

# Analysis and Comparison of Data Visualization using two Popular Tools: Many Eyes and Swivel.

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**Abstract**— We analyze and compare visualization capabilities provided by two freely available popular social information visualization tools, Many Eyes and Swivel. Both tools are easily accessible on the World Wide Web and are designed for a wide range of people to upload data sets and create visualizations in collaborative environment. Both Many Eyes and Swivel are designed for ordinary people and does not require any extensive training or prior knowledge to take a full advantage of functionalities offered. In this paper we provide a detailed analysis of both and make a clear distinction among them in terms of functionality, data handling, graphing techniques, user experience and web techniques used and collaboration approaches. We also suggest future improvements that will improve the user experience based on our own experiences with both visualization tools.

**Index Terms**—Information Visualization, Social Visualization Tools, Web-based Collaboration, Usability of Visualization Techniques, Visualization of Data Sets.

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## 1 INTRODUCTION

The Information Visualization field is constantly growing and various new visualization tools are now used by a large variety of people for many different purposes. Today, it is not only scientists and specialists who take advantage of data visualization techniques to interpret complex data, but ordinary people as well. The availability and accessibility of useful visualization tools on the World Wide Web make it easier for the majority of people to build visualizations of their own data.

This paper describes and compares visualization techniques and outcomes produced by two such visualization tools that are available on the Internet for people to use for free. These tools are called Many Eyes and Swivel. Both applications are social visualization tools that allow people not only create and view visualizations but also introduce a social aspect where people can discuss, share and analyze their visual data with others. Many Eyes and Swivel applications' design and functionality offered recognize that collaboration and sharing of experiences and visualization results among users help to build information visualization communities among ordinary people. Ability to collaborate on the web while using these tools adds a great value to the core visualization functionality both tools have to offer. While both tools provide an ability to graph and visualize their own data, Many Eyes has a stronger emphasis on visual techniques which help to find patterns while Swivel puts more emphasis on data mining techniques to find correlations. Both, Many Eyes and Swivel are intended to be accessed and used by people who do not require any extensive background in data processing or visualization experience.

Many Eyes is a freely available social visualization tool on the Web. Many Eyes was developed at IBM's Visual Communication Lab by Martin Wattenberg and Fernanda Viegas in Cambridge, MA. This application is designed to be an easy to use social tool for sharing visualizations in a collaborative environment. The basic functionality of Many Eyes is to upload data, create visualizations based on selected and uploaded data sets, and to share comments and experiences on both data sets and resulted visualizations with others. Many Eyes uses a wide variety of graphing techniques to visualize data such as world maps, bar graphs, histogram, pie charts, treemaps and many others. The idea behind Many Eyes is to "democratize" (1) visualization techniques by allowing broad and easy accessibility. This tool does not compete with high end scientific tools that are used in the scientific and data processing communities, since Many Eyes tries to strike a balance between providing powerful visualization techniques and a non-technical audience.

Swivel is another social visualization tool. It was founded in late 2005 by Dmitry Dimov and Brian Mulloy. Swivel is also designed to be used by the majority of people and requires no additional training to take a full advantage of available functionalities. This tool is designed for making data useful and sharable among people. It allows for easy data exploration and collaboration. The main functionality that Swivel offers is the ability to upload data from the web, from spreadsheets, or Google spreadsheets and then compare, graph, plot, map, and sort this data as well as share the data and results via email or blogs.

This paper will analyze and compare creating visualizations and comparing these two tools in detail, concentrating on the creation of visualizations as well as utilizing the large-scale collaboration functionality that Many Eyes and Swivel promise to deliver. We analyze creating visualizations using each tool separately while concentrating on major functionalities and features that each tool offers. Then the paper is subdivided into 6 (4.1-4.6) sections in which these two tools are compared side by side on the following aspects: Functionality, Data handling, Graphing features and visualizations, User Experience and Web Technologies, Collaboration Techniques and features and Usability. In this paper the major advantages and disadvantages of generating visualizations by using both tools are analyzed and possible future improvements are discussed.

## 2 OVERVIEW OF MANY EYES

"Many eyes" is an online collaboration community built by IBM's Visual Communication lab. The website allows users to share data and visualizations for collaborative data analysis. Users' main functions on the website include the following:

- Upload new data
- Create visualizations
- Post discussion comments to either displayed data or created visualization.

All visualizations created within the Many Eyes website are public and any users can view and comment on them. Exploring visualization page allows the user to view and search for all visualizations created within the web site. By default, the user is able to sort the visualization by either a date or a rating. Within a website, a user also has capability to search for a specific visualization. Once a user chooses visualization to

view, a java applet is loaded to display a chosen visualization. While selected visualization is displayed, the following actions are available:

- Analyze the visualization using interactive image
- View data set behind the visualization
- Comment and rate the visualization
- Share the visualization with others
- Add the visualization to specific topic hub
- Add the visualization to the watch list to keep track of what other users will say in the future about the visualization or the data behind it.

Posting and viewing comments behind visualization or a data set is the most important feature of “Many eyes”. While discussing specific visualization with others, users might be able to give possible explanations for data trend which can lead to a deeper data analysis. There are no limitations to what type of comments can be posted. Therefore, users can post comment referencing internal and external sources as URL link for further data analysis and research.

Another feature available in “Many Eyes” is the ability to upload new data set. This feature is only allowed for registered users. Users are able to upload data in Excel or tab delimited format. Once the data is uploaded, the user is able to create new visualizations to be shared and discussed with others. Once the data is uploaded it can be modified along with all visualizations created using such dataset. There are some limitations for deleting newly created dataset. As long as no discussions have been created for the newly created dataset and visualization, the user who created such dataset can delete it. However, if discussions have been initiated, only site’s administrator can delete such data.

In addition, any user can also create visualizations using existing data. Different users can create different visualizations using the same data. Different ways a data is represented can open doors to further data analyses.

### 3 OVERVIEW OF SWIVEL

Swivel offers the similar idea of a website in which users can collaborate about visualized data. Similarly as in “Many eyes”, users have capability to upload new data sets into a website. Once the data set has been uploaded, Swivel automatically creates several graphs using uploaded data. The types of graphs include: pie, bar, scatter, and line graphs. While “Many eyes” creates all data sets and visualizations as public, Swivel offers a private edition of the service for an additional usage fee. Free version of the service allows creation of public visualizations and data uploads.

The Graphs page allows the user to search for all graphs available for the public. Once a graph is selected, the following actions become available for the user:

- Registered users can post discussion comments about displayed data. Blog and rating functionalities are also available. Similarly as in “Many Eyes”, there are no limitations to what type of discussions is posted. In Swivel, users can also post URL link to encourage further data analysis among the users.
- Displayed graph is not interactive. However, user can modify the displayed graph by selections additional options. These include: modify the type of the graph; modify the scale; sort and filter data.
- In addition to changing the view of the displayed graph, the user can also use compare functionality. User can choose data from multiple sources to be compared in the

same graph. Swivel will also display data correlation for the new graph.

- The user also has an option to see the data behind the graph in several views. The views include: a table, a map to display geographical data, and a cloud.
- The user is also able to change the background color of the graph to make data appear different to other users.
- The user is also able to view all related graphs as well as related datasets.
- The users can also share graphs by emailing it to friends.

User has similar capability to view and comment on existing data set. Data set is displayed in a table view which can be downloaded to an excel spreadsheet for further analysis. In addition, user can view all popular graphs which were generated using displayed dataset.

Swivel also offer communities feature within a web site. User can choose a community to participate in discussion in. Community can post specific graphs and data sets to be discussed among its users. A registered user can create his/her own community.

In addition to communities, users can also post blogs to be viewed by all users of Swivel.

## 4 COMPARISON OF MANY EYES AND SWIVEL

### 4.1 Functionality

The purpose of both tools lies in navigation the continuously growing collections of visualizations, data sets, and comments, to browse visualizations created by others collaborate on them and learn new aspects of either custom or publicly available datasets.

Many Eyes and Swivel inherit their design from a number of participation-oriented web sites. The core functionality on the sites is to upload data, construct visualizations, and leave comments on data and graphs. The data set browsing pages of Many Eyes shows a table with the latest data sets to have been uploaded to the site. The table also displays metadata about each data set: keywords, source, the contributor’s username, size in bytes and number of rows, date of contribution and links to existing visualizations with that data set. Every day the home page of both sites features visualizations that typically reflect latest events or good models of visualization usage. All visualizations and data sets on both sites have an attached discussion forum where users can share comments and links to other web pages. Since all content on both sites resides at a fixed URL, users can also easily link to other visualizations on the site from both inside and outside Many Eyes and Swivel.

### 4.2 Data Handling

Uploading a data set is quite similar in Swivel and Many Eyes, with Swivel offering more options in addition to pasting a tab-separated file (CSV upload and scraping off a website). Many Eyes is more interactive and flexible, extracting the data and building the table with what seems to be an artificial intuition. Swivel requires a lot more from user – clarification of the format, in some cases reformatting the original data and sometimes having to deal with upload errors.

For creating our visualization we used data that described world rivers that are longer than 1000 km. The data included river’s name, length in km and miles, drainage area, average discharge, outflow and countries in the drainage basin.

We started working with Many Eyes. We were able to simply copy the dataset from Wikipedia’s site [5] then paste it in Excel spreadsheet to verify the uniform distribution of data, and then simply copied the table and pasted it in “Paste the data” field on

Many Eyes site. We used the “Upload data” page and followed the instructions. See figure 1.

On the same page we could check the data to see if Many Eyes recognized the contents properly and the data matches the original dataset. See figure 2. As was mentioned earlier, Many Eyes recognizes data with an amazing precision and displays it properly considering that some of the cells of data set have omitted information.

After the data has been verified we were asked to enter metadata so that our dataset and visualization would be easily recognized once uploaded. See figure 3.

Once the upload process is completed we were presented with the page describing our dataset. See figure 4.

### Data Sets : List of world rivers longer than 1000 km

Uploaded by [Osik](#) Created at: Monday March 10, 8:23 PM  
 Data source: [Wikimedia Foundation, Inc](#) Size: 11k, 184 rows  
 Description: This is a list of the longest rivers on Earth. It includes river systems over 1,000 kilometers

	River	Length (km)	Length (miles)	Drainage area (km <sup>2</sup> )	Average discharge (m <sup>3</sup> /s)	Outflow	Countries in the drainage basin
1	Nile	6,650	4,135	3,349,000	5,100	Mediterranean Sea	Ethiopia, Eritrea, Sudan, Uganda, Tanzania, Kenya, Rwanda, Burundi, Egypt, Democratic Republic of the Congo
2	Amazon	6,400	3,980	6,915,000	219,000	Atlantic Ocean	Brazil, Peru, Bolivia, Colombia, Ecuador, Venezuela, Guyana
3	Yangtze	6,300	3,917	1,800,000	31,900	East China Sea	P.R. China
4	(Chang Jiang)						
5	Mississippi - Missouri	6,275	3,902	2,980,000	16,200	Gulf of Mexico	United States (98.5%), Canada (1.5%)

(See Figure 4 in appendix A for higher resolution of this image)

Process of uploading the data to Swivel took a lot more effort. Swivel offers two choices of entering the data to be visualized. One can choose to upload a .csv file or copy and paste data. We chose to paste the data into the editable field as was done with Many Eyes. See figure 5.

