

February 4th 2017 – AAAI W17: What's Next for AI in Games?

Towards Automatically Extracting Story Graphs from Natural Language Stories

Josep Valls-Vargas¹, Jichen Zhu² and Santiago Ontañón¹

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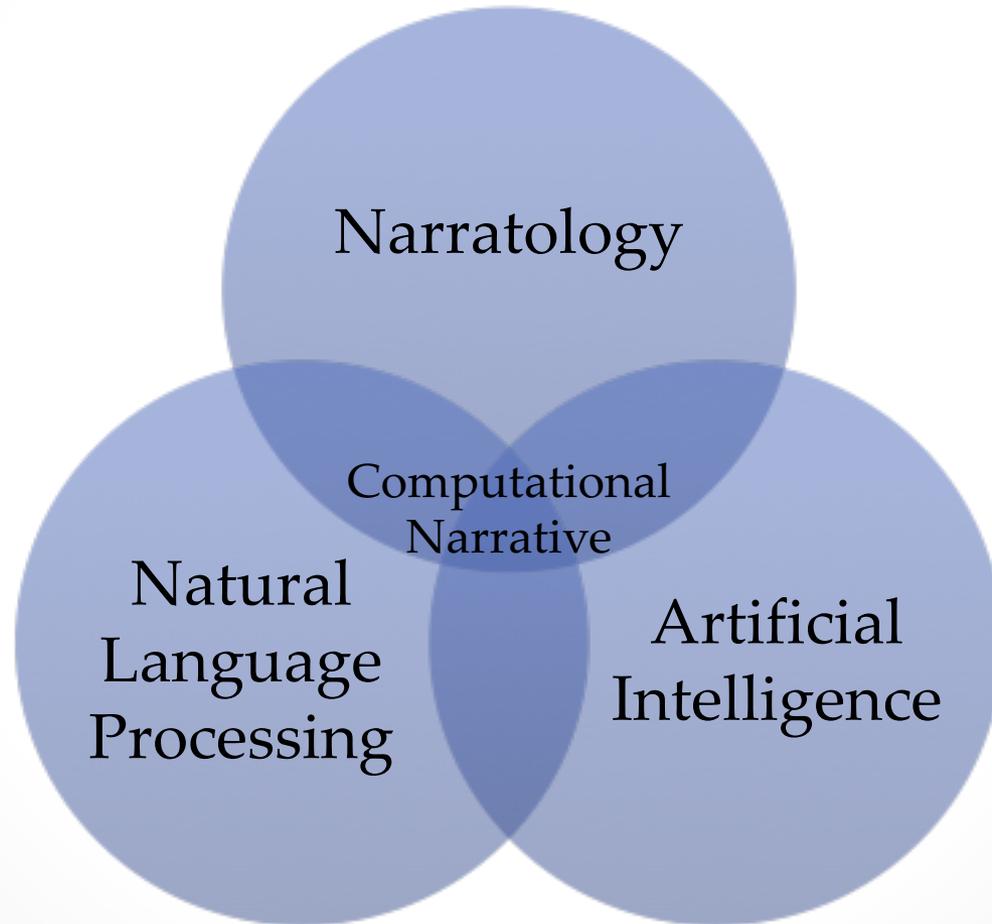
Outline

- Introduction & Motivation
- Story Graphs
- Extracting Story Graphs
- Using Story Graphs

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Introduction



Authorial Bottleneck Problem



Opiate [Fairclough 2007]

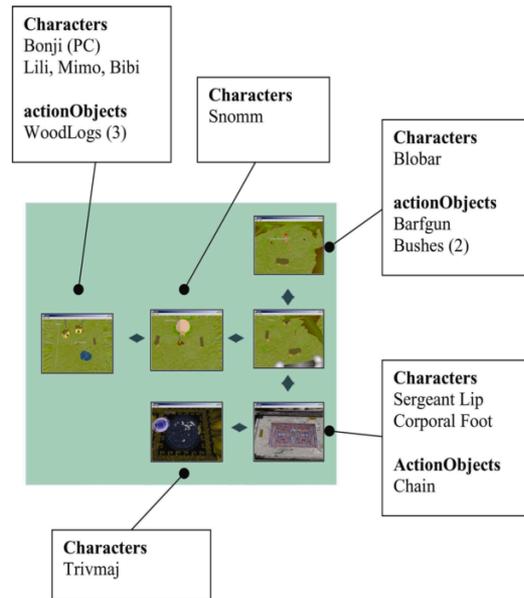
Authorial Bottleneck Problem

- Input required by OPIATE

Characters,
Attitudes, ...

Character Name	Initial Attitudes	Initial Inventory
Lili	Likes Mimo & Bibi	
Mimo	Likes Lili & Bibi	
Bibi	Likes Lili & Mimo	
Snomm		Magic Mirror Problem
Blobar		
Sergeant Lip	Likes Trivmaj & Foot Dislikes Bonji	
Corporal Foot	Likes Trivmaj & Lip Dislikes Bonji	
Trivmaj	Dislikes Bonji	Whirlwind Wand

Locations,
Props, ...



