Spatial Synthesis
Volume II, Book 2:
Making It Clear:  The Importance of Transparency

Sandra Lach Arlinghaus
sarhaus@umich.edu
http://www-personal.umich.edu/~sarhaus/

Volume I of the *Spatial Synthesis* series focuses on theory; Volume II of the series focuses on applications, turning theory into practice.

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These chapters use subtle effects and reflect the importance of transparency in making concepts become clear.

INTRODUCTION

Graphics created on the computer often employ subtle capabilities that did not really exist in a paper and pen environment. Thus, "white" becomes a color to be used in the same way as red or green. "Transparent" also becomes a color by which to uncover parts of other images. Two dimensional maps composed of layers in Geographic Information Systems software may look through one layer to see part of another. Images created in Adobe Photoshop can be assigned partially opaque colors to let still others show through. The world of three-dimensional models suggests a host of opportunity for making things "clear." The emphasis in this second book in Volume II of the *Spatial Synthesis* is on the importance of transparency.

A visual annotated bibliography of previous related applications appears below. In the figure, click on an image (including the Earth at night) to go to related links. Author names appear on linked materials. These images link to electronic materials internal to the Institute of Mathematical Geography (IMaGe). Individual articles contain links to citations to a variety of materials. A poster based on this image was presented at the first "Scientific Applications with Google Earth Conference," October 22-23, 2008, at The University of Michigan, Ann Arbor. (Link to full-sized poster presented by the author.)

**POPULATION-ENVIRONMENT DYNAMICS:  A GOOGLE EARTH APPROACH**

*Sandra Lach Arlinghaus, Ph.D., Adjunct Professor of Mathematical Geography and Population Environment Dynamics, School of Natural Resources and Environment, The University of Michigan; Member Executive Committee, Community Systems Foundation*

**BEFORE GOOGLE EARTH...**

**MUNICIPAL APPLICATIONS:**
PLANNING, ZONING, AND EMERGENCY MANAGEMENT

**ARCHIMEDES IN ANN ARBOR:**
VISUALIZATION OF THE ALLEN CREEK FLOODPLAIN
THEN CAME GOOGLE EARTH...

A HOST OF BUILDINGS (OVER 400) WAS CREATED, TOWN AND GOWN--TEXTURED AND UNTEXTURED, AND FROM THAT WORK, 2006 FORWARD, FLOWED OTHER APPLICATIONS...

Selected References:

ON THE HORIZON...

Software used for analysis:
- DevInfo 5.0: http://www.devinfo.org/
- Adobe® PhotoShop and ImageReady
- Adobe® DreamWeaver
- ESRI:
  - ArcView® 3.2
  - ArcGIS® 9.2
    - ArcCatalog®
    - ArcMap®
- Google Earth®

Author affiliation:
Arlinghaus, Sandra Lach. Adjunct Professor of Mathematical Geography and Population-Environment Dynamics, School of Natural Resources and Environment, The University of Michigan. Executive Committee Member (Secretary) Community Systems Foundation, sarhaus@umich.edu, http://www-personal.umich.edu/~sarhaus/

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Institute of Mathematical Geography
http://www.imagenet.org
http://deepblue.lib.umich.edu/handle/2027.42/58219
October, 2008.
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POPULATION-ENVIRONMENT DYNAMICS: A GOOGLE EARTH APPROACH
Sandra Lach Arlinghaus, Ph.D., a.k.a. “Archimedes” in the Google 3D Warehouse, Adjunct Professor of Mathematical Geography and Population-Environment Dynamics, School of Natural Resources and Environment, The University of Michigan

BEFORE GOOGLE EARTH...
MUNICIPAL APPLICATIONS:
PLANNING, ZONING, AND EMERGENCY MANAGEMENT

ARCHIMEDES IN ANN ARBOR:
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A HOST OF BUILDINGS (OVER 400) WAS CREATED, TOWN AND GOWN--TEXTURED AND UNTEXTURED, AND FROM THAT WORK, 2006 FORWARD, FLOWED OTHER APPLICATIONS...

Allen Creek

The Skyline as Barchart:
The Vertical City--Urban Change over Time.

Banda Aceh,
Piling up of Tsunami Waters

Classical Central Place Theory

Burundi Buffers: DevInfo Data to Google Earth

Google, Escher, and...?

