Terrorist Group Dynamics

Lecture 16
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CSCI 7000-003
Inference, Models and Simulation for Complex Systems

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ter•ror•ism (noun)

a violent act

by non-governmental actors

to create fear

for political purposes

"terrorism from below"   vs.   "terrorism from above"

MIPT TERRORISM KNOWLEDGE BASE℠

▶ incident profile

ABU HAFS AL-MASRI BRIGADE AND SECRET ORGANIZATION OF AL-QAEDA IN EUROPE ATTACKED TRANSPORTATION TARGET (JULY 7, 2005, UNITED KINGDOM)

Incident Date: July 7, 2005

Terrorist Organization(s): Abu Hafs al-Masri Brigade , Secret Organization of al-Qaeda in Europe

Target: Transportation

City: London

Country: United Kingdom

Region: Western Europe

Tactic: Bombing

Weapon: Explosives

Fatalities: 27

Injuries: 0

RAND-MIPT data

- 40 years (1968-2008)
- domestic + international
- 5000+ cities, 187 countries
- 36,018 events (37% deadly)

terrorist organizations

10,335 events attributed to

910 identifiable orgs.

381 groups kill 1+

3,249 fatal events

MIPT **TERRORISM**
KNOWLEDGE BASE℠

▶ incident profile

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major terrorist organizations   1968-2008 (Wave 3,4)

1. Revolutionary Armed Forces of Colombia (FARC)
2. Hamas
3. Taliban
4. Basque Fatherland and Freedom (ETA)
5. Communist Party of Nepal-Maoist (CPN-M)
6. National Liberation Army (Colombia)
7. Palestinian Islamic Jihad (PIJ)
8. Liberation Tigers of Tamil Eelam (LTTE)
9. al-Fatah
10. Communist Party of India-Maoist
11. al-Qaeda Organization in the Land of the Two Rivers
12. Anti-Castro Cubans
13. Hezbollah
14. Fronte di Liberazione Naziunale di a Corsica (FLNC)
15. Shining Path
16. Islamic State of Iraq
17. Popular Front for the Liberation of Palestine (PFLP)
18. United Liberation Front of Assam (ULFA)
19. al-Aqsa Martyrs Brigades
20. Kurdistan Workers' Party (PKK)
21. Tupac Amaru Revolutionary Movement
22. Ansar al-Sunnah Army
23. Black September
24. New People's Army (NPA)
25. Abu Nidal Organization (ANO)
26. Mujahideen Shura Council
27. Armenian Secret Army for the Liberation of Armenia
28. Irish Republican Army (IRA)
29. Revolutionary People's Liberation Party/Front (DHKP/C)
30. People's War Group (PWG)
31. United Self-Defense Forces of Colombia (AUC)
32. Jewish Defense League (JDL)
33. Amal
34. Armed Islamic Group
35. Palestine Liberation Organization (PLO)
36. Earth Liberation Front (ELF)
37. Abu Sayyaf Group (ASG)
38. Popular Resistance Committees
39. Manuel Rodriguez Patriotic Front
40. Revolutionary Organization 17 November (RO-N17)
41. al-Qaeda Organization in the Islamic Maghreb
42. Baloch Liberation Army (BLA)
43. Revolutionary People's Struggle
44. Red Army Faction
45. Islamic Army in Iraq

45. Democratic Front for the Liberation of Palestine (DFLP)
46. UNITA
47. Revolutionary Nuclei
48. al-Gama'a al-Islamiyya (GAI)
49. Free Aceh Movement (GAM)
50. Kurdistan Freedom Hawks
51. April 19 Movement
52. Lord's Resistance Army (LRA)
53. Moro Islamic Liberation Front (MILF)
54. Real Irish Republican Army (RIRA)
55. al-Qaeda
56. Tawhid and Jihad
57. Popular Liberation Army
58. Eritrean Liberation Front (ELF)
59. Montoneros
60. Turkish Communist Party Marxist-Leninist (TKP/ML-TIKKO)
61. Mozambique National Resistance Movement
62. Ulster Defence Association/Ulster Freedom Fighters
63. Purbo Banglar Communist Party (PBCP)
64. National Liberation Front of Tripura (NLFT)
45. First of October Antifascist Resistance Group (GRAPO)
46. Red Hand Defenders (RHD)
47. Lashkar-e-Taiba (LeT)
48. Hizbul Mujahideen (HM)
49. Mujahideen Youth Movement
50. Bersatu
51. People's Revolutionary Army (Argentina)
52. Farabundo Marti National Liberation Front
53. Jaish-e-Mohammad (JeM)
54. Islamic Jihad Jerusalem
55. Peronist Armed Forces
56. Khmer Rouge
57. Justice Commandos for the Armenian Genocide
58. Continuity Irish Republican Army (CIRA)
59. PKK/KONGRA-GEL
60. National Democratic Front of Bodoland (NDFB)
61. Lautaro Youth Movement
62. Action Directe
63. Polisario Front
64. Mujahedin-e-Khalq (MeK)
65. Maoist Communist Center (MCC)
66. Popular Forces of April 25
67. Third of October Group
68. Baader-Meinhof Group
69. Breton Revolutionary Army (ARB)

70. Orly Organization
71. People's Liberation Forces (El Salvador)
72. Front for the Liberation of the Cabinda Enclave
73. Abu al-Rish Brigades
74. African National Congress (South Africa)
75. Moro National Liberation Front (MNLF)
76. Islamic Great Eastern Raiders Front
77. Palestinian Revolution Forces General Command
78. Chukakuha
79. Communist Combatant Cells
80. Popular Front for the Liberation of Palestine -- General Command (PFLP-GC)
81. Red Brigades
82. Japanese Red Army (JRA)
83. Animal Liberation Front (ALF)
84. Committee of Solidarity with Arab and Middle East Political Prisoners (CSPPA)
85. Front for the Liberation of Lebanon from Foreigners (FLLF)
86. Jamatul Mujahedin Bangladesh
87. Informal Anarchist Federation
88. Sudan People's Liberation Army
89. Ninth of June Organization
90. Guerrilla Army of the Poor
91. Loyalist Volunteer Force (LVF)
92. Anti-Imperialist International Brigade
93. All Tripura Tiger Force (ATTF)
94. People's Revolutionary Army (Colombia)
95. Social Resistance
96. Arab Communist Organization (ACO)
97. Anti-Terrorist Liberation Group
98. Riyad us-Saliheyn Martyrs' Brigade
99. Kosovo Liberation Army (KLA)
100. Lashkar-e-Jhangvi (LeJ)
101. Revolutionary United Front (RUF)
102. Jamiat ul-Mujahedin (JuM)
103. Alex Boncayao Brigade (ABB)
104. Pattani United Liberation Organization (PULO)
105. Group Bakunin Gdansk Paris Guatemala Salvador
106. Irish National Liberation Army (INLA)
107. Revolutionary Struggle
108. Lebanese Armed Revolutionary Faction
109. Ananda Marga
110. Tupamaros

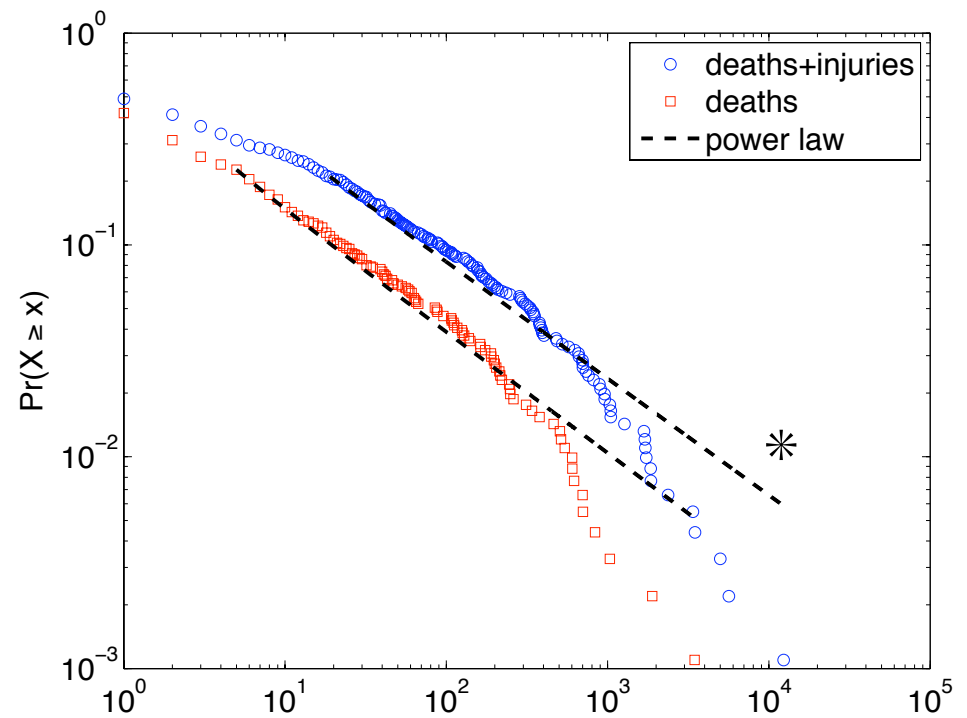# attribution matters a little

50% of "severe" events by:

- al-Qaeda in Iraq (46)
- Tamil Tigers (23)
- Hamas (20)
- al-Qaeda (16)
- Taliban (15)
- Ansaral-Sunnah Army (15)
- FARC (13)
- Hezbollah (12)
- Mujahideen Shura Council (11)
- Lord's Resistance Army (11)
- Islamic State of Iraq (10)
- Fatah (9)

also okay as power law $p > 0.1$
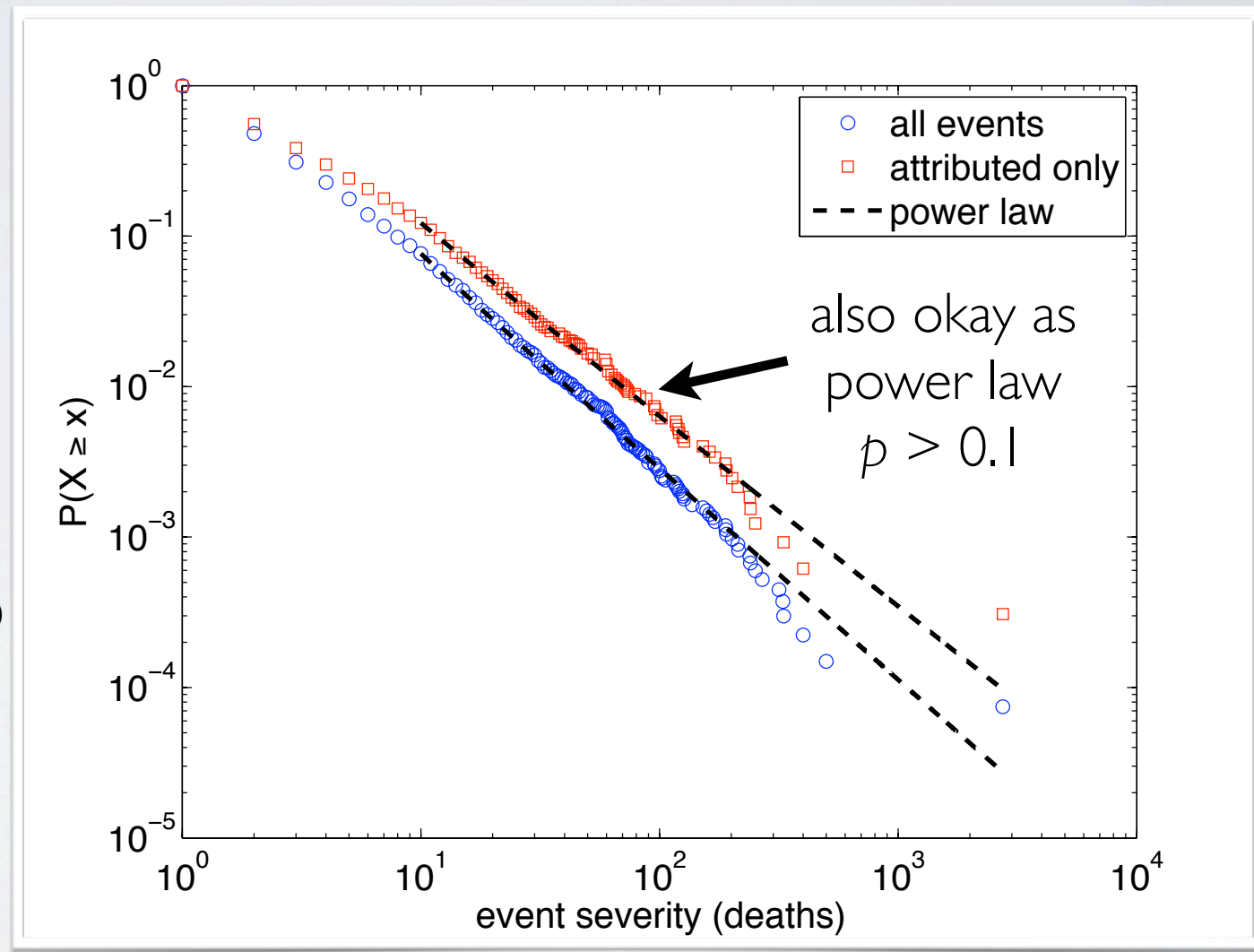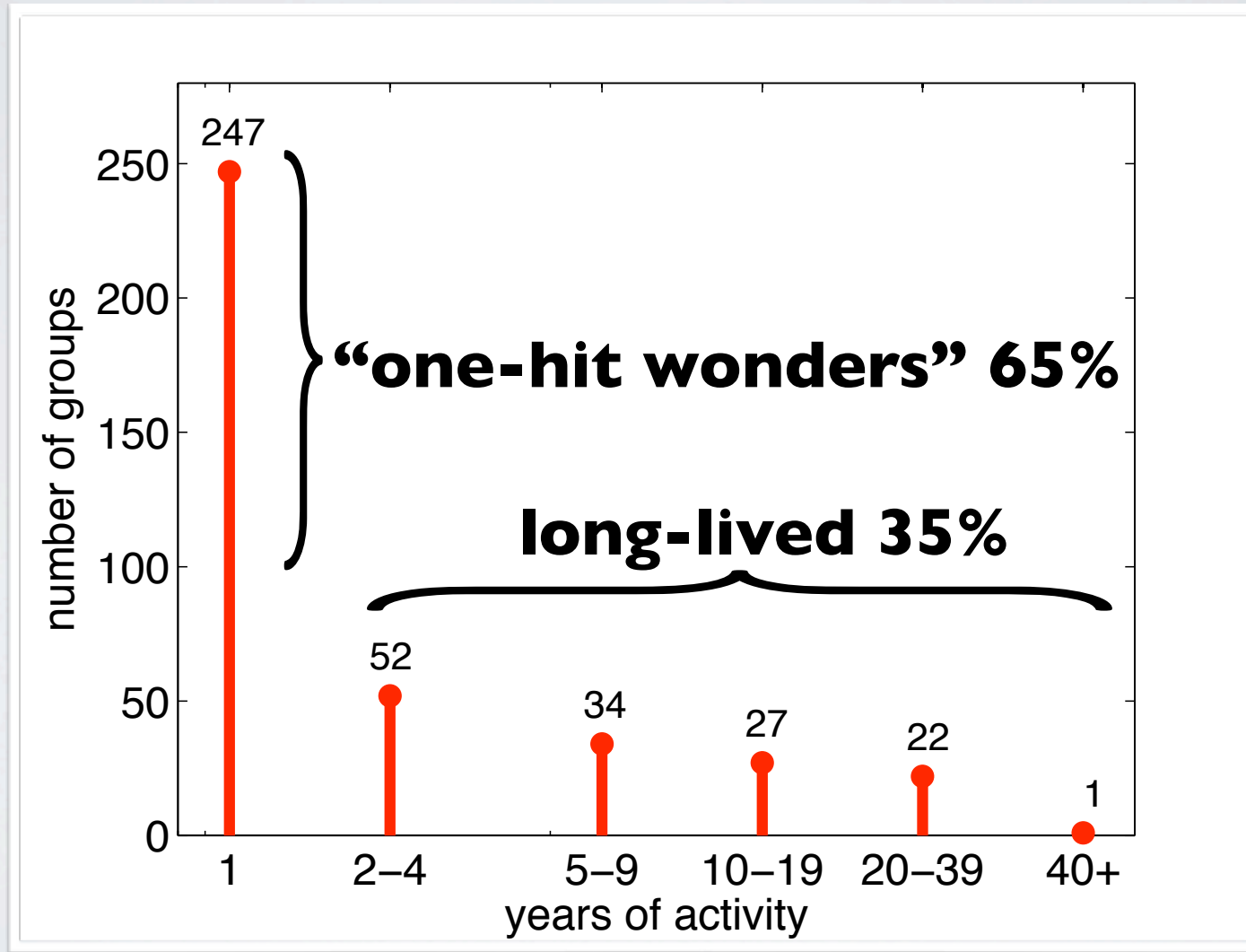
most groups uninteresting
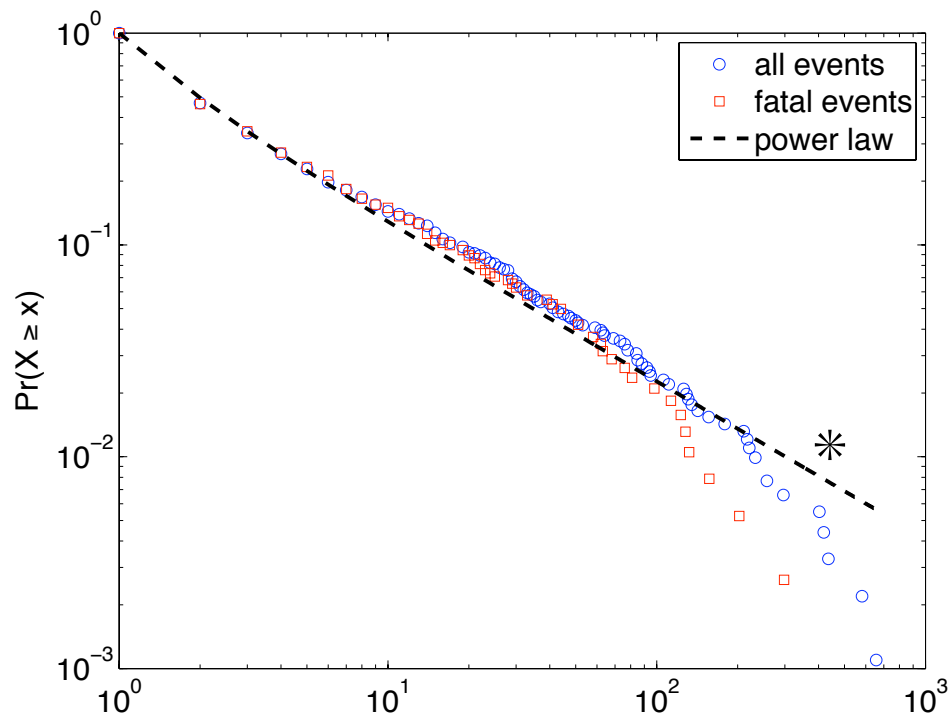
total number of events   total casualties

*these are **not plausible** power laws, $p < 0.1$

most groups die quickly

**behavioral dynamics
of terrorist groups**

**behavioral dynamics
of terrorist groups**

traditional studies:

- political motivation,

- strategic choices,

- organizational structure,

- material support, etc.

behavioral dynamics
of terrorist groups

but, given that a terrorist group acts:

- do its attacks change over its lifetime?

