Applications of AI Planning: Story Telling

Preface

- Application areas: strucutural similarity
- Story: sequence of character actions
- Benefit?

Preface

- Application areas: strucutural similarity
- Story: sequence of character actions
- Benefit?
  - when creating something new

Outline

- Story world modeling
- Differences to classical planning
- Concrete Approaches
  - Fabula
  - Discourse
- Conclusion

Story world modeling

- On a basic level

Attributes of main characters	$\rightarrow$	Predicates
Actions of main characters	$\rightarrow$	Operators

Story world modeling

- On a basic level

"In a fictional world with a continent named Westeros, the highborn refugee Viserys sold his younger sister Daenerys to a warlord in exchange for the warlord's army. He used the army to conquer Westeros and become its king."

Story world modeling

- On a basic level

"In a fictional world with a continent named Westeros, the highborn refugee Viserys sold his younger sister Daenerys to a warlord in exchange for the warlord's army. He used the army to conquer Westeros and become its king."

Story world modeling

- On a basic level

"In a fictional world with a continent named Westeros, the highborn refugee Viserys sold his younger sister Daenerys to a warlord in exchange for the warlord's army. He used the army to conquer Westeros and become its king."

Story world modeling

- A = { V-army , V-king , D-sold }
- O = { V-sell-D , V-conquer-W }
  - V-sell-D = ⟨ ¬V-army ∧ ¬D-sold , V-army ∧ D-sold ⟩
  - V-conquer-W = ⟨ V-army ∧ ¬V-king , V-king ⟩
- I = ¬V-army ∧ ¬V-king ∧ ¬D-sold
- γ = V-king

Story world modeling

- On a basic level

Story world modeling

- More sophisticated

Story world modeling

- More sophisticated
  - Story variations
  - Interactivity
  - Planning of story structures based on world rules

Differences to classical planning

- Similar on basic level
- Different in nature
  - Purpose
  - Key Properties
  - More sophistication $\rightarrow$ challenges
- Specialized planners (IPOCL)
- Interactivity

Concrete approaches

- Fabula
  - Haslum
    Narrative planning: Compilations to classical planning
- Discourse
  - Porteous, Cavazza, Charles
    Applying planning to interactive storytelling: Narrative control using state constraints

