



Police, Crime Analysis, and the Devil's Computer: A Theory of Crime Patterns and the Limits of Police Effectiveness

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This presentation extends a presentation at the
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INTRODUCTION

Puzzle

- Why isn't crime more patterned?
- Legitimate activity is far more patterned than crime.*

* This is, of course a testable proposition. Someone should test this. I am betting that if tested, it the results will be consistent with this statement.

Answer—Adaptation

- Actions alter opportunity structures
- Positive actions reinforce opportunity structures -- making these actions increasingly regular
- Negative actions provoke revisions to opportunity structures -- undercutting regularities in actions

Foundations

- Environmental Criminology & Crime Science
 - Rational Choice Perspective
 - Routine Activity Theory (expanded)
 - Crime Pattern Theory
 - Situational Crime Prevention
 - Problem-oriented Policing
- With ideas from...
 - Information Theory
 - Computer Science
 - Dynamical Systems
 - Evolutionary Theory

Overview of Theory

- **Layer I – Differential Adaptive Response Conjecture (DARC)** describes how Everyday Crime Prevention (ECP) and offending create crime patterns. This is the Devil's Computer.
- **Layer II – Pattern Analysis Response Conjecture (PARC)** describes how Formal Crime Prevention (FCP) tries to crash the Devil's Computer.
- **Conflicts between and within layers produce *all* observed crime patterns.**

An aside

Computation, Computing & Computers are not just about machines

Any operation, not necessarily numerical, that transforms, modifies, re-arranges or orders physical markers in a medium. The physical markers maybe objects or events in their own right as in the computations carried out by the human cell or they may be symbols and descriptions of events as in data processing by a man-made computer. Principia Cybernetica Web
<http://pespmc1.vub.ac.be/ASC/COMPUTING.html>

... (A)ll processes, whether they are produced by human effort or occur spontaneously in nature, can be viewed as computations. Stephen Wolfram (2002) *A New Kind of Science* Champaign, IL Wolfram Media. Page 715

The actual process of computing can be defined in terms of a very small number of primitive operations, with recursion and/or iteration comprising the most fundamental pieces of a computing device. Gary William Flake (1998) *The Computational Beauty of Nature* Cambridge, MA: MIT Press. Page 9

SCOPE

Patterns to Explain

PATTERNS EXPLAINED

- Repeat places
- Risky facilities
- Repeat offenders
- Repeat victims
- Virtual & Near repeats
- Hot products
- Durable hotspots
- High crime neighborhoods
- Absence of patterns
- Others – e.g. hot network nodes

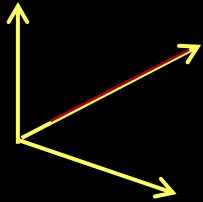
PROCESSES USED

- Desistance
- Deterrence
- Persistence
- Displacement (all types)
- Diffusion of Benefits
- Retaliation & Threats
- Anticipatory Benefits
- Others

The Theory Applies to Patterns in all...

Dimensions

- 1 temporal
- 3 spatial
- N victims
- M offenders
- O others



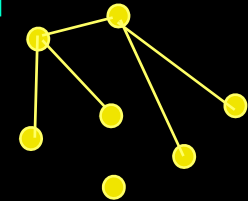
Scales

- Tiny – Large
- Individual
- Small group
- Large group



Substrates*

- Streets
- Transport systems
- Computer nets
- Friendship nets
- Franchise systems
- Other



* A common substrate for all agents may be a necessary condition for this theory.

