WEB-BASED INTERACTIVE CARTOGRAPHY: THE EXAMPLE OF GÉOCLIP IN CANADA

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1. The Usefulness of Cartography for Distributing Statistical Data on the Web

In most administrations, the notion of territory is of particular importance to decision-makers. Whether at the municipal and regional levels or in such disciplines as agriculture, health and social work, territory is at the heart of policy decisions.

In order to make enlightened decisions, policy-makers require knowledge of the characteristics of the territories that they are governing. Unfortunately, this information is often poorly organized, and frequently difficult to access, particularly for decision-makers who may know little about data analysis or geographic information systems.

In response to this need, development of Web-based interactive cartography software has been advancing. Today, there are several tools on the market that allow the uninitiated to consult cartographic databases. With these tools, a decision-maker, without advanced technical knowledge, can create maps, obtain specific information about a territory, and even compare different territories with one another.

This article describes one of these applications, Géoclip, created by a French company. It has been used for the past few years in several organizations in Canada. The following section provides a brief overview of this application and its features, with some examples of how Géoclip is used in Canada.

2. Géoclip and its Features

Géoclip is a Web-based (Internet or Intranet) interactive cartographic solution developed by eMc3. It makes statistical information accessible across a wide range of thematic analyses.

The general principle of the application is to allow users to select statistical information that they want to map and then set up the map using the software functions. Users browse to or click on the interactive map and, selecting the territories of interest to them, build themselves the geographic framework that they want. Prints of the maps and reports, PDF outputs and exports into Excel allow the user to continue to interact with the information offline.

2.1 The Géoclip Model

Géoclip has been designed by statisticians with extensive experience in studying and distributing data about territories. Its aim is to make organized data in an information system more intelligible and meaningful. Géoclip presents indicators, carefully selected and prepared by the application's administrators, in the form of maps, tables and graphics. These indicators are documented, catalogued and organized according to need (for example in time series). Géoclip also manages the suppression of confidential statistics about less populated zones and works simultaneously on different levels of geographic aggregation.

Géoclip seeks to combine the precision of the depictions with the readability of the maps. Therefore, Géoclip directs the administrator towards an analysis discretized into classes whenever pertinent, or into proportional symbols as needed. It also provides automatic smoothing to sharpen spatial contrasts and helps select the best parameters for representation based on, for example, distribution curves, or by applying methods for detecting the most natural thresholds.

Since one piece of data can be put into context when viewed against another, Géoclip offers numerous views (tables and graphics) to compare data in a certain territory (or changes to it) with that in a reference zone.

2.2 The Technology

The Géoclip application uses the Flash format, which provides optimum display and printing quality whatever the resolution or the size of the users screen. Moreover, the user can "play" with the map in a very flexible, rapid manner because the Flash module works from within the user's workstation during interactions between the user and the map.

The cartographic Flash interface also uses information extracted from databases by means of the PHP scripting language. The application supports several database formats (MySQL, PostgreSQL, MSSQL, Oracle).

Data are organized in the database so as to allow the best response time and to facilitate the management of data storage. The technologies used work on all platforms and allow the application

to be operated and managed with no restrictive technical pre-requisite.

2.3 Thematic Analyses

Géoclip has a vast palette of thematic analyses; the main ones are seen in Figures 1-4.

2.4 Not Only Maps, but Tables, Graphics and Reports too

With Géoclip, the user is not just limited to presenting maps. The application also allows information to be displayed in the form of a table, graphic or report.

By mouse clicking on a particular territory, a municipality, for example, the application generates a table showing the data for this municipality as well as the average, minimum and maximum values for the reference zone. This reference zone can be the region, the province or even the coun-

