



THE CENTER FOR ADVANCED STUDIES
IN SCIENCE AND TECHNOLOGY POLICY

FROM DATA MINING TO COMPUTATIONAL SOCIAL SCIENCE FOR COUNTERTERRORISM



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Presentation: Policy issues in applying computational social science to CT

- Definitions
 - What is DM in this context?
- Methodologies
 - How is DM used in CT?
- Policy concerns
 - What is the problem?
 - Preemption
 - Privacy, 4th A, DP, &c.
 - Legal significance
- Observations
 - What is (where is?) the solution?
- Conclusion(s)
 - Where do we go from here?
- *References*

Threshold problem: Definitions

- What is data mining? (policy vs. technical definition)
- Aggregation (access) and automated analysis (sorting) = “data mining” for policy purposes
 - Data matching
 - Link analysis
 - Pattern generation
 - Pattern matching
- TAPAC and DM reporting amendment (Feingold-Leahy)
 - Any query to third party data or secondary use of gov data
- What is “data mining” for CT? Computational social science used to diagnose social pathologies, i.e. hostile, covert networks
- Legal/policy issue: use of DM as predicate for further action

Computational social science in CT

- Mathematics, statistics, economics, political science, cultural anthropology, sociology, psychology, psychiatry, neuroscience, and computer science (modeling, visualization, and simulation)
- Counterterrorism as complex adaptive system - emergence, self-organization, small worlds
- Development and use of nonlinear, nondeterministic theories/models of complex human phenomena (at all scales)
- Move from modeling the individual (AI) to the group (network)
- How do groups organize and act covertly in concert? (~LoneW)

Automated analysis methodology

- Subject based (find out *more about* entity) (“psychology”)
 - Confirm identity
 - Disambiguate identity (~ semantic reconciliation)
 - Evaluate “reputation” to establish trust or suspicion
- Pattern based (find *other related* or *like* entities) (“sociology”)
 - Observed (MO) (**too few examples?**)
 - Hypothesized (red teamed) (**social science**) (**force CM sigs**)
 - “Data mined” (KDD) (**identify avoidance sweet spot**)
 - Forward and inverse problem (model/spot) (“loose-thread”)
- Consequence of “match” (use/inference) (CI for decision-making)
 - Investigative (reasonableness of predicate)
 - Decisional/adjudicatory consequences (fairness of process)
 - Watch lists ... (consequence of “soft triggers”)

Propositional v. relational DM-ing

- Propositional DM (associative/correlations) (homogenous databases/unrelated subjects)
 - “Terrorists order pizza with credit cards” (VV)
 - “My TiVo Thinks I’m Gay” (WSJ)
- Relational DM (connections/interactions) (heterogeneous databases/related subjects)
 - Visualization
 - Social network theory
 - Communications
 - Organization
 - Funding
- Bottom Line: not all shared frequent flyer accounts belong to terrorists, but sharing FF# with a known terrorist is a pretty good predicate for investigation (cf. CASE STUDY)

Outcomes for DM in CT

- Allocate resources (preventative measures)
 - Risk pools (risk management based)
 - Systems and layered defense
 - Recognize and plan for failures
 - Over- and under-inclusions
 - System failures
 - Unintended consequences of success
- System self-awareness (situational awareness)
 - How does/should an information mediated society maintain SA
 - Monitor/control for abuse/misuse (~ can be turned on itself)
 - Discovery and learning (vs. normalization and central limit theorem)
- Predicate for further action - thus, depends on the confidence interval for particular use

