Judicial evaluation of evidence in (Dutch) criminal law

Combining a Bayesian and a scenario approach

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PMJ

Preventing Miscarriages of Justice

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Dutch criminal law

- Continental law
- Judges, no jury

- Adversarial trial: active defendant
- **Inquisitorial system: active judge**

- Factually a free system of evidence

Bayesian & scenario thinking in Dutch criminal law

- **Scenario**
- In many evidentially complex cases Dutch criminal courts refer to and reason in terms of scenarios

- **Bayes**
- Bayes is ‘the norm’ for forensic evidence but has been rejected as approach for analysis of cases as a whole

Scenario approach

Explanationism

- Both: explaining the evidence
- **Qualitative and holistic evaluation** in terms of epistemic virtues

- Scenario more than a single explanation
- **Like a theory**: coherent set of main and auxiliary hypotheses with specific structure and elements

Story model

Pennington & Hastie

Descriptive theory

What jurors do when they evaluate evidence

1 They **construct one or more stories** that can explain the evidence

2 They **evaluate** these stories

Fast, automatic and effortless (system 1)

But error-prone

Warning

People better in constructing than evaluating stories

Biases

Tunnel vision

A compendium of common heuristics and logical fallacies that lead actors in the criminal justice system to **focus on a suspect, select and filter the evidence that will build a case** for conviction, while ignoring or suppressing evidence that points away from guilt.

Product of several biases, especially:

Confirmation bias

Tendency **to seek information that confirms the hypothesis** and to avoid information that would disconfirm it.

Belief perseverance

Tendency **to explain away events that are inconsistent with the hypothesis.**

Scenario approach

Van Koppen

Normative approach built upon story model

Prescriptive: offers **feasible** guidelines meant to protect against biases

Scenario approach

Main guidelines

1. Against confirmation bias:

Not only look for evidence which **confirms** the scenario of the indictment

Look for evidence that is **inconsistent** with the scenario of the indictment

2. Against tunnelvision:

Not only assess scenario of the indictment

Compare **minimally two scenarios**

Story model & scenario approach

Three evaluation criteria

1. **Can the scenario explain the evidence?**
   a. No inconsistent evidence
   b. No evidence gaps

2. **Is the scenario coherent?**
   a. Internally consistent
   b. Complete – no story gaps
   c. Not inconsistent with our general background knowledge

3. **Is the scenario unique?**

Alternative scenarios that also fullfil demands 1+ 2?

Example

The police is conducting routine road-side **alcohol tests** with a breathalyser on a road outside München. Peter is one of the drivers that are randomly stopped, and he **tests positive.**

The **reliability of the breathalyser** is reflected by the following statistical data.

The probability that a person who is under the influence of alcohol gets a positive result is **90%**.

The probability that a person who is not under the influence of alcohol incorrectly receives a positive result is **1%**

What is the probability that Peter is under the influence of alcohol?

0% 1% 5% 10% 25% 50% 75% 90% 95% 99% 100%

Does the scenario approach help to evaluate the evidence?

- **Yes**
- Protects against tunnel vision and confirmation bias
- 1. Think from different scenarios
- 2. Search for inconsistent evidence

- **No**
- No guidelines to assess %
- **No protection against probabilistic thinking errors**

Two probabilistic errors

Error 1

- People think the test tells us:
  - "If a person tests positive, the probability he **has been drinking** is 90% / 99%."

The example

The police is conducting routine road-side alcohol tests with a breathalyser on a road outside München.

Peter is one of the drivers that are randomly stopped, and he tests positive.

The reliability of the breathalyser is reflected by the following statistical data.

The probability that a person who is under the influence of alcohol gets a positive result is 90%.

The probability that a person who is not under the influence of alcohol incorrectly receives a positive result is 1%.

What is the probability that Peter is under the influence of alcohol?

0% 1% 5% 10% 25% 50% 75% 90% 95% 99% 100%

Two probabilistic errors

Error 1

- The test tells us the reverse:
  - "If a person **has been drinking**, the probability that he tests true positive is 90%."
  - "If a person **has not been drinking,** the probability that he tests false positive is 1%."

- **'Prosecutor's fallacy'**

Can it make a huge difference?

Yes!

