On Formal Models of Legal Argument: Modelling Everyday Legal Argument

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ICAIL-09

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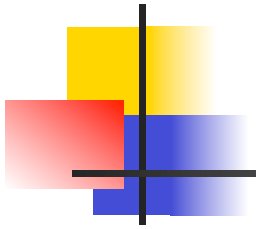
A recent email

I am a practicing bankruptcy lawyer in Los Angeles, California. I am attempting to get a copy of Cabaret, or Hypo, or Cato, so that I can use it in my practice.

I saw your name and email on the Internet.

I was wondering - - is this type of software available to practitioners?

Thank you for any assistance or input you can provide.

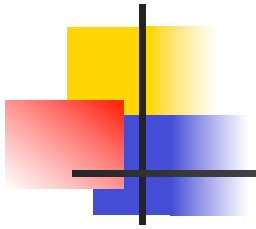


An embarrassment

- Why are there so few fielded applications of our models of legal argument?
  - The knowledge-acquisition bottleneck
  - We focus too much on leading cases

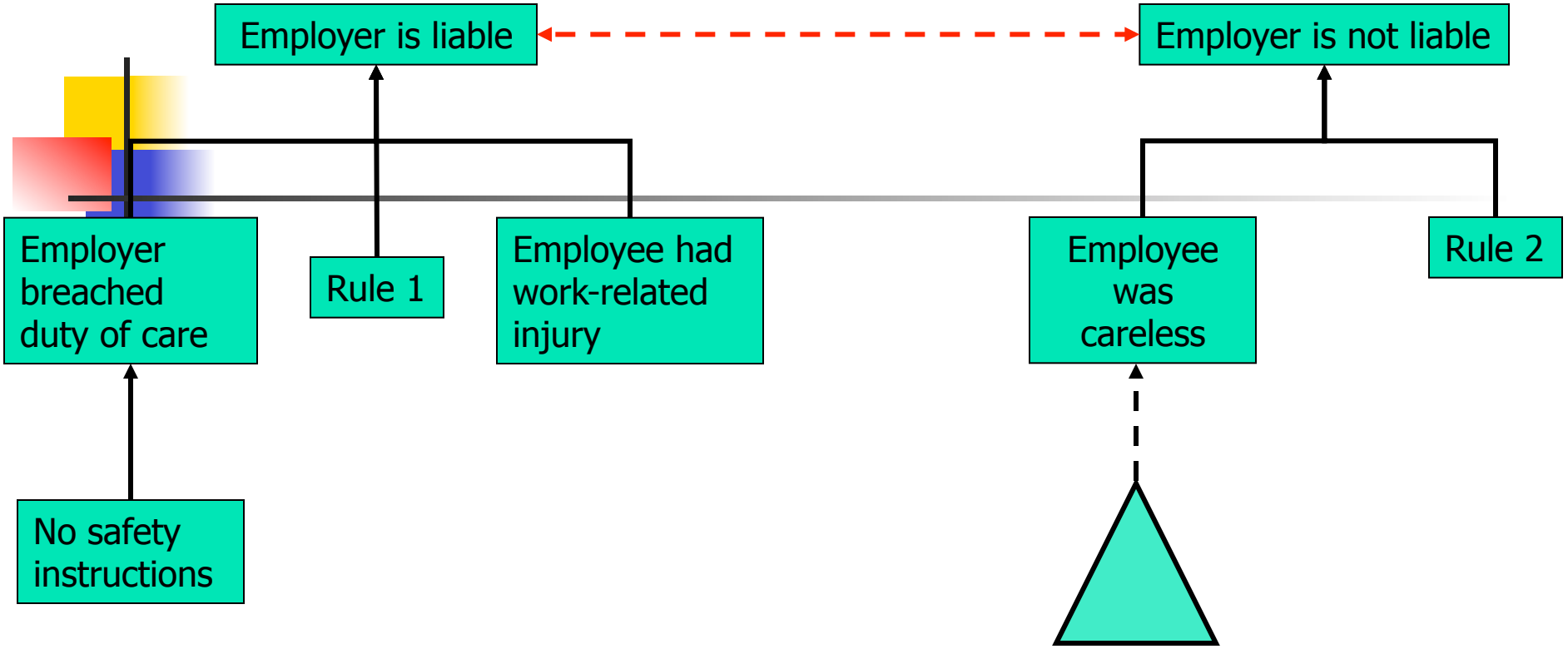
Argumentation management systems

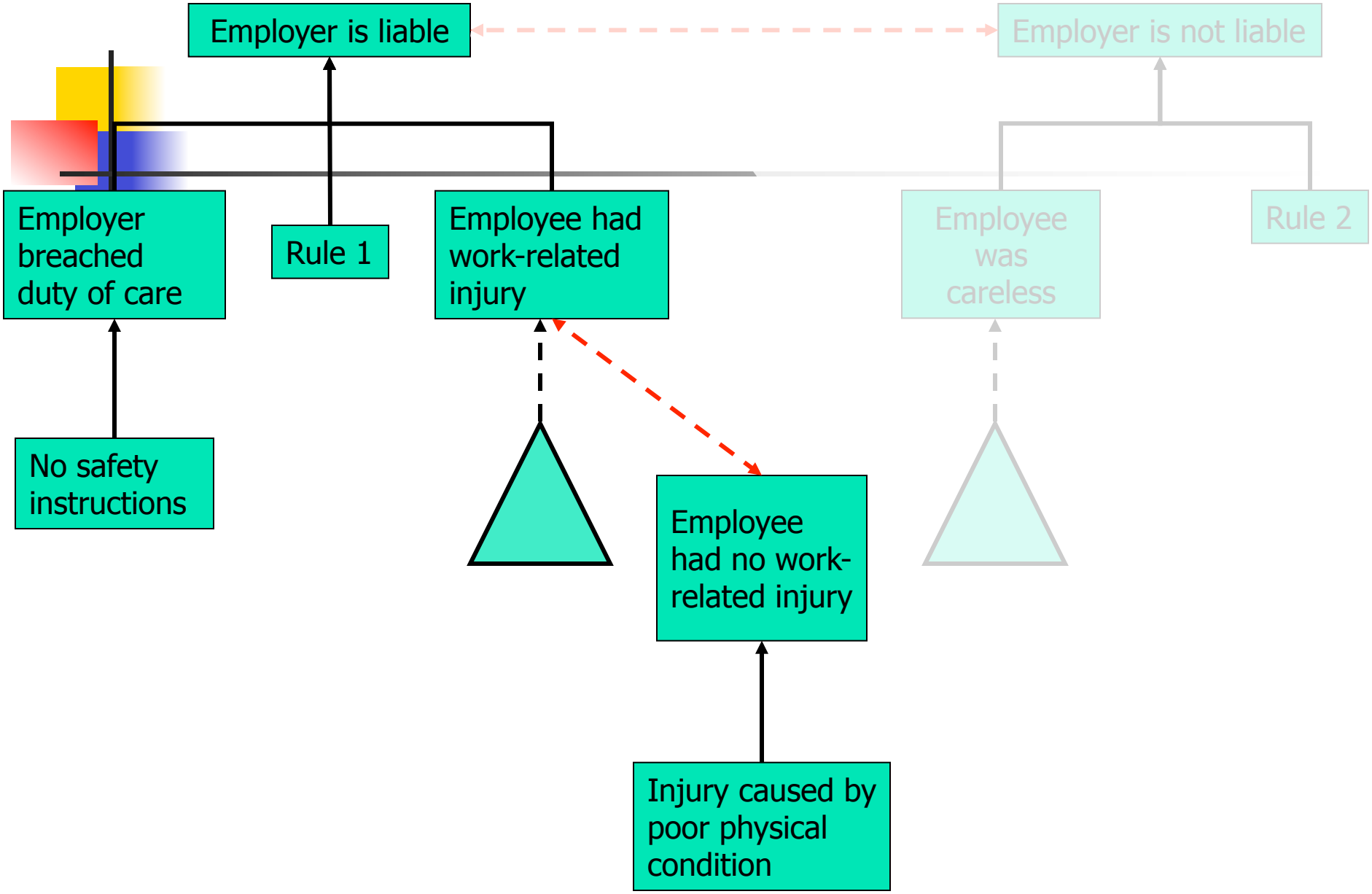
- Support for
  - drafting and visualising argumentation
  - structuring argumentative texts
- Useful for:
  - Sense making
  - Case file management
- Not knowledge-based!



This talk:

- Aim: A formal model of everyday legal argument:
  - With well-understood semantics and proof theory
  - Natural and intuitive for users
- Motivation: increase prospects of fielded applications
- Limitations:
  - Mainly civil-law systems
  - Only inference