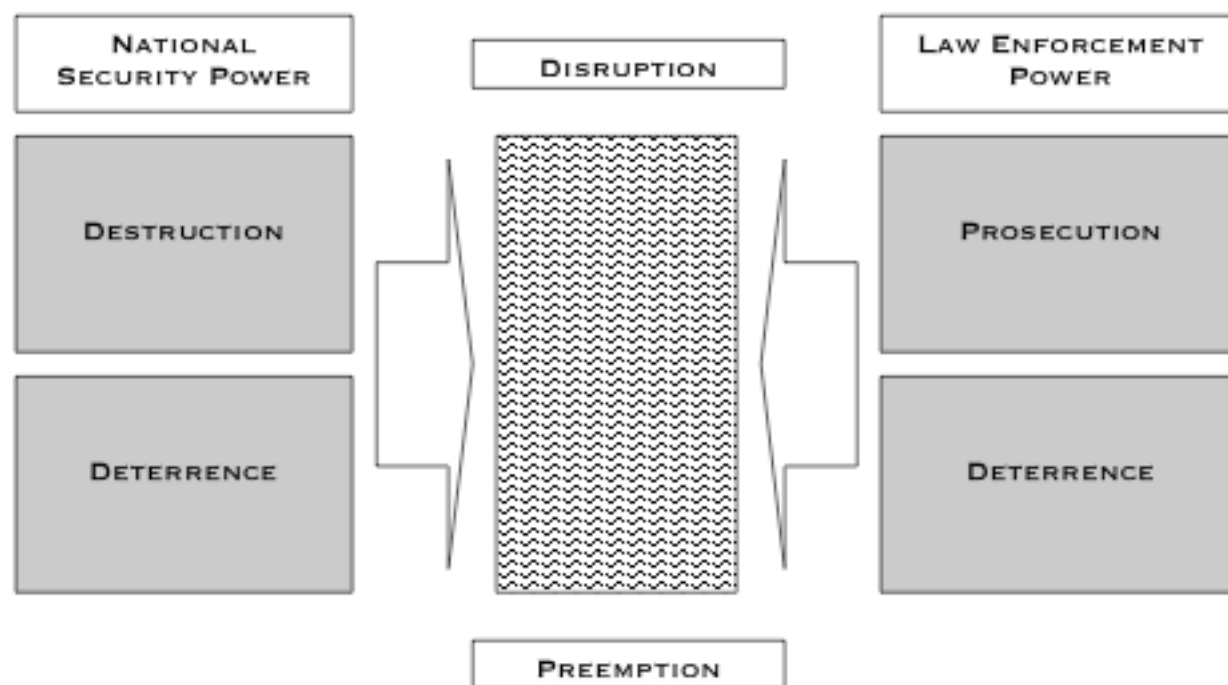
Caveat: the engineering example

- Setting ratio of false positives to false negatives
 - Default system bias / decision heuristic
 - Variable to threat environment and particular circumstance
 - Cost to security (“real” vs. “theater”) (cost of secondary screening)
 - Cost to functionality (friction, limited degrees of freedom)
 - Probability-based security will have failures
- Engineering models and catastrophic collapse
 - Don’t trust models, you over-engineer (costs)
 - Trust your models, you “push the envelope” (collapse)
- DM is only one tool
 - Need “defense in depth”
 - Need to build in error correction and elegant failure modes