Narrative Function
Sequences

```
p114.txt - Notepad
File Edit Format View Help
villainny capture (family ;
donor request ;
reaction ;
provision ;
pursuit ;
rescue hide ;
departure ;
donor ;
reaction ;
provision take ;
return ;
pursuit ;
rescue (object ;
unrecognised ;
recognition ;
wedding ;
```

Opiate [Fairclough 2007]

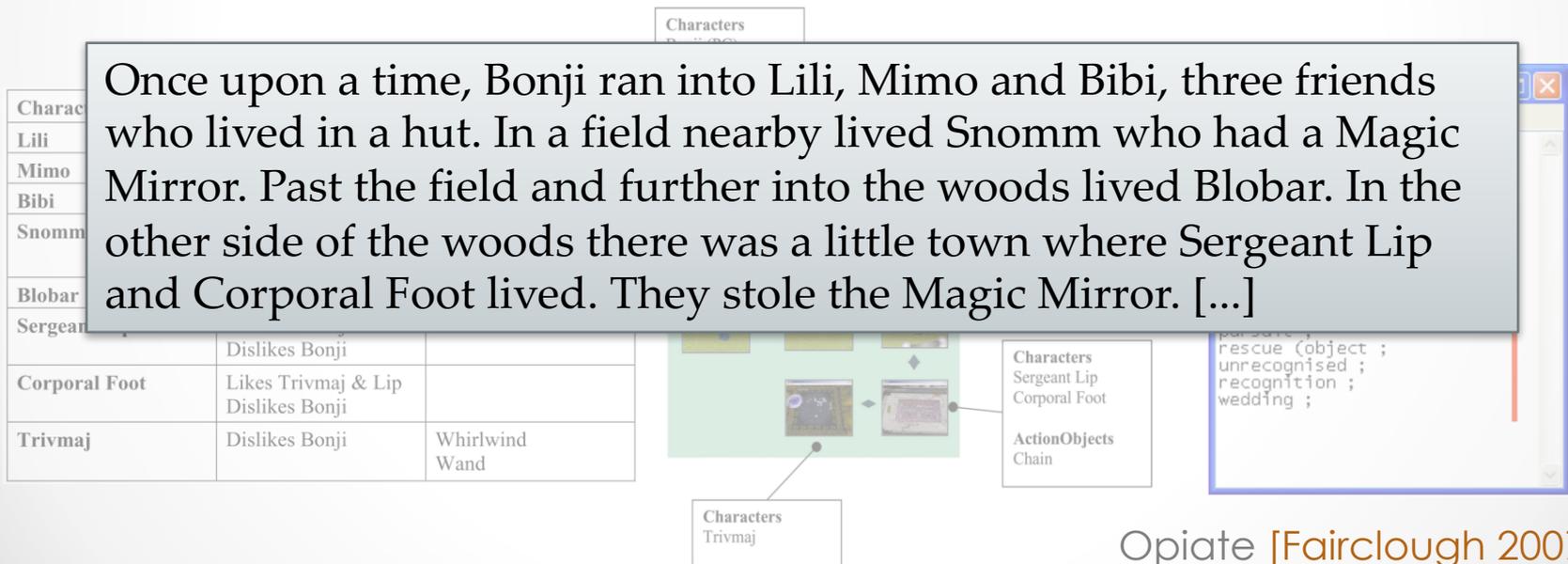
Automated Narrative Information Extraction

- Input required by OPIATE

Characters,
Attitudes, ...

Locations,
Props, ...