- how do they change?

- are there patterns?

- are these patterns stationary?

- can we make predictions?

are dynamics stationary?
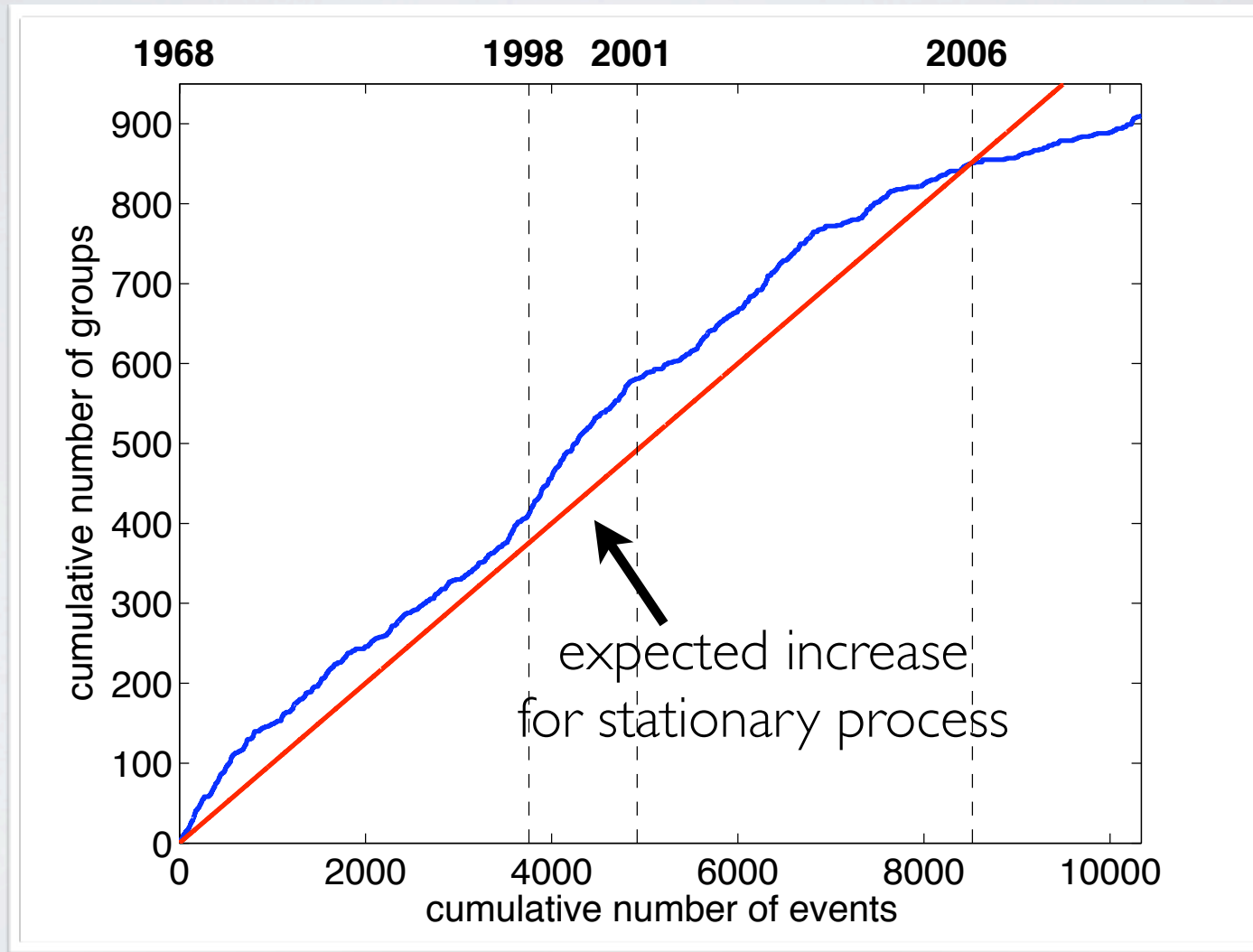
how does terrorism progress? a hypothesis

how does terrorism progress? a hypothesis

attacks ➤ recruitment ➤ growth ➤ more attacks

group size and age determine *rate of attack*
(terrorist "cells" largely interchangeable, size is main limitation on rate)

test this hypothesis using data

development curves

(a.k.a. "experience" curves)

development curves

plots group's behavior as function of maturity k

- facilitates inter-group comparisons
- frequency (time between attacks Δt)
- severity (deaths x)

development curves

behavior

1	2	3	4	5	6	...
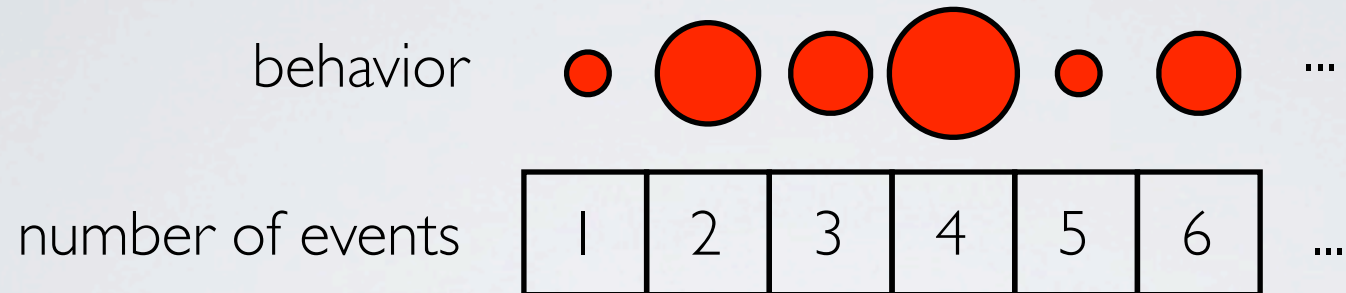
number of events
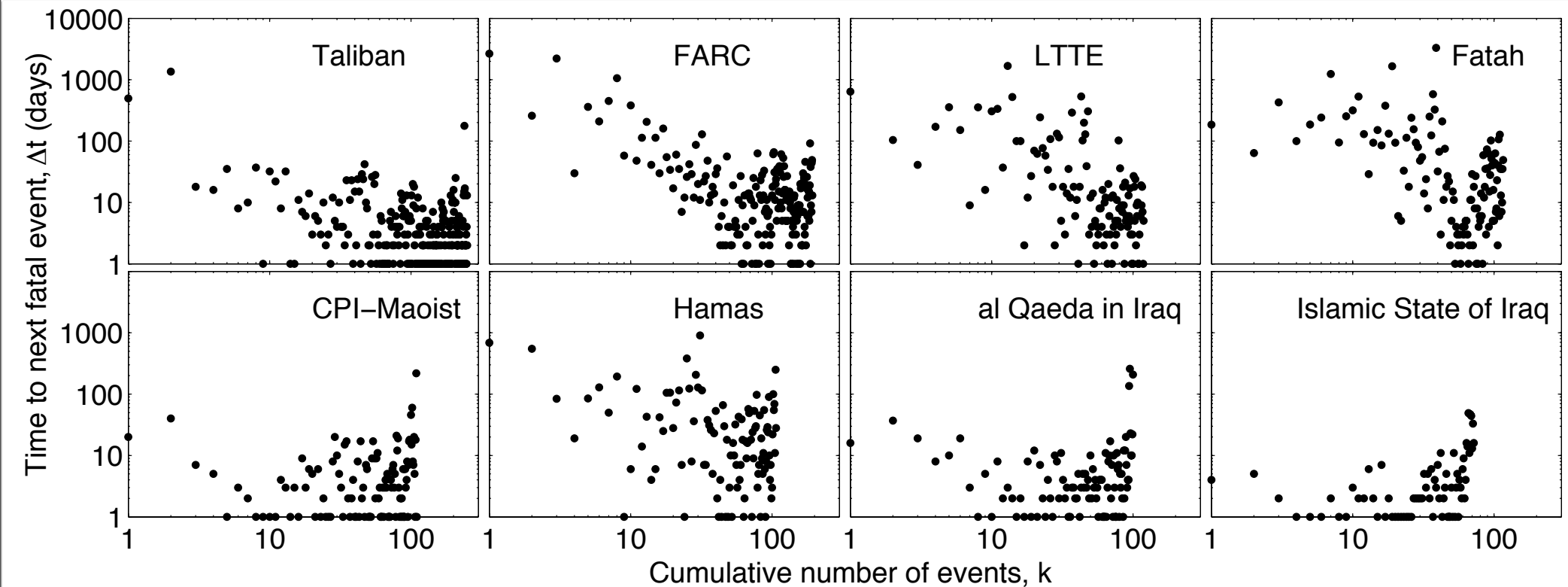
examples:

development curves

behavior

number of events

| 1 | 2 | 3 | 4 | 5 | 6 | ... |

examples:

frequency of attacks
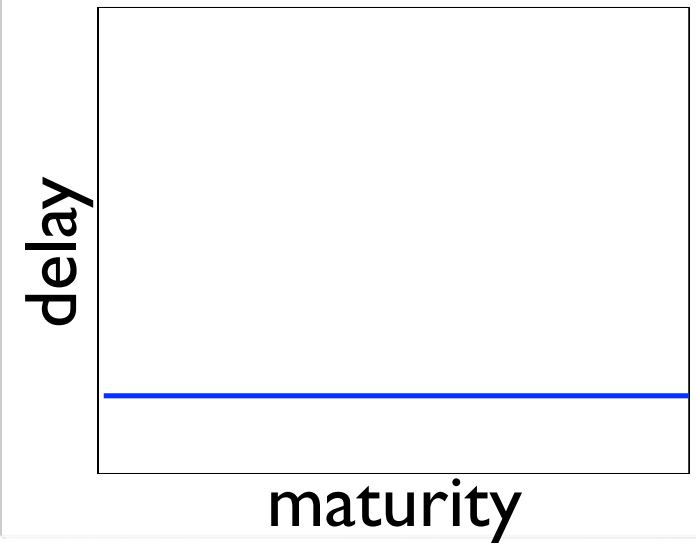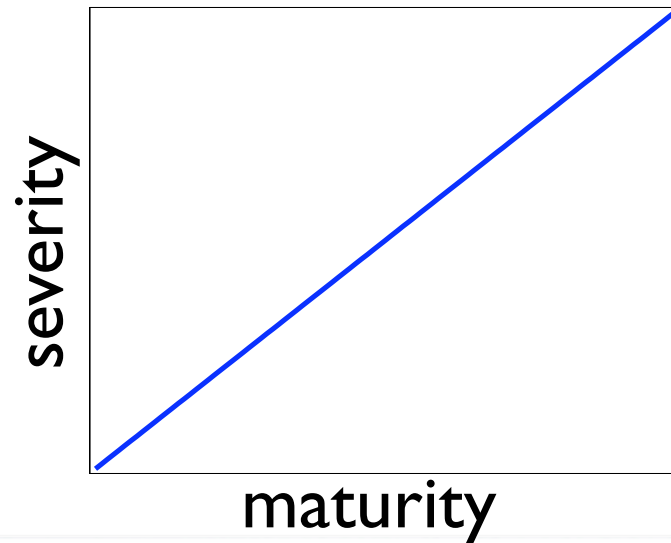
	12 days	15 days	14 days	28 days	43 days	38 days	
time between attacks							...
event number	1	2	3	4	5	6	...
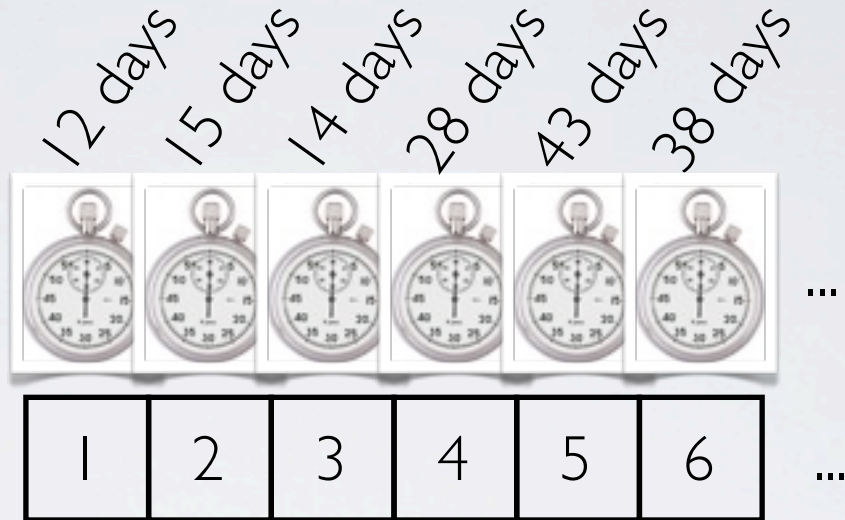
individual curves

combine these curves to extract *typical* trajectory

typical curve
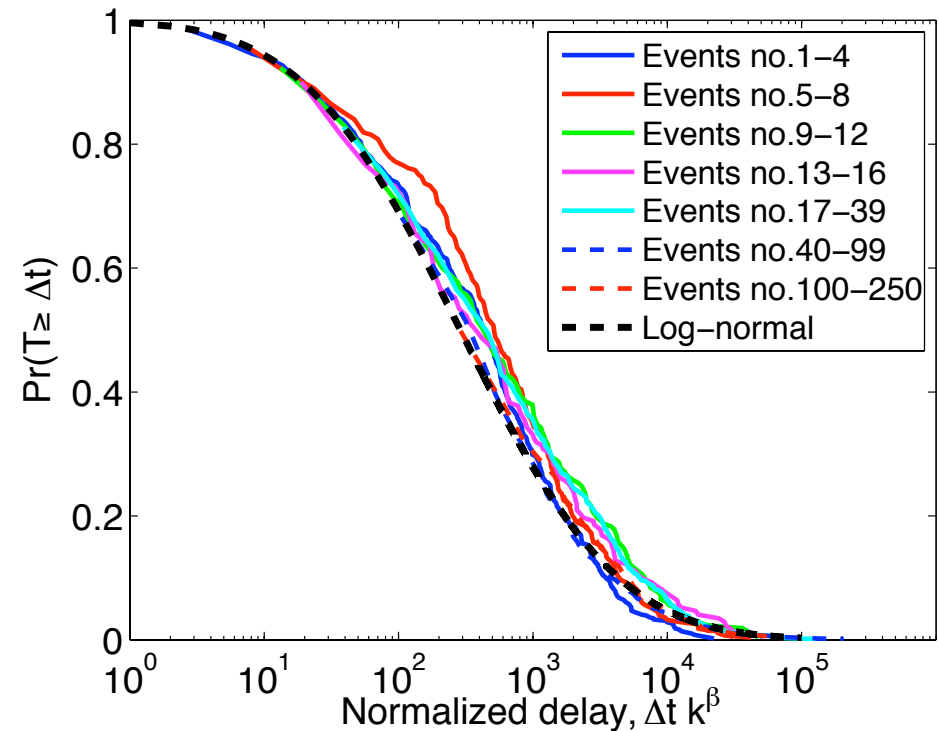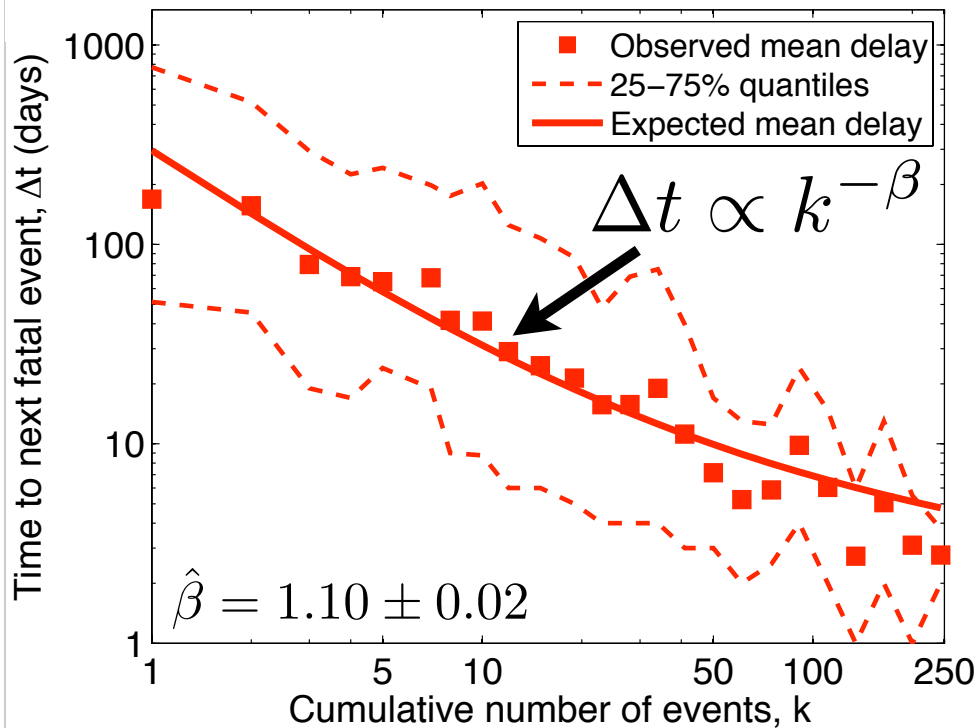
$$\text{truncated, shifted log-normal} \quad \left\{ p(\log \Delta t) \propto \exp\left[\frac{-(\log \Delta t + \beta \log k - \mu)^2}{2\sigma^2}\right] \right\}$$
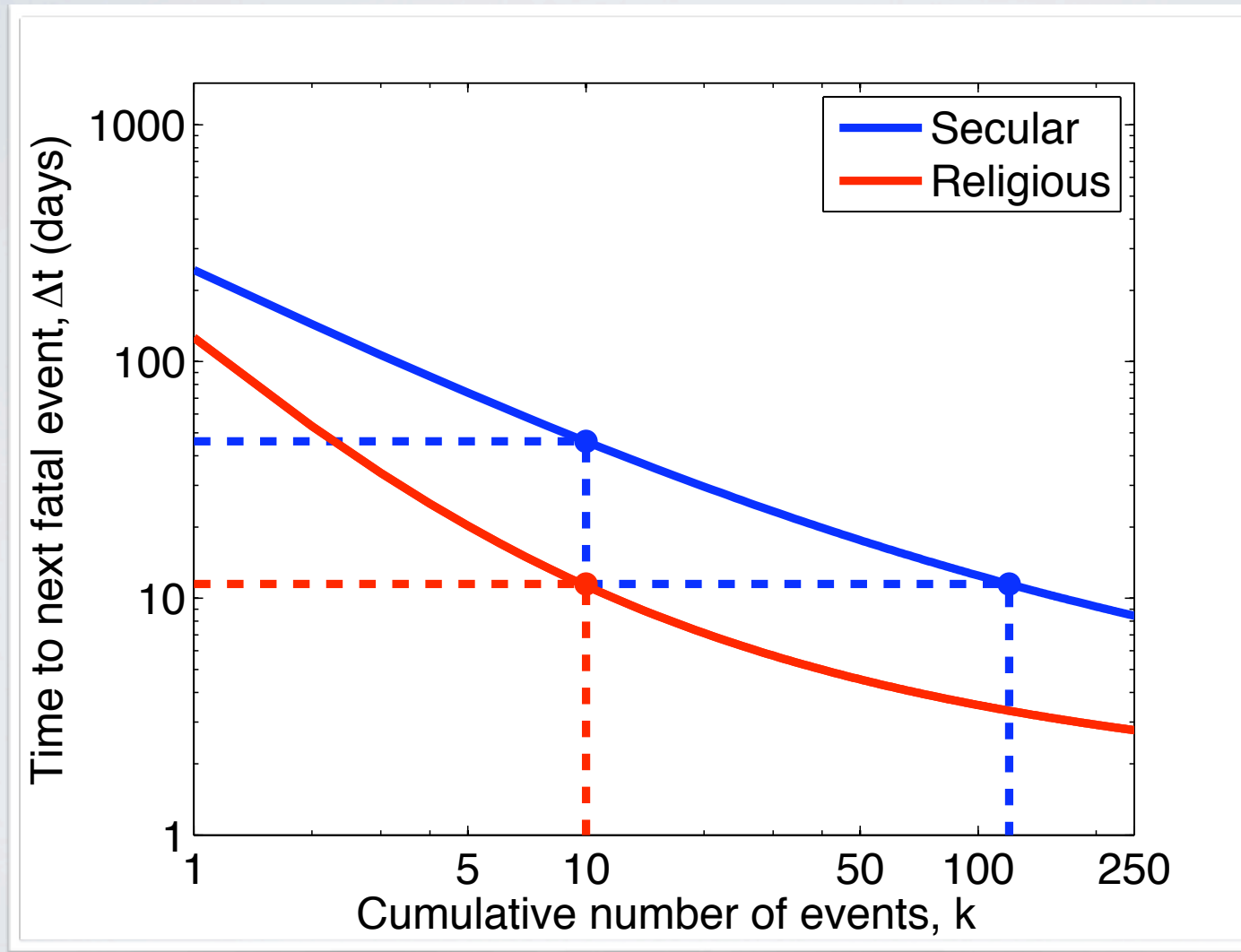
note: events can't be considered strictly independent: $p = 0.00 \pm 0.03$

