

# Turning Museums Inside-Out: “Maths on Your Doorstep” & World Maths Year 2020 ?

MATRIX Conference, Leeds, 1-3 September 2016

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## Introduction

I am particularly pleased to find myself sandwiched today between James Tanton’s “WorldMath” talk and Bruce Bayley on Maths Buses in Arizona, because what I have to say will link with both these ideas – both global and local.

“**Think Global; Act Local**” is one of my mantras, and among the things I wish to propose is a **legacy project** for this MATRIX conference, namely a “World Mathematical Year” in 2020 that will be bigger and better than the one we had in 2000. Specifically, it will have lots of local activities in the context of a world-plan –and a world-equity plan.

To this end, there will be a follow-up meeting to discuss this further, in Auditorium 1 at 1pm today.

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My actual title is slightly longer than the one that was previously announced.

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Apart from proposing World Maths Year, I will also be making two further proposals.

First, we should “**Turn Museums inside out**”. I’ll explain what I mean by this later.

Second, we should focus on **social class equity** and **world equity** – not merely gender equity. We see and hear lots of energy going into beating the drum for gender equity, and that is perfectly proper and correct. But why do similar amounts of energy not go into beating the bigger drums of social class equity and of world equity? The answer has something to do with the distribution of world power, which remains relatively unthreatened by gender equity.

I will also mention several projects I have been associated with, and others that I admire.

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First: my proposal-theorem states that we should “**Turn Museums Inside Out**”. What does this mean?

All good theorems start with axioms and definitions: ...

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**Definition: What is a museum?** Etymologically it is a “temple of the muses”. The muses are sources of inspiration, and are generally portrayed as virtually identical semi-naked passive Greek female statues. Are these sensible sources of inspiration? And are they the only possible muses?

So what are our sources of inspiration?

Mark Peterson’s book poses this question from the point of view of **Galileo**. What were Galileo’s muses? One might expect such a great scientist to have scientific muses. However, according to Peterson, Galileo’s muses – the sources of his inspiration – are not scientific at all. Only **architecture** has any claim to be scientific. The others - **poetry, painting and music** – are archetype muses from the humanities and soft arts. **If these muses were good enough for Galileo, they are good enough for me!** I would like to see poetry, painting and music throughout all science and maths centres.

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But can we do better than that? If we had time, I would pause now in the interests of peer involvement, and ask you to discuss with your neighbour what **your** muses are – what are your sources of inspiration? However, coffee beckons and I do not have time. So rather flippantly, but with an element of seriousness, let me propose three modern muses. Each conveys an important theme:

- **Agora** – we must get out of the building, into foreign fields. Let's think “*outside the box*” (generalising, in other words)
- **Humora** – let's keep laughing and light-of-touch
- **Ludora** –maths is a game, as well as a language, a logic, and all the other things that maths can be (including architecture and engineering – Galileo's muses; "Look at it – it's mathematics in action isn't it?" said one of the engineers who worked on the Forth Road Bridge, in a documentary shown on BBC last week. "Mathematics in Action" – that's a good name for a museum, isn't it?!)

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### **Models of Museums: The standard model**

Other axioms for my “inside-out” theorem require a definition of “the standard museum”. Here is my definition – it may remind you of institutions that you know and love.

1. The standard museum requires a **building** – preferably a large, iconic, awesome, wow-inspiring building. (Eminently fundable – people love having their name on a building!)
2. The standard museum requires **visitors** – people who come to visit the building. (“They” come to visit “Us”.)
3. The standard museum requires “**collections**” – valuable items, lovingly preserved, conserved and curated by “our” experts (but paid for by the public)
4. Finally, “**Education**” – this is the profession that museum professionals profess, albeit “informal” education. This defines what “we” do to “them”. We have expertise: “You learn; We teach.”

Although often called “informal education”, this standard model of museum mirrors many of the most restrictive and formal aspects of standard formal education, in schools and colleges.