Tracking the spread of possible honeybee extinction

Harmonic Map Projection
Desargues's Two Triangle Theorem

The Transparent Google Globe: The Next Frontier?
Tetrahedron in the Google Globe

ON THE HORIZON...

Selected References:

Solstice: An Electronic Journal of Geography and Mathematics
http://www.imagenet.org/


Lists of various other contributors can be found in associated books and articles found at the url above. In addition, all those works are also archived in Deep Blue:
http://deepblue.lib.umich.edu/handle/2027.42/58219

"Archimedes" is a Featured Google Earth Modeler in the 3D Warehouse
http://sketchup.google.com/3dswarehouse/

Models by “Archimedes” are also featured in “Help Model A City” and in “Cities in Development.” http://sketchup.google.com/3dswarehouse/

Making It Clear: The Importance of Transparency.
Includes a range of applications from Mathematics to Art
to Population-Environment Dynamics.
Escher/Barr Earth; Klein Earth, Fractal Earth
E-book, in press.

More Population-Environment Dynamics applications,
some with Michael Petty.

More Mathematical Geography applications.
Spatial Synthesis
Volume II, Book 2:
Making It Clear: The Importance of Transparency

Sandra Lach Arlinghaus
sarhaus@umich.edu
http://www-personal.umich.edu/~sarhaus/

ANNOTATED RELATED LINKS
ARCHIMEDES IN ANN ARBOR: VISUALIZATION OF THE ALLEN CREEK FLOODPLAIN
Virtual reality files created in 3D Studio Max suggest local changes in flooding that might come from a downstream disruption. While these files are correctly referenced in relation to each other they are not correctly geo-referenced in relation to latitude and longitude and therefore are not compatible with the original City of Ann Arbor GIS maps that served as base maps. The red semi-opaque chimneys on the rooftops are not there in the real world. These serve as links to pages that inventory the building content for emergency management purposes.

IMaGe LINKS
The links in this section go to files presented to municipal authorities (at the 3D Laboratory of the Duderstadt Center at The University of Michigan, at City Hall, and at the Downtown Development Authority) to visualize possible outcomes from displacement of water due to the building of new structures in the Allen Creek floodplain and also to understand implications that might involve emergency management.
The red rooftop links to building content inventories were designed as a consequence of a building fire in the downtown in which a flammable substance stored in the basement caused a problem. Matthew Naud, Environmental Coordinator and Emergency Manager (at the time of file creation) worked with the author to suggest various strategies for the models. Links to the vrml files that create these images are included in the references.

The floodplain model illustrates the problems of building new structures in floodplains and suggests, based on Archimedes Principle of Displacement, the possible unintended consequences that might come about. When one drives through the vrml model, it is possible to see which basements would be flooded in addition to the more obvious problems for buildings above ground.

The vrml files have sounds linked to them to accentuate the effect. A bounding box for various types of sounds, from Beethoven's Sixth associated with the top image, to emergency sirens and rescue helicopters associated with the bottom image, circumscribe sound to make it drop off with distance. Considerable effort was taken to make the scenes realistic. They were shown to members of City Council, Planning Commission, University Administrators, and Downtown Development Authority staff.

In eBooks:


In Solstice: An Electronic Journal of Geography and Mathematics:

- Volume XV, Number 1, 2004
  - The View from the Top: Visualizing Downtown Ann Arbor in Three Dimensions Sandra L. Arlinghaus, Fred J. Beal, and Douglas S. Kelbaugh
  - One Optimization of an Earlier Model of Virtual Downtown Ann Arbor Klaus-Peter Beier
- Volume XII, Number 1 Maps and Decisions: Allen's Creek Floodplain, Opportunity or Disaster? Sandra Lach Arlinghaus

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    - ArcCatalog®
    - ArcMap®
- Google Earth®

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October, 2008.
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Virtual reality files created in 3D Studio Max were linked together using semi-opaque kiosks to move from one virtual reality scene to another. This strategy was created in order to show a larger expanse of territory than might reasonably have been shown in a single file (due to demands on computers for much RAM from large files). The need for such capability was viewed as important in possible emergency management applications.

The links in this section go to files presented to municipal authorities (at the 3D Laboratory of the Duderstadt Center at The University of Michigan, at City Hall, and at the Downtown Development Authority) to visualize possible outcomes from changing...
heights of buildings in the downtown and in understanding how changes in zoning might alter the vertical city.

