Graph-Drawing Contest Report

Therese Biedl[1] and Franz J. Brandenburg[2]

[1] Institute of Computer Research
University of Waterloo
Waterloo, Ontario, Canada N2L 3G1
biedl@magnolia.math.uwaterloo.ca
[2] Universität Passau
94030 Passau, Germany
brandenb@informatik.uni-passau.de

Abstract. This report describes the Eight Annual Graph Drawing Contest, held in conjunction with the Ninth Graph Drawing Symposium in Vienna, Austria. The purpose of the contest is to monitor and challenge the current state of the graph-drawing technology and to display artistic work related to graph drawing.

1 Introduction

Text descriptions of the four categories for the 2001 contest were available via the World Wide Web (WWW) and announced with the Graph Drawing Symposium. The data of the challenge graphs was provided in GML format. Only fourteen separate submissions from eight teams were received, seven teams had at least one German team member. The winners were selected by the jury members Therese Biedl, Franz J. Brandenburg, Peter Eades and Joe Marks. The winning entries are described below, and are available under http://www.infosun.fmi.uni-passau.de/GD/GD2001.

2 Winning Submissions

2.1 Category A

The graph for Category A has an intimate relation to the Graph Drawing Symposia. It is the GD2000 self-citation graph. There is a node for every paper in the proceedings of GD94 to GD2000, and an arc if a paper refers to another GD paper. The citations are restricted only to the proceedings, thus the data is not suited for an analysis and ranking of GD contributions. The data was created by Susanne Lenz, Passau, using Graphlet.

The graph has 311 nodes and 647 edges. It has 52 isolated nodes and 5 isolated edges. There was one erroneous arc (GD94/143, GD98/423) which should have been reversed. There are four small cycles by mutual references in the GD94 and GD95 proceedings.

