Argumentation Schemes for Reasoning about Factors with Dimensions

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Reasoning with Cases

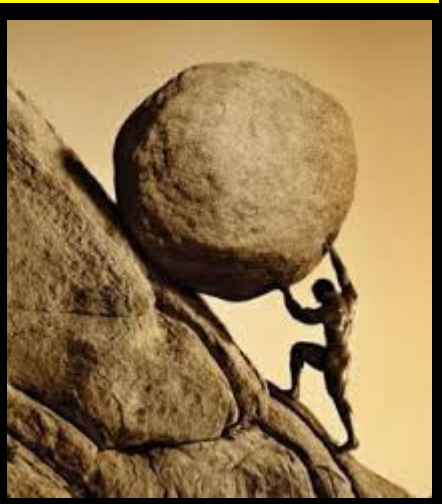
- Reasoning with cases has been central to AI and Law from the very beginning
  - Thorne McCarty, *Eisner v Macomber*
- Important Systems include
  - HYPO: Rissland and Ashley
    - Dimensions
  - CATO: Ashley and Aleven
    - Factors

- But how best to understand the reasoning involved?

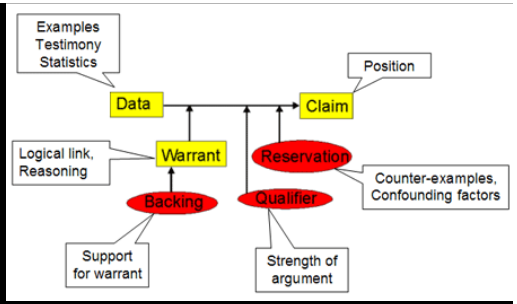
Some of My Various Attempts

Prakken and Sartor AI and Law 1998
Expresses precedents as rules

- Algorithmic
  - Jurix 1997
- Comparison of Partial Orders
  - ICAIL 1999
- Agent Based
  - Mark Allen and Geof Staniford, Dexa 2000
- Theory Construction
  - Giovanni Sartor Artificial Intelliegence 2003
  - Alison Chorley, AI and Law 2005
- Practical Reasoning
  - Katie Atkinson and Peter McBurney, AI and Law 2005
- Logic of Precedent
  - John Horty, AI and Law 2012



