2019 ACM RICHARD TAPIA CELEBRATION OF DIVERSITY IN COMPUTING CONFERENCE
PRESENTED BY CMD-IT

Understanding the Technological and Experiential Requirements of Improvisational Storytelling Agents

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Why is storytelling important?

Most natural way of communicating

What if computers could tell stories?

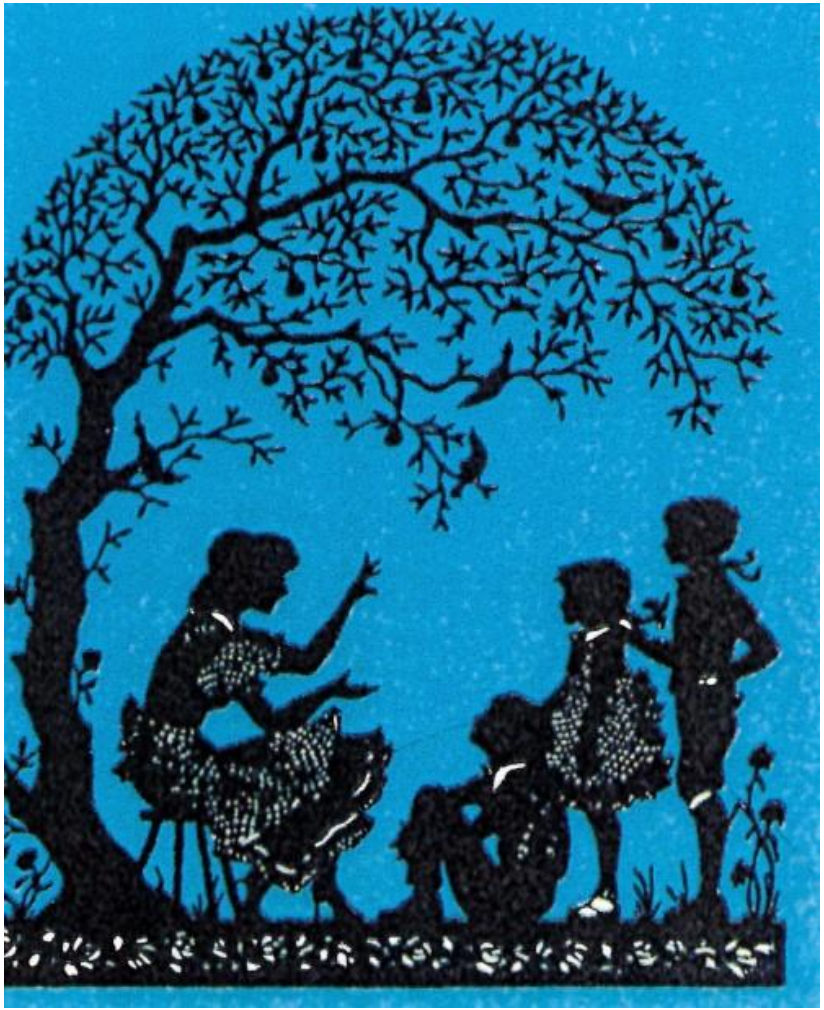


Image from: https://www.nowplayingutah.com/event/2018-vernalutah-storytelling-festival/

They could…

- Help us plan
- Teach us
- Train us for hypothetical scenarios
- Do anything else that requires long-term context and commonsense information!

Automated Story Generation

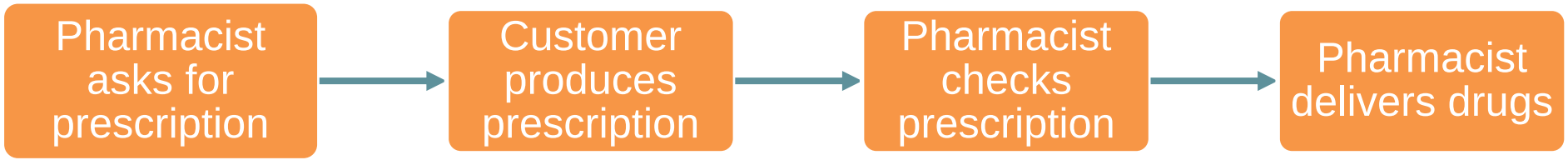
Teaching computers to tell stories

Main Takeaway (tl;dr)

