It Doesn't Take A Genius:
the life and times of a mathematician

Dr. Eugenie Hunsicker

Loughborough University

LMS Women in Mathematics Committee Chair

Somerville Maths Reunion

24 June 2017

Starting University: Pre Med

Junior Year Abroad: Oxford

Karin Erdmann, my first woman mathematics lecturer

Graduate School:

the Spartan approach to grad students

First Women in Maths Activities

Mental Health:
Generalized Anxiety Disorder

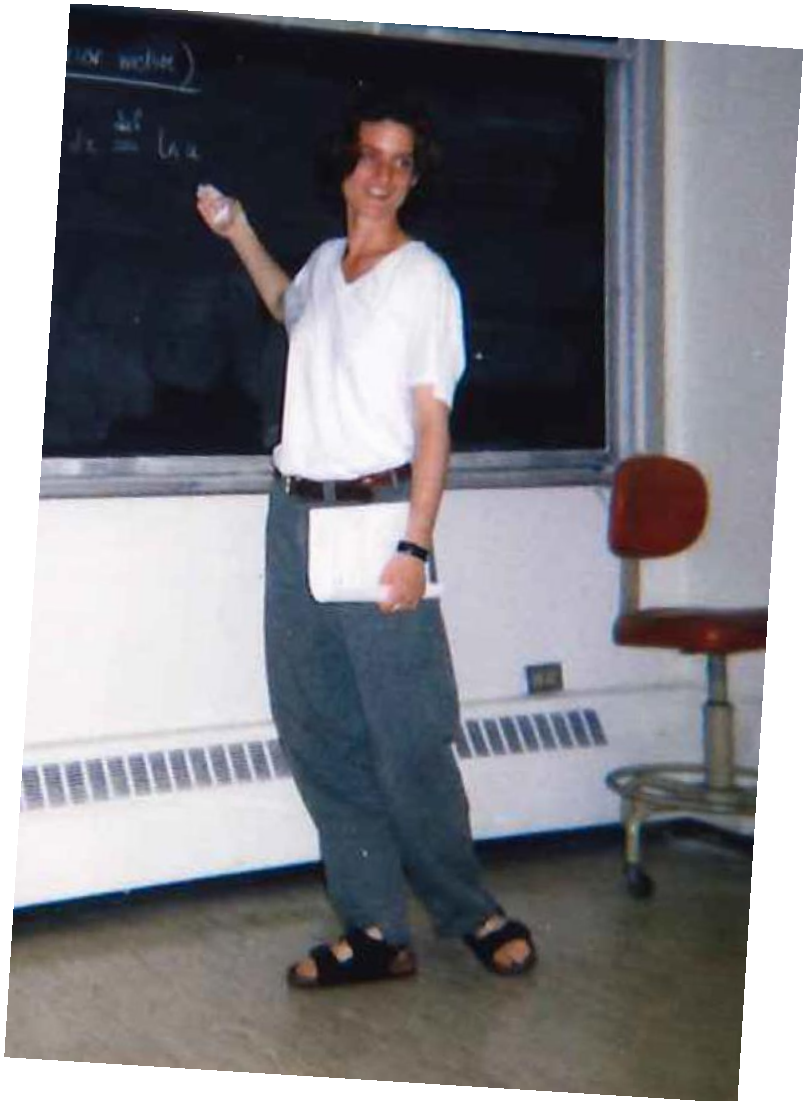
Are you troubled by the following?

Yes ○ **No** ○	Excessive worry, occurring more days than not, for a least six months
Yes ○ **No** ○	Unreasonable worry about events or activities, such as work, school, or your health
Yes ○ **No** ○	The inability to control the worry

Are you bothered by at least three of the following?

Yes ○ **No** ○	Restlessness, feeling keyed-up, or on edge

A Career in Teaching?