Swivel does a great job at recognizing problems within the dataset and offers a chance to reload it before uploading the data. It is imperative to note that Many Eyes allows editing the data “on the fly” – using the upload pages, but Swivel requires re-entering the data in the correct format. After we forced Swivel to upload the data deliberately knowing that some of the cells miss the content we received a confirmation screen. See figure 6.

On the next screen we were asked to enter metadata – the same information Many Eyes required but the instructions were clearer than the ones offered by Many Eyes and the screen layout was cleaner. On the last screen Swivel included an advertisement for “Flickr” – a great business decision but a poor usability feature.

The process of uploading the data and creating the visualization took exactly twice as many steps as Many Eyes. What was done in three steps in Many Eyes, had to be done in six in Swivel. After clicking “Finish” we received an error message that there is a problem with the requested page. After trying to repeat all six steps we ended up on the same error page. Then we decided to upload the original Excel spreadsheet but got the following error page: (see figure 7.)

After this we spent a considerable of time editing the data to make sure that it contains as few mistakes as possible. We repeated steps required to create the visualization and got to the summary page. See figure 8.

**Data Summary** [Edit Data](#)

Showing last 6 rows and first 4 columns

River	Length (km)	Length (miles)	Drainage area (km <sup>2</sup> )	Average discharge (m <sup>3</sup> /s)	Outflow	Countries in the drainage basin
<a href="#">Loire</a>	1,012	629			Atlantic Ocean	France
<a href="#">Essequibo</a>	1,010	628			Atlantic Ocean	Guyana
<a href="#">Khopet</a>	1,010	628			Don	Russia
	1,006	625			Atlantic Ocean	Spain, Portugal
<a href="#">Tagus</a>						
<a href="#">Colorado (Argentina)</a>	1,000	620			Atlantic Ocean	Argentina

[more...](#) [more...](#) [more...](#) [more...](#) [more...](#) [more...](#) [more...](#)

[Download to spreadsheet](#) [See entire table >](#)

**Recent Comments**

No one's commented yet. Have something to say? [Add your comment](#)

**Popular Graphs**

(See Figure 8 in appendix A for higher resolution of this image)

On this page we could view our data in a table format. See figure 9.

Swivel added some bogus information in some of the cells which we had to revise again and reload the data. Swivel allowed us to categorize our data set by columns. See figure 10.

Once our data was uploaded we began experiencing even more differences than was noted earlier. Many Eyes offers user to select the appropriate visualization technique to better describe the uploaded dataset as shown in the later chapter, while Swivel creates visualizations automatically. Swivel spits out on the screen bar graphs for all the categories (columns) of the dataset. Swivel doesn't take into consideration that most of the visualized categories are useless to the users and creates more graphs that are needed and certainly many more graphs than there are datasets. This gave us an impression that Swivel designers view their software as a repository for visualizations, not taking into the consideration users' needs. With so many graphs it becomes difficult to navigate through the site to find the necessary information.

Swivel also offers a chance to participate in their premium service, and to eventually sell subscriptions. This service would allow users to use proprietary data to graph, and promises to shield the work from the public eye. We signed up for this premium service, but never received an invitation to try it out. This undermined our trust in such a service and if we would have to visualize the data that must not be shared with other users on the web we probably wouldn't trust Swivel to handle this task

In contrast to Swivel, Many Eyes only creates graphs that describe the primary characteristic of the uploaded dataset. It then offers a chance to visualize any other category, but that would be the user's choice. This makes Many Eyes cleaner from the usability point of view. Fewer graphs make it easy to navigate through the web site and make it more interesting to investigate the data with a chance to visualize what could have been missed during the original visualization. This functionality also makes Many Eyes a data-oriented site. Although the site was “preloaded” few data sets and visualizations, most of the content is contributed by ordinary users, who upload data sets, discuss them, create visualizations from the data, and then discuss those visualizations.

Since users can upload their data to both sites they benefit from the fact that they can visualize their own data. Many Eyes also brings

a collective benefit: other users can augment the uploaded data by adding additional, related information. There's also an opportunity for research to understand user demand of the types of data that people visualize the most.

Both sites face interesting constraints on their design. Since data is uploaded to the site by end users, the data model provided by both competitors must be easily understandable, with a format that is appropriate for non programmers. At the same time, the format must be flexible enough to express the data structures used by visualizations. Many Eyes impressed us by handling this task with better approach, offering users such visualizations as treemaps and other complex graph layout algorithms. In addition to constraints on the data model, both sites also handle changes to data. Data sets and their visualizations are to be commented on and discussed. All annotations are to remain valid even when the underlying data is changed.

Another aspect of data handling is redistribution of dataset that is often necessary in preparing for visualization. Both sites use table structure as a model behind the scenes. Models define data types of columns to be either textual or numeric, with Swivel being able to handle other datatypes – such as Date and currency. As shown later in this paper, Swivel allows changes in data types “on the fly”, while Many Eyes trusts the algorithms to determine the best suitable format, which seemed to us flawless for our dataset. In our research we found that Many Eyes might not handle Date datatype correctly, but we never had any problems with our dataset. Both sites also support data that comes in the form of unstructured text. Each data set, whether a table or unstructured text, is associated with a collection of metadata. Some metadata, such as a (required) title, the source of the data and a paragraph-length description is provided by the user. Other metadata is automatically set by the systems, such as creation date and author. Datasets are stored on servers in plain text format.

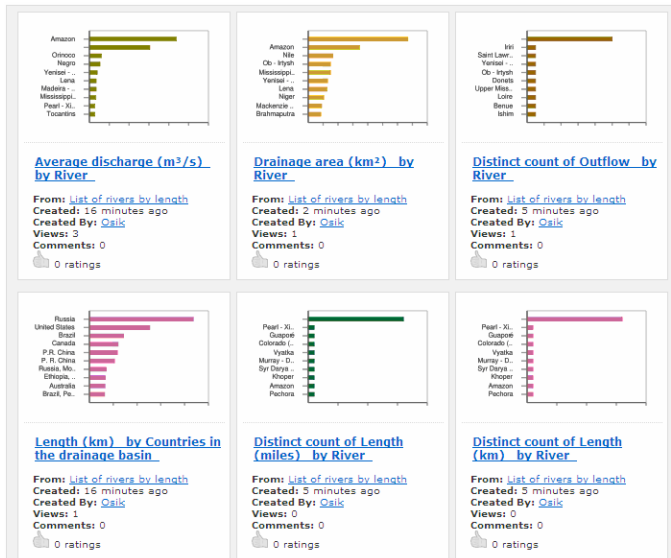
We uploaded our data to Many Eyes via an HTML form. The form contains a text area where we could paste in a data set. The data can either be in the form of text, in which case it is interpreted as unstructured data, or a tab-delimited grid, in which case it is interpreted as a table. In our case the data was in tabular format because it was a copy from Microsoft Excel. In this case, the system determines the type of each column – whether it is numeric or textual. In the event that the system makes a mistake, the user may override the automatic type choice. [1]

Both sites include a considerable amount of educational materials to aid in the process of data preparation and uploading. Metadata attached to the datasets is then used in the visualization procedure to describe graphs and define their attributes.

Datasets can be navigated a variety of ways: a standard search box; use of keywords or “tags” and a list that can be ordered by upload data, contributor, and other meta data.

### 4.3 Comparison of Graphing Features

Swivel offers users following visualization techniques: vertical and horizontal bar charts, scatter plots, and line charts. The data to be shown is processed as absolute value, difference from the average (in the data set), and as a percentage of the largest value. Once our data was processed Swivel also gave us an option to view it as a graph, table, in a cloud form and as a map, as shown later in this chapter. Swivel allowed us to change the colors of the background and lines, which is a necessary feature to keep all the graphs from looking the same. On the page personalized for our group we could find graphs of the categories that we told Swivel to extract from our data.



(See Figure 11 in appendix A for higher resolution of this image)

Unlike Swivel, Many Eyes offers variety of visualization types such as traditional charts, treemaps, world maps, block, bubble, and network diagrams. All of the visualizations are interactive. We encountered the following page after our data was ready to be visualized: see figure 12.

Many Eyes offers many visualization types, divided into 6 categories:

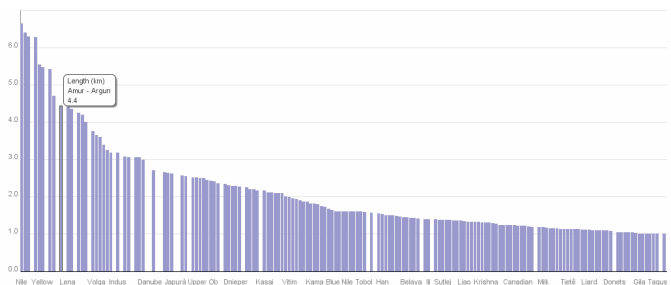
- Text analysis – offering visualizations: tag clouds and word trees
- Comparison of set of values: bar charts, block histograms, and bubble charts
- Data relationship: matrix charts, network diagrams and scatterplots
- Parts of the whole: pie charts, treemaps and treemap for comparison
- Maps: country maps and world map
- Changes of data over time: line graphs, stack graphs and stack graphs for categories.

All of Many Eyes' visualizations are interactive, allowing the user to query exact numbers, zoom, change graph parameters, select different category to visualize. We could really appreciate this flexibility when looking at data uploaded by others and visualizing it as maps.

The resulting graphs look much nicer on Many Eyes, and are also easier to read. The legends in Swivel's graphs are badly laid out and the color spots next to the descriptions are too small to be clearly seen and matched with the colors of the lines.