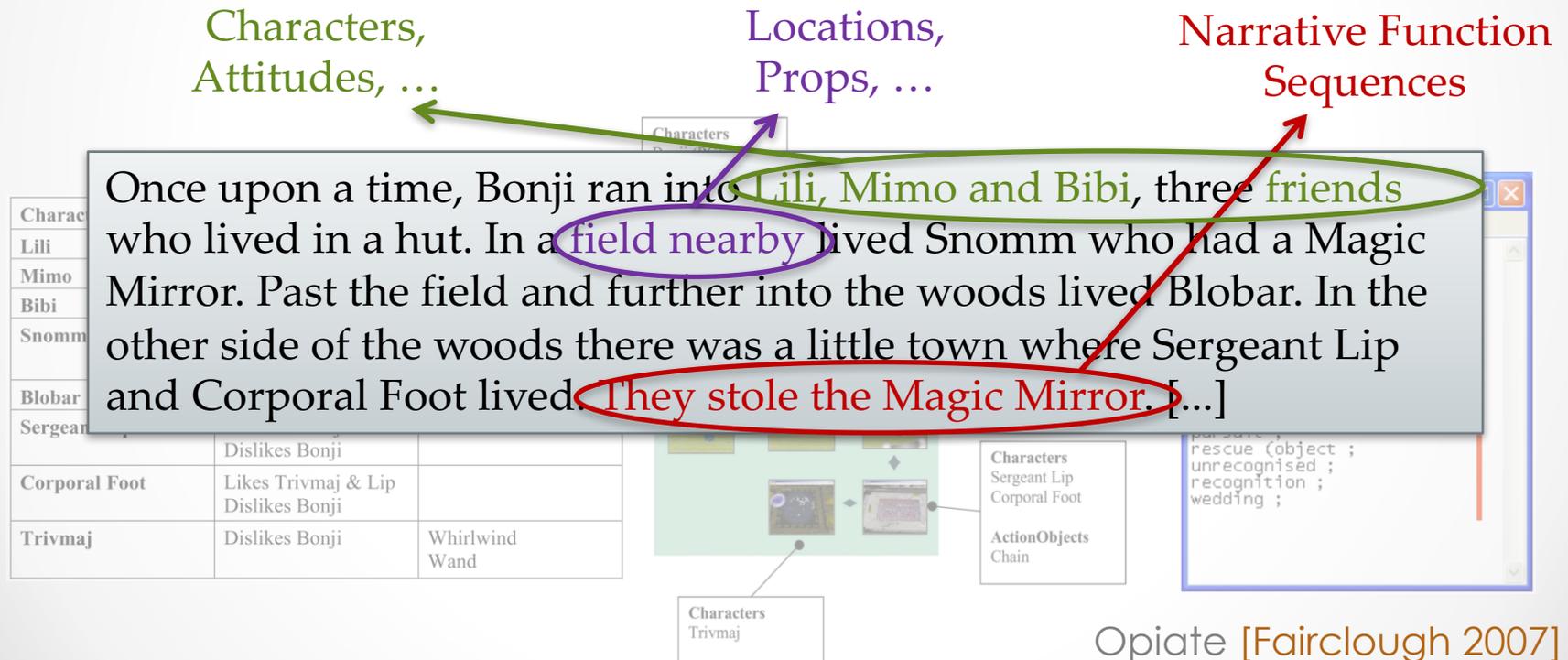
Narrative Function
Sequences



Opiate [Fairclough 2007]

Automated Narrative Information Extraction

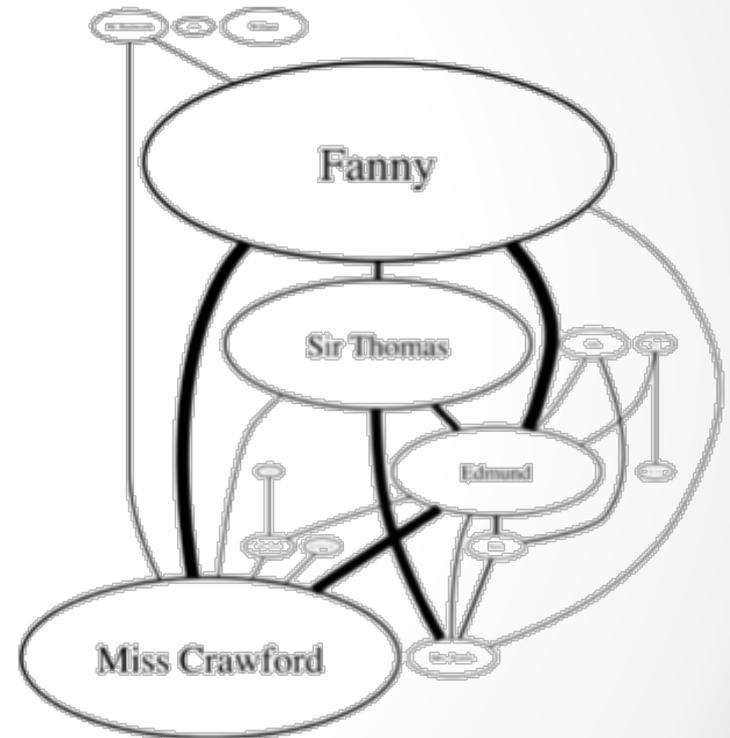
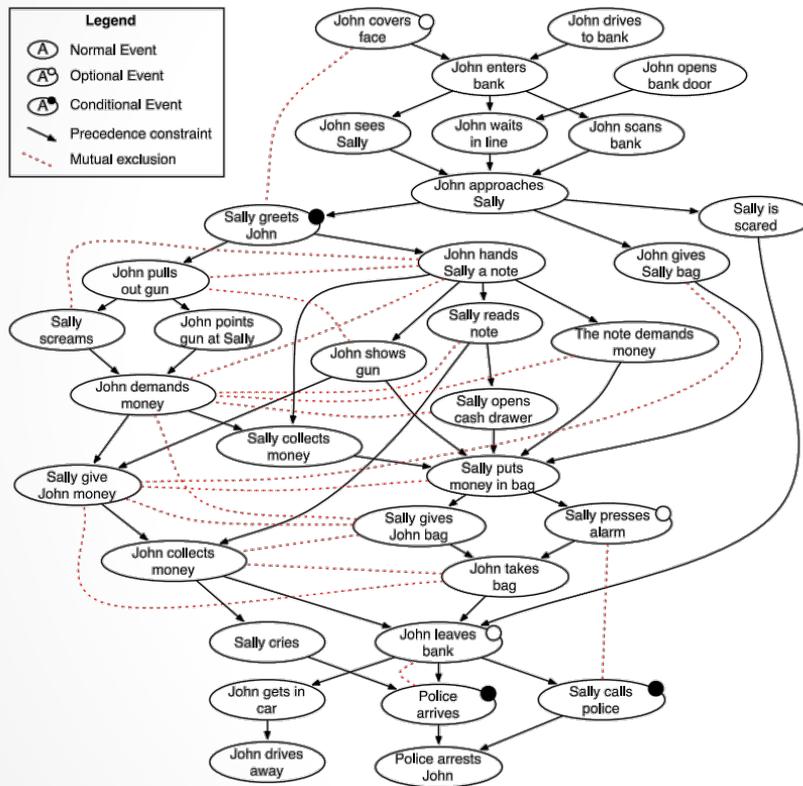
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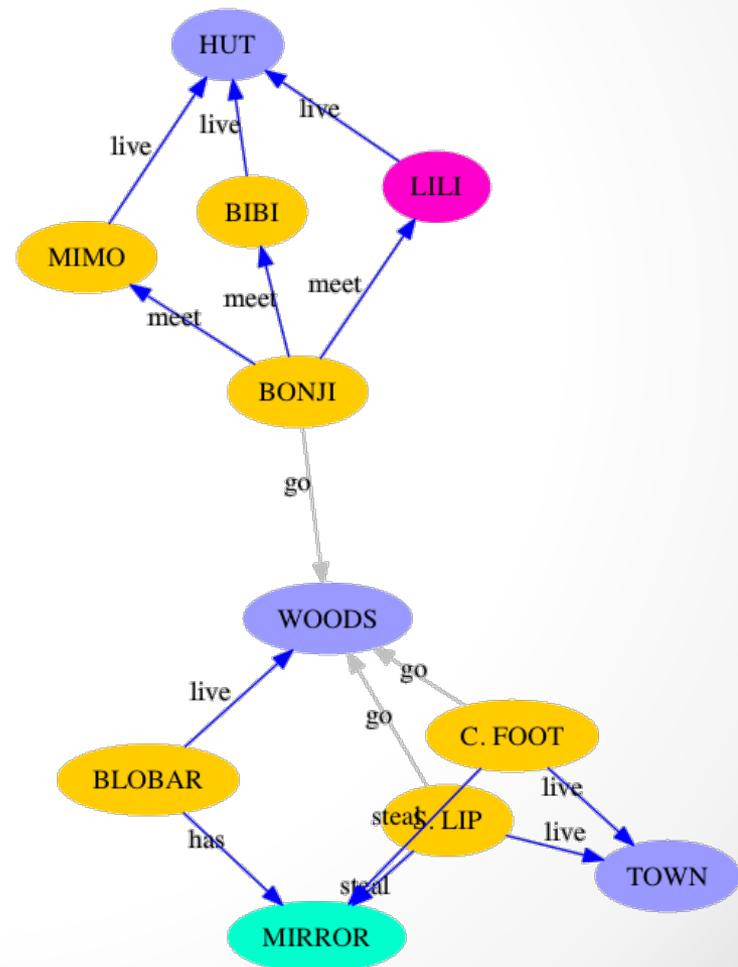
Story Graphs