- What is the probability that an animal has four legs
- **given that it's a cow?**
- **HIGH**

- What is the probability that an animal is a cow
- **given that it has four legs?**
- **LOW**

Two thinking errors

Error 2

- **Error 2**. Many people do not take into account how many drivers drive with alcohol
- **‘Base rate fallacy’**

The example

The police is conducting routine road-side alcohol tests with a breathalyser on a road outside München. Peter is one of the drivers that are randomly stopped, and he tests positive.

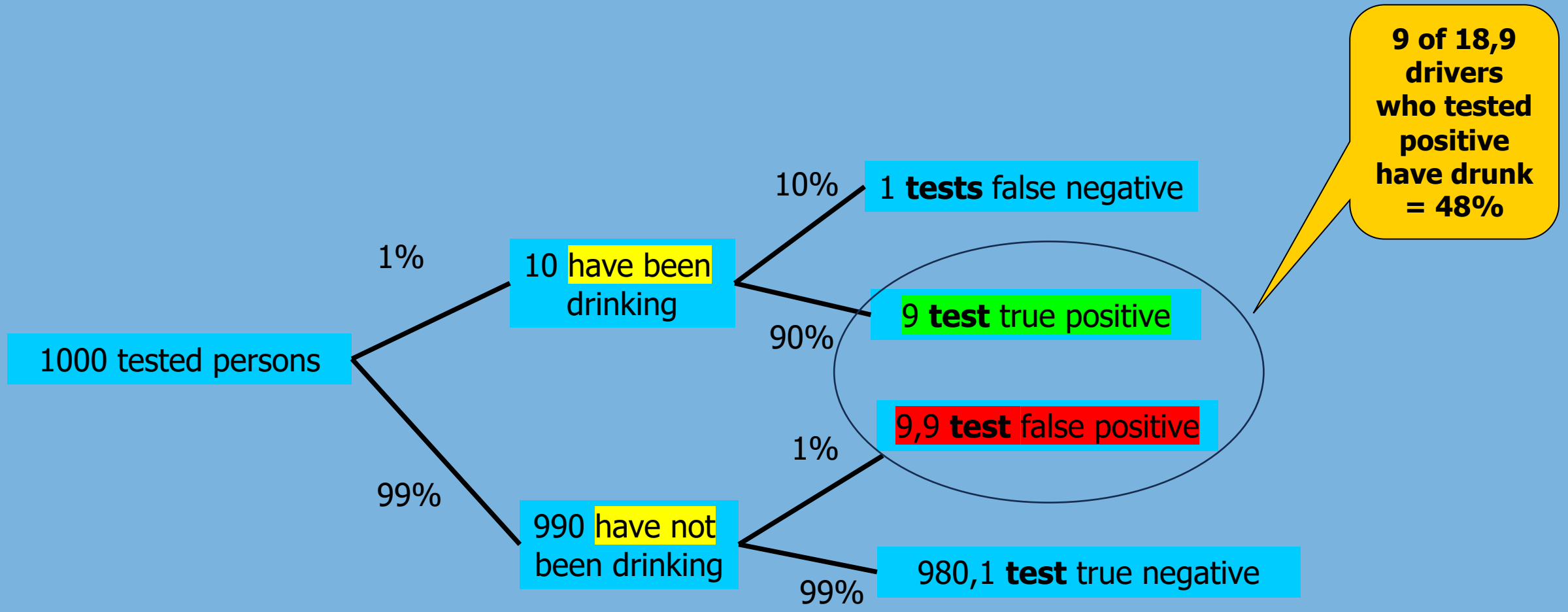
The reliability of the breathalyser is reflected by the following statistical data. The probability that a person who is under the influence of alcohol gets a positive result is 90%. The probability that a person who is not under the influence of alcohol incorrectly receives a positive result is 1%.

According to general statistics, about one in a hundred drivers (1%) are under the influence of alcohol.

What is the probability that Peter is under the influence of alcohol?

0% 1% 5% 10% 25% 50% 75% 90% 95% 99% 100%

Bayesian analysis of the example



Interim conclusion

- Bayes seems superior when it comes to evidence evaluation
- However …

Use of Bayesian approach in Dutch criminal cases

- Bayes is regularly used to evaluate **forensic** evidence

- Should / can Bayes also be used to evaluate
- **Non-forensic** evidence
- **Cases** as a whole?