Using Argumentation Schemes

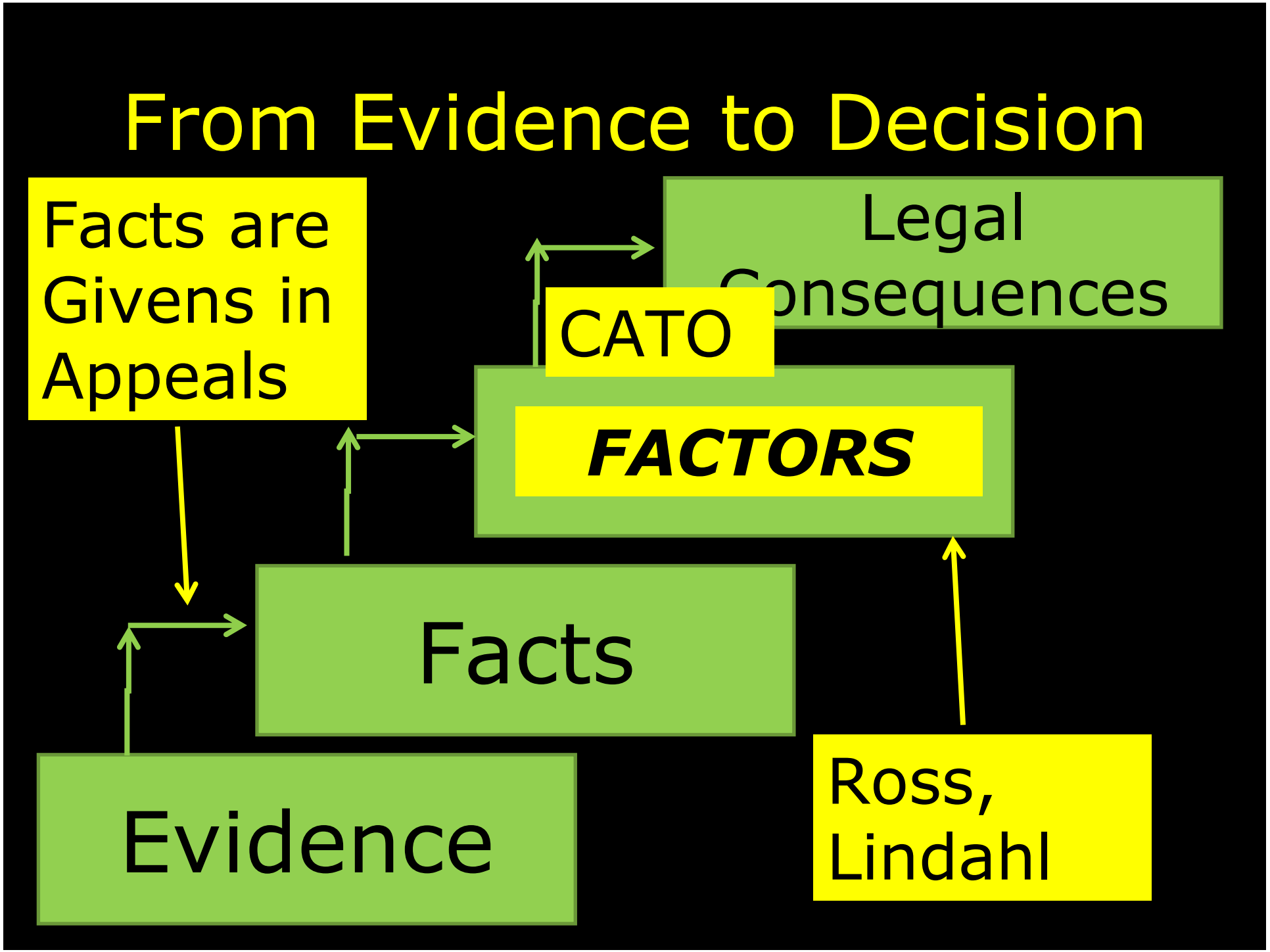


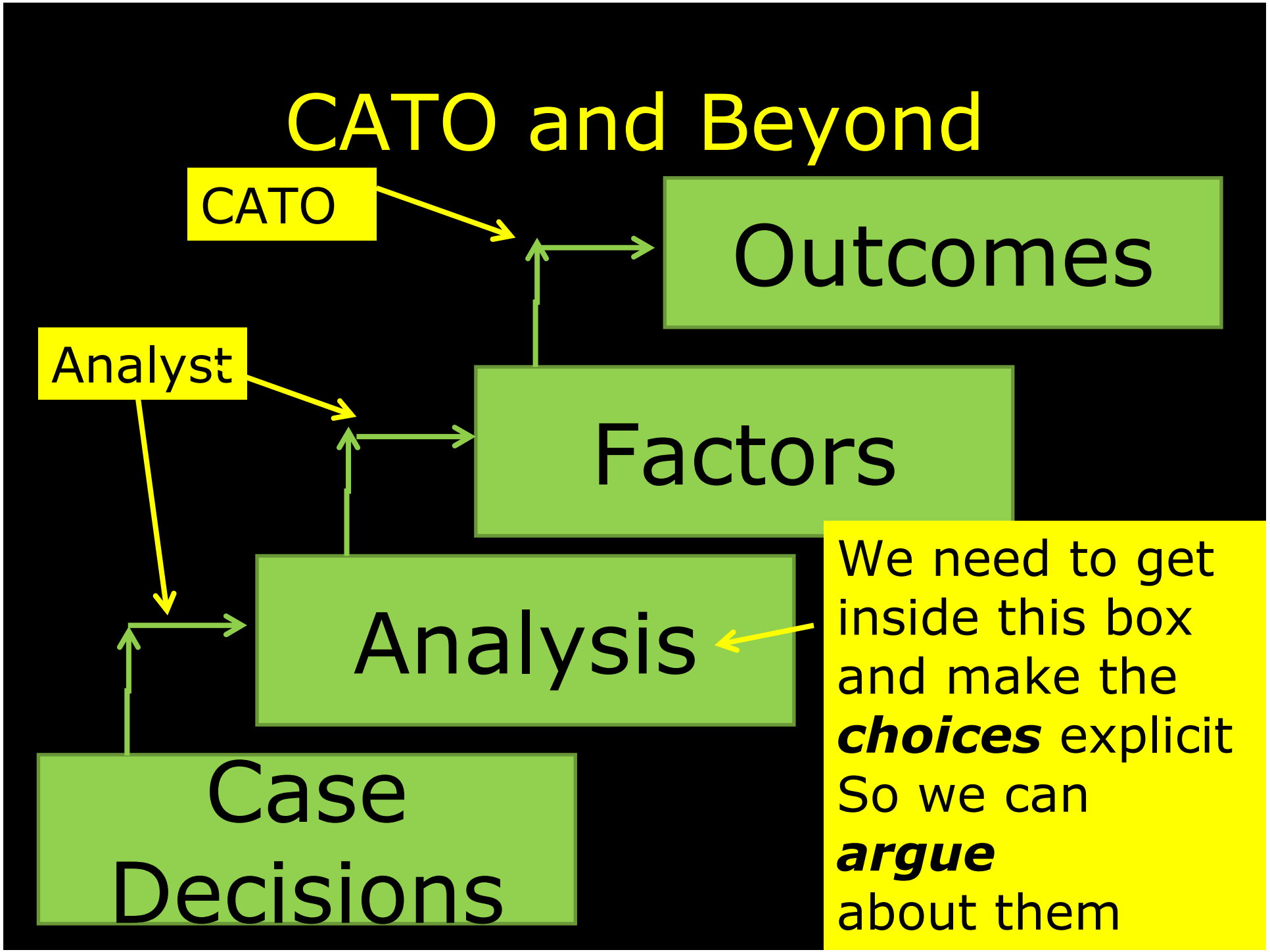
- ***Idea: Express the reasoning as a set of specific argumentation schemes***
  - to provide a precise and transparent account of what is involved in the reasoning, in particular to articulate the argumentation involved;
  - to specify the knowledge that must be supplied to the system by the analyst;
