

A REASSESSMENT OF
TOULMIN'S ARGUMENT PATTERNS
IN THE CONTEXT OF
SAFETY ARGUMENTATION

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McMaster University

OUTLINE

Some basic elements of logic

Safety argumentation seen from a logical perspective

Toulmin's argument patterns

GSN-based approaches to safety argumentation

SOME ELEMENTS OF LOGIC

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entailment relation $\Gamma \vdash \varphi$

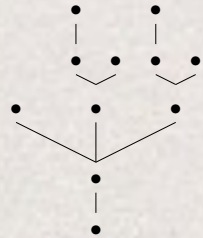
SOME ELEMENTS OF LOGIC

object language	Sen
entailment relation	$\Gamma \vdash \varphi$

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proof	

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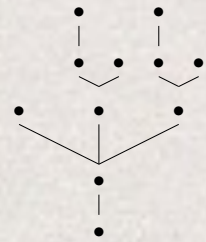
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propositional language

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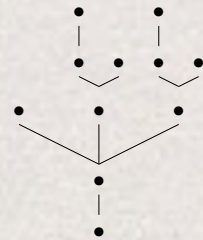
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$\{ \neg p \vee \neg q \} \vdash_{\text{CPL}} \neg(p \wedge q)$

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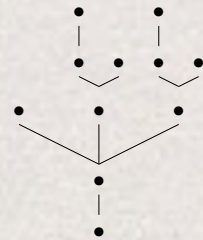
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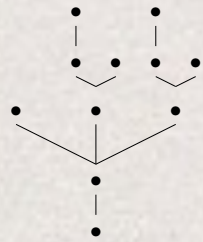
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$$\frac{\neg p \vee \neg q \quad \frac{\frac{\overline{p \wedge q}^{(2)}}{p} \quad \overline{\neg p}^{(1)}}{\perp} \quad \frac{\frac{\overline{p \wedge q}^{(2)}}{q} \quad \overline{\neg q}^{(1)}}{\perp}}{\perp}^{(1)}}{\neg(p \wedge q)}^{(2)}$$

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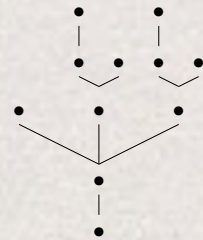
entailment relation

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Analyzability

propositional language

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$$\frac{\neg p \vee \neg q \quad \frac{\frac{\overline{p \wedge q}^{(2)}}{p} \quad \overline{\neg p}^{(1)}}{\perp} \quad \frac{\frac{\overline{p \wedge q}^{(2)}}{q} \quad \overline{\neg q}^{(1)}}{\perp}^{(1)}}{\perp}^{(1)}}{\neg(p \wedge q)}^{(2)}$$

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entailment relation $\mathcal{P} \sim_s \mathcal{X}$

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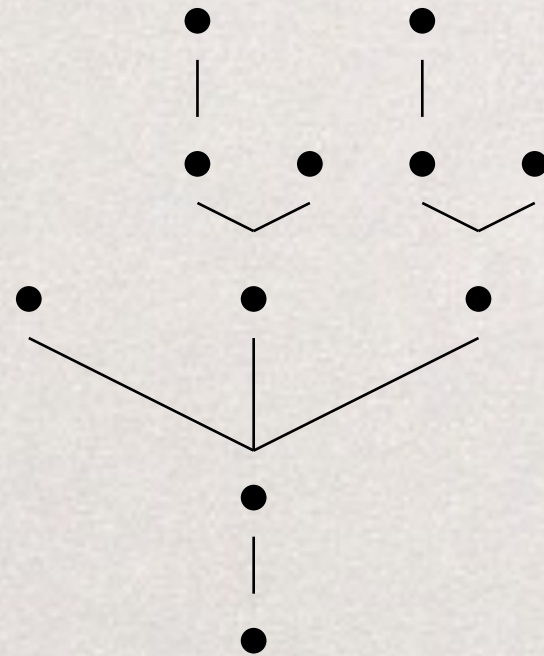
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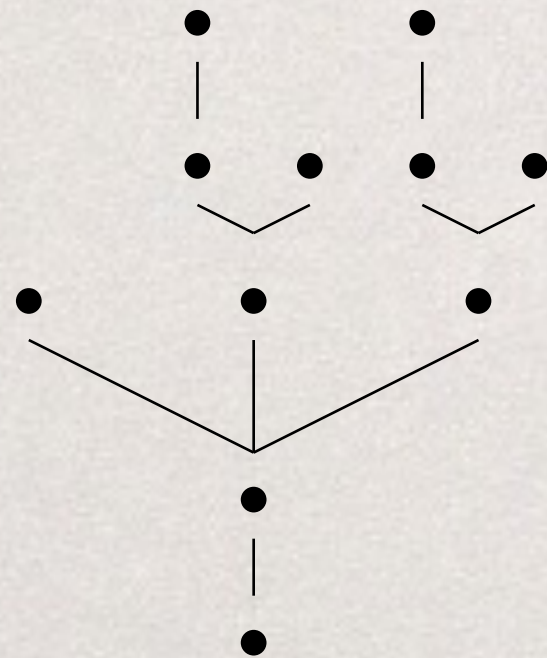


SOME ELEMENTS OF SAFETY ARGUMENTATION

entailment relation $\mathfrak{P} \sim_s \chi$ \mathfrak{P} premisses are to be grounded in evidence

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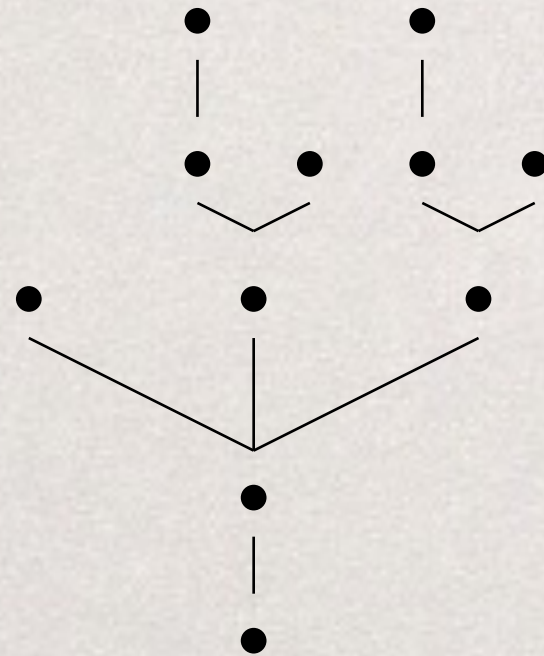


~~Is it possible to complete the picture classically?~~

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entailment relation	$\mathfrak{P} \sim_s \chi$	\mathfrak{P}	premisses are to be grounded in evidence
inference system	InfSys_s	InfSys_s	what are sensible rules of inference?

proof

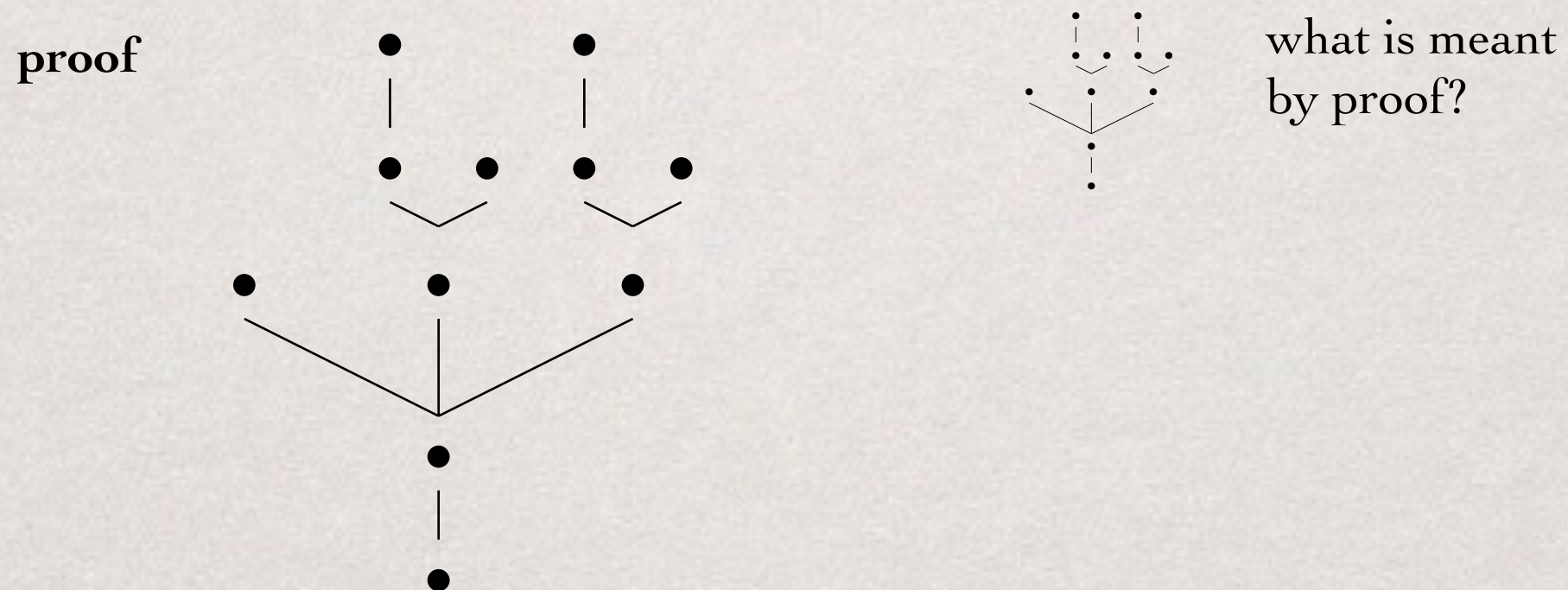


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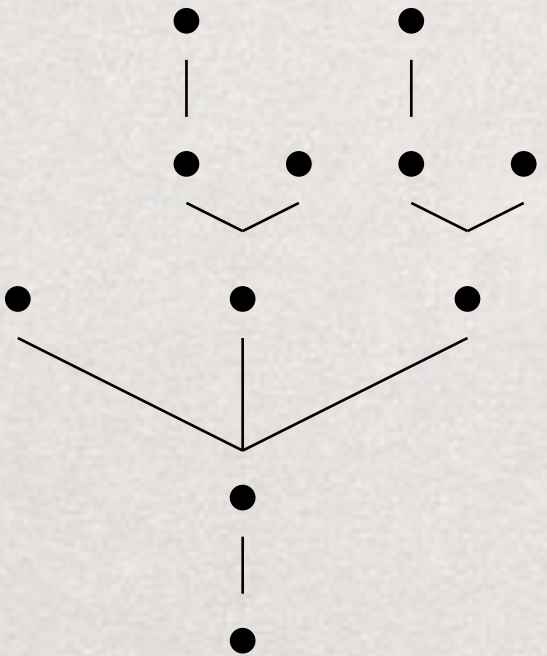


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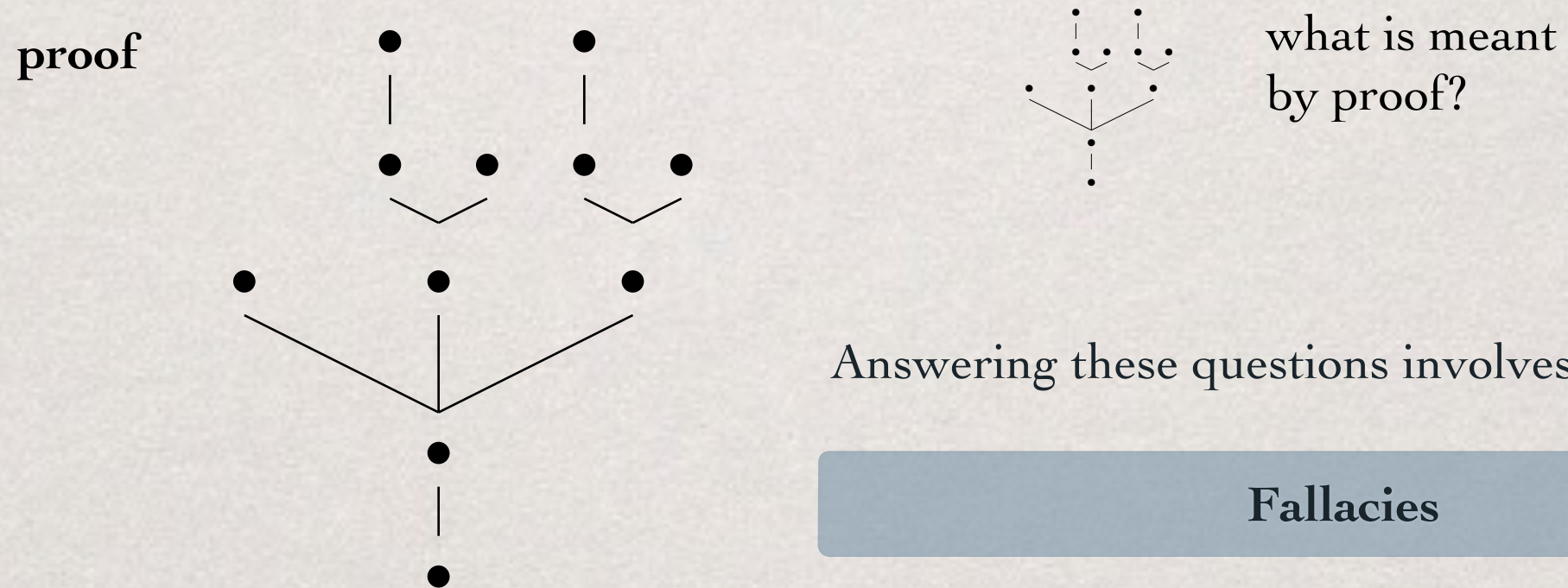
Answering these questions involves dealing with:

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Answering these questions involves dealing with:

Fallacies

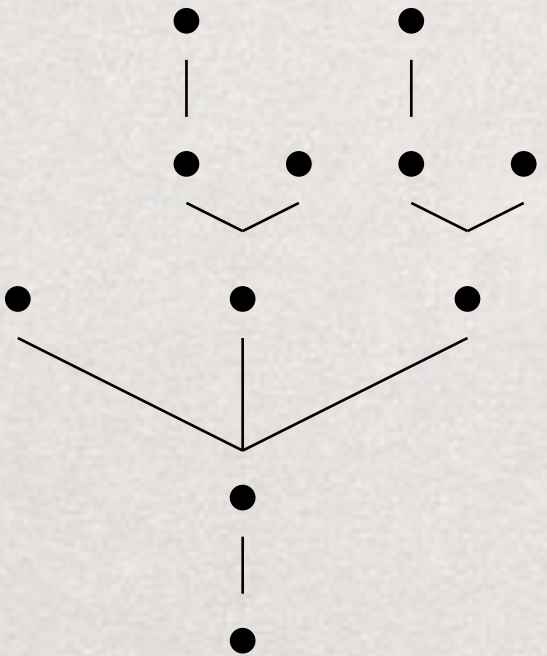
Defeasibility

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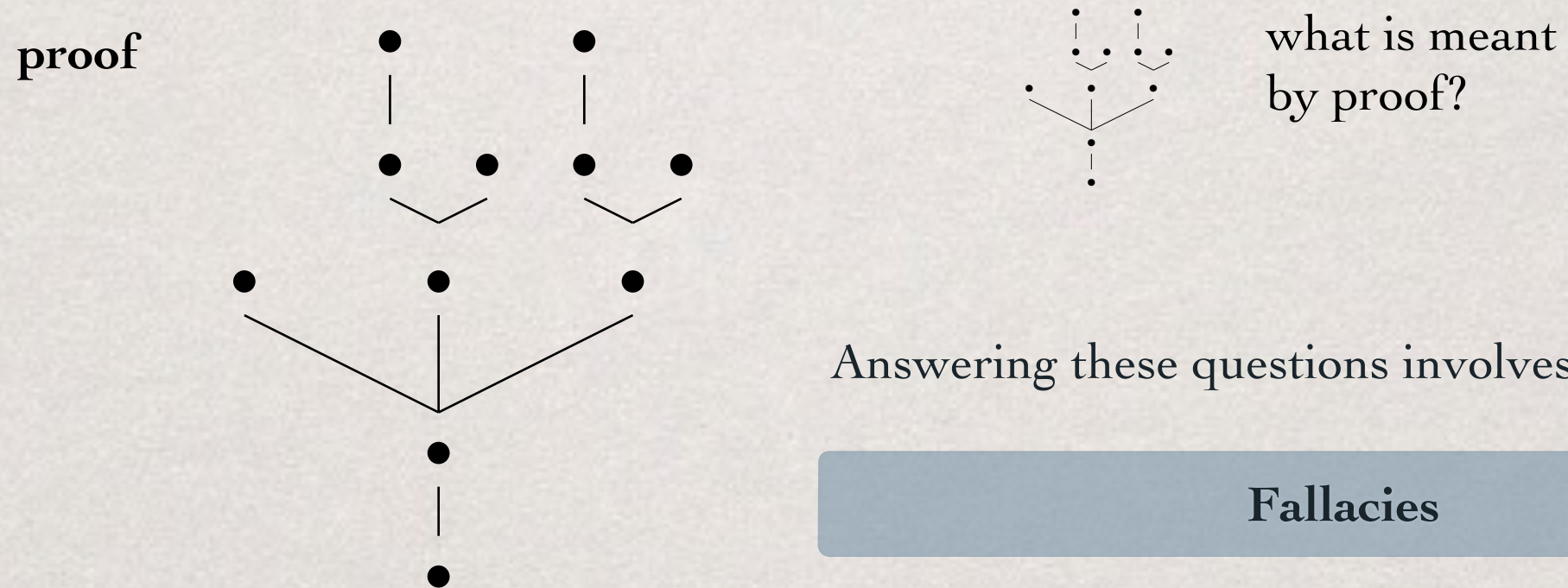
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Answering these questions involves dealing with:

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$\mathfrak{P} \sim_s \chi$ $\mathfrak{P} \leq \mathfrak{P}'$ $\mathfrak{P}' \not\sim_s \chi$

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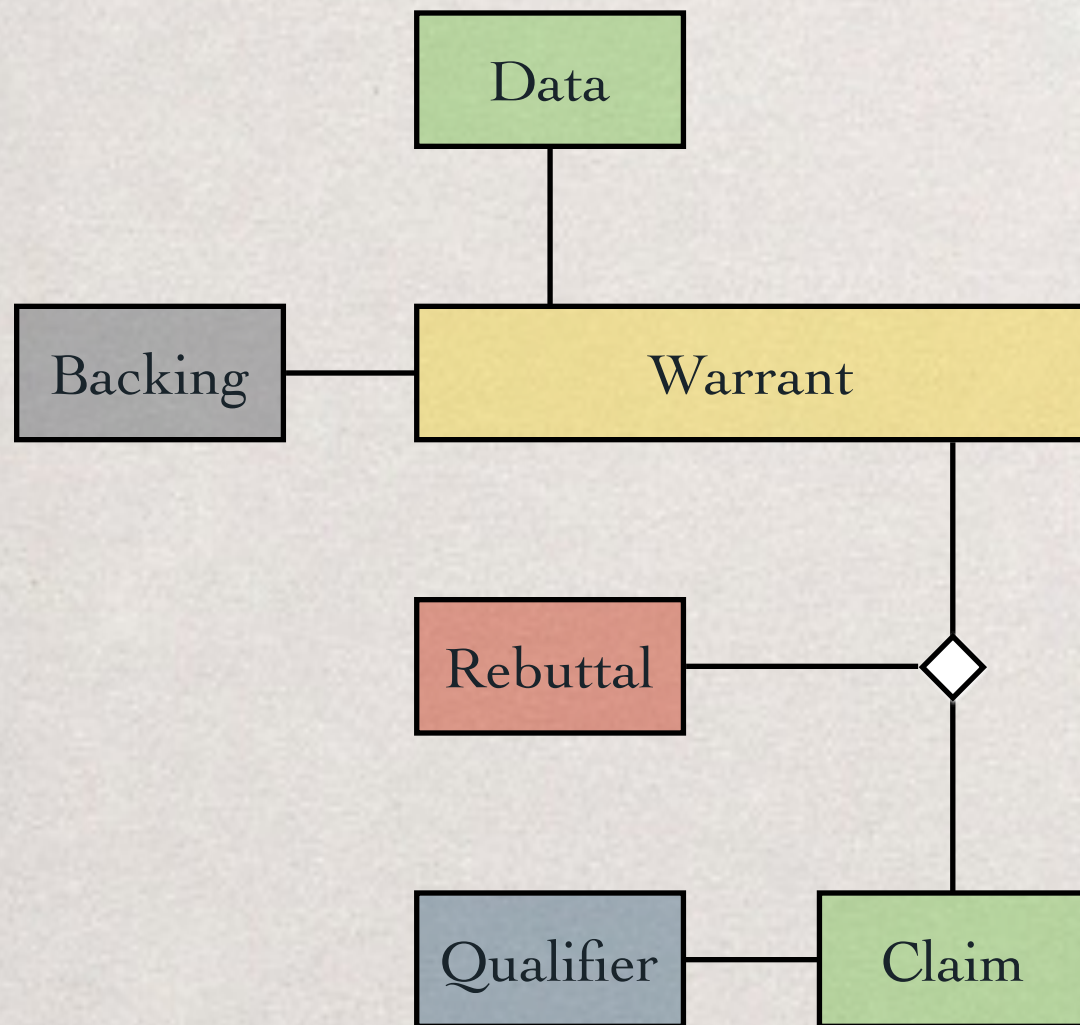
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What is Toulmin's notion of an **argument pattern**?