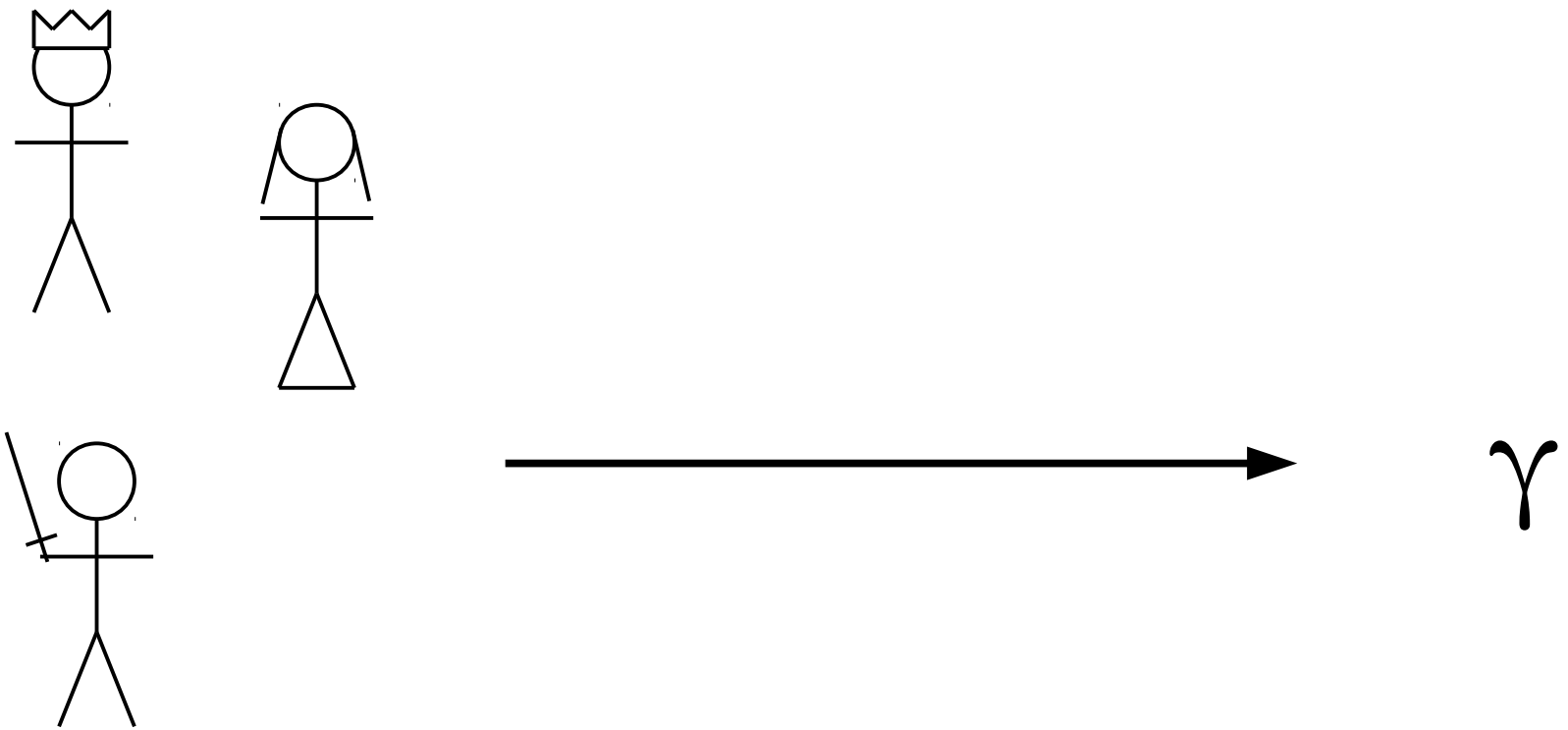
Concrete approaches

"In simple terms, the [fabula] is the *what* in a narrative that is depicted, discourse is the *how*." — Chatman