  - to use a formalism which will enable logical properties such as consistency and closure to be proven of the formalised knowledge;
  - to provide precise specifications which can readily be implemented using standard techniques.

Argumentation schemes as domain heuristics

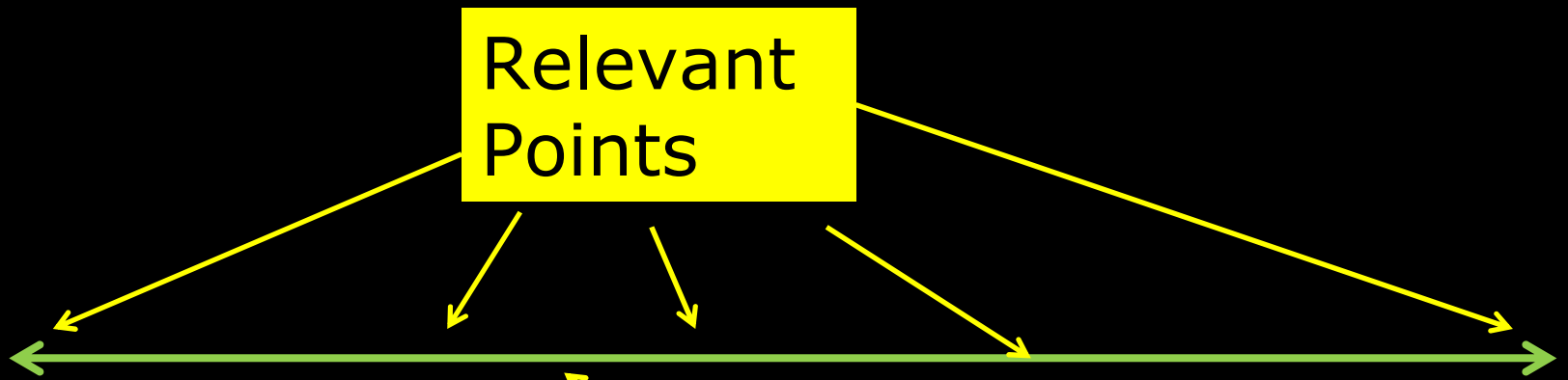
Stages in the "Project"