Employer is liable
Employer is not liable
Employer breached duty of care
Rule 1
Employee had work-related injury
Employee was careless
Rule 2
No safety instructions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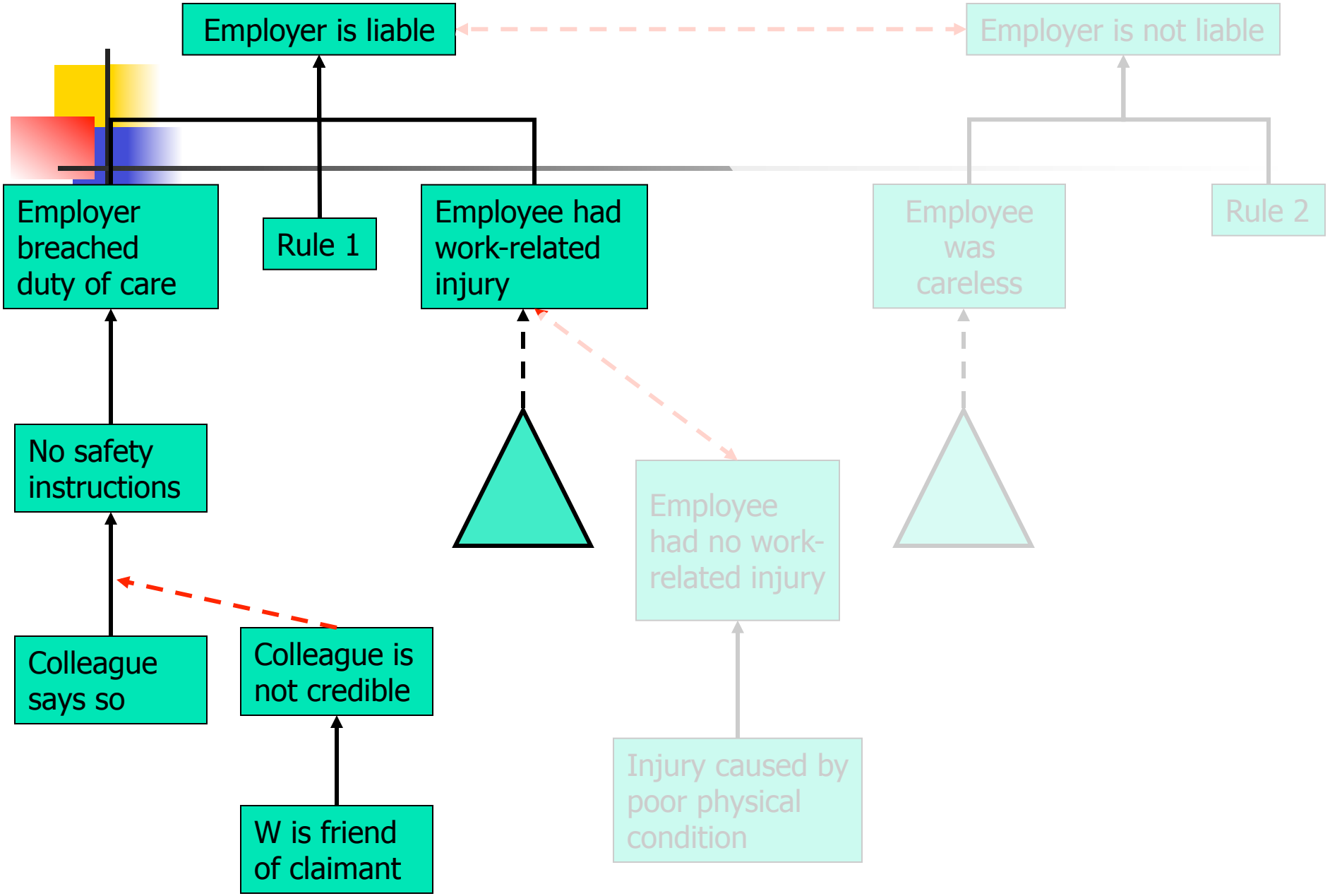
Injury caused by poor physical condition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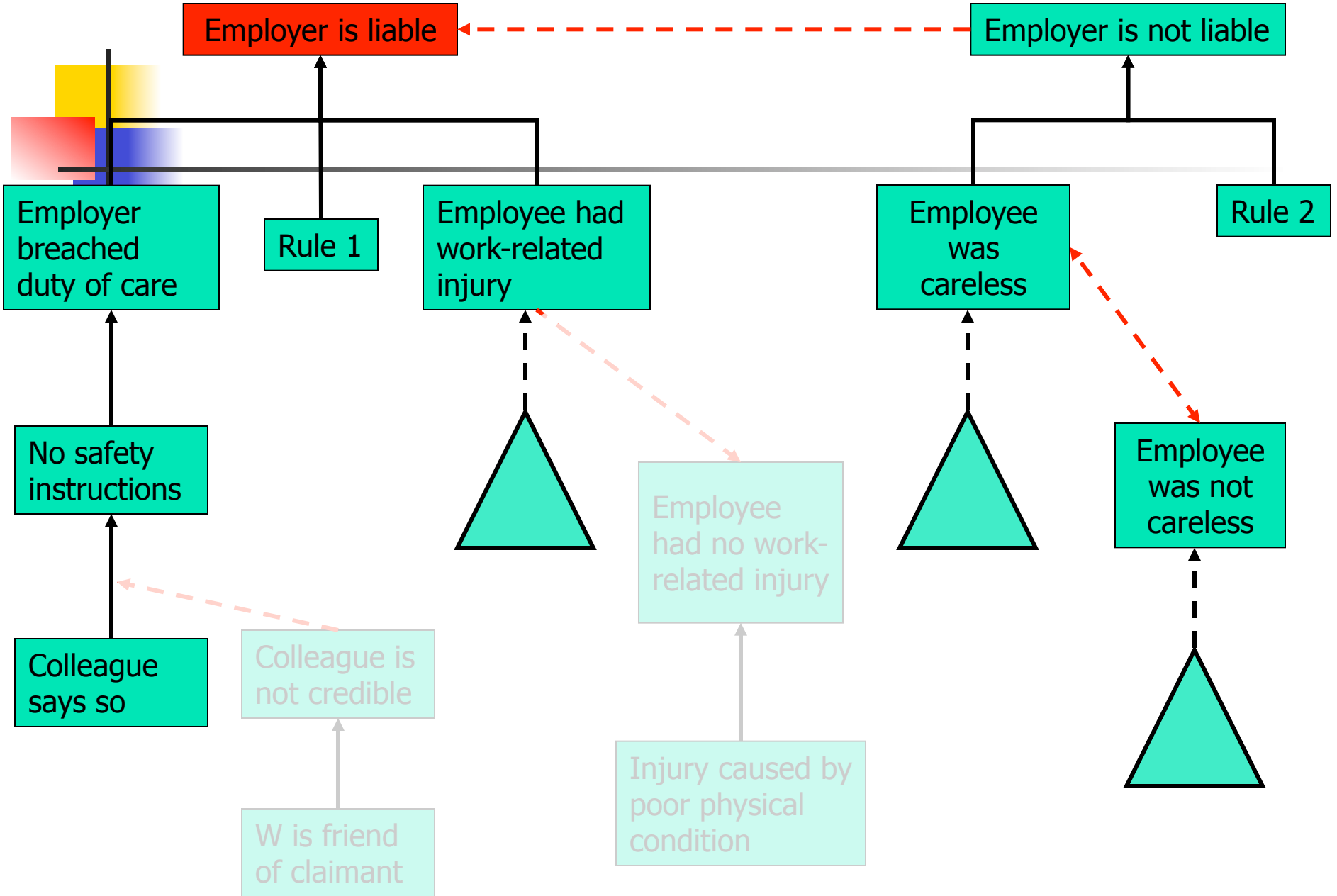
Colleague says so
Colleague is not credible
Injury caused by poor physical condition
W is friend of claimant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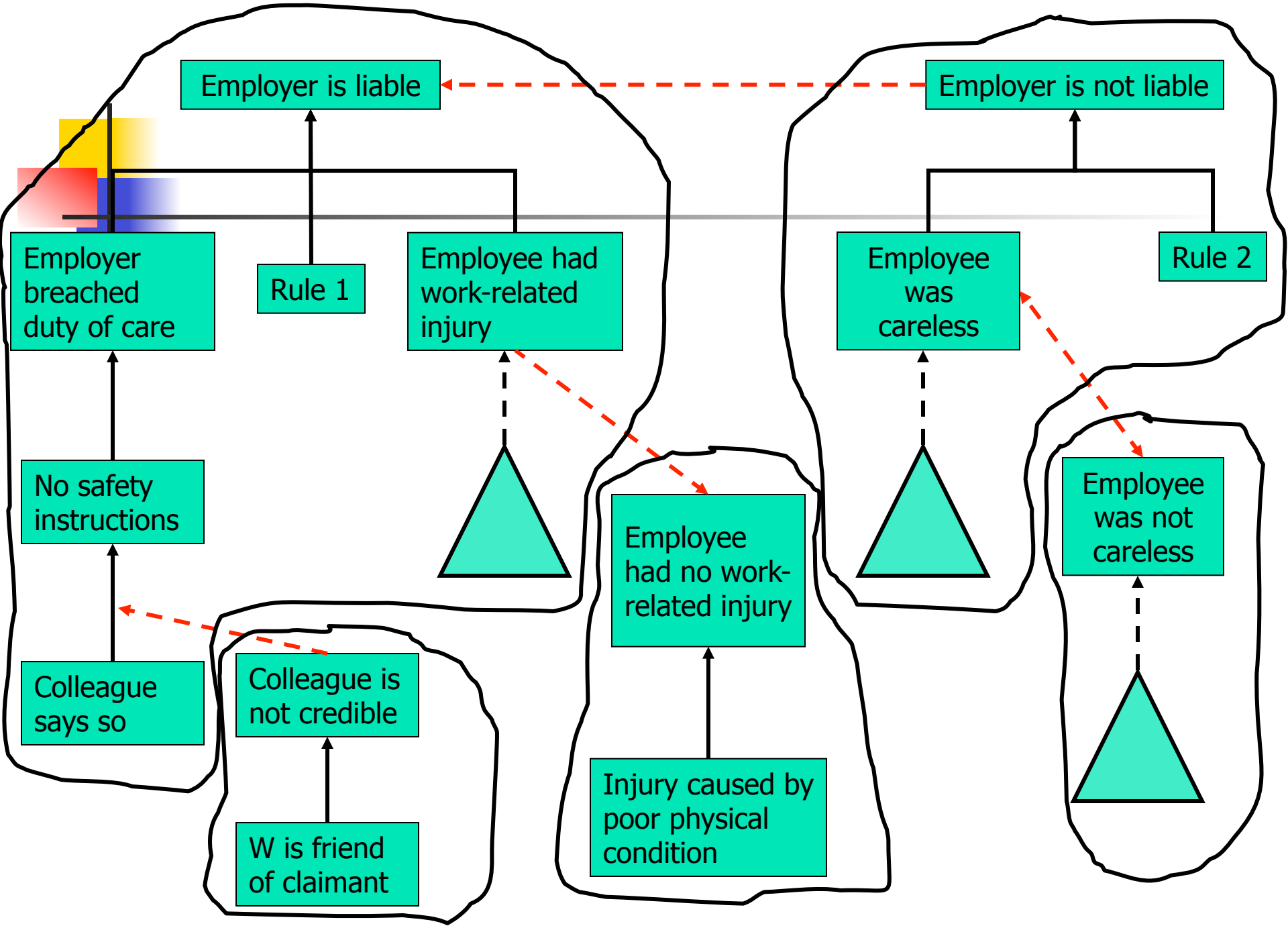
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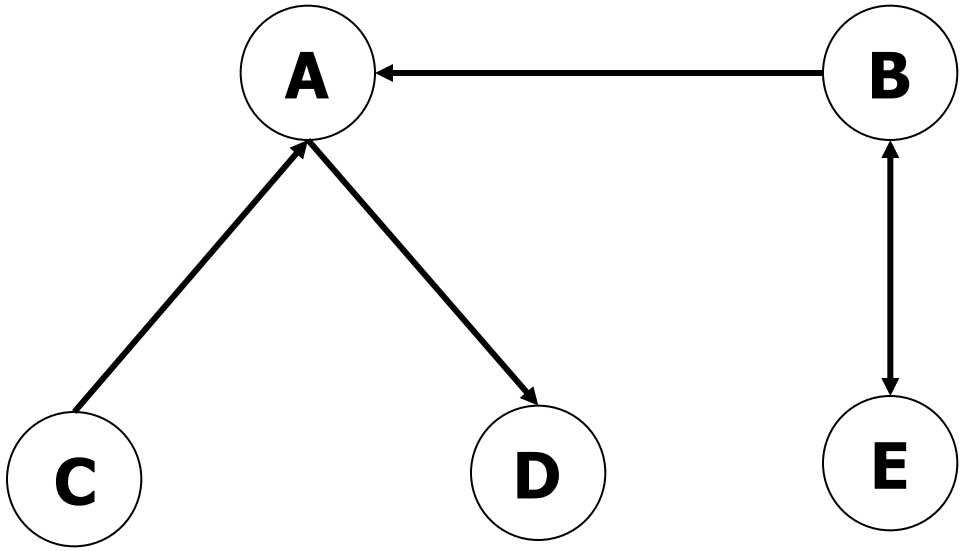
1. An argument is *In* if all arguments defeating it are *Out*.
2. An argument is *Out* if it is defeated by an argument that is *In*.



