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Web Mapping for the Dissemination of Census Data: Canadian Experience

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Web Mapping for the Dissemination of Census Data: Canadian Experience

Introduction

Statistics Canada first established its presence on the World Wide Web more than a decade ago. Since then, the internet has increasingly become a key medium for both the collection and dissemination of census data at Statistics Canada. For the 2001 Census, an internet response channel option was offered to a small number of respondents. This option was made available nation-wide for the 2006 Census with great success. More than 18% of responses were provided through the internet response channel. The importance of this response channel is expected to further increase for the 2011 Census.

The importance of the internet in the dissemination of census data has increased dramatically over the last ten years. Since the late 1990s, the internet has been the key dissemination medium at Statistics Canada, not only for census data but for all statistical programs.

Web-based dissemination has enormous potential to provide the user with great flexibility in accessing statistical data. A key to exploiting this potential is the provision of tools that permit the user to easily explore the data that are available. Statistics Canada has developed a web mapping tool in an effort to increase both data accessibility and utility. This paper summarizes some key experiences at Statistics Canada regarding the development of this web mapping tool for the dissemination of census data.

Evolution of a Web Mapping Tool

The Geography Division of Statistics Canada first developed a web mapping tool to support the dissemination of census data from the 1996 Census. This first implementation was not designed as a tool for geographic exploration of data. It merely provided a spatial reference for an area of interest. This tool was embedded in a web-based community profile system. The user selected an area within the system and a tabular profile was provided. The user was then able to request a map for the area. In this initial version, the tool was simply playing the role of an online reference map. It did not guide an individual nor facilitate the exploration of the data.

At the time of the first implementation, the searching capability and the types of geographic areas that could be mapped were limited. Nevertheless, Statistics Canada identified web mapping as having great potential as a key means to explore the wealth of information available from the census.

Following the positive experience of the 1996 Census, the tool evolved for the 2001 Census to become a key point of entry into exploring the geographic structure. For the 2001 Census the tool was named GeoSearch. GeoSearch was designed to allow users to explore census data from a geographic perspective. It became a key entry point from which a user could access data. With GeoSearch, one could move spatially across Canada and access population and dwelling counts for any geographic area – from the block to the national level. In addition, the user was able to access profile data from the municipal to the national level. Finally, enhancements to GeoSearch's search capability and user interface further increased the ease of accessibility, and more importantly it increased data comprehension.

As a result of GeoSearch's success for the 2001 Census, the mapping application was further leveraged for the 2006 Census in order to increase accessibility to the enormous amount of statistical data available from the census. Several important improvements were implemented for 2006. First, basic thematic mapping capabilities were added. This permits the user to thematically map selected variables at the census tract level and higher. Second, the profile data at the census tract level are now accessible. This detailed profile contains more than 200 lines of data covering all content dimensions of the census. Third, links were added providing the user direct access to the 2006 Census reference maps. This permits the user to print a high-quality PDF reference map displaying their area of interest.

The final key improvement implemented for the 2006 Census was the re-design of the user interface. This was undertaken in order to conform to a new user interface standard developed at Statistics Canada for web mapping tools.

Lessons Learned from the Development of a Web Mapping Tool

Statistics Canada learned several key lessons from their experience with the evolution of the web mapping tool.

Lesson 1: Need for common look and feel

Over the past 10 years several program areas at Statistics Canada independently developed web mapping tools. As a result, the need for a common user interface to increase ease of adoption by users was identified. As with any standard, this required change across the agency. The development of this standard is discussed in detail later in this paper under Development of Common Look and Feel Standards for Web Mapping.

Lesson 2: Use a common engine for many applications

Web mapping tools were also developed for internal use during census operations for both the 2001 and 2006 Censuses. These intranet applications were used to: create collection units for field work; perform geographic search of dwellings due to telephone calls to the Census Help Line; monitor progress of collection activities; and perform interactive geocoding of place-of-work responses. In each of these versions of a web mapping tool, common modules were used and improvements were made over time to the modules.

The use of a common engine approach had several benefits. First, the risk of failure was lowered for the dissemination application. The lowered risk was a result of developing the complex modules over a longer period of time than if all modules had been built only at the time the dissemination application was needed. In particular, this permitted large volume use of a tool similar to the one for dissemination within a controlled operational environment internal to Statistics Canada. Second, the cost of the investment in building the modules was amortized over several uses. For example, the thematic mapping functionality was first developed and implemented within a web mapping tool used by census management to monitor and control collection operations. Third, the maintenance costs related to the tools were minimized as a result of using a common engine.