P. Mutzel, M. Jünger, and S. Leipert (Eds.): GD 2001, LNCS 2265, pp. 513–521, 2002.

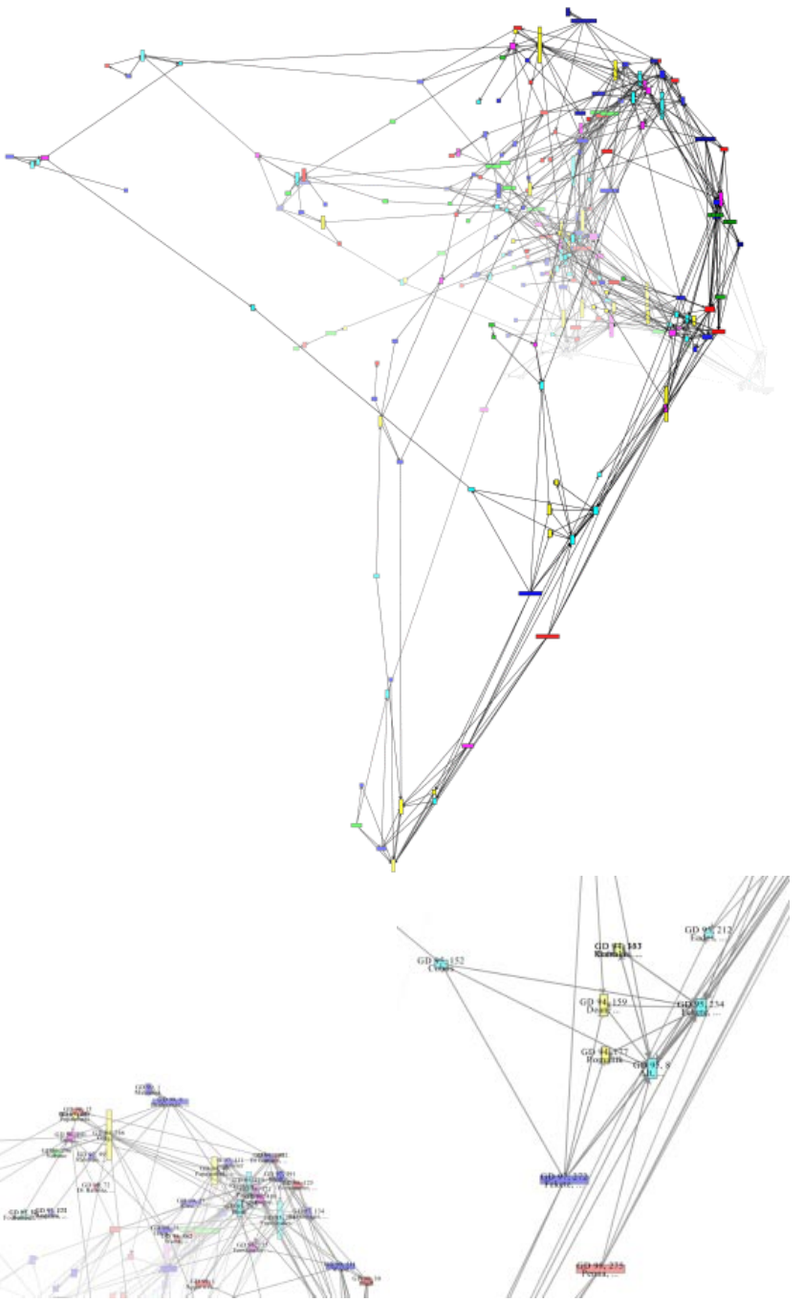

Fig. 1. Three-dimensional drawing of GD proceedings papers.The layout clusters dense subgraphs which in turn correspond to topics considered in graph drawing.

The winning entry is a poster submitted by Ulrik Brandes and Marco Gärtler from the University of Konstanz. The poster shows eight two-dimensional projections of a three-dimensional layout with depth cues. The projections correspond to views through the faces of an enclosing octahedron. Each paper is represented by a rectangle, where height and width indicate the number of citations received and made. Positions are determined by three eigenvectors of a generalized Laplacian matrix of the underlying undirected graph without manual postprocessing. The layout clearly shows that the citation network clusters around topics typically considered in graph drawing (Fig. 1), and how these are connected to each other. The poster also offers another perspective common in citation network analysis, in which just one eigenvector is used for the x-coordinate, and an index ranking papers by authority [4] is used for the y-coordinate (Fig. 2).

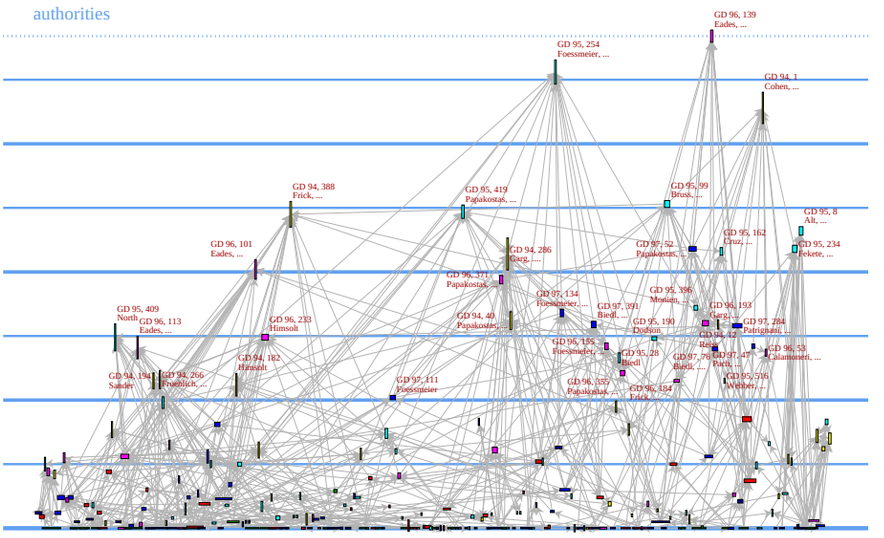

Fig. 2. GD proceedings papers ranked by authority with topical clustering in horizontal direction. The most authoritative paper relative to this data set is [2].