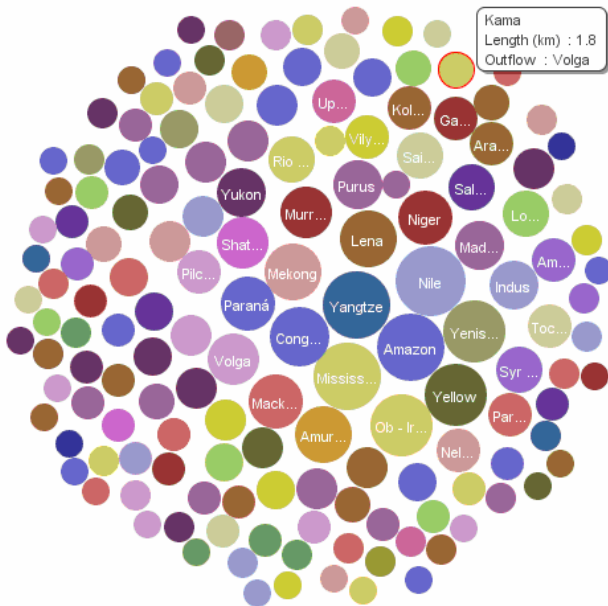
#### Our data in Many Eyes:

First, we selected “bar chart” to visualize our data. Many Eyes understood the columns to be better presented in a bar chart form and gave us options to change the visualization parameters.



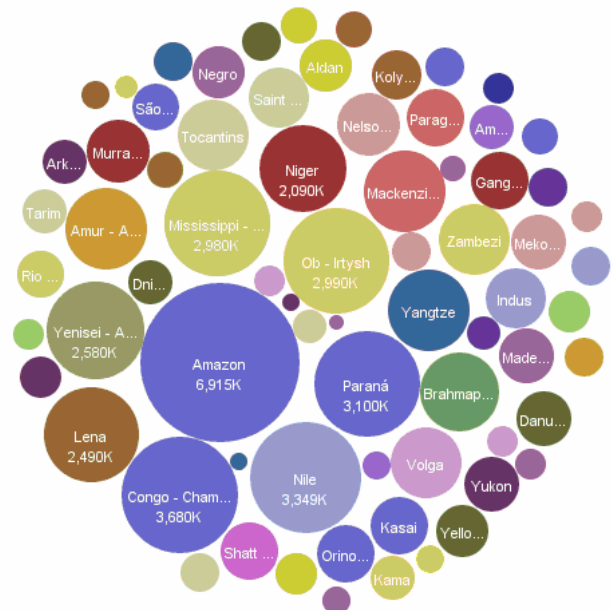
(See figure 13 in appendix A for higher resolution of this image)

One of the most common types of real world data is simply a list of labeled numbers. Such lists are often easily displayed via standard bar charts or histograms, but these methods can run into trouble for highly skewed distributions. To address this difficulty, Many Eyes included a “bubble chart” which represents items by circles, whose areas are proportional to the displayed quantity. These charts effectively perform a visual square-root transformation. See figure 14. We found that bubble chart was easier to navigate, more user-friendly and provided better interaction. Items were associated by color and depending on the property selected in the left navigation menu the appropriate “bubbles” would be highlighted, therefore giving users an amazing visual aid in researching their data.



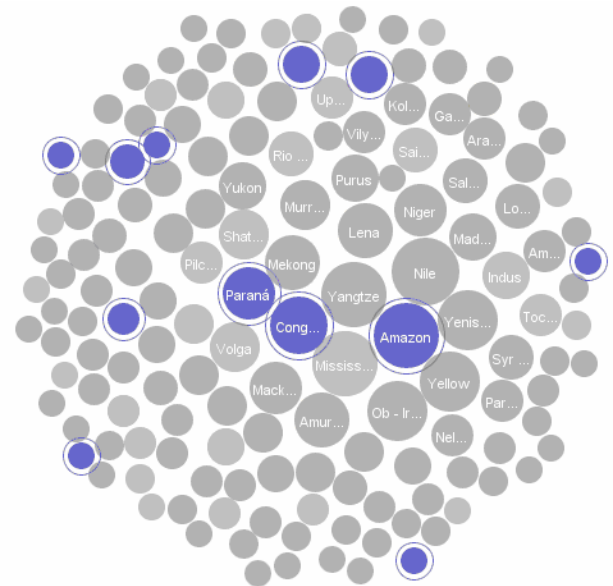
(See Figure 14 in appendix A for higher resolution of this image)

By selecting the categories to be graphed we could see how our visualization changes. Bubble size is controlled by the drop down box that lists all columns of the uploaded data. See figure 15.



(See Figure 15 in appendix A for higher resolution of this image)

As was mentioned earlier, users can further research their datasets by selecting a common data property from the available set of categories. In our case we selected a common outflow property to find the related rivers, which were highlighted upon our selection. See figure 16.



(See Figure 16 in appendix A for higher resolution of this image)

For data that has hierarchical structure Many Eyes offers “stack graph for categories” visualization. Clicking on elements in the tree control filters the stack graph to show only time series at that level of hierarchy.

For unstructured text Many Eyes offers “Tag Clouds” visualization, which can quickly give the user an overview of the items in the text. It seems that Many Eyes is able to measure the frequency of two word tags in the text and able to dynamically filter the tag cloud by entering query strings in a text box. Tag clouds seem to be an attraction to a set of users, whose interest is primarily in textual data instead of numbers.

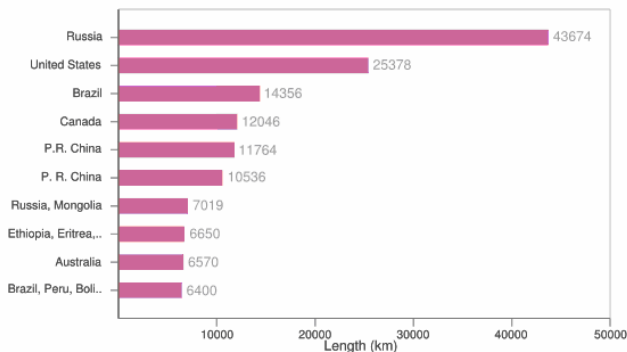
To visualize a dataset Swivel and Many Eyes have to match data to the visualization technique. For Many Eyes this is a more difficult task, since the number of techniques is larger. As expected the same data can not be displayed by all visualizations. The same data will be displayed from different perspectives if two different graphing techniques are selected. For example, a tree map requires a hierarchy to be defined in the data, while a bar graph only requires a set of textual and numeric columns – one to define the size of the bar and another one for the label.

Although both sites provide graph visualizations of a user-uploaded file they differ in the graphing algorithms. Many Eyes uses a force directed graph drawing algorithm in a zoomable user interface. [1] The layout algorithms are implemented in java and run on the client machine, requiring less input from the potentially overloaded server, thus producing layouts in a matter of one or two seconds. Although many different data formats for graphs exist, Many Eyes uses “simple edge table”. [1] Although not the most efficient storage format it proves to be both highly understandable and suitable with table-oriented design.

The main difference between Many Eyes and Swivel in graphing features is that, instead of providing static business graphics, Many Eyes offers a number of interactive visualizations of user’s data. This interactivity allows users to drill down into details, view the data from different perspectives and generally makes the visualizations fun to use.

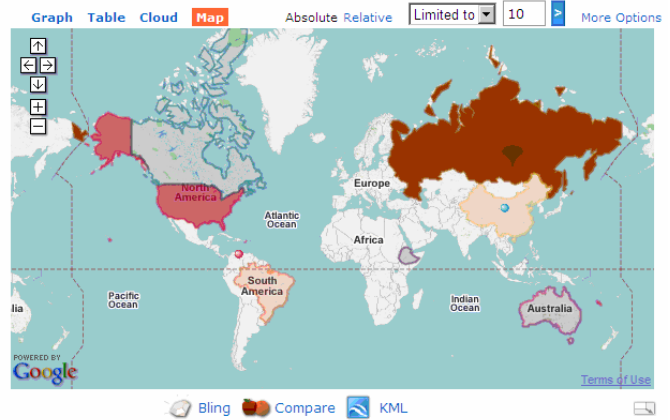
*Our data in Swivel:*

As mentioned earlier, Swivel creates a number of visualizations without requiring selecting the appropriate one. See figure 17.



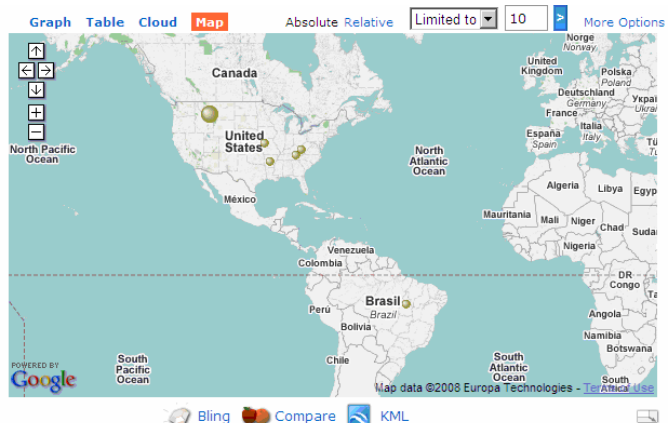
(See Figure 17 in appendix A for higher resolution of this image)

Among the visualization options Swivel offered to review our data in the bar graph form, in the table form, as a map and as a “cloud”. We didn’t find Maps and Clouds particularly useful since they didn’t describe our data properly. These visualizations could be omitted, but Swivel didn’t ask our opinion about these graphs, it just gave them to us. This might present a potential problem since unnecessary graphs present data from a different perspective, the one that might not apply to the dataset. When this bogus information is reviewed by users, it might spawn discussions based on the false representation of data. See figure 18. Here our data is presented in a form of the world map, which ambiguously represents our data.



(See Figure 18 in appendix A for higher resolution of this image)

On this page we could change the parameters by which the graph is built, but it didn’t change the nonsense of representation of our data in the form of the map. See figure 19.



(See Figure 19 in appendix A for higher resolution of this image)

Same comment can also be applied to the “Cloud” visualization of our dataset. See figure 20. We found that pop-up labels describing the combined length of all rivers of particular country are useful, but the arrangement of the countries in the cloud form doesn’t make much sense. Again, Swivel practiced a technique of “visualize and ask questions later”.



(See Figure 20 in appendix A for higher resolution of this image)

In addition to the unnecessary graphs, Swivel also calculates a measure of correlation for all possible pairs of data dimensions present in the graph, and shows them as bar graphs. This provides users with a lot of information that was never required and might be absolutely useless. On the positive note, Swivel allows users to graph two different datasets, allowing users to compare the data from two different sources. This functionality is missing in Many Eyes.

Many Eyes on the other hand allows users to add more data to the uploaded dataset, but Swivel is unable to perform such operation since it is limited in the functionality by the Ploticus library that it uses. [2]

In terms of capabilities, we found that Many Eyes is on the top of the game. Better User interface, faster graphing, more flexibility, better user communication and more graphing options – all point in favor of Many Eyes. The only advantage that Swivel has over Many Eyes in terms of the visualization is the ability to combine data from multiple datasets.