Although a common engine was utilized for all web mapping tools developed for the 2006 Census, each version employed a different interface. This approach was adopted in order to engineer the interface for the greatest efficiency and effectiveness for each of the required operations. This is in contrast to the goal of having a common user interface across Statistics Canada for data dissemination.

Lesson 3: Web mapping enhances accessibility to census data

It is clear from both user feedback and web usage statistics that a web mapping tool aids the user in exploring, understanding and acquiring census data. During consultation for the 2006 Census, users requested greater functionality in the application. In particular, the ability to access a greater range of data was frequently suggested.

Lesson 4: Integrate products

There are numerous products that result from a census. Those that can be integrated or tied to a web mapping tool not only increase the exploratory experience of the user but also increase the likelihood of data discovery. In particular, any geographic reference product or statistical product that can be tied to specific geographic areas should be integrated with a web mapping tool.

Lesson 5: Need ability to scale architecture due to varying demand

The dissemination of census data results in peaks of demand. Immediately following each data release, the demand on the related web pages is highest. It is therefore important that the architecture employed to support web mapping applications is scaleable to ensure good response during peak demand periods, while being cost-efficient. Based on usage patterns, for the 2006 Census, Statistics Canada scaled up the architecture for the web mapping application prior to the release of the population and dwelling counts until two months following this release. This strategy ensured good user response times, while managing the overall costs.

Development of Common Look and Feel Standards for Web Mapping

Government-Wide Common Look and Feel Standards

In 1999 the Government of Canada implemented *Common Look and Feel* (CLF) standards for websites following extensive consultations with departments. The purpose of the CLF is to provide a consistent and predictable on-line presentation of government services and content on the web. The ultimate goal is to help the user more easily interact with a website regardless of the government department. This is achieved by reducing the individuality and diversity of presentation in government websites and in turn reducing the user's learning curve. The CLF standards include elements concerning accessibility, identity and collaborative arrangements, navigation and format, and official languages. One key aspect of the CLF standards is a template for the layout of a web page. This layout is identified in diagram 1.

Diagram 1: Common Look and Feel Web Page Layout
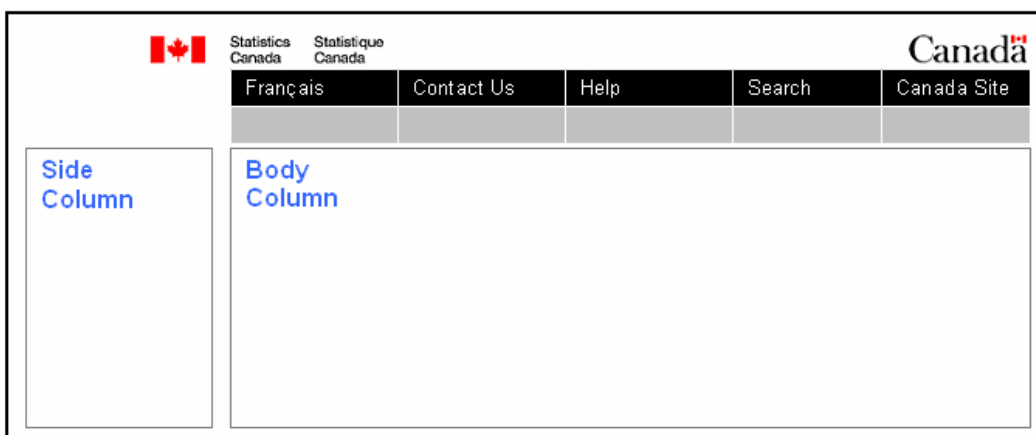
Need for Common Look and Feel in Web Mapping Applications

Over the last ten years, a number of web mapping tools at Statistics Canada have been implemented as vehicles to disseminate data from a number of statistical programs. These were developed independently within each statistical program and did not have specific guidelines nor standards for a common look and feel. Although the government-wide CLF standards were followed by each of the web mapping tools disseminated by Statistics Canada, they lacked a common user interface. As an example, action buttons were not displayed in the same order, nor did they use the same design. As a result, users had to learn different mapping interfaces in order to access various data.

Statistics Canada conducts annual market research to identify areas for improvement in the organization of its website. A recent key finding was the need to improve the accessibility and visibility of Statistics Canada's geographic information. Due to the increasing number of web mapping tools and their increasing usage, the need for a standard user interface across the agency was identified. As with the government-wide CLF standards, a key driver of creating a common interface standard for web mapping applications was to reduce the learning curve for users of multiple mapping applications on Statistics Canada's website.