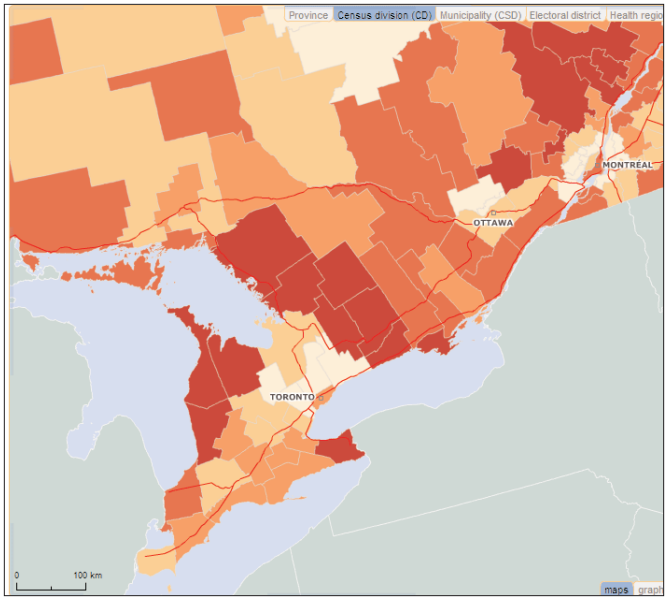

Figure 1: Analysis by coloured areas (or choropleth technique, for continuous variables), to show ratios and percentages. For example, this analysis enables the comparison of regions according to the percentages of people having certain characteristics (seniors, people living below the poverty line, diabetics, etc.).

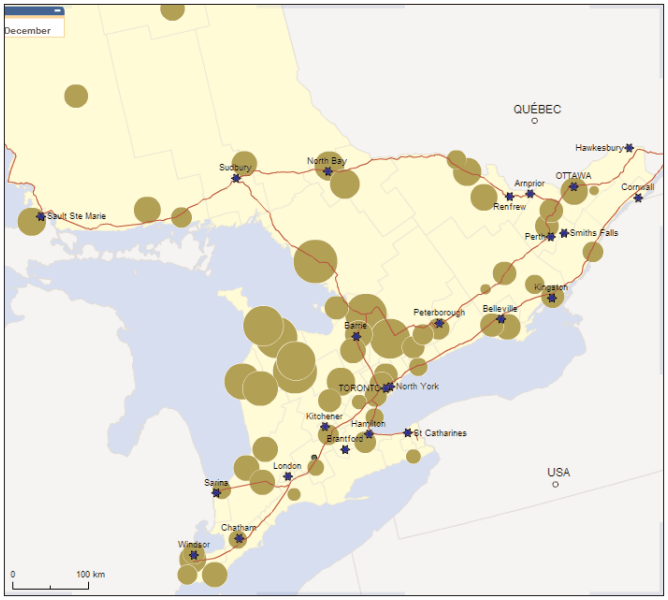

Figure 2: Analysis by proportional symbols, to show absolute quantities. Here, dots on the map are sized according to the values associated with them. For example, the user can map the number of residents in each town within a country, or the number of beds in each of the hospitals within a particular region.

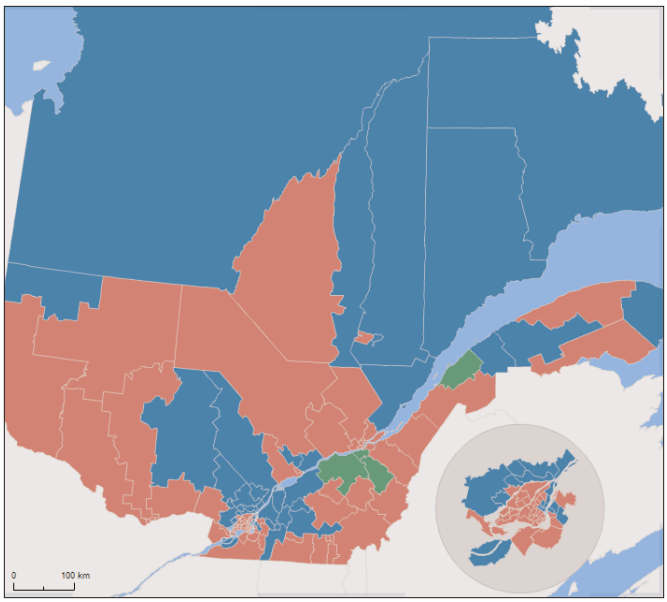

Figure 3: Analysis of individual values, to show qualitative variables (typologies). This analysis is used when the user wants to differentiate territories based on particular characteristics, for example, urban and rural areas, or in the case of a municipality, land use zoning (residential, commercial, agricultural, industrial zones, etc.).

