Taking Decisions with Systems Oriented to the General Public

Applying Visual Information Based on Viennese Method

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Abstract. Business Intelligence (BI) systems are designed to provide a user friendly way to make reports, elaborate queries and take decisions based on data stored in a special type of database called data warehouse. Normally, BI systems provide a large variety of graphic tools for these tasks. Nevertheless they are all based in a very mathematical way of displaying data. This is reasonable to managers, economists and those familiar with mathematical tools. Nevertheless it can be inappropriate to use these tools when the report was designed to be exhibit to the general public. In this work we suggest to use the Viennese Method, or ISOTYPE, in order to deal with this type of situation. We also present an example where a BI system uses this method for a public transportation system.

Keywords: Information Systems, Visual Language, Viennese Method.

1 Introduction

There are two main approaches when we want to create a database system for a company. The first one concerns the usage of such database as a day-by-day tool involved in providing data for the operational level of the enterprise. This is the so-called OLTP (Online Transaction Processing) approach. The second approach is to develop an OLAP (Online Analytical Processing) system oriented to create reports that enable the managers of the company to take informed decision [7].

Moreover, this second approach entitles the managers to build their own reports in a friendly way without the need of any expert in IT (Information technology) contribution. Business Intelligence (BI) systems are designed according to this second approach. With BI systems, managers can take informed decision even when a vast quantity of data is employed [13].

Such systems use a special architecture that causes a strong impact on the way they are used. BI systems use the concept of dimensions of the enterprise as a model to

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create a metaphor, and sometimes the physical structure, of the data stored. Normally, sales date, sales employee, branch of the enterprise and product are mentioned as usual examples of dimensions [11].

A major element of a BI system is the graphic system employed to extract and portrays data stored in the system. Such graphic system must be user-friendly and with tools that facilitates the understanding and the decision making process. The reports created out of the BI system must present the most important feature of an information visualization analysis: the user must easily grasp what is unique and surprising about data being portrayed and observe trends and outliers in a effortless way [3].

Currently, we can find in BI systems a large collection of graphics tools for building and portraying reports. For instance, all graphics tools widely used in spreadsheets systems, as Excel, are available. Others mot so common tools like hyperbolic browsers, bargrams, mosaics, interactive histograms and digital cartography are possibly used as well.

Unfortunately, BI systems developers seem to be unaware of the importance of the work developed by the Viennese Method (or ISOTYPE) during the first half of the twenty century. It is really regrettable that little effort was conducted to include this type of approach to display social and business statistics in BI reports.

We may describe ISOTYPE as a graphical language originally developed by the Austrian social scientist and philosopher Otto Neurath (1882-1945). It was previously called Viennese Method in honor of the city that hosted the first ISOTYPE exhibition. Later, in England, to where Neurath had to evade during the world war two, the Viennese Method was renamed to the way it is known today [12].

It is proper to describe ISOTYPE as a language since we may discern syntax, semantics and pragmatics views in it. It is the acronym for International System of TYpographic Picture Education. Besides being involved in communicating social data for a broad audience, Neurath was also concerned about teaching this same audience how to read and interpret the data presented. Therefore it is also proper the word education inside the acronym ISOTYPE. The main goal of ISOTYPE is to entitle a broad audience to understand social, political, and economic data [8].

In a nowadays Business Intelligence scenario, an ISOTYPE chart would equally inform managers and ordinary workers of a company. Its goal is to develop an approach for communication of social and management data that fits both the laymen and the experts on the specific field being studied.

The first usage of Otto Neurath´s concepts resulted in one of the Information Visualization field masterpieces. The Atlas of social data in 1930, called Gesellschaft und Wirtschaft – Society and Economics – for the exhibition with the same name in Vienna, introduced some concepts that were later applied in several others situations [1]. As illustration, we may mention the usage of ISOTYPE concepts in wayfinding in airports, shopping centers, cultural centers and museums. Newspapers, scientific magazines, national statistics offices and NGOs (Non-Governmental Organization) are other examples of organizations that use to rely on ISOTYPE to display their data [8].

Nevertheless, despite this great acceptance of Neurath work, BI systems do not offer any ISOTYPE environment for building reports or tools based on it. The reason for this attitude may rely on the difficult to build algorithms that realize what Neurath described as the transformation phase of working over collected data. In this phase, data must be grouped in a proper way that facilitates further display and understanding about what we can conclude out of the data. In this article, we propose that BI systems could include ISOTYPE based tools for visualization.

We suggest the usage of ISOTYPE in an interactive way to simulate the transformation phase. The BI system must also include a knowledge based about the circumstances that make ISOTYPE an option for the visualization of the data being analyzed. Such knowledge base is built in a similar way to the case based expert systems from the Artificial Intelligence field.