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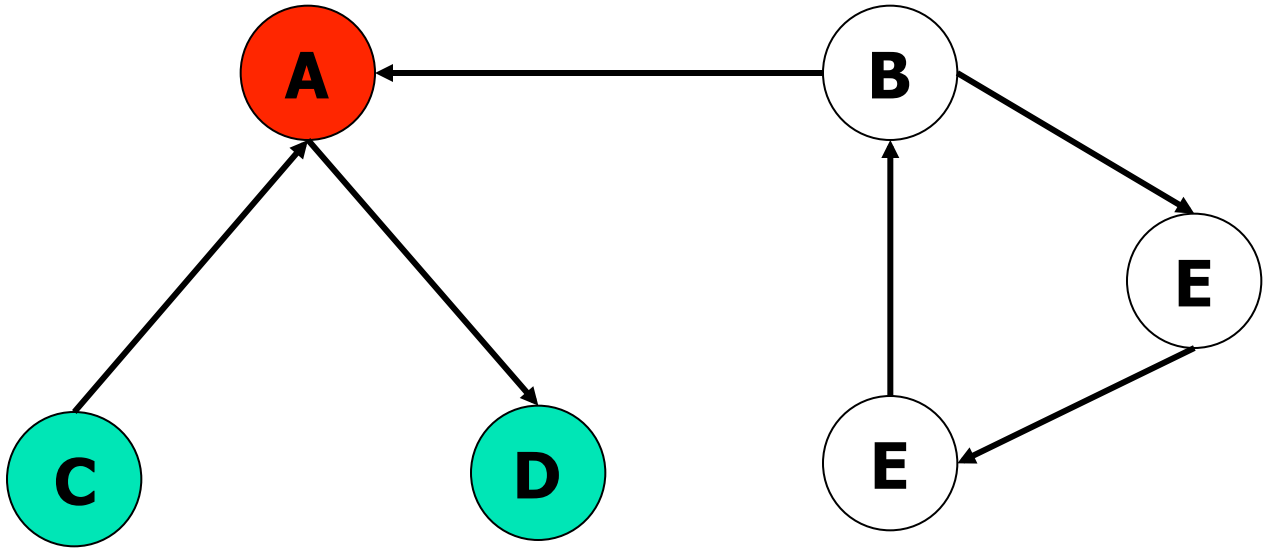
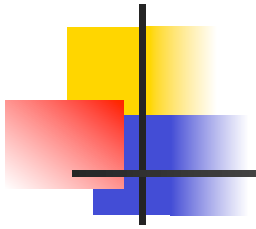


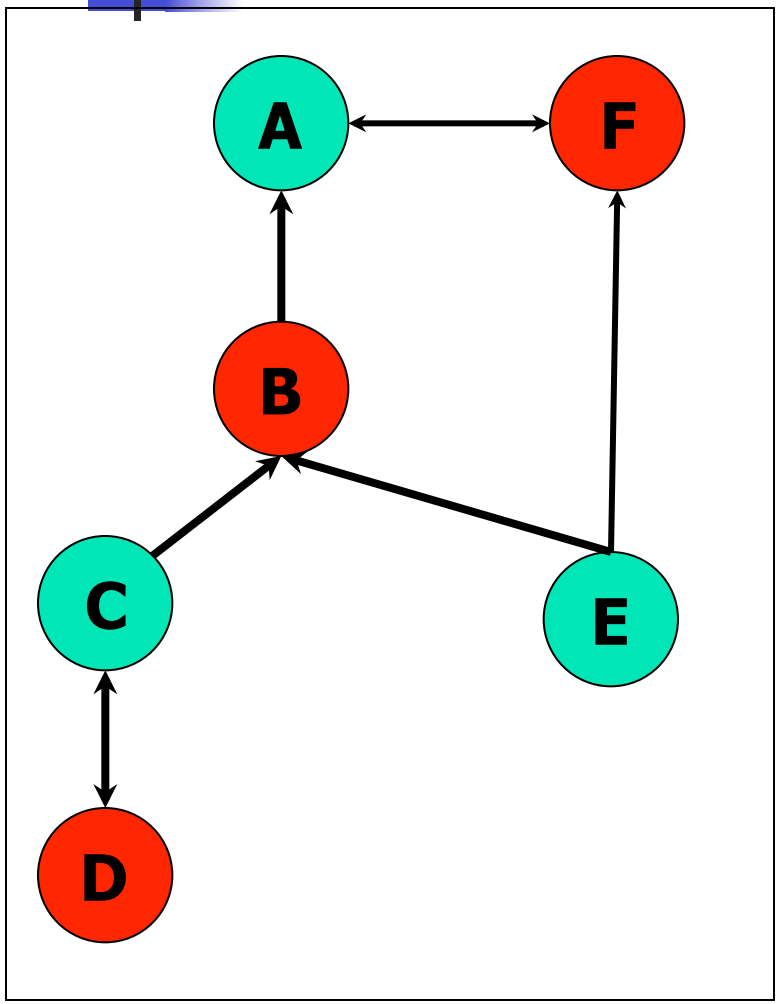
An argument game for grounded semantics



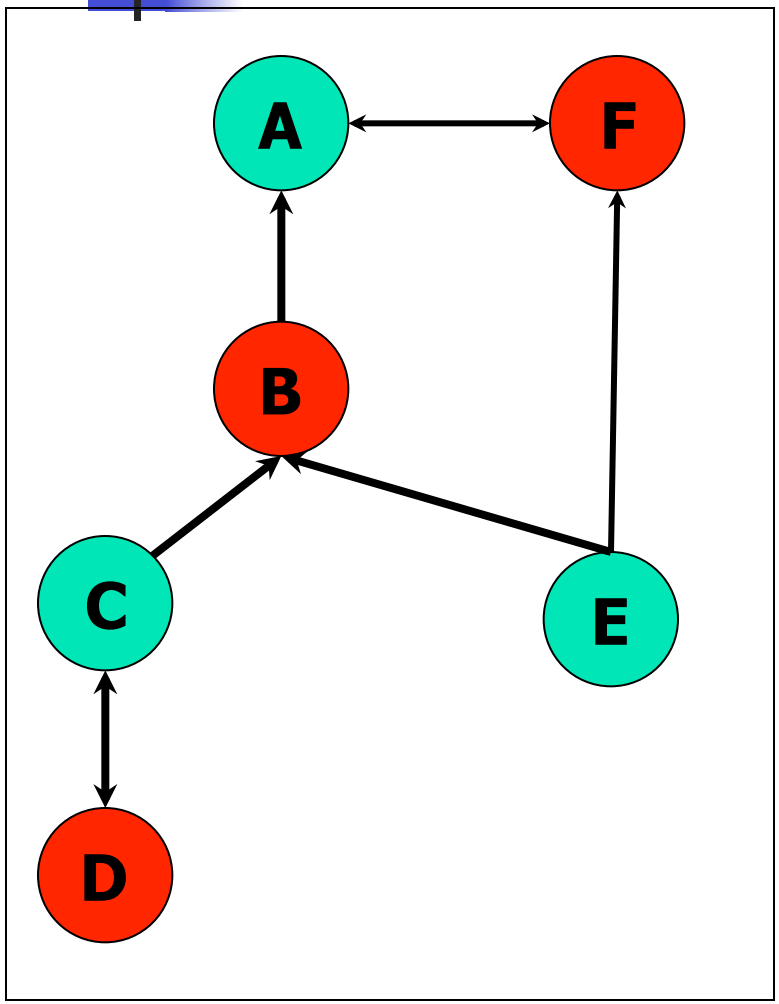
- Rules of the game:
  - Each move replies to previous move
  - Proponent moves strict defeaters, opponent moves defeaters
  - A player wins iff the other player cannot move

- Result: *A* is in the grounded extension iff proponent has a winning strategy in a game about *A*.