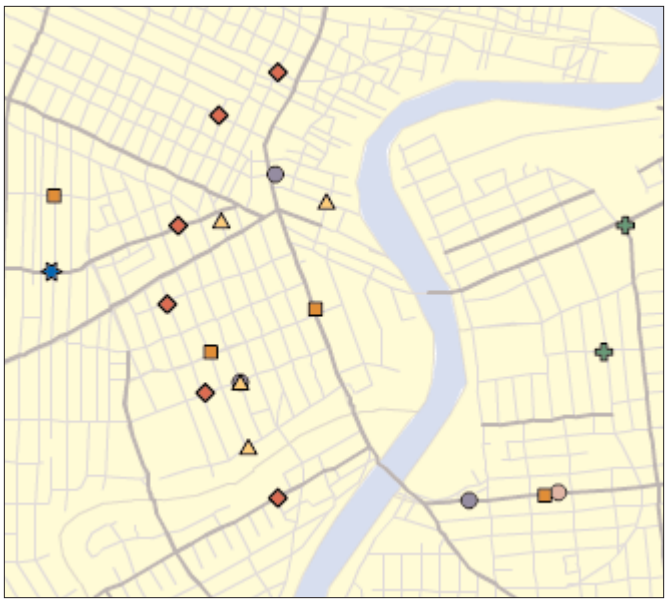

Figure 4: Analysis using point symbols to locate certain features and represent them with qualitative information. For example, when the user wants to map different facilities in a town (schools, police stations, hospitals, etc.) each type of facility can be represented by a different shape and/or colour.

try within which the municipality lies (Figure 5).

In addition to the table, the application can generate a report about the same zone. This report can be in the form of several pages containing different types of graphics (histogram, line graph, pie chart, etc.) as well as tables. The report thus provides a quantified image of the main indicators for the municipality selected. It is possible to create a customized report for each municipality, or for a group of municipalities (Figure 6).

2.5 Importing Your Own Data

While the user can "play" with all the information already in the application's database, they can also import their own data by simply copying and pasting. They can then create their own indicators, which will be accessible in the list of indicators, just as if these had been programmed in by the application's designer (Figure 7).

By using the save functions, the user can then save their project and share it with other users.

2.6 Data Exchange with Other Servers

WMS protocol broadens the field for data that can be accessed by the application. Thus, a Géoclip server can download an image or a map layer distributed by another server anywhere in the world, as long as the projection systems are compatible. In the other direction, a Géoclip application itself becomes a WMS server, offering dynamic, thematic maps to other

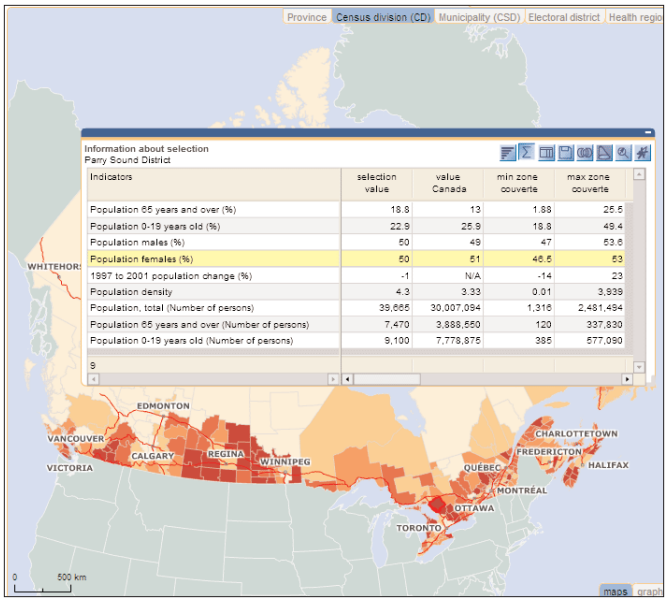

Figure 5: Table with data about the territory selected.

