Population Movement

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Problem Statement

In General
Visualization of large data sets for periodic population movement in a defined geographic region.

Specific Case Study
The Department of University Residence Halls (URH) has for some time collected records of students moving between dormitories on campus, yet has never applied the information to an analysis. They are specifically looking to

Despite their awareness of this short time commitment,
dormitories on campus, yet has never applied the

They want to characterize time patterns of relocations (e.g. times of the year). This will have a direct effect on staffing requirements and moving logistics.

Solution

Interface
We have designed a 2D Interactive Map in which the strongest visual attributes address the information analyst’s most important questions. Graphical elements such as city blocks, buildings, and relocation links are initially part of the same layer of the map. As they gain importance, they move to the foreground while assuming a more dominant hue and contrast.

Relocation Links
Relocations links between two given buildings are drawn with curving clockwise links; the increasingly curved arcs sharply home in on the target object, while the clockwise flow further reinforces the direction of travel. This design was selected from several iterations (see the section Implying Motion with Link Shape below).

Periodic Filter
The time period over which data is presented can be interactively changed and manually animated by using the time slider (see section Interface Tools below).

Acknowledgements
Discussions with W. Bradford Paley were the source of the representation of relocation links and color choices and were fruitful in helping to keep the visual representations driven by the needs and expectations of the analysts rather than just the structure of the data.

Implying Motion with Link Shape

Straight Lines

Uniform Curvature

Decreasing Curvature

Increasing Curvature

The simplest method of representing

buildings with directed straight lines (vectors). This does not intuitively
distinguish direction other than by means of arrow heads.

Here, the arcs were given a uniform

curvature to visually separate incoming from outgoing links. This

may also help distinguish rectilinear buildings from curvilinear links in an
earlier stage in visual processing.

These two representations, the profile of the curve was changed from a simple circular arc to one with an ever increasing curvature. This makes it easier to visually distinguish the beginning from the end of an arc, and complements the use of a directed arrow. Additionally, this design opens up the previously denser display. We are still almost ambivalent about which of these two better implies motion. Help us out and vote!

Interface Tools

Two-sided Time Slider

Relocation data can be selected in bounded periods of time using the two-sided Time Slider, a tailored version of the one introduced by Shneiderman. Lower and upper bounds are determined separately by movable arrows, while the period can be moved as a fixed-length unit.

An embedded histogram summarizes the overall activity for each period. Bar heights are scaled logarithmically to account for large differences between time periods.

Summary Card

The program displays relocation summary “cards” for each building selected; they provide a numerical summary of the relocation data for the selected time period. Cards can be moved freely within the interface remaining stationary with respect to the window, or pinned to the map like a PostIt note.

Data Model and Interoperability

In a one-time pre-process step, a bitmapped geographical map is vectorized to create a list of polygons, with fill colors used as an index, then stored in a text file. A second text file maps colors to building names. A third contains relocation matrices for each time period for the relevant buildings.

Using this data model any geographical area can be presented in the visualization tool, including cities, building floor plans – even material of a non-geographical nature.