Aside from increasing the ease of use for the user, there are advantages that can be derived by a national statistical agency from having a common look and feel for web mapping applications. The design of the user interface often takes a significant amount of the development time. Thus, the existence of a standard should reduce the time required to develop an application. In addition, common look and feel can facilitate user support. A common user interface reduces the learning curve for help desk staff who also use the web mapping applications to respond to enquiries. Finally, having a standard facilitates global upgrades to functionality by identifying a general approach for the implementation of new functionality.

Process to Develop Common Look and Feel for Web Mapping Applications

The development of a common look and feel for web mapping applications was achieved in four months by a working group consisting of participants from numerous programs throughout Statistics Canada. The broad representation ensured that the views and experiences of individual statistical programs that were producing such dissemination applications were considered. At the same time, representation from functional areas responsible for the corporate-wide dissemination strategy ensured that this standard respected corporate dissemination standards. Finally, the chair of this working group was a manager from the Geography Division. As a result, this ensured that a deep level of understanding of GIS technology and experience was brought to the debate.

The working group followed several steps to develop the common look and feel standard. The first step was a review of all of Statistics Canada's interactive mapping applications. These included both web-based and CD-ROM-based applications. The second step was a review of other web mapping applications external to the agency available on the internet. The websites reviewed included a number of national statistical organizations and some freely available from private organizations. The objective of these first two steps was to identify the more common functions available in web mapping applications.

The final step in developing the standard was a usability test involving individuals from the general public, the educational sector, and private sector professionals. The purpose of the test was to evaluate the layout, design, terminology, icons, and functions of two applications at Statistics Canada with very different interfaces. This usability testing proved to be invaluable and resulted in specific suggestions for enhancing the usability of the applications. The key findings are summarized below.

1. Design a "map-centric" interface
   The map should be central to the layout. This translates into ensuring that a significant amount of space on the web page be dedicated to the map itself.

2. Simplify the layout
   Users found that too many options presented at the same time were confusing. They reported that the web page must not be cluttered with data and numerous function buttons that are not required.

3. Place tools together
   Users indicated that tools, such as function buttons, should be grouped together.

4. Use buttons with icons and text
   Although there are de facto icon standards for certain functions that are employed in graphical interfaces (e.g. zoom in, zoom out, pan), users indicated that both icons and text are beneficial to enhance usability. This is an important conclusion as these tools are developed for a wide range of users with varying degrees of experience with graphical interfaces.

5. Use a consistent interface
   Users expected that an organization would use a common interface for similar functions in order to reduce the learning cycle for the user.

The Web Mapping Common Interface (WMCI) Standard

The Web Mapping Common Interface (WMCI) standard is a set of web publishing standards that defines a mapping style framework that is to be applied across Statistics Canada for the dissemination of statistical data. The standard consists of a web page layout and a library of function buttons. The web page layout (figure 2) contains blocks of space for mapping function buttons, the map, a locator map, links to other Statistics Canada web pages, the map legend, and tabs for program specific function, data, statistics or other products.