Working at a Liberal Arts College

New Collaborations: Stanford

THE paper

(that got me a research job at Loughborough)

HODGE COHOMOLOGY OF GRAVITATIONAL INSTANTONS

TAMÁS HAUSEL, EUGENIE HUNSICKER, and RAFE MAZZEO

Abstract

We study the space of L^2 harmonic forms on complete manifolds with metrics of fibred boundary or fibred cusp type. These metrics generalize the geometric structures at infinity of several different well-known classes of metrics, including asymptotically locally Euclidean manifolds, the (known types of) gravitational instantons, and also Poincaré metrics on $\mathbb{Q}$-rank 1 ends of locally symmetric spaces and on the comple-

DUKE MATHEMATICAL JOURNAL
Vol. 122, No. 3, © 2004
Received 6 September 2002. Revision received 3 June 2003.
2000 *Mathematics Subject Classification*. Primary 58A14, 35S35; Secondary 35A27, 35J70.
Hausel's work supported by a Miller Research Fellowship at the University of California, Berkeley

Adoption:
the bureaucratic nightmare 2008-2010

…and more recently

Starting a New Direction: Statistics

2011: Start teaching (and learning!) undergraduate applied statistics, become programme director for new Mathematics with Statistics programme

Summer 2012: HEA Teaching Development Grant: Undergraduate summer research project to develop online resources and teaching materials

2012-13: Five final year undergraduate projects in different statistics topics

Summer 2013: Another undergraduate research project to develop online statistics resources, funded by Loughborough Teaching Innovation Award

2015: Midlife crisis—decision to change research

2015-16: Developing collaborations

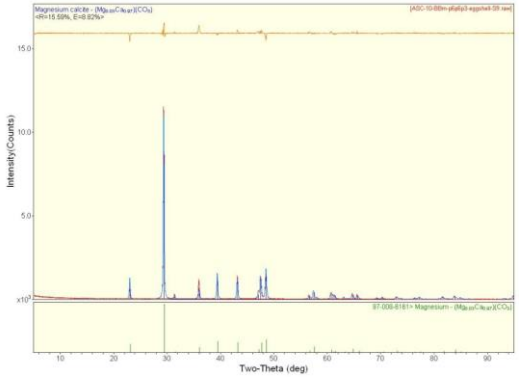
2016: First PhD students in statistics

2017: First publications

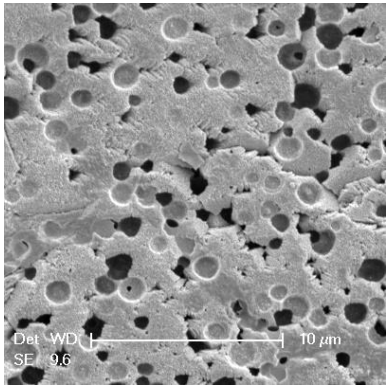
Characterising Materials:

Q: How do composition and structure influence materials properties?

Composition



Structure



Materials Properties

?

?

- Rigaku.com: spectrograph of eggshell
- The Stoddard Lab www.marycstoddard.com : An SEM image of an eggshell surface. © M. C. Stoddard.
- www.monday-8am.com: eggshell in a vice

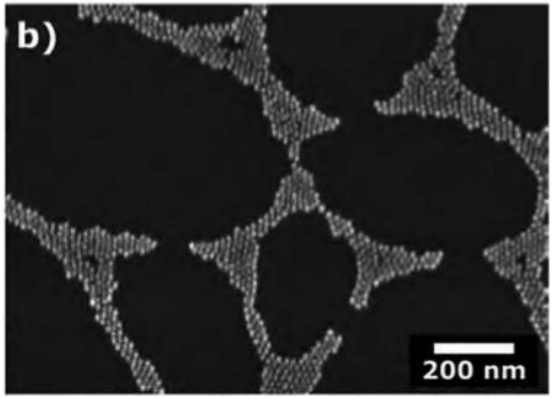
Creating materials:

How can we compare materials created in different ways?

Naturally occurring

?

Laboratory fabrication



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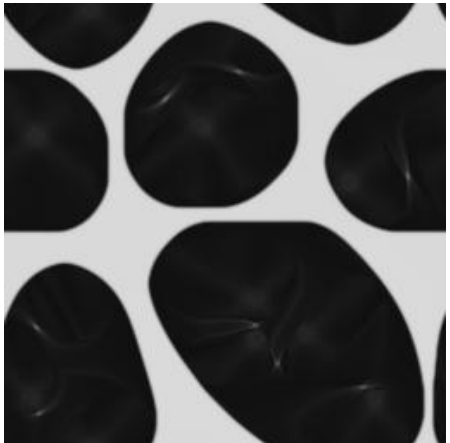
Numerical Model

