

The Meta-Morphing Model Used in TARGIT BI Suite

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Abstract. This paper presents the meta-morphing model and its practical application in an industry strength business intelligence solution. The meta-morphing model adds associations between measures and dimensions to a traditional multi-dimensional cube model, and thus facilitates a process where users are able to ask questions to a business intelligence (BI) system without the constraints of a traditional system. In addition, the model will learn the user's presentation preferences and thereby reduce the number of interactions needed to present the answer. The nature of meta-morphing means that users can ask questions that are incomplete and thereby experience the system as a more intuitive platform than state-of-art.

1 Introduction

According to leading industry analyst, Gartner, ease of use has surpassed functionality for the first time as the dominant business intelligence platform buying criterion [5]. This change represents a shift from prioritizing the IT department's need to standardize to prioritizing the ability for casual users to conduct analysis and reporting.

Ease of use, in the decision processes that managers and employees go through, has been the focal point in the development of TARGIT BI Suite since its early version in 1995. However, different from other solutions that seek the same objective, TARGIT has methodically applied the CALM philosophy [1], which seeks to create synergy between humans and computers as opposed to using computers simply as a tool to create efficiency. In the CALM philosophy, the entire organization is divided into multiple observe-orient-decide-act (OODA) loops and computing is applied to make users cycle these loops as fast as possible, i.e., with as few interactions as possible. The patented meta-morphing [4], described in the following section, allows users to analyze data by stating their *intent*, and thus facilitates users cycling OODA loops with *few interactions*.

2 The Meta-Morphing Model

The meta-morphing model is an extension of the cube model traditionally used in a data warehouse where associations between measures and dimensions, as well as, presentation preferences are included. As a prerequisite for the meta-morphing model, we assume that the data has been organized in measures (numerical data) and dimensions (entities for which measures will be listed, e.g., time periods, products, etc.), and that these measures and dimensions are organized in one or more cubes. Whether the cube structures are materialized or virtual is irrelevant to the functionality.

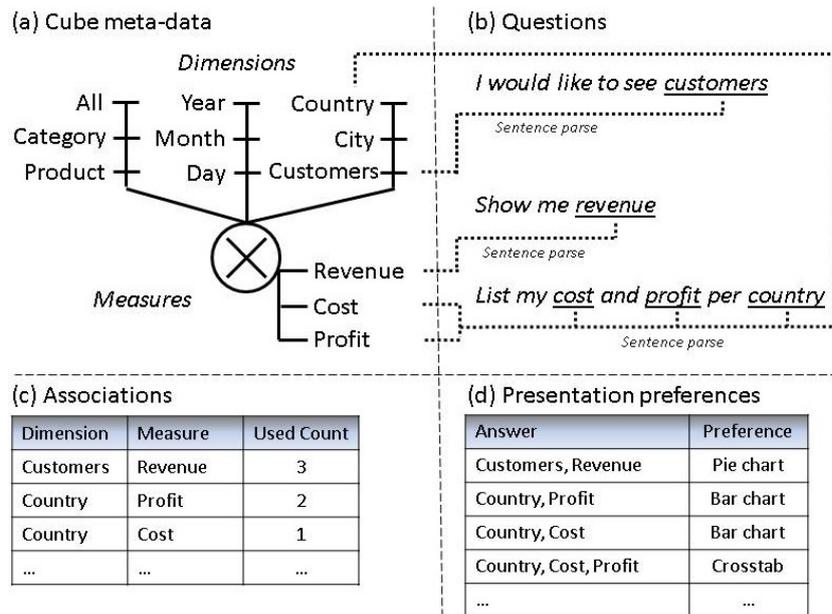


Fig. 1. The meta-morphing model

The meta-morphing model, shown in Figure 1, facilitates the following four steps:

1. A question is parsed into a set of one or more measures or dimensions.
2. If the question is incomplete (meaning that it has either only dimension(s) or measures(s)) then an *association* with the most relevant measure (if question had only a dimension) or dimension (if question had only a measure) is created.
3. A query based on the associated measures and dimensions is executed on the cube.
4. The preferred presentation of the returned data is selected given by either the *user's preferences* (earlier behavior) or if no previous "experience" exists an expert system will determine the presentation based on the size and shape of the returned data. The returned dataset is displayed to the user with the presentation properties identified.

Example: A user submits the question "I would like to see customers".

Step 1 parses all words in the sentence representing the questions (Figure 1(b)), and these words are subsequently matched against the meta-data of the data warehouse (Figure 1(a)). If a word in the sentence is not matched in the meta-data it is simply thrown away. The output from Step 1 will be a set of dimensions and/or measures; and if the set is empty, the meta-morphing process is simply terminated. In our example, the only word that will remain from this parsing is "customers".

Step 2 compensates for the problem of the user's question containing only measures or dimensions. In a traditional system, asking incomplete questions like "I would like to see customers" or "Show me revenue" would at best return a list of customers (the members of the customer dimension) or the sum of revenue for all data in the data warehouse. By creating an association between measures and dimensions (Figure 1(c)), the system will learn the *individual user's* behavior based on what he clicks, e.g., if he clicks to select revenue and customers at the same time, then an association between

revenue and customers will be created. Therefore, the answer to both questions will be a list of customers with their respective revenue. Associations are also created while the user loads any analysis, meaning that he does not need to actively pose a question including the association. This means that the user will simply feel that he is receiving information in the way he is used to. In the event that a user has never seen or asked for a given relationship, the meta-morphing process will look into which dimension or measure the user most often uses, and then create an association that is used most often, i.e., the measure or dimension from the association with the highest Used Count (see Figure 1(c)). The output of Step 2 is a combination of measures and dimensions.