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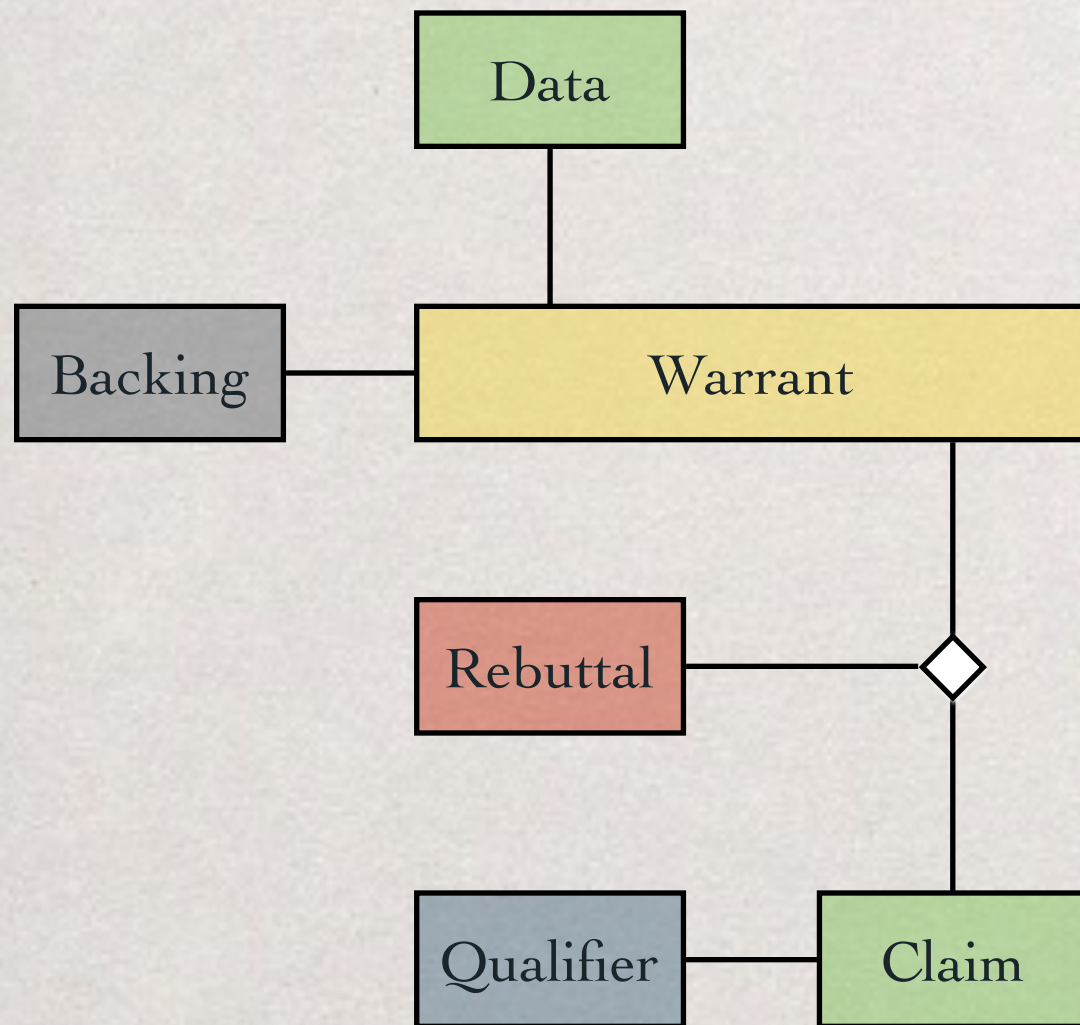
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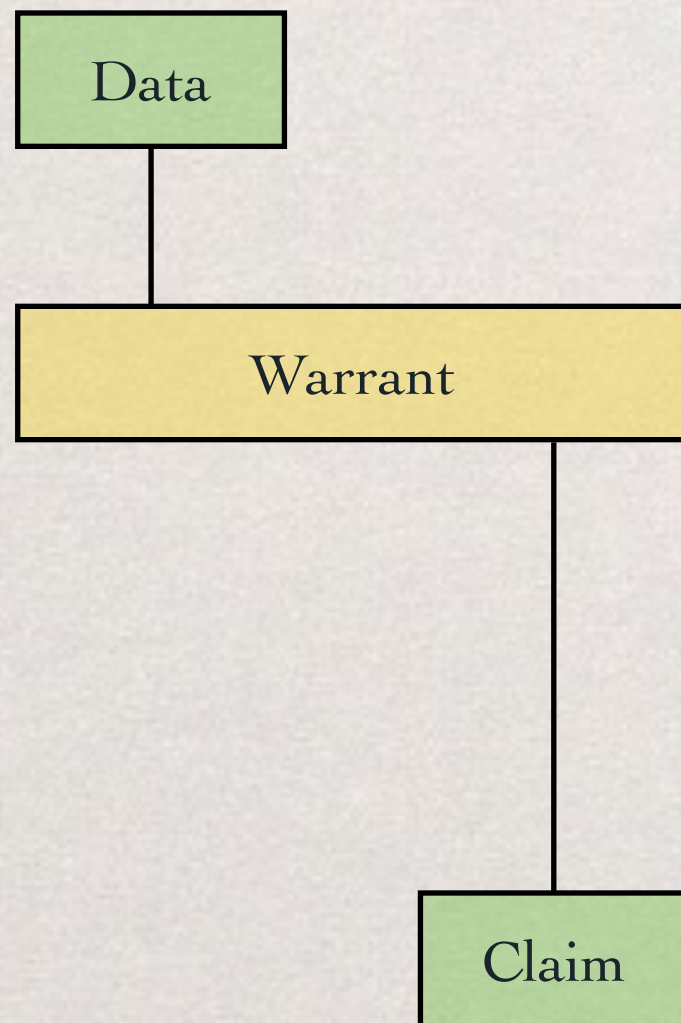
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**Conceptual tool for analyzing
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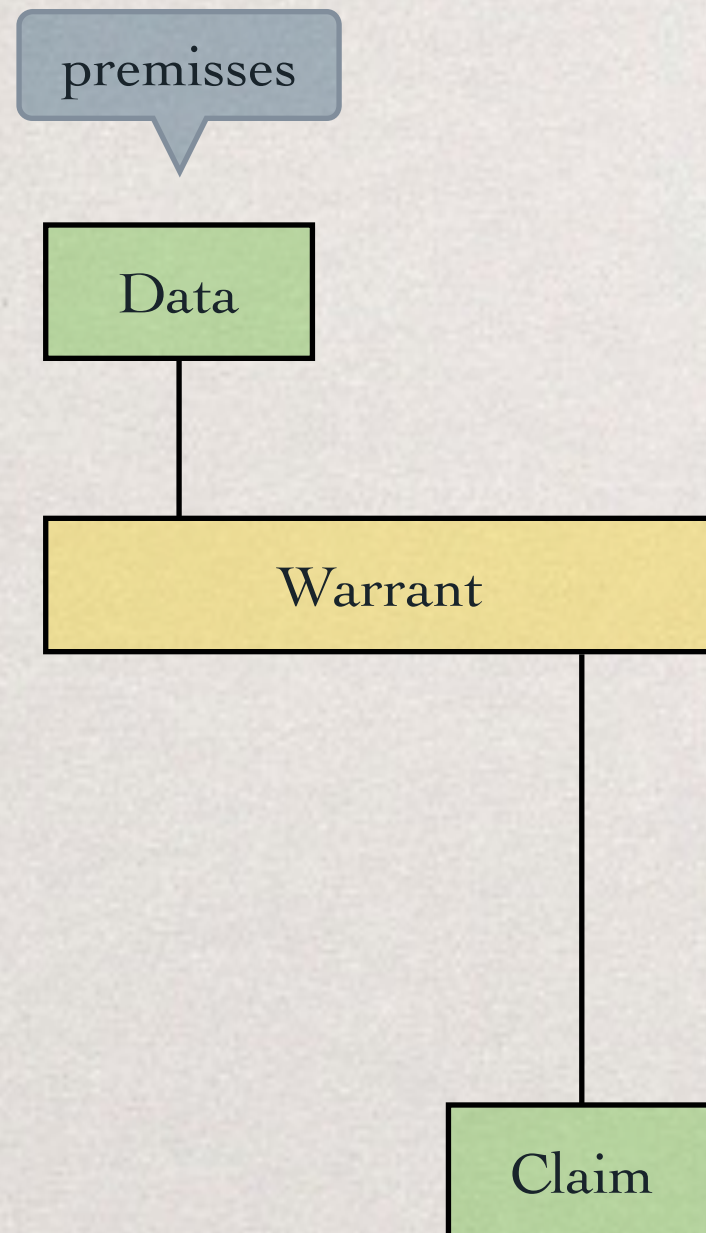
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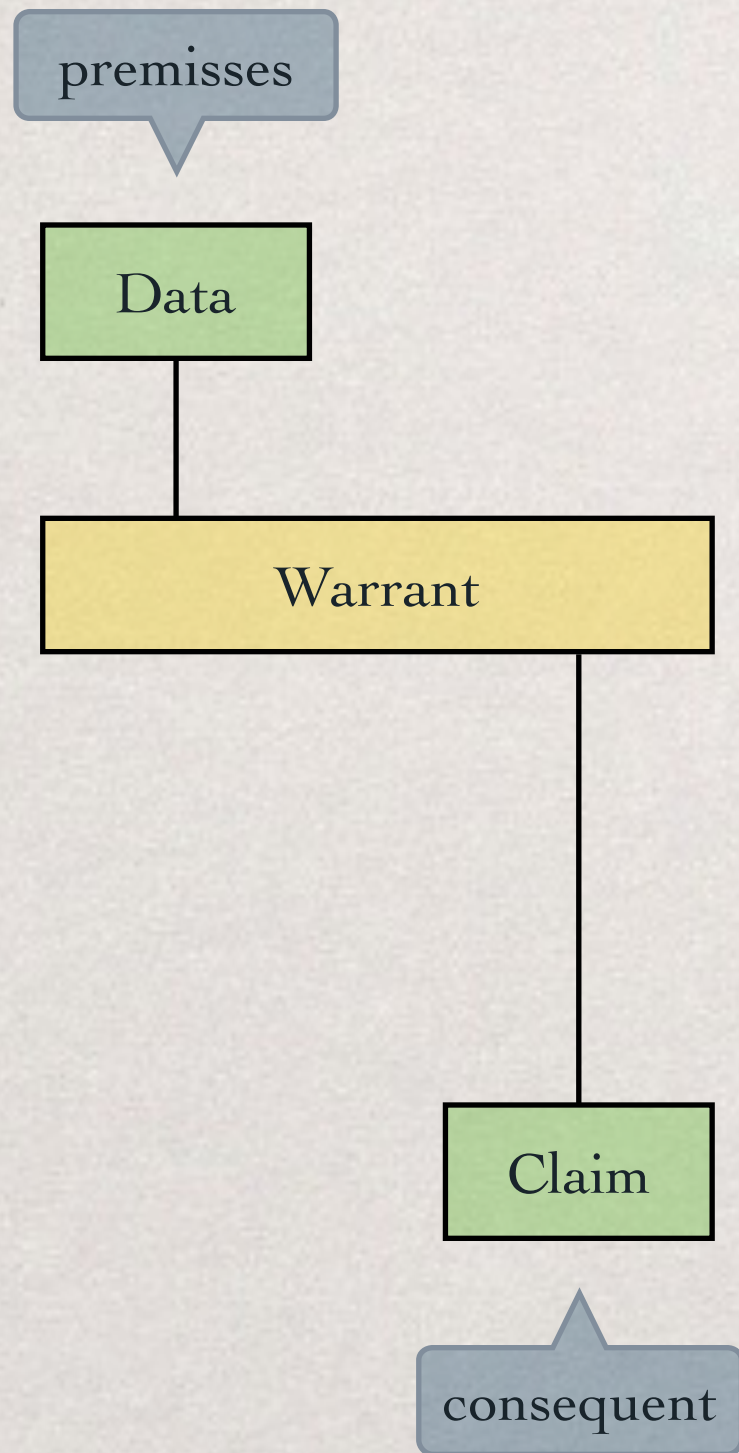
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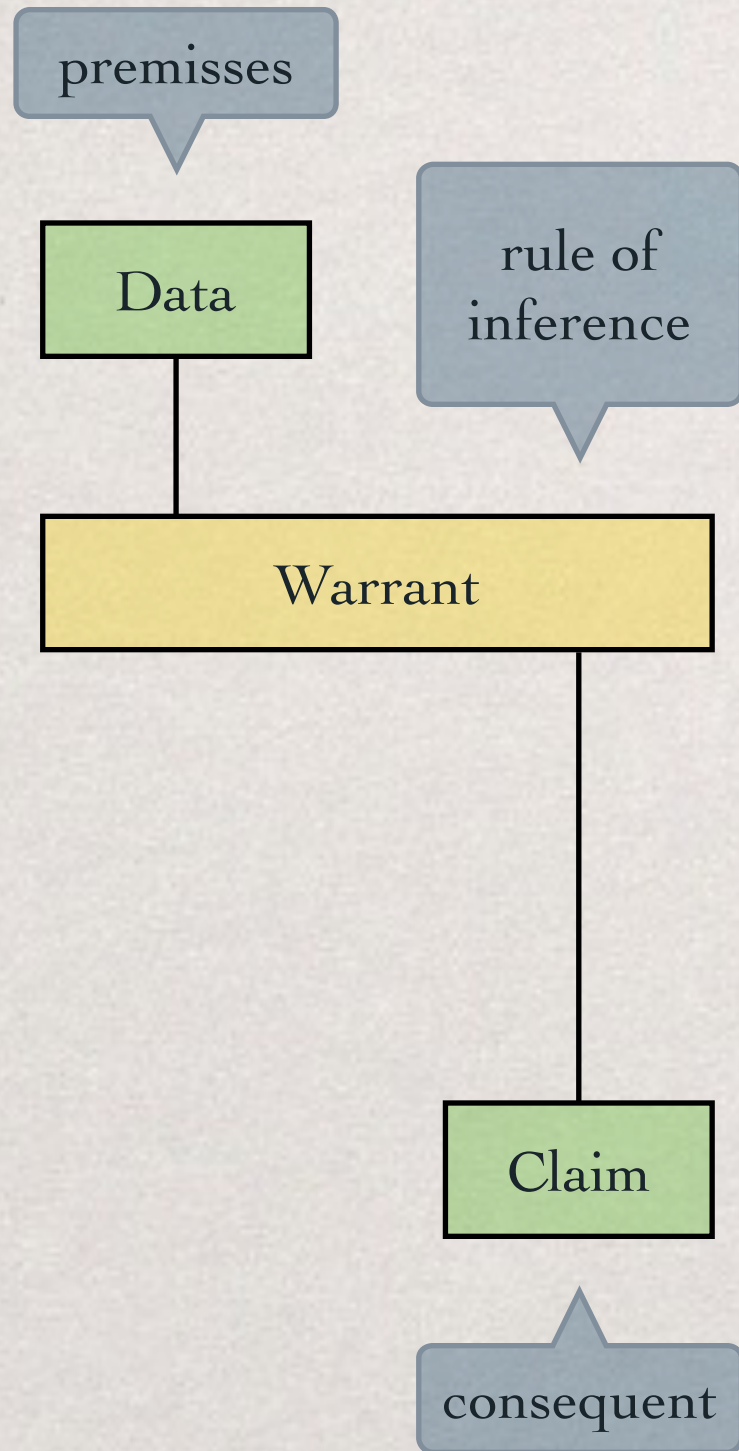
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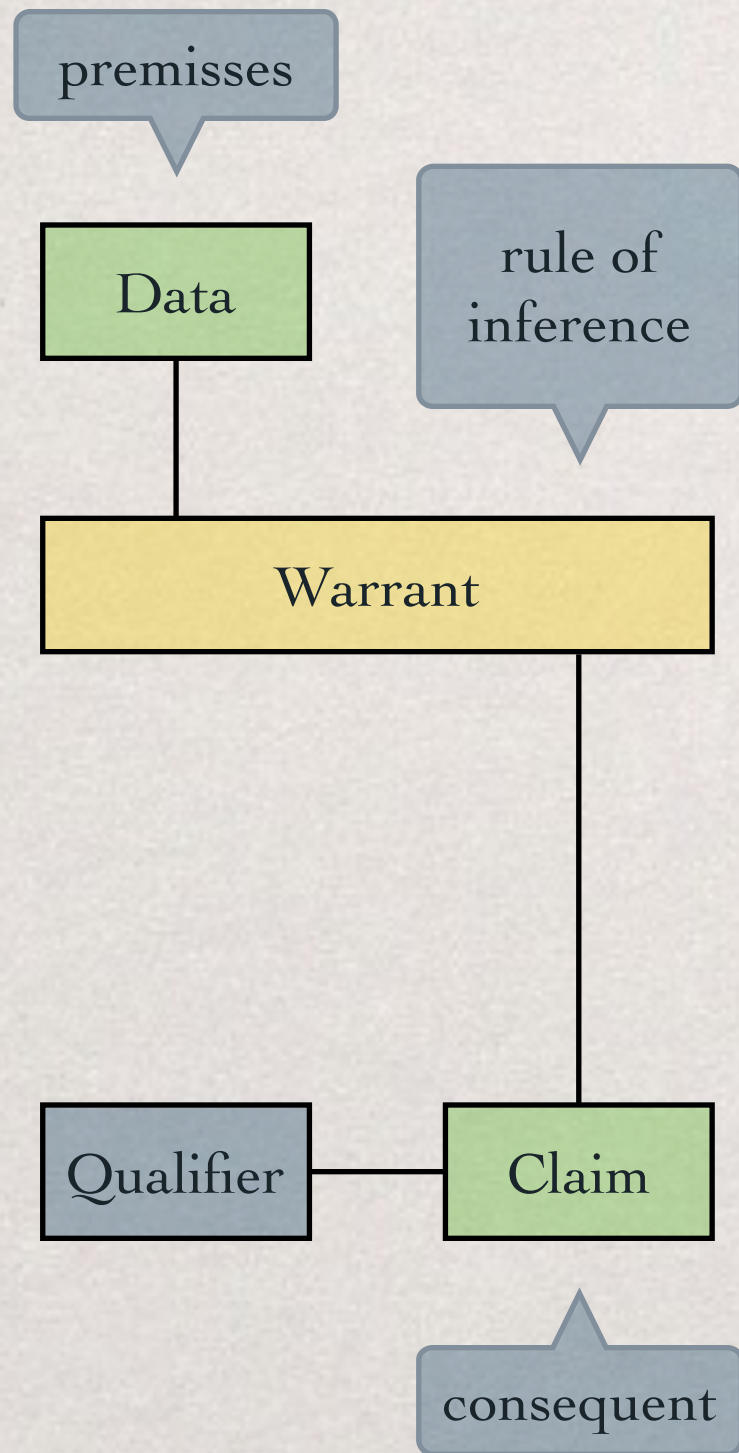
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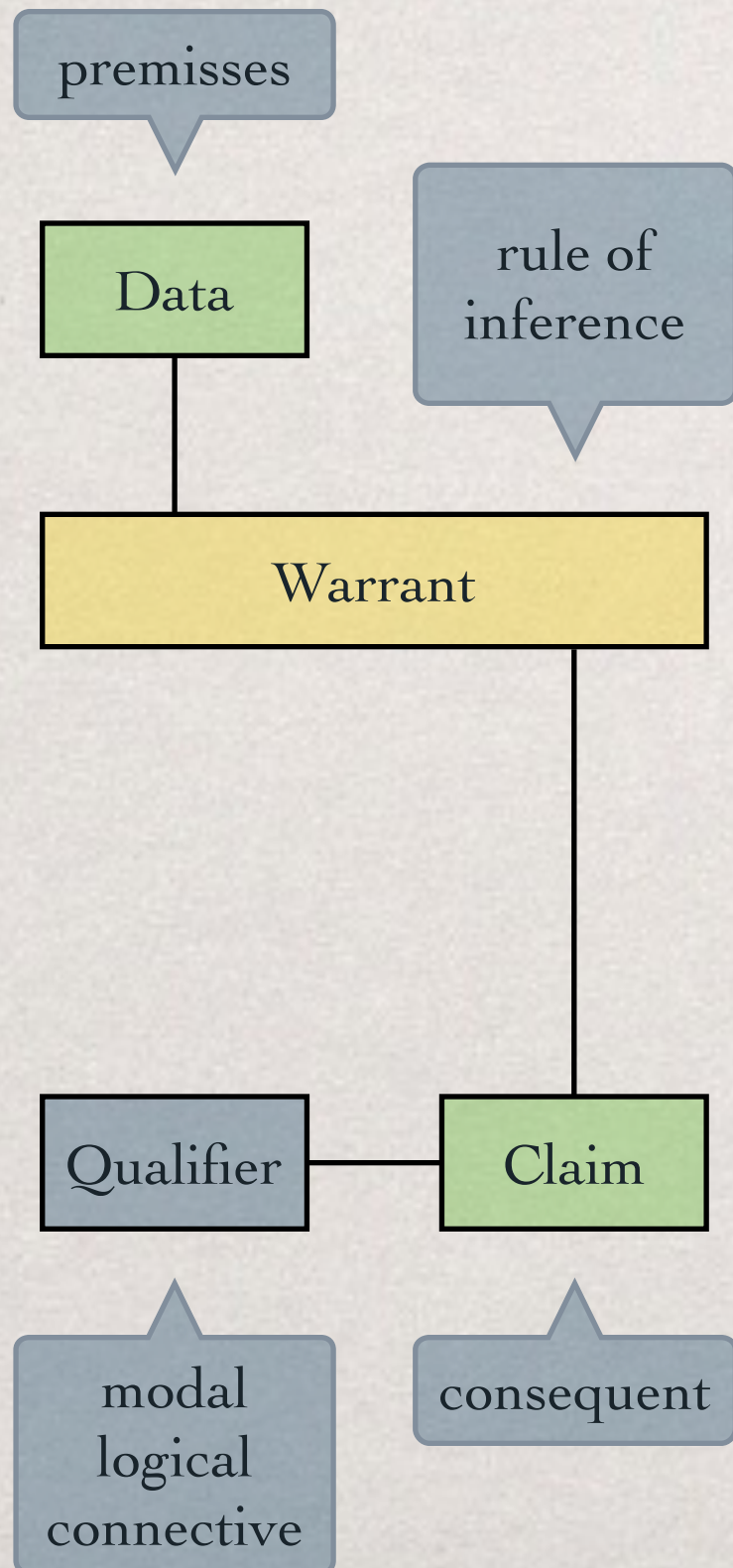
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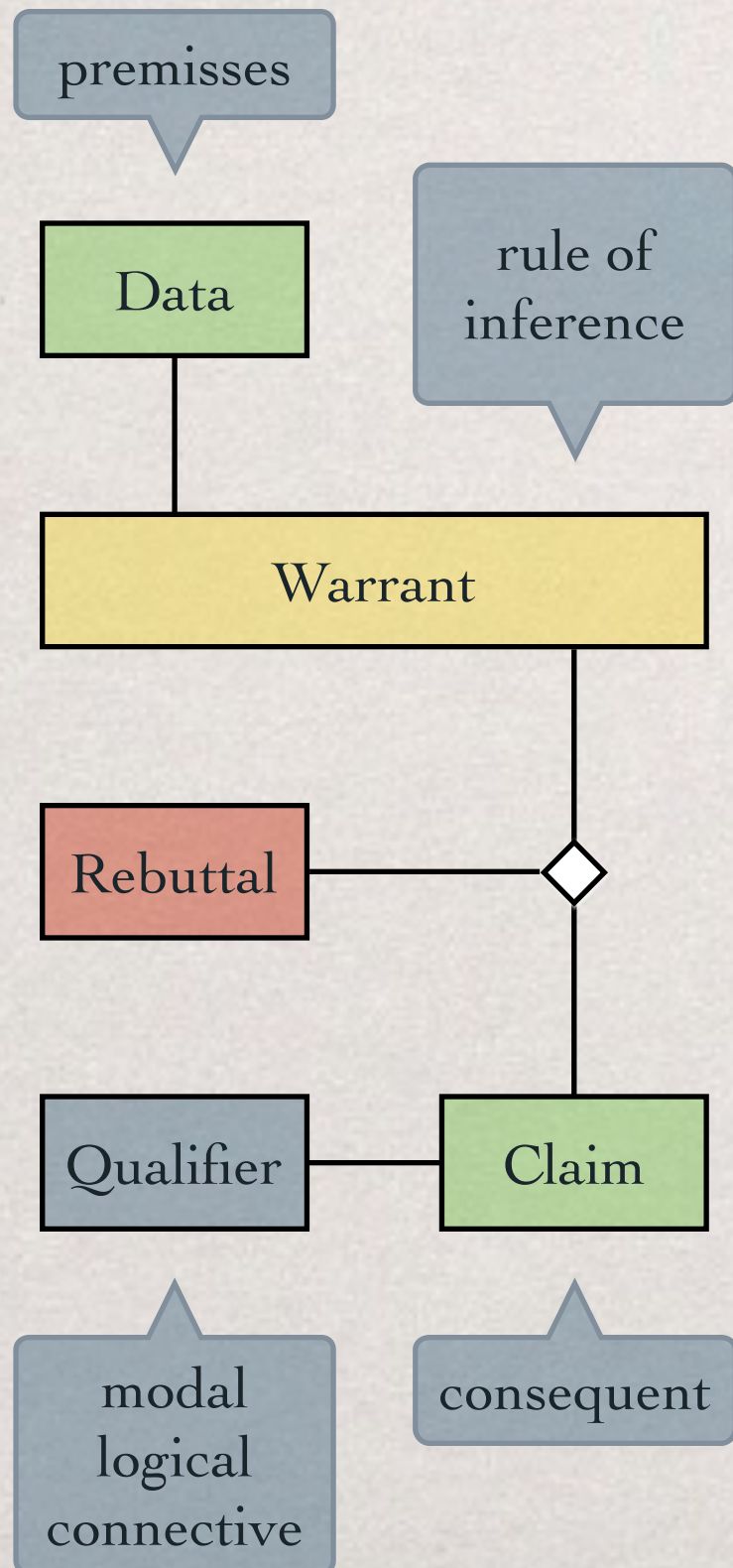
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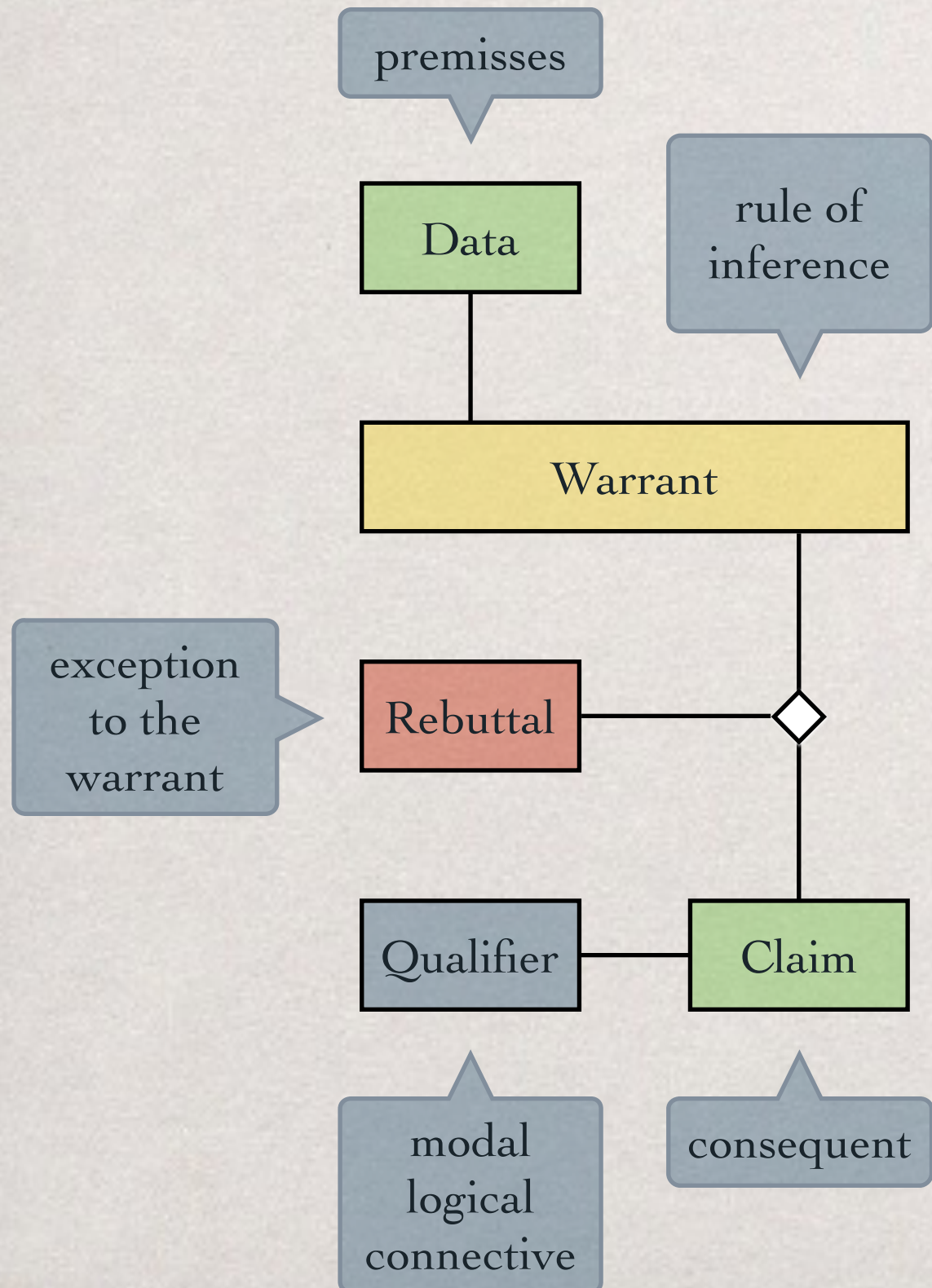
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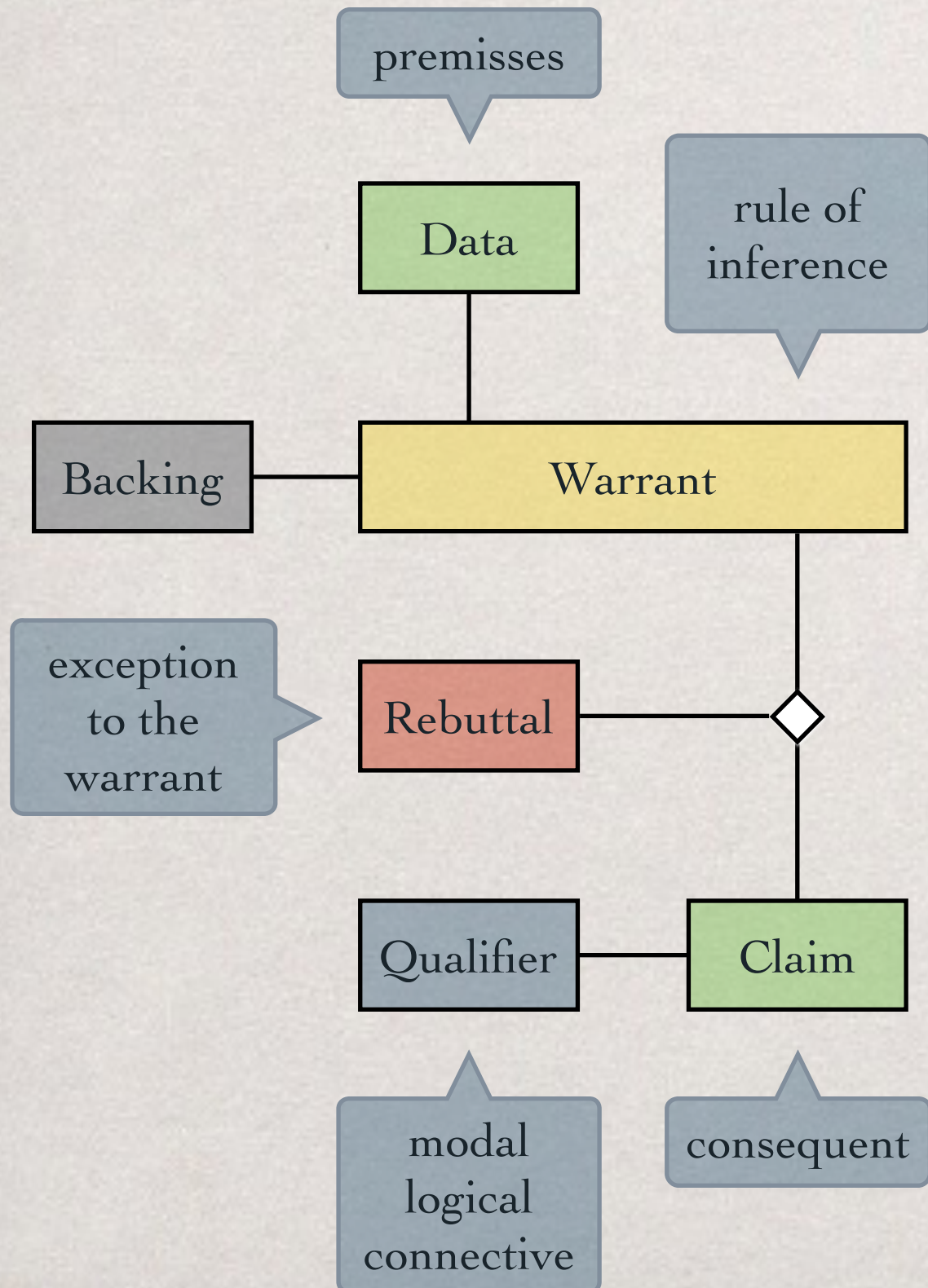
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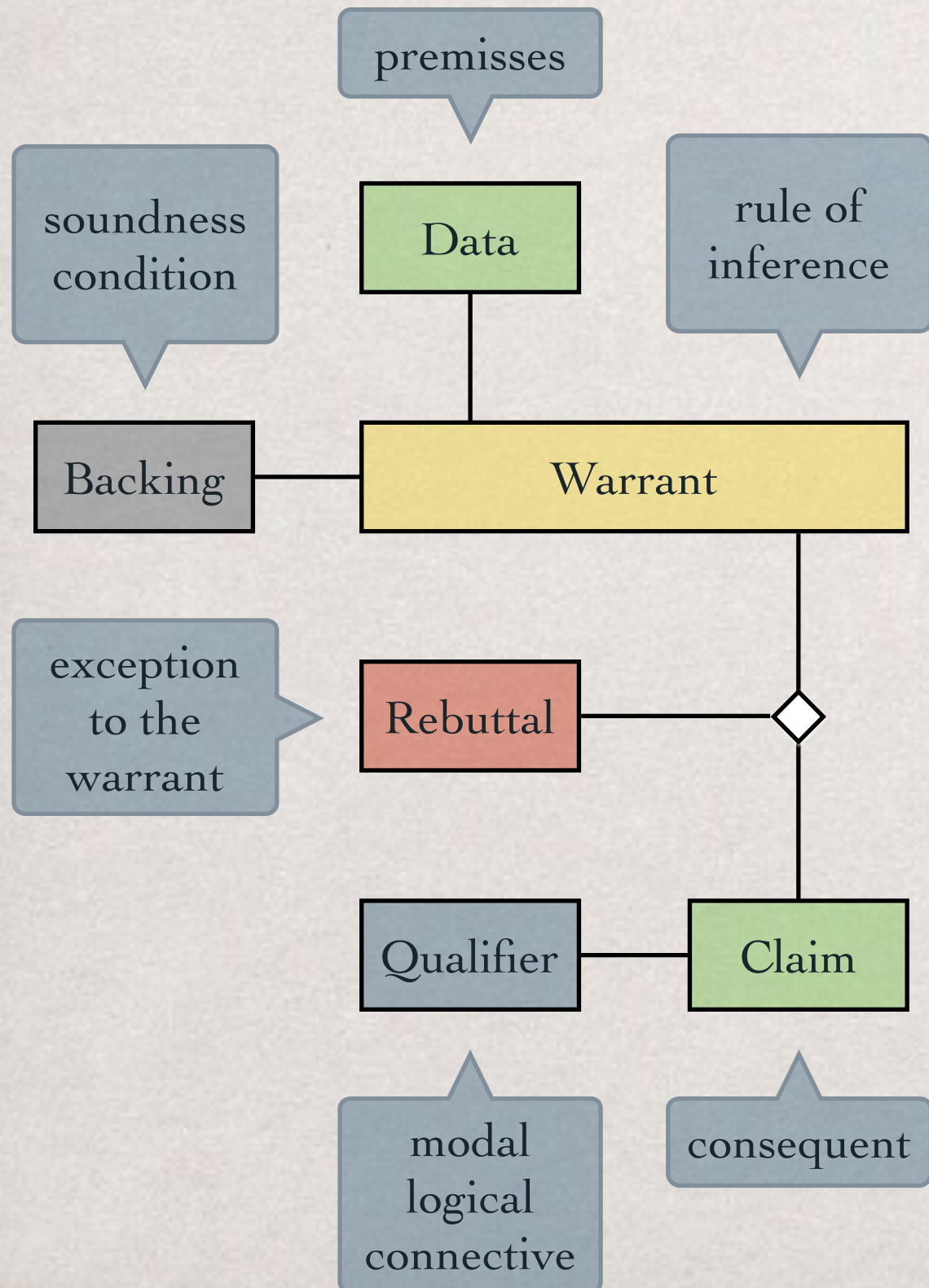
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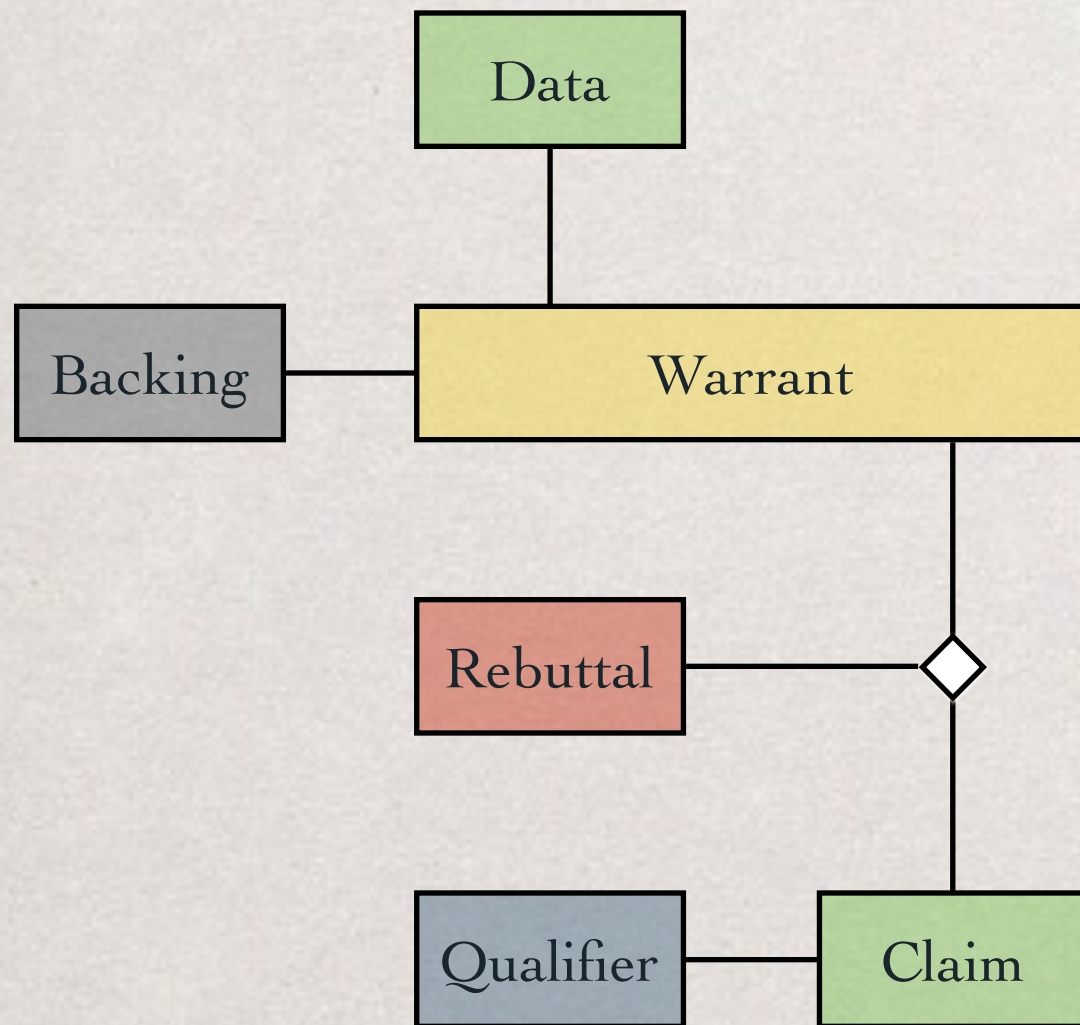
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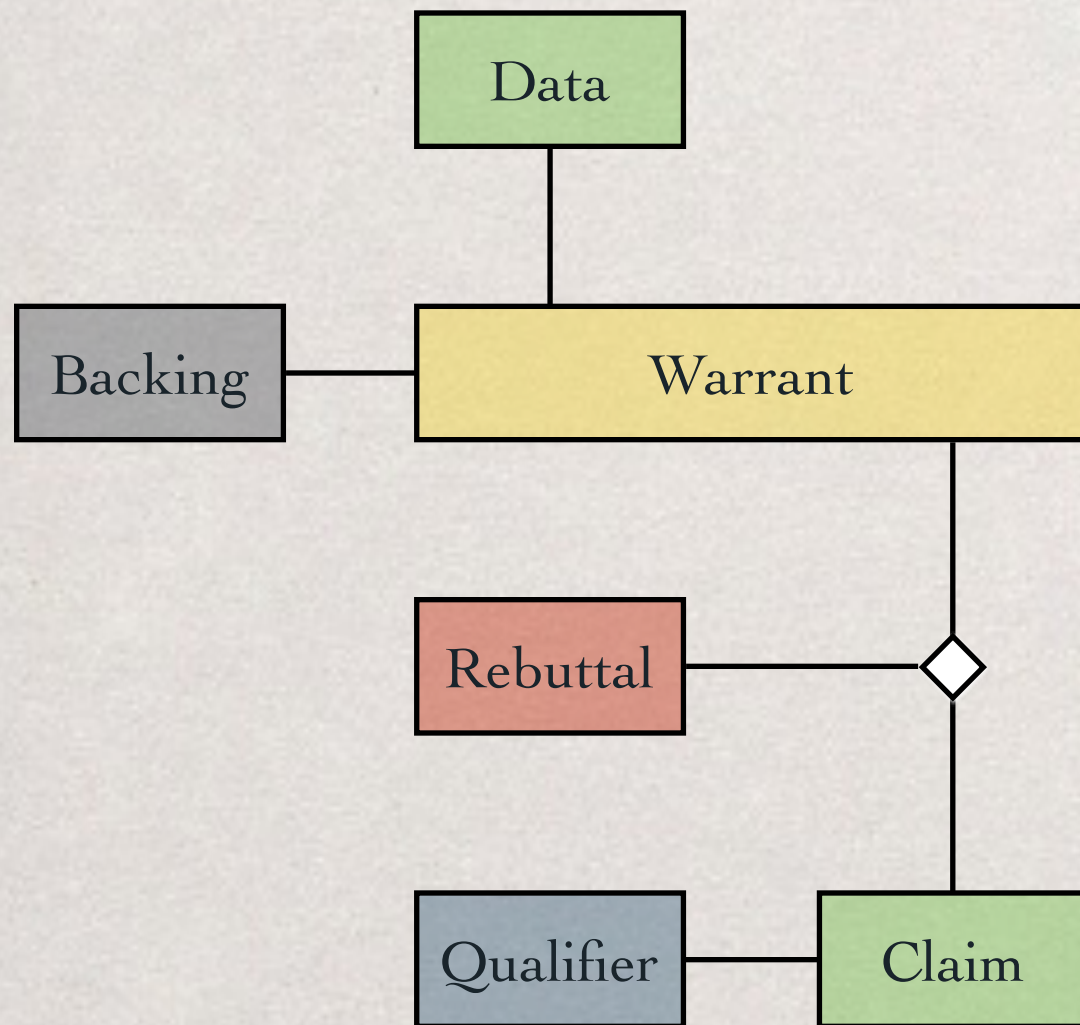
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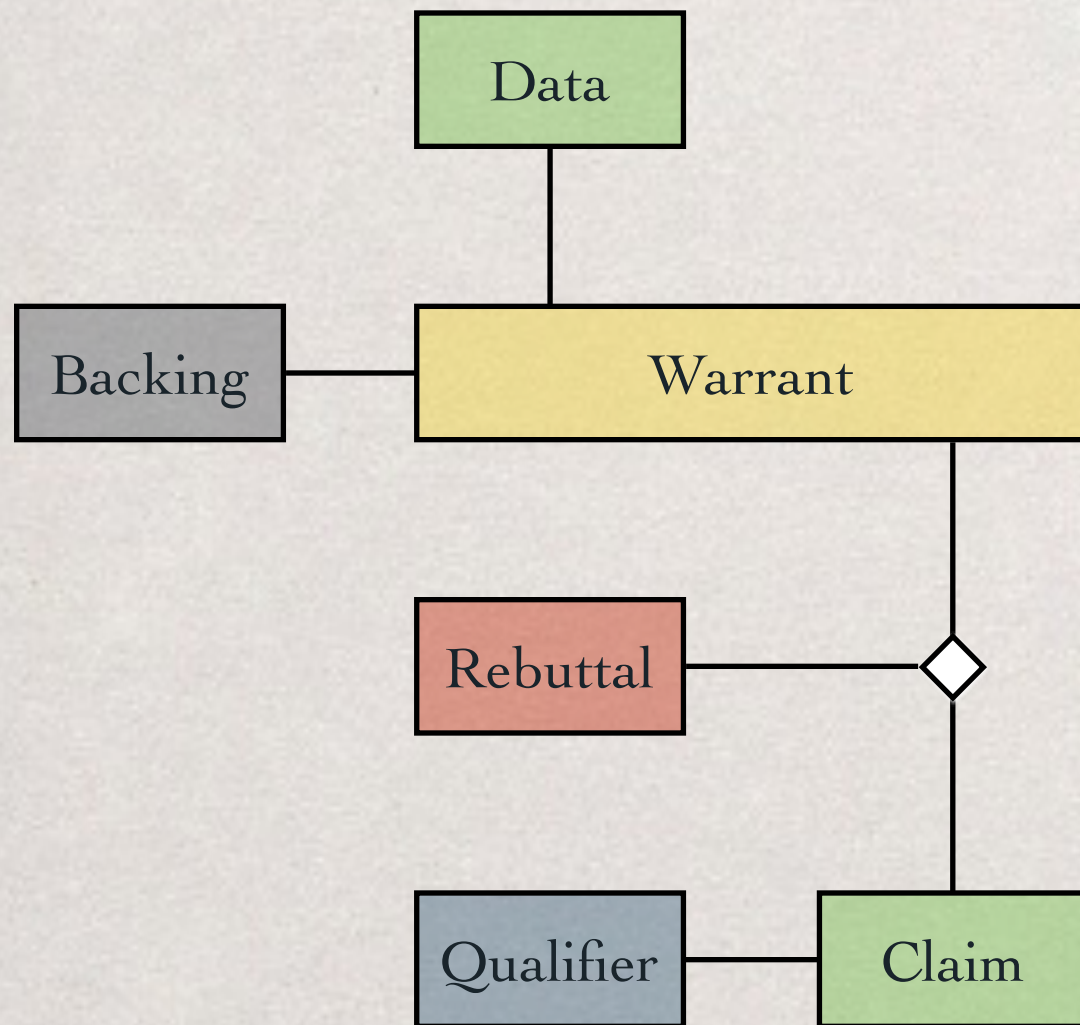
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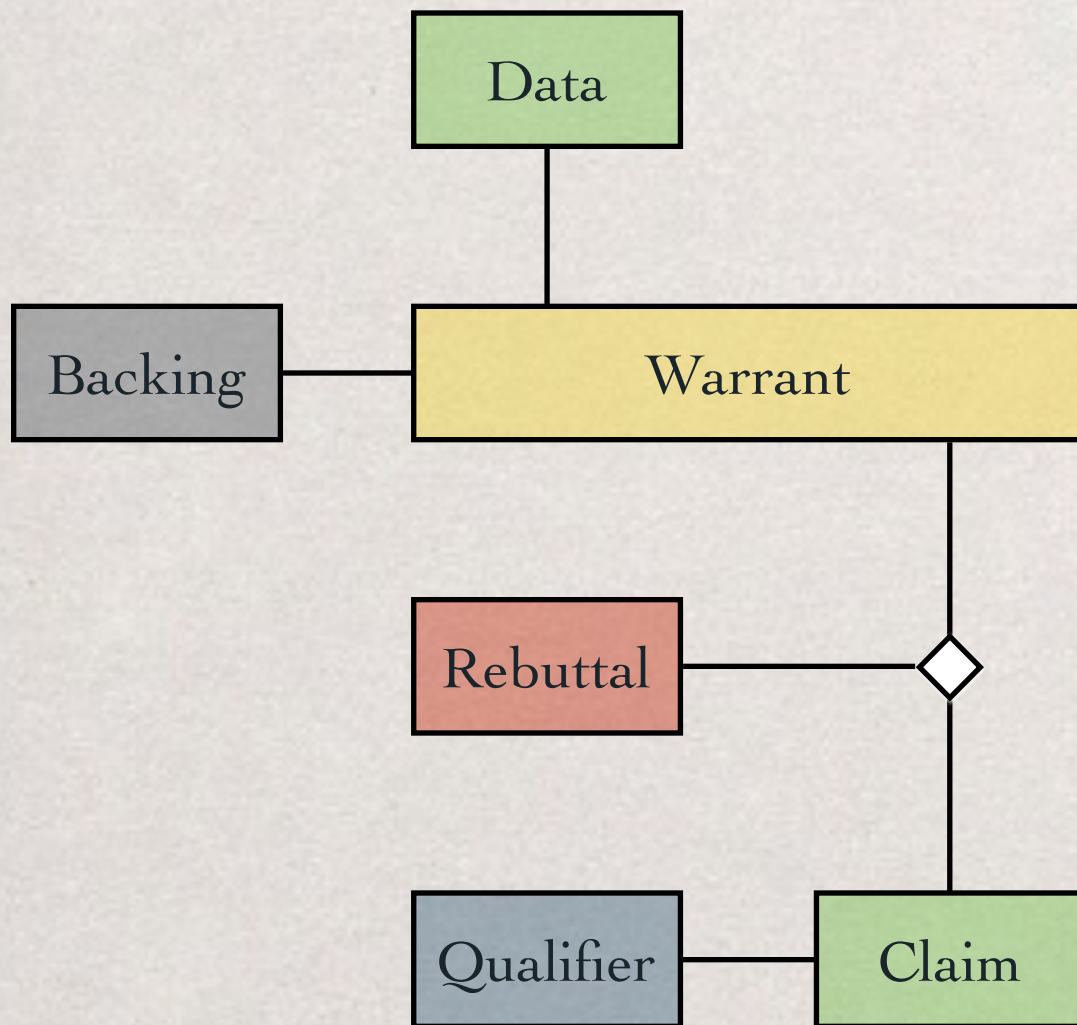
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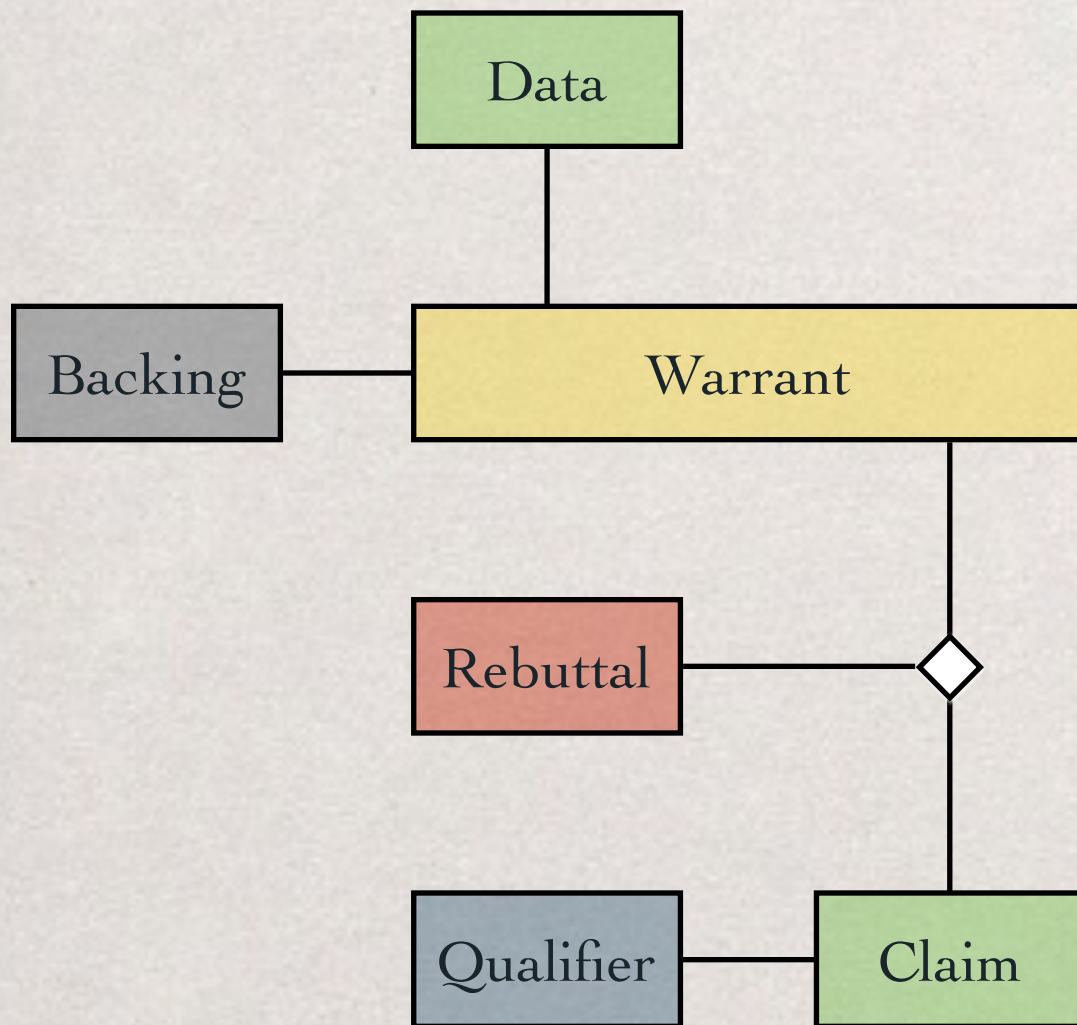
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It provides a **basis for formulating rules of inferences for safety argumentation**