Consider the Extremes

- **Crime is perfectly predictable** – all crimes are exact duplicates of previous crimes, everything repeats.
 - If you know about one crime you know about them all.
 - Each crime contains 0 information.
- **Crime is perfectly random** – there are no repeats of anything (offenders, places, products, victims).
 - Regardless of what you know about any number of crimes, you cannot say anything about other crimes.
 - Each crime contains maximum information
- **Real crime patterns fall between these extremes.**
 - Knowledge about some crimes helps understand others, but imperfectly.
 - Each crime contains some information



THE DEVIL'S COMPUTER

Current Explanations for Crime Patterns*

- **Many Offenders** (crime attractors) – but some patterns require only a few offenders
- **Many Targets** (crime generators) – even when targets controlled for concentrations often are found
- **Big Streets** (pattern theory) – concentrations vary along arterials
- **Few Controls** (crime enablers) – numerous places have few controls, but have few crimes

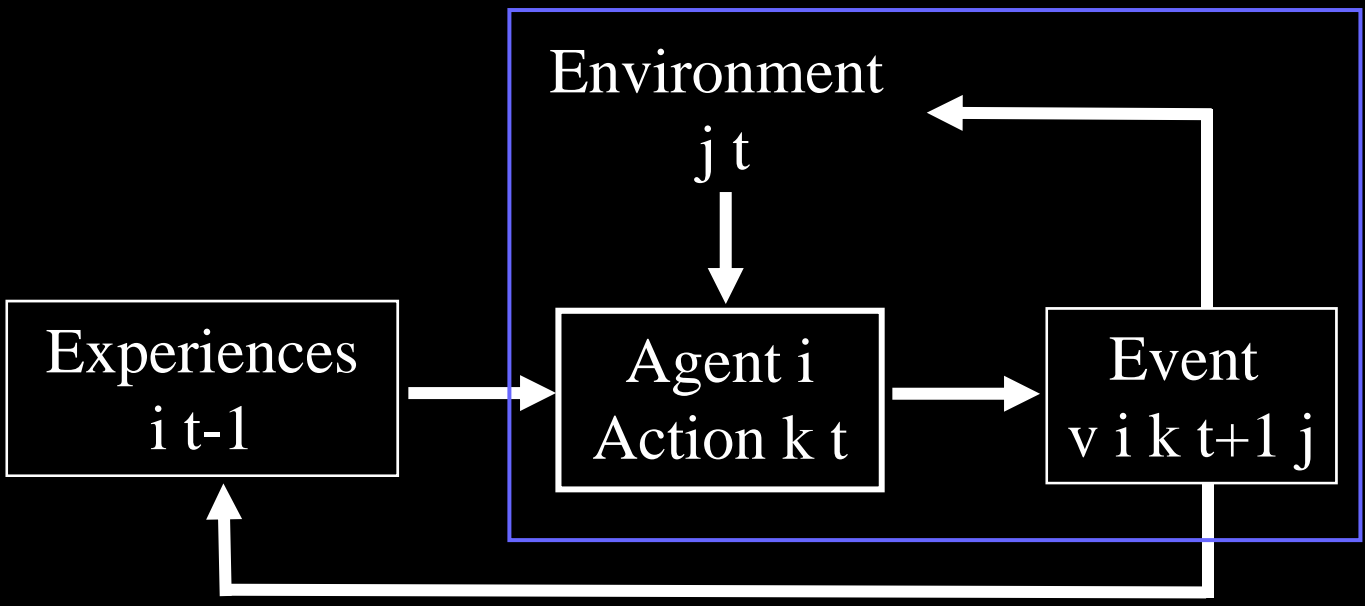
*Derived from Routine Activity Theory, Crime Pattern Theory, and allied perspectives.

DARC – The Differential Adaptive Response Conjecture

- A theory of how agents* change behaviors
- Agents choose actions based on environments and past experiences
- Consequences of actions update experience
- This feedback results in adaptation
- Adaptations vary across agents
- The combination of feedback and differences give rise to crime patterns

* Offenders, targets, guardians, handlers, managers, but not police etc.