A game tree

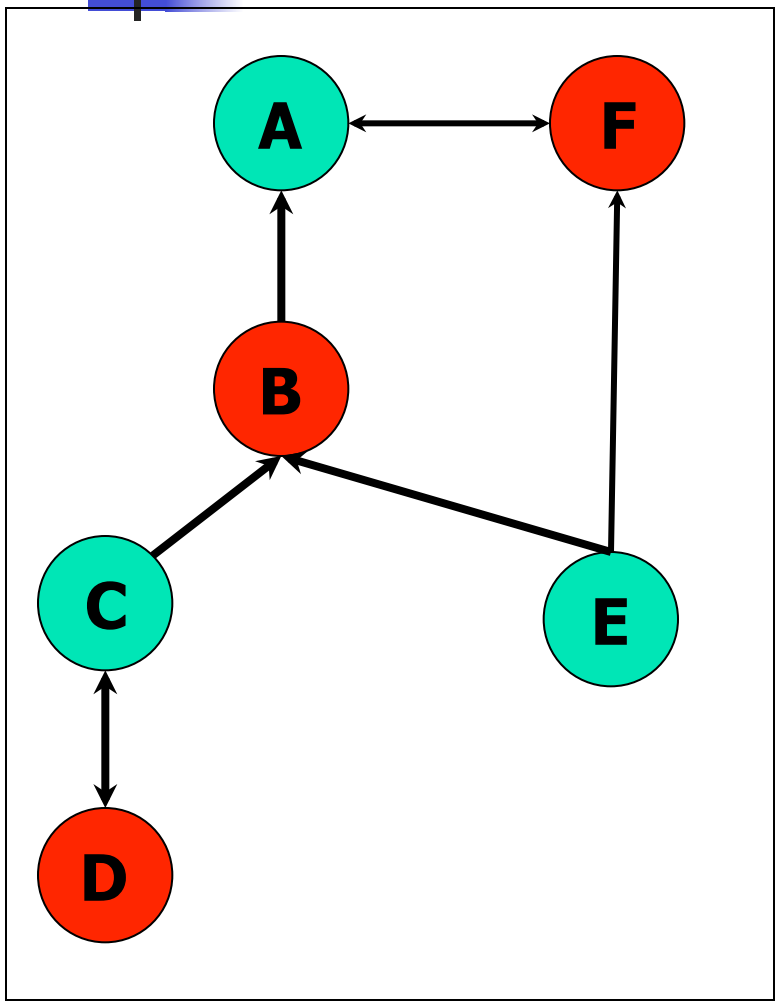


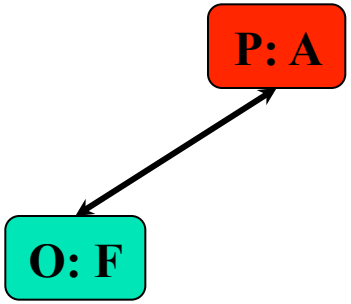
A game tree



P: A

A game tree





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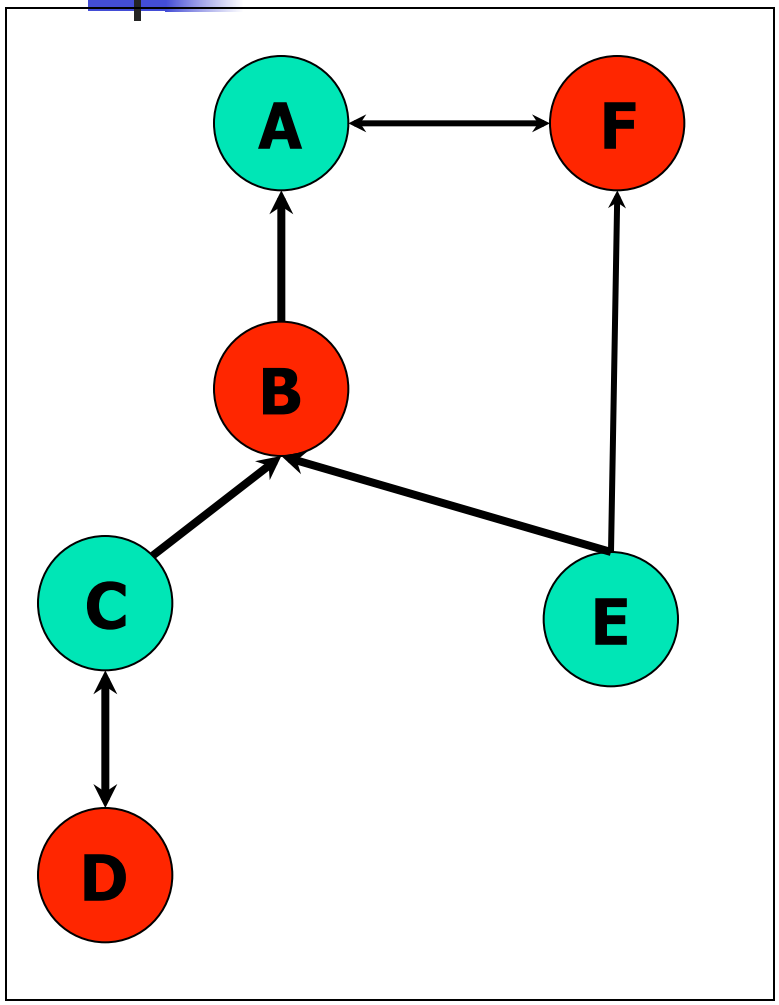

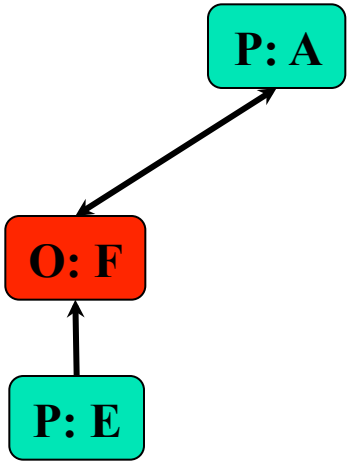

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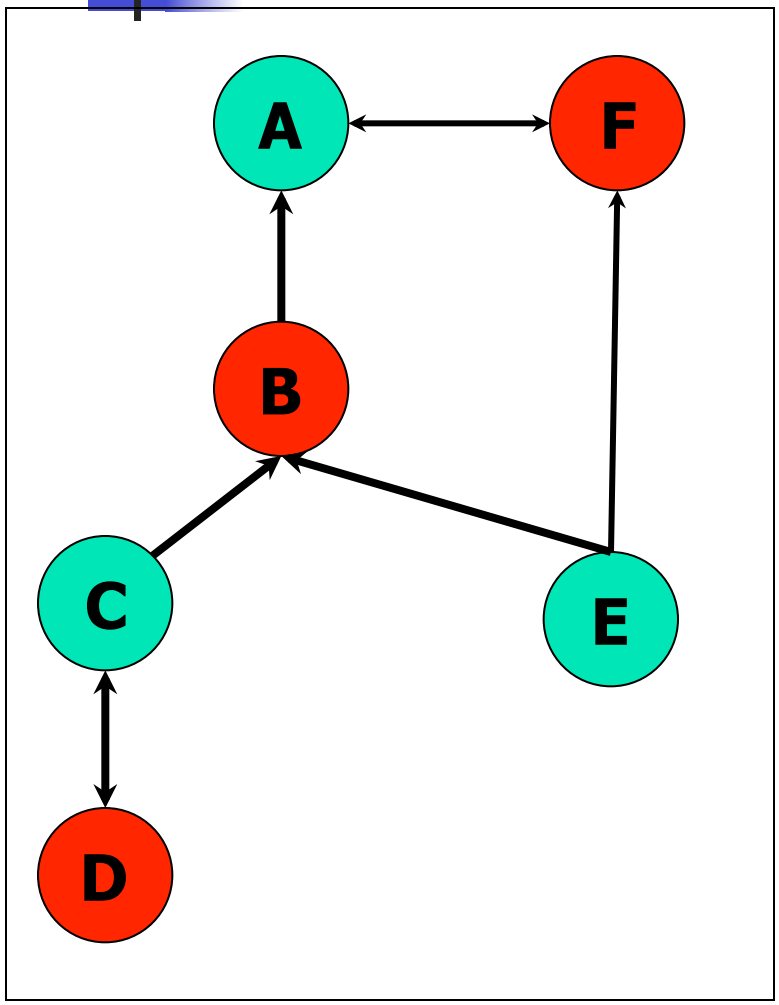

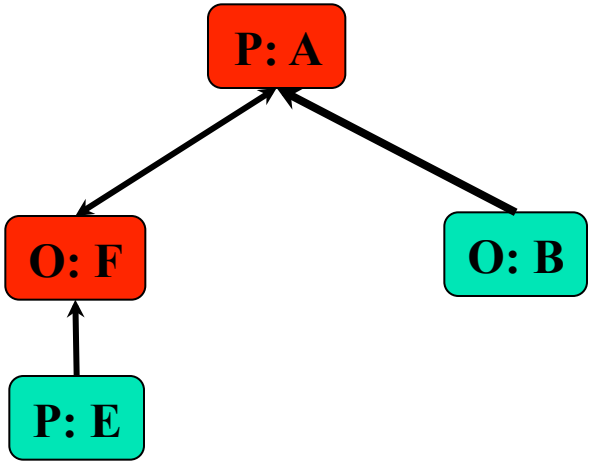

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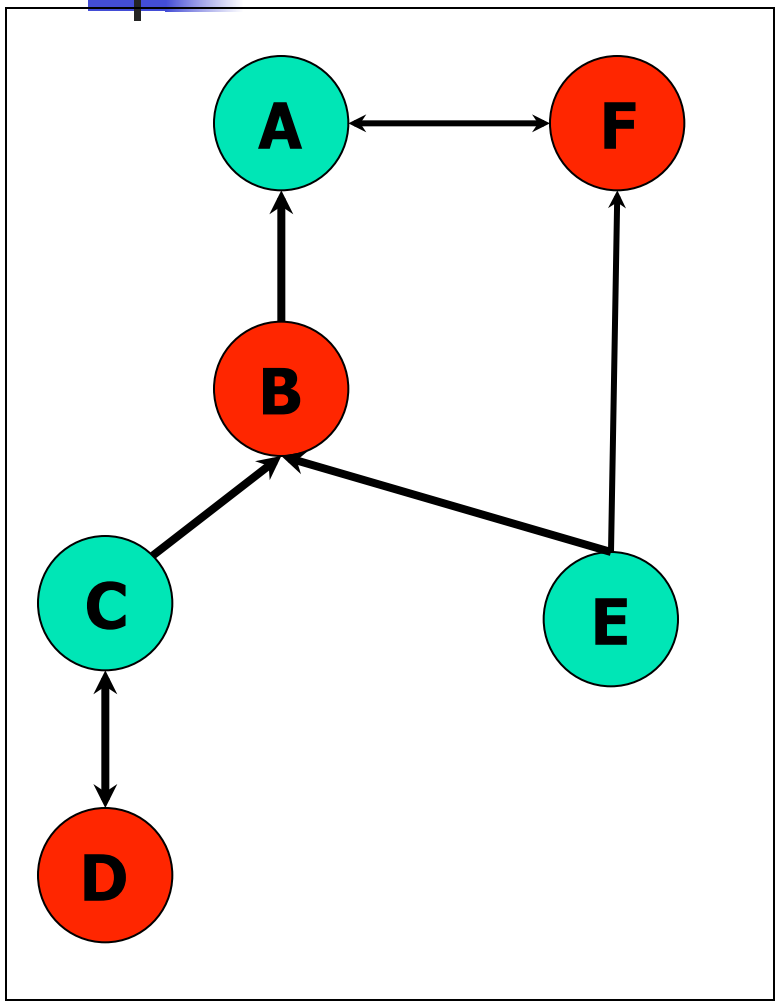

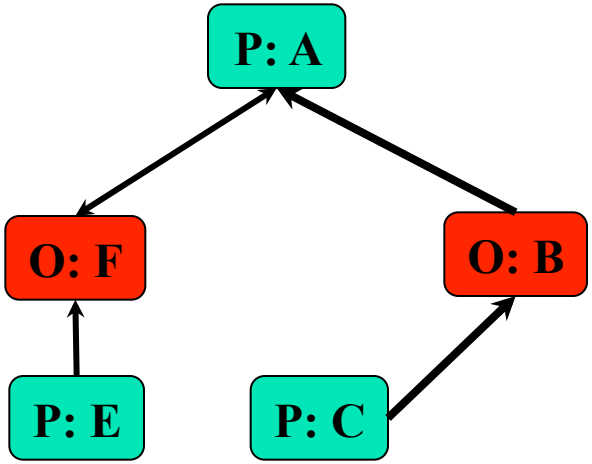

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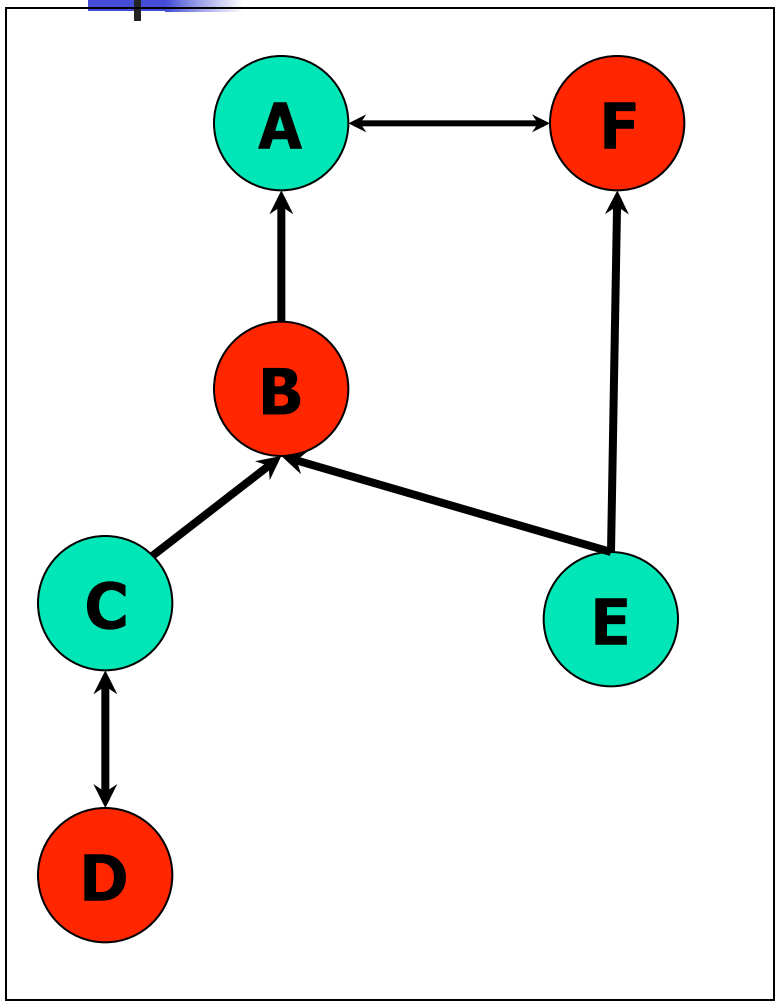