The author introduced 3D models to her colleagues on the City of Ann Arbor Planning Commission during her years of service to that group (1995-2003). Initially, in the late 1990s, there were 3D models with no textures made in ArcView 3.2 with Spatial Analyst and 3D Analyst extensions. The Ordinance Revisions Committee of Planning Commission was able to use these in selected applications.

The image at the top of the page shows a report on a public hearing in Council Chambers in Ann Arbor City Hall. That hearing was the outcome of months of work using the urban planning models described above in association with the Downtown Residential Task Force of the Downtown Development Authority (DDA). The models were handed over to the DDA and ultimately to Calthorpe Associates who subsequently used them in making a variety of recommendations to City Council.

In 2003, after leaving City Planning Commission, the was able to learn (when serving as a Faculty Advisor) to make more realistic looking models in 3D Studio Max. In continuing work with Matthew Naud, Environmental Coordinator for the City of Ann Arbor (and then Emergency Manager, as well) a variety of other 3D models were developed with textures on the buildings so that they appeared to be more realistic.

The second image on this page shows a screen capture of a virtual reality file made using 3D Studio Max. The files were large in size and were not georeferenced. Thus, their use was not backward compatible with the city GIS files from which the building footprints were originally derived. Also, they were not aligned with the City aerials and contours. Nonetheless, their realism was attractive. Naud saw them as a possible way for firefighters, in their downtime, to have fun with them on laptops with the intended consequence of having them learn more about the road network and street names of the city they were serving.

Because, the file size is large, separate files with building textures were built a block at a time. In all, 12 blocks of the downtown were done. Photographic assistance came from students in Prof. Klaus-Peter Beier’s Virtual Reality course in the College of Engineering of The University of Michigan. Being able to link between files was of course critical if one were to drive around town and learn about it. The semi-transparent red “kiosk” in the street intersection in the bottom figure is not really there; it was introduced as a place to click to go to the next file. Because it is somewhat transparent, building façades are not obscured.

The list of references below is selected from a much larger set. Additional citations may be found in the linked article co-authored by Arlinghaus, Beal, and Kelbaugh.

In eBooks:


In Solstice: An Electronic Journal of Geography and Mathematics:

- Volume XIV, Number 2, 2003; Kioskland: A Strategy for Linking Hierarchical Levels of Virtual Reality Maps; Sandra Lach Arlinghaus et al.
- Volume XIV, Number 1, 2003; The View from the Top: Visualizing Downtown Ann Arbor in Three Dimensions; Sandra L. Arlinghaus, Fred J. Beal, and Douglas S. Kelbaugh—contains many references to related work.
- Volume XIII, Number 2, 2002; One Optimization of an Earlier Model of Virtual Downtown Ann Arbor—Klaus-Peter Beier
- Volume XIII, Number 1, 2002; Ann Arbor, Michigan: Virtual Downtown Experiments, Part II Taejung Kwon, Adrien A. Lazzaro, Paul J. Oppenheim, Andrew Rosebush, Sandra L. Arlinghaus
- Volume XII, Number 1, 2001; Ann Arbor, Michigan: Virtual Downtown Experiments; Part I; Klaus-Peter Beier, Sandra Lach Arlinghaus
- Volume XI, Number 3, 2000; Ann Arbor, Michigan: Virtual Downtown Experiments; Sandra Lach Arlinghaus

In Solstice: An Electronic Journal of Geography and Mathematics:

- Volume XVI, Number 1, 2005; Kioskland: A Strategy for Linking Hierarchical Levels of Virtual Reality Maps; Sandra Lach Arlinghaus et al.
- Volume XV, Number 1, 2004; The View from the Top: Visualizing Downtown Ann Arbor in Three Dimensions; Sandra L. Arlinghaus, Fred J. Beal, and Douglas S. Kelbaugh—contains many references to related work.
- Volume XIV, Number 2, 2003; Ann Arbor, Michigan: Virtual Downtown Experiments, Part II; Taejung Kwon, Adrien A. Lazzaro, Paul J. Oppenheim, Andrew Rosebush
- Volume XIV, Number 1, 2003; Ann Arbor, Michigan: Virtual Downtown Experiments; Sandra Lach Arlinghaus
- Volume XIII, Number 2, 2002; One Optimization of an Earlier Model of Virtual Downtown Ann Arbor—Klaus-Peter Beier
- Volume XIII, Number 1, 2002; Ann Arbor, Michigan: Virtual Downtown Experiments; Sandra Lach Arlinghaus

