

**CONSTRUCTING CONTINUOUS CARTOGRAMS:
A CONSTRAINT-BASED APPROACH**

A Thesis

by

CHRISTOPHER JAMES KOUMOUD

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

December 1997

Major Subject: Visualization Sciences

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Approved as to style and content by:

Donald House
(Chair of Committee)

Terry Larsen
(Member)

Daniel Sui
(Member)

Julius M. Gribou
(Head of Department)

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Major Subject: Visualization Sciences

ABSTRACT

Constructing Continuous Cartograms:

A Constraint-Based Approach. (December 1997)

Christopher James Kocmoud, B.S., Texas A&M University

Chair of Advisory Committee: Dr. Donald House

We present a constraint-based automatic cartogram construction method that successfully achieves desired region areas while maintaining map topology and preserving essential shape cues to enable region recognition. Results are compared with a number of existing methods, and appear to be superior in both accuracy and preservation of shape recognition cues.

A continuous area cartogram is a map transformation in which the map regions are resized relative to the geographic distribution of a data set. By spatially reflecting the data within the map base, the cartogram emphasizes each region's data instead of territorial land area, thereby providing a powerful tool for visualizing data distribution.

There are two distinct and conflicting goals in the construction of cartograms: adjusting region sizes and retaining region shapes. Our Constraint-Based Method utilizes three foundational mechanisms to achieve these goals: alternating relaxation, constrained dynamics, and hierarchical resolution. We converge upon each goal in an alternating relaxation fashion, by achieving desired areas without regard to shape, and then utilizing constrained dynamics to attempt to hold the areas fixed while shape is restored. Through hierarchical resolution, we perform gross adjustments initially upon a coarsely resampled map and refinements later at progressively higher levels of detail.

DEDICATION

Ad majorem Dei gloriam

----- “*For the greater glory of God,*” -----

*who alone has given me the
wisdom, ability, and endurance
to complete this degree.*

*May the dedication of this work
and the dedication of my life
be eternally pleasing to Him.*

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This endeavor to complete a Masters degree and thesis could never have been accomplished without the support and assistance of so many over the years. My most heartfelt thanks goes to my Kimberly Kay – my wife, lover, and mother of my five boys. Your sacrifice, patience, and endurance has been a gift that I will cherish always. May God guide our next steps together along our journey of life.

Special thanks goes to my Advisory Committee Chair, Dr. Donald House, whose wisdom and knowledge has guided this project from its inception and whose friendship I have come to value. May our collaboration continue on for many years. Thank you to my Committee Members, Dr. Daniel Sui and Terry Larsen, whose support has been such an encouragement. Many thanks to my boss, Charles Rhea, for years of enjoyable work, professional development, and times of spiritual sharing. Thanks also to the Texas A&M Visualization Laboratory staff and students for many years of quality education, and especially for the friendships I found in Jeff Griswold, Kevin Reuter, and Michael Ringham.

Kimberly and I extend a bear-hug of thanks to our extended families: to NanaMary and Grandad Eugene Kocmoud for their years of love, help and support, especially during the birth of each of our children; to Grandmommy Wanda Jones for her years of dedication, support, and doughnuts. Thank you to Nathan, Matthew, Jonathan, Stephen, and Andrew Kocmoud. May God give your Mommy & I wisdom to parent you in the way of Christ.

And thank You, God, for the life you have given us to share. May our every word and action reflect the love that You have lavished upon us.

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