

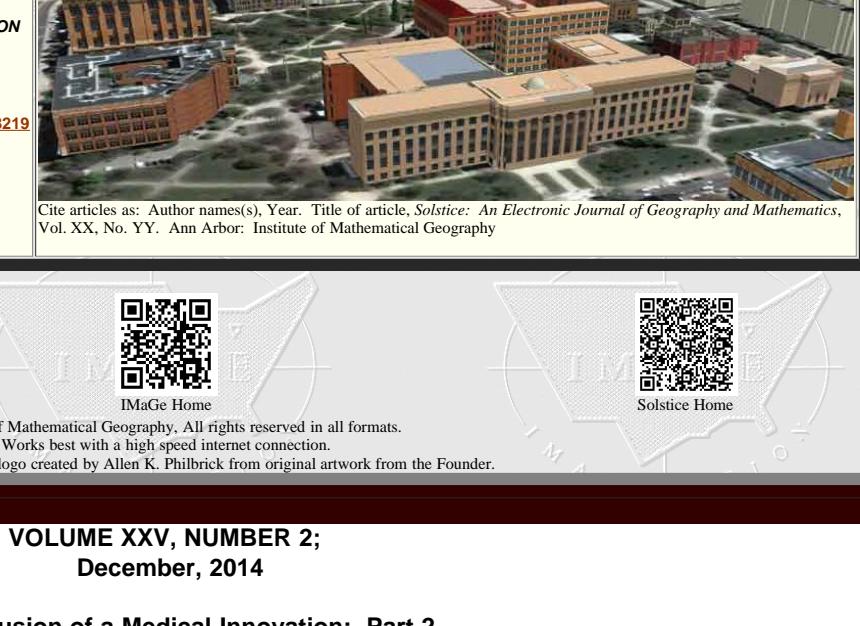
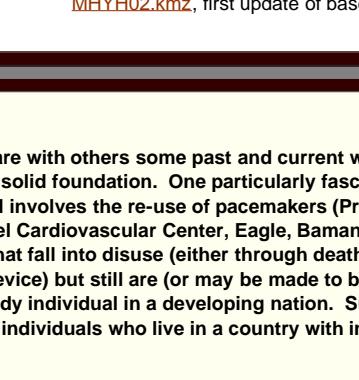
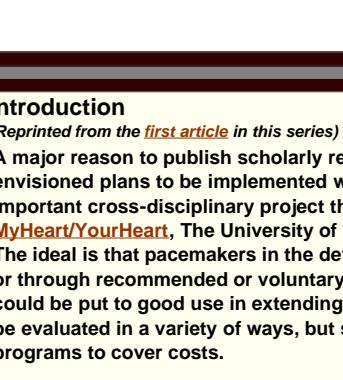

SOLSTICE:
An Electronic Journal of
Geography and Mathematics

COMPLETING ITS 25TH YEAR OF PUBLICATION

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Works best with a high speed internet connection.

Final version of IMaGe logo created by Allen K. Philbrick from original artwork from the Founder.

VOLUME XXV, NUMBER 2;
December, 2014**The Diffusion of a Medical Innovation: Part 2**

Sandra L. Arlinghaus, Thomas C. Crawford, Kim A. Eagle*

Associated downloads to open in Google Earth (.kmz files):

[MHYH.kmz](#), baseline file of publications in geographical context[MHYH02.kmz](#), first update of baseline file**Introduction**(Reprinted from the [first article](#) in this series)

A major reason to publish scholarly research is to share with others some past and current wisdom so that envisioned plans to be implemented will be built on a solid foundation. One particularly fascinating and important cross-disciplinary project that is envisioned involves the re-use of pacemakers (Project [MyHeart/YourHeart](#), The University of Michigan Frankel Cardiovascular Center, Eagle, Baman, and Crawford). The ideal is that pacemakers in the developed world that fall into disuse (either through death of an individual or through recommended or voluntary upgrade of a device) but still are (or may be made to be) functional, could be put to good use in extending the life of a needy individual in a developing nation. Such 'need' might be evaluated in a variety of ways, but surely excludes individuals who live in a country with insurance programs to cover costs.