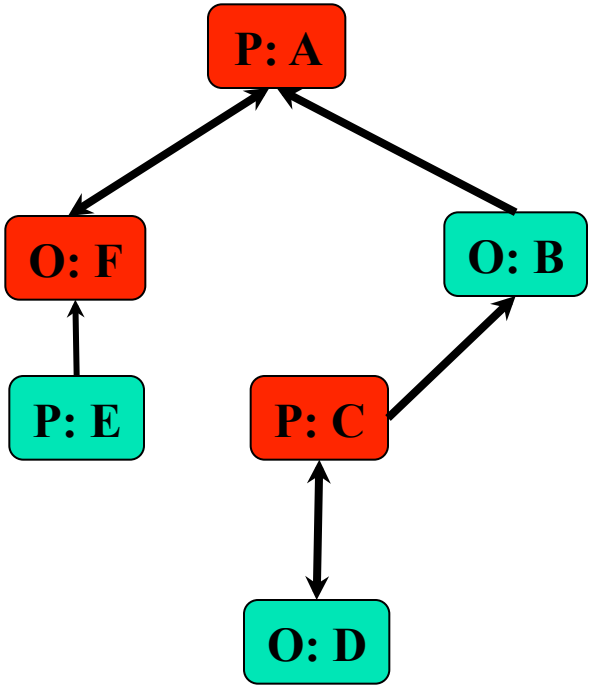

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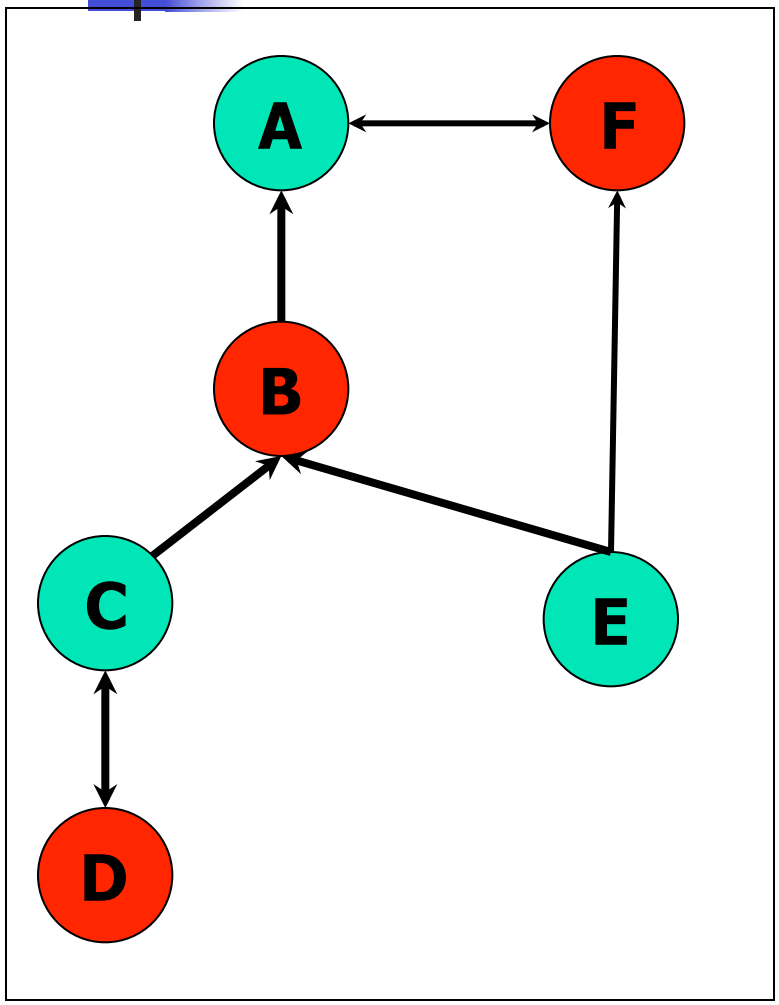
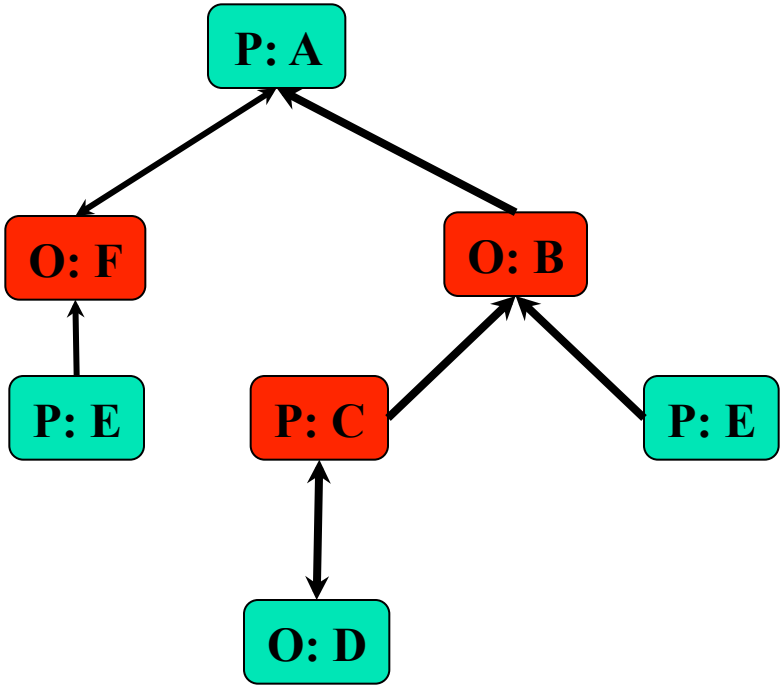




Aspic system: refining Dung

Argument structure based on Vreeswijk (1997)

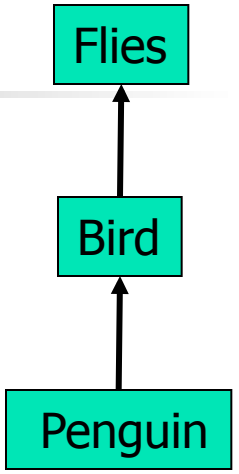
- ≈ Trees where
  - Nodes are wff of logical language $\mathcal{L}$ closed under negation
  - Links are applications of inference rules
    - Strict (ϕ_1, ..., $\phi_1 \rightarrow \phi$); or
    - Defeasible (ϕ_1, ..., $\phi_1 \Rightarrow \phi$)
  - Reasoning starts from knowledge base $\mathcal{K} \subseteq \mathcal{L}$
- Defeat based on Pollock (rebut, undercut) + premise defeat
  - (Reasoning about) preferences can be added (cf. P+S97, Modgil 2009)
- Argument acceptability based on Dung (1995)

Why natural?

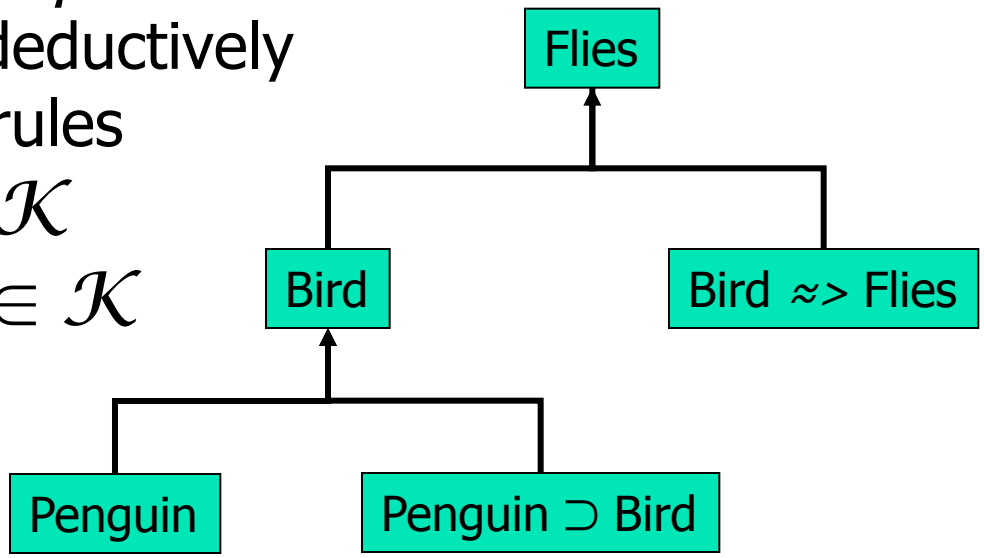
- Three case studies confirm it
  - more or less ...
- Model can cope with
  - Argument schemes
  - Allocations of burden of proof
  - Factor-based reasoning
  - Case-based reasoning
  - ...

Domain-specific vs. inference general inference rules

- R1: Bird $\Rightarrow$ Flies
- R2: Penguin $\rightarrow$ Bird
- Penguin $\in \mathcal{K}$



- R1: $\phi, \phi \approx\!> \psi \Rightarrow \psi$
- Strict rules: all deductively valid inference rules
- Bird $\approx\!>$ Flies $\in \mathcal{K}$
- Penguin $\supset$ Bird $\in \mathcal{K}$
- Penguin $\in \mathcal{K}$



Argument(ation) schemes: general form

Premise 1,

… ,

Premise n

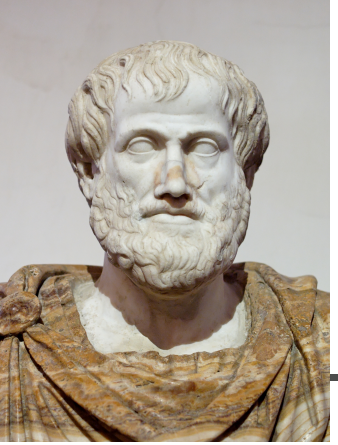
Therefore (presumably), conclusion

- But also critical questions
  - Negative answers are counterarguments

Witness testimony

Witness W says P
Therefore (presumably), P

- Critical questions:
  - Is W sincere?
  - Does W's memory function properly?
  - Did W's senses function properly?

