WHY WON'T THEY USE MY STUFF, AND WHAT SHOULD I DO ABOUT IT?

URSULA MARTIN

OXFORD/EDINBURGH

WHY WON'T THEY USE MY OUR STUFF, AND WHAT SHOULD I WE DO ABOUT IT?

URSULA MARTIN

OXFORD/EDINBURGH


mathematic*
proof*
formalis*
system*
use
develop
theor*
librar*
verif*
point
large
also
express*
literature
building
manifesto
logic
can
well
project
based
methods
look*
QED
language
students
automated
overview
different
principle
theorem
object*
spaces
new
practice
increas*
view
way
example
learning
program
including
discuss
reasoning
knowledge
type
necessary
analysis
computer
data
various
diagrams

TECH TRANSFER STAKEHOLDER

SUSTAINABILITY SWOT ANALYSIS

DASHBOARD STRATEGY

MARGINS KPI

IMPACT GVA

MANAGEMENT METRICS

CO-CREATION GOVERNANCE

ACCOUNTABILITY LEAGUE TABLE

HoDoMS
Heads of Department of Mathematical Sciences

Annual Conference and AGM

4-5 April 2019	The 2019 Annual Conference was held at Edgbaston Park Hotel
4 April 2019	Alison Etheridge(Oxford): REF2021
4 April 2019	Mary McAlinden (Greenwich): Subject-Level TEF: Impact and Implications
4 April 2019	Jon Forster (Southampton): Independent Review of the TEF
4 April 2019	Deborah Ashby (Imperial): The Royal Statistical Society 185 Years Young: Recent Developments and Future Priorities
4 April 2019	Noel-Ann Bradshaw (Sainsbury's Argos), John Greenlees (Warwick): Teaching discussion: Should mathematics students be taught fundamental mathematics or employability skills?
5 April 2019	Alan Champneys (Bristol): Knowledge Exchange Post Bond Review - What Is (Or Is Not) Happening Next
5 April 2019	Matt Butchers (KTN): The Industrial Strategy Challenge Fund: Putting Mathematics at its Heart
5 April 2019	Simon Singh: Encourage Maths Excellence in Schools
5 April 201	Steve Langdon (Reading): New course for Heads in the autumn
5 April 2019	Alan Percy (Oxford): An Overview of Mental Health in the UK University Sector
5 April 2019	Nicky Old (UUK): Higher Education: The Known Unknowns

HOW DOES RESEARCH IMPACT HAPPEN?

impact

noun [C usually singular, U] • UK /ˈɪm.pækt/ US /ˈɪm.pækt/

C2 the force or action of one object hitting another:

The impact of the crash reduced the car to a third of its original length.

*The bullet explodes **on** impact (= when it hits another object).*

B2 a powerful effect that something, especially something new, has on a situation or person:

*The anti-smoking campaign had **had/made** quite an impact **on** young people.*

*The new proposals were intended to **soften** the impact of the reformed tax system.*

SCIENCE, THE ENDLESS FRONTIER, V BUSH, JULY 1945

New frontiers of the mind are before us, and if they are pioneered with the same vision, boldness, and drive with which we have waged this war we can create a fuller and more fruitful employment, and a fuller and more fruitful life. Government should foster the opening of new frontiers and this is the modern way to do it. Advances in science mean more jobs, higher wages, shorter hours, more abundant crops, more leisure for recreation, for study, for learning how to live without the deadening drudgery which has been the burden of the common man for ages past.

Scientific progress on a broad front results from the free play of free intellects, working on subjects of their own choice, in the manner dictated by their curiosity for exploration of the unknown. Basic research is performed without thought of practical ends. It results in general knowledge and an understanding of nature and its laws [which] provides the means of answering a large number of important practical problems, though it may not give a complete specific answer to any one of them.

At left: Professor R. Courant, Professor Emeritus of the Courant Institute at New York University, and special consultant to IBM. At right: Dr. H. H. Goldstine, Director of IBM's Mathematical Sciences Department.

What does this chat on mathematics have to do with biologists, your heartbeat, moon shots and a sizzling steak?

YOU ARE looking in on a work session at IBM's Thomas J. Watson Research Center. The two mathematicians you see here are discussing a system of non-linear differential equations.

It is a most abstruse subject, but out of their work may come dozens of practical applications.

For instance, it may result in a new programming idea for a computer. This, in turn, may help some biologist probe deeper into life processes, or enable a cardiac specialist to analyze the heart's electrical activity with new precision. Or speed an astronaut to the moon. Or, simply, show a rancher how to raise better beef.

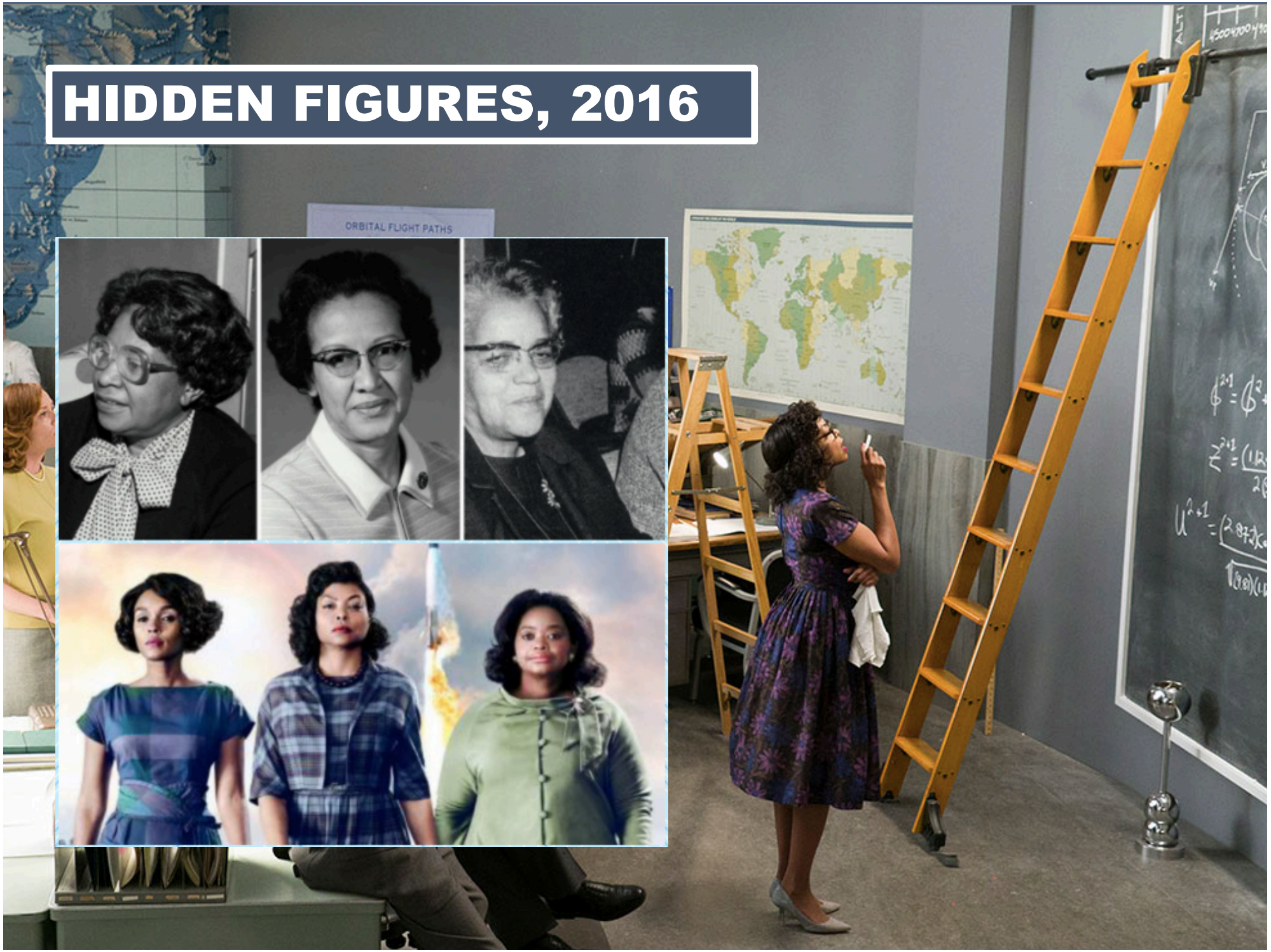
Mathematical thought has a world of destinations at IBM. Its applications are almost as numerous as humanity's needs—and dreams.

IBM.

Scientific American, Sept 1964, p99


HIDDEN FIGURES, 2016
ORBITAL FLIGHT PATHS

HIDDEN FIGURES, 2016



HOW DOES MATHS IMPACT HAPPEN?

