

## Argumentation in Artificial Intelligence, With Applications in the Law

Course at the Institute of Logic and Cognition,  
Sun Yat-Sen University

### IIIa: Reasoning with Evidence

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## Ia Introduction Ib Abstract Argumentation, Argument Structure IIa Argument Schemes and Argumentation Dialogues IIb Argumentation with Rules and with Cases

### IIIa: Reasoning with Evidence

#### Topics:

Reasoning with Evidence

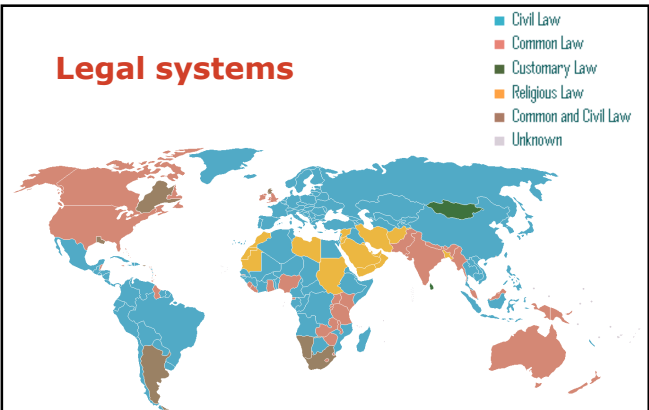
#### Goals:

- Acquire knowledge about three styles of reasoning with evidence: argumentative, narrative and probabilistic

#### Literature:

Van Eemeren et al. (in preparation). Sections 11.12

## Legal systems



## Legal systems

#### Adversarial

Parties collect and present evidence  
Judges chair the hearing and ensure that the rules of evidence and procedure are adhered to

#### Inquisitorial

Judges review evidence and interrogate defendants, witnesses and experts  
Law enforcement officials are expected to adduce evidence both favourable to and against the defendant  
Witnesses and experts are generally called to the stand by law enforcement officials and not primarily by the defence

(Source: Malsch & Freckelton 2009)

## Approaches to evidential reasoning in the law

#### Argument-based, atomistic

Focus on elements of evidence, on contradictions, individual events

#### Story-based, holistic

Focus on scenarios as a coherent whole, comparing stories

(Malsch & Freckelton hypothesize that adversarial legal systems tend to use an atomistic approach, while inquisitorial systems more easily have a holistic approach)

## Reasoning with evidence

### Arguments

Wigmore (1913), New Evidence Theorists (1985 >)

### (Explanatory) Stories

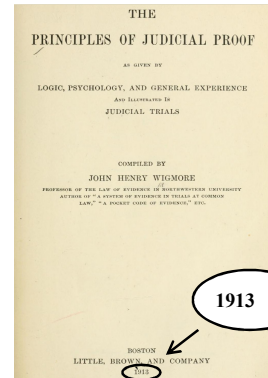
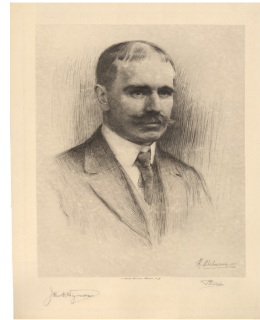
Psychological studies: Bennet & Feldman, Pennington & Hastie (1985 - 1995)

Anchored Narratives Theory: Crombag, van Koppen & Wagenaar (1993)

Explanationism (Allen, Thagard)

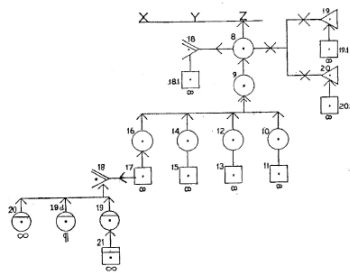
### Hybrid Approach

Bex, Prakken, Van Koppen, Verheij (2005 >)



1913

## A 1931 Wigmore chart



### KEY LIST

- Z: The charge that U killed J.
- 8: Revengetful murderous emotion toward J.
- 9: J's falsely charging U with bigamy, trying to prevent the marriage.
- 10: Letter received by priest stating that U already had a family in the old country.
- 11: Anonymous witnesses to 10.
- 12: J was author of letter (although it was in a fictitious name).
- 13: Anonymous witnesses to 12.
- 14: Letter communicated by priest to U.
- 15: Anonymous witnesses to 14.
- 16: Letter's statements were untrue.
- 17: Anonymous witnesses to 16.
- 18: U's marriage being finally performed, U would not have had a strong feeling of revenge.
- 18.1: Wigmore does not tell us what this represents. Maybe it is witness testimony.
- 18(2): The witness is biased.
- 19: U and J remaining in daily contact, wound must have rankled.
- 19.1: Witness to daily contact.
- 19(2): The witness is a discharged employee of U.
- 21: Anonymous witness to 19(2).
- 19d: Discharged employees are apt to have an emotion of hostility.
- 20: Wife remaining there, jealousy between U and J probably continued.
- 20.1: Witness to wife remaining.
- 20(2): The witness' strong demeanour of bias while on the stand.