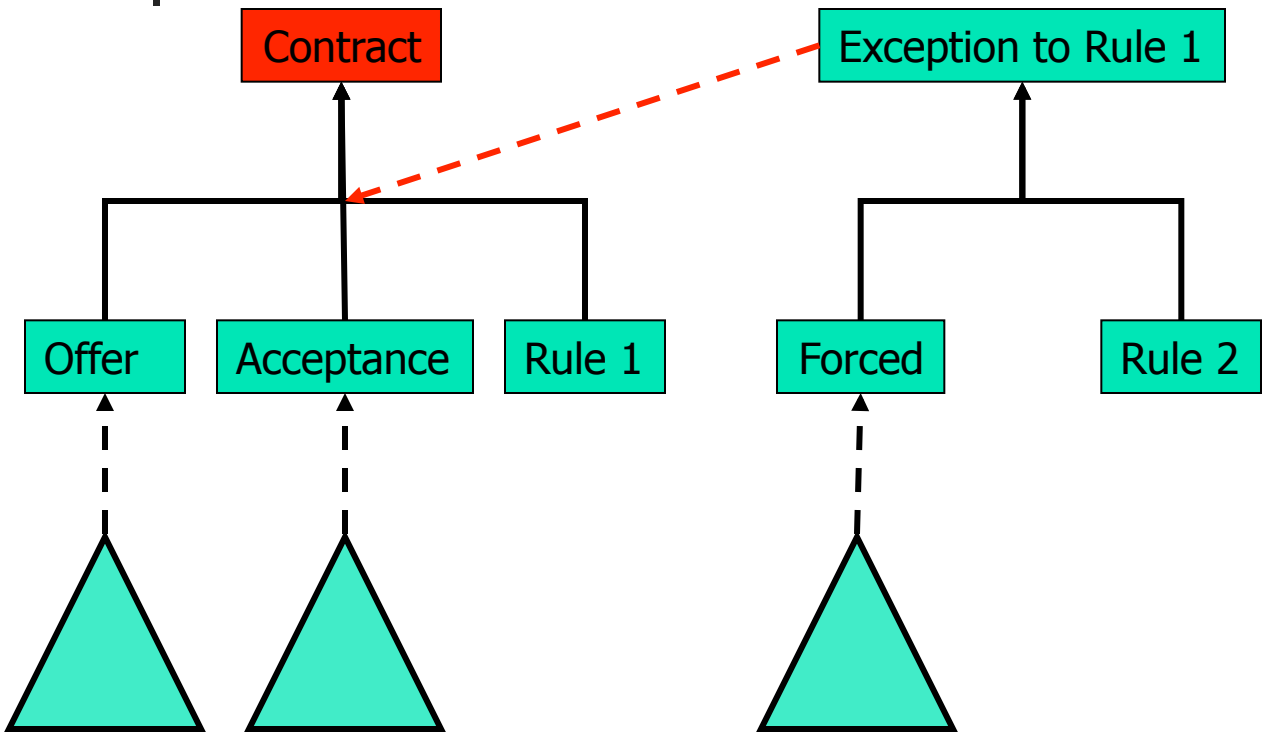


Arguments from consequences

Action A brings about G,
G is good
Therefore (presumably), A should be done

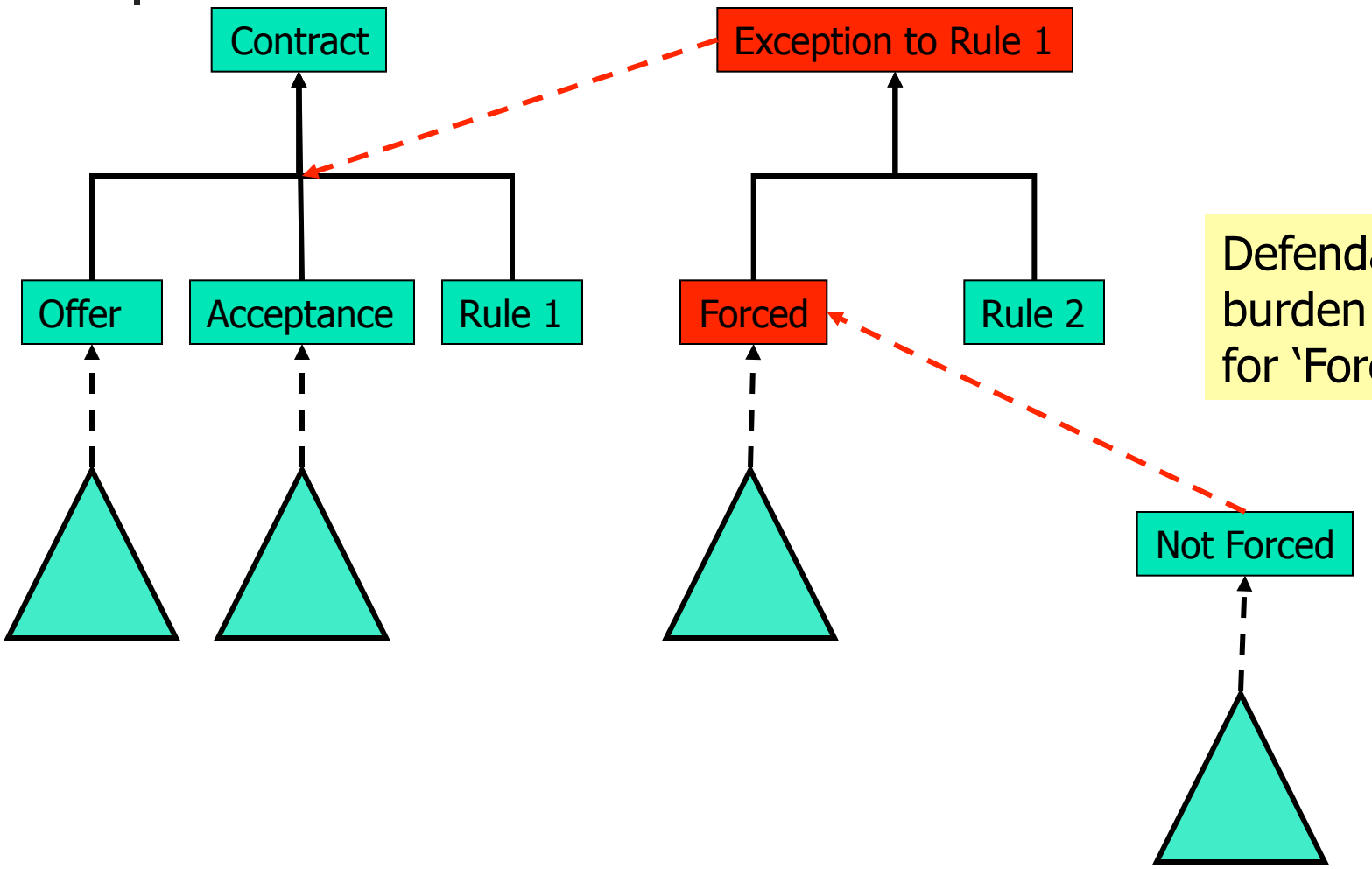
- Critical questions:
  - Does A also have bad consequences?
  - Are there other ways to bring about G?
  - …

Burden of proof: A problem



Defendant has burden of persuasion for 'Forced'