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This standard model has been adopted and adapted by most maths museums that I know of – especially the big, important ones, and some in the planning stage. To take just one recent example (2009), MathsWorldUK “aims to establish the UK's first National Exploratorium of Mathematics”. Big building. Big money. Big problems!

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### **The Freirian model of learning**

But the standard model is dangerous. It diverts us from what we want to do. It also uses a poor model of learning. We teachers are not as important as we think we are. Students learn not from us, but from each other, and from themselves – we engage with our own struggles, with our peers and comrades, and with the world as it is.

I sincerely recommend you to watch this YouTube video. It features a discussion between two great thinkers. First, the Marxist Paulo Freire, whom I first encountered via his seminal work on basic literacy and numeracy in Portuguese West Africa. Second, Seymour Papert (founder of “turtle mathematics”, who died recently). Two phrases stand out:

1. “**Learning without teaching**” – we teachers are far less important than we think we are! Learners learn from co-learners, by reflecting on their own struggles, not from teacher in front of the class
2. The “**pedagogy of curiosity**” – the key to learning is to keep alive and alert to the next *unanswered* question. Past ‘*answered*’ questions are less important. Focus on the future, not the past!

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### **The “inside-out” model**

My take on the standard model is to disrupt these key assumptions one by one, and turn them all “inside-out”. So – no iconic building, no valuable ‘collections’, and no ‘visitors’ – because WE visit THEM. This brings a different model of education, based on struggle and cooperation. It still needs muses and sources of inspiration. But it does not require a big ambitious building with lots

of money, lots of visitors, and lots of problems. We should go for events on street corners, in shopping centres, pubs, cafes, and at football matches etc.. That way we get to people who would never think of going into a maths museum – or a museum of any type. “Maths in your face” or “on your doorstep” provides the basis for an alternative non-standard model.

I am reminded of a woman at a Mathsfest we organised in a shopping centre at Blackbird Leys in Oxford: “My husband will wonder where I’ve got to. I came out at 9 o’clock to do my shopping, and now five hours late I’m still here. And I haven’t started doing my shopping yet!”

The “inside-out” model of museums does not require valuable collections and curators, and it does not use the standard model of learning. The following are the main features of the “inside-out” museum:

1. It is **mobile** and flexible, with low set-up costs. It functions best in “non-standard learning environments”. The 1990s York “Computer Bus” contained far more than computers. Not only did it tackle the digital divide; it also developed numeracy, literacy and social skills among travellers young and old, as well as drug users, offenders, homeless people, and others excluded by society
- 2 It is on **your** doorstep. You do not need to come to our smart awe-inspiring building. On the contrary, **we come to you** – wherever you are. This may be at home, in your village square, at the shops or mall or car-boot sale, or football match, or bus or train stop, or even *on* the buses and trains. (Shopping malls are good – they can provide people, cover, security, funding and focus.)
- 3 **Activities** – you get *engaged* and *do* things. Mathematicking maybe. Maths is not a spectator sport.
- 4 **Peer learning** – you learn via struggle, reflection, and discourse with your co-learners. Talk, listen, discuss, struggle, learn! Hands-on; Mouths-on; Minds-on; Hearts-on! Speak Maths, Learn Maths! Maths is a language and maths is a noisy subject!
- 5 **Follow-up** – post-visit planning is a perennial weak point. I don’t know the answer, but it is important. Consolidation requires coherent layers of learning – a pyramid perhaps, although one without a pinnacle! (Pre-visit planning is another area which needs serious attention.)

Here let me mention two international examples of the above (and in passing let me mention how noticeable it is that people of colour are badly under-represented at this MATRIX conference – should we do something about this?):

- The Indian project “Mobile Science and Maths” – they have a whole *fleet* of buses! (Thanks to Bhagwant Singh.)
- “Meet Maths” – the Palestine Maths Museum near Jerusalem. “Meet Maths” actually started using a fairly standard museum model, complete with awe-inspiring building and regular bus-groups arriving daily from throughout Palestine. However, the Israeli separation wall was then built right through the museum grounds – within 10 metres or so. This cut the museum off from over half their catchment population. Also, continual Israeli checkpoints made group-travel difficult or impossible. But Palestinians are used to obstacles of this sort, and invariably there is some ingenious way of getting round the preoccupations of occupation – wasteful though it is. It also led to some interesting mathematics – if you have a graph of random checkpoints, and each one can hold you up for anything from 5 to 50 minutes, how long is your journey to the museum likely to last? So Meet Maths’ new model is rather non-standard, and closer to the “inside-out” model described above. But it’s still a struggle!