Objections against the use of Bayes in court

- 1 There are **no 'objective' numbers** for non-forensic evidence
- 2 Bayes is **too difficult**
  - For judges
  - To apply to cases as a whole
- 3 Bayes' rule is **controversial**
- 4 Application of Bayes' rule **depends on selection and evaluation** of the evidence

Objection 1

There are no ‘objective’ numbers

- Bayesian estimations are **‘subjective’ beliefs**
- ‘Objective’ numbers only for forensic evidence

- **Why quantify subjective beliefs?**
- E.g. interpretation of “probable” varies from 41-86%

- **Possible solutions**
- Making estimates quantitative = more transparancy and equality
- Bayes can also be used qualitatively

Objection 2

Bayes is too difficult

- 1 Most legal professionals do not know how to use Bayes' rule
- 2 Analysis of more than one hypothese / piece of evidence soon becomes too complex, also for experts

- **Possible solutions**
- Education
- Forensic advisors in criminal court
- Bayesian Networks = graphical visualisation & software for calculations

Dutch judicial decisions about the use of Bayes' rule

- Zeeland-West Brabant District Court (ECLI:NL:RBZWV:2016:3060)

- "The calculation ... which would show that the defendant is - in short - probably innocent was made according to Bayes' theorem.
- Thereby a - in the court's opinion **not uncontroversial - rule** from probability theory was used for the criminal truth finding **whose outcome depends to a large extent on the selection and evaluation of the evidence** ... ."

Objection 3

Court: "not uncontroversial rule of probability theory"

- Bayes' rule is not 'controversial'
- **Bayes = logic, rational change of belief**

- But logic allows for "**garbage in, garbage out**"

- **Example**
- All humans are murderers (garbage)
- Socrates is a human (no garbage)
- ---
- Socrates is a murderer (garbage)

Objection 3 cont.

Belief bias

- Not using Bayes can result in logically incorrect reasoning

- Most people who drink alcohol test positive
- Peter tests positive
- ----------
- Peter has probably been drinking

- **Belief bias**: Tendency to judge the strength of an argument and to accept it
- On the basis of the **plausibility of the conclusion**
- Rather than on how strongly the premisses support the conclusion

Objection 4

Court "Outcome depends … on selection and evaluation of evidence … "

- **Bayes tells us**
- How our beliefs **should change** in the light of the evidence

- **Bayes does not tell us**
- Which scenarios and evidence we should **select**
- How to **estimate** the probability of scenario and evidence
- Whether the investigations into alternative scenarios and evidence have been **thorough** enough

Scenario & Bayesian approach

Two main functions

- **Two main functions**
- Scenario construction and selection
- Scenario evaluation

- Scenario approach = better for construction than evaluation: logic of discovery & pursuit