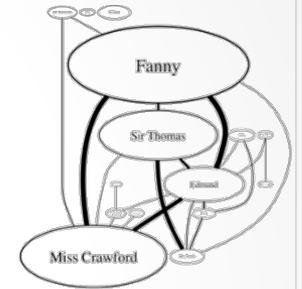
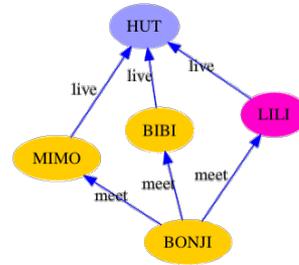
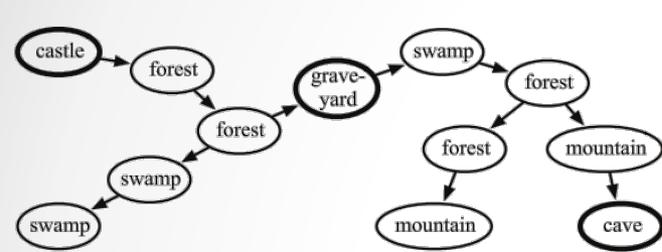
Plot Graphs [Li et al. 2013] Social Networks [Els0n 2010]

Story Graphs

Once upon a time, **Bonji** ran into **Lili**, **Mimo** and **Bibi**, three friends who lived in a **hut**. In a field **nearby** lived **Snomm** who had a **Magic Mirror**. Past the field and further into the **woods** lived **Blobar**. In the other side of the woods there was a little **town** where **Sergeant Lip** and **Corporal Foot** lived. They stole the **Magic Mirror**. [...]



Story Graphs



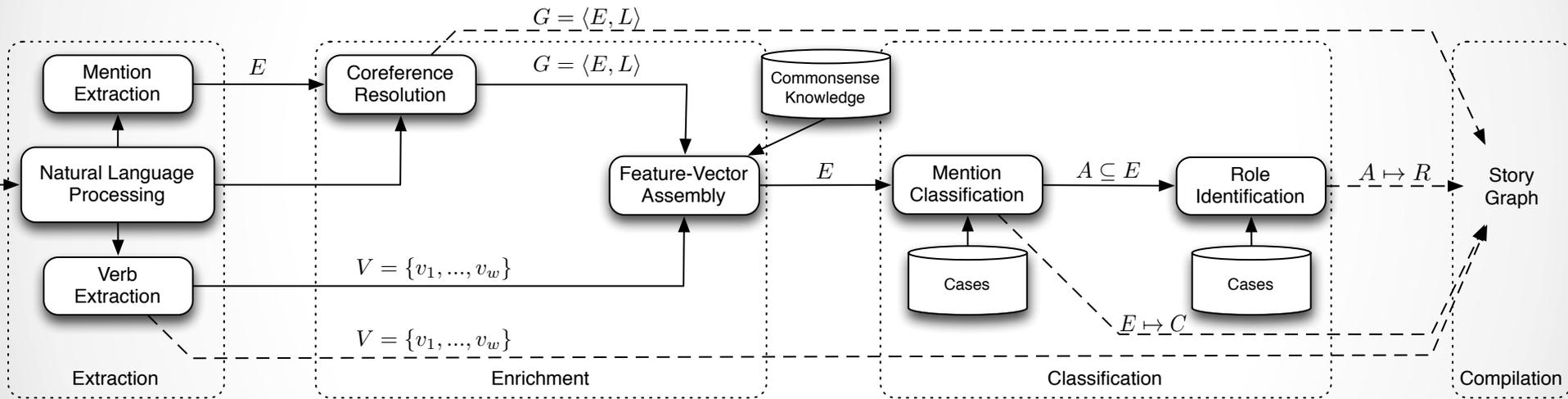
Game Forge [Hartsook et al. 2011], Opiate [Fairclough 2007], Prom Week [McCoy et al. 2011]