IMPACT150: MATHS IMPACT STORIES

“All mathematicians are convinced that mathematics has broad impact, but it can require work to convince others. These stories celebrates the long term, pervasive and holographic impact of mathematics. I hope you will enjoy them, and share them with friends, family and colleagues.”

IMPACT150: MATHS IMPACT STORIES

LONDON MATHEMATICAL SOCIETY
EST. 1865

"All mathematicians are convinced that mathematics has broad impact, but it can require work to convince others. These stories celebrates the long term, pervasive and holographic impact of mathematics. I hope you will enjoy them, and share them with friends, family and colleagues."

Developments in the Theory and Applications of Moving Frames

This article surveys recent advances in the equivariant approach to the method of moving frames, concentrating on finite-dimensional Lie group actions. A sampling from the many current applications — to geometry, invariant theory, and image processing — will be presented.

According to Akivis, [**2**], the method of *repères mobiles*, which was translated into English as *moving frames*†, can be traced back to the moving trihedrons introduced by the Estonian mathematician Martin Bartels (1769–1836), a teacher of both Gauß and Lobachevsky. The apotheosis of the classical development can be found in the seminal advances of Élie Cartan, [**25**, **26**], who forged earlier contributions by Frenet, Serret, Darboux, Cotton, and others into a powerful tool for analyzing the geometric properties of submanifolds and their invariants under

The *Syzygy Theorem*, first stated (not quite correctly) in [**37**] for finite-dimensional actions, and then rigorously formulated and proved in [**128**], states that there are, in essence, a finite number of generating differential syzygies along with those induced by the commutator equations (5.11). Again, this result can be viewed as the differential invariant algebra counterpart of the Hilbert Syzygy Theorem for polynomial ideals, [**32**].

RESEARCH IMPACT - UK GOVERNMENT

- **Delivering highly skilled people to the labour market**
- **Improving the performance of existing businesses**
- **Creating new businesses**
- **Improving public policy and public services**
- **Attracting R&D investment from global business**

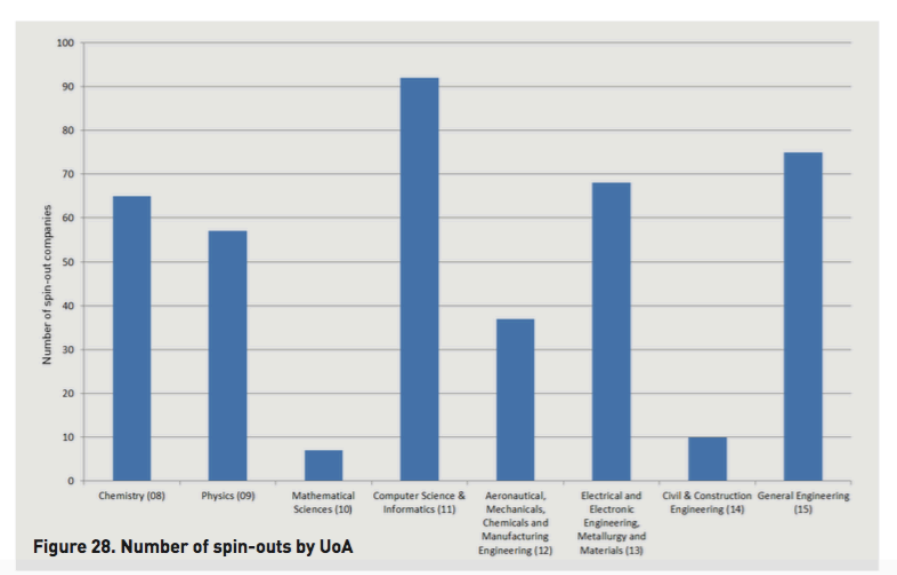
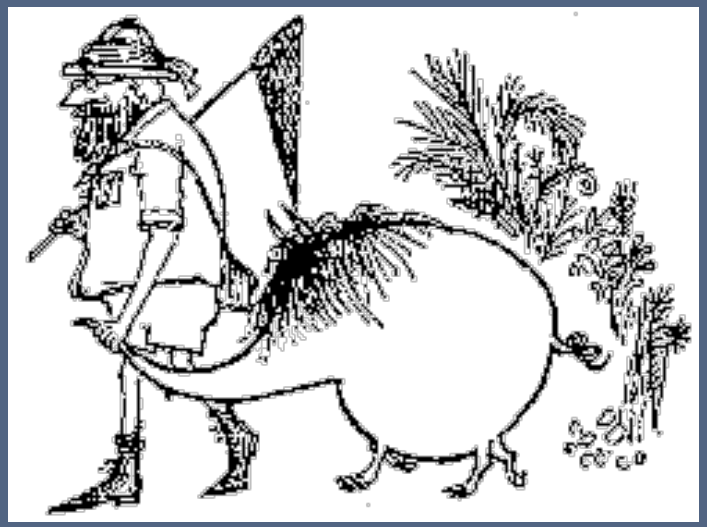


Figure 28. Number of spin-outs by UoA

Number of spinouts reported in 2014 REF



Higgs finds the boson and leads it into captivity

CHALLENGE: HOW DO MATHS IMPACTS HAPPEN?

- Has huge impact – Deloitte 16 % UK total GVA
- Low scores on standard impact metrics
- Practitioners disquiet ; focus on long-term linear model

CHALLENGE: HOW DO (UK) MATHS IMPACTS HAPPEN?

- Has huge impact - De Loitte 16 % UK total GVA
- Low scores on standard impact metrics
- Practitioners disquiet ; focus on long-term linear models

L Meagher, U Martin, 'Slightly dirty maths': the richly textured mechanisms of impact, Research Evaluation 2017

Studied 209 Maths REF impact case studies

Impact case study (REF3b)

Institution: Queen Mary University of London (QMUL)

Unit of Assessment: B10 Mathematical Sciences

Title of case study: Informing policy and mitigating risk – modelling infrastructure networks

1. Summary of the impact

Researchers at Queen Mary have applied mathematical modelling techniques to understand how and when problems may arise in complex man-made infrastructure networks including electricity, gas, global shipping and haulage networks. Many of these networks have points of vulnerability where a local issue such as an earthquake, a terrorist attack or even a simple engineering problem can bring down widespread areas of the network. Our research and the associated modelling techniques have impacted on organisations including the UK Treasury Office and the European Commission's Joint Research Centres at both Petten and Ispra, where it has been used to inform UK and European policy guidelines and legislation for infrastructure projects.

2. Underpinning research

Our research in the study of infrastructure networks has focused on:

- Building new datasets, particularly of European electricity and gas network data, overlaying these networks to determine important common nodes, and offering a range of new insights using mathematical measures of robustness that are based on network topology; and
- Applying mathematical analysis to networks using real-world data and understanding the problems and opportunities this raises.

Our expertise in this area was demonstrated by the development of an EU-wide series of collaborations on the subject of network vulnerability. The MANMADE project (2007-09) [6], which was EU sponsored, addressed the diagnosis of vulnerability in networks, emergent phenomena

Networks Research and Applied Mathematics at Queen Mary: *Scaling and Complexity in Networked Systems*

Queen Mary University of London

EPSRC

TRANSITIVE EFFECTS OF NETWORK CONNECTIVITY

EPSRC GR/S15730: (2002-3)
Adaptive Methods and Congestion Control for Internet Traffic
International Travel Grant
Arrowsmith (Maths/QM) / Mondragon & Pitts (EE/QM)

Outcomes:
EU collaborations

EPSRC GR/R30136: (2001-4)
Small-World Modelling of Internet Behaviour
Mondragon (EE/QM)

Outcomes:
Topology models of Internet at AS level
Concept of "rich club" enables more accurate topology modelling

BT + QM: Resource allocation algorithms in ad-hoc network scenarios
Mondragon (EE/QM) / Arrowsmith (Maths/QM)

Outcomes:
Statistical bounds on random graphs to minimize network interference

EPSRC EP/C520246: (2005-8)
Topology and congestion Invariants in Global Internet-scale Networks
Mondragon & Pitts (EE/QM)

Outcomes:
Search for onset-of-congestion invariants in Internet topologies
Scaling and decomposition of subgraphs
Robustness and cascading effects

EU STREP: (2006-9)
MANMADE – Diagnosing vulnerability, emergent phenomena, and volatility in man-made networks

Arrowsmith (Maths/QM) / Mondragon & Pitts (EE/QM) in collaboration with JRC-IPSC, Collegium Budapest, Macedonian Academy of Sciences and Arts, Universita Carlo Cattaneo, National Emergency Supply Agency, Gestore Mercato Elettrico

CONGESTION, TOPOLOGY, AND PHASE TRANSITIONS

EPSRC GR/R83453: (2002-5) MathFIT
Sources of Long Range Dependence in Internet Traffic and Their Relative Importance in Networks
Arrowsmith (Maths/QM) / Pitts (EE/QM)
Partners: Univ. of York (Maths) and BT labs

Outcomes:
Network invariant relates onset of congestion to (regular) topologies
Large scale simulation for regular topologies

Vodafone + QM:
Measurement in packet networks
Schormans & Pitts (EE/QM)

Outcomes:
Limitations of active techniques
Correlation-induced extreme skewness in Gaussian statistics

EPSRC EP/C541715: (2005-9)
Unifying approaches to design of experiments
Gilmour, Bailey, Bogacka (Maths/QM)

Outcomes:
Improved methods for designing experiments (including coping with power laws, scaling, extreme variability etc.)