Umilian was accused of murdering Jedrusik.

## Overview

Argumentation schemes

Evidence in law

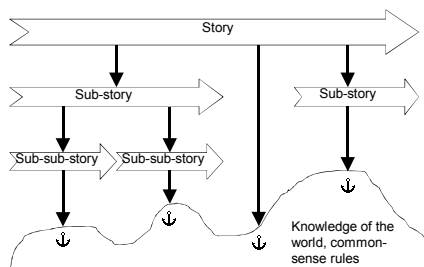
**Anchored narratives theory (ANT)**

A reconstruction of ANT in terms of argumentation schemes

A hybrid approach

An example: two murders

## Anchored narratives



Crombag, H.F.M., van Koppen, P.J., and Wagenaar, W.A. (1992, 1994). *Dubieuze Zaken: De Psychologie van Strafrechtelijk Bewijs*. (Dubious Cases. The Psychology of Criminal Evidence.) (Amsterdam: Contact).

## Ten universal rules of evidence

1. The prosecution must present at least **one well-shaped narrative**.
2. The prosecution must present a **limited set of well-shaped narratives**.
3. **Essential components** of the narrative must be **anchored**.
4. **Anchors** for different components of the charge **should be independent** of each other.
5. The trier of fact should give **reasons for the decision** by specifying the narrative and the accompanying anchoring.
6. A fact-finder's decision as to **the level of analysis** of the evidence **should be explained through an articulation of the general beliefs used as anchors**.
7. There should be **no competing story** with equally good or better anchoring.
8. There should be **no falsifications of the indictment's narrative** and nested sub-narratives.
9. There should be **no anchoring onto obviously false beliefs**.
10. **The indictment and the verdict should contain the same narrative**.

Wagenaar, W.A., van Koppen, P.J., and Crombag, H.F.M. (1993). *Anchored Narratives. The Psychology of Criminal Evidence* (London: Harvester Wheatsheaf).

## Anchored narratives

ANT can be regarded as a mixed approach, with **story-based** and **argument-based** elements.

Verheij, B. (2000). Dialectical Argumentation as a Heuristic for Courtroom Decision Making. *Rationality, Information and Progress in Law and Psychology. Liber Amicorum Hans F. Crombag* (eds. van Koppen, P.J., & Roos, N.), 203-226. Maastricht: Metajuridica Publications.

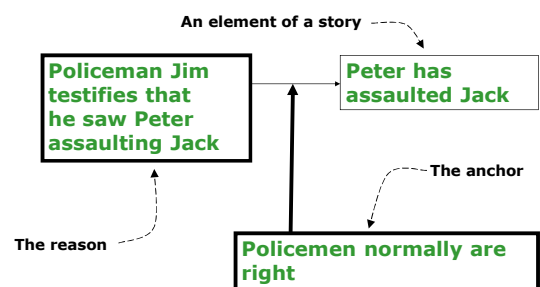
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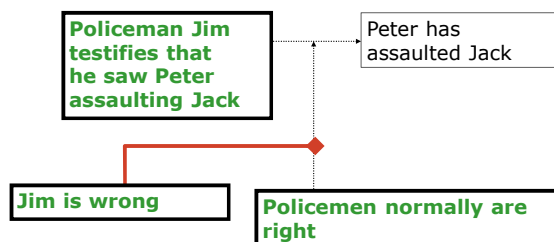
Wagenaar, W.A., van Koppen, P.J., and Crombag, H.F.M. (1993), *Anchored Narratives. The Psychology of Criminal Evidence* (London: Harvester Wheatsheaf).

How are **arguments** and **stories** related?

## An anchored element of a story



## Failing anchoring



## Overview

Argumentation schemes  
 Evidence in law  
 Anchored narratives theory (ANT)  
**A reconstruction of ANT in terms of argumentation schemes**  
 A hybrid approach  
 An example: two murders

## Argument scheme with critical questions

Argument scheme for witness testimony:

Witness A has testified that *P*.  
Therefore: *P*

Critical questions, for instance:

Wasn't A mistaken?  
Wasn't A lying?