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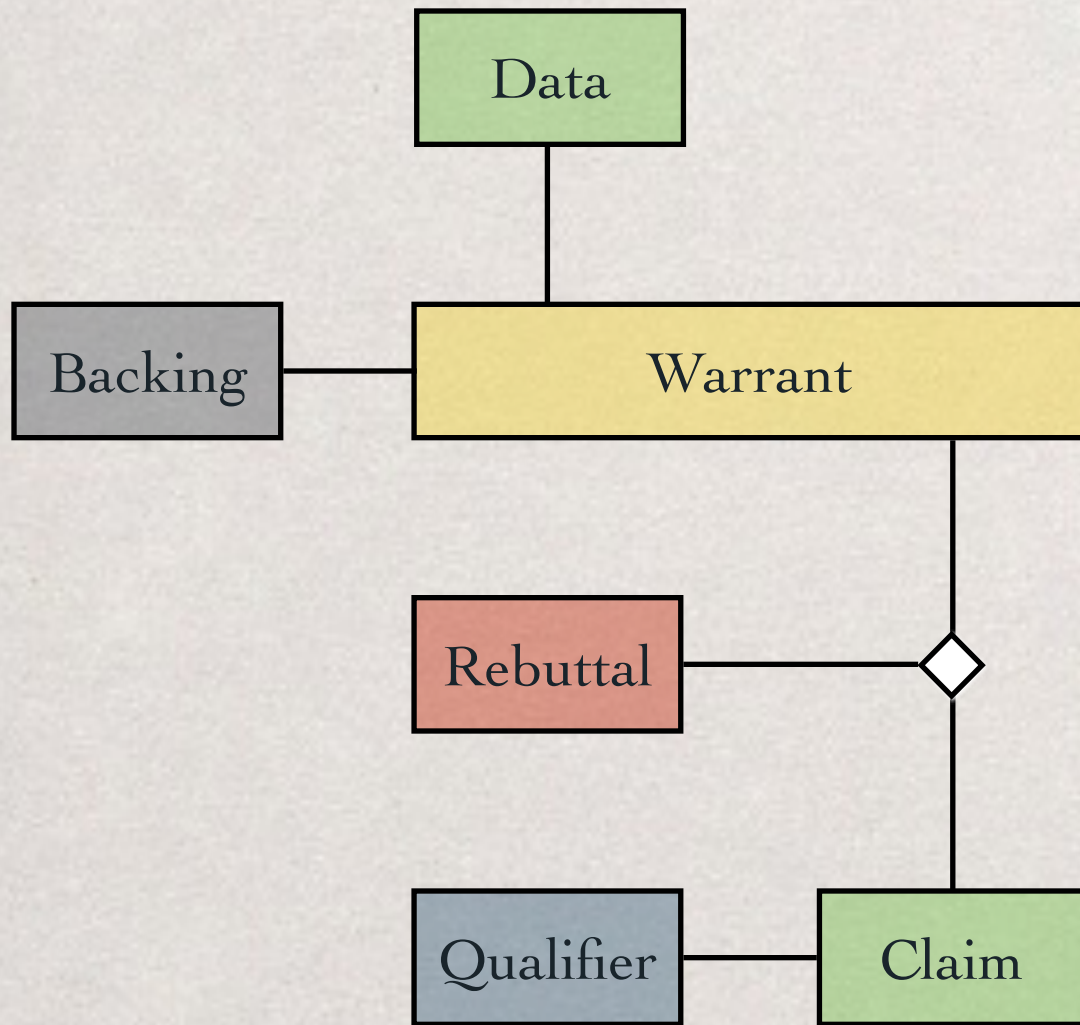
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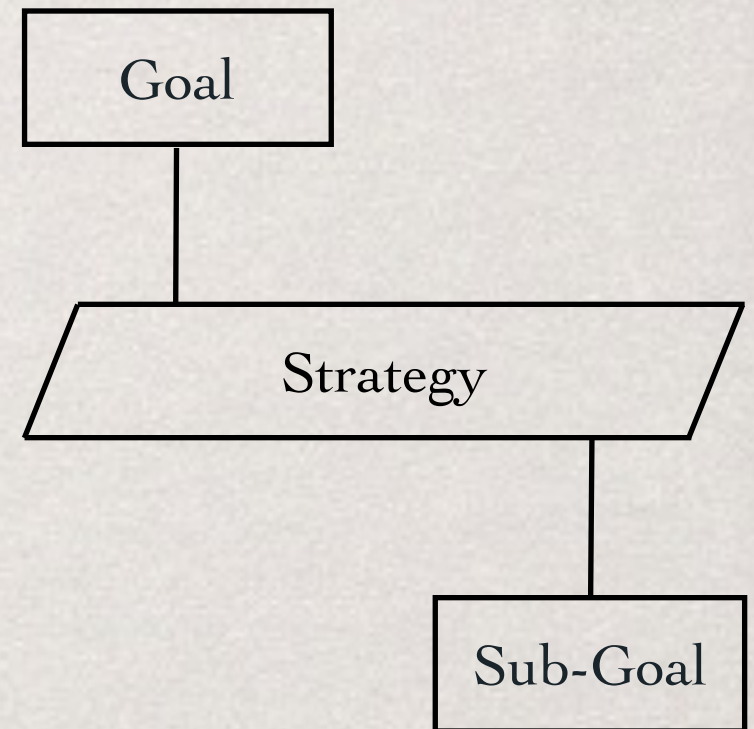