Figure 2: Web Page Layout of Web Mapping Common Interface Standard
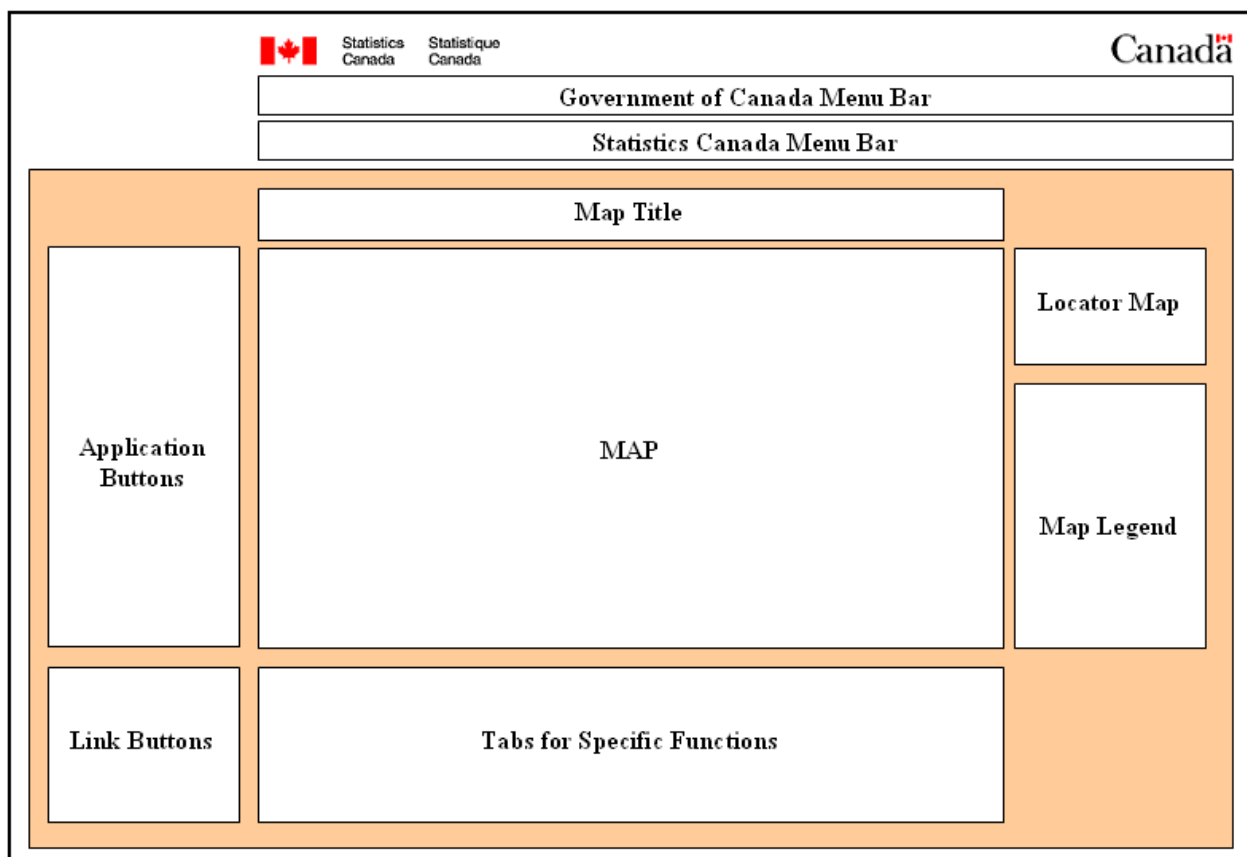
A key layout design element of the WMCI is the use of tabs for specific functions which may differ for each statistical program at Statistics Canada. This design element was introduced to simplify the number of options and data presented to the user at one time. This design element reduces the confusion experienced by the user as it provides the ability to present only the options or data of concern at any onetime. As an example, in the 2006 Census GeoSearch application, there are tabs for: performing a geographic search using place names, addresses, or postal codes; the selection of the geographic limits to be presented on the map; the selection of variables to thematically map; the

presentation of the geographic hierarchy of the geographic unit selected by the user; and links to other census products for the specific geographic unit selected by the user.

The library of function buttons contains all the approved buttons for all web mapping applications at Statistics Canada. This library includes a graphic for each button including both the icon and the text. As well, this library includes a description of the function that each button performs. The library must be used when developing any new web mapping application. The library is expected to grow over time as requirements for new functions are identified. The current function button library is found in Appendix A.

The quick development of the standard was due to the focus on the user interface rather than the underlying technology. This focus ensured that the debate was not about the software to use but the user experience. Thus, the standard does not stipulate a technology.

Conclusion

The World Wide Web provides great opportunity for disseminating census data. However, this opportunity requires a suite of tools which permits users to easily access and explore the enormous volumes of data produced from a census. A web mapping tool provides the user the ability to access the data through a generally easily understood medium – a map. In addition, the proliferation of freely available web mapping applications has increased the general population's awareness of such applications. As a result, the expectations of users of census data have increased beyond accessing data through on-line tables, to the exploration of data with the aid of web mapping tools. Therefore, it is important that national statistical organizations begin using web mapping to increase the accessibility of their data.

As data users become more adept at accessing census data by virtue of a well designed web mapping application, their sophistication as data consumers will grow. As a result, national statistical organizations can expect increased demand for greater integration of census data within such tools. Furthermore, user demand for integration of data across statistical programs can also be expected to increase, as the geographic dimension of data is highlighted. This situation requires that at least common look and feel standards are developed within the organization for web mapping tools.

Appendix A - Web Mapping Common Interface Button Library

(rows in yellow indicate mandatory standard buttons)
(button in bleue indicate that it has been activated)
(note - English button text are in sentence case - example: **S**elect by **r**ectangle)

APPLICATION BUTTONS - TOP SECTION - Select button then click/draw in map (user selects tool and must interact with the map)