- Wyner and Bench-Capon
  - *Jurix 2007*
    - CATO as set of Argumentation Schemes
- Wyner, Bench-Capon and Atkinson
  - *ICAIL 2011*
    - Formalisation (factors)
- Wyner, Prakken, Bench-Capon and Atkinson
  - *Journal of Logic and Computation*
    - Better formalisation – ASPIC+ (factors)
- Wyner, Prakken, Bench-Capon and Atkinson
  - ICAIL 2013
    - Schemes for values
- ***This paper:***
  - ***schemes for dimensions*** ***From CATO to HYPO***


From Evidence to Decision
Facts are Givens in Appeals
Legal Consequences
CATO
FACTORS
Facts
Evidence
Ross, Lindahl


CATO and Beyond
CATO
Outcomes
Analyst
Factors
Analysis
Case Decisions
We need to get inside this box and make the *choices* explicit
So we can *argue* about them

From Dimensions to Factors



Extreme Pro P'tiff

Extreme Pro D'ant

Where is the ***cross over***?

Several Mappings To Factors

Mapping to Factors

- ***One*** Factor: only the extreme pro-plaintiff (defendant) point matters
  - E.g. *Bribed Employee* – no credit for not bribing the employee
- ***Two*** Factors: both extreme points are relevant
  - E.g Product was *Reverse Engineered*
- ***Several*** Factors: need to distinguish intermediate points
  - E.g. *Security Measures* vary from none to extensive, with a range of values in between

We May Need to Argue About

- How many factors correspond to a dimension
  - Are both ends needed?
- Whether two points on a dimension relate to the same factor
  - How does the dimension divide into factors?
- Which party is favoured by a factor
  - Where is the cross over point?

These Things are Important

- Sometimes the whole case is about *what counts as a factor*, *how dimensions map to factors*, or *which side a factor favours*.
- *Pierson v Post*
  - Dimension is *Degree of Pursuit*
  - Two factors – *caught* and *not caught* (e.g Berman and Hafner 1993) leaves Post with no case at all
  - *Hot pursuit* is a point on the dimension: is it a separate factor? Does it favour the plaintiff? Or does it counts as caught? Or not caught?

Running Example

- *Pierson v Post*
  - Post was hunting a fox with horse and hounds in open country
  - The fox went to earth
  - Pierson killed the fox with a fence pole and carried it off
  - Post sued Pierson and won at first instance
  - Pierson appealed and won the appeal

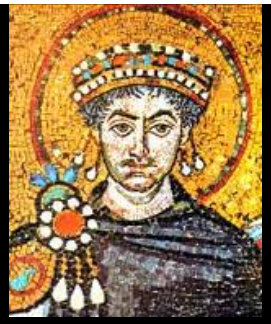
Facts

- We represent our facts as ***points*** on a ***dimension***.
  - *dimension(Pursuit, {Possessed; CaptureInevitable; Wounded; HotPursuit, ChaseStarted; Seen; None}*
  - these are ordered with respect a particular party: here P to D
  - We could have less abstract facts and rules to map them to these points
    - E.g. how close is hot pursuit? What are sufficient conditions for inevitable capture?