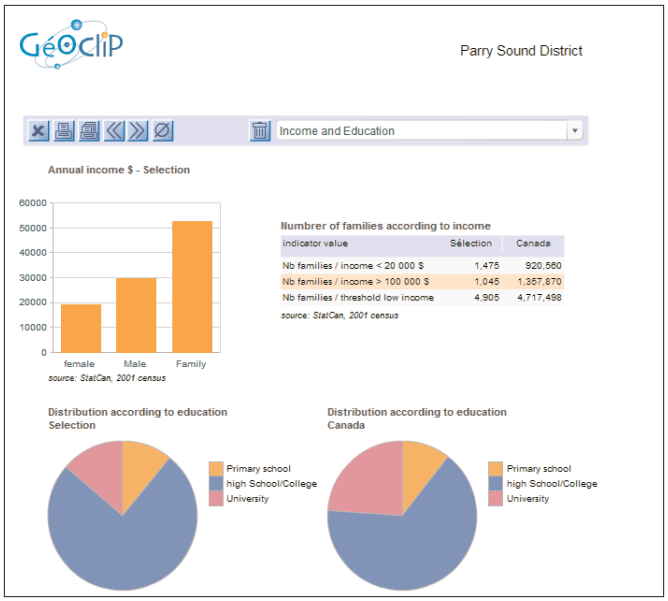

Figure 6: Report with data about the territory selected.

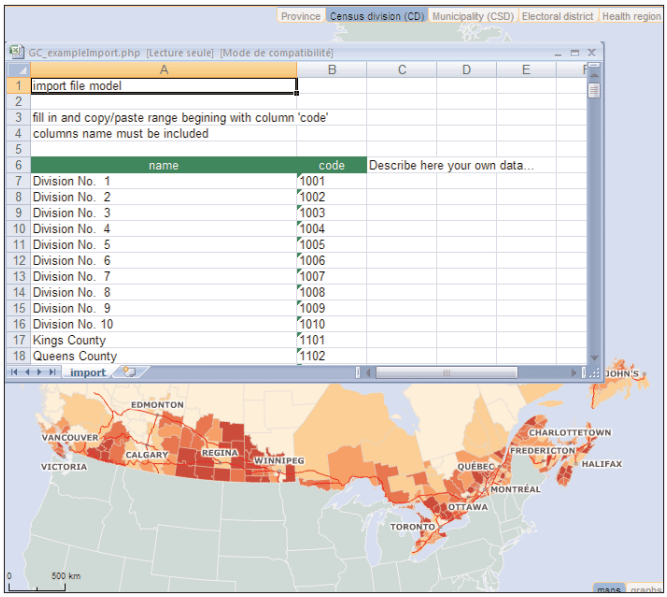

Figure 7: Function for importing data from an Excel file.

Figure 8: Photo of Montreal downloaded from the CMM's WMS server.

applications in the spirit of the CGDI. Furthermore, these functions were developed with the support of GeoConnections (*http://www.geoconnexions.org/en/index.html*) (Figure 8).

2.7 The Application's Management Console

The application's administrator uses a management console that allows them to set parameters for all the components in the application (Figure 9).

Using this console, it is possible to configure the different mapping layers, import data associated with these layers, create indicators, parameterize the analyses, construct reports, create user accounts, etc.

With this console, no prior programming knowledge is needed in order to be able to construct a Web-based interactive mapping application.

3. Examples of Géoclip's use in Canada

Even though the use of Géoclip technology is relatively recent in Canada, several applications have been developed by Canadian organizations using this technology.