There are currently two ways of doing story generation

And I am creating a combined model by taking the best from both

Causal Storytelling Systems

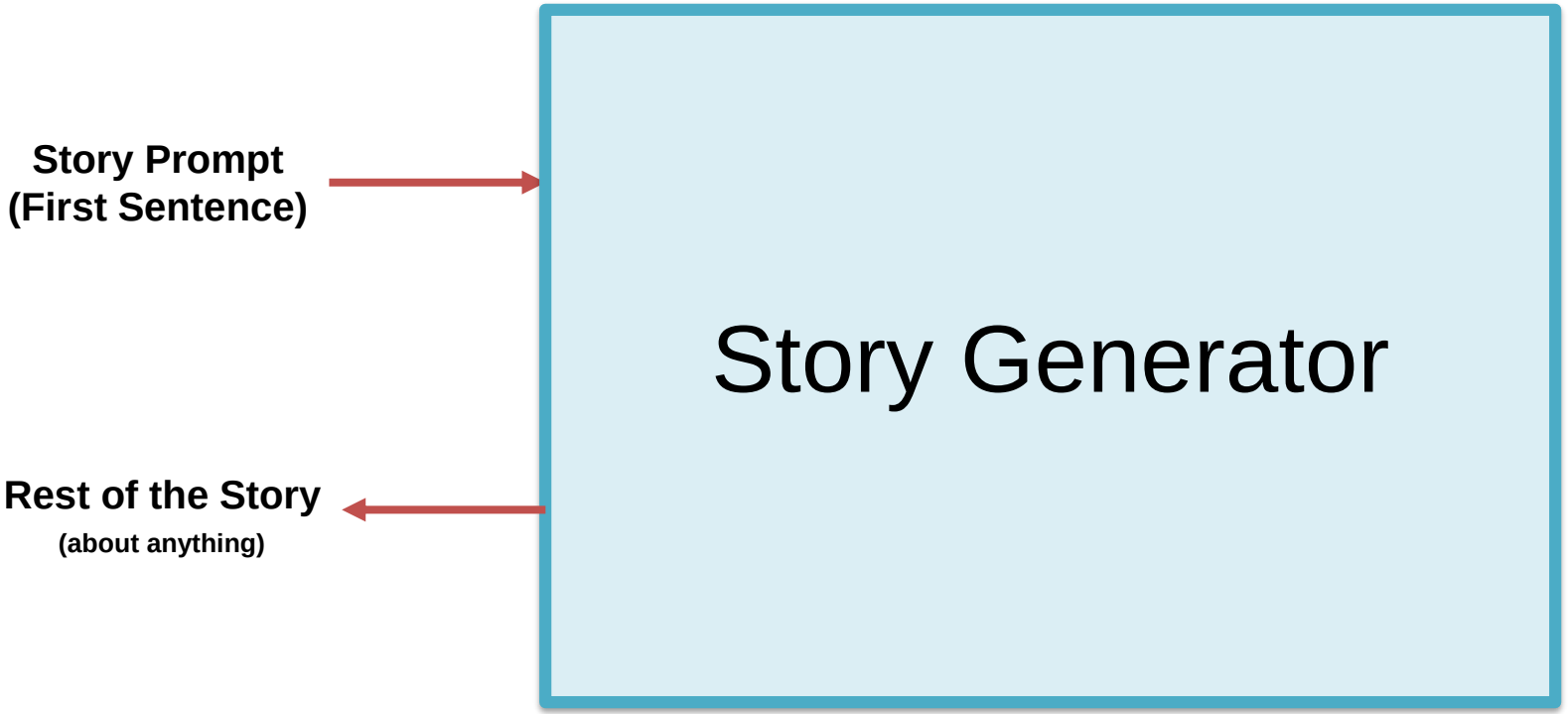


Examples

Universe (1984):
>> LIZ tells NEIL she doesn't love him
working on goal – (WORRY-ABOUT NEIL) – using plan BE-CONCERNED
Possible candidates – MARLENA JULIE DOUG ROMAN DON CHRIS KAYLA
Using Marlena for WORRIER
>> MARLENA is worried about NEIL