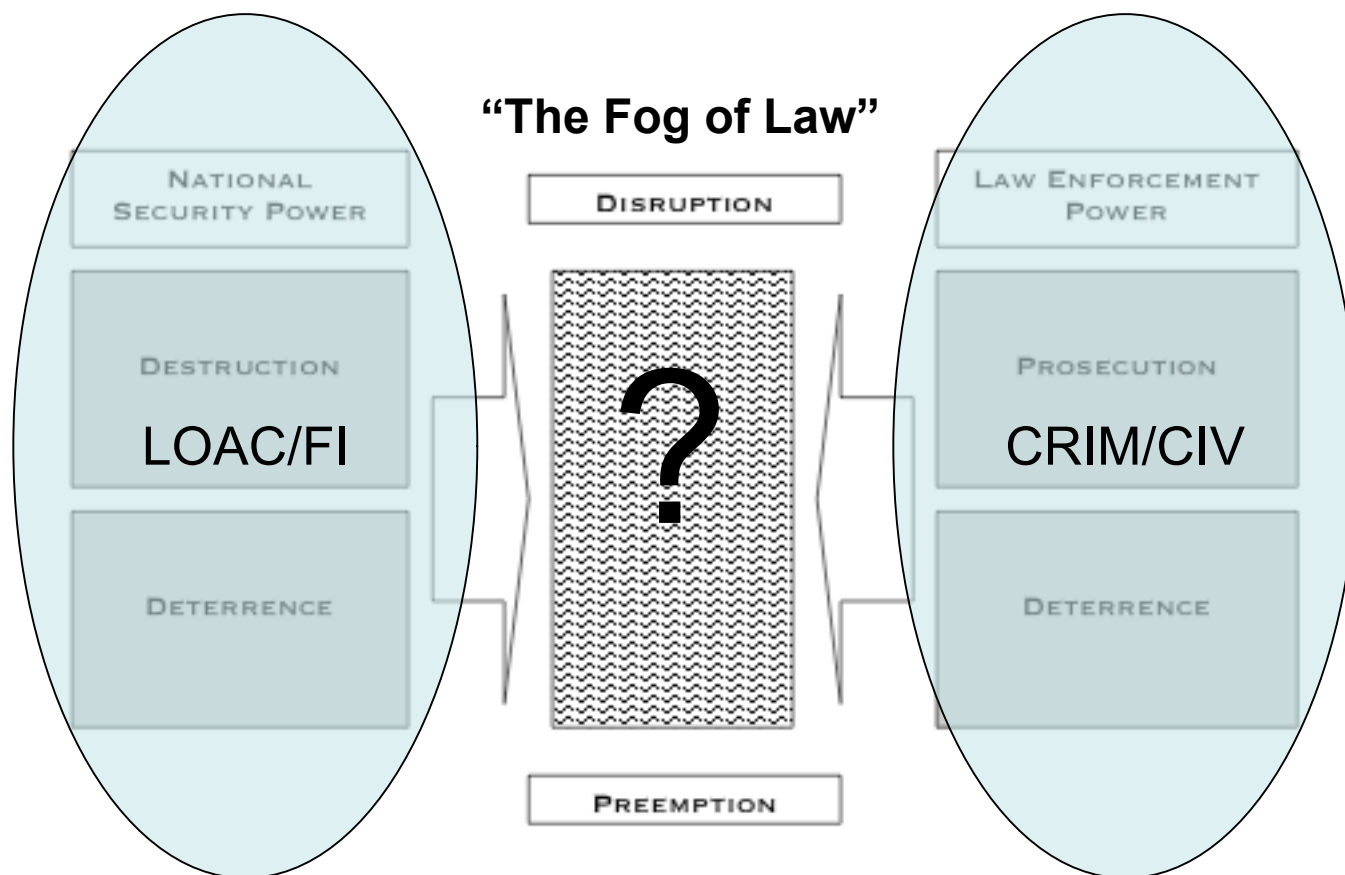
Policy concerns - preemption

- Reactive law enforcement vs. preemptive national security strategies (counter nation-threatening potentials)
 - Disparate doctrinal regimes for foreign v domestic threats
 - “Truth” finding vs. disruption (action and countermeasures)
- *Beccarian model* - punishment and deterrence of deviant individuals by sanctioning commission of criminal acts
- *Foucauldian model* - general social compliance through ubiquitous preventative surveillance and through system constraints
- Changing role of security services - from policing (arrest and prosecution) to *risk management* through surveillance, exchange of information, auditing, communication, and classification.

Converging missions to prevent potential catastrophic (nation-threatening) outcomes



Need for policy reconciliation: doctrinal conflict and vacuum



Policy concerns - “privacy”

- Privacy *interests* (The Private “I”)
 - Secrecy (place or things) 4th Amendment
 - Autonomy (behavior) 5th Amendment
 - Anonymity (identity and speech) 1st Amendment
- Privacy protection
 - Communication -- *Katz v US* (1967) (people not places)
 - Information - *Whalen v. Roe* (1977) (secrecy and autonomy)
 - Third party exception “shared” -- *US v Miller* (1976) (cancelled checks) *Smith v Maryland* (1979) (telecom “attributes”)
 - Identity -- Cf. *Talley, McIntire, NAACP w/ Gilmore, Hiibel*
 - Compare particular request v. general search / general warrant
- “Privacy” is generally a data access not data mining issue (?)

4th Amendment

- “The right of the people to be secure in their persons, houses, papers, and effects, against *unreasonable searches* and seizures, shall not be violated, and no *Warrants* shall issue, but upon *probable cause*, supported by Oath or affirmation, and *particularly describing* the place to be searched, and the persons or things to be seized.” 4th Amendment, U.S. Constitution.
- Two clauses
 - No “unreasonable searches” (protects citizens)
 - Warrants “upon probably cause” (protects officials)