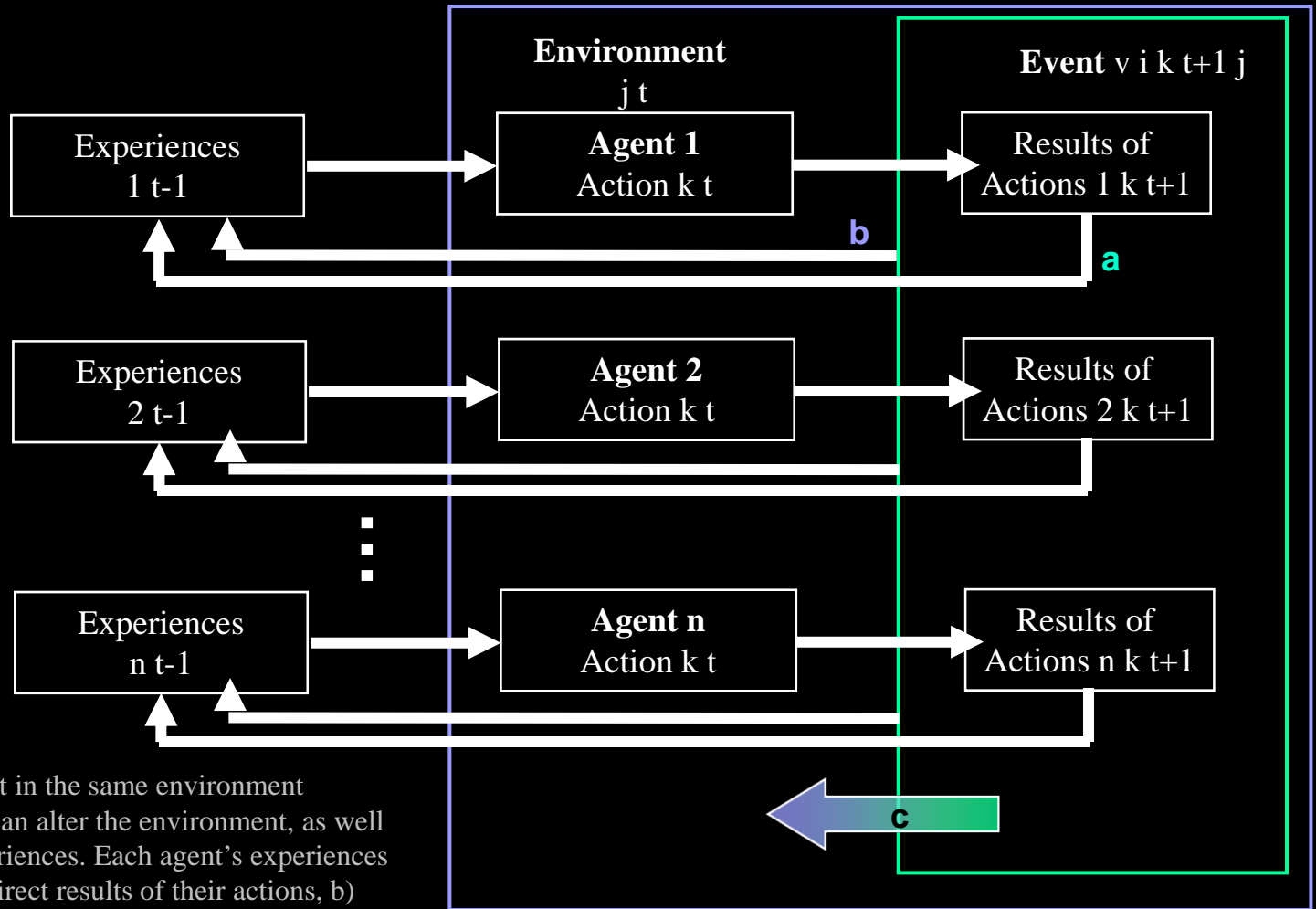
Basic Single Agent Behavior



Agent i in a specific environment, j , brings with him his experiences with other similar environments from previous periods. The agent chooses a set of actions, k , based on the environment and experiences. These action produce events, v , which alter the environment and update the agent's experiences. Time is relative to agent: t is the present, $t+1$ is the future, and $t-1$ is the past.