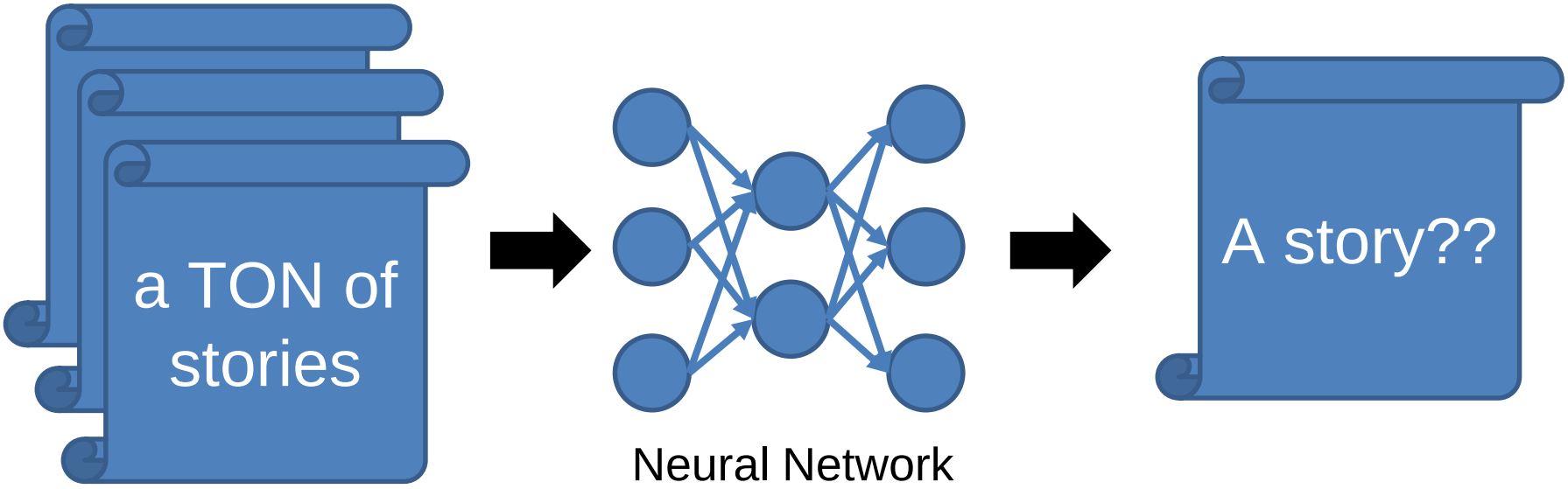
Talespin (1992):
One day,
JOE WAS THIRSTY .
JOE WANTED NOT TO BE THIRSTY .
JOE WANTED TO BE NEAR THE WATER.

The Dream


Story Prompt
(First Sentence)
Story Generator
Rest of the Story
(about anything)


SUNSPRING

Neural Storytellers



A Standard Neural Network's Output

r2d2 carrying some drinks on a tray strapped to his back passes yoda who uses his force powers to hog the drinks

Expected:

obi wan and anakin are drinking happily when chewbacca takes a polaroid picture of anakin and obi wan

Generated:

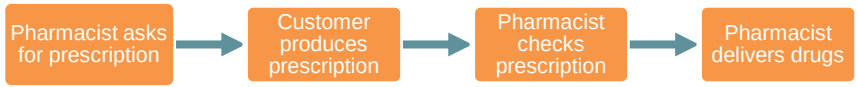
can this block gives him the advantage to personally run around with a large stick of cheese

Comparison

CAUSAL SYSTEMS

\+ Coherent stories

− Limited domain



NEURAL NETWORK SYSTEMS

\+ Unique stories

− Coherence is terrible

This brings me to my thesis statement…


Why don’t we have both?

In other words…

A jointly neural and causal model will create

more *novel* **coherent** **open-domain** stories

than solely probabilistic (neural) or causal models

Outline

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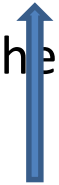
Improving neural networks for storytelling

- Extr from sen
- Lea plot poin

Joint Model

Why is this so weird?

r2d2 carrying some drinks on a tray strapped to his back passes yoda who uses his force powers to hog the drinks



can this block gives him the advantage to personally run around with a large stick of cheese

Problem: Sentences like this only appear once in the dataset

Solution: Fixing sparsity by separating semantics (meaning) from syntax (grammar)