4th Amendment - [un]reasonable search

- The “prohibition on unreasonable searches is not accorded more weight than the permission to conduct reasonable searches”
- “Reasonableness” (“totality of circumstances”)
 - Predicate for action (probative value not probabilistic nature is key)
 - Alternatives (balance of interests)
 - Consequences (intrusion vs. state interest)
 - [Opportunity for error correction?]
- No requirement for notice or hearing
- If reasonable at the time then error cost fall on false positives and only consequence of unreasonableness is exclusionary rule

4th Amendment - [probable cause]+[warrant]

- No universal requirement for warrant
 - Plain view / incident to arrest / stop and frisk
 - Administrative search (~EPA, OSHA)
 - Fixed checkpoint / Airport search / Courtroom search
 - “Special needs” - primary purpose is not LE (drug testing)
- Pre-FISA (1978) - National security and foreign intelligence exception for both surveillance (*Keith*) and search (i.e., 4th Amendment did not apply)
- In upholding FISA (*Megahey* 1982 EDNY) the court held that the 4th A probable cause requirement is not “fixed or static” but depends on the circumstances (thus, FISA was constitutional even if/when you apply 4th A requirements)

Profiling or non-particularized suspicion

- Test is probative value - confidence interval for particular use
- Drug courier profiles - upheld
 - Six Sup. Ct. cases upholding - assessed whether specific facts amounted to reasonable suspicion of drug trafficking
 - Requires “explaining the algorithm” (independent v. dependent variables) (ensemble classifiers) (Bayesian) Etc.
 - statistical expert witness to explain model? (~ police hunch)
- Behavioral profiles (hijacker profile - US v. Lopez) - upheld
 - “in effect ... system itself ... acts as informer ...”
 - 6% weapon discovery in targets upheld based on attempt to single out hijackers (94% false positive OK)
 - But cf. Edmond v Indianapolis (drug sweep traffic stops struck down with 9% arrests) (primary purpose LE) (but cf. drunk driving and other special needs)
 - social science expert witness to explain model?
- BL: Need to explain the model (but cf. *validity* with *accuracy*)

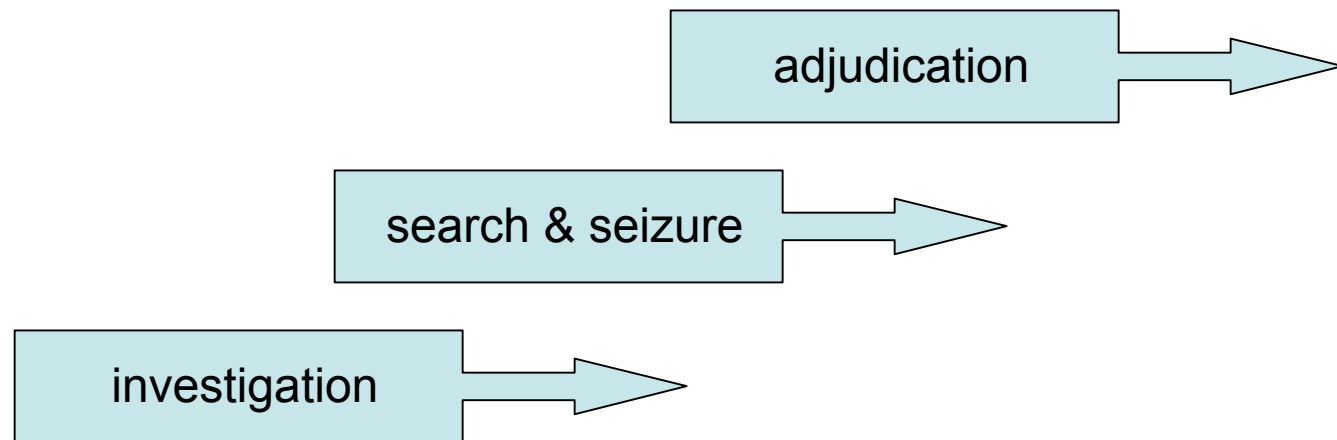
5th Amendment - Due Process

- Deprivation of life or liberty (consequences)
- Mathews v. Eldridge (1976) (“three factor balancing test”)
 - Private interest affected by government action
 - Government interest (“including the function involved” and burdens of additional process)
 - Analysis/affect of greater or lesser process (on accuracy, consequence, or error correction/compensation)
- Notice and fair hearing
- Compensation for error