Agent – i
 Action set – k
 Time – t
 Environment – j
 Event type – v

Multiple Agents Interacting



Multiple agents interact in the same environment creating an event that can alter the environment, as well as change agents' experiences. Each agent's experiences are updated by a) the direct results of their actions, b) the joint consequences of their results, the event, and c) the indirect joint consequences of environmental changes. In this way, the behavior of each agent influences the behaviors of other agents in her environment. There is no assumption of cooperation or coordination. (Results are private and Events are public.)

How Agent Differences Matter

Agents Differ in

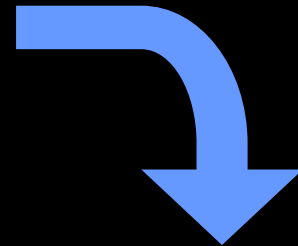
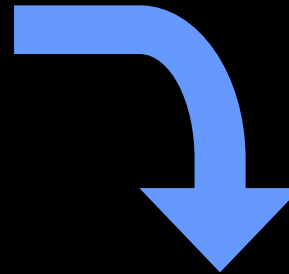
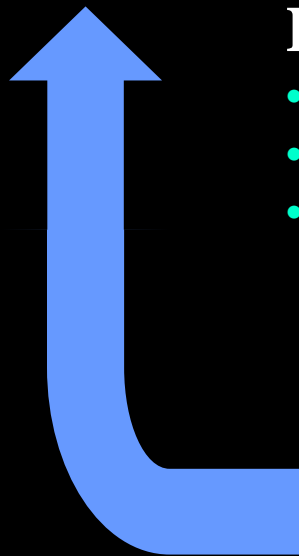
- Capability – skill and power
- Resources – ability to incur costs of changes
- Perceptions – understanding of situations
- Interests – objectives, desires and motivation
- Routines – spatial and temporal

Leading to Adaptation Differences

- Form – type of change implemented
- Speed – how rapidly change implemented
- Magnitude – scale of change

Resulting in Differences in Effectiveness

- Protection against crime
- Success at committing crime
- Success at other goals (unrelated to crime or prevention)



Patterns Emerge When

- Opposing adaptations are *asymmetric*
- Offenders' changes result in
 - Adaptation to opportunity structure or
 - Create new opportunity structures
- Controllers either
 - Fail to adapt
 - Or adaptations are slow, misdirected, or inadequate relative to offenders' adaptations
- *And vice versa*
 - Controllers adapt quickly and appropriately
 - While offenders fail to adapt or are slow, misdirected or inadequate
- Asymmetry varies over substrate

Layer I – DARC and the Devil's Computer

- DARC describes the how ECP and offenders coproduce the Devil's Computer.
- The computation of patterns results from interactions of agents.
- Agents are offenders, potential victims, place manager, guardians, and other.
- Non-offender agents engage in Everyday Crime Prevention (ECP).
- ECP include actions agents take to protect themselves or others against offenders.
- ECP includes actions whose primary function may not be crime prevention.
- ECP does not include Formal Crime Prevention.

