Behavioral Based Visual Queries

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Motivation

Multi-dimensional data is ubiquitous yet extremely difficult to analyze.

- The basic way to organize multi-dimensional data is to use a table format. Working with large amounts of data quickly makes the table organization unwieldy causing people to experience information overload.
- People can extract meaningful information from the data through the use of a specialized query language, but problems still exist. Query languages often require an aptitude for logical relations and explicit training on the syntax of the language. Furthermore, no amount of training can overcome gaps in the expressiveness of the query language.
- Another approach to dealing with multi-dimensional data is the use of visualization. The interpretation of a visualization is largely subjective as it requires the viewer to make personal judgments. The display is statically created, using pre-established parameters instead of user-defined input.

Approach

- Dynamic queries are formed using common interface components
- The avatars are guided by behavior based animation. For example, attract if similar; repel if dissimilar.
- The results of the query are found through the interpretation of avatars response to user initialized stimuli.
- Each row of a database table is represented by a visual data avatar that is programmed with certain behaviors.

Types of Queries on Multi-Dimensional Data

- Similarity
  - User expresses acceptable degree of noise.
  - Elements within the threshold move together forming clusters.
  - By dynamically adjusting the threshold the viewer can gain an appreciation of the different levels of similarity that exist.
- Specified Criteria
  - User sets criteria points that define a specific range of values for a given dimension.
  - Those avatars with the ideal values as defined by the range will gravitate towards the criteria point.
  - The use of multiple criteria points, groups form based on which criteria are met; these groups can be interpreted in a manner similar to that of Venn diagrams.

User Query and Venn Diagram
(Note: the circles are added for the purpose of discussion and are not present in the actual interface)
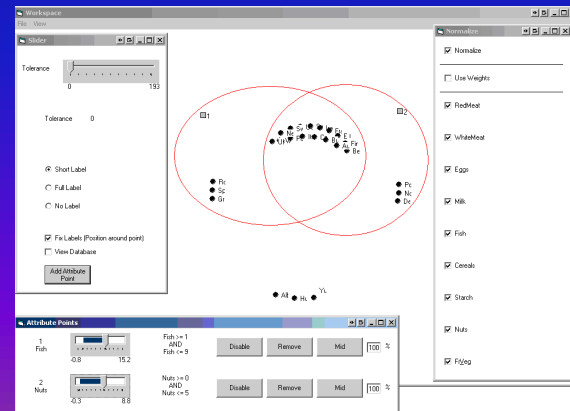
Benefits of Approach

- Multi-dimensional data is more manageable.
- Behaviors induce transitions. Viewers can see change through animation. The question of what is different between two settings is easily answered by watching animation. This solves the problem of overload since the big picture can be seen. It also solves the problem of static approaches since the user can dynamically change the query and see the results of the change.
- Manually moving points can confirm relative location and overcome minima in the data. This means the visualization is not static to the user.
- The viewer participates in the rules for making the visualizations, effectively lessening subjectivity.
- The user does not have to know logical relations before using the criteria driven query. Criteria points can be placed on the workspace and then the groups can be examined to find the wanted points. This always for a logical break down of the data under certain criteria. This eliminates the need for extensive training in the syntax of a query language.
- Sliders and other familiar interface components make forming a query simply; again removing the need of training in a query language.