It might seem simple just to send a pacemaker from one place to another, as an appropriate 'green' approach to extending life. There are, however, federal and state regulations regarding the transport of used medical devices and these do not always fall neatly into a nested hierarchy of regulations that fit cleanly. There are matters of device safety, cleanliness, and sterilization. There are matters of training staff in developing nations to perform implantation and maintenance of devices according to protocol standards that are perhaps different from what the local medical population is accustomed to. In brief, it is a highly complex issue cutting across the medical, biological, environmental, political, and death-care fronts. The [linked visual](#), printed originally in a reference below ([Pacemaker Reuse: An Initiative to Alleviate the Burden of Symptomatic Bradycardia in Impoverished Nations Around the World](#)), offers a clear picture of many of the issues involved in the project.

To achieve the ideals of this project is time-consuming and much needs to be done according to the agendas and schedules of local and federal regulatory process at both the developed and the developing nation ends of the spectrum—rather than at the pace of the scientists. The gap between ideal/mission creation and implementation is one that can be filled constructively with continuing scholarly research on various aspects of the topic. The mechanisms of diffusion from initial adoptors, as represented by authors of published materials, are inspired by earlier work of Torsten Hagerstrand.* As the [MyHeart/YourHeart](#) website notes:

Recycle your Pacemakers!

Our Ultimate Goal: Recycle used pacemakers once regulator approvals are obtained. In the meantime, research is being conducted that will lay the groundwork for this potentially life-saving project.

Each year 1-2 million individuals worldwide die due to a lack of access to pacemakers. Meanwhile, almost 90% of individuals with pacemakers would donate their device to others in need if given the chance.

To see what is happening in that gap, we offer visualization (using Google Earth) of where authors of related articles were located at the time the article was written. This simple tracking of the global distribution of interested scholars points out 'adopters' of the idea who may serve as diffusers within their realms of contact. Indeed the mere tracking of the dissemination of interest in the ideals of the project may, by itself, help to speed the project along its path from conception to implementation! Letting those with other than scholarly agendas see that the world of dedicated researchers is leading the way may move hesitant others along the path toward acceptance and full whole-hearted support.

Visualization in Google Earth

A Google Earth file depicts the location of all authors, present on the [MyHeart/YourHeart](#) website as of early November, 2014. That file is available here to download:

<http://www.mylovedone.com/image/solstice/sum14/MHYH02.kmz>

Save the file on your computer in a location of your choice. Then, using the free version of Google Earth (presumably already on your computer; if not, install it if you wish to look directly at the Google Earth file). Then, open Google Earth and go to File | Open. Navigate to where you saved the file. Open it in Google Earth. The start scene should be similar to the image in Figure 1, below. If it is not, click on the title at the top of the Frankel Cardiovascular Center layer. Letting those with other than scholarly agendas see that the world of dedicated researchers is leading the way may move hesitant others along the path toward acceptance and full whole-hearted support.



Figure 1. Start scene of MHYH02.kmz-linked Google Earth file.

The first article in this series identified directions for future development. One of them involved the updating of the Google Earth file to reflect improvements in the file itself and the associated proliferation of publications. To those ends, we note the following:

- Links added to the catalogue of publications (when available) to online persistent archived materials in DeepBlue, the persistent archive of The University of Michigan; this project is also a growing one, at present with two such links.
- New publications, 2014, since the first article tracking publications were added to the kmz file:
 - Heart Rhythm Society members' views on pacemaker and implantable cardioverter-defibrillator reuse. *Pacing Clin Electrophysiol*. 2014 Aug;37(8):969-77. doi: 10.1111/pace.12418. Epub 2014 May 1. [Hughey AB, Desai N, Baman TS, Gakenheimer L, Hagan JN, Kirkpatrick JN, Oral H, Eagle KA, Crawford TC](#).
 - *Scientific American: Promoting Cardiovascular Health Worldwide: Perspective on the 12 Recommendations from the Institute of Medicine*. Edited by Valentin Fuster, Jagat Narula, Rajesh Vedanathan, Bridget B. Kelly. In particular, see Recommendation 6: Improve Access to CVD Diagnostics, Medicines and Technologies, "Delivering Care Where It's Needed" K. Srinath Reddy, Rajesh Vedanathan, Sylvester Kimaiyo, Andrew B. Hughey, Kim A. Eagle and Thomas C. Crawford. Free download of monograph is available.