CRASHING THE DEVIL'S COMPUTER

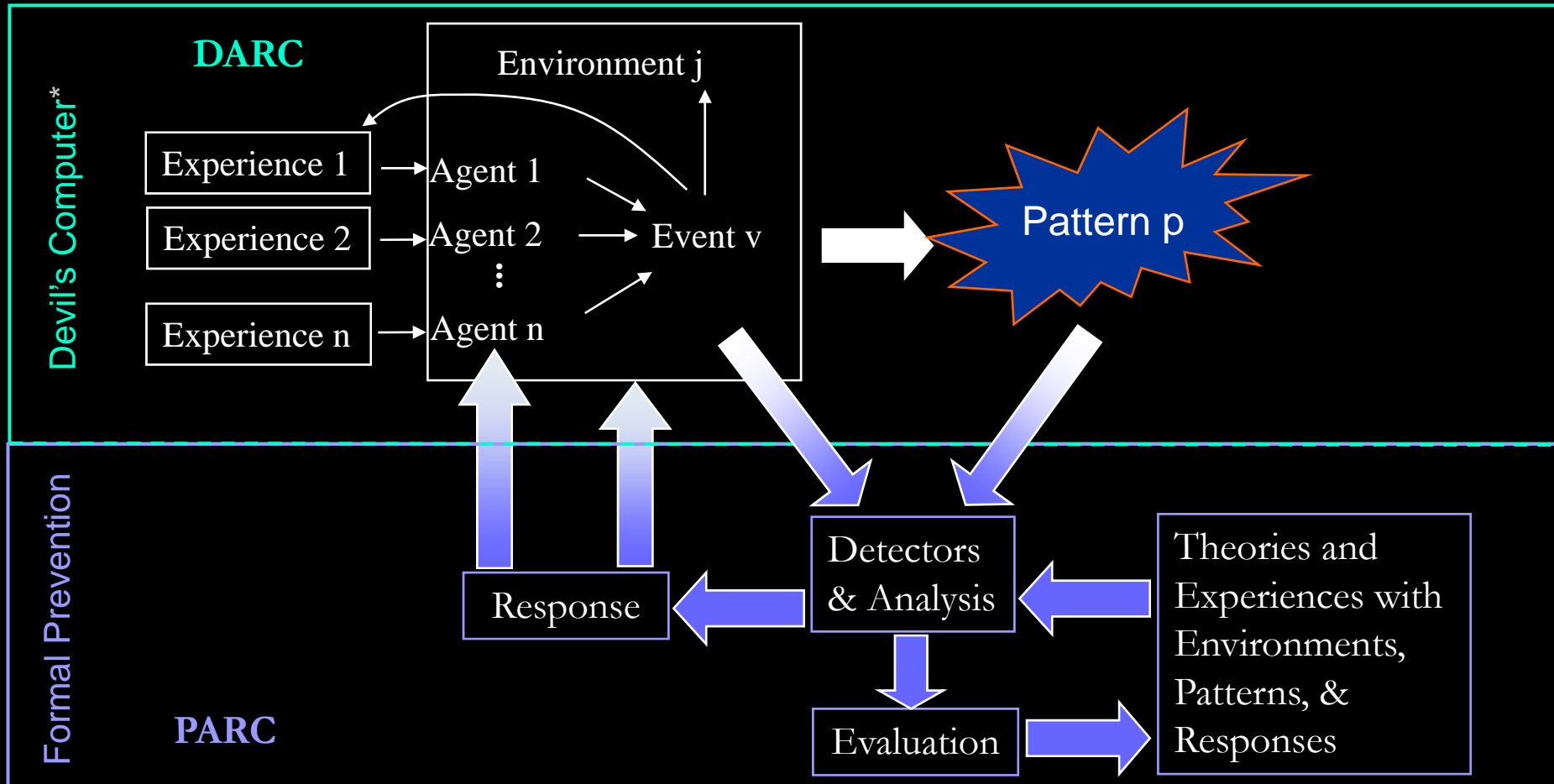
Layer II – PARC Crashes the Devil's Computer

- Formal Crime Prevention (FCP) involves police and other organized attempts to reduce the number of crime events.
- Examples -- police crackdowns, property marking campaigns, street redesign, produce modification, legal changes, publicity campaigns, regulation of property owners, etc.
- The Pattern Analysis Response Conjecture (PARC) describes how FCP attacks the Devil's Computer by using its output as information.
- PARC operates above the macro-level.
- All crime prevention theory and research is within PARC.

PARC – The Pattern Analysis Response Conjecture

- Patterns are detected and subjected to a degree of analysis--from none to just short of complete.
- Responses to pattern are based on analysis filtered through experiences.
- Responses can change environment or influence sets of agents.
- FCP is optional and parasitical on the Devil's Computer.

