Getting to know QM:
The Multiple Faces of Quantitative Methods in Higher Education Social Science Subjects

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Outline

1. A World of Numbers
   - A Constructed World

2. Redrawing
   - ANT
   - Doing

3. Doing QM: Duck and Rabbit

4. Speaking QM: Fantasy or Fact(?)

5. (Re)Presenting QM
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3. Doing QM: Duck and Rabbit

4. Speaking QM: Fantasy or Fact(?)

5. (Re)Presenting QM
A World of Numbers

• From 1997-2012 there has been a 10 percentage point rise in the number of jobs requiring quantitative skills (Mason et al., 2015).

• 1/2 of all students fail GCSE mathematics, and only 15% take it in some form after GCSE (Vorderman et al., 2011)

• Q-Step: Nuffield Foundation, ESRC & HEFCE joined to fund a £15.5 million programme that aims to respond to the “market failure to attract students and teachers into quantitative social science training”(Nuffield Foundation, n.d.: 2)
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It’s a hard world...
It’s a hard world...

• Quantitative methods are often rated as one of the hardest modules students take during their degree (Murtonen & Lehtinen, 2003).

• Students: quantitative reasoning; numerical thinking; maths/stats anxiety

• Staff: maths/stats anxiety; mixed ability classes; limits on teaching time; heavy workload.
Conquering this world

Garfield & Ben-Zvi (2007) - Key Principals

1. Knowledge is constructed through practical *doing*.
2. Doing must be *practiced*, and improved through confronting *errors*.
3. Students should receive constant and helpful *feedback*.
4. *Technology* can be used to aid visualisation and exploration of data.
5. Difficulties in learning basic probability are often underestimated.
6. Student understanding is often over estimated by teachers.

• Embedding skills (Grawe, 2011)
• Using real datasets (Adeney & Carey, 2011)
• Assessments that promote statistical literacy, reasoning, and thinking (Garfield, 1994)
A Constructed World
A Constructed World

• Devoid of cultural attitudes
• Assumes a non-problematic transfer of knowledge
• Human centred representations of the teaching environment
• Assume a unified thing called “quantitative methods”
How to redraw?
What is Actor-Network Theory?

Emerged in response to Kuhn, Strong Programme of Sociology.

Draws on Ethnomethodology, Continental Philosophy (Deluze & Guattari; Serres)

a “ruthless appliance of semiotics” (Law 1999: 3)

“a sensibility, a set of empirical interferences in the world, a worldly practice or craft” (Law & Singleton, 2012: 2)
Speaking Actor-Network Theory?

Translation | Enrolment
(Callon, 1986)

Hybrid actor
(Latour, 1994)
Implications of this?

Performative (over representative) idiom
Representing, producing, correspondence vs Powers, capacities, performances situated in material agency (Pickering, 1995)

Discontent with earlier “per-forms”, embodiment, new potentialities (Thrift & Dewsbury; 2000: 411)

Multiplicity & Complexity
Harvey’s (2004) overlapping absolute, relative and relational space.
Redrawing with ANT: Why?

1. Offers a way of adopting a networked (relational) understanding of the world.
2. Foregrounds non-human and human actors (symmetry).
3. Understands networks as dynamic and performed (enrolment & translation).
ANT in Education

• Fenwick & Edwards (2010): ANT, post-ANT, and ANT-ish. ANT as a way of intervening in educational issues.

• 3 areas: 1) Arguing for ANT 2) Mapping the networks 3) Emphasising the actors involved.

Research Questions:

1. **What** are the actor-networks that make up quantitative methods? How are these actor-networks performed, conceptualised, and created by actors?

2. How do these actor-networks **vary** between disciplines?
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Methods: Observation (59hrs), document analysis, interviews (32), concept mapping (Canas & Novak, 2006)

Context: 16 modules across Criminology, Economics, Geography, Psychology over one academic year in a top ten UK university.