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- Using Story Graphs

Extracting Story Graphs

- VoZ



Dataset



21 Stories
4,791 Mentions
1,586 Verbs

A. Afanasyev [Finlayson 2011] [Malec 2010]

Information Extraction

- Mentions
 - Syntactic parse tree
- Verbs
 - Part-of-speech tags
- Verb Arguments
 - Typed dependencies
- Mentions
 - Recall 1.000
 - Precision 0.893
- Verbs
 - Recall 0.842
 - Precision 1.000
- Verb Arguments
 - Recall 0.204
 - Precision 0.260

Enrichment of Extracted Information

- Additional Information
 - WordNet
 - ConceptNet
 - Gazetteers
- Coreference Resolution
 - $C/Gr = 1.07$
 - $Gr/C = 6.00$

Mention Classification (Entities)

- Instance Based
 - Weighted continuous Jaccard distance
 - One-story-out protocol
- Majority Voting
 - Coreference information

Mention Classification (Entities)

- Character/Non-character
 - Precision 0.929
 - Recall 0.934
- Type (14+1 classes from Chatman's taxonomy)
 - Precision 0.567
 - Recall of 0.507
- Roles
 - Precision 0.425
 - Recall of 0.661

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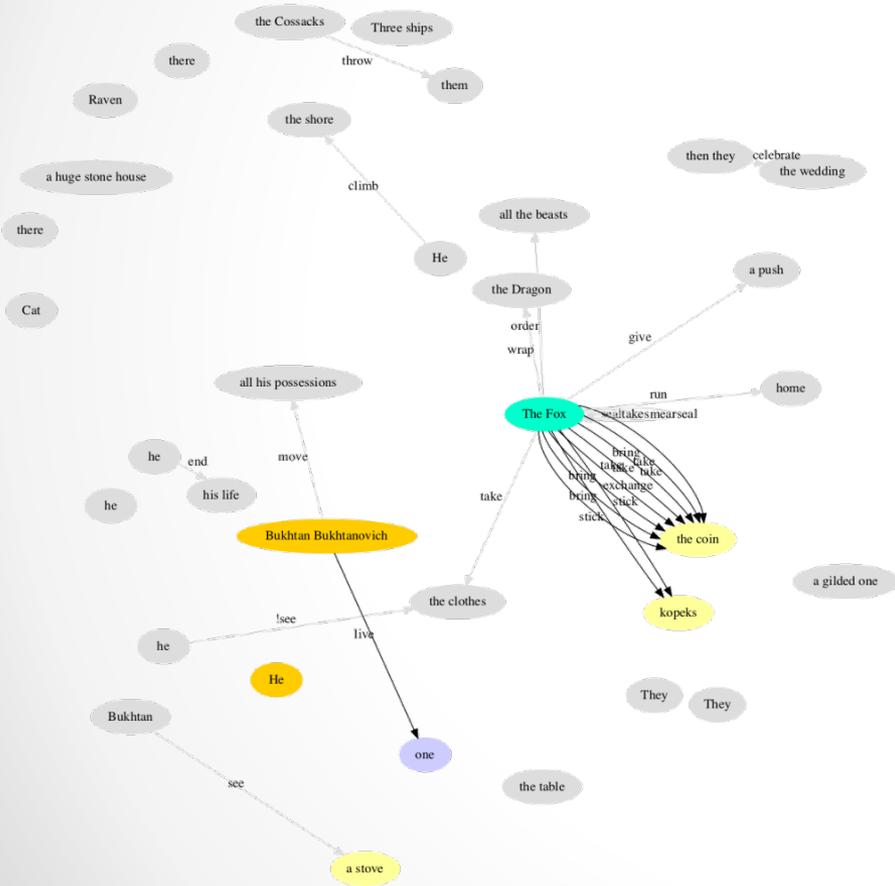
Male/Female/Magical Beings,
Locations, Props, Happenings, ...