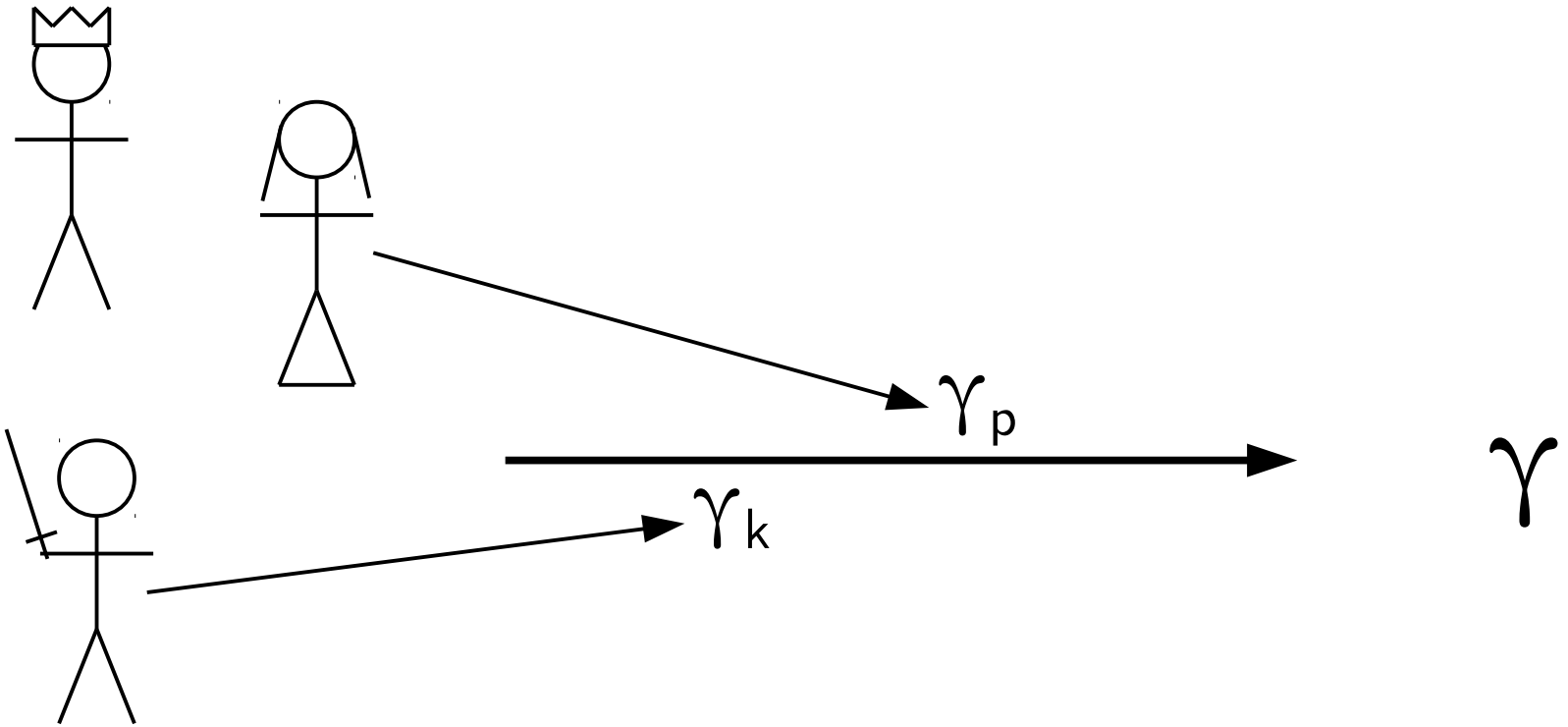
Concrete approaches: fabula

- Based in IPOCL approach
- Focus on intentionality
  - Character goals
  - Delegation
  - Intentional plans, frames of commitment