ACCELERATED SIMULATION

EPSRC GR/T18615: (2004-7)
Whole System Modelling Of Large-Scale Communication Networks For What-If Evaluation
Pitts, Schormans, Phillips, Mondragon (EE/QM) and Arrowsmith (Maths/QM)

Outcomes:
Methodological challenges of large-scale network simulation (scenario scale/complexity; analysis and visualization; reproducibility and validation)
Accelerated models for event reduction in heterogeneous scheduling techniques

EPSRC EP/D078741: (2006-9)
Machine Learning for Resource Management in Next-Generation Optical Networks
Phillips & Pitts (EE/QM) in collaboration with CS/RHUL

Outcomes:
Techniques for dealing with uncertainty in complex networks; adaptive, and provides confidence information

Functional Model using Confidence Machine to Determine whether to Modify Behaviour

EPSRC / QM + CASE (BT):
Internet teletraffic modelling
Pitts (EE/QM), Arrowsmith and Bogacka (Maths/QM)

Outcomes:
Chaotic map models for multiscale behaviour

EPSRC GR/L78659: (1988-2001)
Chaotic control for fast resource management
Pitts (EE) / Arrowsmith (Maths)

Outcomes:
Chaotic intermittency maps as source / aggregate LRD traffic models, and control elements
Queue behaviour modelling

NORTEL: Intelligent Connection Management
Phillips (EE/QM)

Outcomes:
Patent applications on layered connection management schemes for ASON environments, and resilience planning in optical networks

EPSRC EP/D052092: (2006)
An investigation into routing algorithms for optical networks (DISCIPLINE HOPPING AWARD)
Phillips (EE/QM) in collaboration with Operational Research at City University

Outcomes:
Graph Colouring and Linear Programming for Resource Management
Selective redeployment to cope with uncertainty

AGGREGATE TRAFFIC AND QUEUEING ANALYSIS

Lucent Technologies:
Network scalability and decentralised control of networks
Pitts (EE/QM)

Outcomes:
Patents granted in resource allocation and complexity measurement

NON-LINEAR DYNAMICAL SYSTEMS

obstruction

slow change - long range dependence

fast change - short range dependence

2001 2002 2003 2004 2005 2007 2009

CHALLENGE: HOW DO (UK) MATHS IMPACTS HAPPEN?

- Has huge impact - De Loitte 16 % UK total GVA
- Low scores on standard impact metrics
- Practitioners disquiet ; focus on long-term linear models

L Meagher, U Martin, 'Slightly dirty maths': the richly textured mechanisms of impact, Research Evaluation 2017

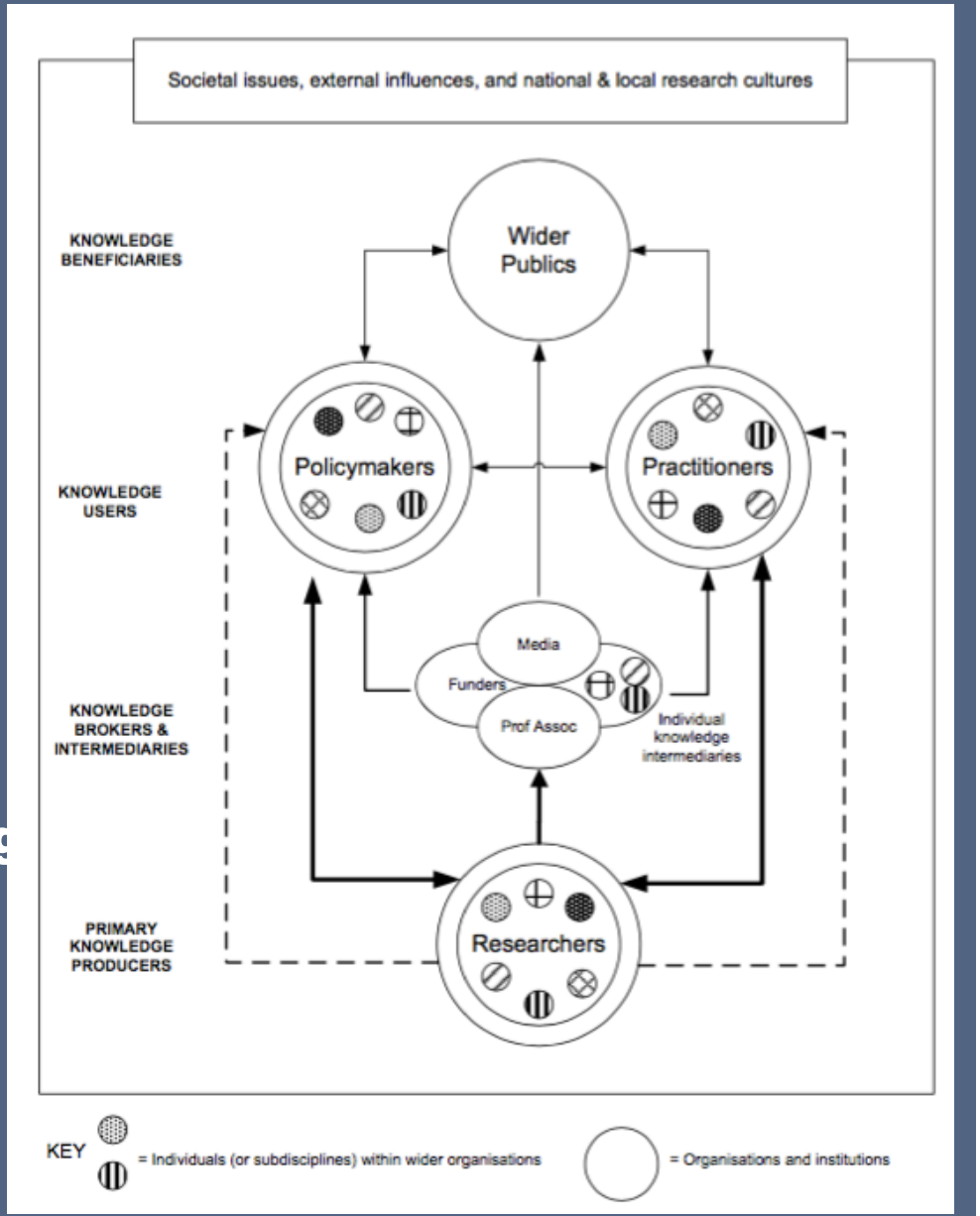
Studied 209 Maths REF impact case studies

Conclusions: people not processes make impact!

- REF reinforces myths of linear narratives, power and labour
- Variety of impact types, especially conceptual impacts
- Variety of mechanisms: relationships, interdisciplinarity
- Knowledge intermediaries, not tech transfer offices

CLASSIFICATION OF IMPACT, MEAGHER NUTLEY 2008

- instrumental impacts: “tangible” products or services
- conceptual impacts: generating new understanding or “thinking differently”
- capacity building: training and/or developing collaborative abilities
- attitude or cultural change: by individuals and/or organisations
- enduring connectivity: establishing long-lived external relationships



Impact case study (REF3b)

REF2014
Research Excellence Framework

Institution: Queen Mary University of London (QMUL)

Unit of Assessment: B10 Mathematical Sciences

Title of case study: Informing policy and mitigating risk – modelling infrastructure networks

1. Summary of the impact

Researchers at Queen Mary have applied mathematical modelling techniques to understand how and when problems may arise in complex man-made infrastructure networks including electricity, gas, global shipping and haulage networks. Many of these networks have points of vulnerability where a local issue such as an earthquake, a terrorist attack or even a simple engineering problem can bring down widespread areas of the network. Our research and the associated modelling techniques have impacted on organisations including the UK Treasury Office and the European

Impact Type	% HoDs aware of this in their department	% HoDs reporting submitting in an ICS	% of ICS where this impact seen	% UOAs where this impact seen in at least one ICS
Instrumental	96%	91%	86%	94%
Conceptual	75%	55%	60%	92%
Capacity-building	79%	27%	20%	51%
Attitude/Culture Change	50%	22%	2%	8%
Enduring Connectivity	75%	13%	18%	43%

Figure 5: Types of impact across departmental portfolios

collaborations on the subject of network vulnerability. The MANMADE project (2007-09) [6], which was EU sponsored, addressed the diagnosis of vulnerability in networks, emergent phenomena

CHALLENGE: HOW DO (UK) MATHS IMPACTS HAPPEN?