In order to make these concepts more tangible, we developed a BI system, developed in Microsoft SQL Server, that create reports about the daily usage of the Rio de Janeiro underground transportation system according to ISOTYPE approach. The BI system is concerned with orienting the general population about how to avoid peak moments and select best routes. We show that a Neurath way of building reports is very much proper to be integrated in nowadays BI suite of tools for Information Visualization.

2 The ISOTYPE System

In [10], the authors suggest that design performs in its relation to science a role similar to the one performed by the classical view of philosophy. This latter is interested in analyzing knowledge generated in other sciences and evaluate the impact of this knowledge in our society. Design is interested in interpreting this same type of knowledge and creating objects that can be useful for people. Under this perspective, both design and philosophy may be regarded as meta-knowledge. Both have the necessity of dealing with the general public which is the main reason the Viennese method was conceived.

In Figure 1 we have an illustration of an ISOTYPE work. Neurath intention was to show the rate of deaths and births in Germany and to make very clear the years when the first surpasses the latter.

In this work, we can find some characteristics of Neurath system. The description of these characteristics are presented in a comprehend way in [8].

First we must use symbols to represent quantities. These symbols are called pictograms. In this picture we can see two main pictograms: babies, representing births and coffins representing deaths. In order to give the notion of amount of births and deaths, Neurath suggest repetition of symbols. He believed such repetition had a much better educative impact than making the symbol size proportional to the amount being represented [12]. Moreover, pictograms should be exhibited having equal spaces among them. Others Neurath suggestions can be also realized from this picture. Preferably, time should be shown in vertical axis and amounts and statistics in horizontal axis. Pictograms should be two-dimensional pictures. The usage of perspective should be avoided.

Neurath had a team to work on ISOTYPE graphics. In some moments this team involved 25 members and included Gerd Arntz, a graphic designer responsible for many ISOTYPE pictograms and solutions. Neurath divided his team in three main groups. The first one, called data collectors, was involved in collecting the data to be portrayed. The second group, called transformers, was involved in the process of analyzing, selecting, ordering and then making visual the information, data, ideas and implications involved [8]. Finally there was the artistic group, involved in creating the graphics.

In this work, we believe data stored in databases may be the result of the first group work. A designer is still essential to perform the transformer phase. Nevertheless, it should be accomplished with a further requirement. The basic idea of how to display the results should be scalable according to the amounts being exhibit. For instance, how could we remake Figure 1 for showing this same data for Austria rather than Germany? We believe an information system can be programmed to adapt a basic idea of displaying data to several different contexts. Finally, designers could perform the artistic group as well.

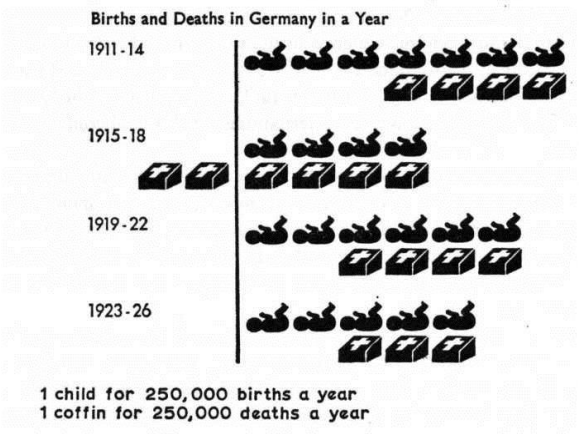

Fig. 1. Deaths and births in Germany from 1991 to 1926. Extracted from Lima (2008)

3 A Business Intelligence Systems Oriented to the General Public

In BI systems, it is very common to analyze data according to the facts stored and the several dimensions we can use to categorize those facts. We may illustrate this using the Rio de Janeiro underground transport system. Such system has two main lines, simply called line 1 and line 2, and each one of these lines have two directions. Line 1 has directions Saens Peña and Ipanema, and line 2 has directions Botafogo and Pavuna.

Rio de Janeiro underground transport system, called Metrô Rio, is able to control the number of passengers that enter each station. Through the usage of the turnstiles, it is also possible to monitor the direction each passenger takes. In BI terms, we

would call a fact each moment a passenger performs his or her trip involving two stations of the Metrô. Each passenger may be recorded by his or her ticket number.

The system we are going to use as illustration is supposed to communicate to the general public information about the intensity of the flow of passengers in different moments and dates. The public could rely on the reports generated by this system in order to decide the best moments and stations to perform their trips.