#### 4.4 Web Technologies and User Experience

Visualizations in Swivel and Many Eyes are delivered using different technologies thus they offer different user experiences while using these tools. Swivel utilizes AJAX and Many Eyes is built on Java. The capabilities of the two tools and produced visualizations greatly depend on the power and capabilities of two technologies. AJAX is relatively new and more client friendly language that requires extensive use of JavaScript language. It is a promising technology that is only beginning to offer on its user experience promises. While this technology provides quick response time for the user it comes with the price of poor compatibility among different types and versions of browsers. From personal experience it can also be very tricky to code. While Swivel is already functioning on this platform it seems like with advances in this field of Web Development the product will provide a better and more robust experience as times goes on.

Many Eyes is built with the more stable and robust Java technology that has been proven to deliver solid and reliable applications. Java's advantage over AJAX is that it allows for more advanced interactions at this point in time. Consequently the Many Eyes user experience is more interactive than Swivel. Producing the same user interaction experience in AJAX or Flash requires extremely complicated programming algorithms. Java is also known for its Object Oriented approach that allows reusability of common components. This probably allowed the Many Eyes developers to minimize development time of the application while delivering a richer UI. Swivel appears to build visualizations slower than Many Eyes potentially because it generates images on the server side while Many Eyes handles it on the client's java platform. However, Java applications also have disadvantages. The Java plug-in has to be installed on the client browser to enable correct visualization presentation. This is a weak point of Many Eyes and used as one of the arguments against it.

Swivel is using third party software, Ploticus, for drawing visualizations while Many Eyes has developed its own libraries. Even though Ploticus is powerful software component that allows creating static images and interactive maps it limits Swivel features and does not allow for future expansion. Many Eyes on the other hand has greater capabilities for expanding its visualizations and advanced interactions.

AJAX ties Swivel to the Internet and consequently limits Swivel audience. Java based applications can be installed on any platform and any environment, which makes Many Eyes more appealing from the business and user experience perspectives.

#### 4.5 User-oriented approach

Both sites make visualization a social activity. Besides uploading and visualizing the data, a huge part of the sites' functionality lies in users' ability to collaborate on their work. This broadens horizons of visualization and brings out the "human" aspect of human-computer interaction.

Many Eyes handles comments much better than Swivel. Since graphs are interactive, users can include snapshots of the modified graph and include it in the comments. Every snapshot becomes a link to the graph and all the modification parameters are passed along with the link.

Both sites also have forums where users share their experience working with the software. Users are able to refer to the visualizations by providing links to them, and while Many Eyes

gives a user a choice of interact with the graph, Swivel only allows changing the background of the visualization or the color of the graph. As was mentioned earlier, a notable feature of Swivel allows users to compare data to a different dataset.

Both sites allow users to rate the visualization. This option doesn't seem to be as popular in Many Eyes as it is in Swivel, which features the best rated graphs on its front page. Swivel also includes tags for graphs that provide easy and means of navigation and search, and become a standard for interactive website.

What deserves to be noted is the decision of both sites not to restrict users to discussing visualization only on their sites. For this reason, they provided "points of entrance to discussions" that were external to the Swivel and Many Eyes themselves — for instance on blogs or in forums.

The main communication feature in Many Eyes and Swivel is the on-site communication via textual comments. In Many Eyes comments can be attached to visualizations and datasets. Every time users interact with graphs they can comment on visualizations.

Both sites attach visualizations and data sets to the users. This is important for socially-oriented web sites. This personalizes the user-experience and allows users to interact with one another. Each user has an activity history where the site contributions can be accessed. This allows seeing the interests of users when browsing their work.

It is interesting to review the Many Eyes' approach to offering users to link to the modified visualizations of the original. For this purpose Many Eyes employs bookmarks and annotations. Whereas bookmarks allow users to capture the state of visualization, annotation enables users to highlight specific items within a particular state of visualization. [1] Since all visualizations are interactive, they might have many states where users might want to point; this is defined by the settings of filtering, navigation, and parameters of visual encoding. [1]

It is important that visualizations across the sites to share, as much as possible, a consistent visual language. We found interesting in our review that while Many Eyes uses a common highlighting color in all visualizations, it's standards are different for pie charts, where slices become detached from the chart. Also, as was shown on the bubble chart, selection of the multiple items produces a sum of the values of the selection. On the network diagram selection clarifies the details of the particular branch of the graph.

Many Eyes also features a functionality that eases embedding the visualization in various blogs and forums. Simply by pressing "blog this" users are given a snippet of html code to be pasted onto their blogs or into the comments section. The code contains both a static snapshot of the visualization and a link back to the URL of the visualization on the Many Eyes site. There's also an RSS feed for data sets, visualizations, and comments on Many Eyes site, and this becomes more and more popular on the web. Users can sign up for feeds of the latest visualizations or data sets contributed to the site overall or they can sign up to watch for new comments to specific visualizations and data sets.

## 5 CONCLUSION

In this paper we have compared and discussed two visualization tools and visualizations created by Many Eyes and Swivel. Both tools have their pros and cons. Even though Swivel provides nice visualizations and ways for sharing, it needs to work on the more dynamic visualizations. In the current design Swivel visualizations are presented as static images. On one hand it allows for easier sharing since users can just copy visualization images and transfer them to other applications or presentations but on the other hand it greatly limits user interactions with visualizations. Also due to the poor search and filtering capabilities information is hard to find in Swivel. Often search results return duplicate and unnecessary data. It would be highly beneficial to incorporate metadata that would simplify search mechanism. Swivel also needs to expand its

capabilities and customer base. To stay on the market it needs to appeal to more sophisticated customers.

Many Eyes is more organized and dynamic. Many Eyes enables users to interact with data sets, create new visualizations and modify current ones. It also provides different types of visualizations such as tree maps, bubble charts, network diagrams and many others. This makes Many Eyes tool very appealing for customers who are interested in variety of solid dynamic visualizations that can be customized and manipulated to meet business needs. But Many Eyes has its negative sides too. As we discussed in this paper it is based on the Java technology and its use of Java applets is hard to sell for many users. Java applets are viewed as an aging technology and look less and less appealing for advanced users. In comparison with Swivel interactive visualizations are much harder to export and share than static images. There are several steps Many Eyes can take to increase its popularity. Some of them are incorporating latest technologies such as AJAX and Flash in addition to Java that can still be used to process data on the backend. It would be wonderful if dynamic visualizations could be transformed on demand to the forms that are easy to share and export. At a same time Many Eyes could benefit of implementing techniques that would allow reading real time data from external sources and creating live visualizations. This would open endless possibilities for Many Eyes and its users making this tool very valuable in multiple areas.

Swivel and Many Eyes use cutting edge technologies that produce beautiful visualizations. One of the future improvements for these applications could be to introduce dynamic components and plug-ins that could be implemented by other visualization tools and sites. Sharing visualizations among other sites would open new horizons for exploration and data visualization.

## REFERENCES

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- [2] Kosara, R. “Review: Swivel vs. Many Eyes” <http://eagereyes.org/VisCrit/Swivel-vs-Many-Eyes.html> retrieved 02-25-2008
- [3] Many Eyes <http://services.alphaworks.ibm.com/manyeyes/home> retrieved 02-24-2008
- [4] Swivel <http://www.swivel.com/> retrieved 02-25-2008
- [5] Wikipedia [http://en.wikipedia.org/wiki/List\\_of\\_rivers\\_by\\_length](http://en.wikipedia.org/wiki/List_of_rivers_by_length)



# Appendix A

Figure 1. (Uploading the data to Many Eyes)

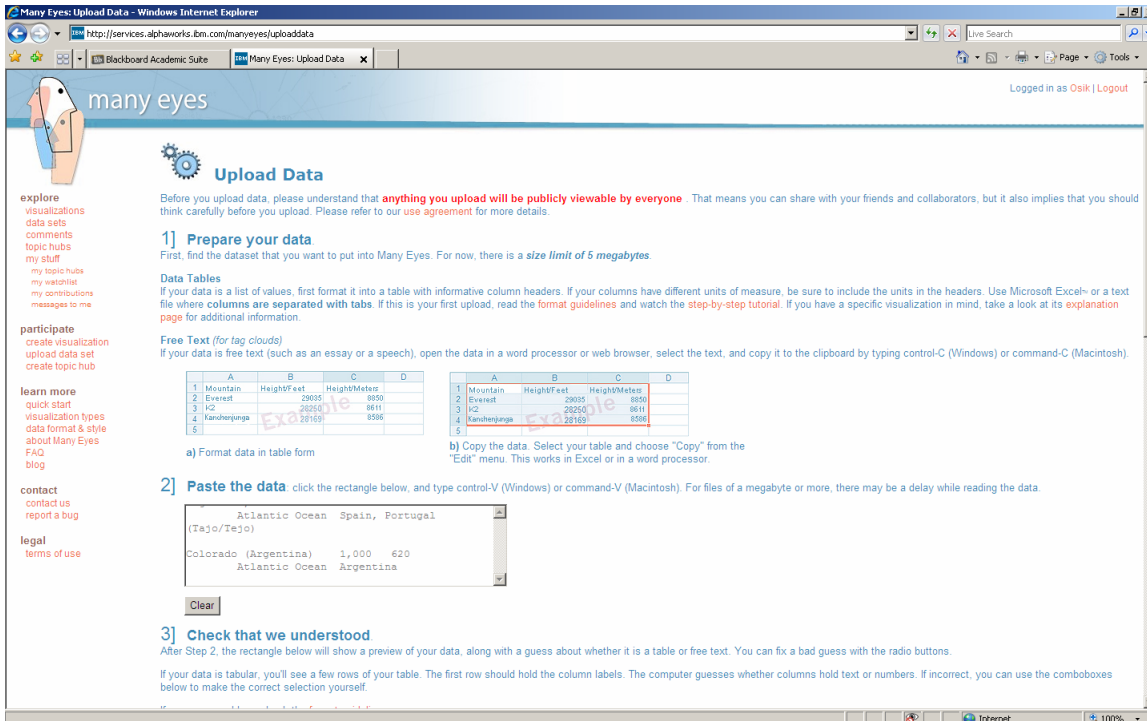


Figure 2 (Data recognition by Many Eyes)