- Has huge impact - De Loitte 16 % UK total GVA
- Low scores on standard impact metrics
- Practitioners disquiet ; focus on long-term linear models

L Meagher, U Martin, 'Slightly dirty maths': the richly textured mechanisms of impact, Research Evaluation 2017

Studied 209 Maths REF impact case studies

Conclusions: people not processes make impact!

- REF reinforces myths of linear narratives, power and labour
- Variety of impact types, especially conceptual impacts
- Variety of mechanisms: relationships, interdisciplinarity
- Knowledge intermediaries, not tech transfer offices

KNOWLEDGE INTERMEDIARIES VS TECH TRANSFER

- **'Once you've seen an algorithm work, you just apply it somewhere else and don't even reference it. It is not generally the culture of mathematicians to establish IP rights.**
- **'There are people paid by the research office but we tend to see them as administrators to get off our backs – "what do they know about this stuff?"'**

INDIVIDUAL

- **It is a role I'm adopting all the time. … I am often at the edges of my knowledge in all directions, a bit like being a translator when not completely fluent in either language ..It is a very important role …. (But) it is not very highly valued**

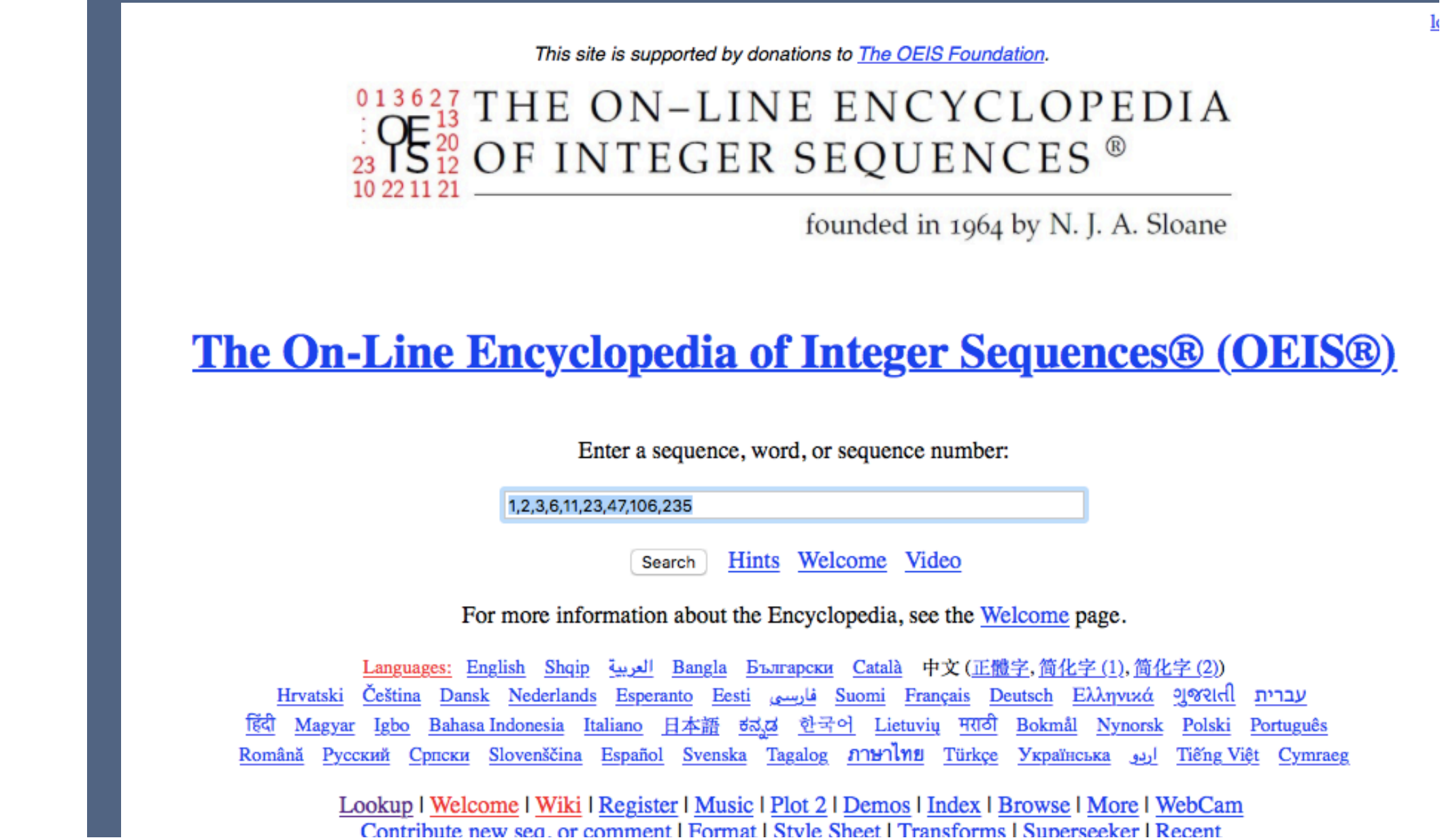
HIDDEN LABOUR OF IMPACT

STAKEHOLDER INSTITUTIONS: LEARNED SOCIETIES, . . .

- **Coordinate actions** **Provide trusted neutral ground**
- **Establish governance** **Advocacy**

HIDDEN LABOUR & KNOWLEDGE INTERMEDIARIES

http://oeis.org/



This site is supported by donations to The OEIS Foundation.

THE ON–LINE ENCYCLOPEDIA OF INTEGER SEQUENCES®

founded in 1964 by N. J. A. Sloane

The On-Line Encyclopedia of Integer Sequences® (OEIS®)

Enter a sequence, word, or sequence number:

1,2,3,6,11,23,47,106,235

Search Hints Welcome Video

For more information about the Encyclopedia, see the Welcome page.

Languages: English Shqip العربية Bangla Български Català 中文 (正體字, 简化字 (1), 简化字 (2))
Hrvatski Čeština Dansk Nederlands Esperanto Eesti فارسی Suomi Français Deutsch Ελληνικά ગુજરાતી עברית
हिंदी Magyar Igbo Bahasa Indonesia Italiano 日本語 ಕನ್ನಡ 한국어 Lietuvių मराठी Bokmål Nynorsk Polski Português
Română Русский Српски Slovenščina Español Svenska Tagalog ภาษาไทย Türkçe Українська اردو Tiếng Việt Cymraeg

Lookup | Welcome | Wiki | Register | Music | Plot 2 | Demos | Index | Browse | More | WebCam
Contribute new seq. or comment | Format | Style Sheet | Transforms | Superseeker | Recent

THE ON-LINE ENCYCLOPEDIA OF INTEGER SEQUENCES®

founded in 1964 by N. J. A. Sloane

1,2,3,6,11,23,47,106,235 Search Hints

(Greetings from The On-Line Encyclopedia of Integer Sequences!)