2.2 Category B

Graph B was this year's "easier challenge". It represents a finite state diagram from an industrial application with 18 nodes and 37 arcs. Two nodes have self-loops and some nodes have parallel arcs in each direction. The nodes and arcs are labeled. The six entries on Graph B were quite similar. Each detected and displayed the symmetries of the two biconnected components. The winning entry

by Carsten Gutwenger, Karsten Klein, Joachim Kupke, and Sebastian Leipert, Stiftung caesar, Bonn, perfectly reflects the structure of the diagram. They observed that the graph is 4-planar when the multiple edges are deleted. The drawing was computed using Tamassia's bend minimization algorithm, first adding a "+60 pos" dummy node and choosing an embedding with maximal outer face containing the node "0 pos". The outcome of the algorithm was not symmetric. Symmetry is obtained by spitting some edges and inserting dummy nodes at expected bends. The final drawing Fig. 3 was obtained by flipping the right biconnected components using Microsoft Visio.

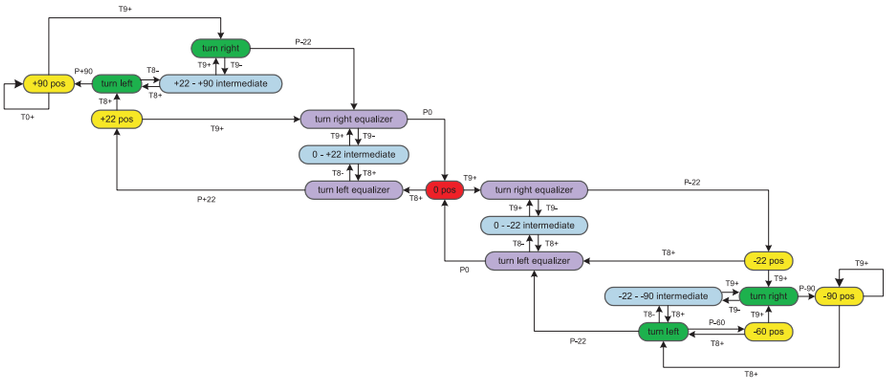

Fig. 3. Symmetric drawing of a finite state diagram.

2.3 Category C

Graph C represents the hierarchical arrangement of visual processing stages, starting with the retina and moving up through the multiple visual areas of the brains. The graph was given together with a prescribed layering of the nodes in 14 layers. It was contributed by Therese Biedl adapting the data from [3].

The winning entry by Roland Wiese, University of Tübingen, was produced automatically with the HierarchicLayouter of yFiles-1.4 using the non-default settings AsIsLayerer (applied to manually layered input sketch), minimalLayerDistance=100, minimalEdgeDistance=10 and weightHeuristic = MEDIAN_HEURISTIC. In the final drawing, nodes and their outgoing edges were colored by a random rainbow color scheme.

2.4 Category D

Category D is the free or artistic category which combines arts and graphs.

The jury selected two out of the four entries. The symposium attendees were asked for a ranking "by applause", which ended in a tie-break.