Each fact associates the passenger with the origin station of the trip and the destiny one. It also records the line direction and the line itself. The fact contains also the date and time when the trip occurred. In BI terms, we say that stations, lines, date and hour are dimensions for data. The time spent on the trip is called a measure for the system. All measures must portray numerical values associated with the fact being stored. The occupancy rate is regarded as a calculated variable. It shows an estimative of the occupancy of the average wagon on that trip.

Figure 2 shows the so-called Star Schema for the situation. The Star Schema is highly used in modeling BI systems. It describes how data is going to be regarded by those who are going to manipulate it. In [7] we may find a detailed introduction to the Star Schema concept.

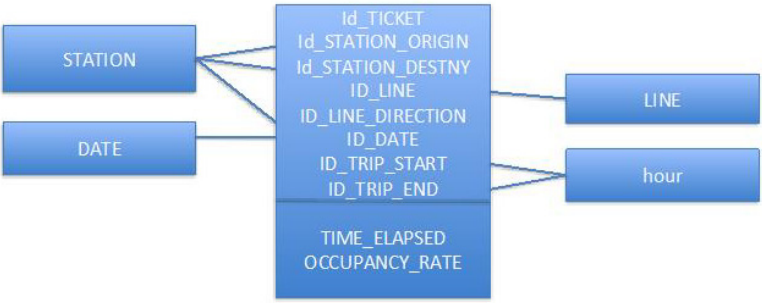

Fig. 2. Star Schema for the Rio de Janeiro underground system example

A BI system built around one Star Schema is called a Data Mart (DM). When we have several Star Schemas somehow interconnected the system is called a Data Warehouse (DW). Both types of systems are used to store huge amount of data and it is not uncommon to deal with BI system with trillions rows in their fact tables. Despite this storage capacity, the system is conceived to deliver reports and aggregated values in very fast and efficient way. Nevertheless, how this can be achieved and the techniques applied for it are beyond the scope of this work. Anyone interested in this aspect of a BI system is suggested to read [14].

4 Displaying Reports

In this work we are interested in showing an alternative way, based on Otto Neurath´s work, for display data stored in a DM or DW. For this, aspects of data storage are not relevant. Actually, BI systems tend to keep the data base structure transparent for their

users. It is very common also that a user is stimulated to access data using a spreadsheet system they are familiar with. For instance, Microsoft suit for BI, called Analysis Services, use Excel for connecting to BI systems. Therefore, users access and manipulate data as they were using a simple spreadsheet rather than a gigantic database [11].

The main tool for promoting interaction with BI systems is the Pivot Table [4-6].One of the best advantage concerning Pivot Tables is the use of a drag and drop procedure to select the rows and columns of the table or report we are interested in. In Figure 3 a report built by this way. It is shown the amount of passengers that entered and left Maracanã Station from 14:15 and 14:30. These quantities should be multiplied by 100.

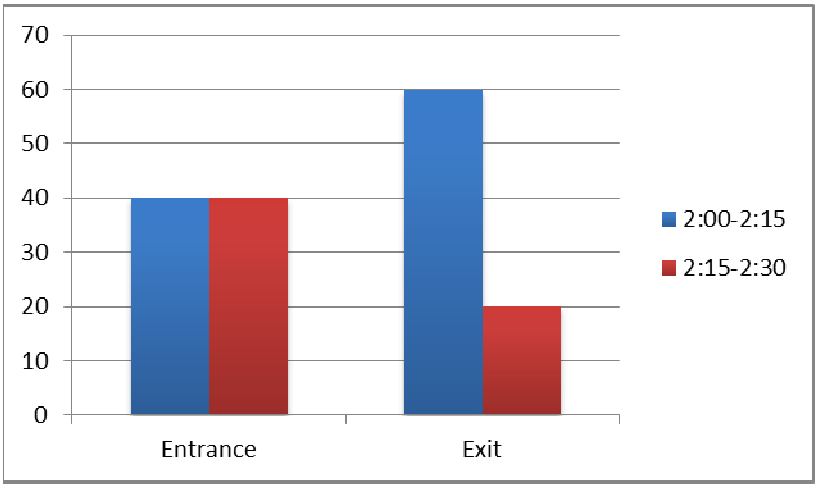

Fig. 3. Chart showing entrance and exit from an underground station

Nevertheless, the type of chart shown in this picture may be regarded as unfriendly for being used by the public in general. People tend to associate statistics in charts as a mathematical visualization and consider then hard to understand. In an underground transport system as Metrô Rio it is necessary a more friendly way to portrait reports.

5 ISOTYPE and BI Systems

A system oriented to provide numeric information for a broad audience must consider the difficulties people face to understand and analyze the quantities involved. Therefore we cannot disregard people resistance in dealing with charts, graphs and other mathematical tools to visualize numeric data.

