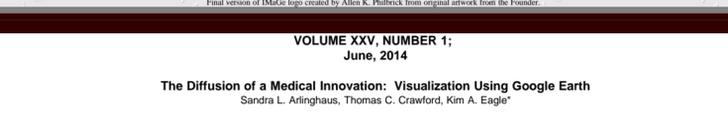


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Final version of IMaGe logo created by Allen K. Phillbrick from original artwork from the Founder.

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The Diffusion of a Medical Innovation: Visualization Using Google Earth
Sandra L. Arlinghaus, Thomas C. Crawford, Kim A. Eagle*

Introduction

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 (Eagle, 2009), 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 adopters, 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 by 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 more tracking of the dissemination 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 May, 2014. That file is available here to download: <http://www.mhahomeat.umich.edu/images/solstice/sum14/MHYH.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. Click on the 3D Buildings layer to bring up the buildings shown below.

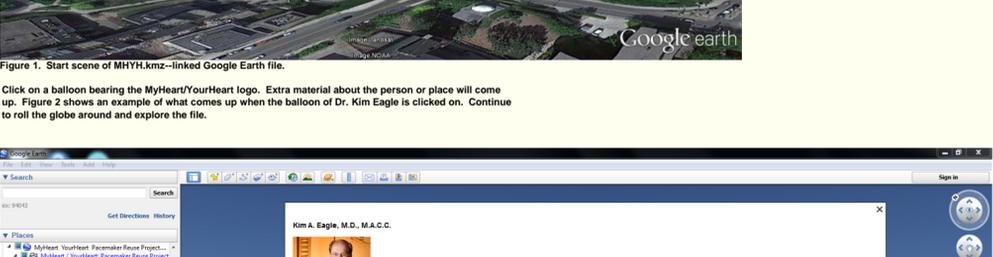


Figure 1. Start scene of MHYH.kmz-linked Google Earth file.

Click on a balloon bearing the MyHeart/YourHeart logo. Extra material about the person or place will come up. Figure 2 shows an example of what comes up when the balloon of Dr. Kim Eagle is clicked on. Continue to roll the globe around and explore the file.

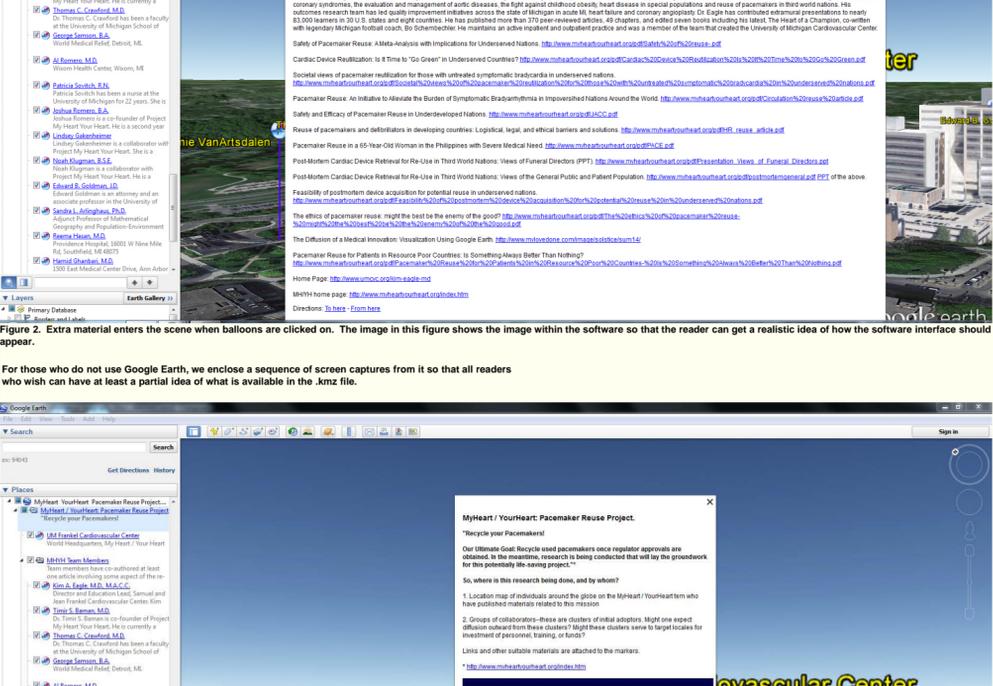


Figure 2. Extra material enters the scene when balloons are clicked on. The image in this figure shows the image within the software so that the reader can get a realistic idea of how the software interface should appear.