Additional policy concerns

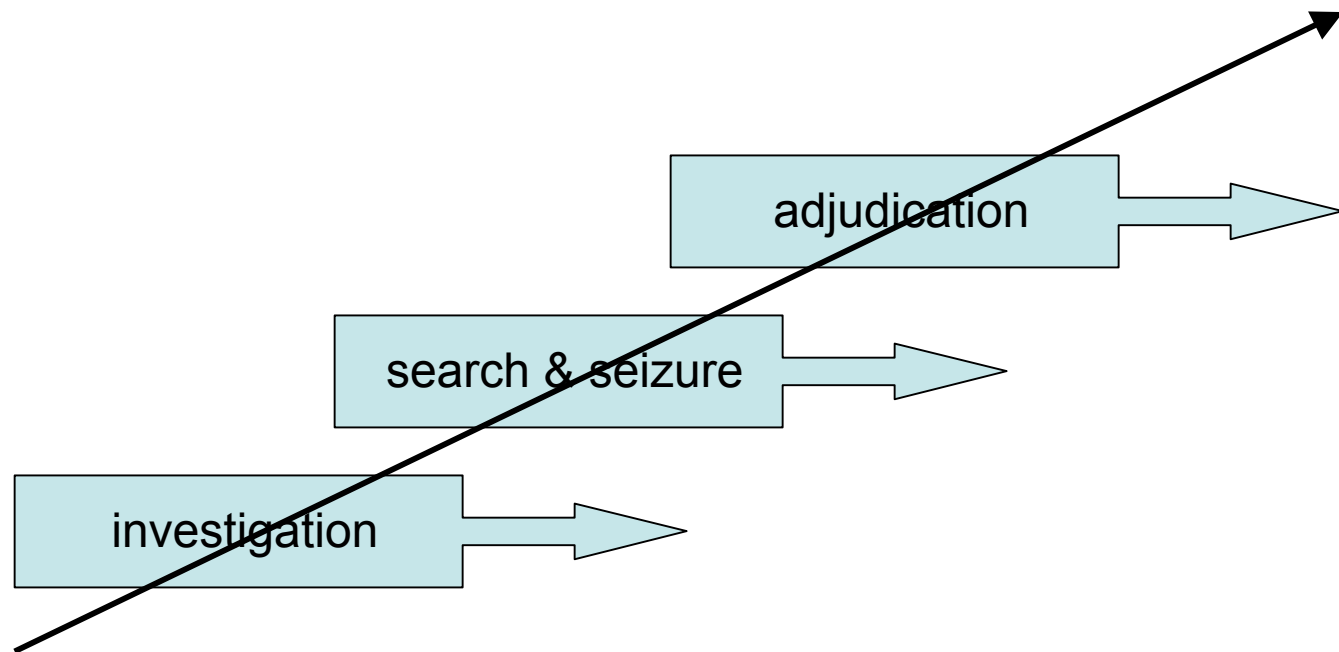
- 1st Amendment “chilling effect” (*but* there is no 1st Amendment right to plot terrorist acts in secret)
 - Material support statutes
 - Need to redefine “clear and present danger” for network effect?
 - See references in “Info War” presentation at <http://seekingsymmetry.info>
- Slippery slope
 - Mission creep
 - Data appetite
 - Bureaucratic expansion
- Selective enforcement (“equal protection” - 14th Amendment)
 - Precursor or low level activities targeted in suspect population
 - Disproportionate impact
- Trusted system problem (see IEEE article in materials)
 - Authorization (totalitarian) (DEFAULT=DENY)
 - Accountability (freedom) (DEFAULT=PERMIT)

