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Overcoming Display Boundaries for Multiple View Visualization

Abstract

In the field of information visualization **multiple linked views** and **focus+context** are well known methods to visualize complex data. However, when presented on a single planar display, the arrangement of multiple views is challenging. In this poster we present a **multi-display environment** that can be adapted to the employed views and thereby mediate focus and context information.

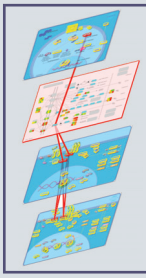
Motivation

A big challenge in information visualization is the arrangement of data in order to fit a given display. The increasing usage of large scale displays solves the problem only partially. While display walls provide a large physical space to spread multiple views - thereby providing access to multiple observers - the placement of views on the large display area still remains a challenging task. A straightforward side by side arrangement of views may lead to an undesired mental effort to identify relevant information and its context.

We propose the utilization of an adaptive multi-display environment for information visualization with multiple linked views. Considering the intended views and associated interaction techniques, the displays can be arranged taking into account existing room structures and providing well fitting display space for each view.

GeneView Visualization Framework

In the field of systems biology, cellular functions in living cells are modelled as a large collection of so-called pathways. From the computer science perspective pathways are planar graphs. Due to the fact that a huge and complex network is artifically flattened to a set of pathway graphs, the individual graphs are highly interwoven. Therefore, experts from the biomedical domain are not only interested in a detailed view on a specific pathway but also in the interconnections to related graphs. This interactive visual data mining process using multiple views is supported by GeneView. The system employs prominent information visualization techniques as linking & brushing, details-on-demand and focus+context.

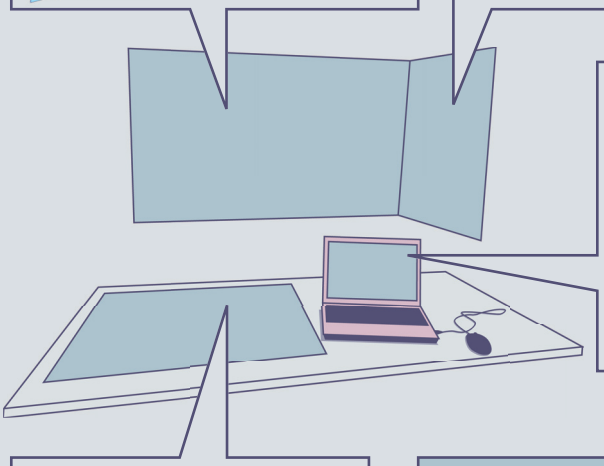


2.5D Pathway Stack View

Navigation in the network of pathways is facilitated by a stack of planes. Upon node selection in the focus pathway, the system dynamically loads graphs that contain the same entity to the stacked representation. Multiple occuring entities are visualized by connection lines among the layers. The user can switch a pathway to the focus view by simply picking the pathway.

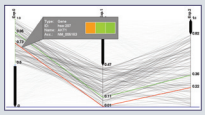
Browser View

Following the details-on-demand paradigm information about selected nodes is loaded to the integrated browser view.
The browser is connected to major database websites and shows detailed information about genes, enzymes, protein structures and other pathway entities. This knowledge is essential to understand the complex network.



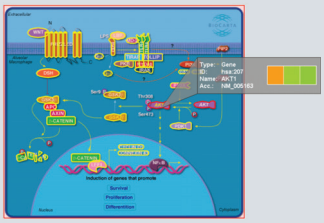
Parallel Coordinates View

The parallel coordinates show additional information about the selected pathway node. In this view the user can filter data for the selected pathway.



Focus Pathway View

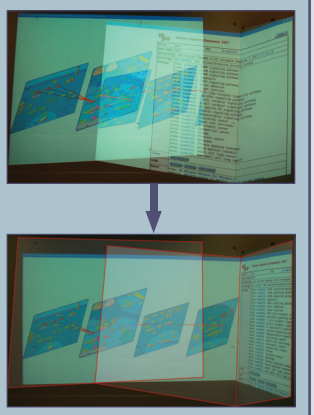
The table top projection contains the pathway which is currently under users' inspection. Nodes in the graphs are superimposed onto the pathway textures. Triggered by mouse-events, selected nodes are propagated to dependent views.



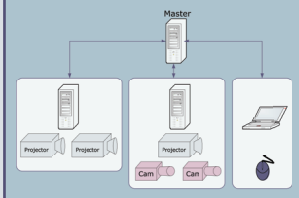
A multi-display environment naturally supports the multiple view approach of GeneView. The selected views for a given medical task may differ in their degree of interactivity, their relevance to the task, and how much detail is required. Derived from their properties the user chooses an appropriate size, resolution, and proportion for the view. By accommodating the display environment the user can control the oberservers' attention not only by the visualization but also by the properties of the display setup.
In our prototype setup GeneView was employed with four different linked views. We chose the high resolution table projection close to the users as primary focus view showing a detailed view of a selected pathway. The contextual information is provided by the pathway stack shown on the large wall projection, next to the browser view for additional meta-information. The user controls the cursor from his laptop where the parallel coordinates view provides detailed information about the selected pathway.

Multi-Display Setup

We developed a distributed multi-display system that registers all display devices within the environment using a projector-camera system and compensates for perspective distortions due to oblique projector angles on multi-planar surfaces. Overlapping projected areas are blended to create large displays. Geometric warping and edge blending are implemented as plugins for an OpenGL-based compositing window manager.



Based on a 3D model of the displays obtained from the calibration process, so-called cursor transitions are defined, so the cursor may cross over to another display - possibly driven by another machine. This allows for a seamless cursor interaction between displays and machines within the environment.



All distributed components of the system are organized in a software framework with three layers. The top layer features a singleton master application. On the second layer server applications are forked on each display host. These in turn fork a number of client applications such as the compositing window manager.

GeneView on Multiple Displays

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