Step 3 is, given the output of Step 2, a trivial query in the data warehouse retrieving “revenue” for each member on the “customers” dimension. The output of this step is a dataset as well as the dimensions and measures used to provide it.

Step 4 preferences are created for each user given the way they would normally see an answer given its dimension/measure combination, e.g., customer/revenue is usually displayed as a pie-chart (see Figure 1(d)), profit per country is usually displayed as a bar-chart, etc. Given the “experience” with the user’s preferences that are collected whenever the user sees or formats a piece of information, the dataset received from Step 3 is formatted and displayed to the user. In the event that no preferences have been collected for the user, an expert system will inspect the dataset and make a call for the best presentation object (pie, bar, geographic map, table, etc.), this expert system is based on input from a TARGIT BI domain expert. In our example, the returned revenue for each customer will be presented as a pie chart based on the data in Figure 1(d).

Using the meta-morphing model, users are able to pose incomplete questions that will still return relevant answers, while at the same time save the users a number of interactions in formatting the dataset returned since these are already known to the system. In other words, the user will be guiding the system with his intent, and the computer will provide him with the best fitting output based on the his individual preferences.

Another interesting aspect of meta-morphing is that it will allow the user to ask questions in human language as opposed to a database query language, which will allow a much more natural intuitive feel to the application that exploits the process. In particular, with regards to speech recognition, the parsing of question to meta-data in Step 1 will mean that the recognition will be enhanced simply from the fact that fewer words will be in the vocabulary, as opposed to a complete language. The combination of meta-morphing and speech is also a patented process [3].

3 Meta-Morphing in the TARGIT BI Suite

The TARGIT BI Suite is recognized by analysts as being one of the leading global business intelligence platforms with more than 286,000 users World-wide. Although no specific usability study has been conducted, the TARGIT BI Suite has been surveyed by leading industry analysts to have a unique strength in its ease of use achieved by reducing the number of interactions that a user needs to conduct in order to make decisions [5]. The so-called “few clicks” approach has been demonstrated to allow users to easily interpret the datasets displayed using automatically generated explanations [2].

In the TARGIT BI Suite, the meta-morphing process is integrated such that users

have the option of activating it dynamically in three different scenarios: guided analytics called *Intelligent Analysis*, a quick drag-drop function called *TARGET This*, and finally, an analytical link to all dashboards and reports known as *Hyper-Related OLAP*. **Intelligent Analysis** allows users to compose sentences similar to our example in the previous section by clicking on meta-data in a semi-structured environment. Once a question is posed, the process using the meta-morphing model can be activated.

TARGET This is a drop-area to which either a dimension or a measure can be dropped, and upon “release” of the item dropped, the process using the meta-morphing model will commence with the question “I would like to analyze [measure or dimension]”.

Hyper-Related OLAP is perhaps where the most powerful results are achieved by the meta-morphing process. Hyper-Related OLAP allows the user to click any figure in the TARGET BI Suite in order to analyze it. Since any figure presented on a business intelligence platform is a measure “surrounded” by dimensions (either as grouping or criteria), the process using the meta-morphing model can be activated by a single click at any figure, with the question “I would like to analyze [measure]”. This gives the user a starting point for analyzing any figure whenever he sees something he wants to investigate further. This functionality significantly reduces the time and interactions needed from whenever a problem is observed to when an analysis can be conducted in order to reach a decision with subsequent action. In other words, Hyper-Related OLAP directly assists the users in cycling their individual OODA loops with fewer interactions.

4 Conclusion

This paper presented the meta-morphing model and showed its practical application in an industry strength business intelligence solution. It was specifically demonstrated how the meta-morphing model will allow users to freely pose questions in human language, including in speech, and subsequently receive a presentation of the answer in accordance with their preferences. It was demonstrated how the meta-morphing model can contribute with greater ease of use by reducing the number of interactions needed in data analysis. Moreover, it was demonstrated how meta-morphing can reduce the time and interactions for users cycling an observation-orientation-decision-action loop.

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References

1. M. Middelfart. *CALM: Computer Aided Leadership & Management*. iUniverse, 2005.
2. M. Middelfart and T.B. Pedersen. Using Sentinel Technology in the TARGET BI Suite. *PVLDB* 3(2): 1629–1632, 2010.
3. M. Middelfart. *Presentation of data using meta-morphing*. United States Patent 7,779,018. Issued August 17th, 2010.
4. M. Middelfart. *Method and user interface for making a presentation of data using meta-morphing*. United States Patent 7,783,628. Issued August 24th, 2010.
5. R.L. Sallam, J. Richardson, J. Hagerty, and B. Hostmann. *Magic Quadrant for Business Intelligence Platforms*. www.gartner.com/technology/media-products/reprints/oracle/article180/article180.html, as of April 28th, 2011.