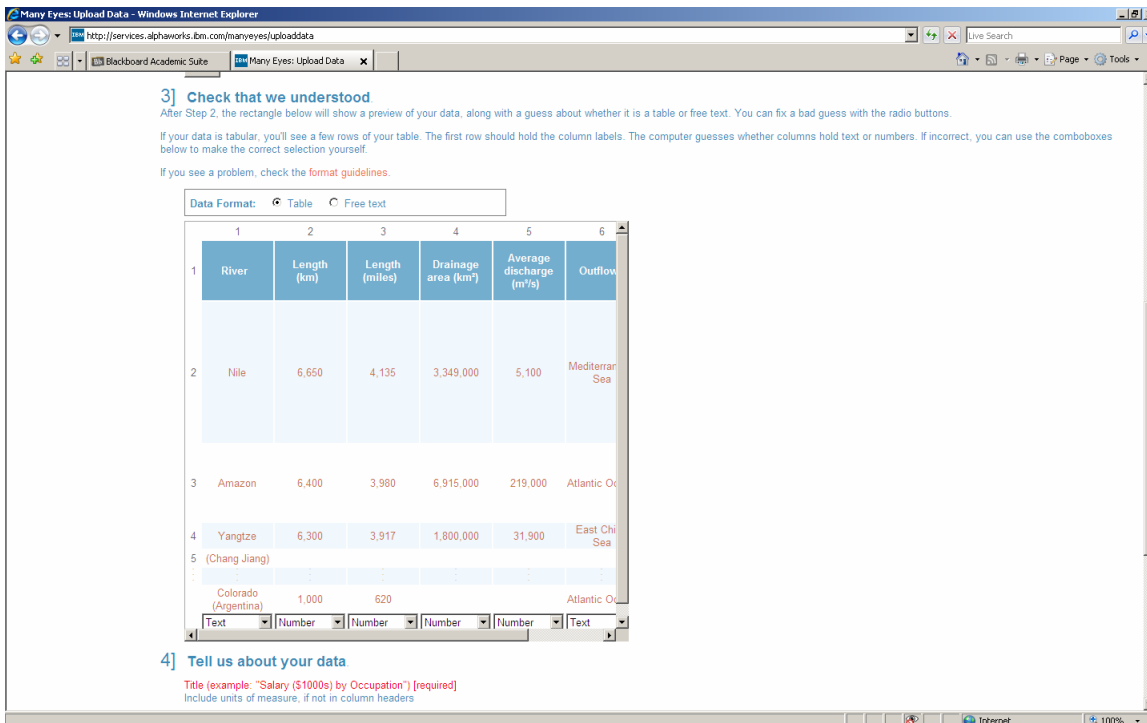


Figure 3 (Meatdata for our visualization.)

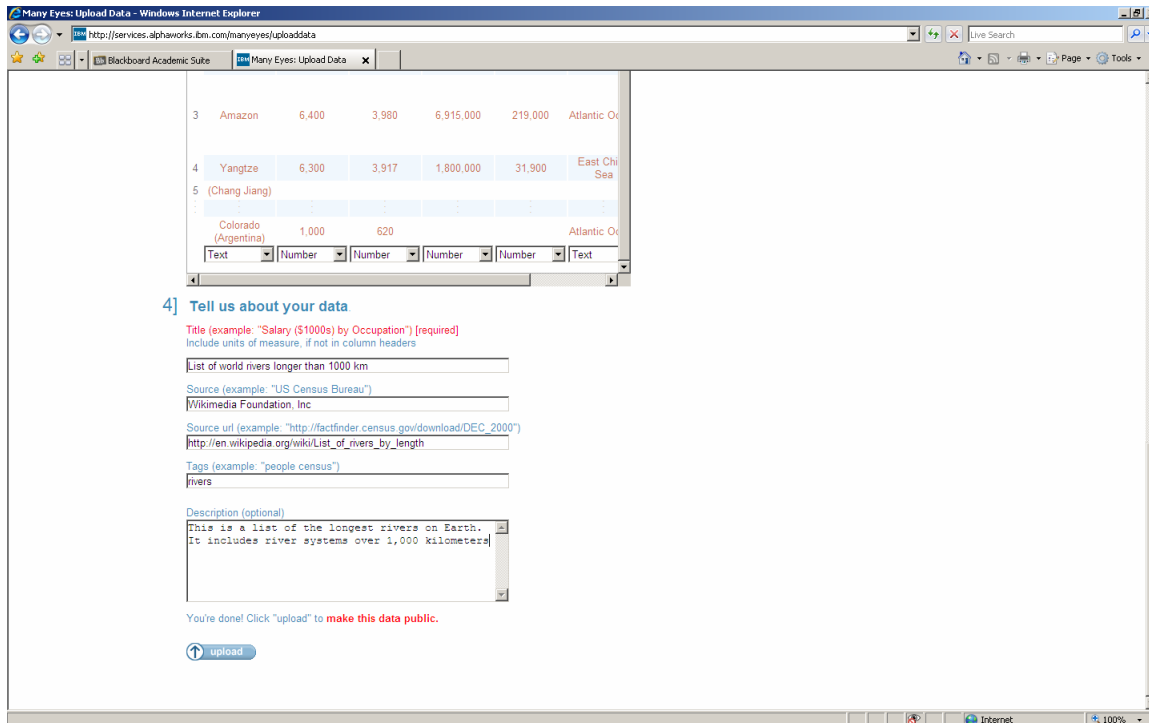


Figure 4 (Dataset description and verification by Many Eyes)

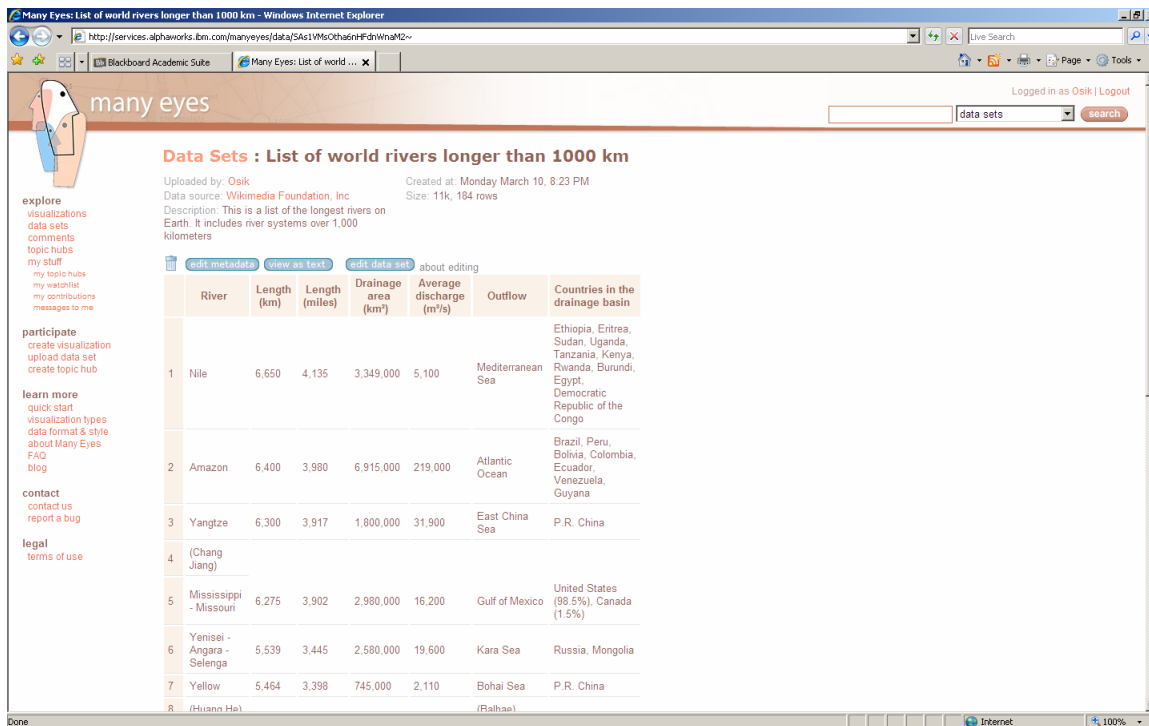


Figure 5 (Uploading the data to Swivel)

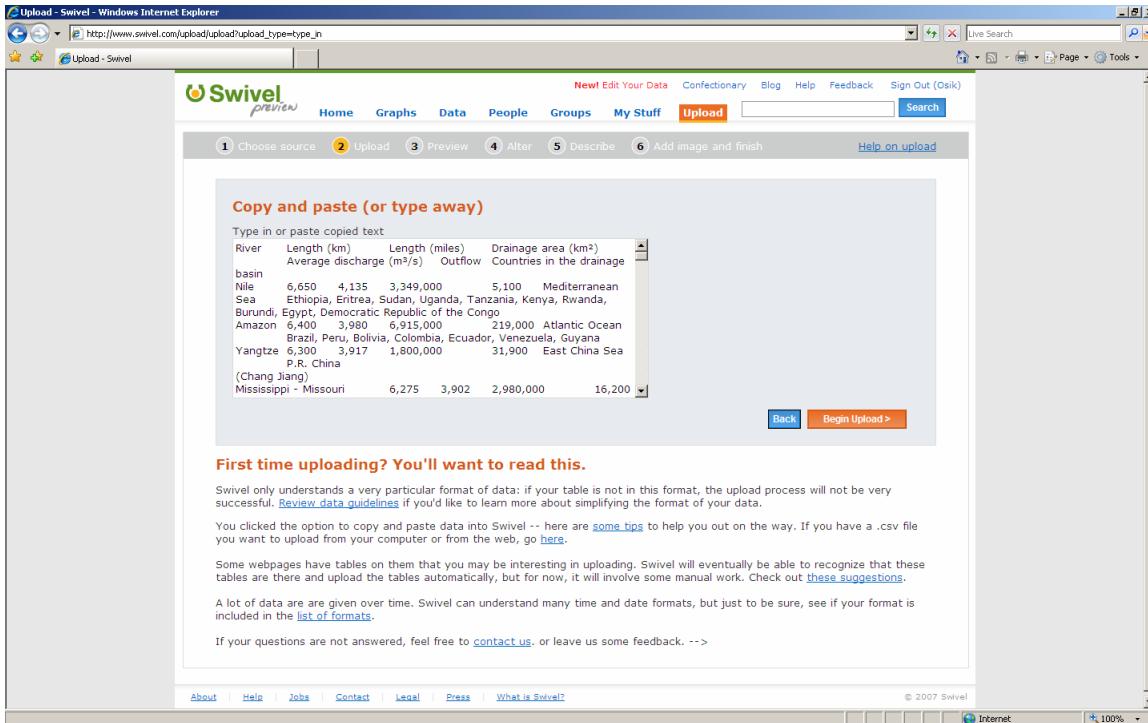


Figure 6 (Data upload confirmation and data type correction - Swivel)