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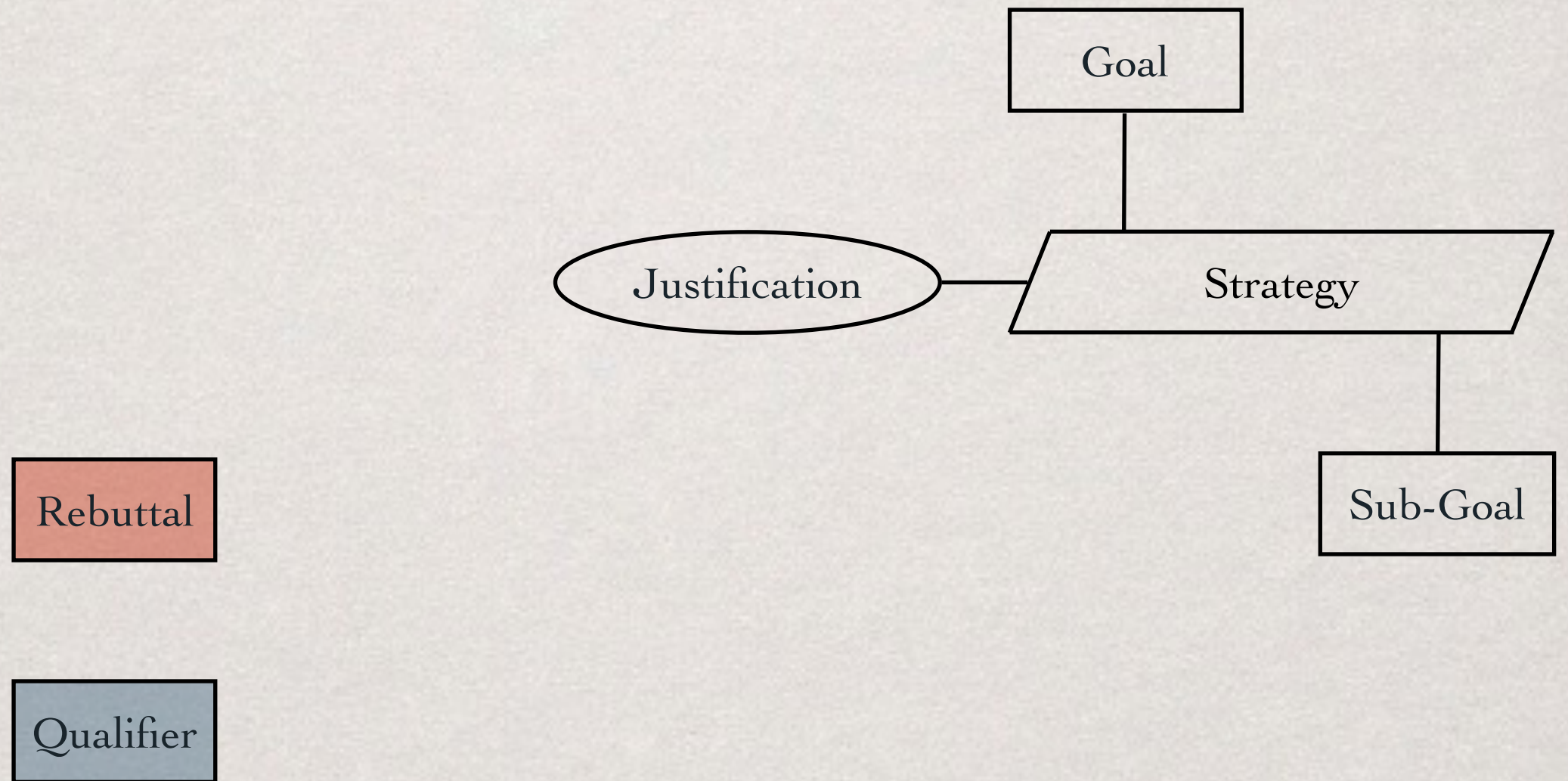
Backing