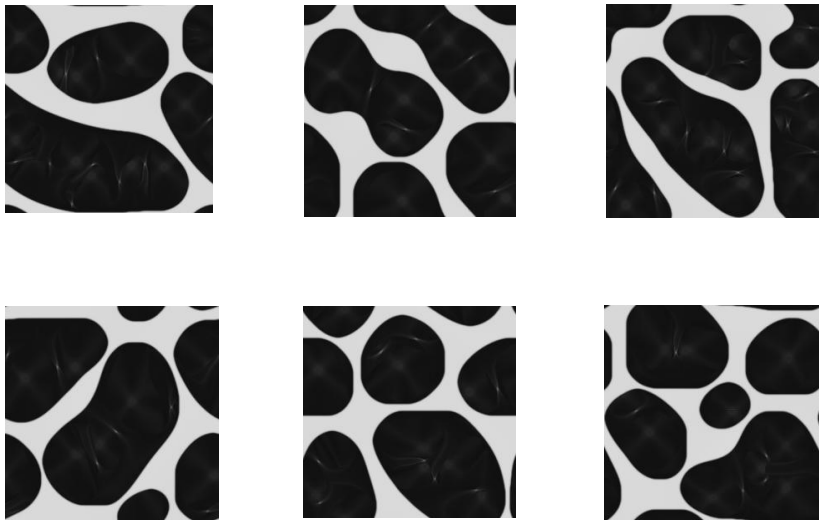


?

- Salt Pans, evaporative deposition, Alamy stock photo
- Gold Nanoparticle deposition: Kunstmann-Olsen et al, 2015
- DDFT model

Materials Image data: Challenges

Random Variation



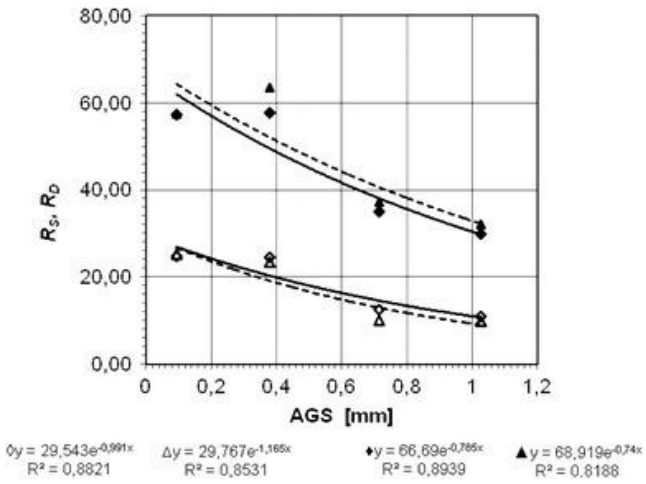
Cost of data

To overcome these, we need robust and efficient statistical methods for comparing image data.

http://www.microelectronics.scu.edu/REVISE/equipment.htm

How do we do statistics on images?

Typical engineer approach: Calculate a few numbers from each of eight images and put in error bars ☺



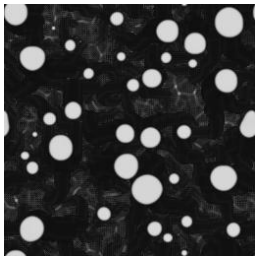
Better approaches:

- Machine learning/ bootstrapping and nonparametric statistics: excellent results when there is a vast amount of data. (e.g. Facebook profile photos)
- Parametric statistics: use *models* to improve inferential ability with smaller amounts of data (small prototype batch of new material).

For the second approach, we need to be able to say how far apart two images are in some appropriate sense.

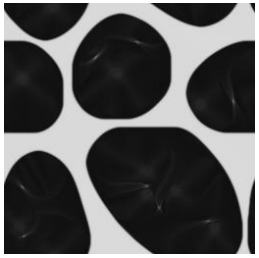
Challenges in parametric statistics of materials images

Describe good geometric models for material structures

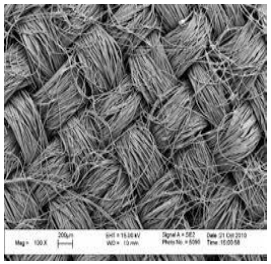


Grains or particles

Branches or capillaries

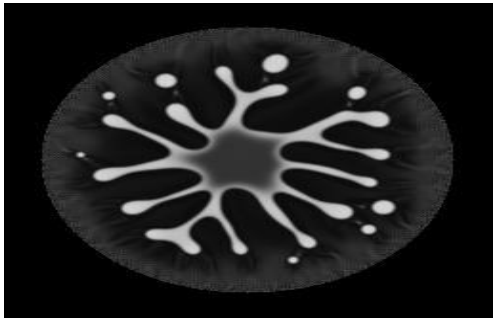


Pores or cells



Periodic structures,
Multiscale structures

Define and study distances between pairs of images



Which two images are the closest?