- Bayes = for evaluation: logic of of justification

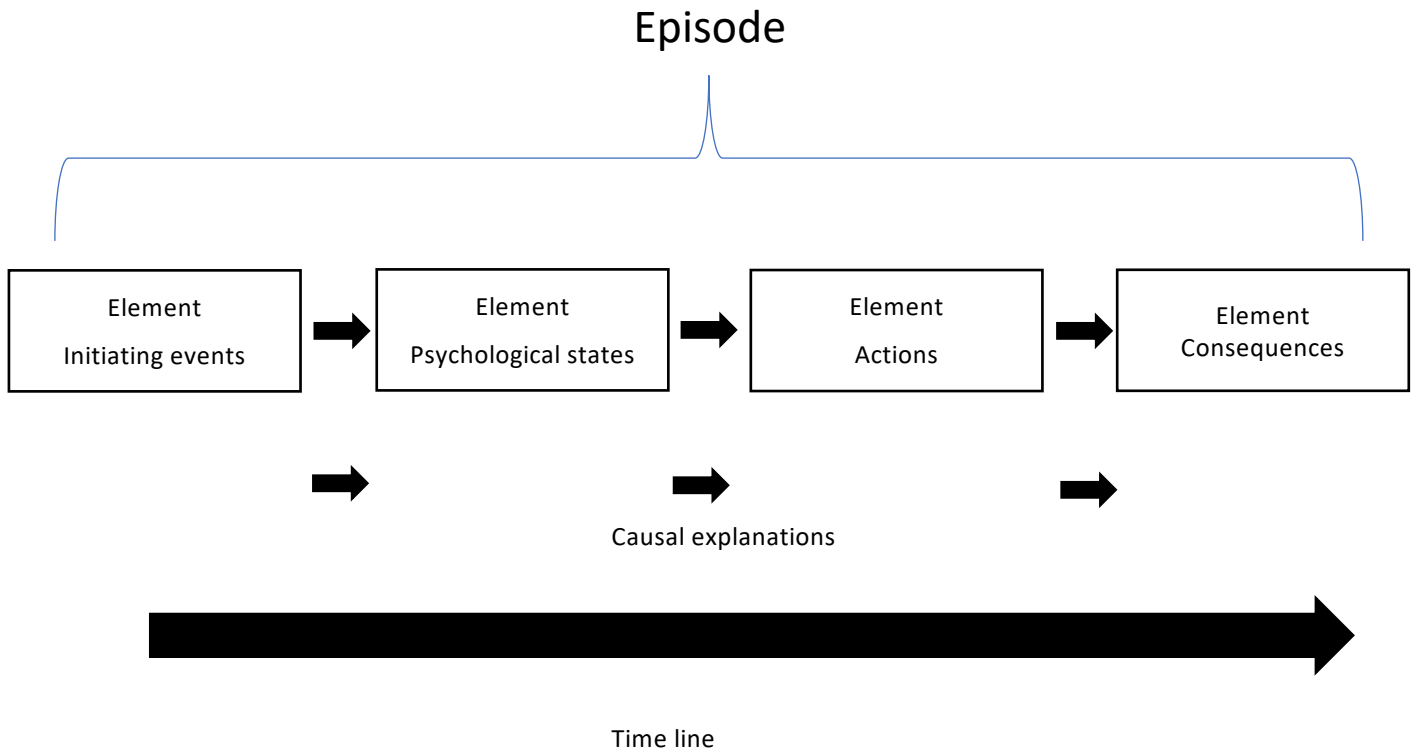
Scenario approach

Functions

- **1 Overview** of information
- **2 Selection** of scenarios and evidence
  - Evidence determines selection and construction of plausible scenarios
  - Scenario determines relevance of evidence and search for further evidence
- 3 Evaluation of **scope and completeness** of investigations
- 4 Evaluation criteria are intuitive way to grasp Bayes' rule