In Solstice: An Electronic Journal of Geography and Mathematics:

- Volume XII, Number 3, 2001; Ann Arbor, Michigan: Virtual Downtown Experiments; Part II; Taejung Kwon, Adrien A. Lazzaro, Paul J. Oppenheim, Andrew Rosebush
- Volume XII, Number 1, 2001; Ann Arbor, Michigan: Virtual Downtown Experiments; Sandra Lach Arlinghaus

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- SCHRER / BARR EARTH

Software used in analysis:

- DevInfo 5.0: http://www.devinfo.org/
- Adobe® Photoshop and ImageReady
- Adobe® Dreamweaver
- Adobe® Flash
- ArcGIS 9.2
- ArcScene®
- ArcCatalog®
- PostGIS®
- Google Earth®

Author affiliation:

Arlinghaus, Sandra Lach. Adjunct Professor of Mathematical Geography and Population-Environment Dynamics, School of Natural Resources and Environment, The University of Michigan. Executive Committee Member (Secretary) Community Systems Foundation, sarhaus@umich.edu - http://www-personal.umich.edu/~sarhaus/

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Spatial Synthesis
Volume II, Book 2:
Making It Clear: The Importance of Transparency

Sandra Lach Arlinghaus
sarhaus@umich.edu
http://www-personal.umich.edu/~sarhaus/

ANNOTATED RELATED LINKS
ANN ARBOR, 3D ATLASES AND RELATED MATERIALS

IMaGe LINKS
The links in this section reflect the direct evolution of the 3D Atlas of Ann Arbor series.

In eBooks:

In Solstice: An Electronic Journal of Geography and Mathematics:
- Volume XVII, Number 1, 2006 3D Atlas of Ann Arbor: The Google Earth® Approach Part 1; Part II Sandra Lach Arlinghaus
- Volume XVI, Number 2, 2005 NEWS: UPDATE ON THE 3D ATLAS OF ANN ARBOR
  Archimedes in Ann Arbor? Sandra Lach Arlinghaus
Virtual Flood in the Allen Creek Floodplain and Floodway. Alyssa J. Domzal, Ui Sang Hwang, and Kris J. Walters, Jr.


Volume XV, Number 1, 2004

The View from the Top: Visualizing Downtown Ann Arbor in Three Dimensions  Sandra L. Arlinghaus, Fred J. Beal, and Douglas S. Kelbaugh

One Optimization of an Earlier Model of Virtual Downtown Ann Arbor  Klaus-Peter Beier

Volume XIV, Number 2, 2003

Ann Arbor, Michigan: Virtual Downtown Experiments, Part II  Sandra Lach Arlinghaus


Volume XIV, Number 1, 2003  Ann Arbor, Michigan: Virtual Downtown Experiments  Sandra Lach Arlinghaus

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  ArcMap®
Google Earth®

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The vertices of sculptor David Barr's Four Corners Project inscribed in the Google Globe.

IMaGe LINKS
The link in this section is to a monograph about the work of sculptor David Barr. Imagine all the figures from this earlier book cast in the Google Globe so that one might try to understand the great difficulty in traversing the terrain difficulties Barr encountered in planting his four corners in Easter Island, the Kalahari Desert, the Greenland icecap, and Irian Jaya. Later material in this book will examine the detail of making the Google Earth ball become transparent and present other ways to use the transparent
Google Globe.

Book

Monograph One 78 pp. (master document prepared using MTS by Gwen Nystuen)

*Mathematical Geography and Global Art: the Mathematics of David Barr's 'Four Corners Project'*

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  - ArcGIS® 9.2
    - ArcCatalog®
    - ArcMap®
- Google Earth®

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http://www-personal.umich.edu/~sarhaus/

ANNOTATED RELATED LINKS
NEIGHBORHOOD WATCH AND COMMUNITY SITES

IMaGe LINKS
The links in this section include material from the City of Ann Arbor, from The University of Michigan, and from a local citizens group. The image above shows a screen capture of a Google Earth display of crime statistics from the City of Ann Arbor Police Department, Neighborhood Watch Program, gathered during the authors tenure on the city-wide Neighborhood Watch Advisory Panel (to Adele El-Ayoubi, Neighborhood Watch Coordinator, City of Ann Arbor Police Department). Because there is very little crime in Ann Arbor, it was possible to enter the data by hand to display
the power of the approach, especially when coupled with the 3D building stock (created by the author as Archimedes--over 400 buildings). Work is underway to automate the process using a live feed (see the article below by Lars Schumann).