Categories vs. rankings/probabilities



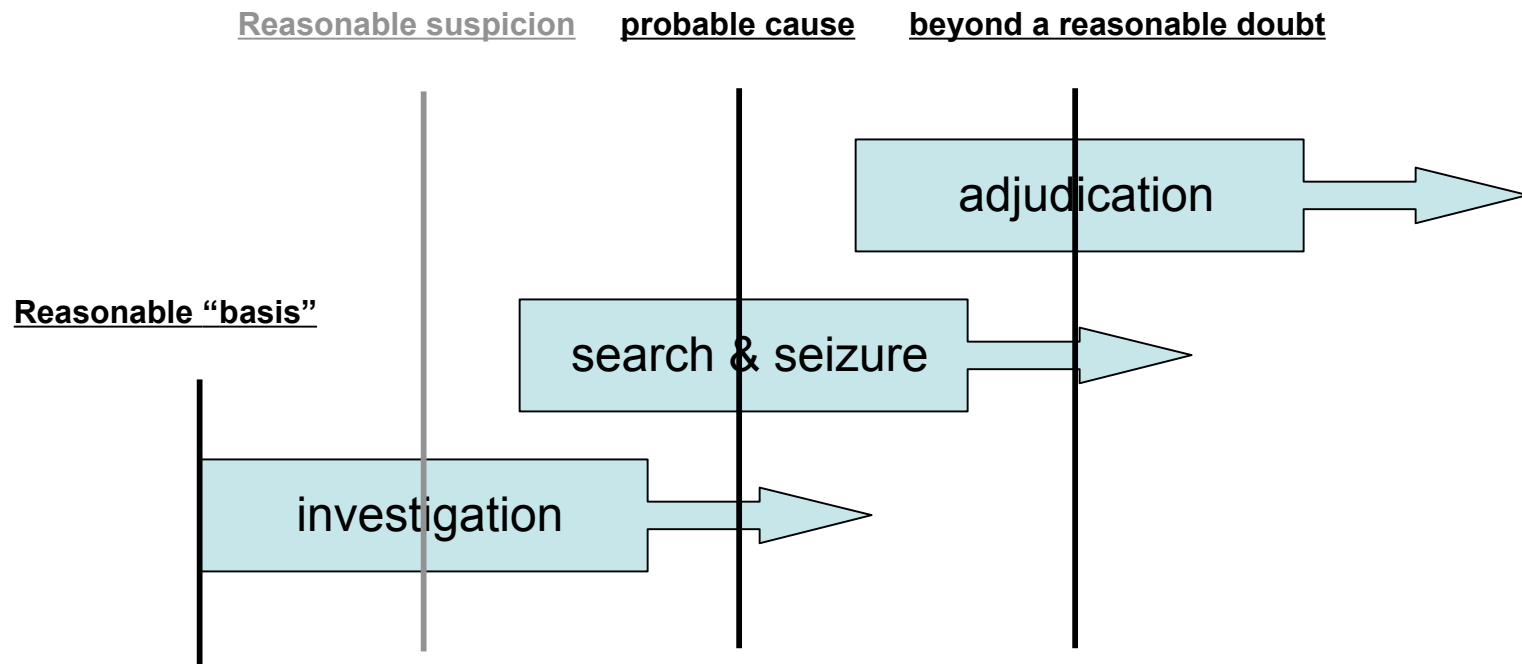
The law (and policy) is categorical (discrete) but reality is continuous ...

“Real-world” suspicion (~ confidence)



The law (and policy) is categorical (discrete) but reality is continuous ...

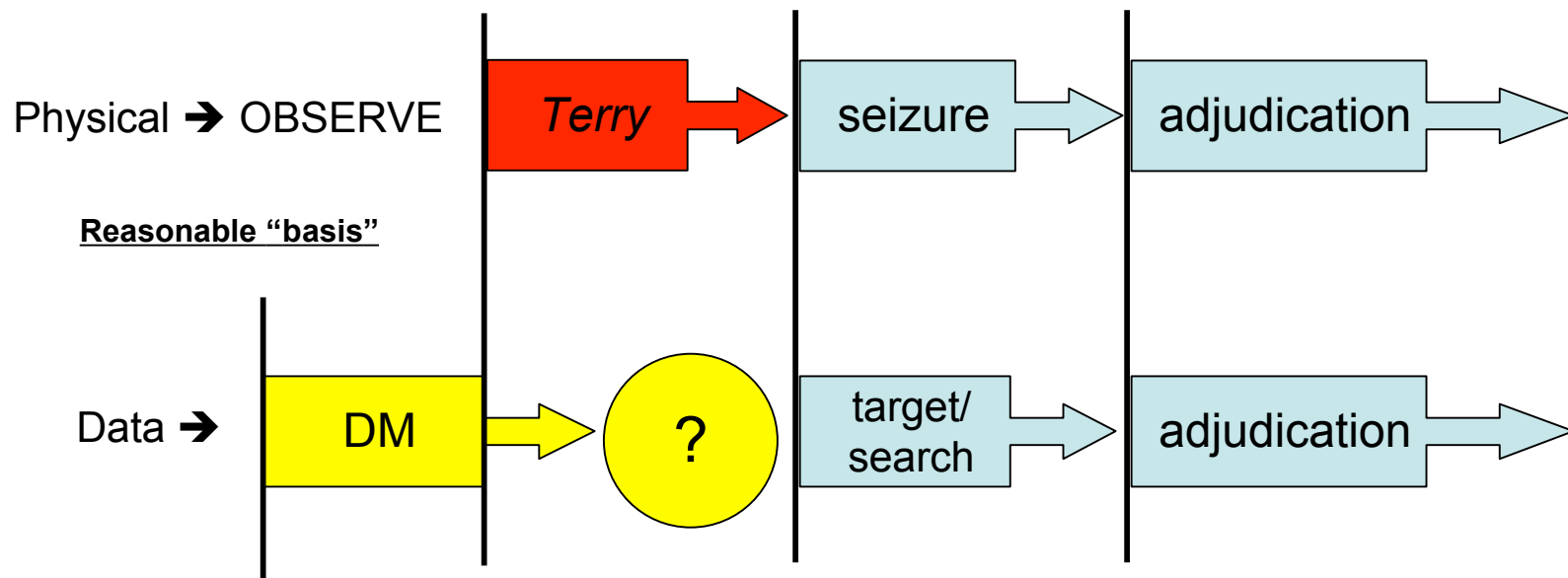
“Legal” suspicion (~ significance)