Burden of proof: A problem



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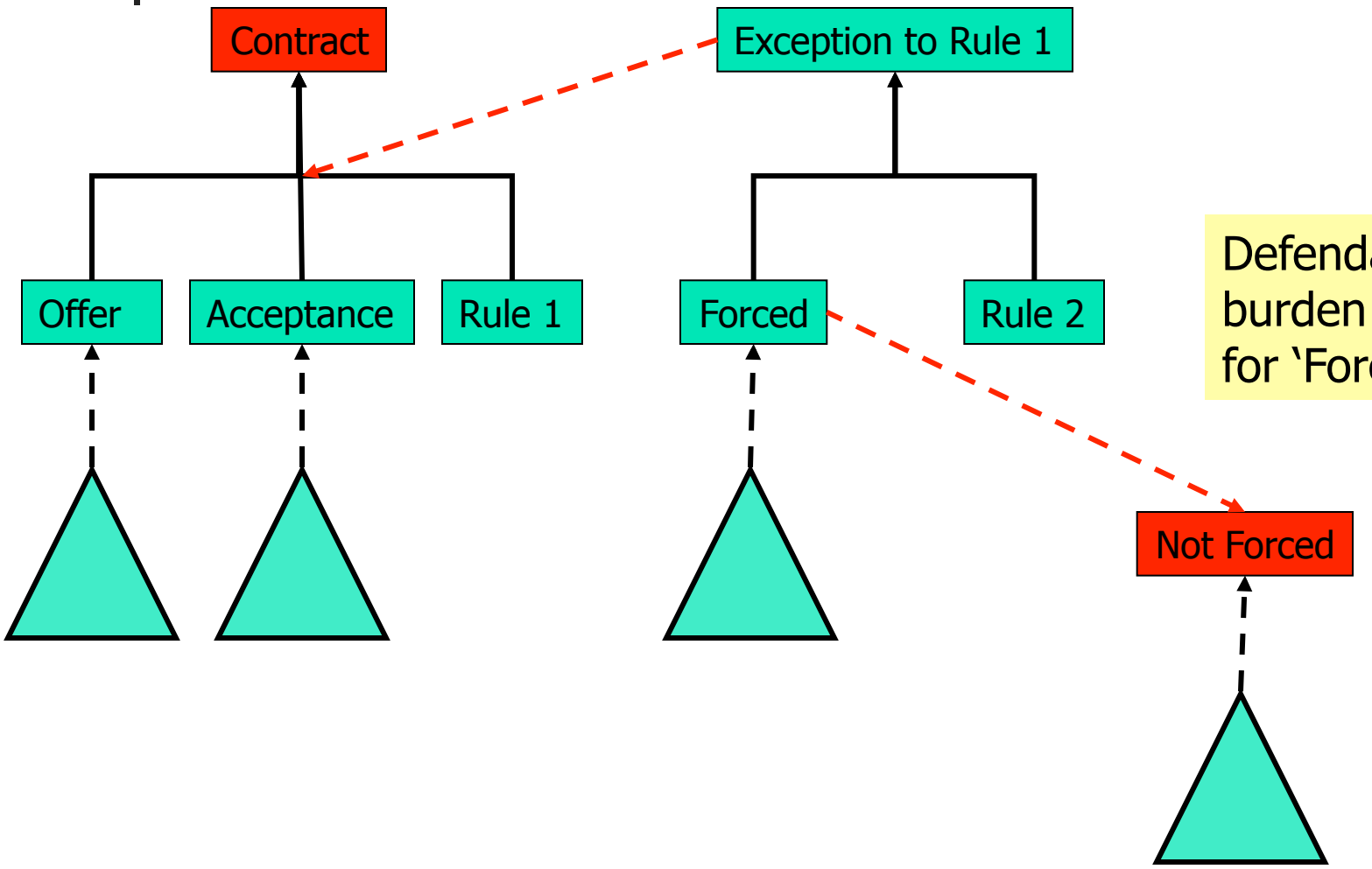
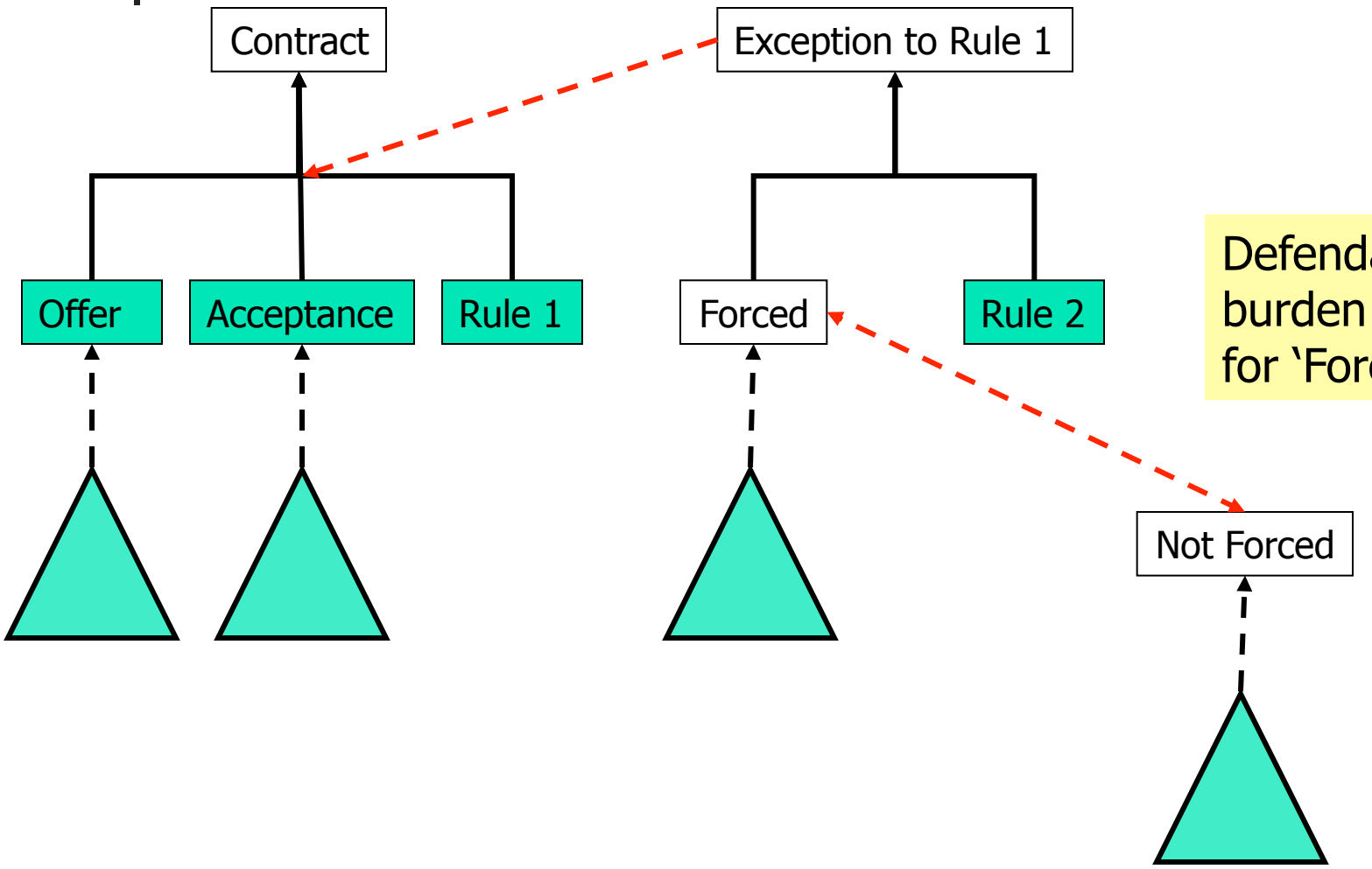
Burden of proof: A problem



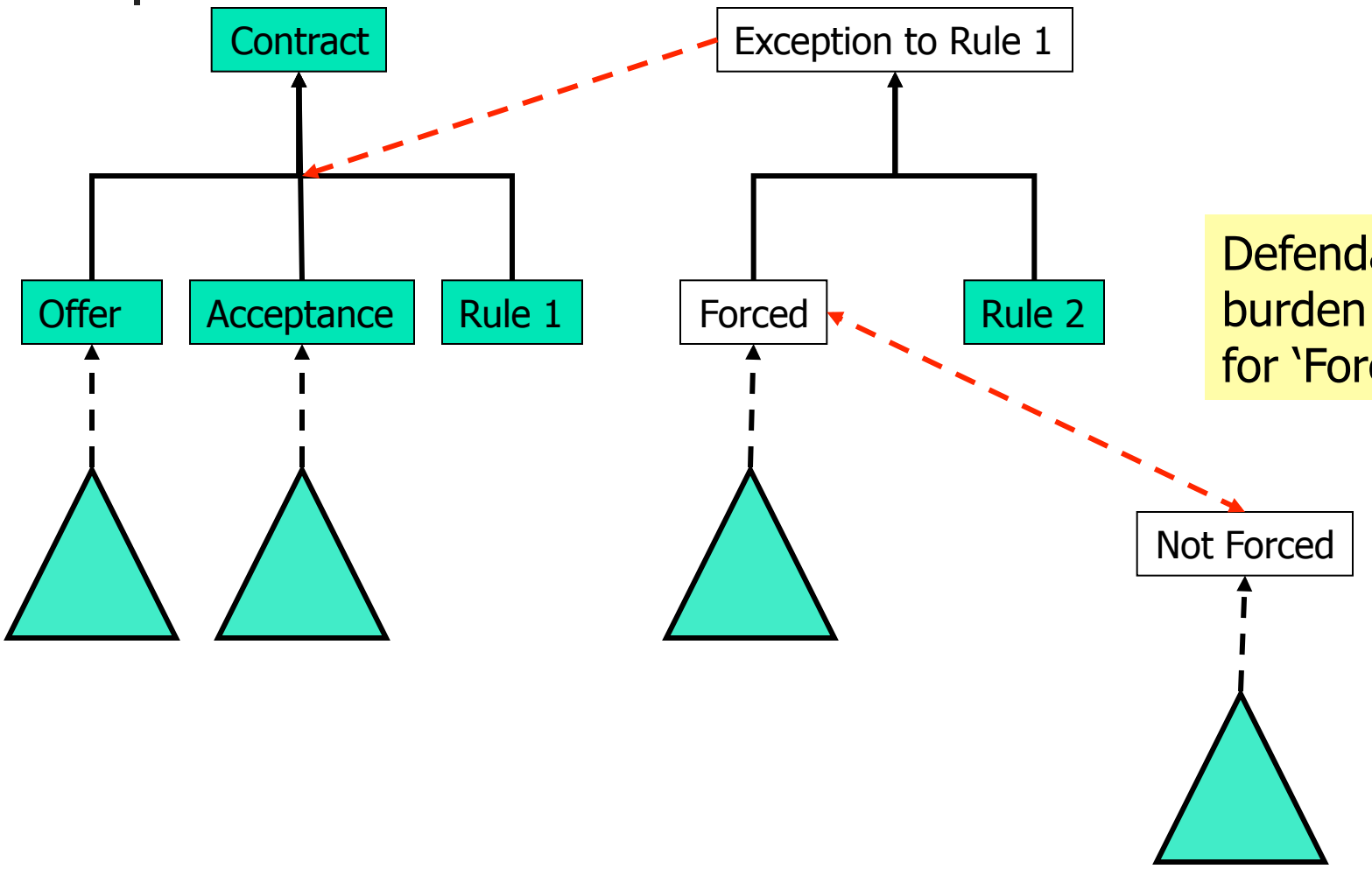
Defendant has burden of persuasion for 'Forced'

If evidence is balanced: in `standard' ASPIC this the outcome …



Defendant has burden of persuasion for 'Forced'

… but it should be this



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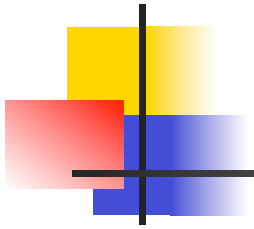
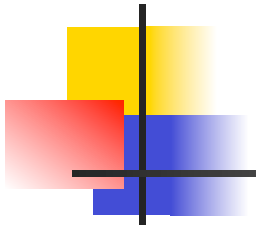


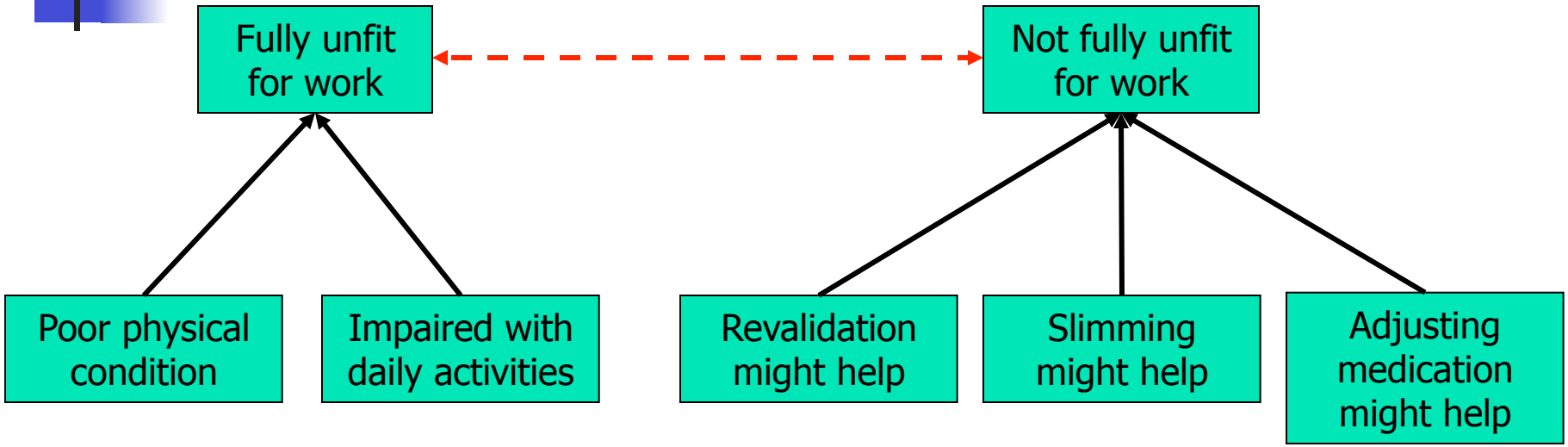
Changing the grounded game

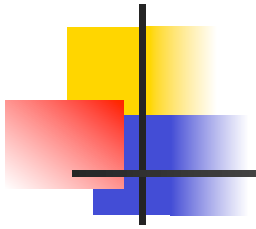
- Prakken & Sartor (1996,1997)
  - Dialectical asymmetry hardwired against proponent
- Prakken (2001)
  - Allocations of burden of persuasion made explicit
  - Dialectical asymmetry switches when the opponent moves an argument for a claim that she has to prove
  - A problem: new game has no semantics
    - Solved!(?)