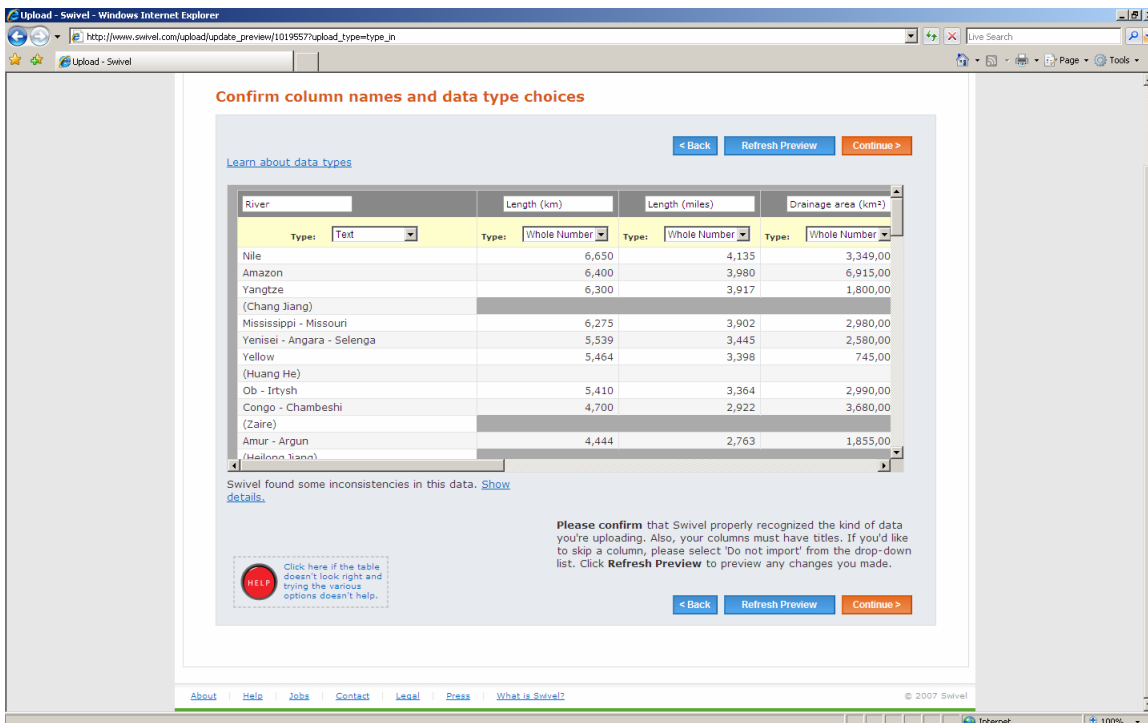


Figure 7 (error message after the data has been uploaded - Swivel)

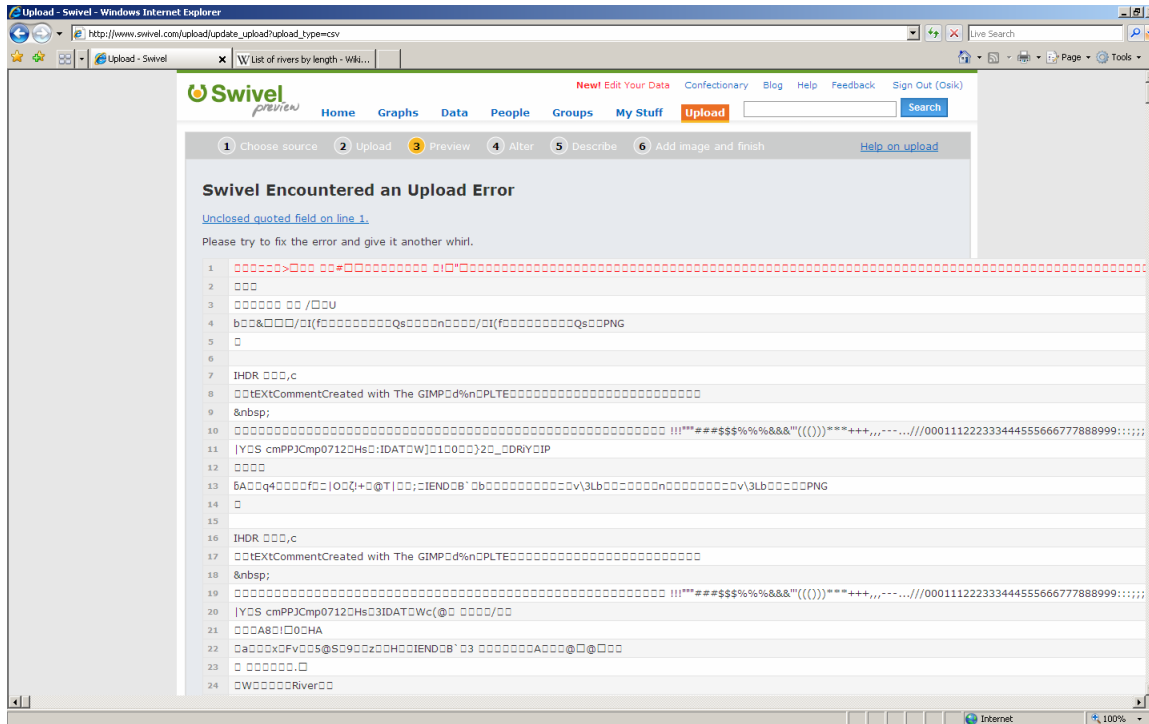


Figure 8 (upload summary and revision of data - Swivel)

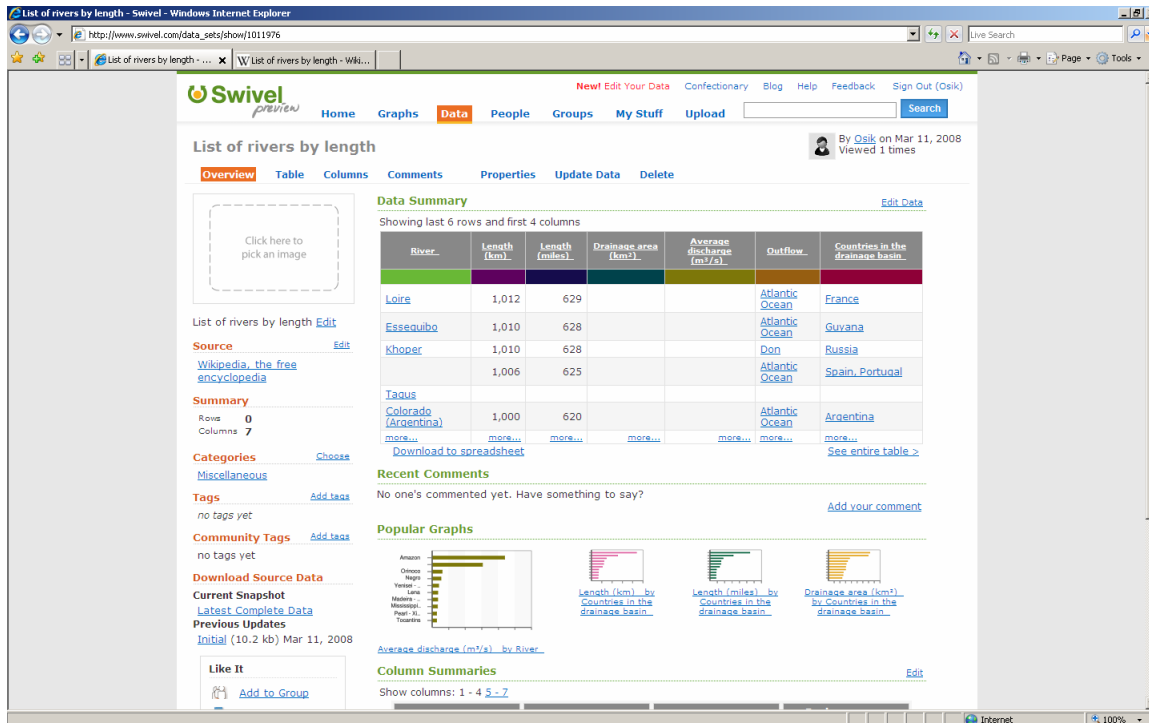


Figure 9 (Dataset in table format - Swivel)

River	Length (km)	Length (miles)	Drainage area (km <sup>2</sup> )	Average discharge (m <sup>3</sup> /s)	Outflow	Countries in the drainage basin
Nile	6,650	4,135	3,349,000	5,100	Mediterranean Sea	Ethiopia, Eritrea, Sudan, Uganda, Tanzania, Kenya, Rwanda, Burundi, Egypt, Democratic Republic of the Congo
Amazon	6,400	3,980	6,915,000	219,000	Atlantic Ocean	Brazil, Peru, Bolivia, Colombia, Ecuador, Venezuela, Guyana
Yangtze	6,300	3,917	1,800,000	31,900	East China Sea	P.R. China
Mississippi-Missouri	6,275	3,902	2,980,000	16,200	Gulf of Mexico	United States (98.5%), Canada (1.5%)
Yenisei-Angara-Selenga	5,539	3,445	2,580,000	19,600	Kara Sea	Russia, Mongolia
Yellow	5,464	3,398	745,000	2,110	Bohai Sea	P.R. China

Figure 10 (data type correction - Swivel)

Hide	Name	Color	Type	Aggregation Formula	Category?
<input type="checkbox"/>	Average discharge (m <sup>3</sup> /s)	#7D7709	Whole Number	total	<input checked="" type="checkbox"/>
<input type="checkbox"/>	Countries in the drainage basin	#8E0037	Text	high	<input checked="" type="checkbox"/>
<input type="checkbox"/>	Drainage area (km <sup>2</sup> )	#E4A41A	Whole Number	total	<input checked="" type="checkbox"/>
<input type="checkbox"/>	Length (km)	#DES9F	Whole Number	total	<input checked="" type="checkbox"/>
<input type="checkbox"/>	Length (miles)	#005F3A	Whole Number	total	<input checked="" type="checkbox"/>
<input type="checkbox"/>	Outflow	#965E11	Text	high	<input checked="" type="checkbox"/>
<input type="checkbox"/>	River	#441874	Text	high	<input checked="" type="checkbox"/>

Figure 11 (Graphs extracted from our dataset by Swivel)