Rebuttal

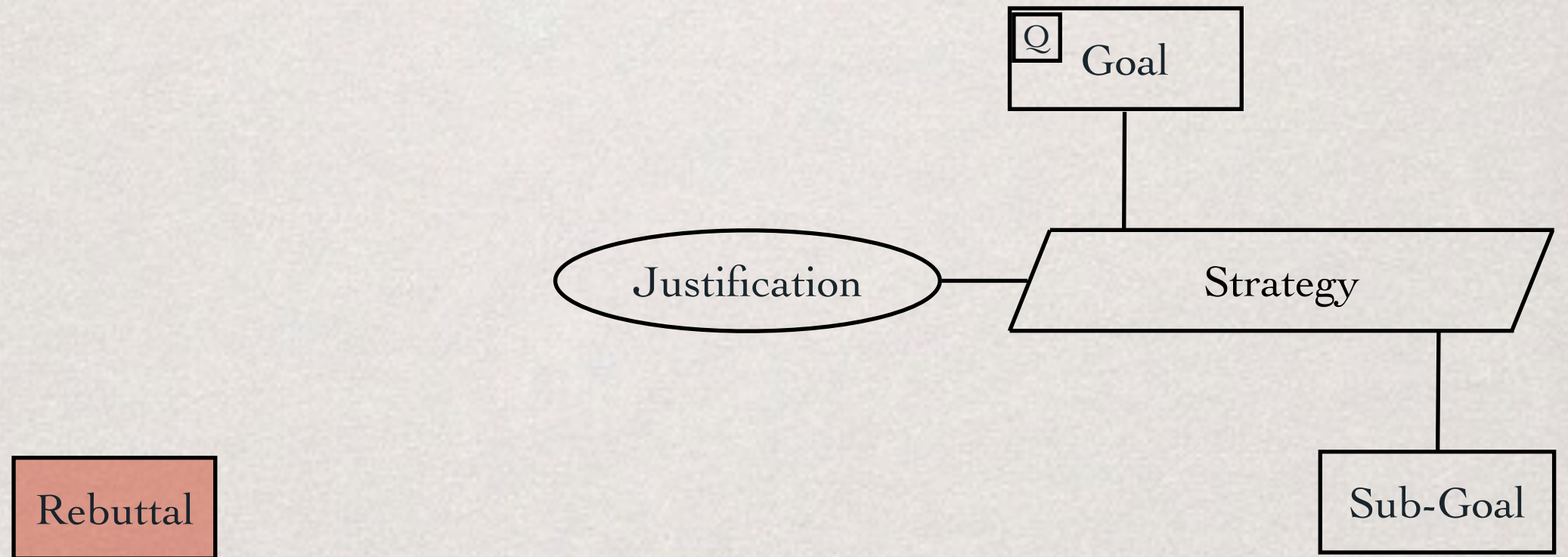
Qualifier



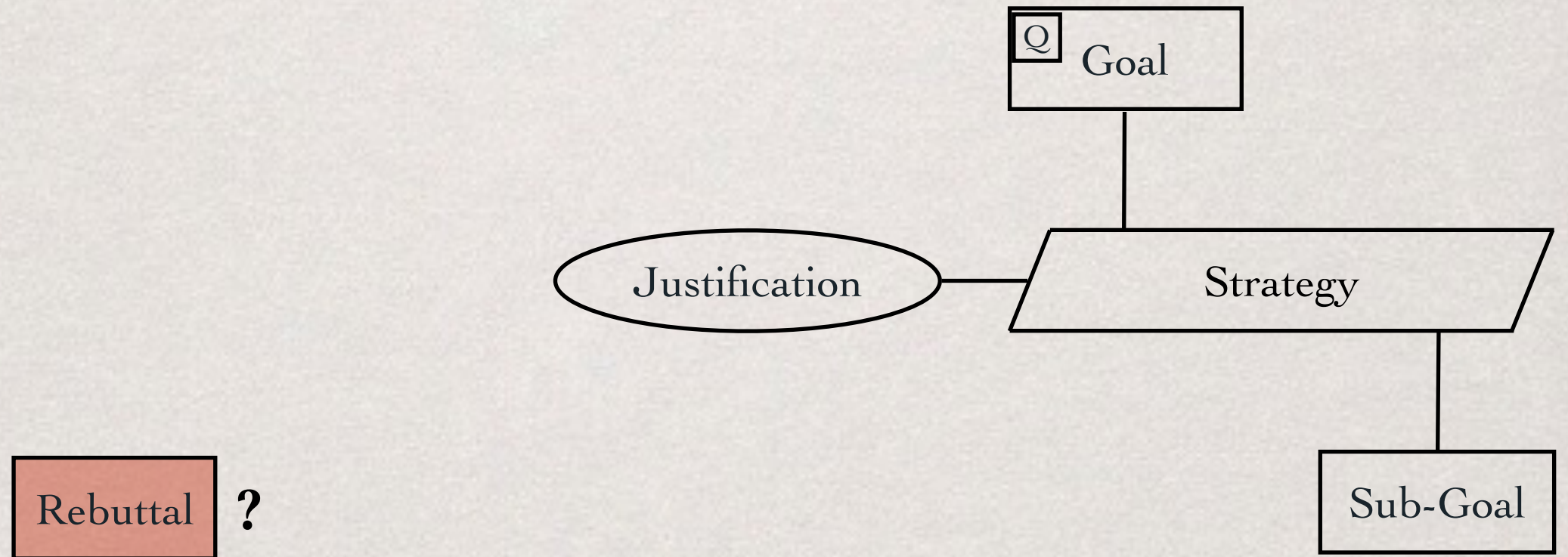
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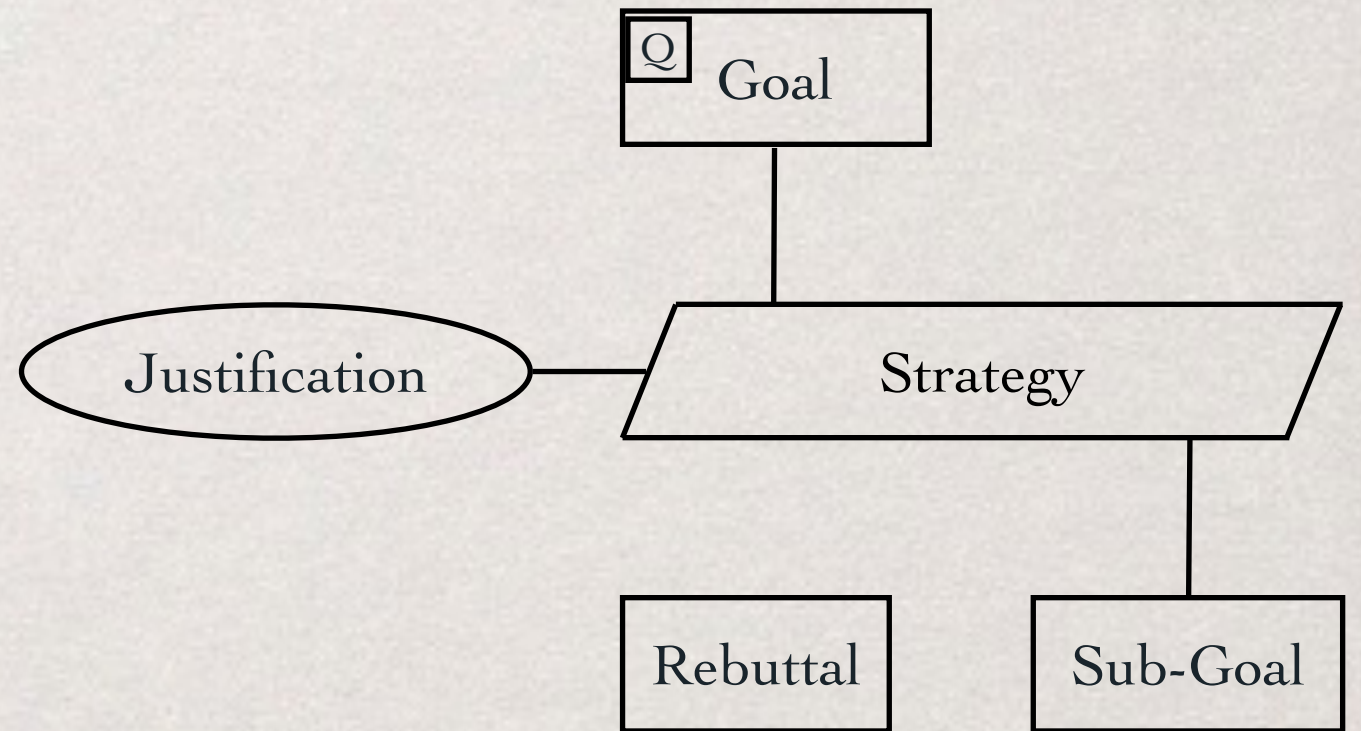
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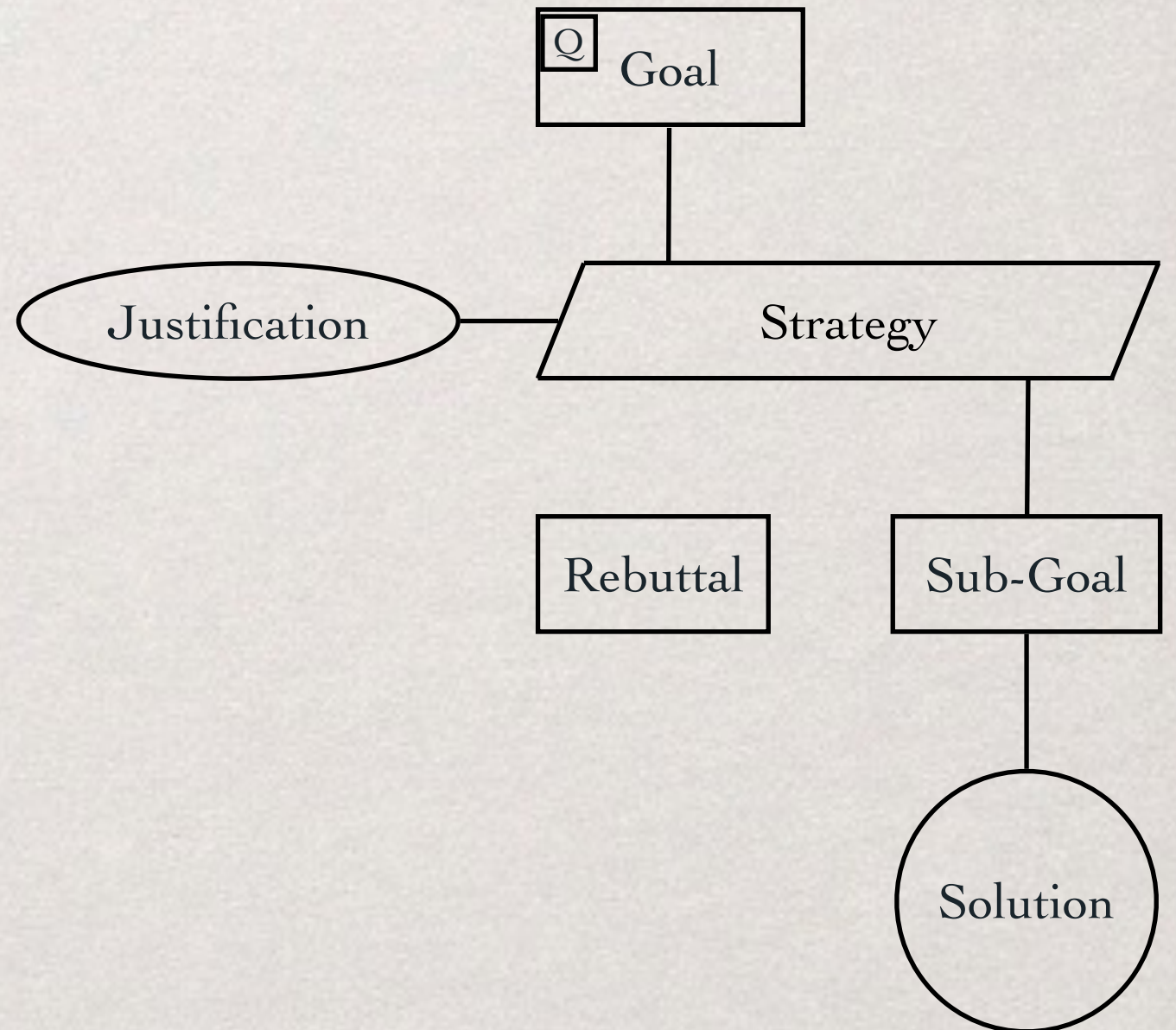
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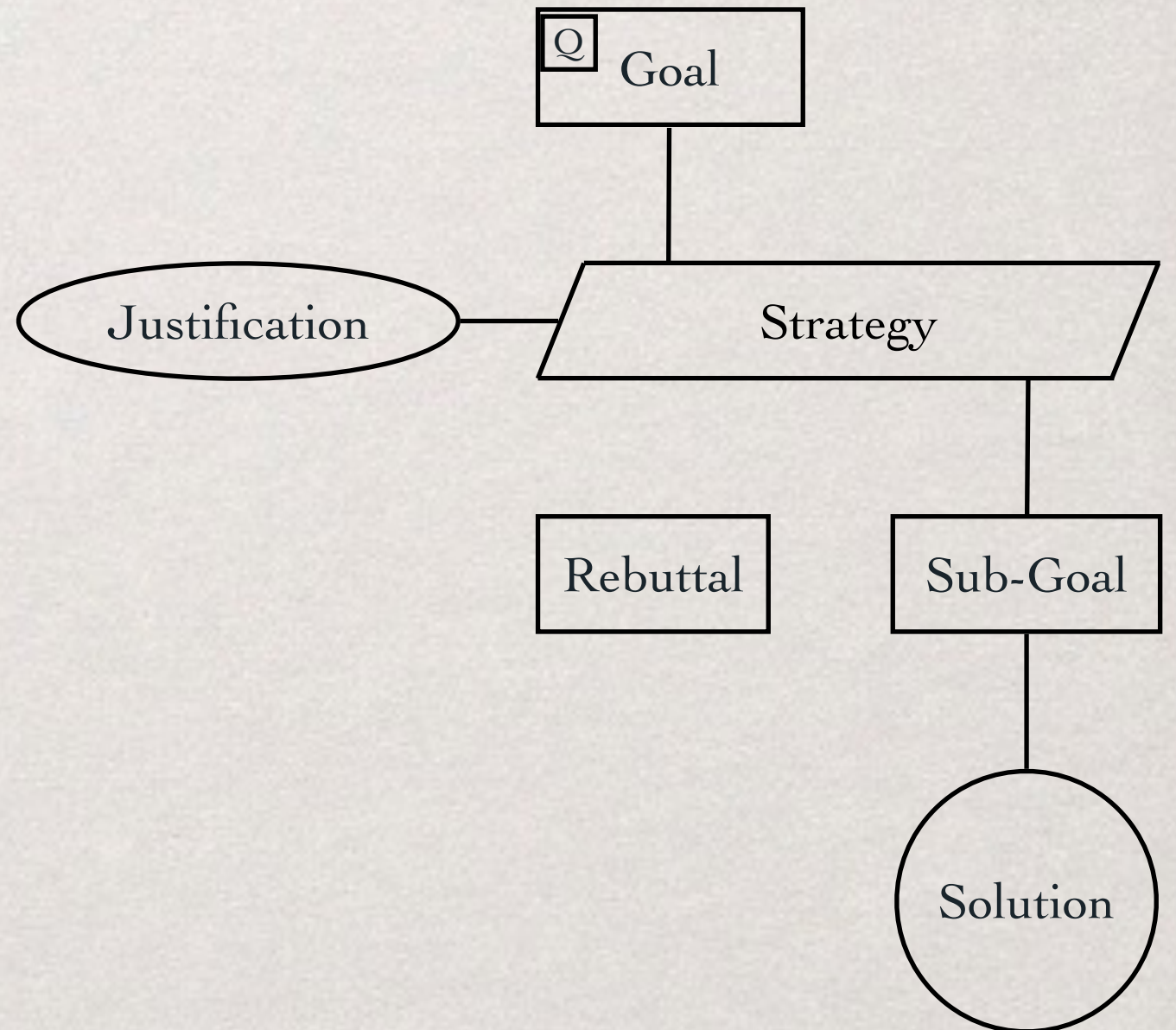
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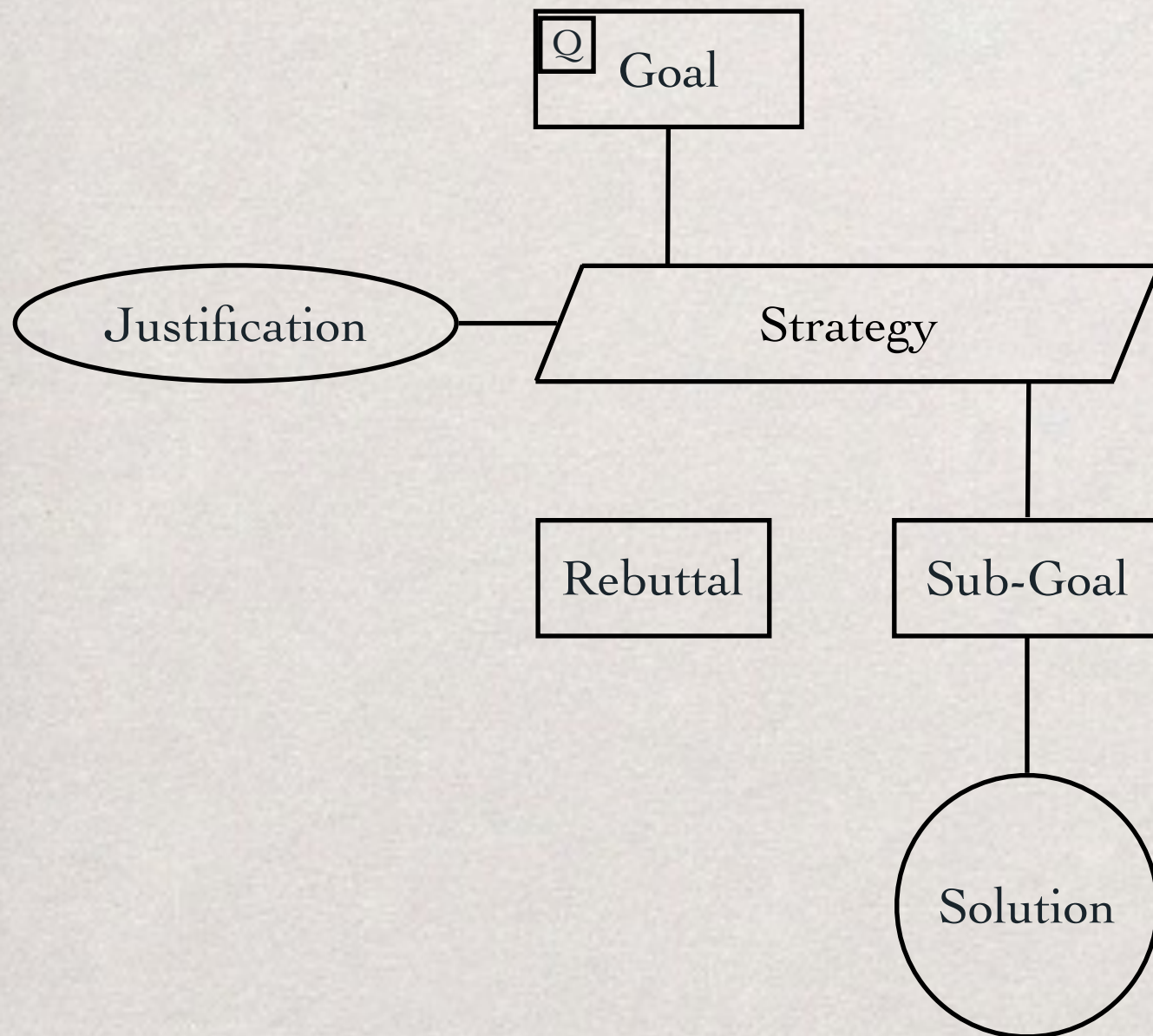
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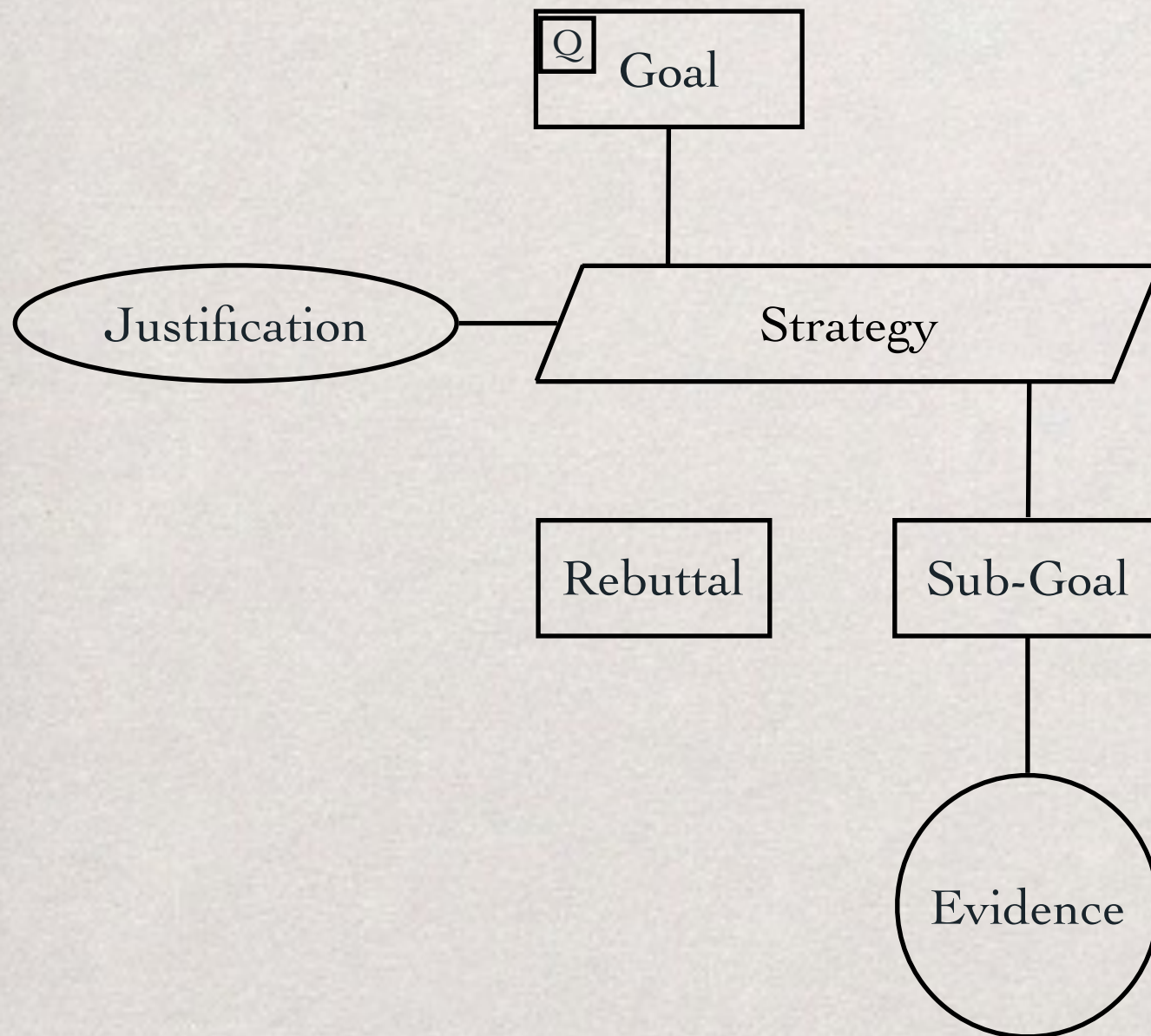