In **Solstice: An Electronic Journal of Geography and Mathematics:**

- **Volume XIX, Number 1, 2008**
  - Another Tale of Two Cities: Neighborhood Watch from Ann Arbor to Baghdad Sandra Lach Arlinghaus
  - Google Earth Applications in a Community Information System: Scio Residents for Safe Water Roger Rayle
  - Huron River Tour, Ann Arbor Matthew Naud
  - Real-time Animation Scripts for Google Earth Lars Schumann
- **Volume XV, Number 1, 2004**

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Spatial Synthesis
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Making It Clear: The Importance of Transparency

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sarhaus@umich.edu
http://www-personal.umich.edu/~sarhaus/

ANNOTATED RELATED LINKS
DESARGUES'S TWO TRIANGLE THEOREM
The links in this section suggest the power of Google Earth in visualizing non-Euclidean geometry theorems. The image above uses transparency to look through the otherwise complicated appearance of Desargues's Two Triangle theorem from Projective Geometry. The lines joining corresponding vertices of two triangles are concurrent, forming a tower with these triangles as sections. In this case, the tower is situated over the Sidney Smith Building of the University of Toronto, home to the Department of Mathematics and the late, great, geometer Professor H. S. M. Coxeter: mathematics history is linked to the mathematics itself.
Transparency makes the locations of intersection points of corresponding sides, and their associated collinearity, become clear. Visualizing a two-dimensional theorem in three dimensions, using semi-opaque colors, makes geometric relationships become clear.

In **Solstice: An Electronic Journal of Geography and Mathematics**:

- **Volume XVIII, Number 2, 2007** (all by Sandra Lach Arlinghaus)
  - Special Issue on Projective Geometry Constructions
  - Geometry/Geography, Visual Unity
  - The Animated Pascal
  - Desargues's Two-Triangle Theorem
- **Volume XVII, Number 1, 2006** Zipf's Hyperboloid? Sandra L. Arlinghaus and Michael Batty

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  - ArcGIS® 9.2
    - ArcCatalog®
    - ArcMap®
- Google Earth®

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ANNOTATED RELATED LINKS
HARMONIC MAP PROJECTION THEOREM
IMaGe LINKS
Read about harmonic conjugacy in association with true perspective projections of the globe to a mapping plane. All perspective mapping is captured by this projective geometric construction!
In Solstice: An Electronic Journal of Geography and Mathematics:

Volume XVIII, Number 2, 2007 Geometry/Geography, Visual Unity Sandra Lach Arlinghaus

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ANNOTATED RELATED LINKS
TRACKING THE SPREAD OF POSSIBLE HONEYBEE EXTINCTION
IMaGe LINKS
The links in this section track the progress of Diana Sammataro's research on the Varroa mite that threatens the world's honeybee population.

In Solstice: An Electronic Journal of Geography and Mathematics:
- Volume XVIII, Number 1, 2007 Update on the Varroa Mite Map Diana Sammataro [with Editorial Commentary]
- Volume XVII, Number 2, 2006 Update on the Varroa Mite Map Diana Sammataro
- Volume XII, Number 1, 2001 Update on the Varroa Mite Map Diana Sammataro
- Volume IX, Number 1, 1998 Animaps Sandra L. Arlinghaus, William D. Drake, and John D. Nystuen with data and other input from: Audra Laug, Kris S. Oswalt, and Diana Sammataro

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ANNOTATED RELATED LINKS
GOOGLE, ESCHER, AND ?
IMaGe LINKS

The links in this section reflect a variety of uses of transparency, blank space, alternative viewpoints, and imaginative input. The paraphrase in the title is a reference to Douglas Hofstadter's Pulitzer Prize winning book, *Gödel, Escher, Bach*. One "natural" way to fill in the "?" in the page title of "Google, Escher, ?" is with the rhyming maiden last name of the author, thus making the title, "Google, Escher, Lach"...however, there may well be better ways and that remains a challenge to readers!