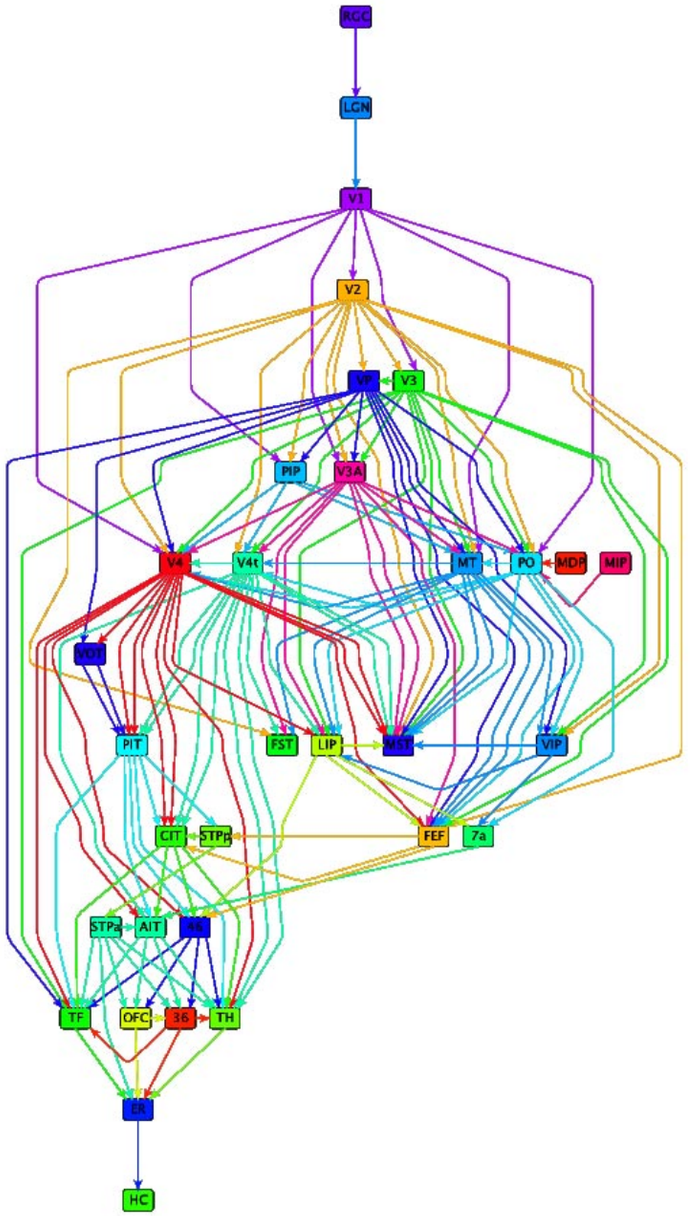

Fig. 4. A hierarchical drawing of the graph with a predefined hierarchy.

D1. The images of the information visualization by Carsten Friedrich from the University of Sydney, were created by combining the painting "False Mirror" by René Magritte (Fig. 5) with the drawing of a graph (Fig. 6). The layout of the graph was computed using the jjGraph graph drawing software. The graph drawing was then created by using a ray tracing program to render the layout. The result was finally modified using various image processing filters and effects, e. g. Fig. 7.

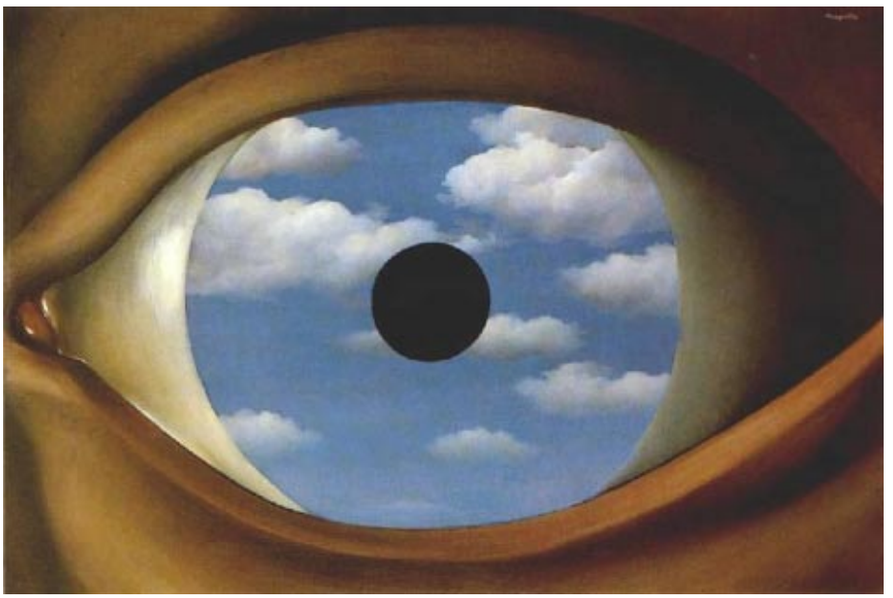

Fig. 5. False Mirror, René Magritte, 1935.