Updating of the Google Earth file involves several hours of effort per new article, as new authors are searched for on the Internet and geocoded placemarks are inserted on the globe. Once an entry is found, material is inserted in the Google Earth file in both the list of authors and in the catalogue of articles (with authors attached). New html code is written to update materials as needed in each of these situations.

List of publications cited previously and included in the baseline Google Earth File, MHYH.kmz.

- 2009. Safety and Efficacy of Pacemaker Reuse in Underdeveloped Nations
- 2009. Pacemaker Reuse in a 65-Year-Old Woman in the Philippines with Severe Medical Need
- 2010. Pacemaker Reuse: An Initiative to Alleviate the Burden of Symptomatic Bradycardia in Impoverished Nations Around the World
- 2010. Impact of Pacemakers and Defibrillators in Developing Countries: Logistical, legal, and ethical barriers and solutions
- 2011. Societal views of pacemaker reutilization for those with undiagnosed symptomatic bradycardia in underserved nations
- 2011. Safety, Efficacy, and Performance of Implanted Recycled Cardiac Rhythm Management (CRM) Devices in Underserved Patients
- 2011. Safety of Pacemaker Reuse
- 2011. Cardiac Device Reutilization: Is It Time to "Go Green" in Underserved Countries?
- 2011. The ethics of pacemaker reuse- might the best be the enemy of the good?
- 2011? Post-Mortem Cardiac Device Retrieval for Re-Use in Third World Nations: Views of Funeral Directors (PPT)
- 2011? Post-Mortem Cardiac Device Retrieval for Re-Use in Third World Nations: Views of the General Public & Patient Population (PPT)
- 2012. Impact of Pacemakers: Comparison of Short and Long-term Performance
- 2012. Pacemaker reutilization for those in underserved nations: Examining preliminary data and future prospects
- 2013. Cardiac Implantable Electronic Device Reutilization: Battery Life of Explanted Devices at a Tertiary Care Center
- 2014. The Diffusion of a Medical Innovation: Visualization Using Google Earth

Future updates might track authors as they move around; other updates will of course be based on the proliferation of publications. It will be interesting and perhaps important to track this movement over time. The current map is a one step beyond the baseline from which to measure both infill and expansion, all coming from the diffusion of the innovation of pacemaker reuse.

**Torsten Hagerstrand. 1968. *Innovation Diffusion as a Spatial Process*. Translation and Postscript by Allan Pred. Chicago: University of Chicago Press.

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Solstice was a Pirelli INTERNETEL Award Semi-Finalist, 2001 (top 80 out of over 1000 entries worldwide)

One article in Solstice was a Pirelli INTERNETEL Award Semi-Finalist, 2003 (Spatial Synthesis Sampler).

Solstice is listed in the Directory of Open Access Journals maintained by the University of Lund where it is maintained as a "searchable" journal.

Solstice is listed on the journals section of the website of the American Mathematical Society, <http://www.ams.org>

Solstice is listed in Geoscience e-Journals

IMaGe is listed on the website of the Numerical Cartography Lab of The Ohio State University: http://ncl.sbs.ohio-state.edu/4_homes.html

Congratulations to all Solstice contributors.

Remembering those who are gone now but who contributed in various ways to Solstice or to IMaGe projects, directly or indirectly, during the first 28 years of IMaGe:

Allen K. Philbrick | Alma S. Lach | Donald F. Lach | Frank Harary | William D. Drake | H. S. M. Coxeter | Saunders Mac Lane | Chauncy D. Harris | Norton S. Ginsburg | Sylvia L. Thrupp | Arthur L. Loeb | George Kish |

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