Event Representations

Use linguistic knowledge to bootstrap the neural network

From sentence, extract event representation

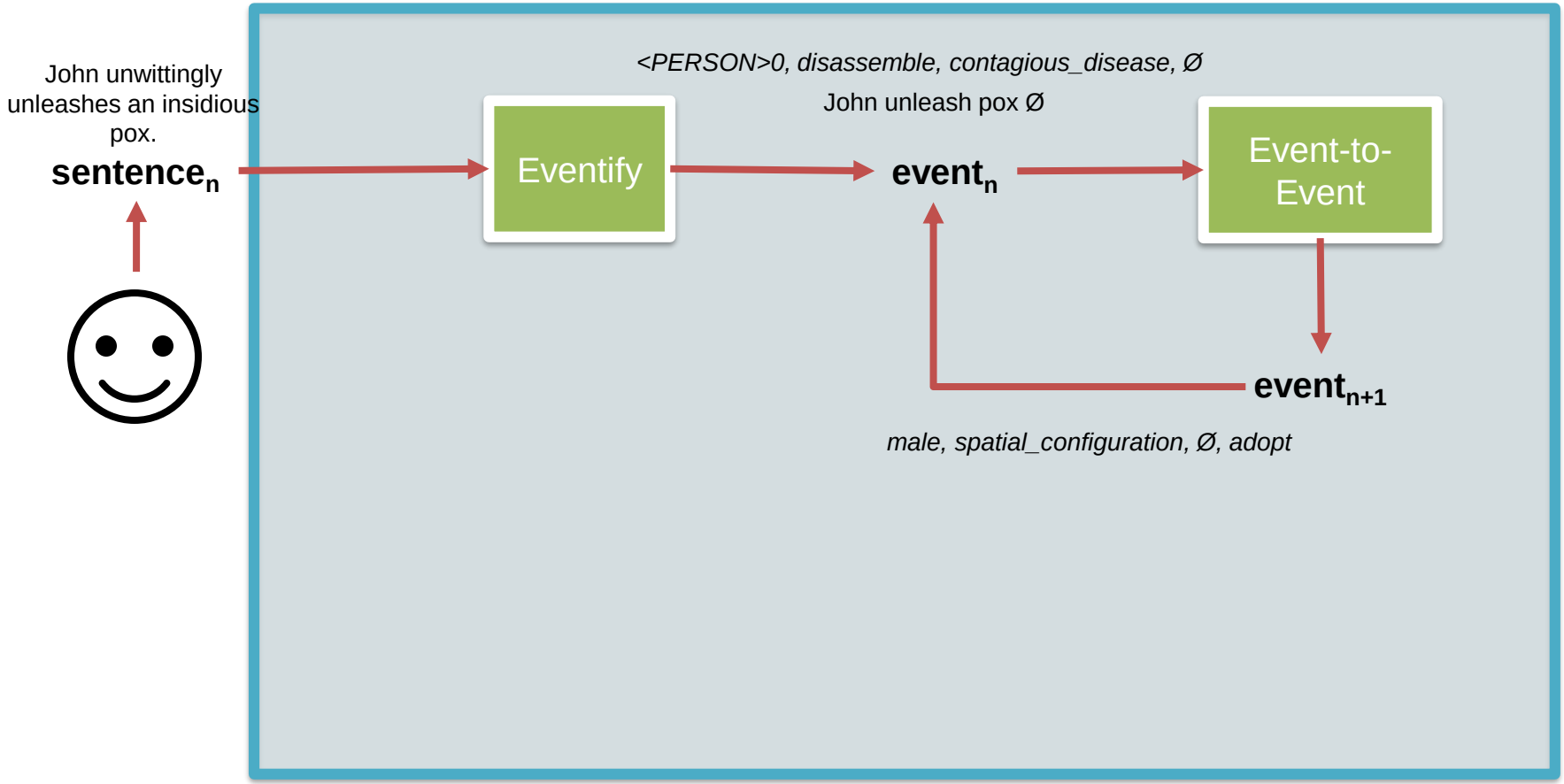
(subject, verb, direct object, modifier)