Ad 1 Overview function

Scenario
Episodes
Elements

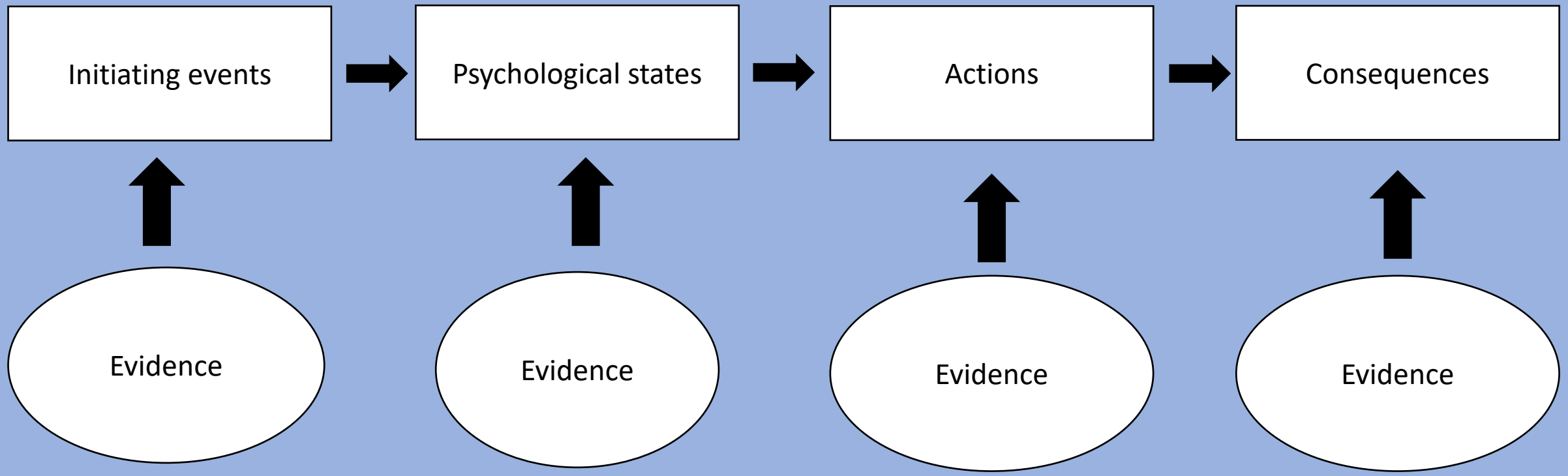


Ad 2 Construction & selection of scenarios & evidence

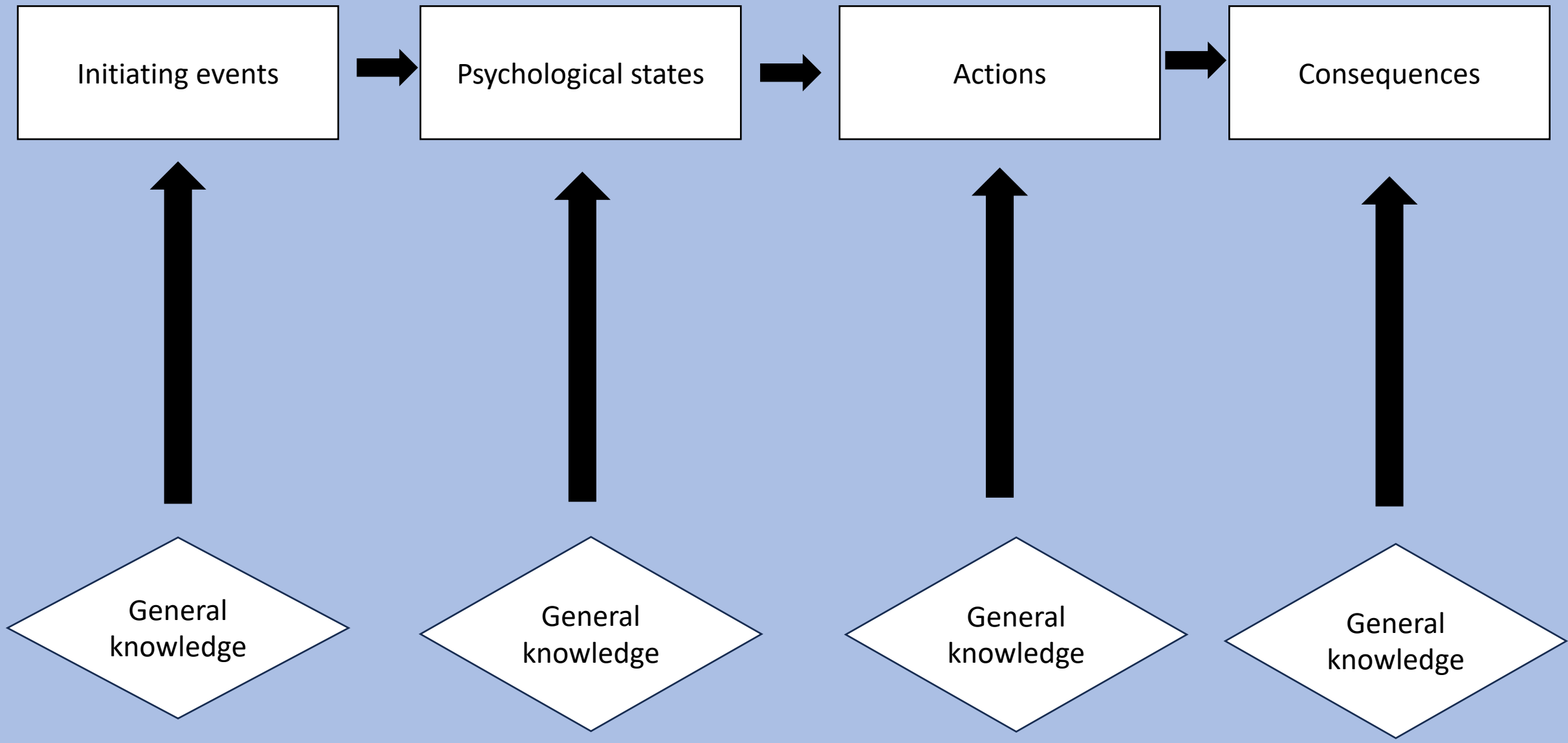
- **Three types of knowledge in scenario construction & selection**