The painting False Mirror displays a realistic image of an eye. The white part of the eye however is replaced by white clouds on a blue sky. The human system for visual perception, of which the eye is the most visible and prominent part, gathers data by means of light hitting the eye. From this data it extracts knowledge, that is semantic information about the world. This information will eventually be reflected back to us, thus imposing on the eye the double role of window and mirror referred to by Magritte. Graph drawings are artificial constructs that are used to visualize abstract relational data. That is, they make abstract data accessible to the human eye and by that accessible to perception and understanding. It lies in the nature of these visualizations that even if they try to communicate this data as true as possible they can never achieve this goal completely. The visualization has to convert the data into a metaphor and set it into a context which alters the way we perceive it. In the background picture we

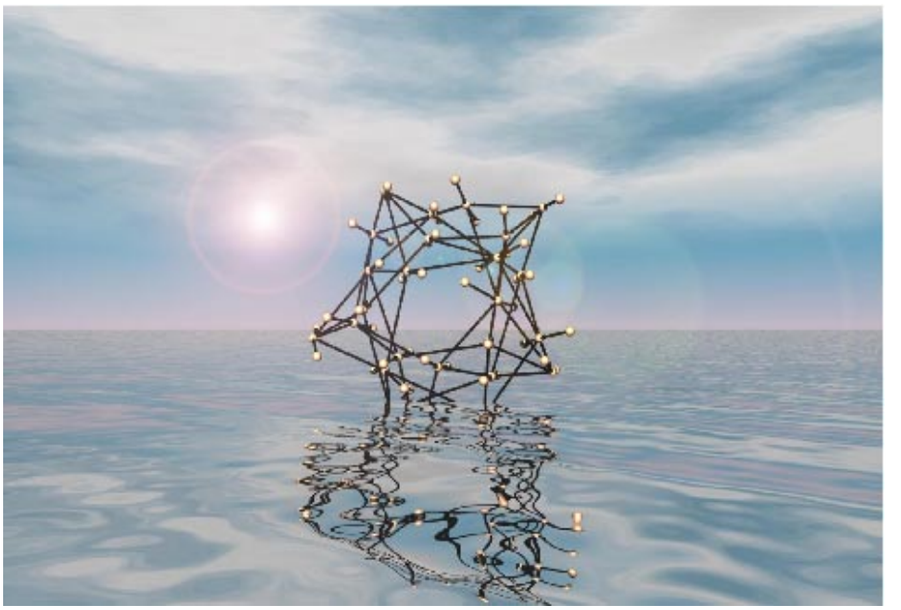

Fig. 6. 3D drawing of a graph.

Fig. 7. Composition of Fig. 5 and Fig. 6.

see a graph interpreted as a three-dimensional object and set into a scenery which reflects the graph, highlights certain parts, obscures or hides others, but overall stays mainly neutral. Apart from the objective physical settings and biological mechanisms, perception is always highly subjective. Whatever a person perceives will always be altered by the special idiosyncratic circumstances. This effect is of course exponentiated when we try to perceive how somebody else perceives. The sequence of drawings shows interpretations of these effects.

D2. The *Vienna ferris wheel graph*, the GD'2001 logo, was designed by Merijam Percan from the University of Cologne. The logo was created as a three dimensional representation of a graph, representing the vertices by spheres and the edges by cylinders. The drawing of the graph of Vienna's Ferris Wheel was generated using PovRay3.1*g* and animated using gifmerge. The entry consists of a picture and a gif-animation. The scene contains an island with a lighthouse, a house, birds and trees. Some of these objects were taken from `www.povworld.de` and modified and composed to the picture. Merijam Percan expresses her thanks to Martin Gruber for providing the necessary hardware and his advice.

Fig. 8. Scene with Vienna ferris wheel graph.

3 Observation and Conclusion

The high quality and originality of this year's contributions, particularly for the challenge graphs, demonstrates the capabilities of graph drawing. There were 573 visitors on the web site of the GD competition, but too few entries. For next year's GD competition we will try to attract members inside and outside the graph drawing community to contribute to the graph drawing competition and shall open new categories.

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References

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