Original sentence: yoda uses the force to take apart the platform

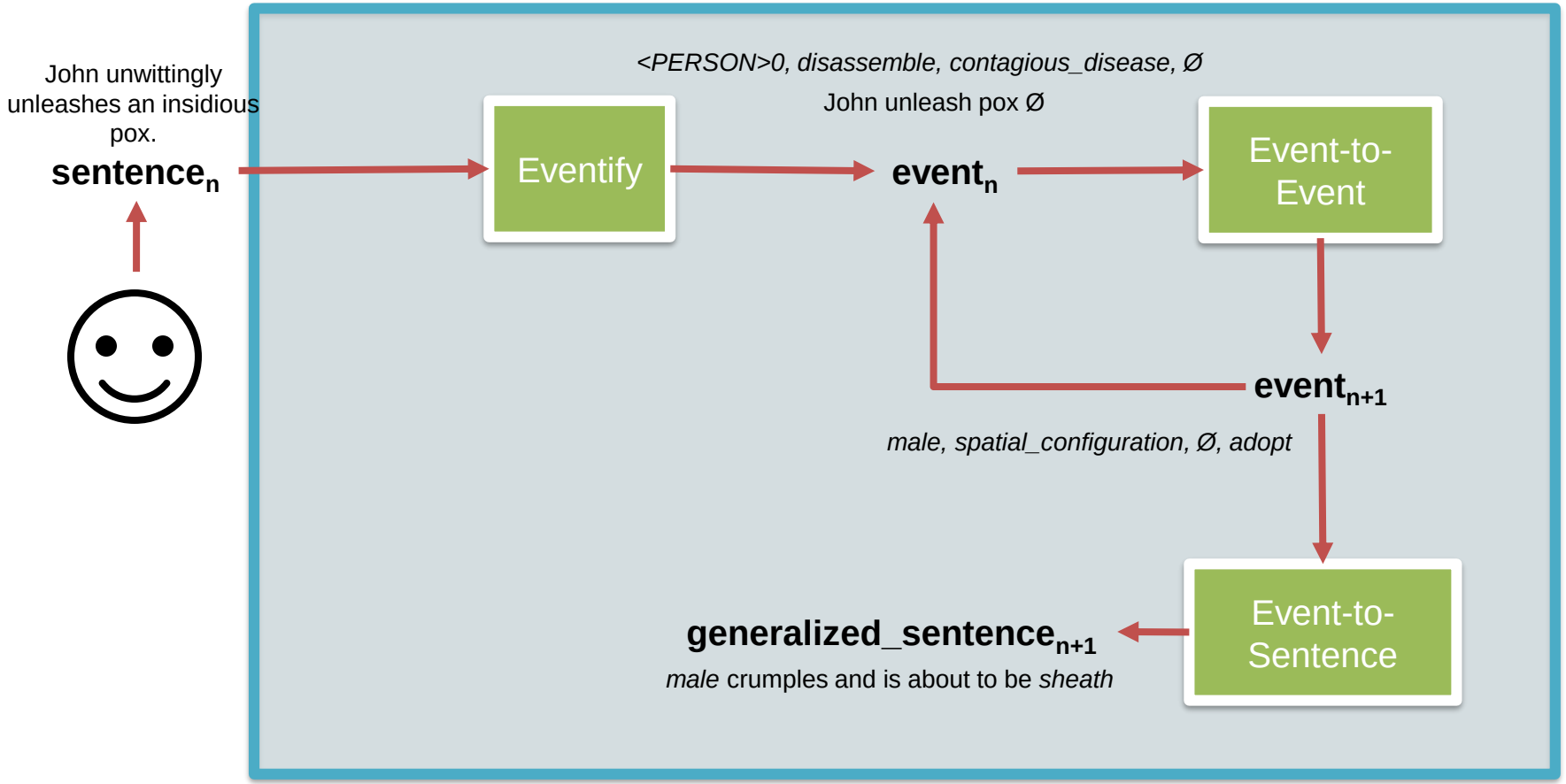
Event: yoda, use, force, Ø

Generalized Event: *<PERSON>0, fit, power, Ø*

Martin, Lara J., et al. "Event representations for automated story generation with deep neural nets." *Thirty-Second AAAI Conference on Artificial Intelligence*. 2018.


John unwittingly unleashes an insidious pox.
sentence$_n$
Eventify
<PERSON>0, disassemble, contagious_disease, Ø
John unleash pox Ø
event$_n$
Event-to-Event
event$_{n+1}$
male, spatial_configuration, Ø, adopt

How do you read that?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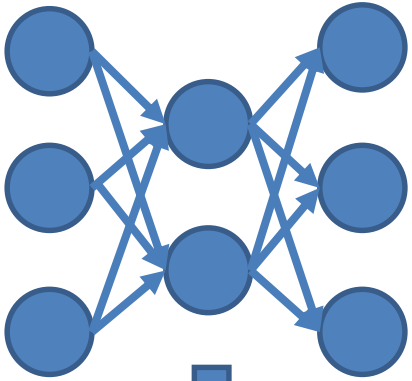
sentence$_n$
Eventify
<PERSON>0, disassemble, contagious_disease, Ø
John unleash pox Ø
event$_n$
Event-to-Event
event$_{n+1}$
male, spatial_configuration, Ø, adopt
Event-to-Sentence
generalized_sentence$_{n+1}$
male crumples and is about to be sheath