Image (E)	Text (E)	ALT Text (E)	Functionality
Zoom in	Zoom in	To look more closely at a specific area, draw a rectangle or click on the map	User clicks on zoom in, and clicks or draws on the map to enlarge the map centered around that zoom area.
Zoom out	Zoom out	To see a larger area, draw a rectangle or click on the map	User clicks on zoom out and clicks or draws on the map to see more of the map centered around that zoom area.
Pan	Pan	To view a new area, click on the map, hold the mouse button down, drag the mouse then release the mouse button	User clicks on pan then clicks, holds and drags the mouse to move the map in the direction they are dragging. This will show another section of the map directly opposite of the ending location of the user's mouse pointer.
Identify	Identify	To retrieve more information, click on an area of interest on the map	User clicks on identify then clicks on a region on the map. Depending on the application, this will bring up more information on that particular area (name, data values, population, etc.)
Select	Select	To select feature(s), click on the feature(s) on the map	User clicks the select button then clicks on one or more areas in the map (to add them to a selection set). This selection (set) is then used depending on the functionality of the application.
Table	Table	To view tabular data, click on an area of interest on the map	User clicks the table button and then clicks in the map to view data for that specific region displayed in tabular format (if in a new window - add to ALT text (a new window will open))
Graph	Graph	To view a graph, click on an area of interest on the map	User clicks the graph button and then clicks in the map to view data for that specific region displayed in graph format (if in a new window - add to ALT text (a new window will open))
Chart	Chart	To view a chart, click on an area of interest on the map	User clicks the chart button to view data displayed in chart format (if in a new window - add to ALT text (a new window will open))
Select by rectangle	Select by rectangle	To change the currently selected regions, click and drag a rectangle shape on the map	User clicks select by rectangle then clicks and drags a rectangle over the map. Areas on the map touching that selection rectangle will be added to a selection set.
Select by circle	Select by circle	To change the currently selected regions, click and drag a circle shape on the map	User clicks select by circle then clicks and drags a circle's radius over the map. Areas on the map touching that selection circle will be added to a selection set.
Deselect	Deselect	To remove a feature from the selection set, click on the feature on the map	User clicks the deselect button then clicks on an area in the map to remove it from being selected or from the selection set.

Image (E)	Text (E)	ALT Text (E)	Functionality
Deselect			
Measure / Measure	Measure	To measure distances	User clicks measure then clicks and drags a line over the map displaying the distance between the start and end of the line. Alternately, the user must select a starting point and ending point and a line is generated between the two points.

APPLICATION BUTTONS - BOTTOM SECTION - Click on button to perform action (one-click button)

Image (E)	Text (E)	ALT Text (E)	Functionality
Print preview / Print preview	Print	View a printable version of the current map	User clicks the print preview button and a new page is displayed with only the map and appropriate titles, notes, etc. for printing. Note, this must print to an 8 1/2 X 11 inch sheet.
Help / Help	Help	View the help file	User clicks on help and views a help file in HTML (if in a new window - add to ALT text (a new window will open))
Map size / Map size	Map size	Switch the size of the map.	User clicks map size and the map area of the screen will either enlarge (to fit 1024 X 768) or decrease (800 X 600) depending on what is currently displayed.
Remove identify / Remove identify	Remove identify	To remove the shading/labelling from the result of the identify function, click this button.	User clicks the remove identify button and the shading and labelling from a previous identify function is removed.
Deselect all / Deselect all	Deselect all	Removes all selected features	User clicks the deselect all button and all selected features are removed from being selected.
Table / Table	Table	Display tabular data	User clicks the table button to view data displayed in tabular format (if in a new window - add to ALT text (a new window will open))
Graph / Graph	Graph	Display graph	User clicks the graph button to view data displayed in graph format (if in a new window - add to ALT text (a new window will open))
Chart / Chart	Chart	Display chart	User clicks the chart button to view data displayed in chart format (if in a new window - add to ALT text (a new window will open))
Full extent / Full extent	Full extent	Resize the map to full extent	User clicks full extent to view the current map completely zoomed out to the farthest extent (to see the entire map) but retains any selections or modifications to the map such as theme changes, colors, etc.
Canada map / Canada map	Canada map	Resize the map to view all of Canada	User clicks Canada map to view a map of Canada
Undo / Undo	Undo	Undo last action performed	User clicks the undo button and the last action performed is immediately undone. This information would have to be tracked/stored by the application.

	Save	Save map as image	User clicks the save button and is able to download an image of the currently shown map as an image onto their local system.
	Restart	Return to the starting map view	User clicks restart and begins the application again, resetting the view to the one they originally saw when they first started the application. This would theoretically undo all changes, selections, etc. the user has done in the session (application specific)
	Clear selections	Clear all selections on the map	User clicks clear selection and immediately all selections on the map are removed from the selection set.

LINK BUTTONS - Click on button to go to a specific location

	Maps and Geography	<same as new homepage>	
	Agriculture	Go to <app specific>	
	CCAP	Go to <app specific>	