From Facts to Factors

- We assume that the background contains a set of factors, and which side they favour.
  - *factor(caught,platiff), factor(notCaught,defendant)*
- Cases are now described as bundles of ***dimension-points***, not bundles of ***factors***.
- We generate arguments from rules of the form
  - *rule(rulename; fact; factor ; justication;Type*)
- ***Type*** may be a *commentary* (authority), a *precedent*, a *definition* (ordinary use), or a *contention* (unsupported claim)

Example Rules



- rule(Rule1 ; Pursuit:CaptureInevitable; NotCaught; Justinian; Commentary)
- rule(Rule2 ; Pursuit:Wounded; Caught; Pufendorf ; Commentary)
- rule(Rule3 ; Pursuit:None; NotCaught; None; Definition)
- rule(Rule4 ; Pursuit:HotPursuit; NotCaught;Tomkins; Contention)
- rule(Rule5 ; Pursuit:HotPursuit; Caught; Livingston; Contention)

Rules 1 and 2 Conflict

Rules 4 and 5 Conflict

Rule 4 will become a precedent

Argumentation Scheme

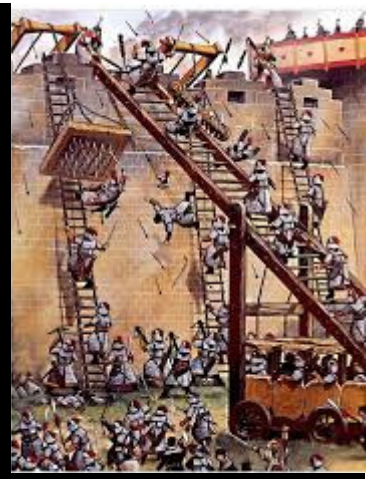
- ***CS1***: From facts to factors
- ***Premise 1***: The Current case has Fact1
- ***Premise 2***: There is a Justification of a certain Type to regard Fact2 as an instance of Factor
- ***Premise 3***: Fact1 points at least as strongly to Factor as Fact2
- ***Conclusion***: The Current case has Factor

Formalisation gives precision, enables properties to be proved, facilitates implementation

One Scheme or Four?

- We have presented a single scheme, which can be instantiated by any type.
- We could have presented four different schemes, one for each type
- The different types can be attacked differently:
  - Commentaries may be too old
  - Precedents may be wrong jurisdiction
  - Definitions may be archaic (or introduced ***after*** the statute)

Attacks



- The attacks that we want to use will need additional knowledge
  - E.g. date and topic of commentary, date and jurisdiction of precedent, etc.
- Livingston attacked Justinian as too old, so we have this example undercutter:
  - ***If*** *commentary(justification; date; code) and (date < 1400)* ***then cannot use*** *CS1(ruleName; fact; factor ; justication; Commentary; curr)*

Supporting Arguments

- Can use some general principles
  - e,.g. *lex superior*, *lex posteri*or
- Can have priorities
  - E.g. rank the commentaries in order of their authority
  - The example is a two-factor dimension: we can use similar rules to split a dimension into several intervals
  - Note that factors may also ***subsume*** or ***exclude*** one another, giving rise to further arguments

***What does this Achieve*?**

- We have now made the rationale of the analyst transparent and disputable.
- What was a given is now part of the system
- What was a black box is now exposed to view

Summary

- We have identified reasoning about which factors apply to a case as sometimes being crucially important
- We have provided a means to argue about which factors should be ascribed to a case
  - An argumentation scheme
  - Example attacking scheme
- We have identified the supporting information needed to launch and resolve attacks

Conclusion: A Small Step on a Long Road

- Previously we have worked on the move from factors to conclusion, taking the factors present in a case as given
- Here we extend the reasoning back to enable argument about which factors are present in cases represented as dimensions-points.
- We have already identified schemes to use values to go beyond *a fortiori* factor based reasoning, but more work remains:
  - argumentation about differing strengths of factors;
  - arguments about how observable facts relate to the points on a dimension used here; and
  - arguments about how facts are assigned on the basis of, perhaps conflicting, evidence.