In *Solstice: An Electronic Journal of Geography and Mathematics*:

- Volume XIX, Number 1, 2008 *Mouth Geography...Or, Sleep Apnea and Linguistics?* William E. Arlinghaus
- Volume XVIII, Number 2, 2007 *The Animated Pascal* Sandra L. Arlinghaus
- Volume XVII, Number 1, 2006 *PseudoCoup: A Psubtle Puzzle* Sandra Lach Arlinghaus
- Volume XVI, Number 1, 2005 *A Methodology for Historical Geography: Internet Implementation* Ann Evans Larimore with Sandra Lach Arlinghaus and Robert Haug
- Volume XV, Number 2, 2004
  - Two Rivers Ridge: Capturing Art Sandra Arlinghaus and Braxton Blake
  - Goode's 80th! Sandra Lach Arlinghaus
- Volume XIV, Number 1, 2003 *Animated Time Lines: Coordination of Spatial and Temporal Information* Sandra Arlinghaus, Michael Batty, and John Nystuen
- Volume IX, Number 1, 1998 *Revitalizing Maps or Images?* Sandra L. Arlinghaus, Ruben De la Sierra

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ANNOTATED RELATED LINKS
BURUNDI BUFFERS: DEVINFO TO GOOGLE EARTH
The links in this section suggest a variety of uses, most involving transparency and others involving related ideas, for spatial buffers. Buffers are often used to represent tributary errors to point locations—the city and its hinterland, and so forth. Partially transparent buffers permit us to look through to other maps, as Schlossberg suggests. Later work lets partially transparent reveal terrain and all that Google Earth has to offer.

When Google Earth is linked to DevInfo, particularly strong possibilities for 3D modeling in developing nations become apparent (see the first book below). DevInfo is software in place, through the United Nations, in over 80 developing nations of the world. It was developed by Community Systems Foundation (Ann Arbor), an international NGO in partnership with the United Nations. The backbone of the software is GIS. It is a stand alone package that is given to client nations along with training so that they become self-sufficient in monitoring and evaluating a host of humanitarian issues. It has seen use in a variety of humanitarian applications, from maternal and child health care to rescue efforts following earthquakes. Related links: http://www.CommunitySystemsFoundation.org/ ; http://www.csfnet.org/

In eBooks:


In Solstice: An Electronic Journal of Geography and Mathematics:

- Volume XV, Number 1, 2004 Visualizing Accessibility II: Access to Food Marc Schlossberg
- Volume XIV, Number 2, 2003 Tornado Siren Location, Response to Previous Article
  - Letter from United States Member of Congress, John Dingell
  - Quotations from articles in The Ann Arbor News
- Volume XIV, Number 1, 2003 Tornado Siren Location: Ann Arbor, Michigan Sandra Lach Arlinghaus
- Volume XIII, Number 2, 2002 Visual Accessibility with GIS Marc Schlossberg
- Volume XII, Number 2, 2001 Base Maps, Buffers, and Bisectors Sandra Lach Arlinghaus
- Volume X, Number 2 A Map of Jackson, Mississippi Sandra L. Arlinghaus
Author affiliation:

Arlinghaus, Sandra Lach.  Adjunct Professor of Mathematical Geography and Population-Environment Dynamics, School of Natural Resources and Environment, The University of Michigan.  Executive Committee Member (Secretary) Community Systems Foundation, sarhaus@umich.edu, http://www-personal.umich.edu/~sarhaus/

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Spatial Synthesis
Volume II, Book 2:
Making It Clear: The Importance of Transparency

Sandra Lach Arlinghaus
sarhaus@umich.edu
http://www-personal.umich.edu/~sarhaus/

ANNOTATED RELATED LINKS
A STUDY IN SHADOWS

December

IMaGe LINKS
The links in this section are related to shadows. The image above shows shadow change, modeled in Google SketchUp for a segment of downtown Ann Arbor. The shadows that grow over time are more transparent than are the fixed ones that came in with the aerial baseplate from Google Earth.

In Solstice: An Electronic Journal of Geography and Mathematics:

- Volume XVI, Number 2, 2005  Beyond the Shadow  Sandra L. Arlinghaus and William C. Arlinghaus (Variation on a submission for the Pirelli Challenge of 2005).