ISOTYPE is a good option for dealing with this problem. It can even be applied to communicate statistics that come out of an information system. For instance, Figure 4 shows how data shown in Figure 3 could be portrayed using ISOTYPE. Basically, this type of solution displays quantities in a more familiar way to the layman who uses the Metro system.

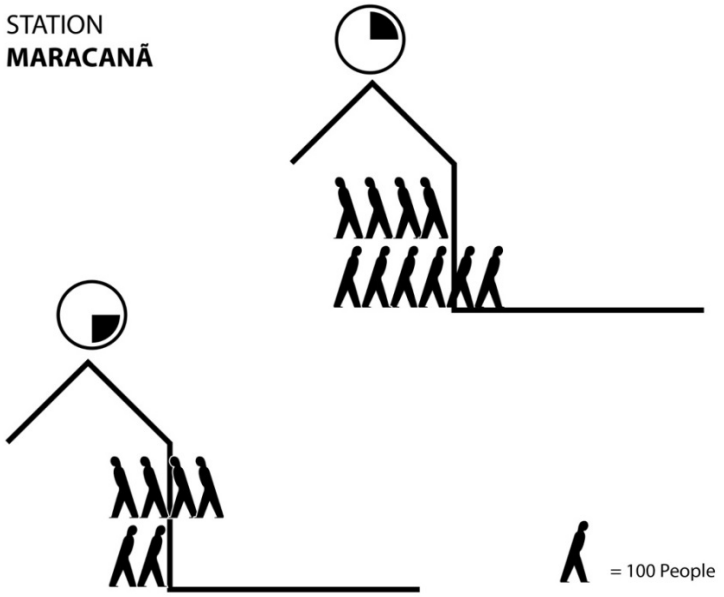

Fig. 4. Flow of passengers in an underground station

In order to use ISOTYPE associated with an information system, we need to provide scalable solutions. Therefore, we are no longer interested in building a solution to a limited and previously specified numeric set. We must find a framework that can fit the range of possible numeric data associated to the context being analyzed. Therefore, the solution shown on Figure 4 must be adaptable to data from other underground stations and for all moments of the day. In this solution, the ordinary user of Metrô Rio can take several conclusions more easily than observing Figure 3. In Figure 4 becomes quite clear that if a typical passenger waits more fifteen minutes, he or she is going to face a less busy station than it is now. Also the volume of the flow of passengers is more easily grasped by the pictograms shown.

Figure 5 shows a possible ISOTYPE solution for data concerning the flow of passengers using one of the lines available in Metrô Rio. Again, the solution provided was designed to portray data regardless of the stations involved or the moments selected. From this solution, users of Metrô Rio can easily realize that to wait fifteen further minutes would allow a much more confortable trip. In order to design this solution we imagined a typical 280 people wagon having 40 seats available.

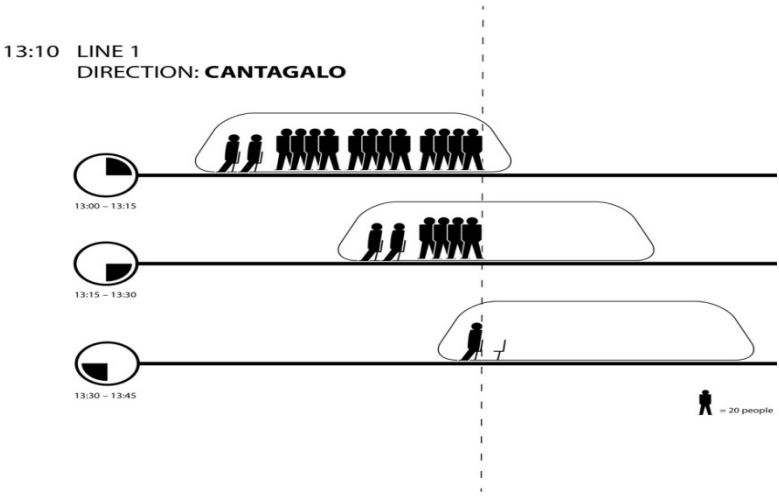

Fig. 5. Occupancy rate for the Rio de Janeiro underground example

6 Conclusions

In [12], the authors state that there are two main types of statisticians. The first one writes for specialized audiences, familiar with statistics jargon, and well versed with mathematical tools to visualize data. The second group is concerned with showing data to the general public and how this audience will be able to interpret, take conclusions and make decisions over the data displayed.

Otto Neurath is certainly part of this second group. Although his ideas were introduced in a pre-computer era, they are still valuable resources for communicating data generated by modern BI systems for broad audiences.

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