forecasting?
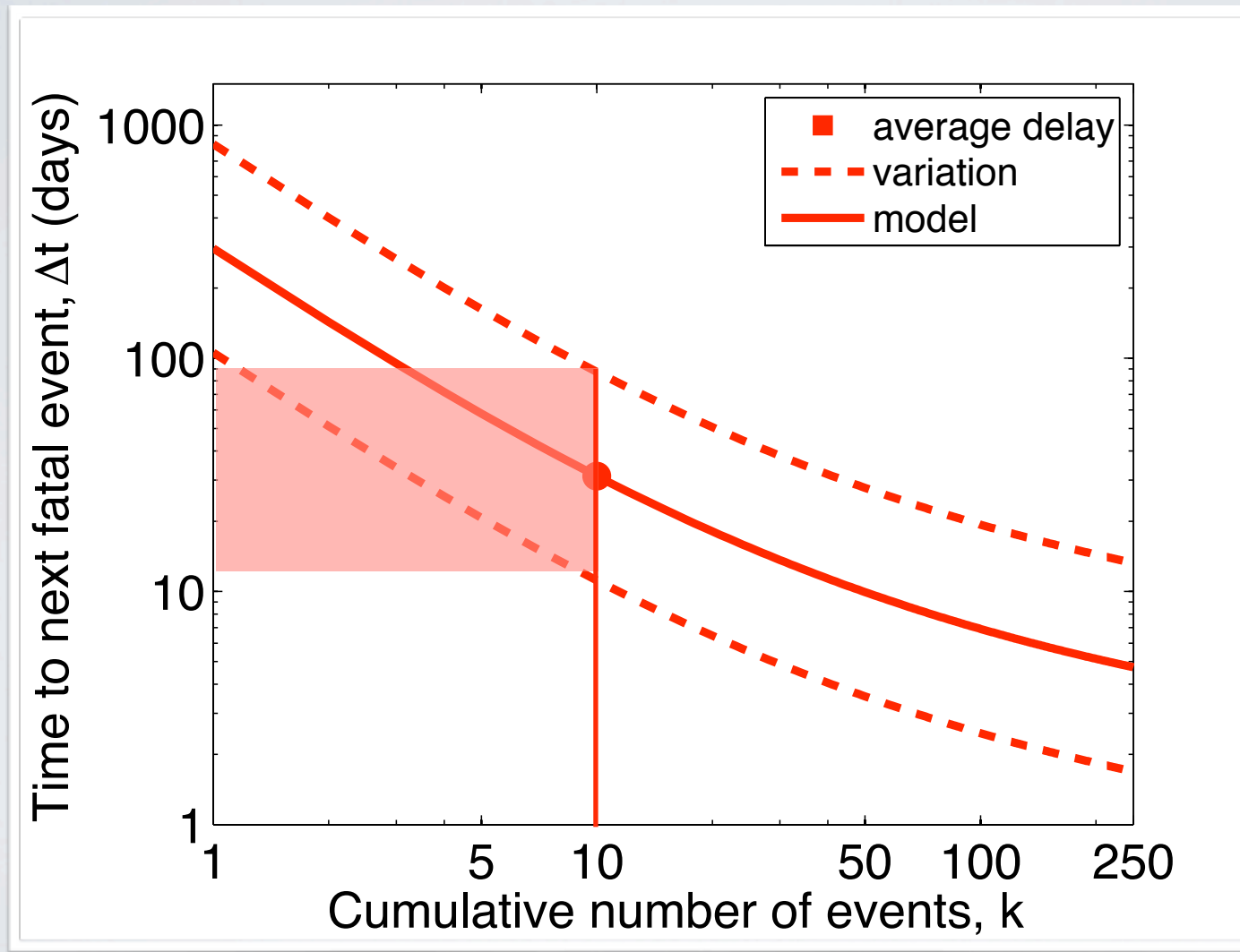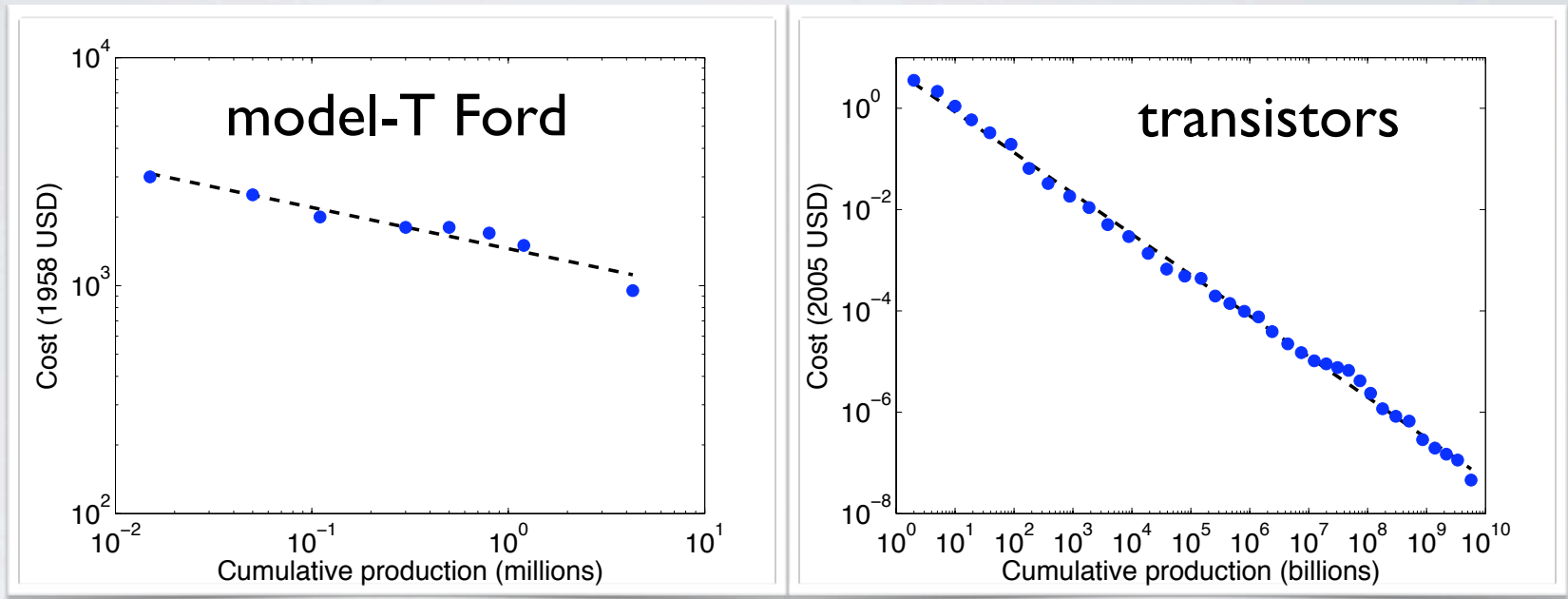
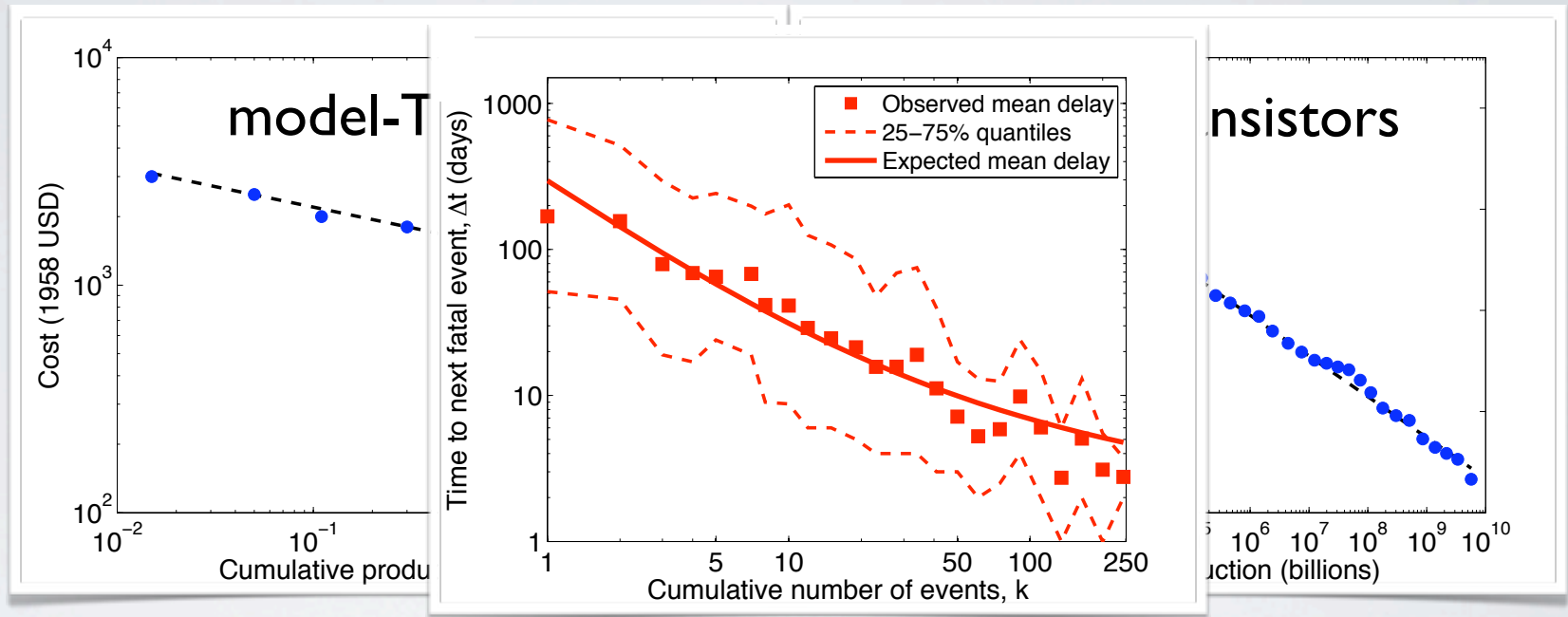# secular vs. religious terrorism