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Software used in analysis:

- DevInfo 5.0: [http://www.devinfo.org/](http://www.devinfo.org/)
- Adobe® PhotoShop and ImageReady
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- ESRI:
  - ArcView® 3.2
  - ArcGIS® 9.2
    - ArcCatalog®
    - ArcMap®
- Google Earth®

Author affiliation:

Arlinghaus, Sandra Lach. Adjunct Professor of Mathematical Geography and Population-Environment Dynamics, School of Natural Resources and Environment, The University of Michigan. Executive Committee Member (Secretary) Community Systems Foundation, sarhaus@umich.edu, [http://www-personal.umich.edu/~sarhaus/](http://www-personal.umich.edu/~sarhaus/)

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ANNOTATED RELATED LINKS
CLASSICAL CENTRAL THEORY

IMaGe LINKS
The image above illustrates a strategy for aligning an historical map with the actual landscape. It also inserts bars as part of a hierarchy of the spatial distribution of cities and tributary areas in World War II Poland.


**In Solstice: An Electronic Journal of Geography and Mathematics:**

- *Volume XVII, Number 2, 2006* (all by Sandra Lach Arlinghaus)
  - Special Issue on Internet Geometry and Geography: Introduction to the Special Issue
  - Visualizing a Map of Walter Christaller, Poland 1941
    - Part I: Benchmarking the Map
    - Part II: Interpolation of the Benchmarked Map

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The land channel linking two coasts created greater piling up of Tsunami waters inland than along either coast. A similar, but not identical, effect occurs with tides in the Bay of Fundy. Policy makers of all sorts might be well-advised not to create channels with man-made structures that could cause unintended consequences from the piling up of water, air, or other naturally flowing substances.

IMaGe LINKS

The links in this section reflect a growing association in using Google Earth in projects and interests of Community Systems Foundation, an international NGO in Ann Arbor partnered with the United Nations.


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sarhaus@umich.edu
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ANNOTATED RELATED LINKS
THE SKYLINE AS BARCHART: THE VERTICAL CITY--URBAN CHANGE OVER TIME
United Kingdom 1901 urban population data of Michael Batty, visualized in Google Earth.
The links in this section reflect collaboration between S. Arlinghaus and M. Batty in the use of geometry in geography. An added link to a Tobler paper reflects his long-standing and continuing interest in that same interaction. A wide variety of linked articles reflecting relations between geometry and geography is available in the Solstice archive and in the online eBooks archive, http://www.imagenet.org/

In Solstice: An Electronic Journal of Geography and Mathematics:

- **Volume XVII, Number 2, 2006** Visualizing Rank and Size of Cities and Towns Sandra Arlinghaus and Michael Batty
  - Part I: England, Scotland, and Wales, 1901-2001
  - Part II: Greater London, 1901-2001
- **Volume XVII, Number 1, 2006** Zipf's Hyperboloid? Sandra L. Arlinghaus and Michael Batty
- Volume XII, Number 2 Spherical Measures without Spherical Trigonometry Waldo Tobler

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Semi-opaque layers of flood waters at different contours allow the reader to look through and see previous flood stages as well as what is already present in Google Earth and in the stock of 3D buildings. Diving through the layers permits one to see which basements lie below the flood waters at various levels.

IMaGe LINKS
The link in this section goes to files presented to municipal authorities (at the 3D Laboratory of the Duderstadt Center at The University of Michigan) to visualize, in Google Earth, possible outcomes from displacement of water due to the building of new structures in the Allen Creek floodplain. The image above shows an overlay in which different levels of water are visible. The image below shows an animation of successive fillings of the floodplain to different contour levels, from 770 to 900 feet. Both were used in conjunction with a discussion of Archimedes Principle of Displacement (“bathtub principle”) to illustrate the difficulty of building new structures in an existing floodplain. New structures will cause unintended consequences when the "bathtub" is filled; the filling water that has been displaced will overflow the "tub" perimeter.
In Solstice: An Electronic Journal of Geography and Mathematics:

- Volume XVI, Number 2, 2005 NEWS: UPDATE ON THE 3D ATLAS OF ANN ARBOR
  - Archimedes in Ann Arbor? Sandra Lach Arlinghaus
  - Virtual Flood in the Allen Creek Floodplain and Floodway. Alyssa J. Domzal, Ui Sang Hwang, and Kris J. Walters, Jr.