In the health field, several organizations already use Géoclip to distribute their data on the Internet. This is the case for the *Agence de la santé et des services sociaux de Montréal* (*http://www.cmis.mtl.rtss.qc.ca/fr/atlas/index.html*), for the *Institut de santé publique du Québec* (*http://www.inspq.qc.ca/santescope/default.asp?Lg=fr&amp:NumVol=6&amp:nav=M)* and for the Calgary Health Region. Certain organizations such as Agriculture Canada with their Community Information Database (*http://www.cid-bdc.ca/english/index.html*), and the Canadian Council on Social Development, have implemented Géoclip applications to display the sociodemographic characteristics of population in different areas of Canada. Finally, the Canadian

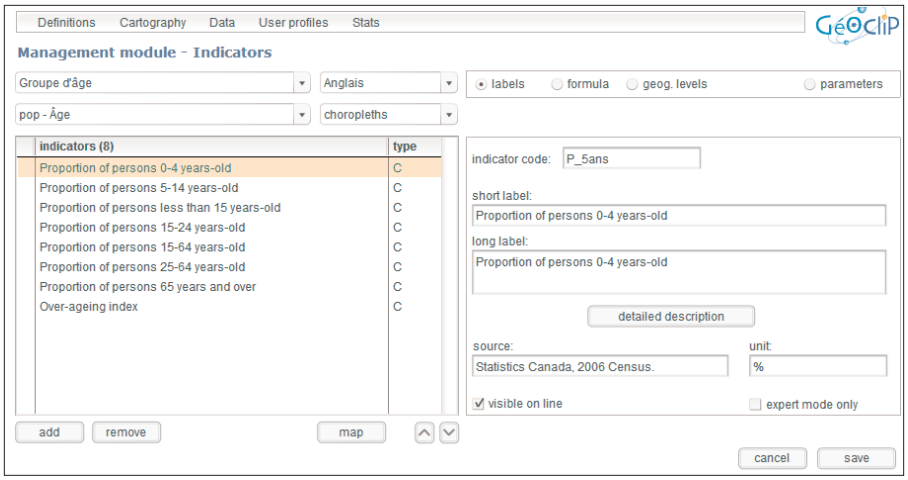

Figure 9: Géoclip Management Console.

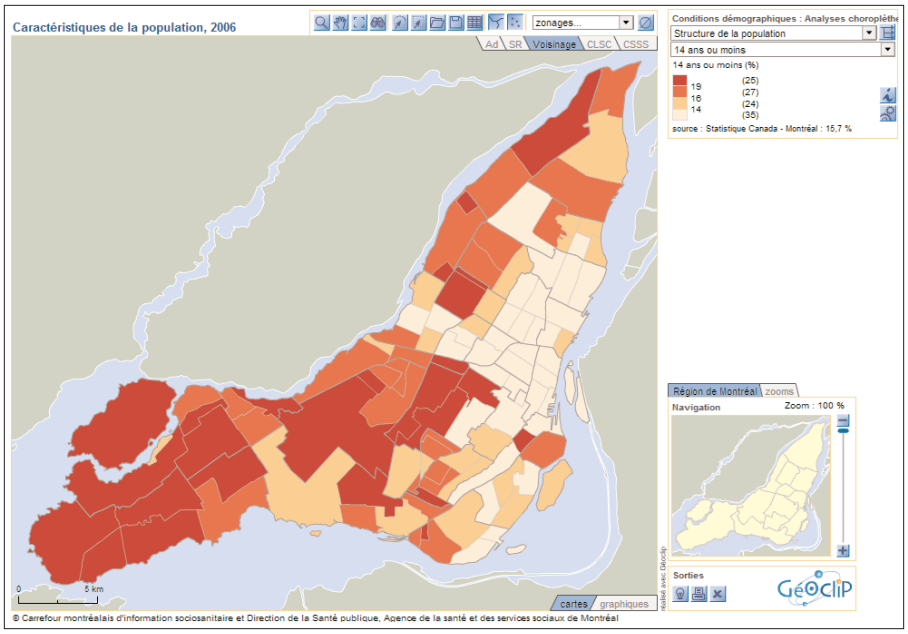

Figure 10: Demographic characteristics of the population of Montreal.

Council on Learning (*http://www.cclcca.ca/CCL/Reports/CLI/index.htm?Language+EN*) uses Géoclip to present their Composite Learning Index for Canadians.

The *Agence de la santé et des services sociaux de Montréal* has been a forerunner in the use of Géoclip in Canada. Since 2003, it has been developing a geographic information system to aid in the planning, deployment and evaluation of health services. This has proved necessary, because the organization of health services is based on individual territories within the Montreal area.