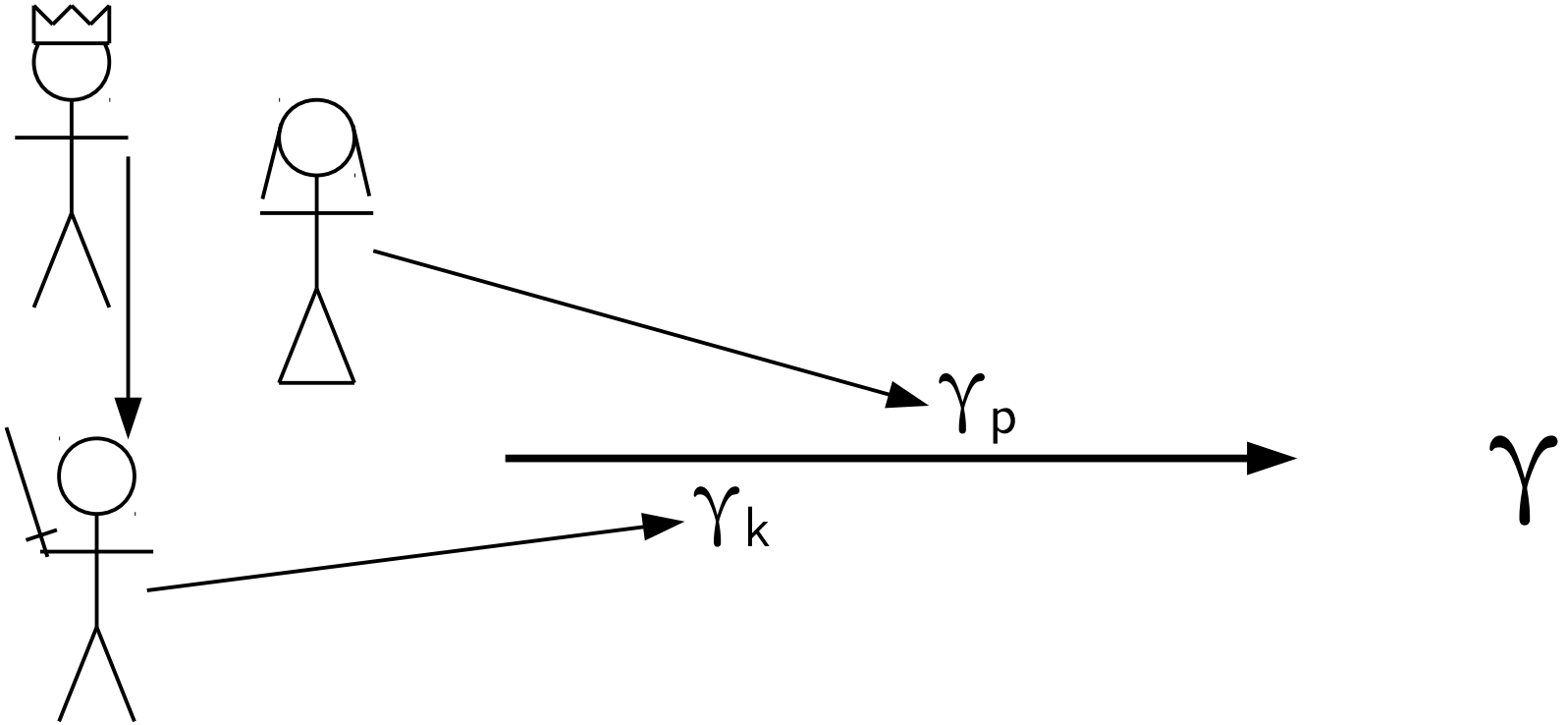
Concrete approaches: fabula



Concrete approaches: fabula



Concrete approaches: fabula

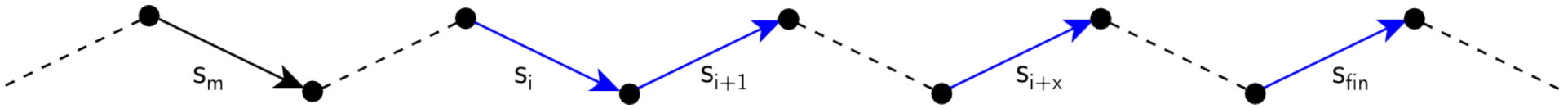


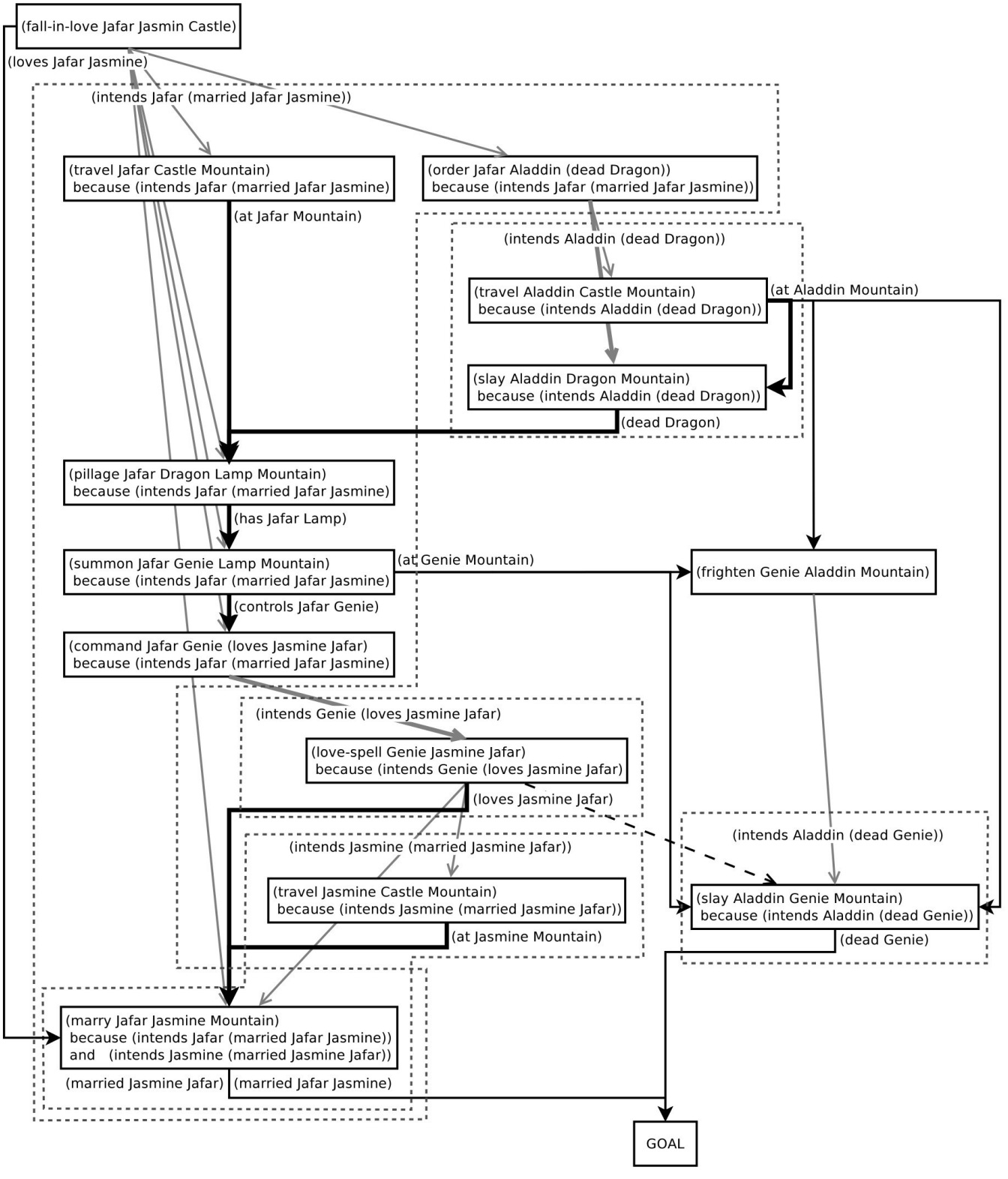
Concrete approaches: fabula

- Def. Intentional plan:
  - Intentional actions: associated with (intends A g)
  - Final step $s_{fin} \in S'$ makes g true
  - Motivating step $s_m \notin S'$
  - Causal or motivational links to s_{fin}

Concrete approaches: fabula

- Def. Intentional plan:
  - Intentional actions: associated with (intends A g)
  - Final step $s_{fin} \in S'$ makes g true
  - Motivating step $s_m \notin S'$
  - Causal or motivational links to s_{fin}