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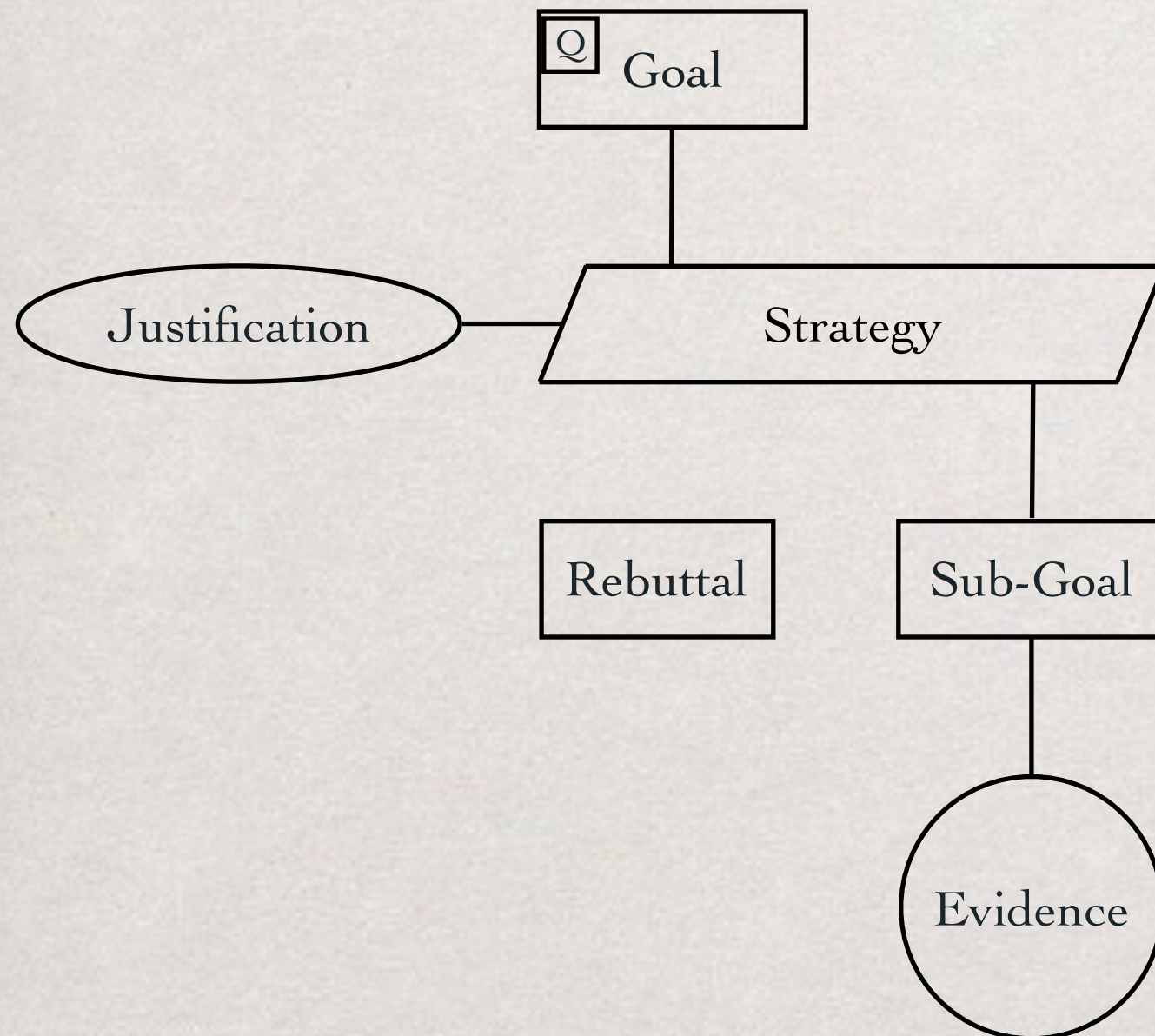
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What is captured by **GSN diagrams**?



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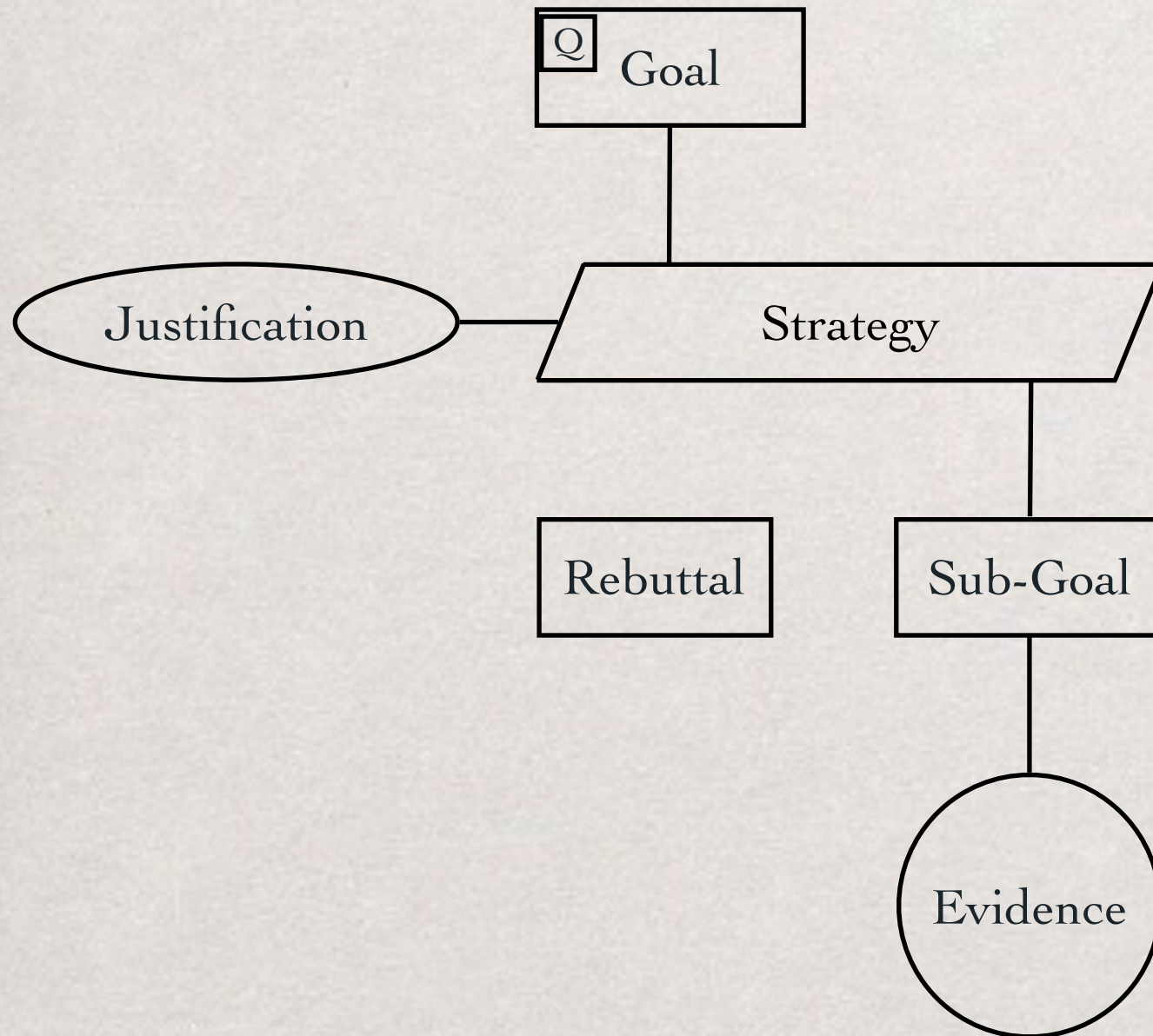
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Safety goal structured design