PARC v DARC: The Full Theory

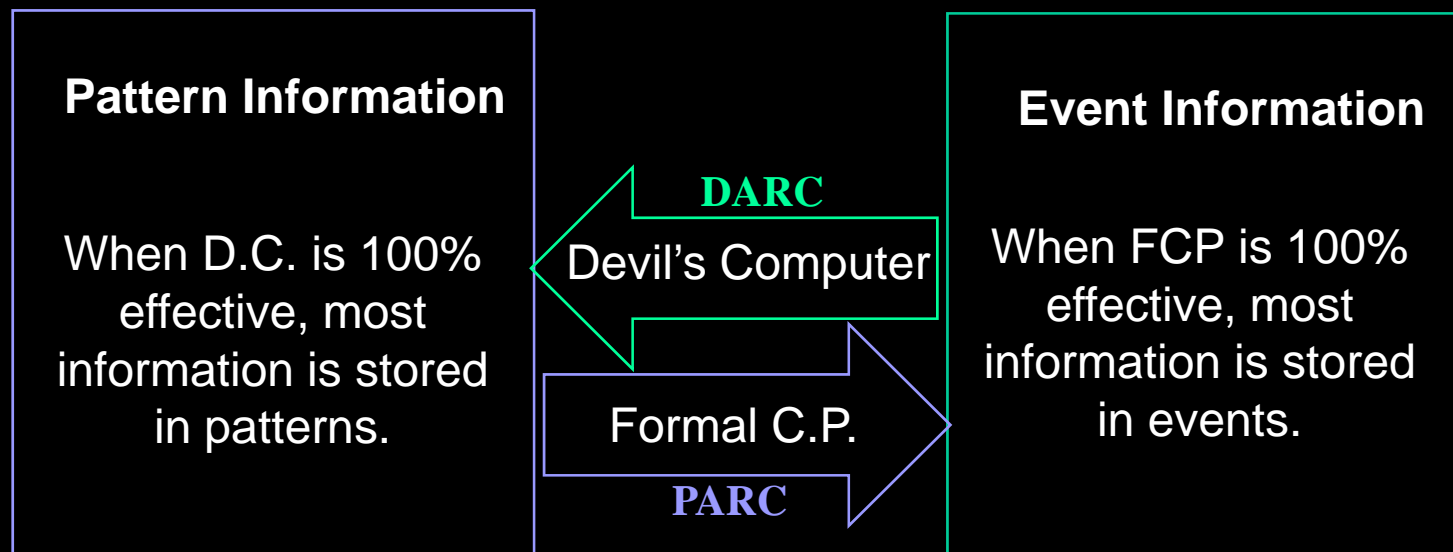


→ Micro process → Macro process

* Devil's Computer simplified for presentation clarity.