- 1 **Evidence**
- 2 **General** world knowledge
- 3 Knowledge about **completeness** of story structure (episodes, elements)

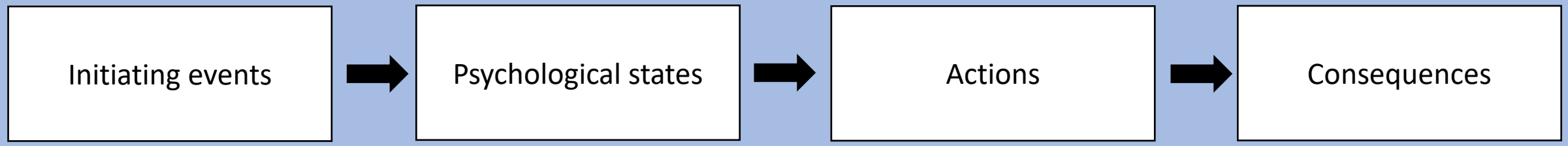
Ad 1 Evidence



Ad 2 General world knowledge

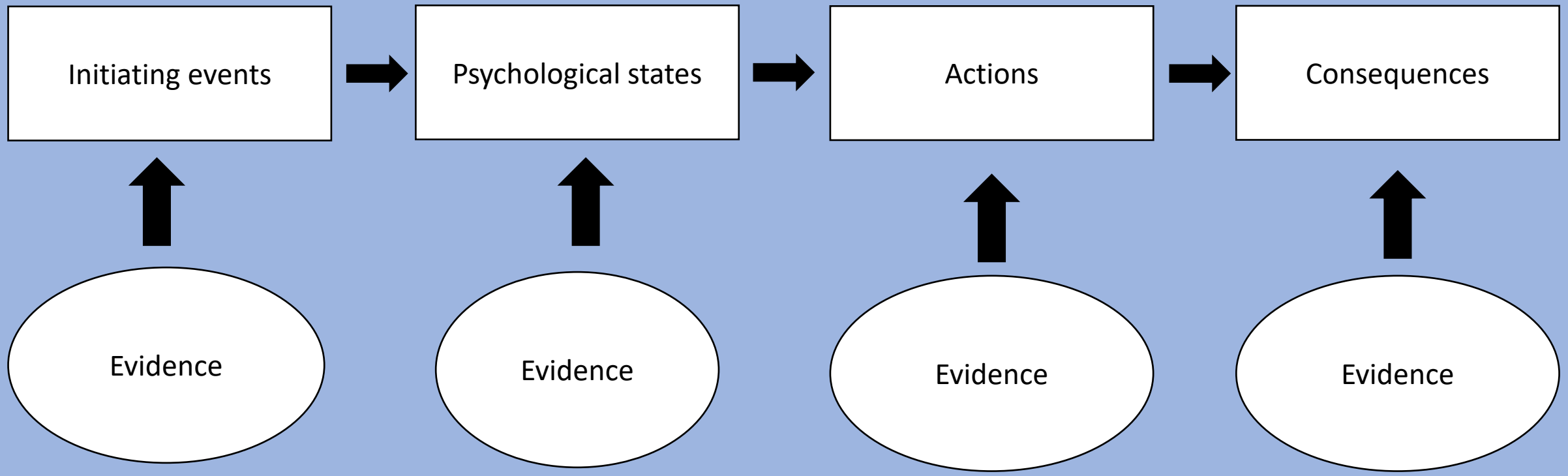


Ad 3 Scenario completeness