For those who do not use Google Earth, we enclose a sequence of screen captures from it so that all readers who wish can have at least a partial idea of what is available in the .kmz file.



Figure 3. Read about MyHeart/YourHeart when the link on the top layer is clicked on.

Figure 4 shows a tour of the Google Earth file. It is embedded in the browser window. Click on the buildings. See what comes up. Look around for yourself. If you stop the tour, just push the play arrow and it will start up again. Or, download the Google Earth file (from the link above) and then click on the tour to see it directly in a larger view. Then, navigate around the scene yourself, clicking on links to get a good sense of the richness of this project in terms of depth of global contacts.

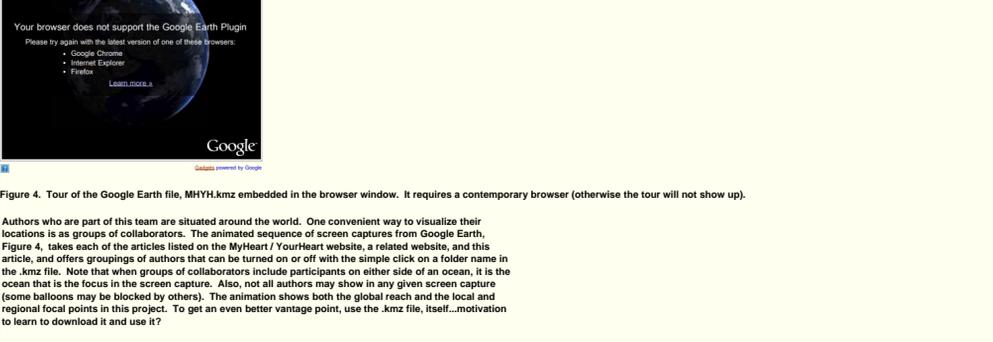


Figure 4. Tour of the Google Earth file, MHYH.kmz embedded in the browser window. It requires a contemporary browser (otherwise the tour will not show up).

Authors who are part of this team are situated around the world. One convenient way to visualize their locations is as groups of collaborators. The animated sequence of screen captures from Google Earth, Figure 5, takes each of the articles listed on the MyHeart/YourHeart website, a related website, and this article, and offers groupings of authors that can be turned on or off with the simple click on a folder name in the .kmz file. Note that when groups of collaborators include participants on either side of an ocean, it is the ocean that is the focus in the screen capture. Also, not all authors may show in any given screen capture (some balloons may be blocked by others). The animation shows both the global reach and the local and regional focal points in this project. To get an even better vantage point, use the .kmz file, itself...motivation to learn to download it and use it?



Figure 5: Diffusing collaborators shows both the global reach of the project as well as local and regional focal points.

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 baseline from which to measure both infill and expansion, all coming from the diffusion of the innovation of pacemaker reuse.

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

*Sandra L. Arlinghaus, Ph.D., is Adjunct Professor of Mathematical Geography and Population-Environment Dynamics at The University of Michigan School of Natural Resources and Environment and also Adjunct Professor at The University of Michigan Institute for Research on Labor, Employment, and the Economy (Chrysler Street History Study). Thomas C. Crawford, M.D., is Clinical Assistant Professor, Internal Medicine - Cardiology at The University of Michigan Health System. Kim A. Eagle, M.D., is the Allison Walter Hewlett Professor of Internal Medicine and Director of the Samuel and Jean Frankel Cardiovascular Center at The University of Michigan Health System.

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Solstice was a Pivotal INTERNETIONAL Award Semi-Finalist, 2007 (top 80 out of over 1000 entries worldwide)

One article in Solstice was a Pivotal INTERNETIONAL Award Semi-Finalist, 2003 (Spatial Synthesis Semester)

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 *Journal's* section of the website of the American Mathematical Society, <http://www.ams.org/>

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IMaGe is listed on the website of the Numerical Cartography Lab of The Ohio State University: http://ltdl.olsl.ohio-state.edu/ef_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 25 years of IMaGe:

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