Introduction: Math Circle at SDSU

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Agenda:

1. **INTRODUCTIONS:** my purpose of this math circle - I think)
   (a) what is math good for in today's world?
   (b) have fun doing math applications.

   what do you want out of this meeting?

2. **HOW IS MATH USED IN OUR WORLD TODAY?** overview

3. **SIMPLE SOCIAL EXAMPLE:** acts of kindness

4. **MODELING LONDON RIOTS:** human behavior & policy

5. **FEEDBACK:** your feedback on today & what to do next time

Please get coffee refills, etc at anytime.

Why Is Math So Vital In Today's World?

What Math Have You 'Used' Today?

PEACE-GAMING: Variables of Interest

What are some key variables that we might need to consider in this problem?

PEACE-GAMING: Variables of Interest

P = power/influence
D = aid
R = forced cultural shift
S = adopted cultural shift
E = economy
T = social media exposure
Q = religion/ideology
D = attitude towards democratic values
A = red attitude toward blue

H = humility v. pride
I = individualism v. common
O = responsibility to family/ other
F = fear of enemy/ fear of own side's judgement & punishment
I = information v. propaganda
G = level of organization
W = weapon power
N = size of supporters/ opponents
T = freedom of thought

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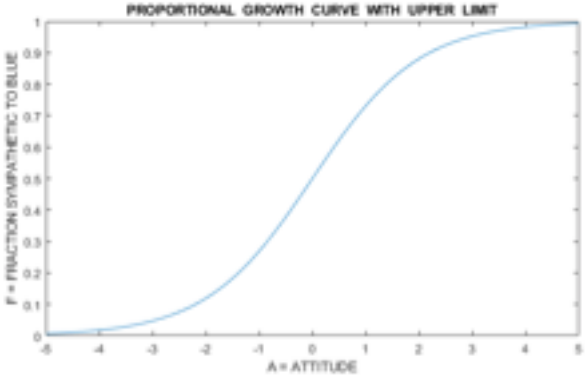
$$A = D\text{-}E\text{-}P$$

possible relationships

$$A = -H+I+O-F+I-G-W+N+T$$

PEACE-GAMING: Fraction of Red Sympathetic to Blue

$$F = 1/(1 + \exp[-A])$$



Equation exhibits:
(1) proportional growth,
(2) critical mass in mid-level,
(3) diminishing returns.

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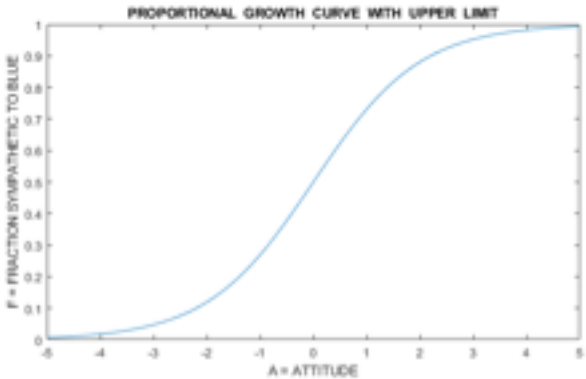

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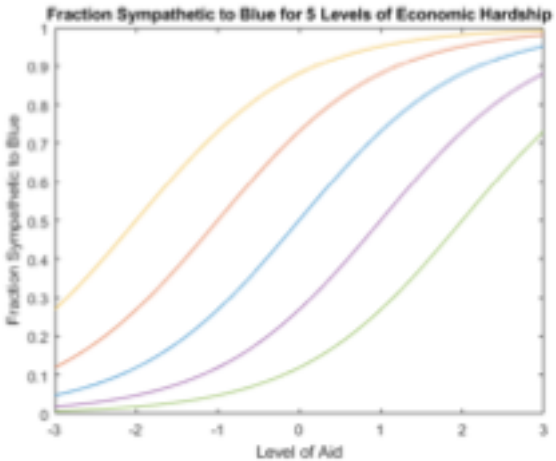
$$A = D - E$$

Attitude **Aid** **Econ Conditions**



Fraction sympathetic to blue for 5 levels of economic hardship.

An Equation to Model Behavior

Prob(person does thus & such)

$$= 1/(1 + e^{-A})$$

$$= e^{A} / (e^{A} + 1)$$

where $A = \ldots$

London Riots

Equations to model behavior

Variables	Inputs	Outputs

London Riots

Variables to model behavior

Variables

Deprivation
Distance
Site choice
Deterrence
Floorspace
Decision to participate
Decision to offend

Inputs

Deprivation
Distance
Floorspace
Deterrence

Outputs

Site choice
Decision to participate
Decision to offend

London Riots

Attractiveness of site j to person i

$U_{ij} =$

A =

London Riots

Attractiveness of site j to person i

U_{ij} = floorspace distance deterrence

London Riots

Attractiveness of site j to person i

$$U_{ij} = a \log(Z_j) - b\, d_{ij} - c\, (Q_j/D_j)$$

Floorspace

Distance I to j

Number of police

Number of rioters

Deterrent

London Riots

Attractiveness of site j to person i

$$U_{ij} = a \log(Z_j) - b\, d_{ij} - c\, (Q_j/D_j)$$

Floorspace

Distance I to j

Number of police

Number of rioters

$$W_{ij} = Z_j^{a} \exp(-bd_{ij}) \exp(-cQ_j/D_j)$$

Fry et al. 'ANSWER' on slide 14 & 15

What other behavior is of interest?

And could you/we model it?

What other behavior is of interest?

And could you/we model it?

A change process:

1. Build a math'cal model
2. Validate it until people come to believe it's true
3. Use it to show something different will work

Next time(s)?

Infectious disease model

Optimal search

Optimal supply delivery for humanitarian aid

Renter's insurance

Balance of peace in Middle East