

The BITPICT Computation System

George W. Furnas

School of Information and Department of Computer Science
University of Michigan
Ann Arbor, MI 48103-1092
furnas@umich.edu

Abstract

This demo will show the Bitpict Computation System, a pixel-rewriting production system that performs a rich variety of graphical computations, from solving certain topological problems to simulating physical processes.

Output

This “demo” will present videos of the original Bitpict Computation System [Furnas 1990, 1991, 1992] in operation. The Bitpict Computation System was a rule-based production system that, instead of rewriting items on a blackboard of expressions in predicate calculus, rewrote pixel patterns (bitmap fragments called “bitpicts”) on a large bitmap. A surprising variety of rich graphical computations could be accomplished, often with quite simple pixel rewrite rules.

The demo will begin with some simple examples of pixel rewriting to illustrate the basic concepts, and then move on to more powerful examples, to convey both the variety of application areas and the rich space of “pixel-rewrite” fundamental algorithms. Examples will fall into several categories outlined below:

ALGORITHMS - illustrating a variety of basic graphical algorithms, such as finding shortest paths and bounding boxes, or efficiently reducing connected components.

NAÏVE PHYSICS – illustrating the approximate simulation of simple physical processes, such as balls flowing out of a hopper and diffusion-limited aggregation.

PUZZLES AND PROBLEMS – illustrating the solution to various graphical problems, such as counting connected components, finding the longest of several sticks, predicting gear and rod movement, and solving mazes.

GUI INTERFACE – illustrating how simple graphical rewrite rules capture much Graphical User Interface

behavior, such as moving a file icon to the trash, graphical painting, and PacMan.

ANIMATIONS – illustrating how loops of rules modifying cartoon-like pictures of people and objects can create “self-animating” worlds, such as a little man who builds a stairway to heaven.

ACTIVE DIAGRAMS – illustrating how diagrams of functioning elements can be made to actually “run” right from the pixels, such as when a logic circuit diagram runs itself by rewriting its pixels.

MISCELLANEOUS – illustrating various other effects, such as the construction of fractals, flying bars that wreak havoc, etc.

Acknowledgement

Special thanks are due to Michael Anderson for his extraordinary help in the demo presentation.

References

- Furnas, G. W. 1990. Formal models for imaginal deduction. In Proceedings of the Twelfth Annual Conference of the Cognitive Science Society, July 25-28, 1990, Cambridge, Mass., Hillsdale, NJ: Lawrence Erlbaum.
- Furnas, G. W. 1991. New Graphical Reasoning Models for Understanding Graphical Interfaces. In *Human Factors in Computing Systems CHI '91 Conference Proceedings*, New Orleans, April 28 - May 2, 1991, 71-78. ACM.
- Furnas, G. W. 1992. Reasoning with Diagrams Only. In Proceedings of the AAAI Symposium on Reasoning with Diagrammatic Representations, Stanford, CA 3/25/92-3/27/92.