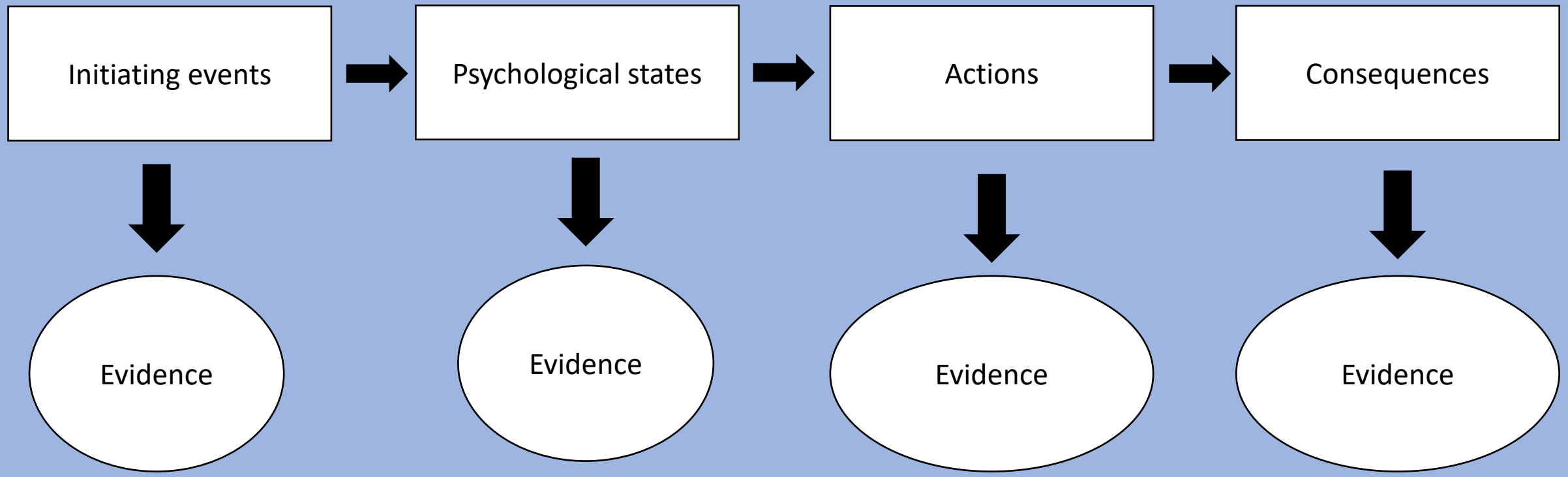


Episodes
Elements
Plausible timeline
Plausible causal relations between elements

Evidence used to construct & select scenario



Result 1: scenario used to explain evidence

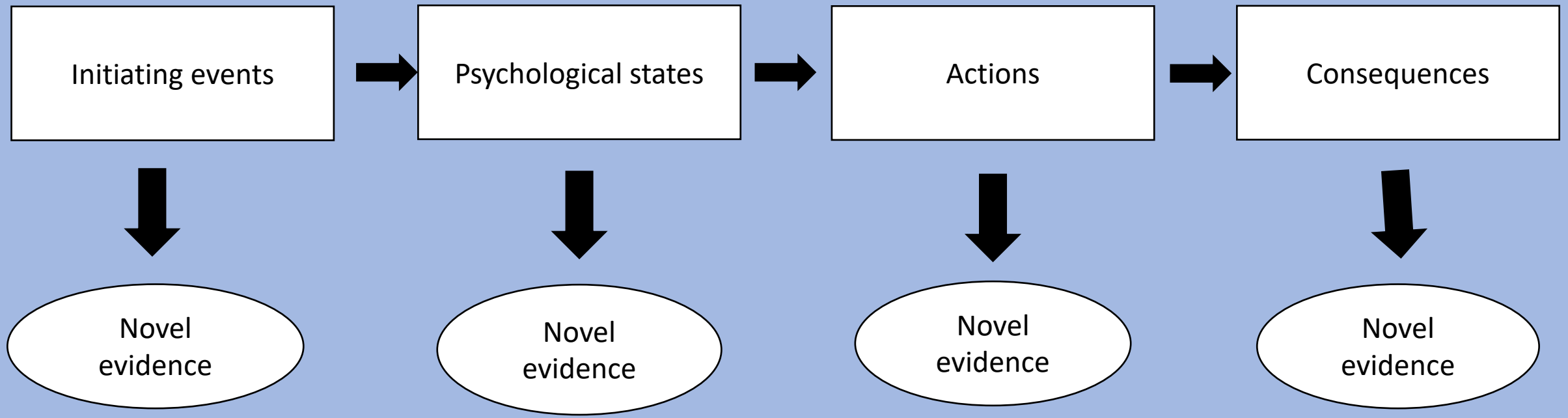


Explanation or circular reasoning?

