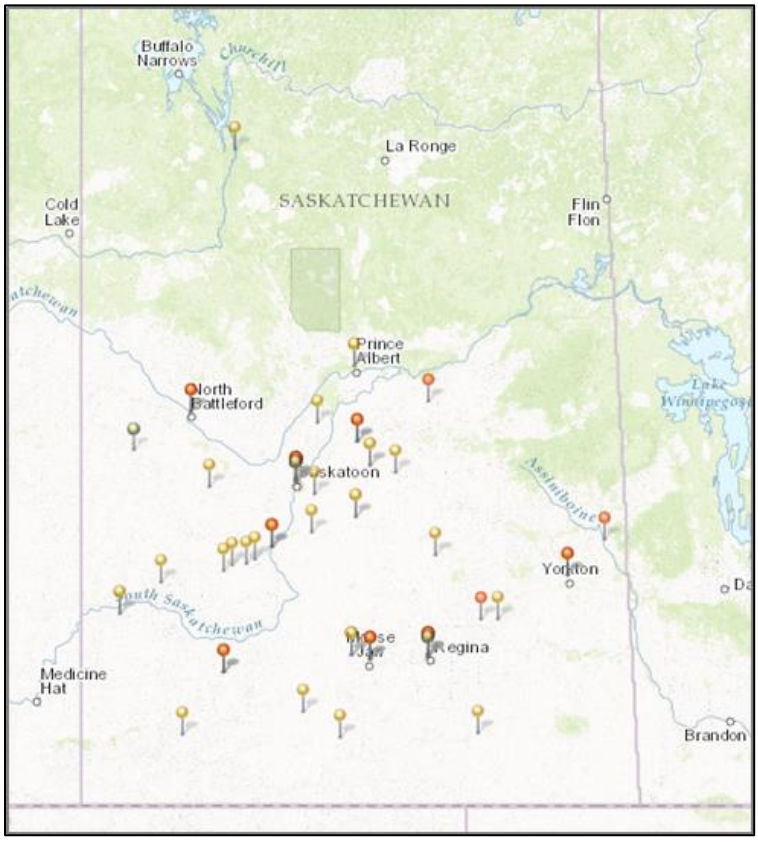

Figure 3
Concentration of large ensembles by genre: orchestras, bands, and choirs.

comparing the number of ensemble types to the location data, findings show that more concentrated centres such as Regina and Saskatoon are likely to contain all three ensemble types, while the choirs are more likely to appear in rural locations (see Figure 4).

When ensemble types are compared alongside ensemble names using the table feature in ArcGIS, we can see trends between ensemble location and the responsible community organization. While orchestras are more likely to be associated with a city or university (e.g., University of Saskatchewan Wind Orchestra and

Saskatoon Junior Symphony Orchestra), bands were more often associated with a school, community organization, or military affiliate (e.g., Aden Bowman Collegiate Band, Melfort Kinsmen Band, and Royal Canadian Air Force Wing Auxiliary Band,). Finally, choirs were associated with a wider variety of organizations, including schools, churches, universities, and community organizations (e.g., College Park School Choirs and Rosthern Mennonite School Choir). The correlation between population size, available services or community organizations, and appearance of musical ensembles demonstrates a strong link between community development and musical activity within the province.

Search Interface

Comparison of the three interfaces where the SMC materials are now available for searching shows both the benefits and drawbacks of searching within the mapping tool. Most notably, the map allows for non-text based interaction with the collection, while text searching remains more effective in either the catalogue or Islandora, except in the case of searching by ensemble location (see Table 3).

Discussion

The findings of this paper provide an as-yet unseen picture into the history of large ensembles within Saskatchewan. While the existing narrative histories provide more anecdotal perspectives on the musical activities, the visualization allows us to see the big picture of development and its reach within the province.

Ties to Local History

The ability to track the development of these three large ensemble groups within the province offers insight into the similarities and differences between them. The establishment of orchestras and bands typically relies on access to a variety of resources including specific instruments, instruction, rehearsal space, and musicians, which may have limited their overall numbers within the province. Bands and orchestras may have needed community funding or financial support from community organizations, which could have limited their numbers in comparison to community choirs. Meanwhile, choirs were well established in the tradition of church and school activities, and would have required fewer resources. As churches and schools had a well-developed and pervasive network within both urban and rural locations in the province, the development of community choirs throughout the province was inevitable.

Musical activity within the province was one indicator of development, which can be tied to many others. Comparing the data of musical recordings to other data related to community development or local history would provide a more complete picture of the establishment of such community organizations and individuals within them. Church records, local histories, or provincial archives might have additional information on the formation and activity of musical ensembles.

While musical recordings are just one type of evidence of musical development and activity, it is nonetheless an important consideration of how music was produced, consumed and distributed. Access to the album covers and liner notes often provides insight into the activities of the ensembles, including rehearsal schedules, tour dates and locations, individual members, and supporting members of the community. It is these connections to community and place that make these materials such an insightful window into local history.