(fall-in-love Jafar Jasmin Castle)
(loves Jafar Jasmine)
(intends Jafar (married Jafar Jasmine))
(travel Jafar Castle Mountain)
because (intends Jafar (married Jafar Jasmine)
(order Jafar Aladdin (dead Dragon))
because (intends Jafar (married Jafar Jasmine))
(at Jafar Mountain)
(intends Aladdin (dead Dragon))
(travel Aladdin Castle Mountain)
because (intends Aladdin (dead Dragon))
(at Aladdin Mountain)
(slay Aladdin Dragon Mountain)
because (intends Aladdin (dead Dragon))
(dead Dragon)
(pillage Jafar Dragon Lamp Mountain)
because (intends Jafar (married Jafar Jasmine)
(has Jafar Lamp)
(summon Jafar Genie Lamp Mountain)
because (intends Jafar (married Jafar Jasmine)
(at Genie Mountain)
(frighten Genie Aladdin Mountain)
(controls Jafar Genie)
(command Jafar Genie (loves Jasmine Jafar)
because (intends Jafar (married Jafar Jasmine)
(intends Genie (loves Jasmine Jafar)
(love-spell Genie Jasmine Jafar)
because (intends Genie (loves Jasmine Jafar)
(loves Jasmine Jafar)
(intends Aladdin (dead Genie))
(intends Jasmine (married Jasmine Jafar))
(travel Jasmine Castle Mountain)
because (intends Jasmine (married Jasmine Jafar))
(slay Aladdin Genie Mountain)
because (intends Aladdin (dead Genie))
(at Jasmine Mountain)
(dead Genie)
(marry Jafar Jasmine Mountain)
because (intends Jafar (married Jafar Jasmine))
and (intends Jasmine (married Jasmine Jafar))
(married Jasmine Jafar)
(married Jafar Jasmine)
GOAL