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ANNOTATED RELATED LINKS
SPATIAL SYNTHESIS

Great Lakes Basin: City Lights in Google Earth. Link to an earlier related article in Solstice: Volume XIII, Number 1, 2002 The Lights Are On, All Over the World Sandra Lach Arlinghaus.

IMaGe LINKS
The links in this section reflect the direct evolution of the Spatial Synthesis series.

In eBooks:

In Solstice: An Electronic Journal of Geography and Mathematics:
- Volume XVI, Number 1, 2005
  - Spatial Synthesis: The Evidence of Cartographic Example: Hierarchy and Centrality Sandra Lach Arlinghaus
  - Spatial Synthesis: Investigations in Progress Sandra Lach Arlinghaus
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sarhaus@umich.edu
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ANNOTATED RELATED LINKS
AWARDS

IMaGe LINKS
The link in this section shows selected "Blue Ribbon" models, of Archimedes, in the Google 3D Warehouse. Models receiving a Blue Ribbon appear in the default loadset of Google Earth when the 3D Buildings switch is clicked on. The scene above is aligned correctly with the underlying aerials. As aerials have changed in Google Earth over time, the alignment has become distorted.

In Solstice: An Electronic Journal of Geography and Mathematics:
Volume XVIII, Number 2, 2007

Awards (contains recent listing of "blue ribbons" from the "Best of the Google 3D Warehouse")

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Spatial Synthesis  
**Volume II, Book 2:**  
**Making It Clear: The Importance of Transparency**  

Sandra Lach Arlinghaus  
sarhaus@umich.edu  
http://www-personal.umich.edu/~sarhaus/  

**Volume I of the Spatial Synthesis series focuses on theory;**  
**Volume II of the series focuses on applications, turning theory into practice.**  

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These chapters use subtle effects and reflect the importance of transparency in making concepts become clear.

### INTRODUCTION

Graphics created on the computer often employ subtle capabilities that did not really exist in a paper and pen environment. Thus, "white" becomes a color to be used in the same way as red or green. "Transparent" also becomes a color by which to uncover parts of other images. Two dimensional maps composed of layers in Geographic Information Systems software may look through one layer to see part of another. Images created in Adobe Photoshop can be assigned partially opaque colors to let still others show through. The world of three-dimensional models suggests a host of opportunity for making things "clear." The emphasis in this second book in Volume II of the Spatial Synthesis is on the importance of transparency.

A visual annotated bibliography of previous related applications appears below. In the figure, click on an image (including the Earth at night) to go to related links. Author names appear on linked materials. These images link to electronic materials internal to the Institute of Mathematical Geography (IMaGe). Individual articles contain links to citations to a variety of materials. A poster based on this image was presented at the first "Scientific Applications with Google Earth Conference," October 22-23, 2008, at The University of Michigan, Ann Arbor. (Link to full-sized poster presented by the author.)

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**POPULATION-ENVIRONMENT DYNAMICS: A GOOGLE EARTH APPROACH**

Sandra Lach Arlinghaus, Ph.D., Adjunct Professor of Mathematical Geography and Population Environment Dynamics, School of Natural Resources and Environment, The University of Michigan; Member Executive Committee, Community Systems Foundation

**BEFORE GOOGLE EARTH...**

**MUNICIPAL APPLICATIONS:**  
PLANNING, ZONING, AND EMERGENCY MANAGEMENT

**ARCHIMEDES IN ANN ARBOR:**  
VISUALIZATION OF THE ALLEN CREEK FLOODPLAIN
THEN CAME GOOGLE EARTH...

A HOST OF BUILDINGS (OVER 400) WAS CREATED, TOWN AND GOWN–TEXTURED AND UNTEXTURED, AND FROM THAT WORK, 2006 FORWARD, FLOWED OTHER APPLICATIONS...

Allen Creek

The Skyline as Barchart:
The Vertical City–Urban Change over Time.

Banda Aceh,
Piling up of Tsunami Waters

Classical Central Place Theory

A Study in Shadows

Burundi Buffers: DevInfo Data to Google Earth

Google, Escher, and...?

Tracking the spread of possible honeybee extinction

Desargues's Two Triangle Theorem

Harmonic Map Projection Theorem

The Transparent Google Globe:
The Next Frontier?
Tetrahedron in the Google Globe

Neighborhood Watch

Selected References:

ON THE HORIZON...

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