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Now a few points about Maths Year 2000 and its successor project “Count On” – which won many prizes for “Best UK Educational Website”. [www.counton.org](http://www.counton.org) still looks good despite being unchanged for 15 years.

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Our pay-roll included Tony Blair, Carol Vorderman, and other animals”!

World Maths Year 2000 was conceived in 1992. But seven years later, Britain’s dynamic Blairite government had still not made up its mind! Eventually however, generous funding was secured; staff was appointed, and we got on with things. One of our first actions involved the Millennium Dome, who were persuaded to include a MathsZone. Here and elsewhere, ECSITE, the European

Consortium of Science Museums was extremely important, as were Toni Reardon, Richard Mankiewicz, and Albrecht Beutelspacher from the Mathematikum.

### **Getting out of our physical silos**

My main responsibility was to arrange “MathFests” up and down the country. I asked the organising committee to fund ten events like the York Maths Funfair, but came out of the meeting with an unasked-for budget of £500,000 and a commission to organise **one thousand** such events! These were mainly small events (100 people or so) and locally organised, but we also had several large regional events with 5000+ visitors for example one at Main Road, Manchester City’s football ground, and one at Leeds United too. We also had events

- On the buses and on the trains – and at interchanges too
- In care-homes for elderly people and others with special needs
- On the street (young offenders, drug users, homeless people etc.)
- In pubs and cafes – including “maths menus”, maths table-cloths, and puzzles and games on beermat(h)s
- At car boot sales, agricultural and other fairs, and so on.

So we escaped from the physical silo of a single large building.

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### **Getting out of our intellectual silo**

So we escaped from the physical silo of a single large building. We also tried to get out of our intellectual silos, by stressing interdisciplinary links (accountancy to zymology), and especially hobbies and everyday activities including the artistic muses of Galileo referred to above as well as everything else from gardening and genetics, knitting and knotting, and beyond. All these are “Maths in Action”.

### **History - Back to the Future!**

History is important. In 2009, MathsWorldUK envisaged a “major museum”. One plan in Manchester involved a long walkway of 200 metres or more. This was tailor-made for physical representations of mathematical timelines –on a square-root scale (because linear was too extended, and logarithmic was too compact).

### **A personal timeline - including Maths Year 2000 and WMY2000**

My own personal timeline is much more modest! I owe a lot to my dynamic colleagues at the Open University in its early days. This introduced me to “we bring it to you learning” in the days when audio cassette-tapes were the cutting-edge technology.

Later, whilst between jobs, I established QED Books as a resource centre for maths educators. We were small fry, but in our little pond we sometimes seemed big – at one ICME conference we were the largest exhibitor, bigger even than Cambridge University Press! Most QED publications lost good money. But for several years my family fed on proceeds from the FunMaths Calendar which appeared annually from 1991 to 2000 and presented “a puzzle per day” for classrooms around the country.

After Maths Year 2000 I worked till 2003 on EUmath - a massively ambitious international project which *nearly* got mega-funding, but fell at the last fence. Many ideas from EUmath ideas remained undeveloped until 2009 when MathsWorldUK began, using the standard “iconic building” model. But two useful spinoffs have resulted:

1. The MATRIX conferences in Dresden and in Leeds
2. Possible plans for Maths Year 2020.

### **World Maths Year 2020**

#### **I want you to join with me in planning World Maths Year 2020.**

2020 is the bicentenary of Florence Nightingale’s birth. We can capitalise on this for gender equity reasons but she also because brings in historical, geographic and medical themes.

Nightingale is often presented as a statistical icon, sometimes in a rather inflated and misleading way which rarely looks beyond the feminist discourse.