Recall

## A format for Argument schemes

Consequent: *P*.  
Antecedent: Person *E* says that *P*.  
Person *E* is an expert with respect to facts like *P*.  
Exception: Person *E* is lying.  
Condition: Experts with respect to the facts like *P* provide reliable information concerning the truth of *P*.

Recall

## Anchored narratives: accepting a story as true

Consequent: Story S is true.  
Antecedent: Story S is good.  
Story S is anchored.

## Anchored narratives: accepting a story as true

Consequent: Story S about topic T is true.  
Antecedent: Story S is good.  
Story S is well-anchored.  
Exception: Story S' about topic T (unequal to S) is good.  
Story S' (unequal to S) has equally good or better anchoring.

## Anchored narratives: story quality

Consequent: Story S is good.  
Antecedent: Story S has a central action to which all elements are related.  
Story S explains how the central action was performed.  
Story S explains why the central action was performed.  
Story S is unambiguous.  
Story S does not contain contradictions.

## Anchored narratives: attacking the anchoring of a story

Consequent: Story S is not well-anchored.  
Antecedent: Component C of story S is essential.  
Component C of story S is not safely anchored.

## Anchored narratives: component anchoring

Consequent: Component C of story S is safely anchored.

Antecedent: There is a piece of evidence E.  
**Story SE about piece of evidence E is true.**  
 Component C of story S is anchored to piece of evidence E by anchoring generalization G.  
 Anchoring generalization G is safe.

## Anchored narratives: story quality

Consequent: Story S is good.

Antecedent: **Story S fits story structure G .**  
 Story S is unambiguous.  
 Story S does not contain contradictions.

## Restaurant Script

```

Scene 1 Entering
PTRANS self into restaurant
ATTEND eyes to empty tables
MBUILD place to sit
PTRANS self to table
MOVE sit down
Scene 2 Ordering
ATRANS Get menu
MTRANS Read menu
MBUILD decide what self wants
MTRANS Order to waitress/waiter
Scene 3 Eating
ATRANS Get food
IMBEST Eat food
Scene 4 Exiting
MTRANS Ask for check
ATRANS Get check
ATRANS Tip waitress/waiter
PTRANS Self to cashier
ATRANS Money to cashier
PTRANS Self out of restaurant
    
```

Schank & Abelson 1975

### Scripts Plans Goals and Understanding

An Inquiry into Human Knowledge Structures

Roger Schank,  
Robert Abelson  
1984

## Story scheme for murder

**Anomaly that the scheme explains:** person  $y$  is dead.

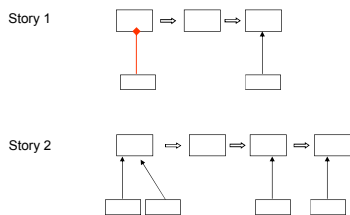
**Central action of the scheme:** person  $x$  kills person  $y$ .

**Other relevant information:** the motive  $m$ , the time of the killing  $t$ , the place of the killing  $p$ , the weapon  $w$ .

**Pattern of actions:** person  $x$  has a motive  $m$  to kill person  $y \rightarrow$  person  $x$  kills person  $y$  (at time  $t$ ) (at place  $p$ ) (with weapon  $w$ )  $\rightarrow$  person  $y$  is dead.

**More specific kinds of murder:** assassination (e.g. liquidation), felony murder (e.g. robbery murder), killing of one's spouse.

## A hybrid formal theory for argumentative-narrative reasoning



Floris Bex (2009). *Evidence for a Good Story. A Hybrid Theory of Arguments, Stories and Criminal Evidence*. Dissertation, University of Groningen.

## Some facts

October 1, 2002

- Nadia van de V is doing her laundry at home, meanwhile making a hands free phone call with a friend
- The friend hears her say "Good morning" to someone, then 6 or 7 loud screams
- Nadia is found in her apartment, killed by five bullets in head and neck
- Pascal F is her landlord
- Pascal disappears to Poland until January 2003

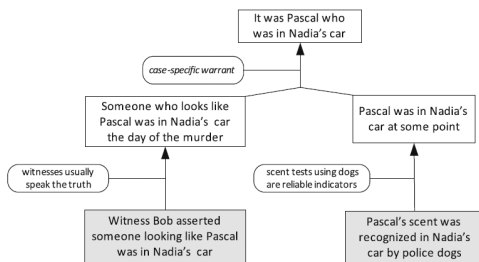
## The prosecution's story

Pascal has killed Nadia because of their quarrel and fled with her car.