Search: **seq:1,2,3,6,11,23,47,106,235**

Displaying 1-1 of 1 result found. page 1

Sort: relevance | references | number | modified | created Format: long | short | data

A000055 Number of trees with n unlabeled nodes. +20 182

(Formerly M0791 N0299)

1, 1, 1, **1, 2, 3, 6, 11, 23, 47, 106, 235**, 551, 1301, 3159, 7741, 19320, 48629, 123867, 317955, 823065, 2144505, 5623756, 14828074, 39299897, 104636890, 279793450, 751065460, 2023443032, 5469566585, 14830871802, 40330829030, 109972410221, 300628862480, 823779631721, 2262366343746, 6226306037178 (list; graph; refs; listen; history; text; internal format)

OFFSET 0,5

COMMENTS
Also, number of unlabeled 2-gonal 2-trees with n 2-gons.
Main diagonal of A054924.
Left border of A157905. - Gary W. Adamson, Mar 08 2009
From Robert Munafo, Jan 24 2010: (Start)
Also counts classifications of n items that require exactly n-1 binary partitions; see Munafo link at A005646, also A171871 and A171872.
The 11 trees for n = 7 are illustrated at the Munafo web link.
Link to A171871/A171872 conjectured by Robert Munafo, then proved by Andrew Weimholt and Franklin T. Adams-Watters on Dec 29 2009. (End)
This is also "Number of tree perfect graphs on n nodes" [see Hougardy]. - N. J. A. Sloane, Dec 04 2015
For n > 0, a(n) is the number of ways to arrange n-1 unlabeled non-intersecting circles on a sphere. - Vladimir Reshetnikov, Aug 25 2016
All trees for n=1 through n=12 are depicted in Chapter 1 of the Steinbach reference. On p. 6 appear encircled two trees (with n=10) which seem inequivalent only when considered as ordered (planar) trees. Earlier instances of such possibly (in)equivalent trees could appear from n=6 on (and from n=9 on without equivalence modulo plane symmetry) but are not drawn separately there. - M. F. Hasler, Aug 29 2017

REFERENCES
F. Bergeron, G. Labelle and P. Leroux, Combinatorial Species and Tree-Like Structures, Camb. 1998, p. 279.

HOW DO INDUSTRY BIG PROOF IMPACTS HAPPEN?

MONOIDICS

HOME COMPANY PARTNERS EVENTS NEWS PRODUCTS CONTACT

WHAT ABOUT THE IMPACT OF BIG PROOF ON UNIVERSITY/RESEARCH MATH?

CLASSIFICATION OF IMPACT

- instrumental impacts: “tangible” products or services
- attitude or cultural change: by individuals and/or organisations
- conceptual impacts: generating new understanding or “thinking differently”
- capacity building: training and/or developing collaborative abilities
- enduring connectivity: establishing long-lived external relationships

HIDDEN LABOUR OF IMPACT

KNOWLEDGE INTERMEDIARIES

INDIVIDUALS

STAKEHOLDER INSTITUTIONS

ATTITUDE/ CULTURE CHANGE

Gowers's Weblog

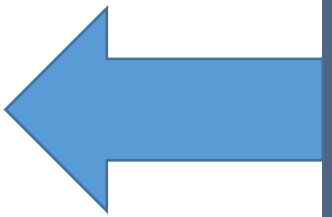
Mathematics related discussions

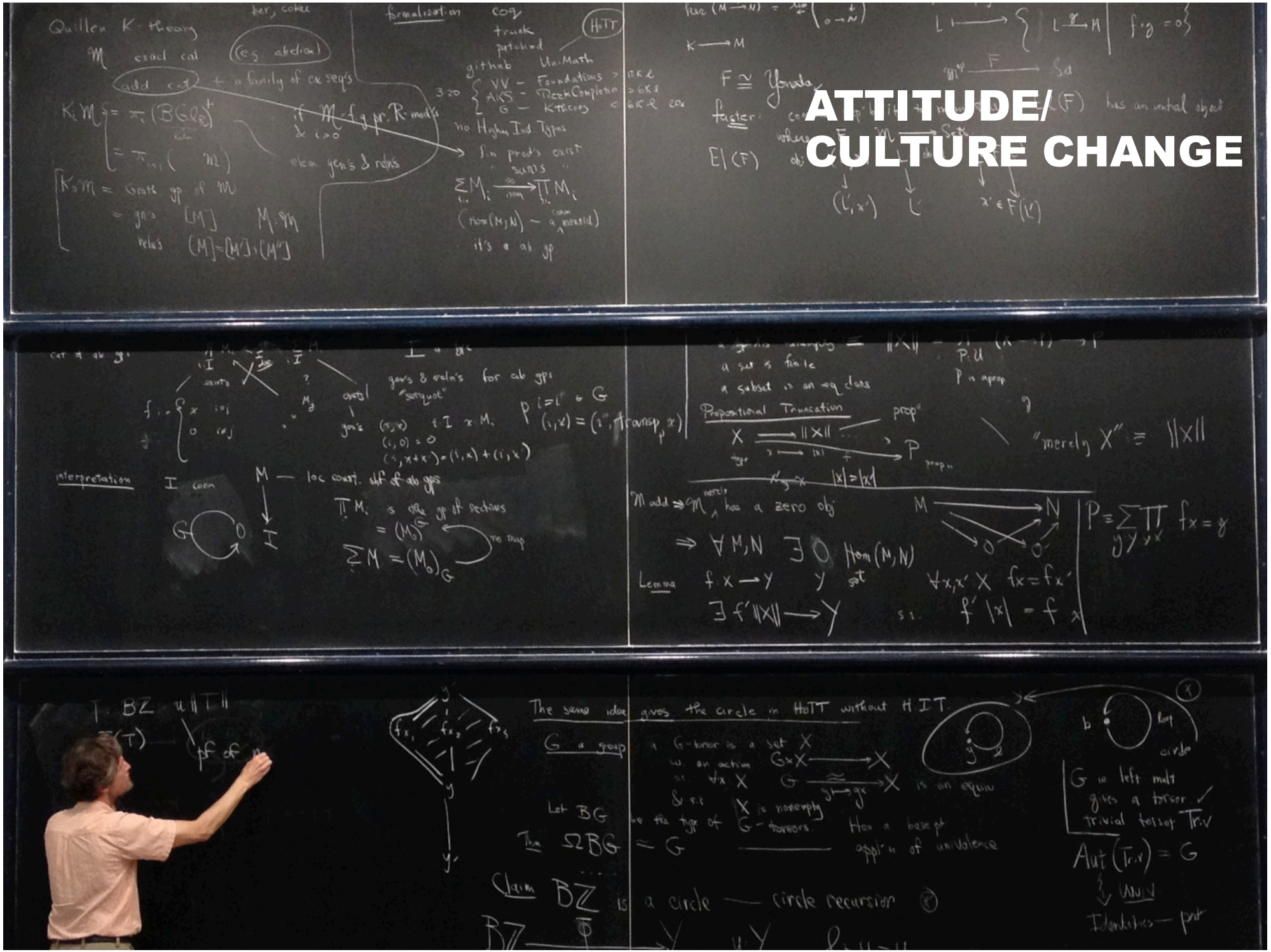
Recent news concerning the Erdos discrepancy problem

The problem is to show that if (ϵ_n) is an infinite sequence of ± 1s, then for every C there exist d and m such that $\sum_{i=1}^{m} \epsilon_{id}$ has modulus at least C. This result is straightforward to prove by an exhaustive search when $C = 2$. One thing that the Polymath project did was to discover several sequences of length 1124 such that no sum has modulus greater than 2, and despite some effort nobody managed to find a longer one. That was enough to convince me that 1124 was the correct bound.

However, the new result shows the danger of this kind of empirical evidence. The authors used state of the art SAT solvers to find a sequence of length 1160 with no sum having modulus greater than 2, and also showed that this bound is best possible. Of this second statement, they write the following: "The negative witness, that is, the DRUP unsatisfiability certificate, is probably one of longest proofs of a non-trivial mathematical result ever produced. Its gigantic size is comparable, for example, with the size of the whole Wikipedia, so one may have doubts about to which degree this can be accepted as a proof of a mathematical statement."

I personally am relaxed about huge computer proofs like this. It is conceivable that the authors made a mistake somewhere, but that is true of conventional proofs as well. The paper is by Boris Konev and Alexei Lisitsa and appears here.




Quillen K-theory
exact cat
(e.g. abelian)
add. cat
+ a family of ex seqs
formalization
coq
trunk
patched
HoTT
github
UniMath
VV - Foundations
AKS - RezkCompletion
G - Kthcory
no Higher Ind Types
fin prods exist
sums
(Hom(M,N) — a commutative monoid)
it's a ab. gp
ATTITUDE/
CULTURE CHANGE
gen's & reln's for ab gps
"setquot"
interpretation
I coeff
M — loc const. shf of ab gps
a set is finite
a subset is an eq. class
Propositional Truncation
"merely X" ≡ ||X||
Lemma
The same idea gives the circle in HoTT without HIT.
G a group
Let BG
Then ΩBG
Claim BZ is a circle — circle recursion
G-torsor is a set X
w. an action
G w. left mult gives a torsor
Trivial torsor Triv
Aut(Triv) = G
Identities — path
circle

...ATTITUDE/CULTURE CHANGE

Lurie: I would like to see a computer proof verification system with an improved user interface, something that doesn't require 100 times as much time as to write down the proof. Can we expect, say in 25 years, widespread adoption of computer verified proofs?

Tao: I hope [we will eventually be able to verify every new paper by machine.]. Perhaps at some point we will write our papers... directly in some formal mathematics system.