INFORMATION & LIMITS TO PREVENTION

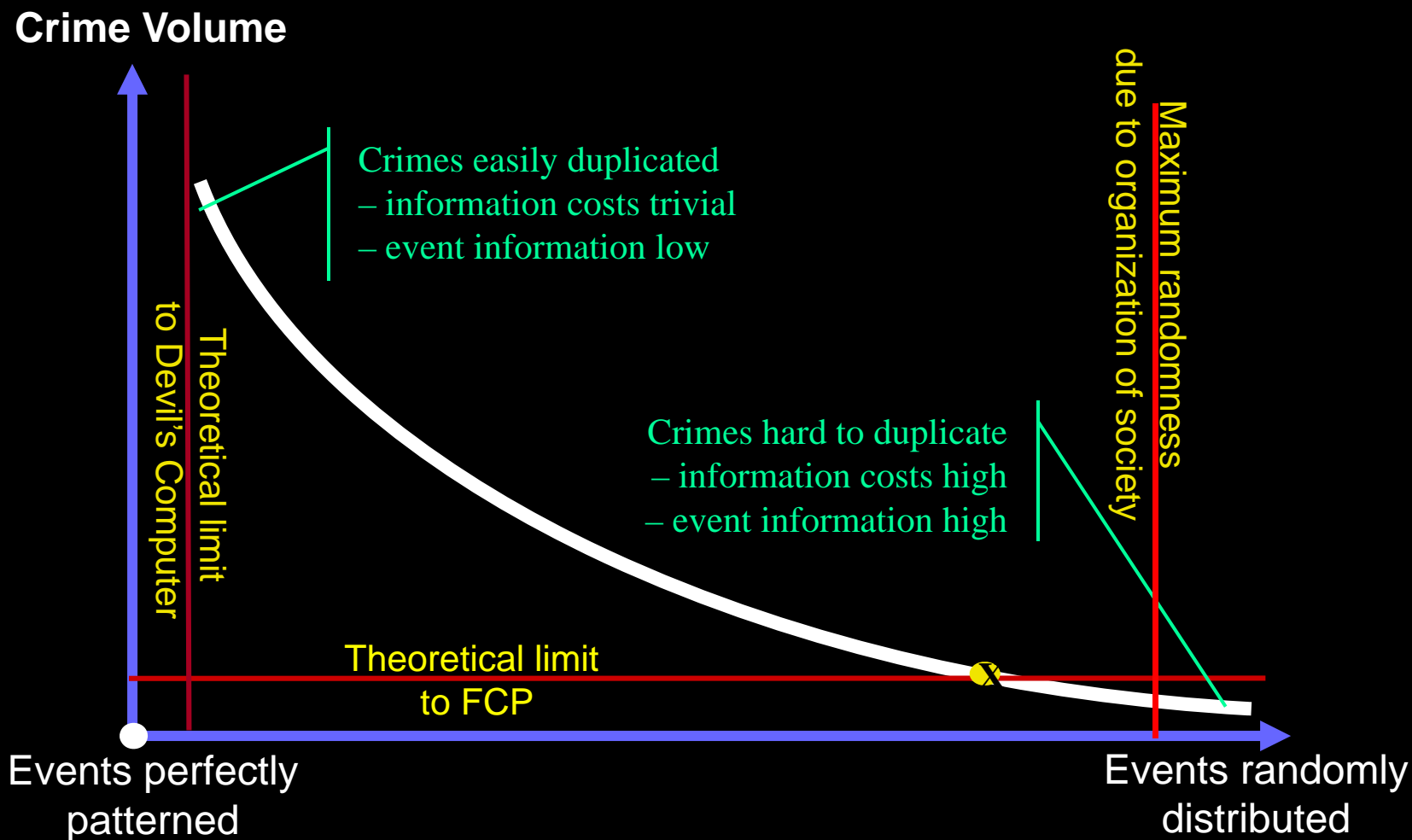
Devil's Computer v Formal Crime Prevention



The Devil's Computer inputs information from events and outputs patterns.

Crime Prevention inputs information from patterns and outputs random events.