Concrete approaches: discourse

- Goals
  - Variation
  - Interactivity
- Methods
  - PoV
  - Decomposition

Concrete approaches: discourse

- PoV
  - Perspective
  - Disposition

- Example
  - V-sell-D = $\langle\ \neg$V-army $\wedge\ \neg$D-sold , V-army $\wedge$ D-sold $\rangle$

Concrete approaches: discourse

$$\text{V-sell-D} = \langle\ \neg\text{V-army} \wedge \neg\text{D-sold}\ ,\ \text{V-army} \wedge \text{D-sold}\ \rangle$$

- Perspective: Viserys / Daenerys
- Disposition:
  - V: indifferent / regretful
  - D: submissive / revengeful

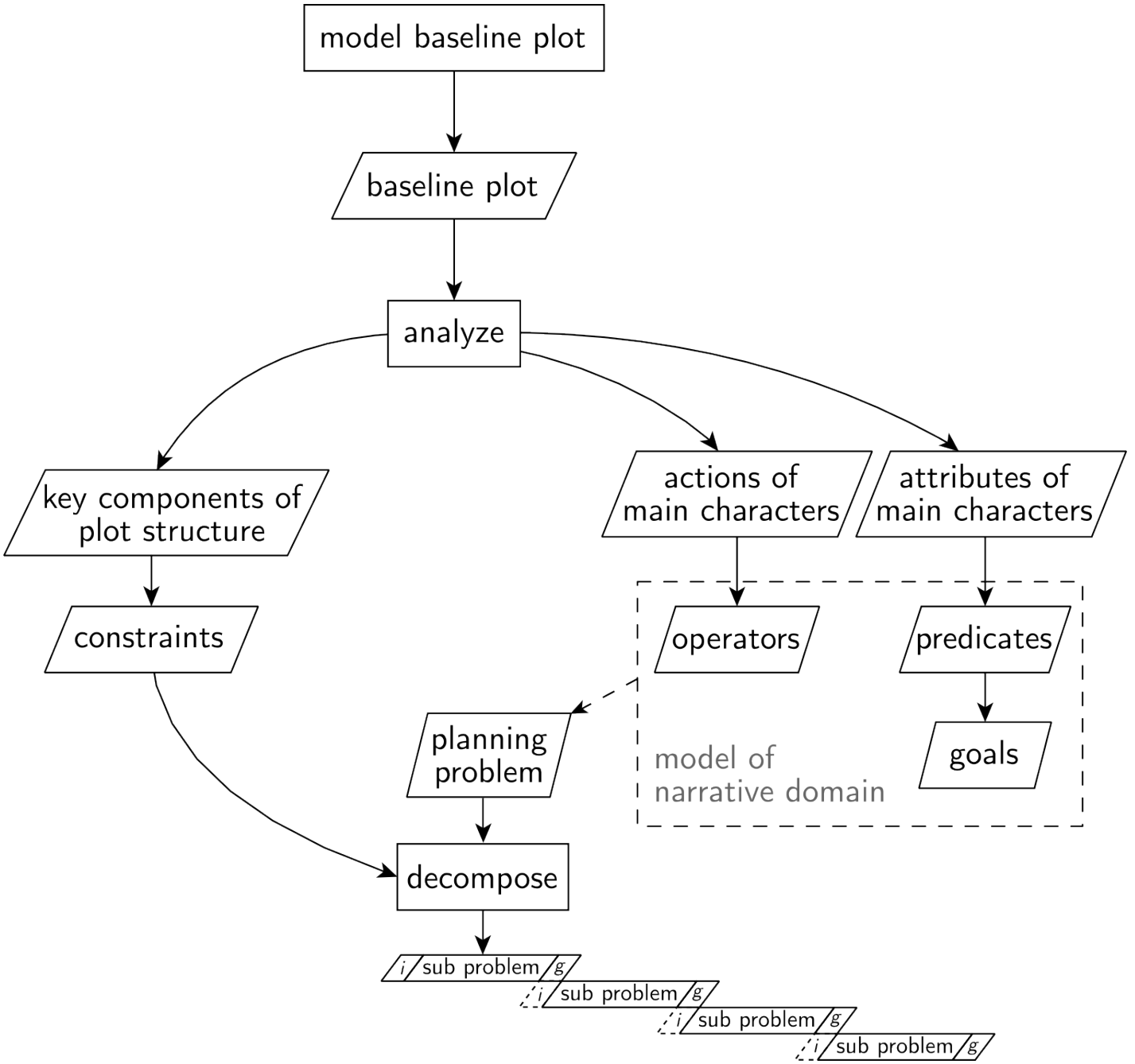
Concrete approaches: discourse

$$\text{V-sell-D} = \langle\ \neg\text{V-army} \wedge \neg\text{D-sold}\ ,\ \text{V-army} \wedge \text{D-sold}\ \rangle$$

- PoVs:
  - Viserys-indifferent $\rightarrow$ V-sell-D = ⟨ ...
  - Viserys-Regretful $\rightarrow$ V-sell-D = ⟨ ...
  - Daenerys-submissive $\rightarrow$ V-sell-D = ⟨ ...
  - Daenerys-revengeful $\rightarrow$ V-sell-D = ⟨ ...

Concrete approaches: discourse

- Goals
  - Variation
  - Interactivity
- Methods
  - PoV
  - Decomposition


model baseline plot
baseline plot
analyze
key components of plot structure
constraints
actions of main characters
attributes of main characters
operators
predicates
goals
model of narrative domain
planning problem
decompose
i
sub problem
g