Outline

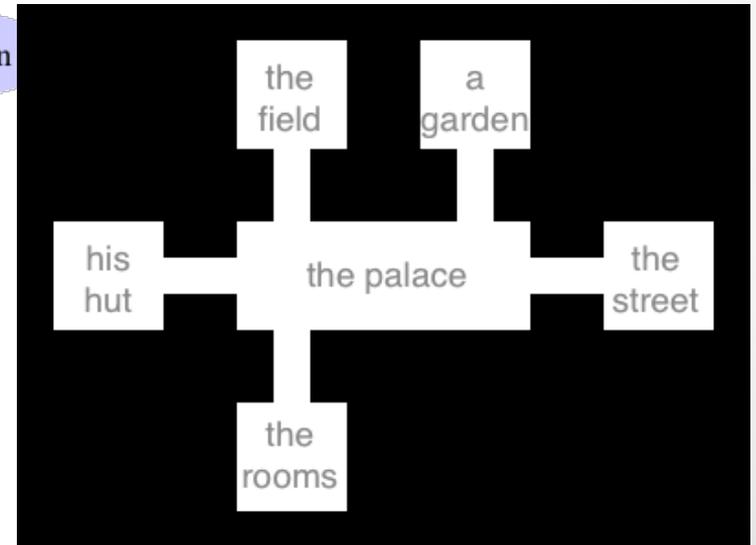
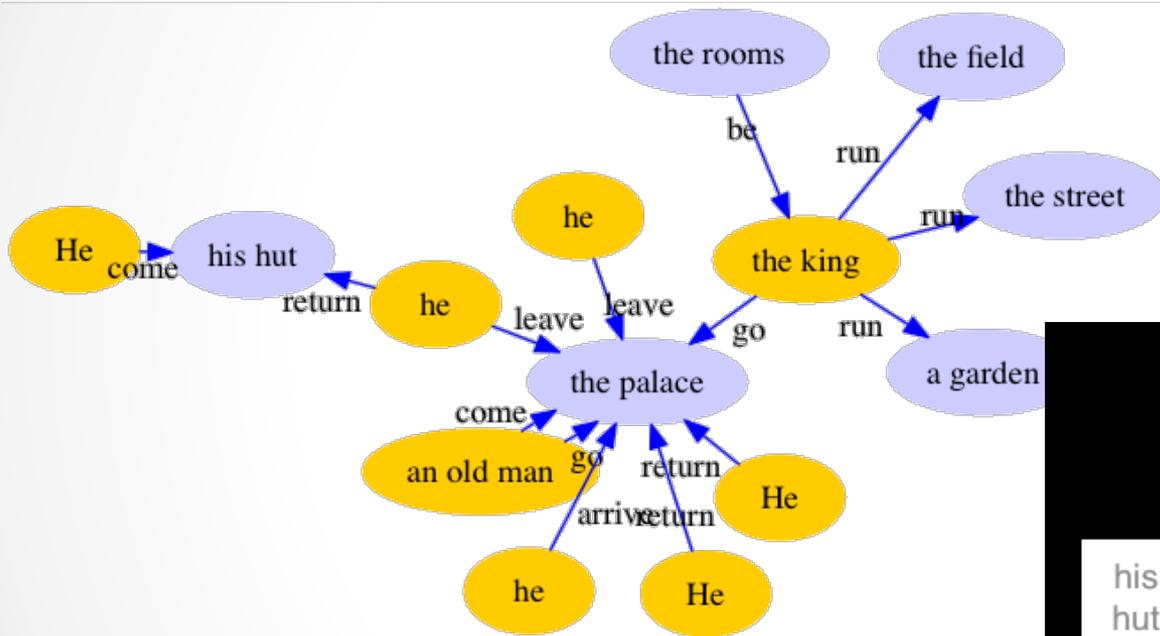
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Story Chronology

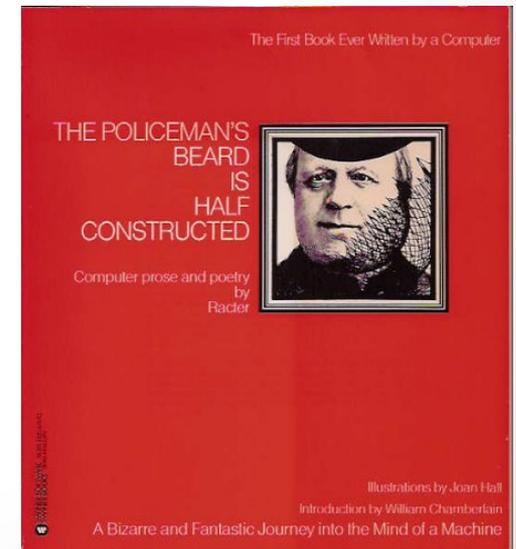
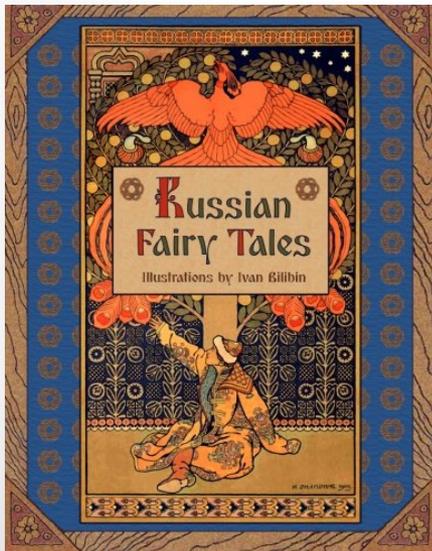


Environment & Spatial Relations



Future Work

- Improve the quality of extracted story graphs
- Map story graphs to the input of computational narrative system