Factor-based reasoning

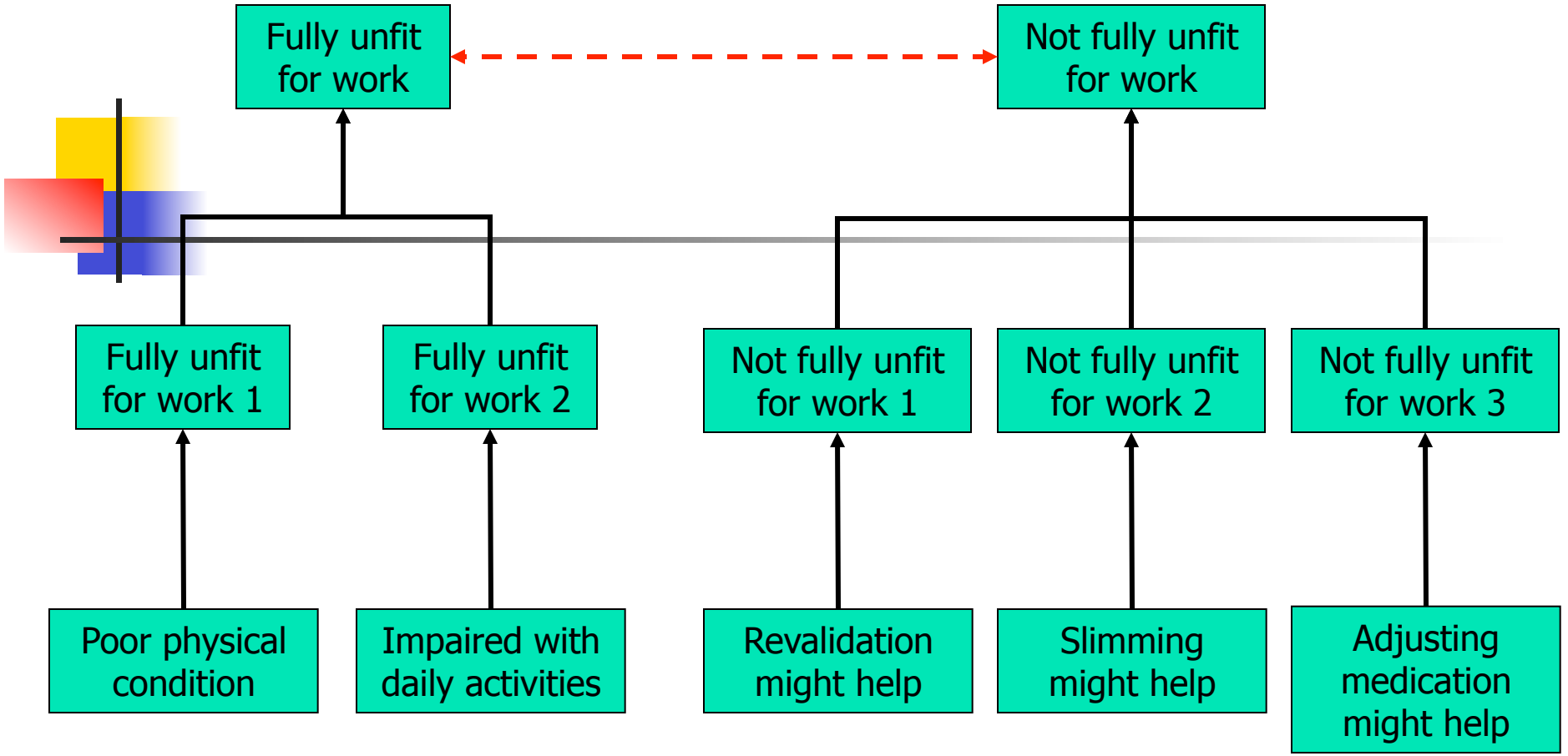
- Factors are tentative reasons pro or con a conclusion
- To draw the conclusion, compare the sets of all applicable factors pro and con


Fully unfit for work
Not fully unfit for work
Poor physical condition
Impaired with daily activities
Revalidation might help
Slimming might help
Adjusting medication might help



Factor-based reasoning (2)

- Factors are tentative reasons pro or con a conclusion
- To draw the conclusion, compare the sets of all applicable factors pro and con
- Factor-based reasoning does not always use cases!
- Can also be modelled as argument accrual (Prakken 2005):
  - Fits the present model
  - Choice can be modelled as priority argument


Fully unfit for work
Not fully unfit for work
Fully unfit for work 1
Fully unfit for work 2
Not fully unfit for work 1
Not fully unfit for work 2
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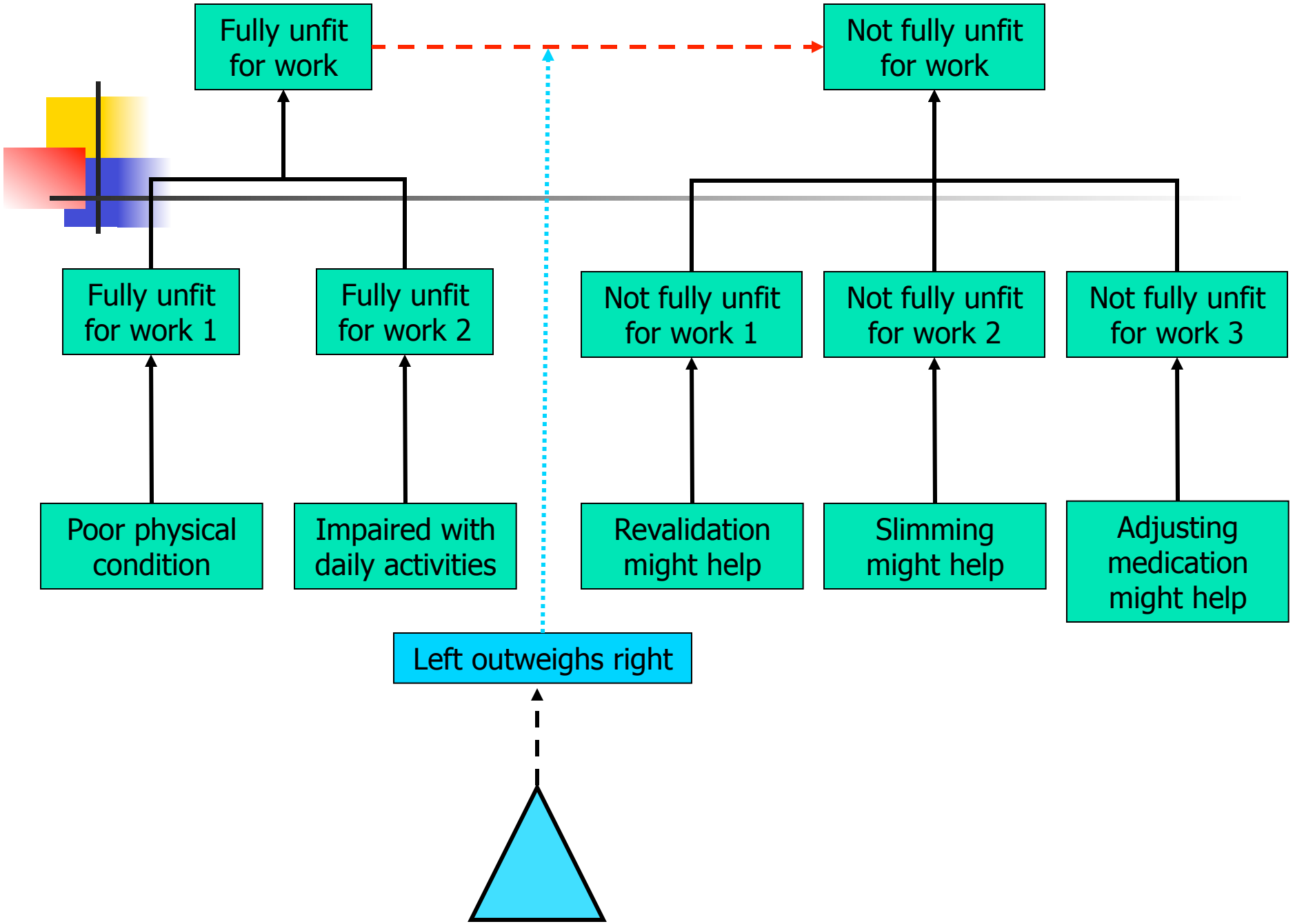
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Not fully unfit for work 1
Not fully unfit for work 2
Not fully unfit for work 3
Poor physical condition
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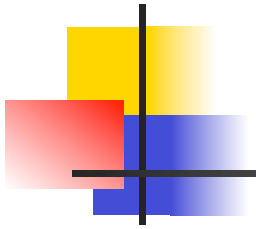
Left outweighs right



Case-based reasoning

- Arguing for a solution of a new case by pointing at similarities to precedents
  - And attacking such arguments
- Case-based reasoning is not always factor-based!
  - Even when it does, the arguments often do not fit familiar AI & Law models

Case-based arguments in Sombekke (2006)

$\phi, \phi \approx> \psi$
Therefore (presumably), ψ

Q

Not P

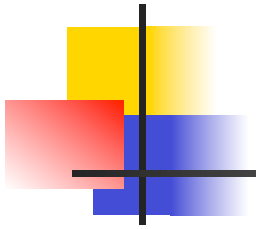
P

P $\approx>$ Q

Court C says that $\phi \approx> \psi$
Therefore (presumably), $\phi \approx> \psi$

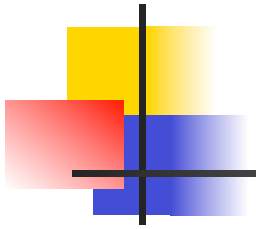
Court C1 says that P $\approx>$ Q

Court C1 did not say that P $\approx>$ Q



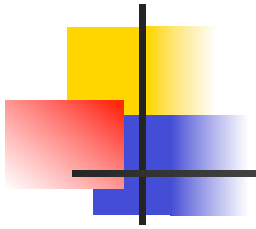
Conclusions on FBR/CBR

- Factor- and case-based reasoning are common in everyday legal argument
- But current AI & Law models may not fit reality



Conclusion (1)

- 'Standard' logical AI models capture a large part of inference in everyday legal argument
  - Applying rules: rule-exception structures for burden of proof
  - Reasoning about rule conditions:
    - Factor-based reasoning is accrual + reasoning about priorities
    - Case-based reasoning is often rule-based
  - Determining the facts: scenario construction does not fit the model (Bex 2009)



Conclusion (2)

- Abstract models of argumentation should be used for analysis, not for representation
- We should focus more on everyday legal argument
  - And more on case files