The third (and often largest!) part of the job: Admin and Service

- 2013: *Member of London Mathematical Society Women in Maths committee*
- 2015: *Chair LMS women in maths committee*
  - *Athena Forum member*
  - *Service Teaching Coordinator*
- 2016: ***sigma*** *steering group member*
- 2017: *Interim director, Centre for Imaging Science*

Sometimes I ask myself…

Have I had a successful mathematics career?

Why is everyone so worried about women in mathematics?

- The UK has a desperate need for highly numerate employees. We can't afford to discourage half the population from such careers.
- Mathematics and industry both benefit from a diverse set of viewpoints and experiences.
- The UK has lower participation rates by women in maths than other EU countries.
- Despite the years since open discrimination was banned, women are still only 7.4% of mathematics professors are women—the numbers at highest levels in industry are not much different.

Some Research:

The Impact of Implicit Bias

New Research Proves Gender Bias Extraordinarily Prevalent in Stem Careers

Columbia Business School experiments show that hiring managers chose men twice as often for careers in science, technology, engineering and math

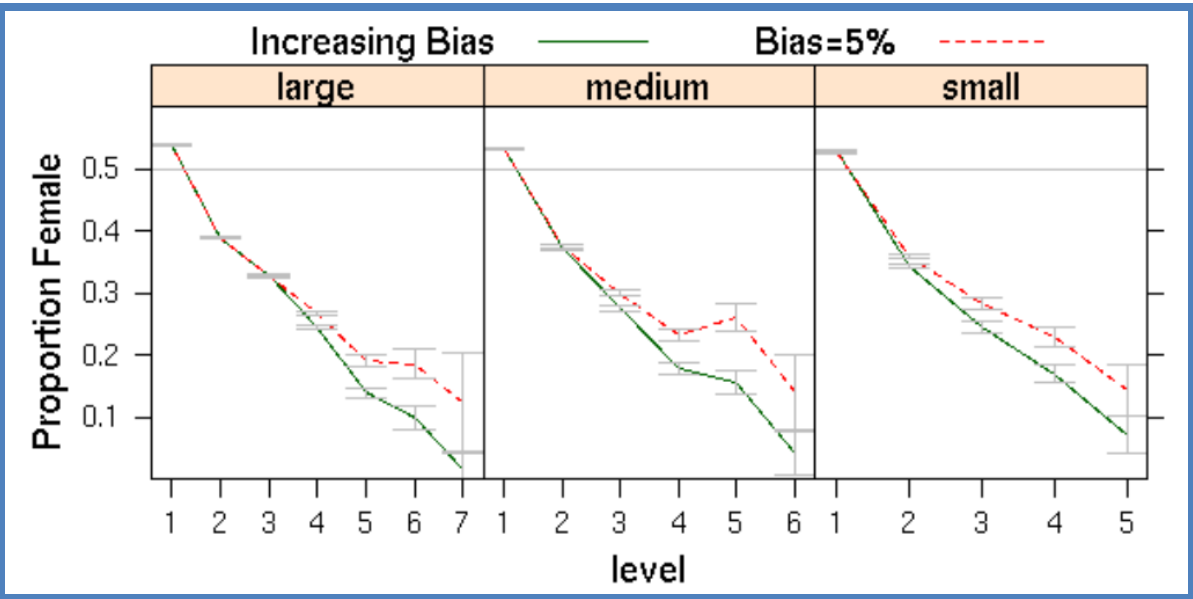
March 19, 2014

Some Research:
The Impact of Implicit Bias

James F. Robison-Cox, Richard F. Martell and Cynthia G. Emrich (2007)

Simulating Gender Stratification

Journal of Artificial Societies and Social Simulation vol. 10, no. 3 8
<http://jasss.soc.surrey.ac.uk/10/3/8.html>



Some Research:

The Impact of Implicit Bias

Science faculty's subtle gender biases favor male students

Corinne A. Moss-Racusin[a,b], John F. Dovidio[b], Victoria L. Brescoll[c], Mark J. Graham[a,d], and Jo Handelsman[a,1]