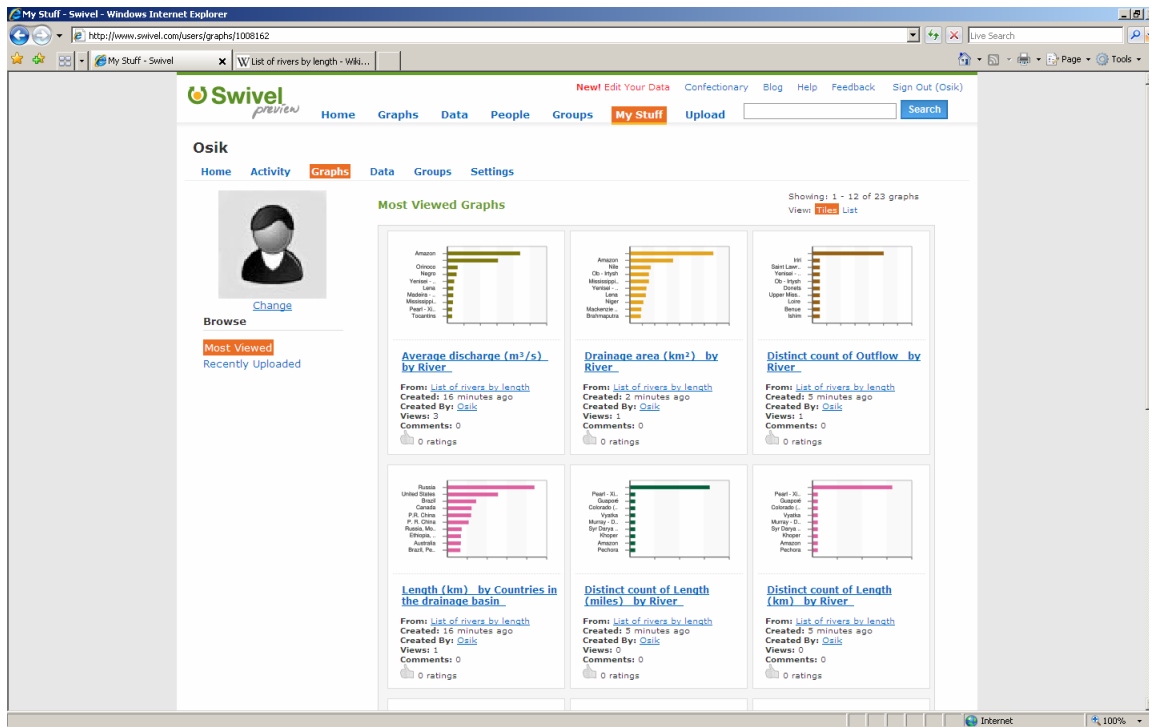


Figure 12 (Choosing a visualization type – Many Eyes)

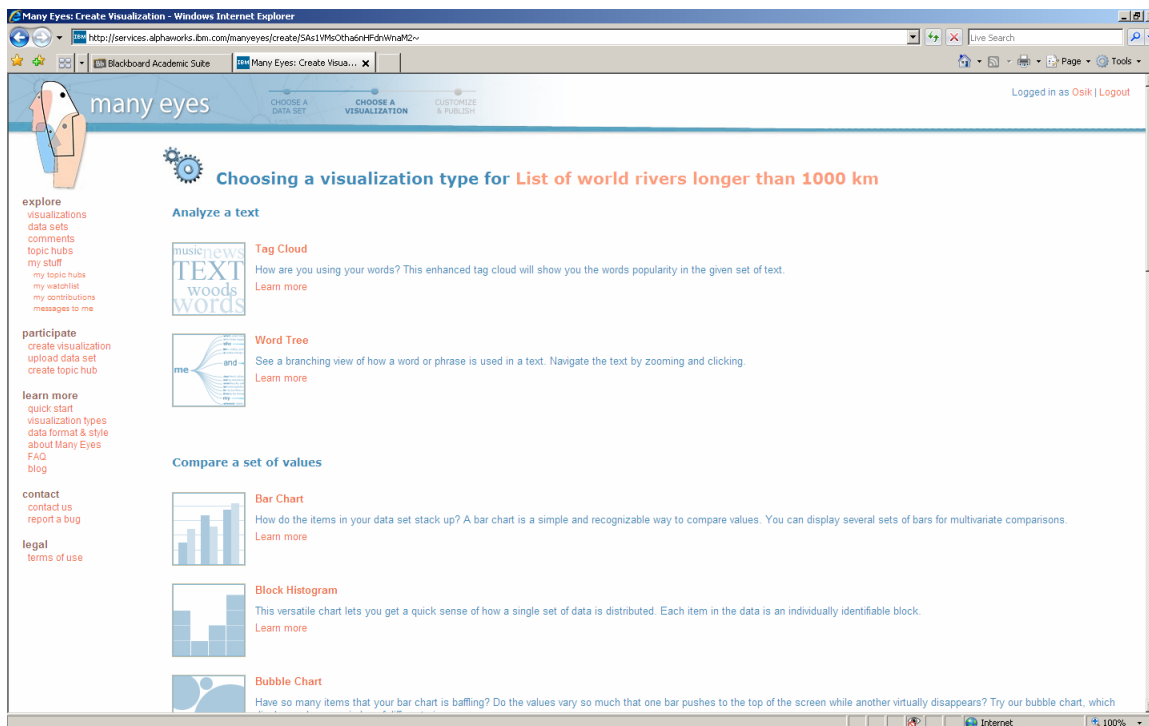


Figure 13 (This graph can be accessed here: <http://services.alphaworks.ibm.com/manyeyes/view/SAs1VMsOtha6vHVc8knaM2~>)

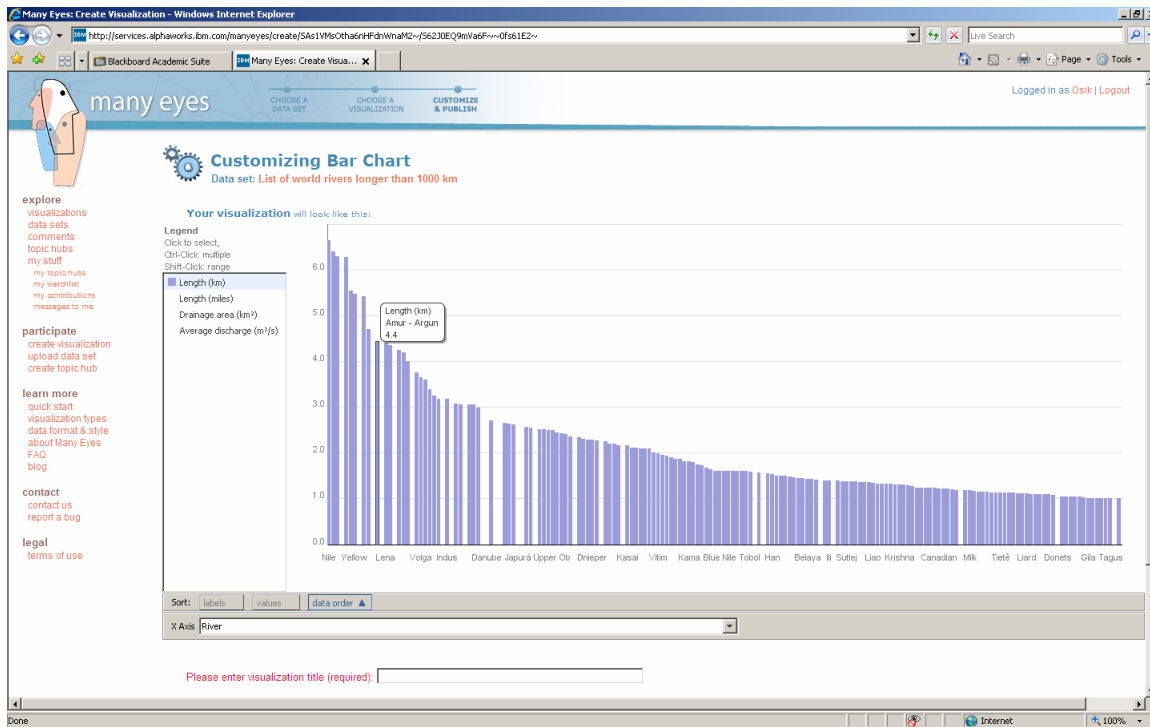


Figure 14 (This graph can be accessed here: <http://services.alphaworks.ibm.com/manyeyes/view/SAs1VMsOtha66IFH6unaM2~>)

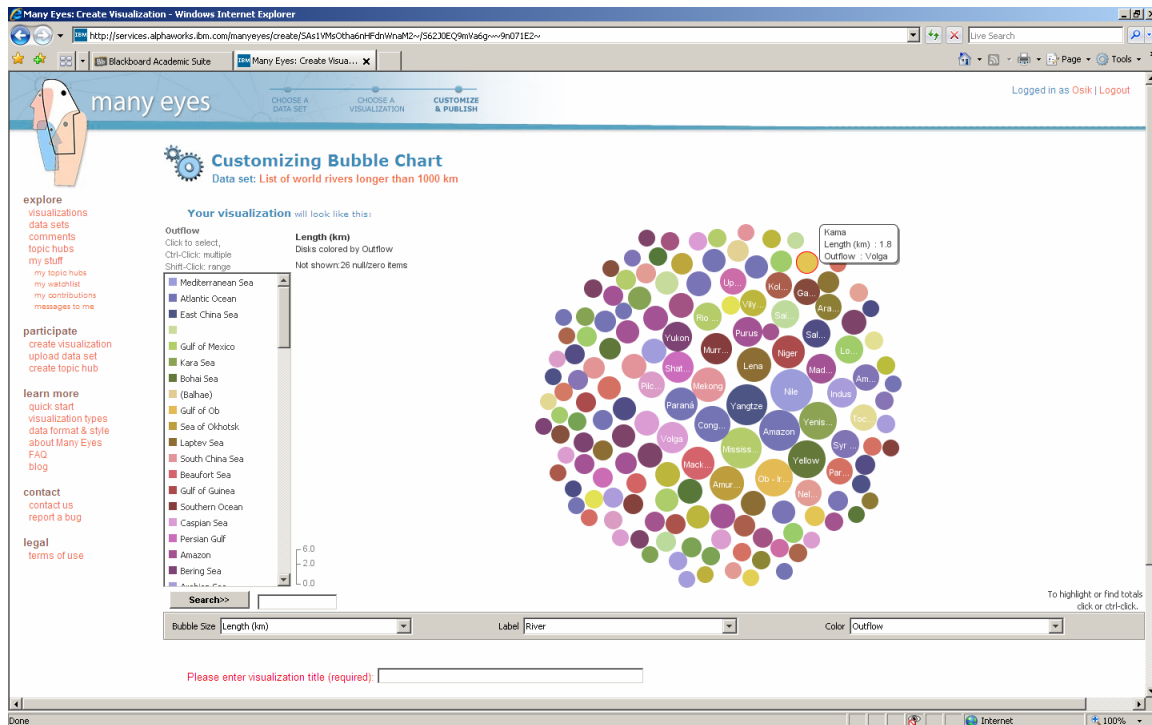


Figure 15 (selecting a different category to be graphed)