secular vs. religious terrorism

ideology classification based on Miller (2007)

experience curves: cost vs. "time"

"our strategy is to get big fast" Jeff Bezos of Amazon.com

experience curves: cost vs. "time"
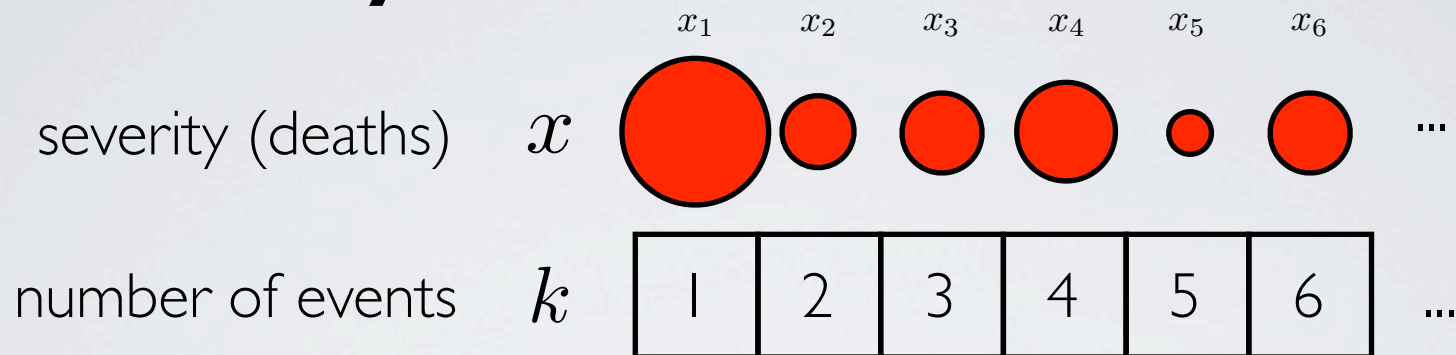

terrorist groups act like businesses
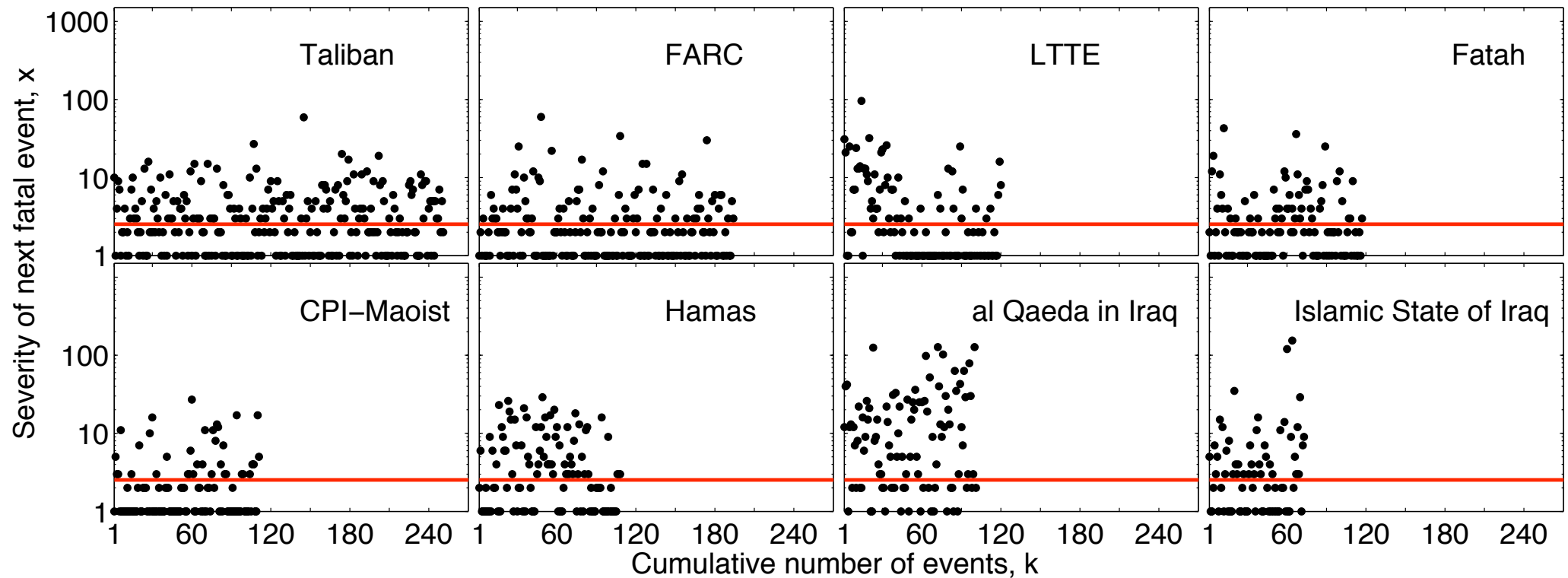(whose "product" is terrorist attacks)

labor constrained industry
(more people = more attacks ≠ more severe attacks; what about cyber?)