- Evidence used to construct scenario
- But then
- Scenario used to explain evidence

- Risk of circular reasoning especially in late defence scenarios

Result 2. Scenario makes it possible to predict evidence



Functions of prediction

- Predictions can result in the discovery of **novel evidence**

- Novel evidence make it possible
  - To **test** scenarios
  - To **improve or reject** scenarios
  - To **predict** yet other novel evidence … etc.

Investigators vs judges

- It is the task of investigators to construct, test and improve scenarios
- It is not the task of the court to do so
- So why is this relevant to judges?

Ad 3

Scope and completeness of investigation

- Dutch criminal law
- **Adversarial trial**
- Defendant is active party, not passive object
- **Within inquisitorial system**
- Judge is active, not passive

- “In establishing the truth in criminal cases, the judge … is active … and has an independent **responsibility for the scope and completeness of the investigation**” (Parliamentary papers)

- Scenario approach can help to assess the scope and completeness of the investigation into evidence and alternative scenarios

Judicial review

ECLI:NL:PHR:2023:906
&
ECLI:NL:HR:2023:1602

Stalking case

Scope and completeness of investigation

- **The applicant's conviction at the time was mainly based on investigation of historical traffic data to the woman's phone number**, which showed that she had actually received the text messages. Subsequently, the police conducted investigations to the four mobile numbers known to the police ...
- ... **The defendant's defence, to the effect that data and phone numbers of the applicant had been misused and that fake Facebook accounts had been created, the court found "no plausible evidence whatsoever".**
- **It did not investigate** at the time whether the messages were actually visible in the historical traffic data of the applicant's mobile numbers.
- **The new investigation revealed that the text messages, which the court used as evidence, were not visible in the historical traffic data of the applicant's mobile numbers**. Further investigation into the IMEI numbers (a unique number associated with a mobile device) of devices used by the applicant also did not show any contact with the woman's mobile number using those devices.
- **Additional research into historical traffic data of the woman's phone number showed that in almost all cases, calls were made to a 0909 number prior to a received text message**. This number (a payment service) was used, among other things, for payment to a website for sending text messages. In 2017, it was possible to enter a 06 number as the sender. ...

Judicial review

Scope and completeness of investigation

- Court considered negation of scenario and an undeveloped alternative scenario
- S "**Defendant sent** the text messages"
- -S "**Defendant did not send** the text messages"
- AS ”**Someone else sent** text messages"

- Court dismissed both –S and AS without exploring specific alternative scenarios such as
- “**Alleged victim** sent text messages via 0909 number”

- Should the **defendant** have come up with this (or another) AS and provide evidence for it?
- Or was this the responsibility of the **prosecution**
- **And what was the responsibility of the court?**

Ad 3 Scope and completeness

- **Conclusion**
- It is the task of investigators to construct, test and improve scenarios
- It is not the task of judges to do so

- **However …**
- Judges have responsibility to assess the scope and completeness of investigations
- To assess the ‘robustness’ or ‘stability’ of findings
- By making use of scenario approach

Ad 4

Scenario criteria intuitive way to grasp Bayes' rule

1. Is the scenario **coherent**?

➔**Prior probability** of H, not of E

2. Can the scenario **explain all evidence**?

➔ **Likelihood** p(E|H)

➔ But holistic assessment: risk of errors

3. Are there a**lternative scenarios** that also fullfil demands 1+2?

➔**Prior probability** of H and **likelihood ratio**

➔But prior and LR not clearly separated: risk of errors

Conclusion

Bayesian & scenario approach complement each other

- **Scenario approach**
- Overview of information
- Selection of scenarios and evidence
- Evaluation of scope and completeness of investigations
- Intuitive way to grasp Bayes' rule
- **Starting point of Bayesian analysis**

- **Bayesian approach**
- Protection against probabilistic fallacies
- Quantitative
- Qualitative with checklist of probabilistic errors

References

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