Crime Patterns and Crime Volume



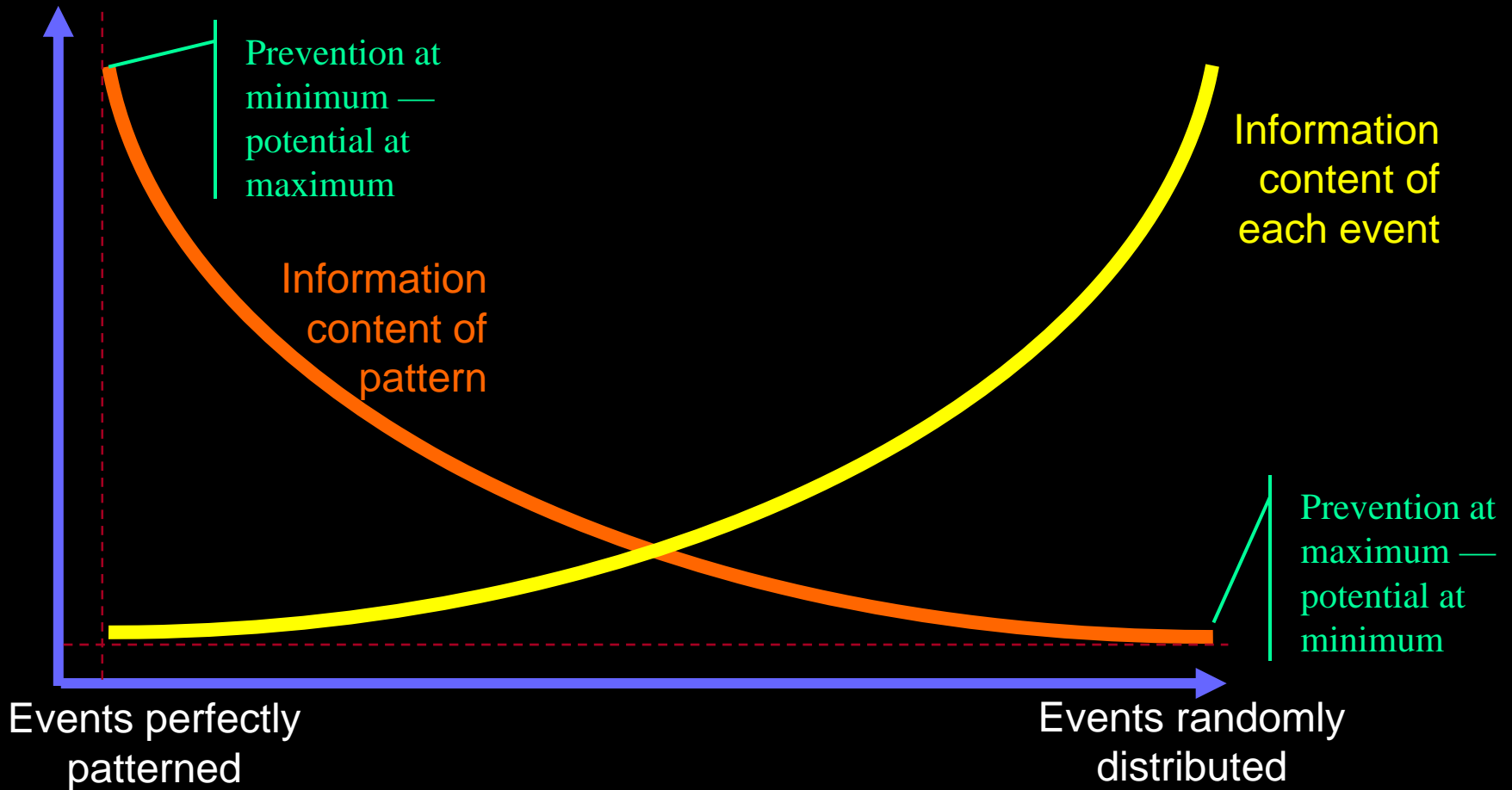
An aside on

Information & Prevention Potential

- Information Theory – information is equivalent to degree of surprise from a message.
- *Event information* is equivalent to surprise from next event
 - highly predictable events have no information
 - unpredictable events have high information
- *Prevention potential is the inverse of event information*

Consequences of Computation

Information



Temporal Fluctuations

1. First reason crime will oscillate
 - a) When patterns are obvious, information will be converted to prevention
 - b) Thus destroying patterns
 - c) Value of analysis & prevention will decline allowing new patterns to grow
 - d) Until they are obvious... → back to step a)

Temporal Fluctuations, continued

2. Second reason crime will oscillate*
 - a) When patterns are obvious, offenders are vulnerable to prevention and arrest
 - b) This destroys patterns
 - c) Absence of patterns makes offending harder to prevent
 - d) So offenders find it easier
 - e) Thus creating new patterns
 - f) Patterns become obvious... → back to step a)

* Emily's conjecture

Crime Time Series Analysis

- All temporal patterns are possible
- They can operate at any time scale
- Multiple temporal patterns can occur simultaneously
- Patterns will depend on parameter settings of dynamic processes (unknown)

CONCLUSIONS

Summary

- Two linked conjectures
 - DARC describes ECP & offending -- the Devil's Computer
 - PARC describes the fight against the Devil's Computer
- Together they explain
 - All crime patterns,
 - In all dimensions, scales, and substrates
 - The limits of prevention

Big Lessons

- The Devil's Computer can be destroyed, in theory
 - “In theory, there is no difference between theory and practice. In practice, there is.”
Chuck Reid
- When destroyed, the Devil's Computer will reconstruct itself
 - Think “horror movie plot”