Simon Donaldson, Maxim Kontsevich, Jacob Lurie, Terence Tao, Richard Taylor: award of $3 million Breakthrough Prizes, 2014

CONCEPTUAL IMPACT: TEACHING

The Xena project.

The Xena project meets on Thursday evenings during term time in the MLC. We typically talk about undergraduate level maths, and type some of it up into Lean. We're building a library of undergraduate level pure maths -- me, a bunch of undergraduates at Imperial, and a small but growing community of other people from around the world. We now have a whole bunch of algebra and topology (we have most of M2PM5 and a bunch of 3rd year algebra and group theory and also much of the 4th year commutative algebra course), but we are lagging behind with analysis: we have pretty much all of M1F and we're working hard on M1P1 but we haven't even typed up a proof that the derivative of sine is cosine yet. Now we're later on in the academic year, most people who are interested have Lean installed on their own laptop. But it is not impossible to get Lean running on the MLC machines -- see if anything here helps.

Mailing list

Sign up to the mailing list (for Imperial people) for local information about what's happening on Thursday nights.

I'm a complete beginner -- how do I start?

Over the summer I am going to write a whole bunch of teaching material for 1st year undergraduate mathematicians who want to learn Lean. The current state of what I have is sufficiently disorganised that it doesn't even have its own site or title page. The project is on hold at the minute but I would like to have it in some sort of shape by October 2019 when the new first years come in. Until then, here are some relevant links which may or may not help.

1) stuff about propositions -- a basic introduction to Lean, which should help with M1F Sheet 1 questions 2 to 4.

2) techniques needed for sheet 1 question 1.

3) stuff about sets which will help with sheet 1 Q7

Other stuff

CLASSIFICATION OF IMPACT

- instrumental impacts: “tangible” products or services
- attitude or cultural change: by individuals and/or organisations
- conceptual impacts: generating new understanding or “thinking differently”
- capacity building: training and/or developing collaborative abilities
- enduring connectivity: establishing long-lived external relationships

HIDDEN LABOUR OF IMPACT

KNOWLEDGE INTERMEDIARIES

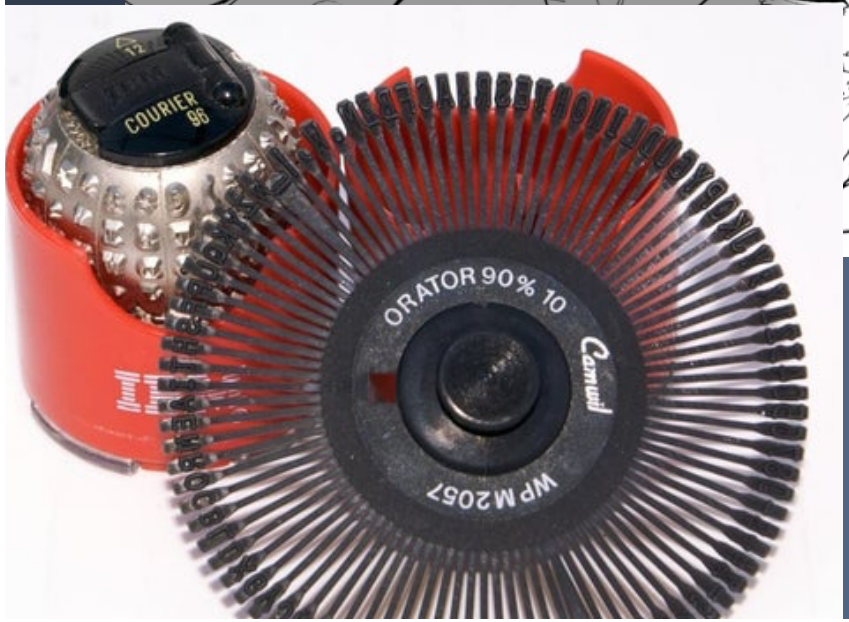
INDIVIDUALS

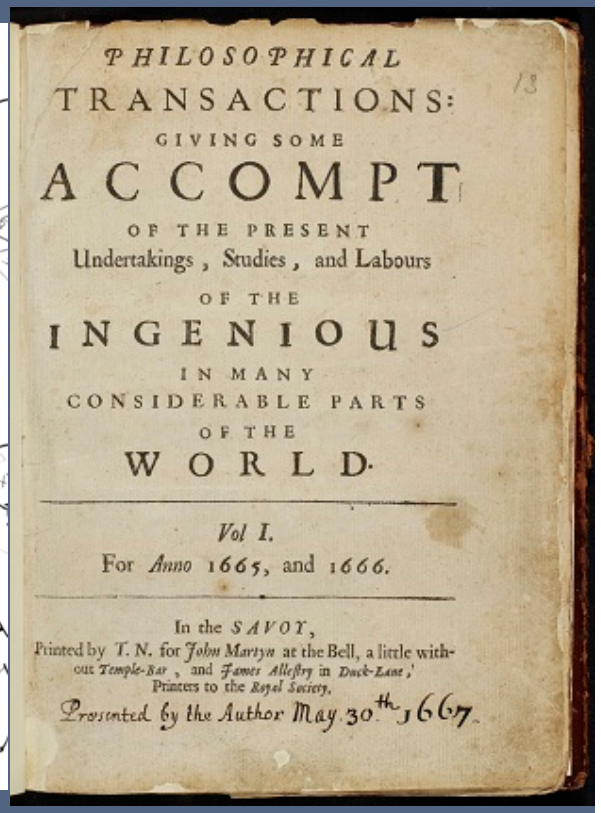
STAKEHOLDER INSTITUTIONS

PLATFORMS

OPPORTUNITY FOR FURTHER CONCEPTUAL IMPACT: MATHEMATICAL PRACTICE / LABOUR

MATHEMATICAL PUBLICATION 2050??

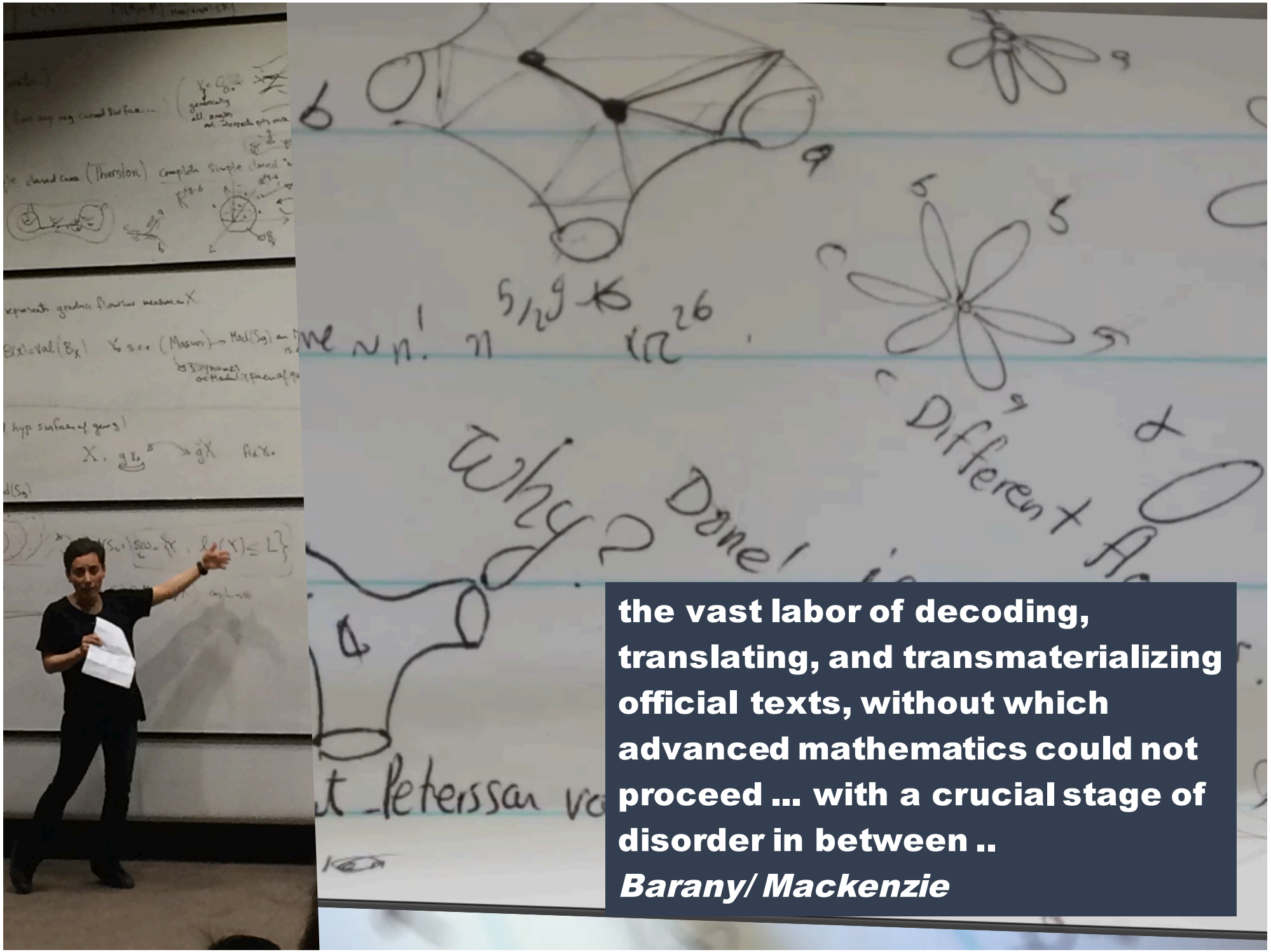




PHILOSOPHICAL
TRANSACTIONS:
GIVING SOME
ACCOMPT
OF THE PRESENT
Undertakings, Studies, and Labours
OF THE
INGENIOUS
IN MANY
CONSIDERABLE PARTS
OF THE
WORLD.

