

Labeling Sloped Nonograms Literature

Eva Timmer

February 25, 2020

1 Literature

1.1 On (solving) Nonograms

It is necessary to describe what nonograms are, specifically the new types of nonograms (curved and sloped) that require automatic labeling. If removing labels is allowed in order to reach a solution, then we must also include an accurate algorithm to determine if the puzzle is still solvable. Otherwise we can assume the initial puzzle and set of descriptions is simple and solvable.

1.1.1 Improved Automatic Generation of Curved Nonograms [16]

Outlines an algorithm for generating curved nonograms. Does not mention labeling.

1.1.2 Design and automated generation of Japanese picture puzzles [17]

Automated generation of regular, tangram (lines have one of four set orientations) and curved nonograms. Does not mention label placement, only that labels can be omitted to increase the difficulty of the puzzle.

1.1.3 The concept and automatic generation of the Curved Nonogram puzzle [6]

Automated generation of curved nonograms. Also goes into aesthetics. No mention of label placement.

1.1.4 Automated generation and visualization of picture-logic puzzles [11]

Generation of regular nonograms, in black and white and color.
12/12 cited 28 times

1.1.5 Solving Japanese Puzzles with Heuristics [14]

Solving of regular nonograms, in black and white and color.
12/12 cited 15 times

1.2 On (solving) puzzles in general

1.2.1 Quantifying over play: Constraining undesirable solutions in puzzle design [15]

Describes an algorithm for automatically generating levels with no undesirable solutions for a specific puzzle game.

1.2.2 The Connect-The-Dots family of puzzles: design and automatic generation [10]

Generation of Connect-The-Dots puzzles and three new puzzle types: Connect-The-Closest-Dot, Connect-That-Dot (connect to dot in that direction), Connect-The-Unit-Dots (connect dots that lie at a unit distance)

1.3 On labeling

Labeling nonograms is similar to labeling graphs. Therefore research on automatically labeling graph boundaries is helpful.

1.3.1 Boundary labeling: Models and efficient algorithms for rectangular maps [5]

17/12 cited 60 times

1.3.2 Boundary Labelling of Optimal Total Leader Length [3]

12/12 cited 13 times

1.3.3 Polygon Labelling of Minimum Leader Length [4]

12/12 cited 25 times

1.3.4 Boundary-labeling Algorithms for Panorama Images [7]

12/12 cited 13 times

1.3.5 Floating labels: Applying dynamic potential fields for label layout [8]

10/12 cited 67 times

1.3.6 Dynamic map labeling [2]

10/12 cited 123 times

1.4 On graph/puzzle aesthetics

At minimum, the goal is to design an algorithm that can determine a labeling where all labels are included and none of the labels overlap, if such a labeling exists. We can apply additional restrictions in order to reach a solution that is also aesthetically pleasing. In order to do this we must first determine what is aesthetically pleasing.

1.4.1 Validating Graph Drawing Aesthetics [13]

An empirical study on three measurable aesthetic qualities of graphs. These aesthetics are symmetry, minimize edge crossings and minimize bends. Only the first applies to this project, as we already assume that edge crossings and bends will reduce the understandability of a labeling, and therefore will only consider labelings without edge crossings and bends. Unfortunately the results regarding symmetry in this study are inconclusive. However, the authors do provide some ideas on how to perform a conclusive study of the symmetrical aesthetic.

12/12 cited 299 times

1.4.2 Metrics for Graph Drawing Aesthetics [12]

This paper presents metrics for measuring the aesthetic presence in a graph drawing for seven common aesthetic criteria. While none of the metrics except "maximizing symmetry" could apply to the problem of labeling, the general ideas concerning how to choose and use are still relevant. The paper proposes that measures should be continuous rather than binary. This is also true for puzzle labeling. Assuming we have a set of measurable aesthetic criteria, we can design an algorithm that minimizes or maximizes these aspects of the labeling.

10/12 cited 262 times

1.4.3 Cognitive measurements of graph aesthetics [19]

Focuses more on how the brain interprets visuals.

10/12 cited 404 times

1.4.4 Metrics for functional and aesthetic label layouts [9]

Presents a system for the internal and external labeling of images.

10/12 cited 65 times

1.4.5 Specifying label layout style by example [18]

10/12 cited 43 times

1.4.6 On the readability of boundary labeling [1]

Only focuses on different ways of drawing leaders *inside* the boundary and is therefore not really relevant.