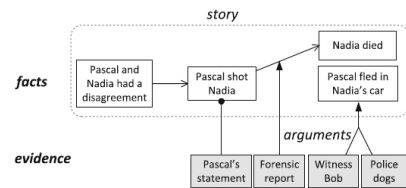
## The defense's story

Pascal has not killed Nadia. He suffers from amnesia. He has been kidnapped, waking up from a coma in the woods. He is the victim of a set-up, perhaps by Nadia's ex boyfriend.

## An evidential argument



## Reasoning about a story using arguments



## Critical questions

- (1) Are the facts of the case made sufficiently explicit in a story?
- (2) Are the facts of the story sufficiently supported by evidence?
- (3) Is the support that the evidence gives to the story sufficiently relevant and strong?
- (4) Has the story itself been sufficiently critically assessed?
- (5) Have alternative stories been sufficiently taken into account?
- (6) Have all opposing reasons been weighed?

## A hybrid formal theory for argumentative-narrative reasoning

**Definition 11** [Hybrid theory] A hybrid argumentative-narrative theory is a tuple  $HT = (ET, CT)$ , where

- $ET$  is an evidential theory
- $CT$  is a causal theory such that every  $f \in F$  is the conclusion of a justified argument  $A$  in  $Args(ET)$  for which there is a  $\phi \in Prem(A)$  which is in  $\mathcal{K}_c$ .

## A hybrid formal theory for argumentative-narrative reasoning

**Definition 4** [Evidential theory] An *evidential theory* is a tuple  $ET = (\mathcal{R}_e, \mathcal{K})$  where

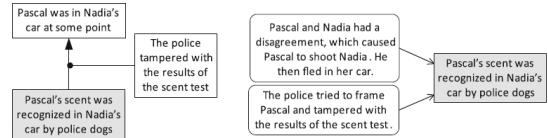
- $\mathcal{R}_e$  is a set of *evidential defeasible rules*.
- $\mathcal{K} = \mathcal{K}_e \cup \mathcal{K}_a$  is a knowledge base, where:
  - $\mathcal{K}_e$ , the *evidence*, is a consistent set of literals from  $\mathcal{L}$ .
  - $\mathcal{K}_a$  is the set of *commonsense assumptions*.

**Definition 8** [Causal Theory] A *causal theory* is a tuple  $CT = (\mathcal{R}_c, \mathcal{H}, \mathcal{F})$  where

- $\mathcal{R}_c$  is a set of causal rules;
- $\mathcal{H}$ , the *hypotheticals* or *hypothetical events*, is a set of ground literals;
- $\mathcal{F}$ , the *explananda* which have to be explained, is a consistent set of ground first-order literals.

Bex et al 2010

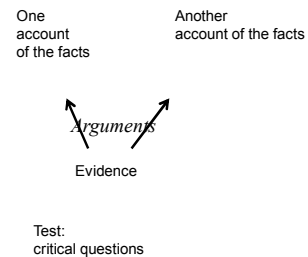
## Arguments and stories as communicating vessels



## Stories & coherence

- Stories have a local coherence
  - => Causal relations
- Stories have a global coherence
  - => Scripts

## Evidence in law



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For more information on argument schemes for anchored narratives theory:  
Verheij, B., & Bex, F.J. (2009). Accepting the Truth of a Story about the Facts of a Criminal Case. *Legal Evidence and Proof: Statistics, Stories, Logic (Applied Legal Philosophy Series)* (eds. Kaptain, H., Prakken, H., & Verheij, B.), 161-193. Farnham: Ashgate.

For more information on the hybrid theory:

Bex, F.J. (2009). *Evidence for a Good Story. A Hybrid Theory of Arguments, Stories and Criminal Evidence*. Dissertation, University of Groningen.

Bex, F.J., van Koppen, P.J., Prakken, H., & Verheij, B. (2010). A Hybrid Formal Theory of Arguments, Stories and Criminal Evidence. *Artificial Intelligence and Law* 18 (2), 123-152.

Bex, F.J., & Verheij, B. (2012). Solving a Murder Case by Asking Critical Questions: An Approach to Fact-Finding in Terms of Argumentation and Story Schemes. *Argumentation* 26 (3), 325-353.