This territorial organization of health services requires not only a good knowledge of the services offered in the territory, but also the characteristics of the population, its health needs and its consumption habits of health services. Therefore the purpose of the *Atlas Santé Montréal* developed by the *Agence de Montréal* is to provide this information to decision-makers and, more widely, to all those working in the health care system.

Thus, the *Atlas Santé Montréal* allows population characteristics in each territory to be compared. For example, the user can highlight territories with a large proportion of seniors or those in which the concentration of people living in poverty is high (Figure 10).

In addition to population characteristics, the *Atlas* includes data on the population's state of health and lifestyle habits, which allows comparison, for example, of adjusted mortality rates or the prevalence of diabetes for the populations in each of the territories (Figure 11).

Another section of the *Atlas* is devoted to the use of health care services. Here the user will find information about the catchment areas for Montreal hospitals, hospitalization rates for certain diagnoses and measures of access to the different medical specialities (Figure 12).

Finally, a section of the *Atlas* is devoted to the resources in the Montreal health care system. It presents information on the different service points such as hospitals, health centres and medical clinics (Figure 13).

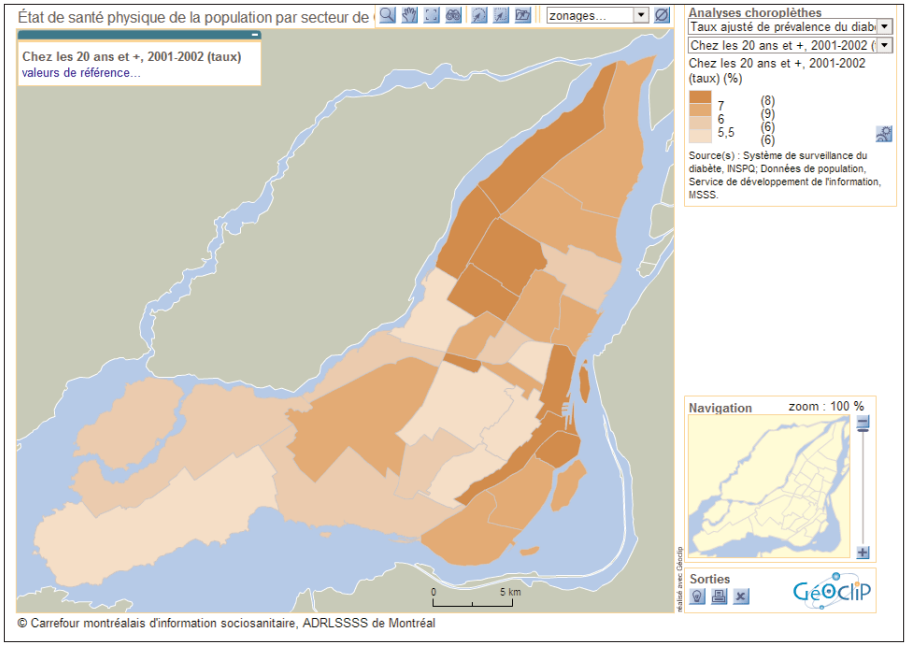

Figure 11: Prevalence rate of diabetes for Montreal.