even terrorists face universal social constraints

attack severity

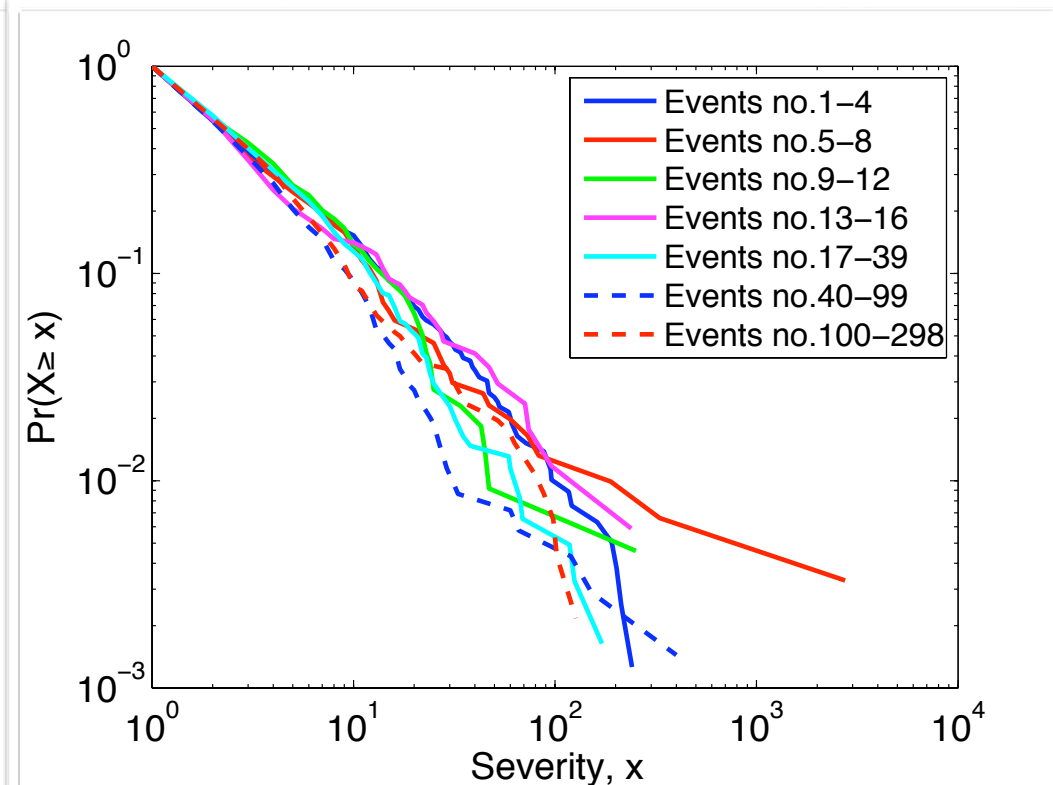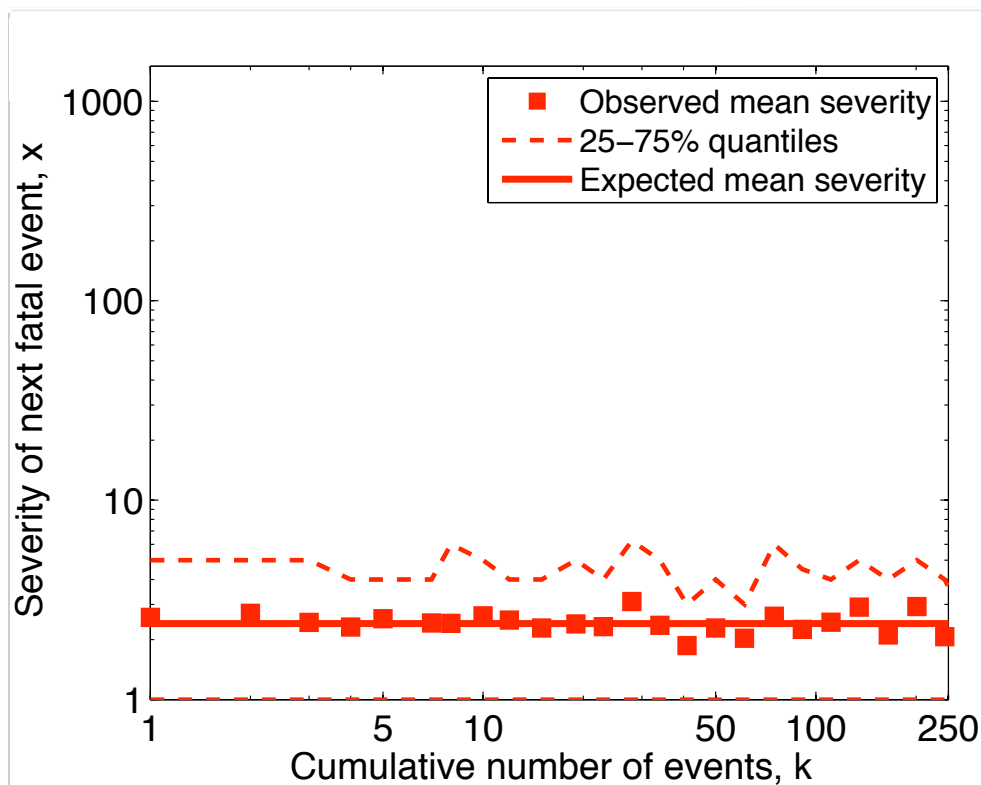severity (deaths) x

$$x_1 \quad x_2 \quad x_3 \quad x_4 \quad x_5 \quad x_6$$

number of events k

1	2	3	4	5	6	...

individual curves

combine these curves to extract *typical* trajectory

typical curve

invariant distribution $\left\{ \quad p(x \mid k) \propto x^{-\alpha} \quad x \geq 1 \quad \right\}$

note: there is more structure in $p(x)$ than we expect from this strict power-law distribution

why does attack rate accelerate?

organizational **learning**

organizational **learning**

existing members become more efficient
(better planning, coordination, execution)

organizational **learning**

existing members become more efficient
(better planning, coordination, execution)

unfortunately, very hard to test empirically
(little data on terrorist event planning)

organizational **growth**

new, replaceable, independent members

(recruit new, independent terrorist cells)

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new, replaceable, independent members
(recruit new, independent terrorist cells)

predicts *delay* and *size* are inversely proportional
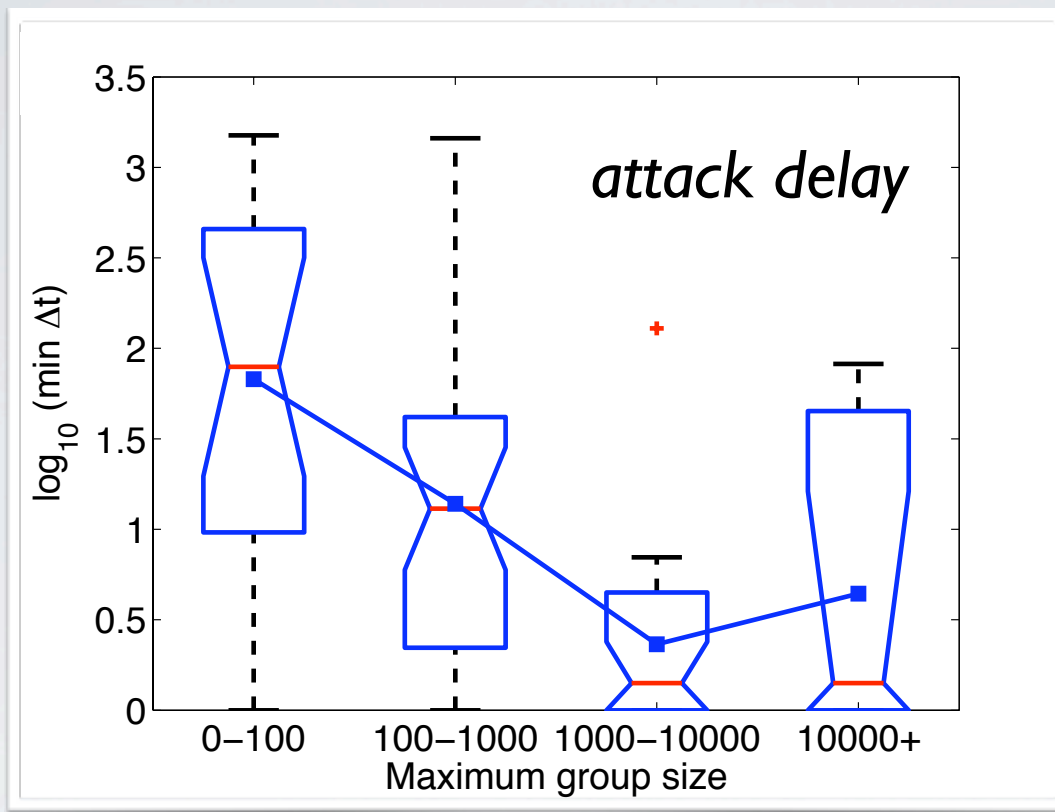
$$\Delta t \propto 1/s$$

size matters

The Nature of the Beast: Organizational Structures
and the Lethality of Terrorist Attacks