Testing a Proof of Concept

The geo-visualization was initially developed as a proof of concept. This varied slightly from the final design presented in this paper, as it used all the SMC items found in the Islandora platform (over 1000) plotted per publication location. The data analysis and visualization were realized

Table 3
Comparison of Search Interfaces: Library Catalogue, Islandora Digital Repository, and ArcGIS Map

Criteria	Catalogue	Islandora	ArcGIS Map
Text searching	Author, title, subject, keyword, call number	Keyword	Location
Visual representation and searching	No	No	Yes
Portion of the collection	Complete collection, 3000+ albums	Digitized items, 1000 albums	Digitized albums by large ensembles, 119 albums
Digital object included	No	Yes – images and sound files	Yes – cover image
Information in record	Standard MARC fields: 001, 003, 005, 007, 008, 028, 040, 090, 245, 260, 300, 500, 505, 590, 650, 700, 710, 740, 830, 850, 902	Selected MODS fields: artist, title, item type, table of contents, subjects, bib number, publisher, place of publication, item description	Selected MARC and added fields: album title, ensemble name, ensemble location, format, publication location, publication date, decade, latitude, longitude, link to catalogue record, link to Islandora record.
Link to other representations of the collection	No	No	Yes – links to both catalogue and Islandora

using CARTO, a software that provides GIS and web mapping tools for display in a web browser (https://carto.com/). The proof of concept was presented during the Mountain Plains Chapter Meeting of the Music Library Association (Bogdan & Doi, 2016), and feedback was gathered on the initial design.

The feedback revealed that the geo-visualization had provided an effective overview of the collection while also compelling users to explore selected albums. However, using the place of publication as the primary location for the recordings presented a challenge for users. While in some cases this geographic information was relevant to the artist or recording (e.g., the album was published in the same city as where the artist resided), in many others, the location of the music label was tangentially related, and provided only supplementary information as to how place relates to the artist or music. Based on this feedback, the dataset was reconceived from June to August, 2016. These changes ultimately led to the decision to further limit the inclusion criteria of the dataset, and to incorporate information about the location of each ensemble.

Challenges

Using catalogue data as a dataset was challenging because historical cataloguing practices have led to inconsistencies due to changes in practice, variations in acceptable language, and human error. This inconsistency was not unique to this collection, and using library collection data will always require cleaning before use.

In this case, the music materials themselves also presented additional challenges. Historical sound recordings offer inconsistent information on basic elements of the publication, and this inconsistency is amplified when many of the albums are independently-published as in this

case. Examples of this include missing publication information, or variations in spellings of titles or artists. While catalogue records are designed to accommodate for variations in spelling or missing information, these variations are more challenging when trying to achieve consistency in the dataset.

Limitations

As the process for adding data to the map is not automated, it does not incorporate newly added digital items from the SMC. As such, the map represents the collection at a moment in time, and significant staff time would be needed to add new content.

The dataset used for this project does not fully represent the recorded history of musical ensembles in Saskatchewan. There are more known items located in the SMC that were excluded because they have not yet been digitized. To achieve a more complete representation of the musical recording history, workflows for adding new content will need to be established.

Future Work

There are many possibilities for expanding the work initiated in this research, including expanding the dataset or adding additional types of information. There is also potential to realize other aspects of the dataset within the visualization, including the correlation between date and location.

While the data currently included is drawn from the SMC, there are many other collections with materials related to the history of music and large ensembles in Saskatchewan. Special collections holdings at the University of Saskatchewan or items in the Saskatchewan History Online project would provide a good starting place for locating related materials. Such materials might extend the depth and breadth of the story of this history and would also make good candidates for inclusion in the project.

Saskatchewan's citizens have produced more than 2000 local history books, which discuss the histories, lives, and activities of the town or city, chronicling the "rise (and in some cases, the decline and demise) of communities, families, churches, and businesses large and small across the province." (Massie, 2006). Linking the information in these sources might serve to build more detailed narratives about the musical histories presented.

While the work to curate the dataset for this project was done by staff at the university, there may be opportunities to draw on local knowledge to enhance the data. Since there are many aspects of local history that are missing from more traditional information sources, implementing a system for collecting music histories from the public might be a worthwhile option for developing the map further. By implementing a crowdsourcing information gathering model, this project would further serve to engage the public, to use the knowledge of the community, and to add value to the data (Holley, 2010).

This project focusses on mapping large ensemble items from the Saskatchewan Music Collection, but there is potential to extend the mapping template beyond this collection. While not all collections will be ideally represented in a geo-spatial environment, there are certainly others to consider that might provide insight when seen through a geographic lens.

Conclusions

This research presents a picture of the history of musical life in the province of Saskatchewan and its connection to historical social and economic development. Findings show that there is a correlation between the population density of the province and the prevalence of large ensembles within communities. It provides evidence that these ensembles are often linked to community organizations and establishments such as schools, churches, service organizations, and arts organizations. As the province

continues to develop we will certainly continue to see these connections between music and place continue to grow and change.

Geo-spatial visualizations have potential as a tool to draw new research conclusions about the contents of library collections. Researchers who are considering using catalogue data will find that it is a rich source of untapped data, which has potential for exploring local histories.

Using an online mapping tool such as ArcGIS provides an alternative way to explore special collections, using parameters that are not accessible in interfaces such as the library catalogue or digital content repositories. These tools demonstrate potential to attract and engage a wide audience to explore library special collections and audiovisual materials.

Acknowledgements

Aspects of this work were originally presented at the 2016 Mountain Plains chapter meeting of the Music Library Association in Greeley, CO and later at the Centre for Evidence Based Library and Information Practice Symposium in Saskatoon, SK in 2016. My thanks to K. Lee who collaborated with me on the implementation of this project. Thank you to my colleagues at the University of Saskatchewan: C. Sjoberg for her assistance with cleaning and enhancing the dataset and J. McLean who offered helpful feedback on OpenRefine and cleaning library catalogue data.

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