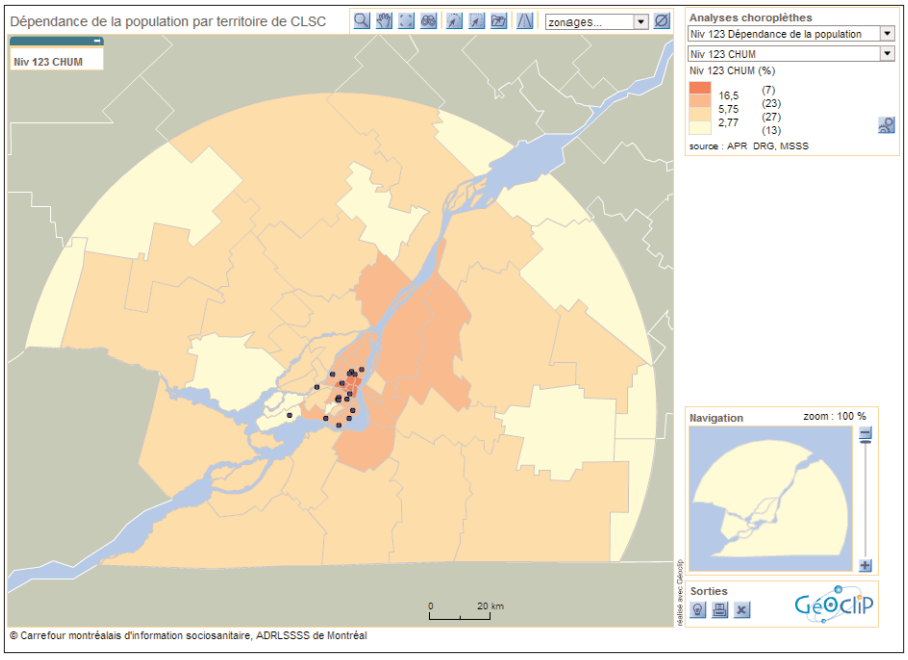

Figure 12: Catchment area for Montreal hospitals.

In just a few years, the *Atlas Santé Montréal* has become a reference for decision-makers in the Montreal health care system. Apart from all the information available and the ease with which it is obtained, above all else, decision-makers appreciate the opportunity to be able to compare their territory with other Montreal territories. Moreover, although a map may only contain a small amount of information (compared to a table), the cartographic representation is particularly meaningful. Thus, for a decision-maker, a map is a strategic tool, especially effective for getting a message across.

The *Atlas Santé Montréal* can be accessed on the Internet at the following address: *http://www.cmis.mtl.rtss.qc.ca/fr/atlas/index.html*

4. Conclusion

Web-based interactive cartography is developing rapidly. Several solutions are available, and moreover, they are affordable. These technologies allow people, with no particular technical knowledge, to have access to geographic information systems that, up to now, were accessible only to geomatics specialists.

If these technologies are to have a promising future, their success will depend largely on the ease of use of these tools and on their capacity to help decision-makers find information that is pertinent.

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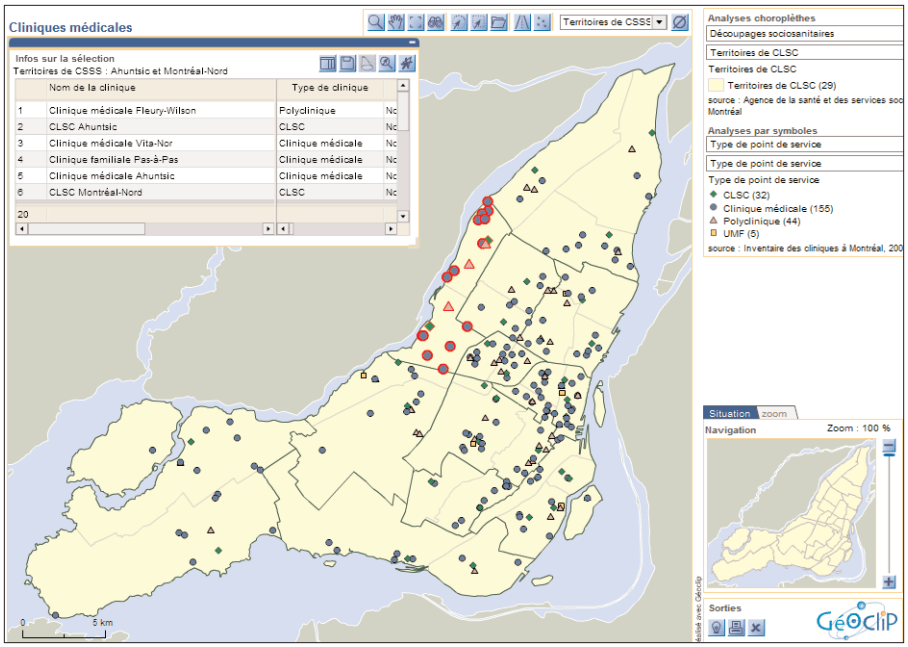

Figure 13: Distribution of medical clinics in Montreal.

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