Victor Asal   University at Albany—State University of New York
R. Karl Rethemeyer   University at Albany—State University of New York

order-of-magnitude estimates
of *maximum* size over 1998-2005
for 381 terrorist groups

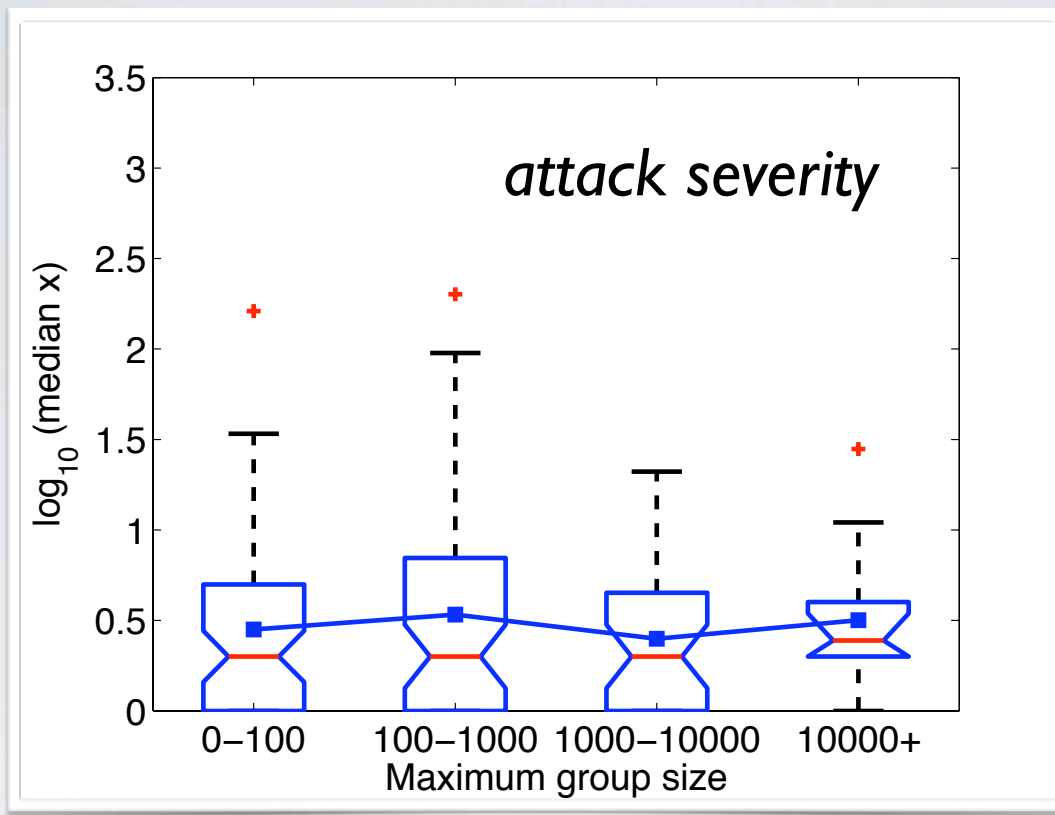prediction: $\min(\Delta t) \propto 1/\max(s)$

delay *decreases* with size

organizational **growth**

new, replaceable, independent members

(recruit new, independent terrorist cells)

but, are larger groups better at killing?

severity *independent* of size

organizational **growth**

new, replaceable, independent members
(recruit new, independent, interchangeable terrorist cells)

attacks ➤ growth via recruitment ➤ more attacks

(organizational learning may still play a role)

predicting the future
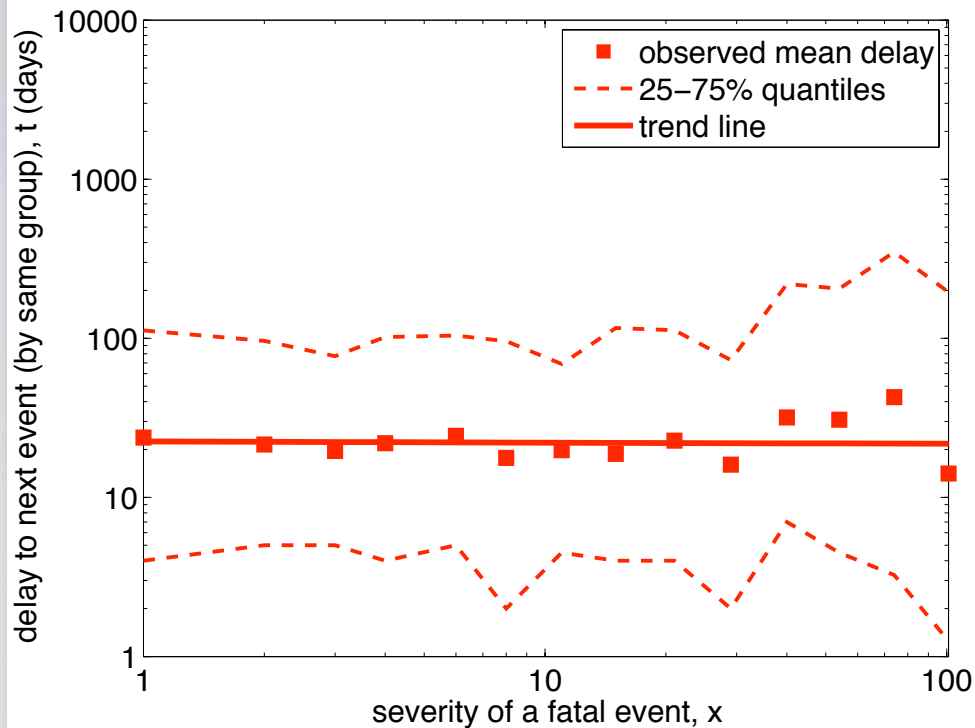
predicting the future

given we know only

- severity of an event by some group,
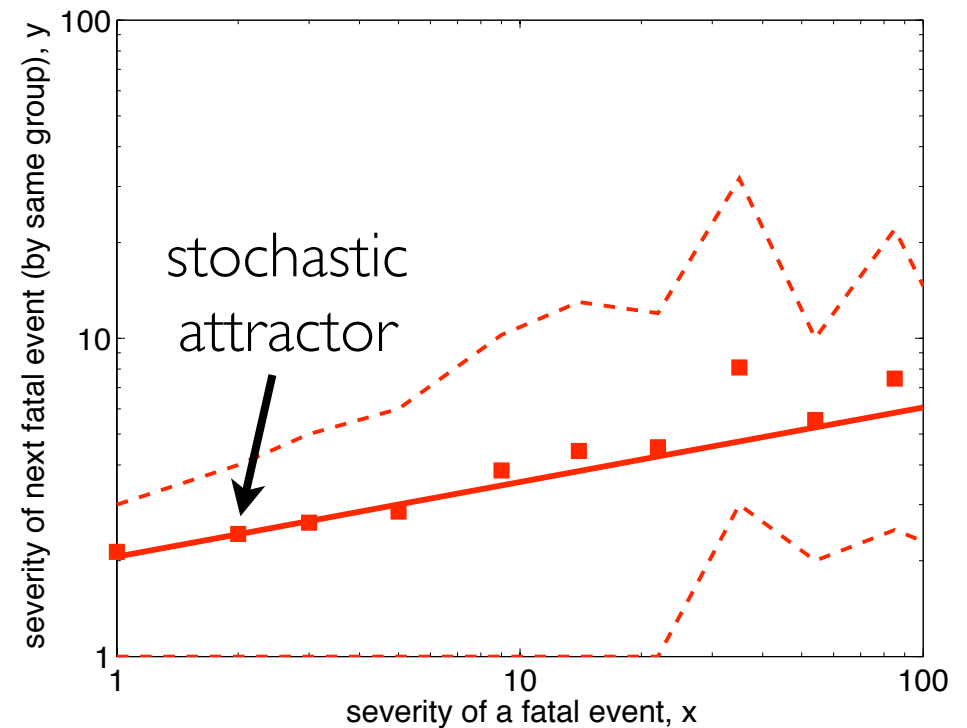
can we predict

- **delay** until next event by same group

- **severity** of that event

predicting the future

$$\Delta t \approx 28.1 \text{ days}$$

independent of severity

$$x_{t+1} \approx 2x_t^{1/4}$$

strong attenuation

summary

- many robust patterns in terrorist group behavior

- a group's attack rate accelerates as with age
  (but group motivation matters)

- feedback loop between attack frequency and size

- terrorist groups like start-up companies
  (whose product is terrorist attacks)

- attack severity follows invariant power law
  (which does not change with group age or size)

- delay independent of severity; recurrent severity strongly attenuated

some open questions

- do terrorist organizations learn?

- what organizational factors determine β ?

  - ideology matters. why? what else?

- where does power law for severity come from?

- can we forecast behavior of individual groups?

- how do these organizations die?

- what is predictable about future terrorist attacks?

tuesday: you!