Vol I.
For *Anno* 1665, and 1666.

In the *SAVOY*,
Printed by *T. N.* for *John Martyn* at the Bell, a little without *Temple-Bar*, and *James Allestry* in *Duck-Lane*,
Printers to the *Royal Society*.
Presented by the Author May 30th 1667.



the vast labor of decoding, translating, and transmaterializing official texts, without which advanced mathematics could not proceed ... with a crucial stage of disorder in between ..

Barany/ Mackenzie


pleasure/altruism; rapport/trust;
share feedback, insights, informal
knowledge, gist; co-create ideas
language, concepts *Lane, 2017*


Professor Barbara @BarbaraFantechi · 1h
Replying to @MBarany @UHMMOxford and 2 others
I hope you're aware that "I asserted over beer" already shows how you (and whoever was beer drinking with you) already start from a position of privilege.

22 December, 2013 at 2:49 pm
Wouter Castryck

There appears to be a precision issue with the value of k for m = 4. One can increase the precision by putting e.g. Digits := 50; on top of the maple file (the default value is 10).

For m = 2 and m = 3 I think the values are correct, although it seems that for m = 3 one can improve k to 1,628,944 by letting c := 1.0043/log(k) and T := 0.8008/log(k).

For m = 4 one can obtain k = 75,000,000 by letting c := 0.999/log(k) and T := 0.838/log(k).

For m = 5 one can similarly find k = 3,400,000,000 by taking c := 1.012/log(k) and T := 0.710/log(k).

Note that the ratios

$$\frac{3400000000}{75000000}, \frac{75000000}{1628944}, \frac{1628944}{35146}$$

all lie close to the asymptotic upper bound $\exp(3.817)$.

tinyurl.com/jt75z2n

4 0 Rate This
Reply

22 December, 2013 at 3:26 pm
Terence Tao

Thanks for catching that! I had noticed that the m=4 values of k were curiously small, but I trusted in Maple without investigating it further.

8 January, 2014 at 12:01 pm
Pace Nielsen

I worked out the $k = 4$ case and get that $M_{4,0.18} \geq 2.0023$. If someone would like to look over my Mathematica code to verify the computation just email me. (It involves a mixture of stuff I wrote, and stuff I borrowed from James; but it is very straightforward.)

8 January, 2014 at 2:36 pm
Terence Tao

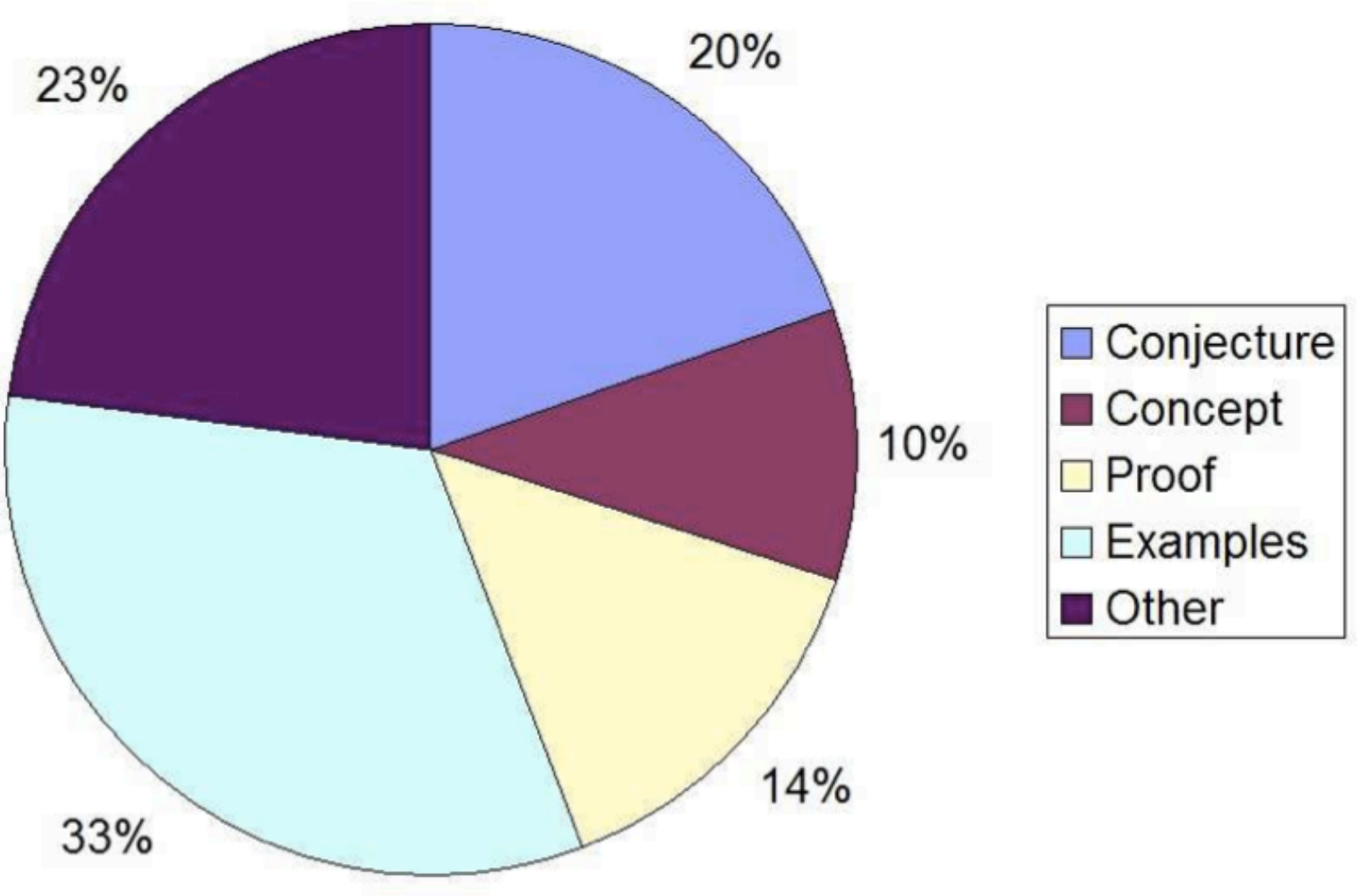
Excellent! So it looks like we have k=4 (and hence $H_1 \leq 8$) on EH, finally dethroning that stubborn bound of 12 on EH that we had not been able to improve upon since the start of Polymath8b. (If you have explicit coefficients for the polynomial optimiser, we would be able to check the various four-dimensional integrals separately with just about any computational mathematics package.)

8 January, 2014 at 10:25 pm
Terence Tao

Maple confirms the value of 2.002351848 for these choices of parameters – looks like $H_1 \leq 8$ on EH is solid.

ANALYSING MINI-POLYMATH

Martin and Pease, 2012++



CLASSIFICATION OF IMPACT

- instrumental impacts: “tangible” products or services
- attitude or cultural change: by individuals and/or organisations
- conceptual impacts: generating new understanding or “thinking differently”
- capacity building: training and/or developing collaborative abilities
- enduring connectivity: establishing long-lived external relationships

HIDDEN LABOUR OF IMPACT

KNOWLEDGE INTERMEDIARIES

INDIVIDUALS

STAKEHOLDER INSTITUTIONS

SO WHAT CAN WE ACTUALLY DO . . .