Thanks



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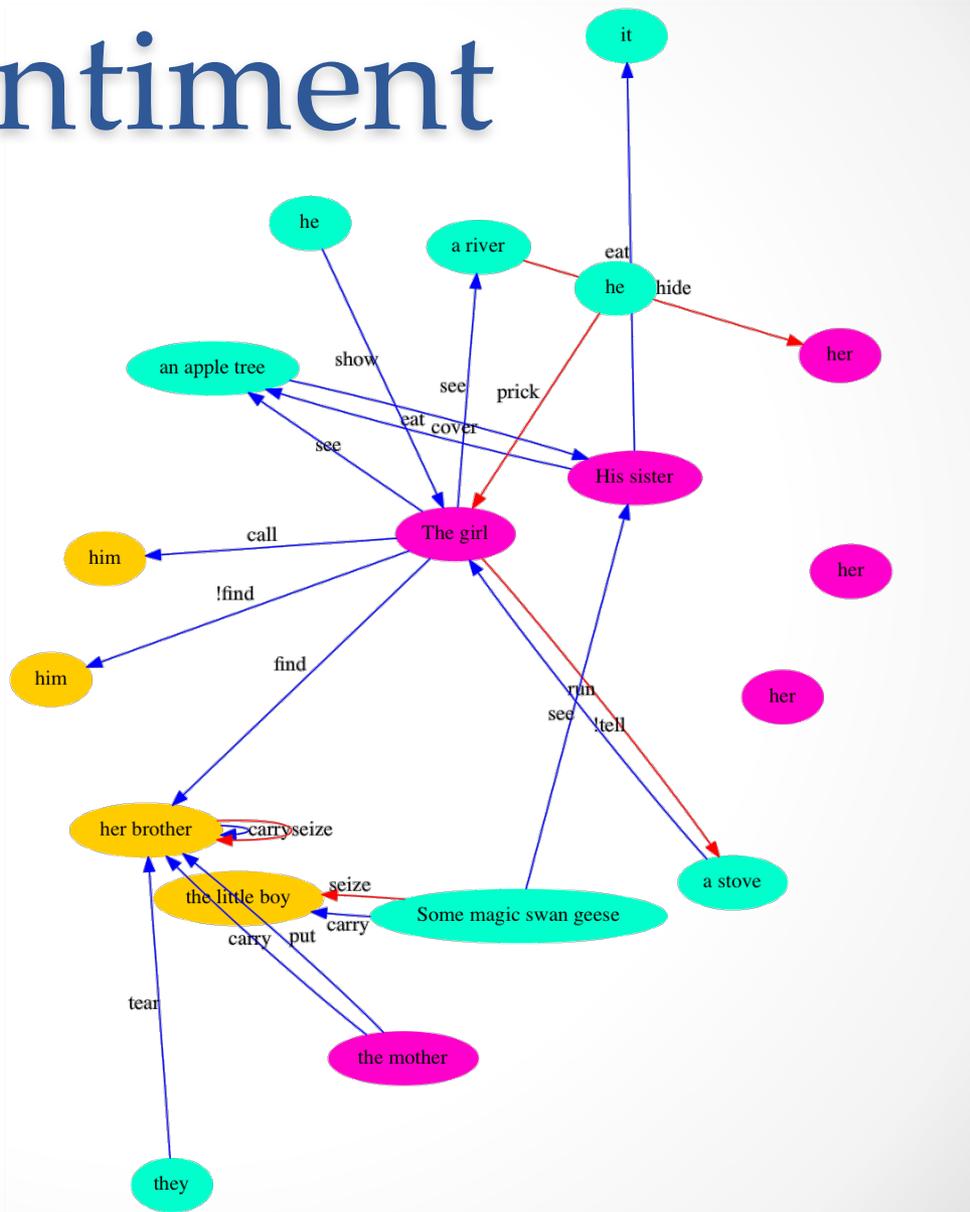
Drexel University



Backup Slides

...

Sentiment



Classification

- 14+1 classes derived Chatman's existents

	N/A	AA	AN	AO	FE	GR	HA	MA	MB	OB	PA	PO	SC	SS	ST	Recall	Prec.
N/A	0	24	1	7	8	17	30	37	4	166	11	0	9	150	47	0	0
AA	0	39	1	2	31	10	1	29	13	22	2	0	0	3	5	0.247	0.151
AN	0	4	2	6	0	2	2	8	2	49	0	0	1	3	7	0.023	0.133
AO	0	1	0	0	0	22	1	7	2	20	1	0	0	7	0	0	0
FE	0	14	0	0	510	3	8	9	0	24	0	0	0	17	4	0.866	0.765
GR	0	10	3	34	62	56	9	55	0	120	2	0	0	5	0	0.157	0.308
HA	0	3	2	1	2	2	4	7	1	60	4	0	6	21	10	0.033	0.033
MA	0	72	1	1	30	37	17	799	17	71	3	0	0	69	11	0.708	0.76
MB	0	34	1	9	1	5	0	57	52	58	0	0	21	1	2	0.216	0.433
OB	0	36	3	11	13	13	30	14	26	375	48	0	16	119	50	0.497	0.318
PA	0	5	1	8	7	5	5	4	0	56	33	0	1	16	0	0.234	0.308
PO	0	0	0	0	0	0	0	0	1	2	1	0	1	1	0	0	0
SC	0	8	0	0	0	2	2	1	1	19	0	0	2	21	6	0.032	0.032
SS	0	4	0	4	1	6	9	13	1	94	1	0	4	283	14	0.652	0.387
ST	0	5	0	0	2	2	2	12	0	42	1	0	2	16	57	0.404	0.268

- Micro-averaged accuracy: 0.537

Automated Narrative Information Extraction

One day, somewhere near Kiev, a dragon appeared, who demanded heavy tribute from the people. He demanded every time to eat a fair maiden: and at last the turn came to the Tsarevna, the princess. But the dragon would not eat her, she was too beautiful. He dragged her into his den and made her his wife. [...] When she wrote a letter to her father and mother she used to tie it to the neck of her little dog. [...] The Tsarevna got every day on more intimate terms with her dragon in order to discover who was stronger. At last he owned that Nikita, the tanner at Kiev, was the stronger. [...] The Tsarevna at once wrote to her father [...] So the Tsar looked for Nikita, and went to him himself to beg him to release the land from the cruelty of the dragon and redeem the princess. [...]