The law (and policy) is categorical (discrete) but reality is continuous ...

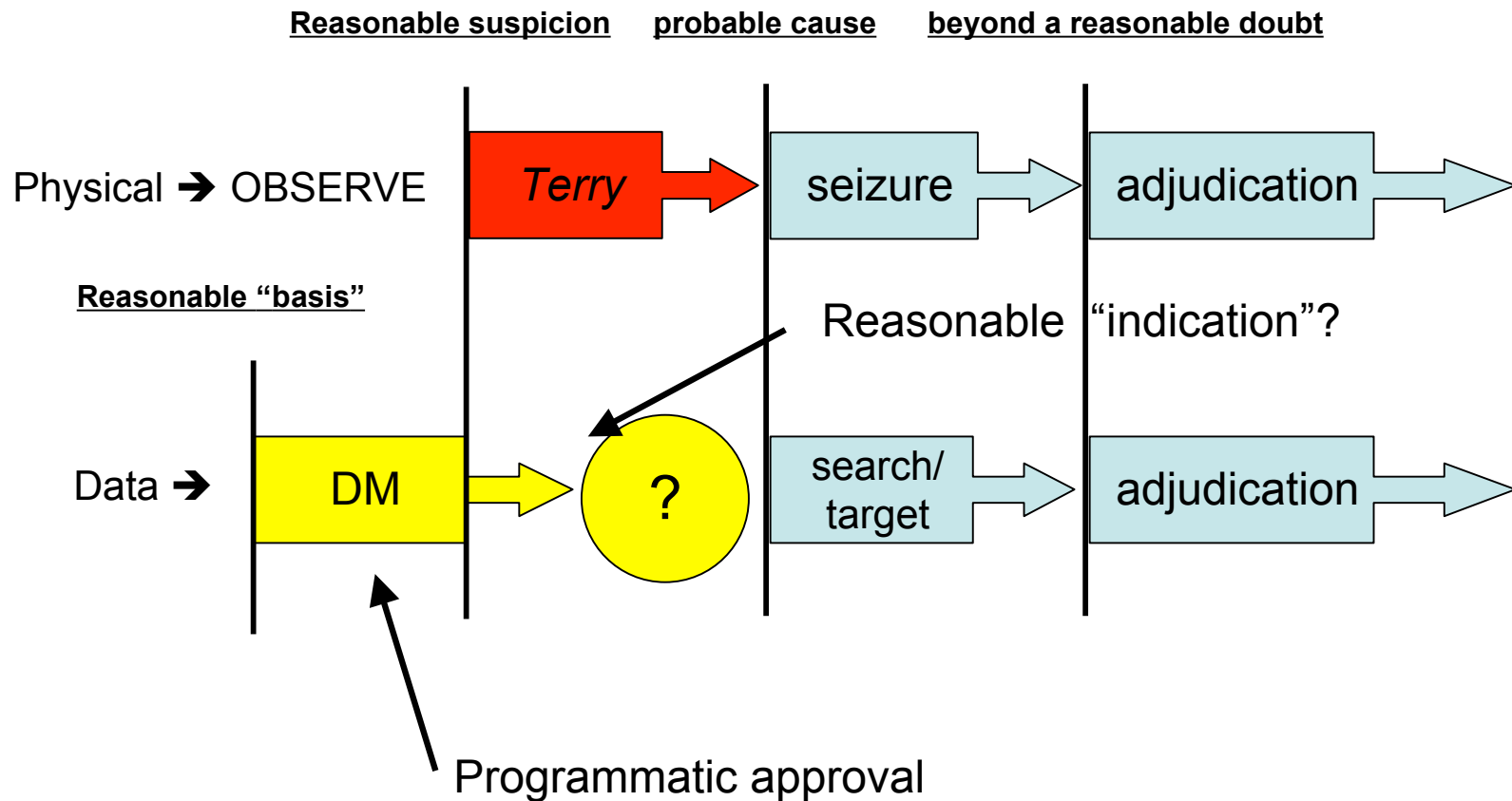
Legal significance testing in the physical world vs. the dataverse