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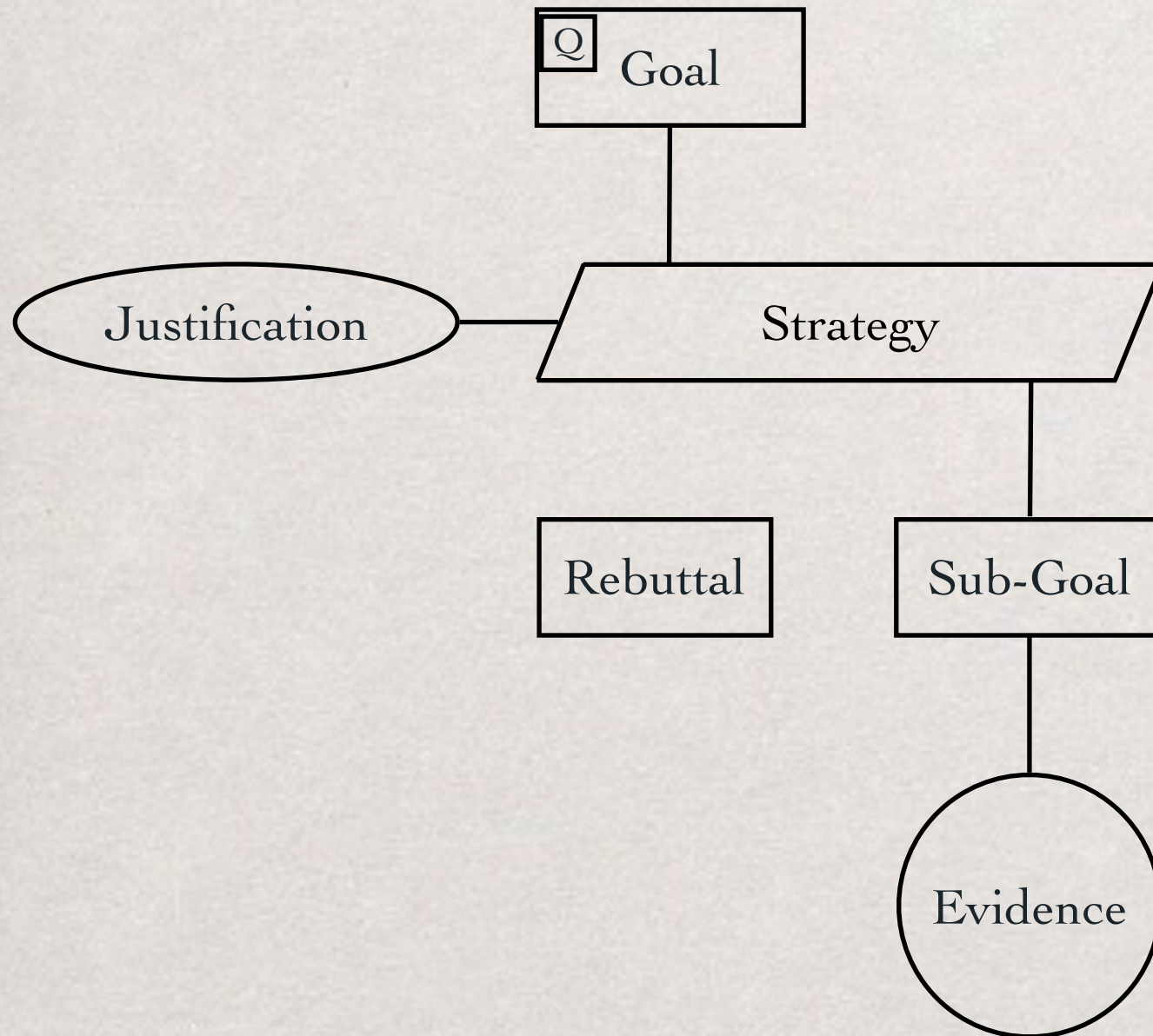


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Are GSN diagrams really capturing **safety arguments**?

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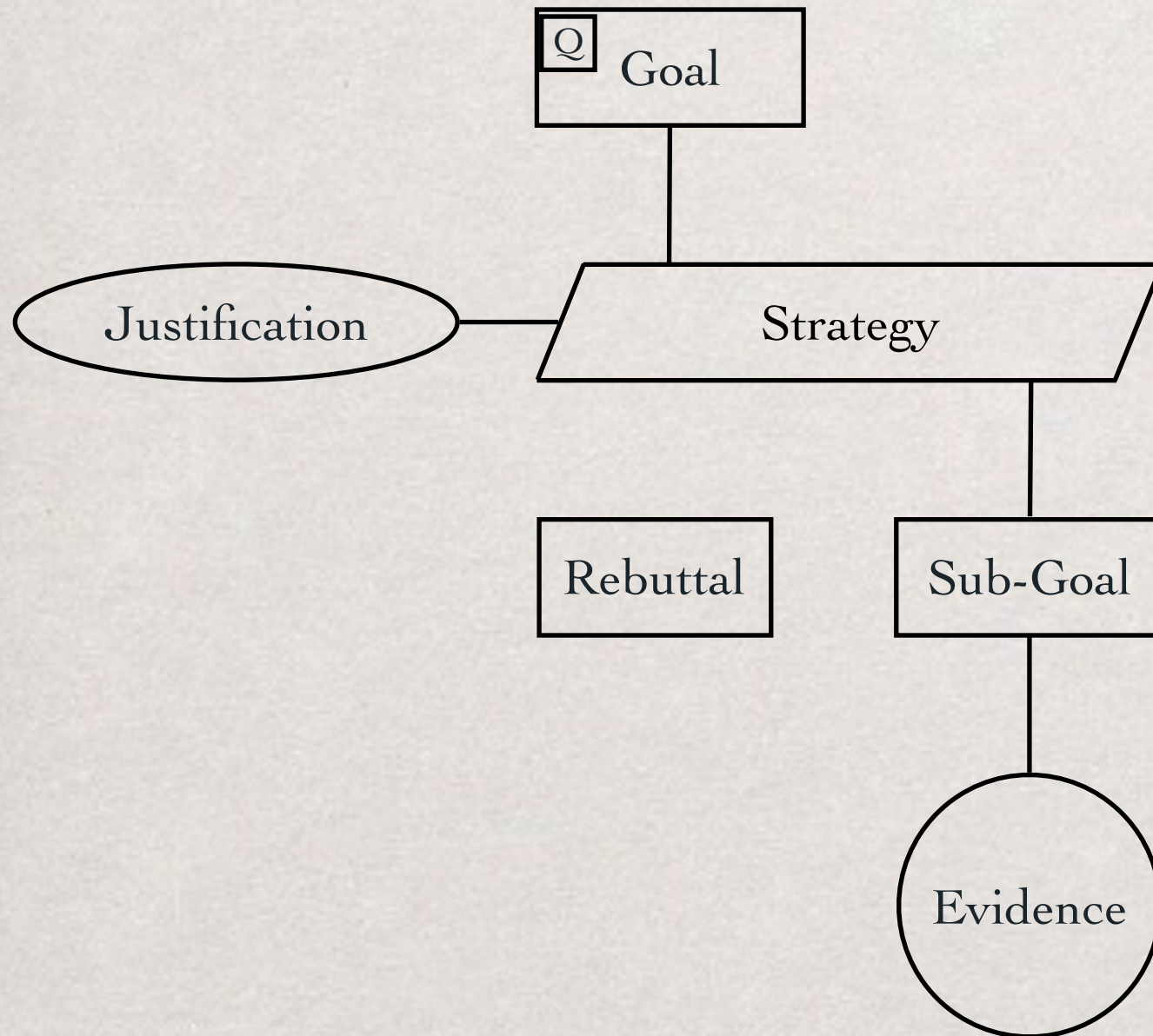


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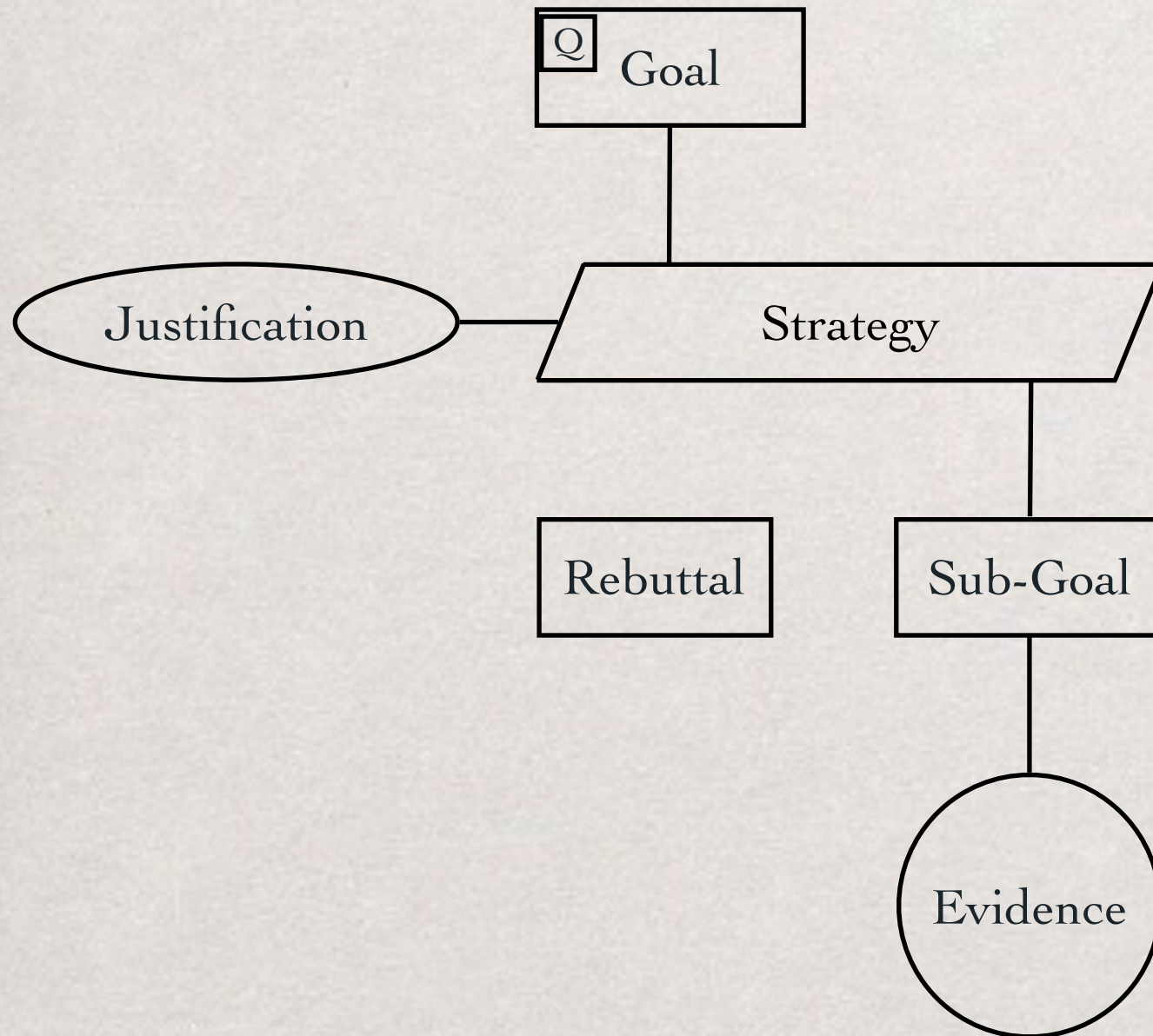
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Are GSN diagrams **logically useless**?

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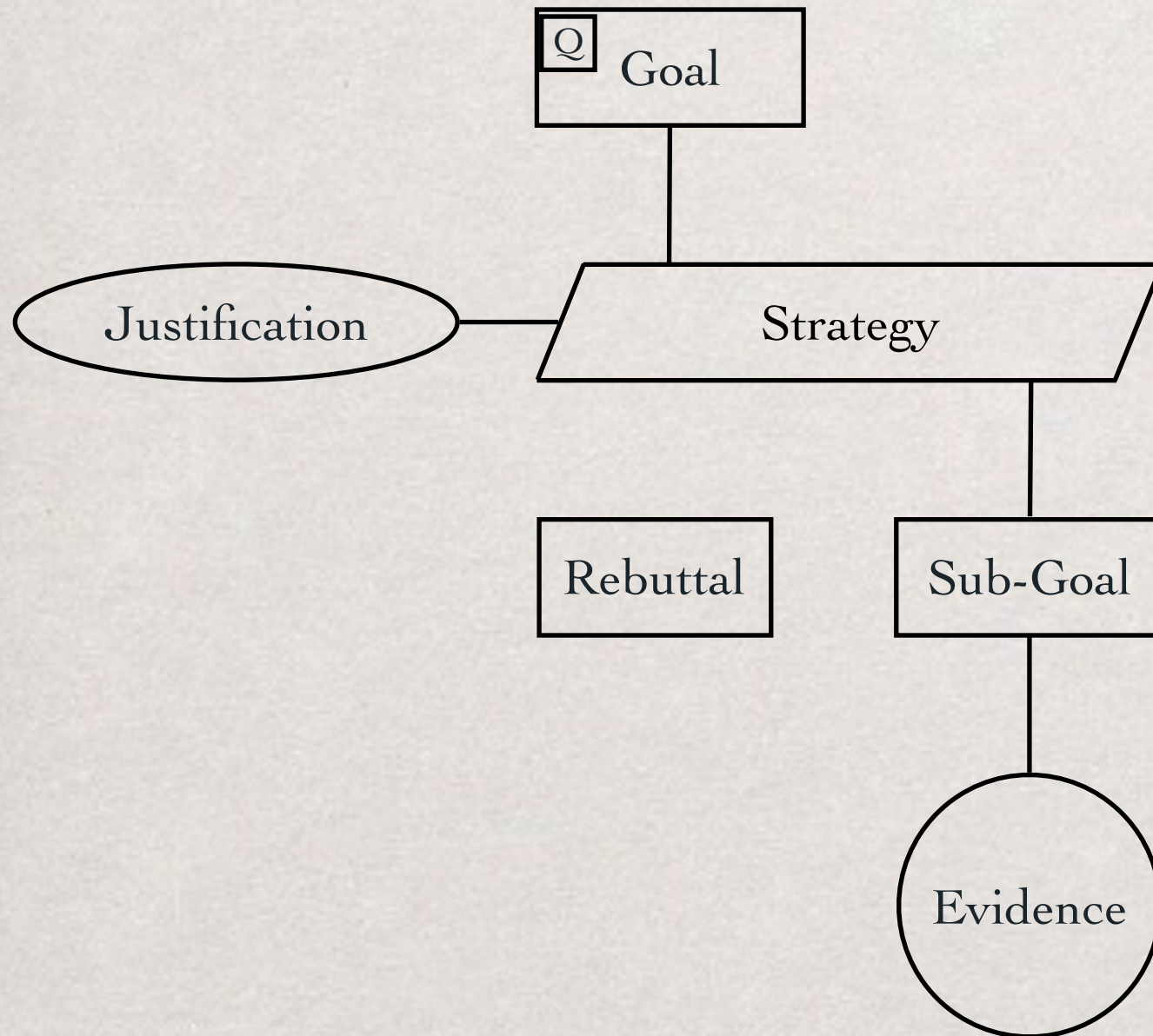
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proof strategies vs. proofs

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$$\frac{\frac{\overline{p \wedge q}}{\mathcal{D}}}{\perp} \quad (1)$$
$$\frac{\perp}{\neg(p \wedge q)} \quad (1)$$

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$$\frac{\frac{\overline{p \wedge q} \quad (1)}{\mathcal{D}} \quad \neg p \vee \neg q}{\perp} \quad (1)$$

$$\frac{\perp}{\neg(p \wedge q)} \quad (1)$$

Safety goal structured design

Are GSN diagrams really capturing **safety arguments**?

$$\frac{\frac{\overline{p \wedge q} \quad (1)}{p} \quad \frac{\overline{\neg p} \quad (2)}{\perp} \quad \frac{\overline{p \wedge q} \quad (1)}{q} \quad \frac{\overline{\neg q} \quad (2)}{\perp} \quad (2)}{\neg p \vee \neg q} \quad (2)$$

$$\frac{\perp}{\neg(p \wedge q)} \quad (1)$$

Are GSN diagrams **logically useless**?

proof strategies vs. proofs

GSN DIAGRAMS

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$$\frac{\frac{\overline{p \wedge q}^{(1)}}{\mathcal{D}}}{\neg p \vee \neg q}}{\overline{\neg(p \wedge q)}^{(1)}}$$

Safety goal structured design

Are GSN diagrams really capturing **safety arguments**?

$$\frac{\frac{\overline{p \wedge q}^{(1)}}{p} \quad \frac{\overline{\neg p}^{(2)}}{\perp}}{\neg p \vee \neg q} \quad \frac{\frac{\overline{p \wedge q}^{(1)}}{q} \quad \frac{\overline{\neg q}^{(2)}}{\perp}}{\perp}^{(2)}}{\overline{\neg(p \wedge q)}^{(1)}}$$

Are GSN diagrams **logically useless**?

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SUMMARY

Presented some basic elements of logic as a science of reasoning

Commented on what safety argumentation looks like when seen logically

Discussed the logical status of Toulmin's argument patterns

Discussed the role of GSN diagrams in the context of safety argumentation

THANKS FOR LISTENING

“Can you suggest any fallacy?”

“He could not have fractured his skull in a fall?”

“In a morass, Watson?”

“I am at my wit's end”.

“Tut, tut; we have solved some worse problems.

At least we have plenty of material, if we can only use it”.

Sir Arthur Conan Doyle - The Return of Sherlock Holmes