12/12 cited 13 times

References

- [1] Lukas Barth, Andreas Gemsa, Benjamin Niedermann, and Martin Nöllenburg. On the readability of boundary labeling. In *International Symposium on Graph Drawing*, pages 515–527. Springer, 2015.
- [2] Ken Been, Eli Daiches, and Chee Yap. Dynamic map labeling. *IEEE Transactions on visualization and computer graphics*, 12(5):773–780, 2006.
- [3] M. A. Bekos, M. Kaufmann, K. Potika, and A. Symvonis. Boundary labelling of optimal total leader length. In Panayiotis Bozanis and Elias N. Houstis, editors, *Advances in Informatics*, pages 80–89, Berlin, Heidelberg, 2005. Springer Berlin Heidelberg.
- [4] Michael A. Bekos, Michael Kaufmann, Katerina Potika, and Antonios Symvonis. Polygon labelling of minimum leader length. In *Proceedings of the 2006 Asia-Pacific Symposium on Information Visualisation - Volume 60*, APVis ’06, pages 15–21, Darlinghurst, Australia, Australia, 2006. Australian Computer Society, Inc.
- [5] Michael A Bekos, Michael Kaufmann, Antonios Symvonis, and Alexander Wolff. Boundary labeling: Models and efficient algorithms for rectangular maps. *Computational Geometry*, 36(3):215–236, 2007.
- [6] TK de Jong. The concept and automatic generation of the curved nonogram puzzle. Master’s thesis, 2016.
- [7] Andreas Gemsa, Jan-Henrik Haunert, and Martin Nöllenburg. Boundary-labeling algorithms for panorama images. In *Proceedings of the 19th ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems*, GIS ’11, pages 289–298, New York, NY, USA, 2011. ACM.
- [8] Knut Hartmann, Kamran Ali, and Thomas Strothotte. Floating labels: Applying dynamic potential fields for label layout. In *International Symposium on Smart Graphics*, pages 101–113. Springer, 2004.
- [9] Knut Hartmann, Timo Götzelmann, Kamran Ali, and Thomas Strothotte. Metrics for functional and aesthetic label layouts. In *International Symposium on Smart Graphics*, pages 115–126. Springer, 2005.
- [10] Maarten Löffler, Mira Kaiser, Tim van Kapel, Gerwin Klappe, Marc van Kreveld, and Frank Staals. The connect-the-dots family of puzzles: design and automatic generation. *ACM Transactions on Graphics (TOG)*, 33(4):72, 2014.
- [11] Emilio G Ortiz-García, Sancho Salcedo-Sanz, Jose M Leiva-Murillo, Angel M Pérez-Bellido, and José A Portilla-Figueras. Automated generation and visualization of picture-logic puzzles. *Computers & Graphics*, 31(5):750–760, 2007.
- [12] Helen C Purchase. Metrics for graph drawing aesthetics. *Journal of Visual Languages & Computing*, 13(5):501–516, 2002.

- [13] Helen C Purchase, Robert F Cohen, and Murray James. Validating graph drawing aesthetics. In *International Symposium on Graph Drawing*, pages 435–446. Springer, 1995.
- [14] Sancho Salcedo-Sanz, Emilio G Ortiz-Garca, Angel M Pérez-Bellido, Antonio Portilla-Figueras, and Xin Yao. Solving japanese puzzles with heuristics. In *2007 IEEE Symposium on Computational Intelligence and Games*, pages 224–231. IEEE, 2007.
- [15] Adam M Smith, Eric Butler, and Zoran Popovic. Quantifying over play: Constraining undesirable solutions in puzzle design. In *FDG*, pages 221–228, 2013.
- [16] MA van de Kerkhof. Improved automatic generation of curved nonograms. Master’s thesis, 2017.
- [17] Mees van de Kerkhof, Tim de Jong, Raphael Parment, Maarten Löffler, Amir Vaxman, and Marc van Kreveld. Design and automated generation of japanese picture puzzles. In *Computer Graphics Forum*, volume 38, pages 343–353. Wiley Online Library, 2019.
- [18] Ian Vollick, Daniel Vogel, Maneesh Agrawala, and Aaron Hertzmann. Specifying label layout style by example. In *Proceedings of the 20th annual ACM symposium on User interface software and technology*, pages 221–230. ACM, 2007.
- [19] Colin Ware, Helen Purchase, Linda Colpoys, and Matthew McGill. Cognitive measurements of graph aesthetics. *Information visualization*, 1(2):103–110, 2002.