Author Affiliations

Edited* by Shirley Tilghman, Princeton University, Princeton, NJ, and approved August 21, 2012 (received for review July 2, 2012)

Some Research:

The Impact of Implicit Bias

Have Gender Gaps in Math Closed? Achievement, Teacher Perceptions, and Learning Behaviors Across Two ECLS-K Cohorts

Joseph R. Cimpian, Sarah T. Lubienski, Jennifer D. Timmer, Martha B. Makowski, Emily K. Miller

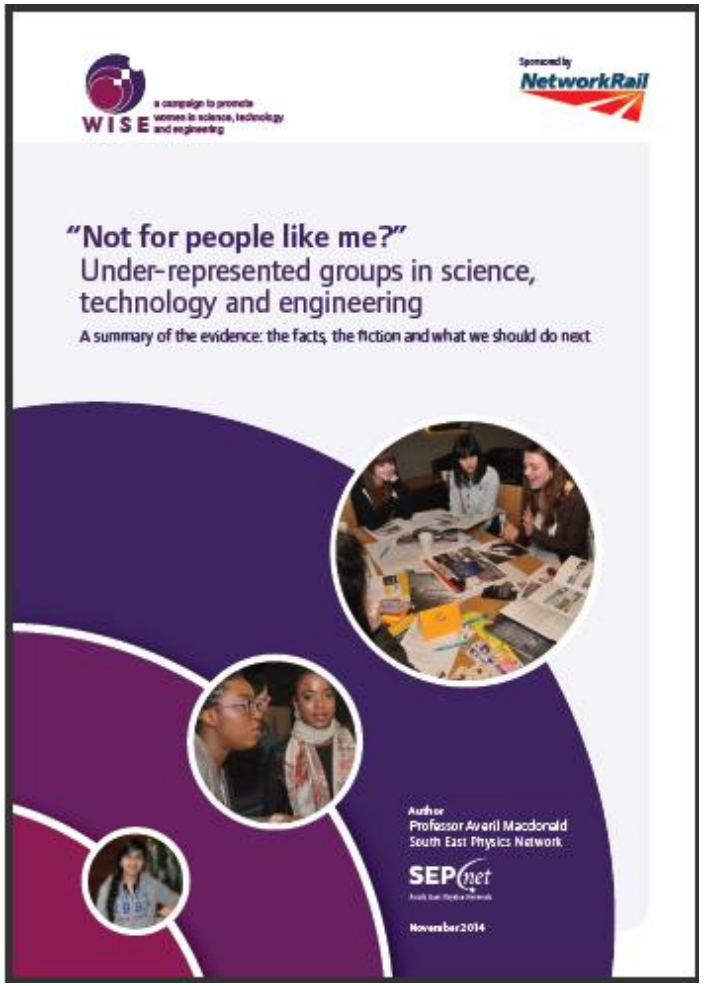
First Published October 1, 2016 | research-article

gaps more at the bottom than the top of the distribution. Overall, this study reveals remarkable consistency across both ECLS-K cohorts, with the gender gap developing early among high achievers and spreading quickly throughout the distribution. Teachers consistently rate girls' mathematical proficiency lower than that of boys with similar achievement and learning behaviors. Gender differences in learning approaches appear to be fairly consistent across the achievement distribution, but girls' more studious approaches appear to have more payoff at the bottom of the distribution than at the top. Questions remain regarding why boys

Already when students are 5 years old!

Some WISE conclusions

- One-off interventions don't work – consistent approaches are essential.
- Initiatives that seek to 'encourage' girls into STEM are misplaced.
- The evidence is that girls are making entirely logical careers choices based on the information available.
- There should be NO implication that girls must change.
- The needs of girls and young women, including supportive employment conditions and the ability to progress while working part time, must be consistently embedded into all messaging from the STEM sector.
- Above all, girls need to be able to self-identify that **'science is for people like me'.**



We need to change POLICIES.

We need to change CULTURE.

This is EVERYONE’S problem.

LMS women in maths activities

Policy:

- Good Practice Scheme
- Policies within LMS
- Carer grants, Grace Chisholm Young fellowships

Culture:

- Women and Girls in Maths events
- Mary Cartwright Lecture
- Anne Bennet Prizes
- Success Stories project

Thanks for listening!