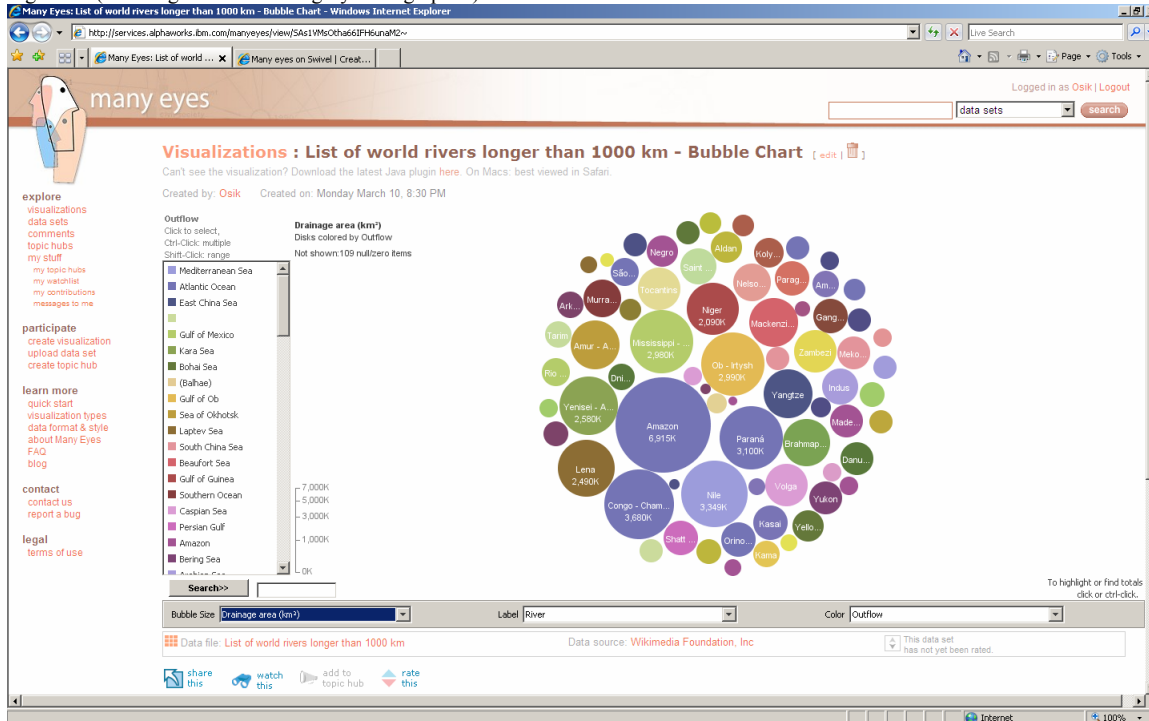


Figure 16 (highlighting data related by common property)

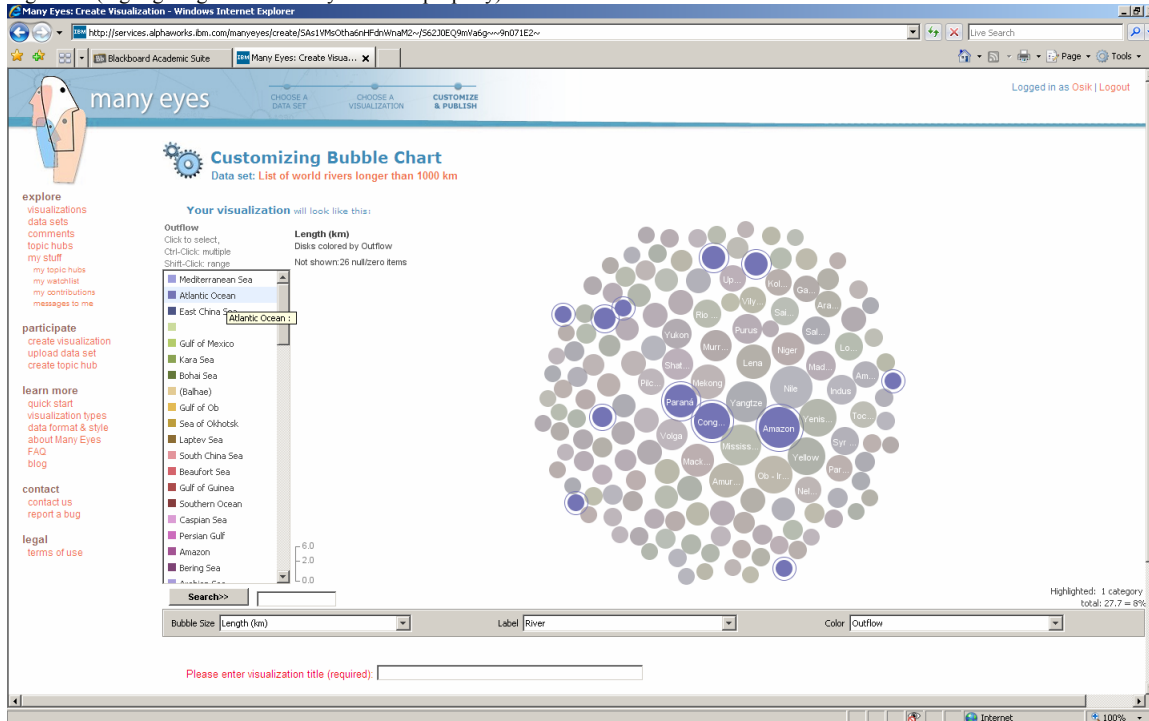




Figure 17 (our dataset visualized in Swivel)

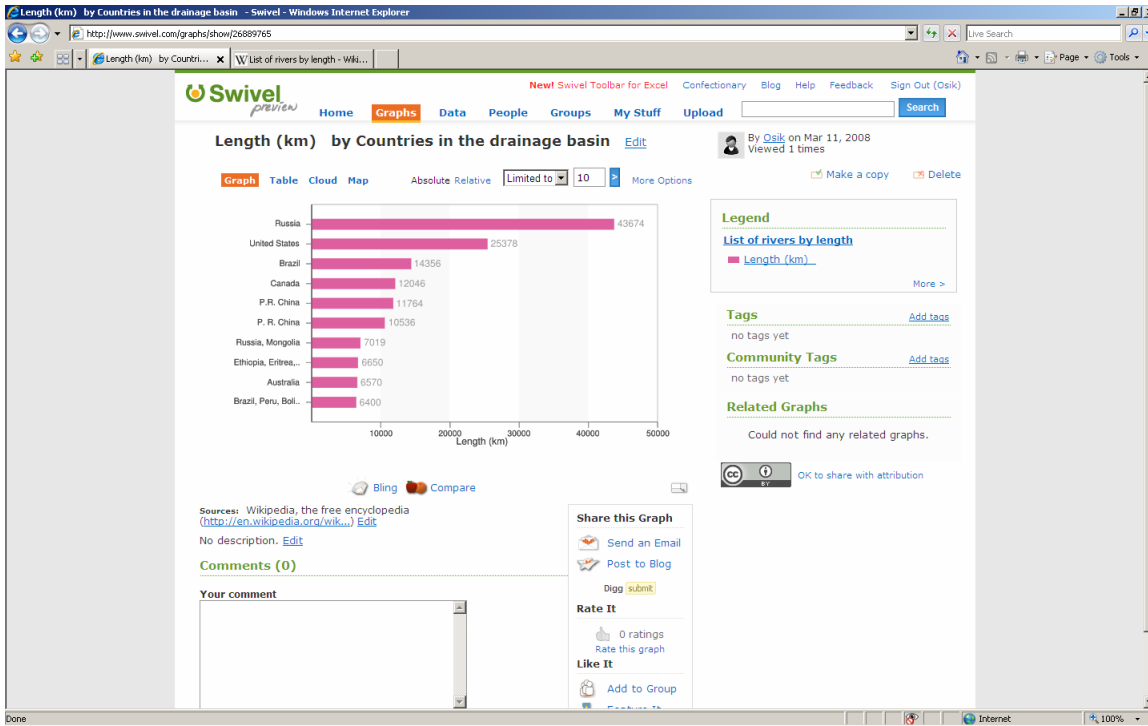


Figure 18 (our data represented in a form of the map - Swivel)



Figure 19 (Our Swivel work can be accessed here: <http://www.swivel.com/users/graphs/1008162>)

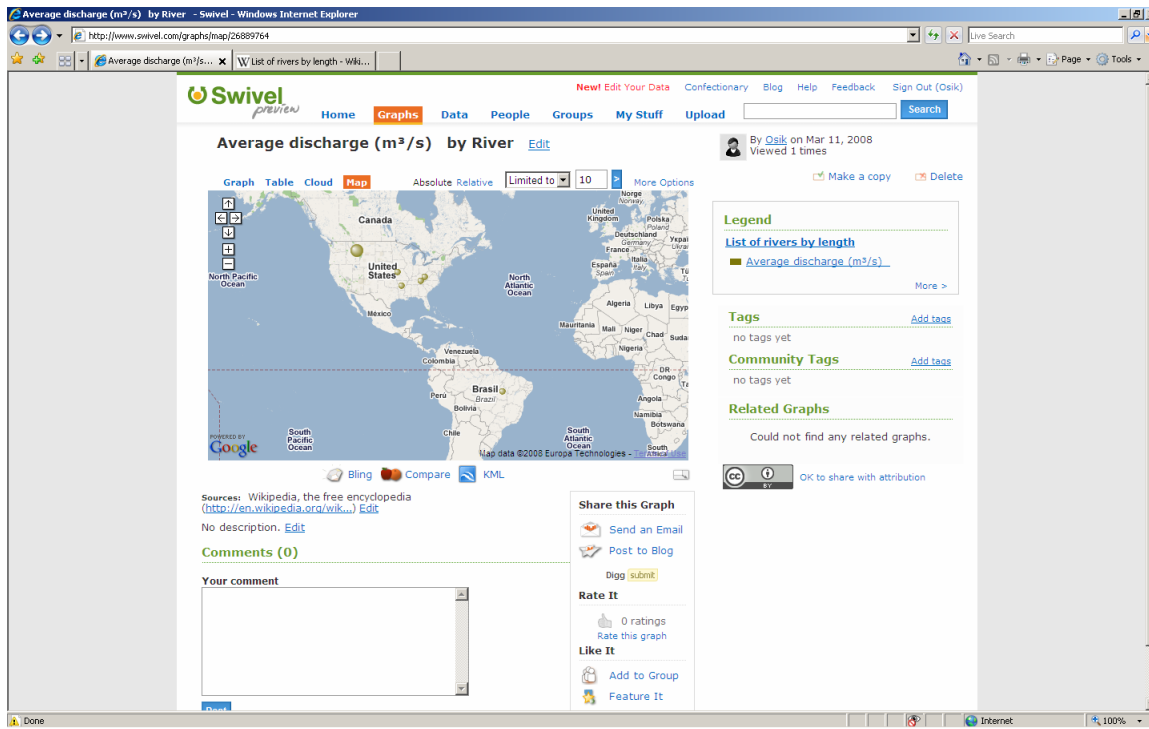


Figure 20 (cloud representation of our data in Swivel)