Reasonable suspicion probable cause beyond a reasonable doubt



The law (and policy) is categorical (discrete) but reality is continuous ...

Required: the *e-Terry* stop



The e-*Terry* Stop

- Need the equivalent of a “*Terry* stop” for dataveillance and electronic surveillance (*Terry v. Ohio* 1968)
- Reasonable basis to initiate automated screening (programmatic approval related to threat targeted) (scalarity)
- Reasonable suspicion (i.e., articulable or statistical facts) to permit limited follow up investigation to eliminate or establish probable cause
 - Disambiguate identity (cf. CAPPS II) (not you)
 - Invalidate relationship (you, but not terrorist)
 - Additional independent variables in common
 - Additional independent variables not in common
 - VALIDATE > probable cause > (target you)
- Need for explicit authority and procedures for use of computational social science as predicate for investigation

Calculus of reasonableness

- due process - fairness (Dworkin) (justice as fairness - Rawls)
 - Predicate for action
 - Alternative
 - Consequences (of false negative and false positive)
 - Error correction
- Threat environment (heuristic bias)
 - Need for dynamic assessment
 - Need to dial up (or down) in response to circumstance
 - Authorized purpose driven (demand) not data (supply)
- Dynamic/runtime - reasonableness judged by totality of circumstances at the time of decision-making
- See discussion in materials (“Why Can’t We All Get Along”)

Requirements

- Develop clear standards - legal and administrative for both R&D and implementation - IC community driven (anticipatory & preemptive)
- Technical features to support due process
 - Mechanisms for intervention and oversight
 - Rule-based processing, selective revelation, “circuit breakers” (build in human or policy intervention points), authentication and audit
 - Design for failure (at systems, applications, and data level)
- Transparency of methodology
 - Statistics/CI's
 - Algorithms/mining/KDD
 - Social science modeling
 - Data reliability, etc.
- Research and “prove” the value of a relationship between the social sciences and computational science in spotting (or predicting) threats

*CAVEAT: Can't burden R&D with success
or technology/social science with perfection*

- R&D
 - Unrealistic expectations to prove outcomes prior to R&D
 - Opposition to research on the basis that it "*might not work*" is an example of what has been called the "*zero defect*" culture of punishing failure, a policy that stifles bold and creative ideas - "*downright un-American.*" David Ignatius, ***Back in the Safe Zone***, Wash. Post, Aug. 1, 2003, at A:19 (discussing the knee-jerk opposition to a "terrorist futures market")
- Development/deployment
 - Perfection shouldn't be the enemy of the good (or the better)
 - "Does it work" should be judged against existing and/or alternative methods not against perfection

Conclusion(s)

- Not a balancing act, no fulcrum, need to *maximize both security and liberty* within the constraints imposed by the other
- Technology development is not deterministic, but it is *inevitable*
- *Law alone* offers little security and brittle privacy protection
- Technology *cannot provide either security or privacy*, but:
 - Properly employed - can better allocate security resources
 - Properly designed - enable existing mechanisms (or analogues)
- The use of computational social science for counterterrorism follows the natural historical development of *social immunology*

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