Automated Narrative Information Extraction

- Characters

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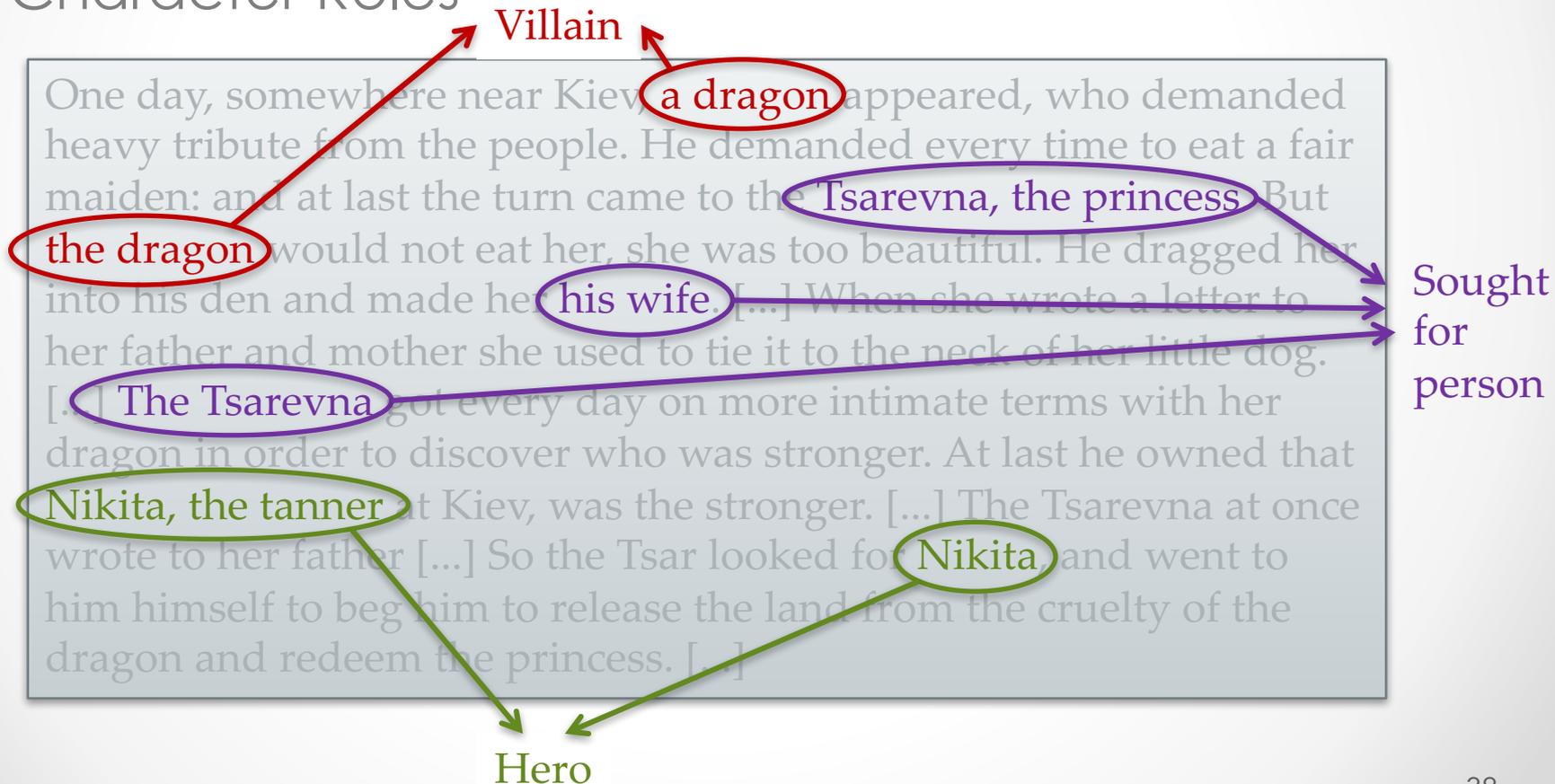
Automated Narrative Information Extraction

- Coreference

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Automated Narrative Information Extraction

- Character Roles



Automated Narrative Information Extraction

- Narrative Functions

A: Villainy

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↑: Departure

Future Work

Bridging the Gap

Scenes &
Narrative Functions

Annotated Text

Coreference

Characters
& Roles

Locations
& Props

```
(:clauses
(c0 (:s phase1 phase2))
(phase1 (:s t1a t2a t3a t4a (:m phase1)))
[...])
(:templates
(t1a "After counting street numbers and puzzling over the scrawl of a 4,
which turned out to be a 9,")
(t2a (s6-notice (ales "Ales") " found a " (s6-in-door (s6-small-door
"small " (door "door"))) " in the side of an " (s6-big-factory "immense "
(factory "factory"))) " that matched the Aristobots description."))
(t3a "Soon after knocking, " (s6-open "a solid, " (workbot "grubby
workbot") " opened up") " and greeted" (ales "Ales") " with a scowl of
pure skepticism.")
(t4a (s6-explain (ales "Ales") " stammered out his situation, describing in
too great of detail the recent " (theft "theft incident,")))
[...])
(:structure
(common
(:entities (ales :type robot) (robot :type animate) (workbot :type robot)
(factory :type inanimate))
(:expressions
((big factory) :name s6-big-factory)
)
)
)
```

Riu [Ontañón and Zhu 2009, 2014]