What counts as math?

Stories from families and from popular media

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Fields Institute Mathematics Education Forum

Two studies

- Family Math Project
  - Stanford University: Roy Pea, Shelley Goldman, Angela Booker, Lee Martin, Kristen Pilner Blair, Osvaldo Jiminez
  - NSF funded to LIFE Center
- NUMB3RS study
  - University of Washington: Reed Stevens
  - NSF funded to LOST dissemination project

LOST: What counts as math?

- ‘What counts’ is determined through interaction, in practice
- Studies of various settings
  - Families
  - Popular media: NUMB3RS

Family Math Project

- http://familymath.stanford.edu/
- Interviews with families with middle school age children
  - ‘Math in a Minute’ stories
  - Family engagement with various types of activities (e.g., home improvement, cooking)
  - Cell phone task

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Math in a Minute stories

- “Tell us a story about something that happened in your life, involving mathematics”
  - Interviewer gives an example
  - Each family member encouraged to give a story
  - Stories often co-told, related to one another in cycles
  - N ~ 80

Two types of stories

- School stories
- Home/work stories

School stories

- Adults and children tell them
- Positive
  - Success on tests, good grades, etc
  - Solving a difficult problem
- Negative
  - “I was never good at math”
  - Bad grades, confusion

What is mathematics?

- Mostly: School problems
  - Math for math's sake
- Sometimes: Mathematical problems encountered when doing other things
  - E.g., spending an hour making a poster in the shape of a pyramid

Who am I?

- Success usually evaluated by someone else (e.g., teacher)
- Success at math becomes a facet of one's identity
  - 'good at math,' or 'bad at math'
  - Sometimes from one pivotal experience

Home stories

- Adults and children tell them (adults often prompt children)
- Overwhelmingly positive
  - Difficult problems encountered in the course of activity
  - Routine mathematical tasks

What is mathematics?

- A way to make responsible decisions
  - Personal responsibility: budgeting, spending money responsibility
  - Social responsibility: donating to charity, teaching mathematics to young people
- A necessary part of getting things done
  - Home improvement, shopping, cooking, running a business, decorating, playing games

Who am I?

- Socially and personally responsible
- Success usually evaluated by outcome
  - If the curtains hang well and look good, I did the math right.
  - If my family is provided for, I've done a good budget.
- Competent

Bottom line

- What counts as math?
  - Almost all participants could contribute stories
  - Involved in many facets of daily life
  - Home:
    - Competence (even with difficult problems)
    - Problem-solving distributed between family members, available resources, etc.
    - Controversial among some ‘home’ stories

What counts as math on NUMB3RS?

- ‘We all use math every day’
  - What is the math?
  - Who does it?

- Season 2
  - Semiotic analysis of ‘mathematics’: 24 episodes
  - Small interview study of one episode

Semiotic analysis: mathematics

- Most often refers to work of professional mathematicians
  - ‘math geeks’
- Not applied to the work of FBI agents
  - Problem solving, deductive reasoning, social network theory, probabilistic reasoning…