• Wagner et al. (2011) call for further research into quantitative methods teaching in the social sciences.
CMaping
Idea of QM:
- Nature of QM: Doing

Needs:
- Action/Role: Data

Means:
- Computers as central

Enrolment/Hands on data:
- via

Enrolment/Computers:
- and

Assumption:
- Methods as learned by doing

Enrolled by:
- by

Requires:
- Nature of QM: need for other resources - not just data

Correct Answers:
- Thinking linked to curriculum (assessment)
- Assessment driving learning.

qm as output (not data type)
- Hidden knowledge: 
- Needed: to fill

Maths support
- Action/Other lecturers

Actor: Formula Sheet
- Actor/Flow chart

Actor: Lookup table
- Actor/Software

Software: Mathematica
- Software: MathLab
- Software: STATA
- Software: SPSS
- Software: Excel
- Software: R
- Software: Evolve
Getting to Know QM
The Duck

If it looks like a duck, swims like a duck, and quacks like a duck then it probably is a duck
The Duck

- What is a Duck?
  Characteristics of QM?

- How is a duck like this?
  How does QM look like this?

- What does it mean to swim like a duck?
  What are the actions of QM?
Characteristics of QM?

1. Linear & fixed knowledge

You know, at the start correlation and so on, going up to statistical modelling [yeah] but then there’s also complimentary but different set of skills which are quantitative skills

Crim, Staff. CRIM4_31_510: 192: 46

Aims and scope: A full first course in statistics and data analysis from a non-mathematical viewpoint. Covering both parametric and non-parametric methods, up to and including generalised linear models.
Geog, PGT Course Description: 157: 262
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2. Learnt through doing

The lecturer continues saying: “Chi-squared test says you’ve got to calculate this thing called a Chi-Squared test statistic, and this is how we do this.”

Geog, 1st year module, lecture: 111:19
How does QM look like this?

1. **Linear & fixed knowledge**
   Flow charts, worksheets fix QM into sequences.

2. **Learnt through doing**
   Assignments, worked examples, exercise sheets
What does it mean to look like this?

1. **Linear & fixed knowledge**  
   Flow charts, worksheets fix QM into sequences.  
   Something to be followed

2. **Learnt through doing**  
   Assignments, worked examples, exercise sheets  
   Obtaining correct answers
The Rabbit
Characteristics of QM?

1. Dynamic, Mischievous, Iterative

Whilst working through [the worksheet] student’s type in the code from the sheet, after hitting enter one student exclaims “Yay!” when the final scatter plot is displayed. One student says to the other “I keep forgetting to put quotation marks in”.

The students continue varying between writing line by line the code, and several lines of code before running it.

Student 1 remarks: There’s such a lot of code to make a decent looking plot. Student 2, after clicking enter: Oh it didn’t like that.

Psyc, Master’s module, workshop: 103: 42
How does QM look like this?

Software

He goes onto say that before they have been dealing with 10s of observations, they’re moving onto dealing with data sets that are comprised of 1000s of observations, which are “straightforward to handle in R”, but not other software’s such as SPSS

Psyc, Master’s module, workshop: 103: 5
What does it mean to look like this?

Dynamic, data hungry, iterative ...

Software ...

Tuning QM to speak through outputs

Tuning - Pickering (1995)
A good ANT account is a narrative or a description or proposition where all the actors do something and don’t just sit there.

Latour, 2005: 128
Statistics Words

Passive:

‘Equipped’, ‘use’, ‘apply’, ‘run’ QMs

Statistics Words

Personified:


Fantasy/Fiction:

(Re)Presenting QM

Work in progress but…

• Multiple faces of QM.
• As other actors are used to enrol students into the learning of QM the concept of what QM is gets translated.
• The linear and doing nature of QM becomes about performances of following, and searching for correct answers, that give power to numbers.
• The mischievous nature of QM with software becomes about tinkering and tuning of user and software on a quest for outputs, forcing numbers into the background.
• Words used to talk about QM equally highlight multiplicity.
(Re)Presenting QM

Still there are…

• Problems of pinning ANT networks into linear accounts
• Blending ANT and Pickering’s (1995) Dance of Agency
Thanks for listening

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