[Authorial Constraint] SEALED-BOND-OVER-LOAN SHYLOCK ANTONIO VENICE-RIALTO
[Narrative Action] GREETINGS-AND-INTRODUCTIONS
Here comes Antonio, my most noble kinsman.
[Authorial Constraint] RESPONDED-TO-BOND ANTONIO VENICE-RIALTO
[Narrative Action] DISMISS-RISK-OF-FORFEIT
You should not seal to such a bond for me: I'd rather dwell in my necessity.
[Authorial Constraint] SEALED-BOND-OVER-LOAN SHYLOCK ANTONIO VENICE-RIALTO
[Narrative Action] SHOW-DISLIKE-OF-USURY
Well then, your bond; and let me see; three thousand ducats; tis a good round sum.
[Authorial Constraint] DISCUSSED-BOND-AND-FORFEIT
[Narrative Action] REQUEST-AN-AUDIENCE
...will thou hear me Shylock?
[Authorial Constraint] RECEIVED-VERDICT-OF-COURT
[Narrative Action] OFFER-TO-REPAY-LOAN
Look Shylock, Bassanio is able to discharge the money He tenders it for you in the court.
[Authorial Constraint] RESPONDED-TO-VERDICT-OF-COURT
[Narrative Action] SHOW-HAPPINESS
I and my friend have by your wisdom been this day acquitted of grievous penalties.
Act 1-1
Act 1-3
Act 2-8
...
Act 3-2
Act 3-3
Act 4-1
Act 5-1
(2) (SHOW-CONTENTMENT A B AR)
(3) (RECEIVE-LOAN-REQUEST A B AR)
(4) (RESPOND-TO-LOAN-REQUEST A B AR)
(5) (RECEIVE-THANKS A B AR)
(6) (GOSSIP-ABOUT-FRIEND A B AR)
(7) (TALK-OF-CARNIVAL A B AR)
A1 (offered-guarantee-loan A B)
(10) (GREETINGS-AND-INTRODUCTIONS A B S VR)
(11) (ASK-TO-BORROW-MONEY A B S VR)
(12) (REVEAL-FEELINGS-ABOUT-LOAN A B S VR)
(13) (SHOW-DISLIKE-OF-USURY A B S VR)
(14) (RECEIVE-OFFER-OF-LOAN-ART A B S VR)
(15) (BORROW-MONEY-CONFIDENT-REPAY A B S VR)
C1 (sealed-bond-over-loan S A)
(16) (DISMISS-RISK-OF-FORFEIT A B VR)
A2 (responded-to-bond A)
(19) (REVEAL-FEELINGS-FOR-FRIEND-ART A B VS)
(20) (SAY-GOODBYE-TO-FRIEND-ART A B VS)
A3 (despatched-friend A B)
(25) (CONSIDER-LOST-SHIPS A AR)
(26) (WRITE-TO-FRIEND A AR)
A4 (asked-to-return A)
(29) (REQUEST-AN-AUDIENCE A S VS)
C2 (discussed-bond-and-forfeit A S)
(32) (OFFER-TO-REPAY-LOAN A D C)
(33) (SHOW-CONTEMPT-FOR A S D C)
(34) (CALL-FOR-JUDGEMENT A S D C)
(35) (RELEASE-FROM-FORFEIT A S D C)
C3 (received-verdict-of-court A S)
(36) (SHOW-HAPPINESS A C)
A5 (responded-to-verdict-of-court A)
(39) (INTRODUCE-AND-WELCOME A B P BM)
(40) (RECEIVE-GOOD-NEWS-SHIPS A B P BM)
C4 (end-of-play)
(39) (NARRATIVE-ACTION LIST-OF-ARGS)
A1 (PoV-specific-constraint LIST-OF-ARGS)
C2 (common-constraint LIST-OF-ARGS)
A: Antonio
B: Bassanio
D: Duke
S: Shylock
BM: Belmont
C: Courtroom
AR: Antonio-Residence
SR: Shylock-Residence
VR: Venice-Rialto
VS: Venice-Street

Conclusion

- Approachable on different levels
  - Fabula
  - Discourse
- Specialized planners vs. modeling
- Interactive story telling

Sources

- Julie Porteous, Marc Cavazza, and Fred Charles. Applying planning to interactive storytelling: Narrative control using state constraints. ACM Trans. Intell. Syst. Technol., 1(2):10:1–10:21, 2010.
- M.O. Riedl and R.M. Young. An intent-driven planner for multi-agent story generation. In Autonomous Agents and Multiagent Systems, 2004. AAMAS 2004. Proceedings of the Third International Joint Conference on, pages 186–193, July 2004.
- S.B. Chatman. Story and Discourse: Narrative Structure in Fiction and Film. Cornell Paperbacks. Cornell University Press, 1980.
- D. Herman, M. Jahn, and M.L. Ryan. Routledge Encyclopedia of Narrative Theory. Taylor & Francis, 2010.
- Patrik Haslum. Narrative planning: Compilations to classical planning. Journal of Artificial Intelligence Research, 44:383–395, 2012.
- Mark O. Riedl and R. Michael Young. Narrative planning: Balancing plot and character. Journal of Artificial Intelligence Research, 39(1):217–268, September 2010.
- Alfonso E. Gerevini, Patrik Haslum, Derek Long, Alessandro Saetti, and Yannis Dimopoulos. Deterministic planning in the fifth international planning competition: PDDL3 and experimental evaluation of the planners. Artificial Intelligence, 173(5–6):619 – 668, 2009.
- Stephen Ware, R. Young, Christian Stith, and Phillip Wright. Interactive narrative planning in the best laid plans. AAAI Conference on Artificial Intelligence, 2015.