In considering social equity we need to move beyond gender equity, and also consider social class equity. In many respects, Florence Nightingale is a poor role model. Not only is she

massively different from today's population, but she and her family were also massively privileged and wealthy.

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I therefore wish to propose an alternative icon – Amy Johnson from Hull. (As I am from Hull, I may be biased!)

Not only was she the first person to fly from Britain to Australia, she was also the first UK female aircraft engineer. So she can provide an entrée into a wide variety of mathematical ideas: engineering, quality control, navigation etc etc. Amy Johnson is a good working-class hero.

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The fact that Amy Johnson came from a humble background – she went to the same school as I did – is a further argument for having her as an icon. She allows us to talk not only about gender equity -which has been mentioned several times at this conference – but also about social class equity, which is a far bigger drum. I recently came across a quote from the 1800s which suggested that social class inequity was regarded as easier to solve than gender inequality: “The solution to the problem of poverty was simply to erase it (but) the Woman Question was infinitely more complicated: biological and social measures presented themselves, but the questions were many and varied, and the answers even greater in number”. In my view, the true situation is the reverse. Gender inequity may be intractable, but social class inequity is far worse in its impact and far more difficult to resolve. Generations of politicians have failed to grasp this hot potato. It needs more energy and attention from the mathematics community too.

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Making mentioned Florence Nightingale, let me also beat the drum for William Farr and Edwin Chadwick. They are not female, but they are for more substantial statistical figures than Nightingale was, and they had far greater struggles.

Farr is often portrayed as little more than Nightingale’s statistical assistant. But he is a far more substantial figure in the history of statistics than she was. Moreover, he came from very humble origins – by contrast with Nightingale who was massively wealthy, immensely privileged, and well networked. Farr’s statistical story merits repeated retelling, as does Chadwick’s. They also remind us that class and social equity are still important issues today, and WMY2020 should focus on this. (Chadwick’s brother Henry moved to the USA where he became “the father of baseball statistics”.)

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So – let us use World Maths Year to bang the drum for social class equity. I have no fixed idea as to how it would operate, except that it will differ from and hopefully improve on MY2000, and that it will differ in different countries. It can be an important legacy from this MATRIX conference.

I would hope that WMY2020 would be more “international” than WMY2000, which was very nationalistic and constrained within national boundaries. In the UK we had four different “national” Maths Years! – although we did get an all-Ireland initiative, in addition to the two in the North and the South.

Two ways of internationalising WMY2020 would be

1. To “twin” nations, possibly dissimilar nations, or to work in small clusters
2. To have projects “Along the line” e.g. linking countries along the Greenwich meridian or along other world-lines.

I also hope that WMY2020 will improve on WMY2000 by stressing **legacy**, so that tangible structures remain until 2030 at least. It is not just a one-year event!

As far as legacy is concerned, I have one vision which was discussed within MathsWorldUK and in Radical Statistics and Full Fact. This is the vision is that a permanent legacy of MY2020 should include **a UK national network of 12-20 regional “Maths/Data Discovery Centres”**.

These would be located strategically so that at least 50% of the population lives within 50 miles of a centre. The centres would all be different: some would stand free; others would piggy-back on existing institutions. They would develop local histories and strengths and would include a range of maths & data related activities and resources including:

- Hands-on maths/data exploratory/museums etc., with outreach, including ‘edutainment’ from the worlds of science, technology, mathematics, art, music, colour, fun, history, philosophy, politics etc., etc.

- Social venue/meeting-place/theatre for events with a science or technology flavour
- Data skill resource centres
- Community resources for community groups and others who use data in their activities.

Can we make something like this happen? Or would you prefer something completely different? Either way, we need to get on with it! I'd welcome your comments, and remind you that a Business Meeting will be held to discuss the World Maths Year proposal at 1pm today. Please come along – or contact me later!

**T H A N K   Y O U !!**

**World Mathematical Year 2020**  
**Join us in getting this campaign going.**  
**Please contact John Bibby**