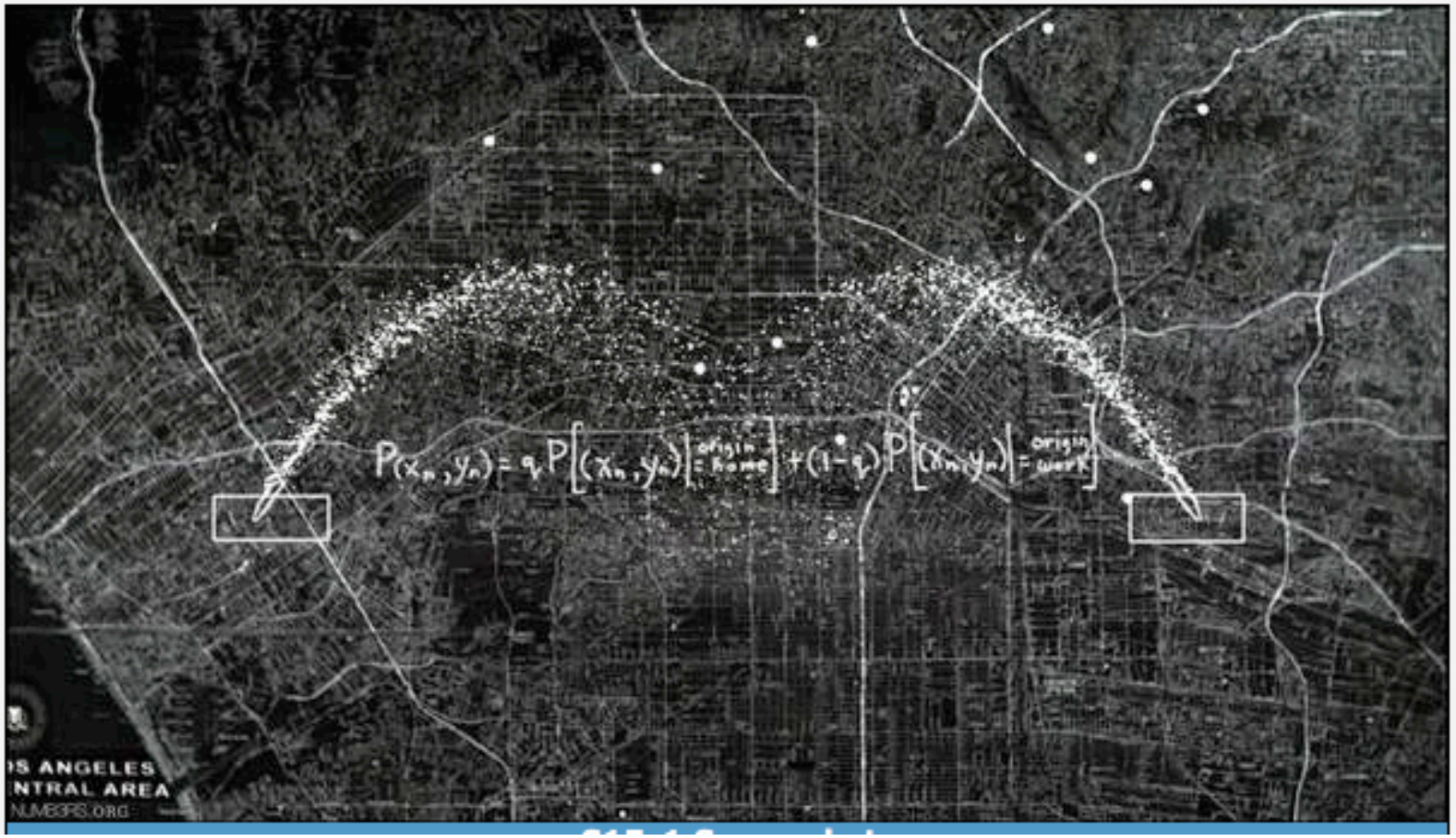
Interviews

- Watch full episode
  - Pause when you see mathematics
  - Discuss how participant identified it as mathematics
- N = 3 (so far)

Who is the ‘we’ who uses math every day?

- Charlie
- And his colleagues (astrophysicists, computer scientists, mathematicians)

- Evidence:
  - Mathematical explanations
  - ‘They were mathematicians and they said something I didn’t understand so I assumed it was math’
  - On-screen images suggesting mathematics


$P(x_n, y_n) = q_1 P\left[(x_n, y_n) \middle| \text{origin} = \text{home}\right] + (1-q_1) P\left[(x_n, y_n) \middle| \text{origin} = \text{work}\right]$
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Examples that are *not* identified as math

- FBI agents
  - Looking for a pattern in the dates of crimes
  - Using a computer program to match bullets

What is the math that ‘we’ do every day?

- Complex
- Filled with jargon
- Above the head of most intelligent people

What counts as math?

- Very narrow definition
  - Academic
  - Complex
  - Underlies everyday events, but not intelligible to most people
- Belies the tag line ‘we all use math every day’

Across both studies…

What counts as math is

- Contingently identified
- Dependent on details of practice
- Malleable, changeable

But influenced by…

- Narrow academic/school definitions
- Representations in popular media, books, etc.