GO WHERE THE MATHEMATICIANS ARE

- NEWTON INSTITUTE, ICMS, OBERWOLFACH, FIELDS
- AMS JOINT MEETINGS

MAKE THINGS EASIER FOR KNOWLEDGE INTERMEDIARIES

- MATH POPULAR WRITING, M'OVERFLOW, "100 THEOREMS"
- WORK OUT HOW TO TELL OUR OWN STORY

ARTICULATE TO ADMINSTRATORS THE TRANSFORMATION OF MATHEMATICAL LABOUR TO CHANGE RECOGNITION AND REWARD KPIs, KEY PERFORMANCE INDICATORS, FOR IMPACT TYPES STANDARDS AND COORDINATION

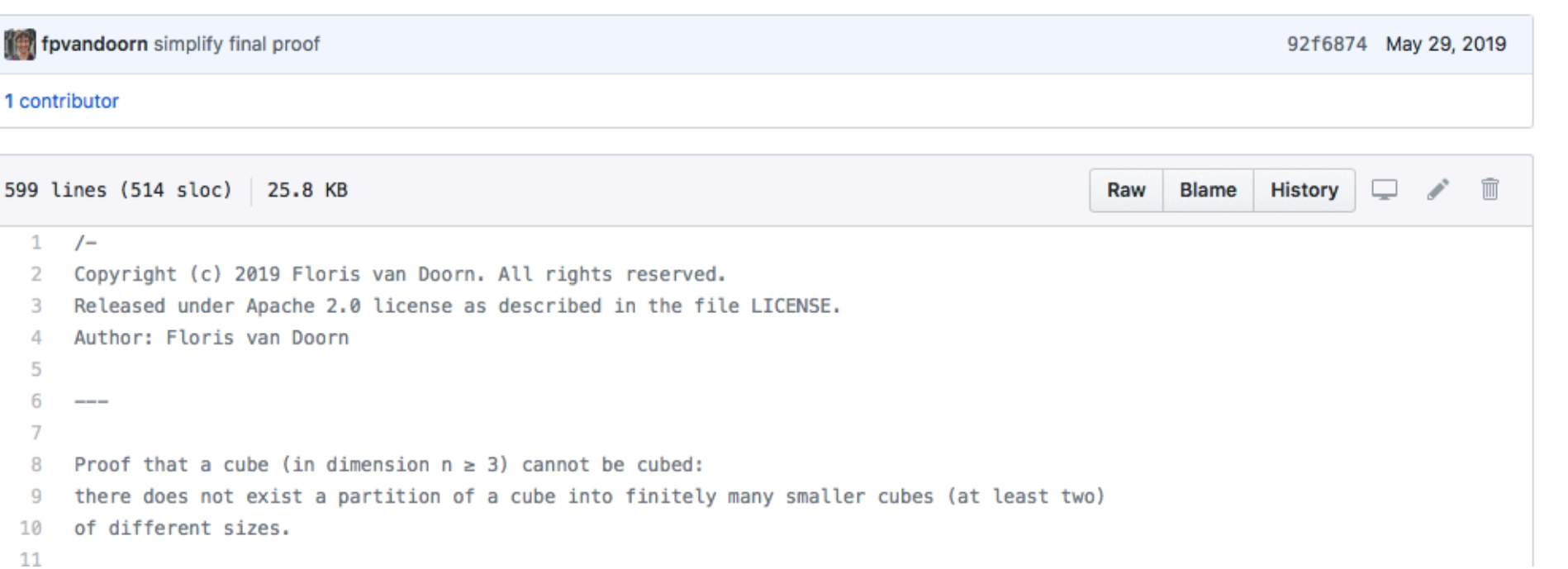
ADVOCATE COLLECTIVELY FOR BIG PROOF

Formalizing 100 Theorems

There used to exist a "top 100" of mathematical theorems on the web, which is a rather arbitrary list (and most of the theorems seem rather elementary), but still is nice to look at. On the current page I will keep track of which theorems from this list have been formalized. Currently the fraction that already has been formalized seems to be

94%

The page does not keep track of *all* formalizations of these theorems. It just shows formalizations in systems that have formalized a significant number of theorems, or that have formalized a theorem that none of the others have done. The systems that this page refers to are (in order of the number of theorems that have been formalized, so the more interesting systems for mathematics are near the top):



fpvandoorn simplify final proof — 92f6874 May 29, 2019

1 contributor

599 lines (514 sloc) | 25.8 KB — Raw | Blame | History

```
/-
Copyright (c) 2019 Floris van Doorn. All rights reserved.
Released under Apache 2.0 license as described in the file LICENSE.
Author: Floris van Doorn

---

Proof that a cube (in dimension n ≥ 3) cannot be cubed:
there does not exist a partition of a cube into finitely many smaller cubes (at least two)
of different sizes.

```

SO WHAT CAN WE ACTUALLY DO . . .

GO WHERE THE MATHEMATICIANS ARE

- NEWTON INSTITUTE, ICMS, OBERWOLFACH, FIELDS
- AMS JOINT MEETINGS

MAKE THINGS EASIER FOR KNOWLEDGE INTERMEDIARIES

- MATH POPULAR WRITING, M'OVERFLOW, "100 THEOREMS"
- WORK OUT HOW TO TELL OUR OWN STORY

ADVOCATE COLLECTIVELY FOR BIG PROOF

- CLEARLY ARTICULATE MATHEMATICAL LABOUR TO ADMINSTRATORS TO CHANGE RECOGNITION AND REWARD
- KPIs (KEY PERFORMANCE INDICATORS) FOR IMPACT
- STANDARDS AND COORDINATION

Academic Careers for Experimental Computer Scientists and Engineers

National Academy Press
Washington, D.C. 1994

COMMITTEE ON ACADEMIC CAREERS FOR EXPERIMENTAL COMPUTER SCIENTISTS

LAWRENCE SNYDER, University of Washington, *Chair*
FOREST BASKETT, Silicon Graphics Computer Systems and Stanford University
MICHAEL M. CARROLL, Rice University
DON MICHAEL COLEMAN, Howard University
DEBORAH ESTRIN, University of Southern California
MERRICK L. FURST, Carnegie Mellon University
JOHN HENNESSY, Stanford University
H.T. KUNG, Harvard University
KURT MALY, Old Dominion University
BRIAN REID, Digital Equipment Corporation

Staff

MARJORY S. BLUMENTHAL, Director
HERBERT S. LIN, Senior Staff Officer
ARTHUR McCORD, Project Assistant (through February 1993)

Academic Careers for Experimental Computer Scientists and Engineers

National Academy Press
Washington, D.C. 1994

ACADEMIC CAREERS FOR EXPERIMENTAL MATHEMATICIANS

COMMITTEE ON ACADEMIC CAREERS FOR EXPERIMENTAL COMPUTER SCIENTISTS

LAWRENCE SNYDER, University of Washington, *Chair*
FORREST BASKETT, Silicon Graphics Computer Systems and Stanford University
MICHAEL M. CARROLL, Rice University
DON MICHAEL COLEMAN, Howard University
DEBORAH ESTRIN, University of Southern California
MERRICK L. FURST, Carnegie Mellon University
JOHN HENNESSY, Stanford University
H.T. KUNG, Harvard University
KURT MALY, Old Dominion University
BRIAN REID, Digital Equipment Corporation

Staff

MARJORY S. BLUMENTHAL, Director
HERBERT S. LIN, Senior Staff Officer
ARTHUR McCORD, Project Assistant (through February 1993)

RECOGNISE VARIETY OF IMPACTS
CO-CREATE KPIs: KEY PERFORMANCE INDICATORS

- instrumental impacts: “tangible” products or services
- attitude or cultural change: by individuals and/or organisations
- conceptual impacts: generating new understanding or “thinking differently”
- capacity building: training and/or developing collaborative abilities
- enduring connectivity: establishing long-lived external relationships

RECOGNISE VARIETY OF IMPACTS
CO-CREATE KPIs: KEY PERFORMANCE INDICATORS

- instrumental impacts: “tangible” products or services
- attitude or cultural change: by individuals and/or organisations
- conceptual impacts: generating new understanding or “thinking differently”
- capacity building: training and/or developing collaborative abilities
- enduring connectivity: establishing long-lived external relationships

BIG PROOF LEAGUE TABLES!! [AMSTERDAM..]

International Mathematical Knowledge Trust

The long-term goal of the International Mathematical Knowledge Trust (IMKT) is the creation of a comprehensive mathematical knowledge base, to be used by people and software systems world-wide.

The IMKT supports a variety of digitization and mechanization projects for mathematical data and knowledge. These efforts are coordinated with a number of commercial and not-for-profit partners, consistent with a commitment to Open Data.