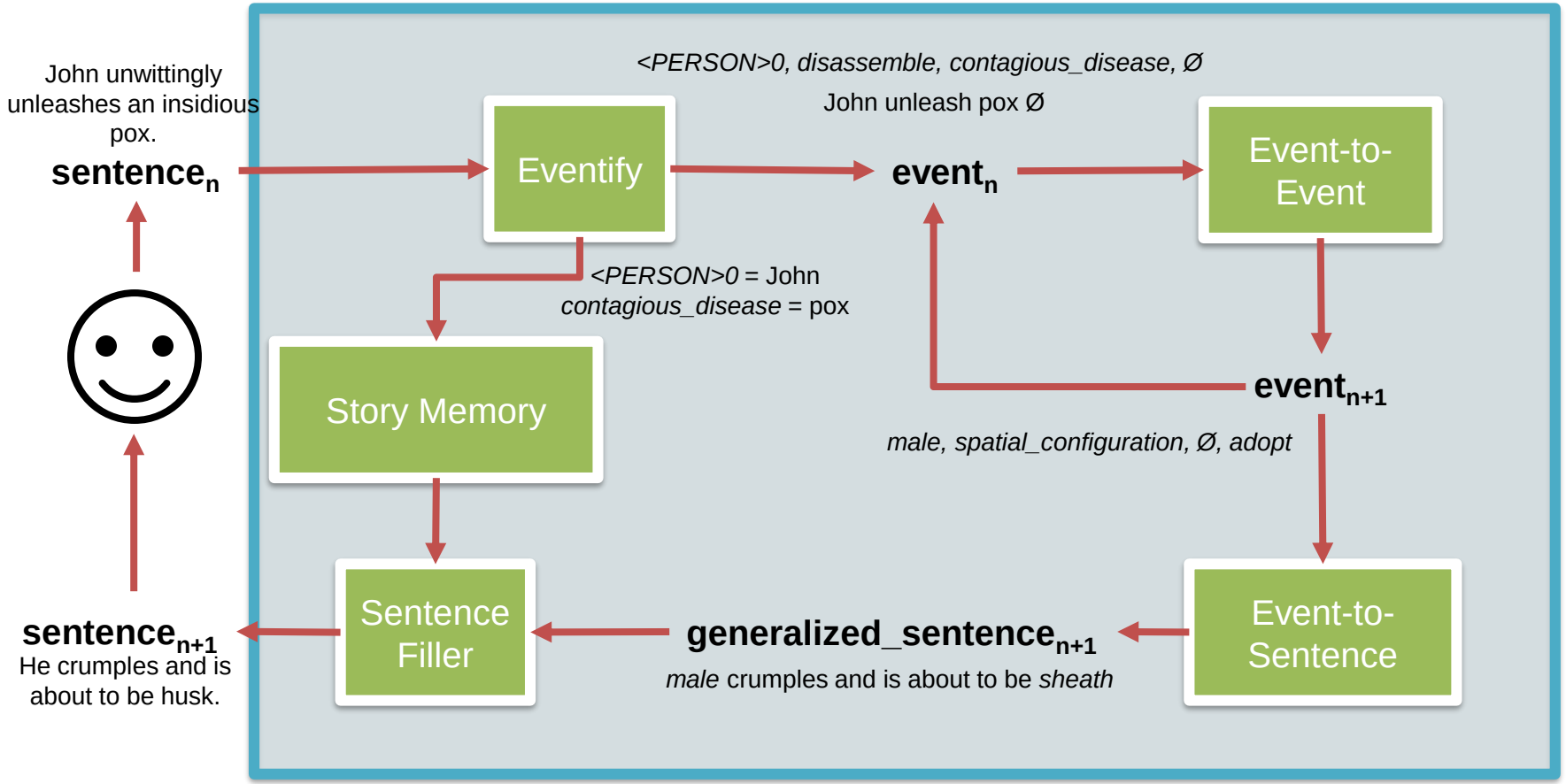
Why are the sentences generalized?

Generalized Event-to-Event



carnivore, eat, animal_tissue, Ø

The dog ate the bone.


John unwittingly unleashes an insidious pox.
sentence$_n$
Eventify
<PERSON>0, disassemble, contagious_disease, Ø
John unleash pox Ø
event$_n$
Event-to-Event
<PERSON>0 = John
contagious_disease = pox
Story Memory
event$_{n+1}$
male, spatial_configuration, Ø, adopt
sentence$_{n+1}$
He crumples and is about to be husk.
Sentence Filler
generalized_sentence$_{n+1}$
male crumples and is about to be sheath
Event-to-Sentence

Global Coherence

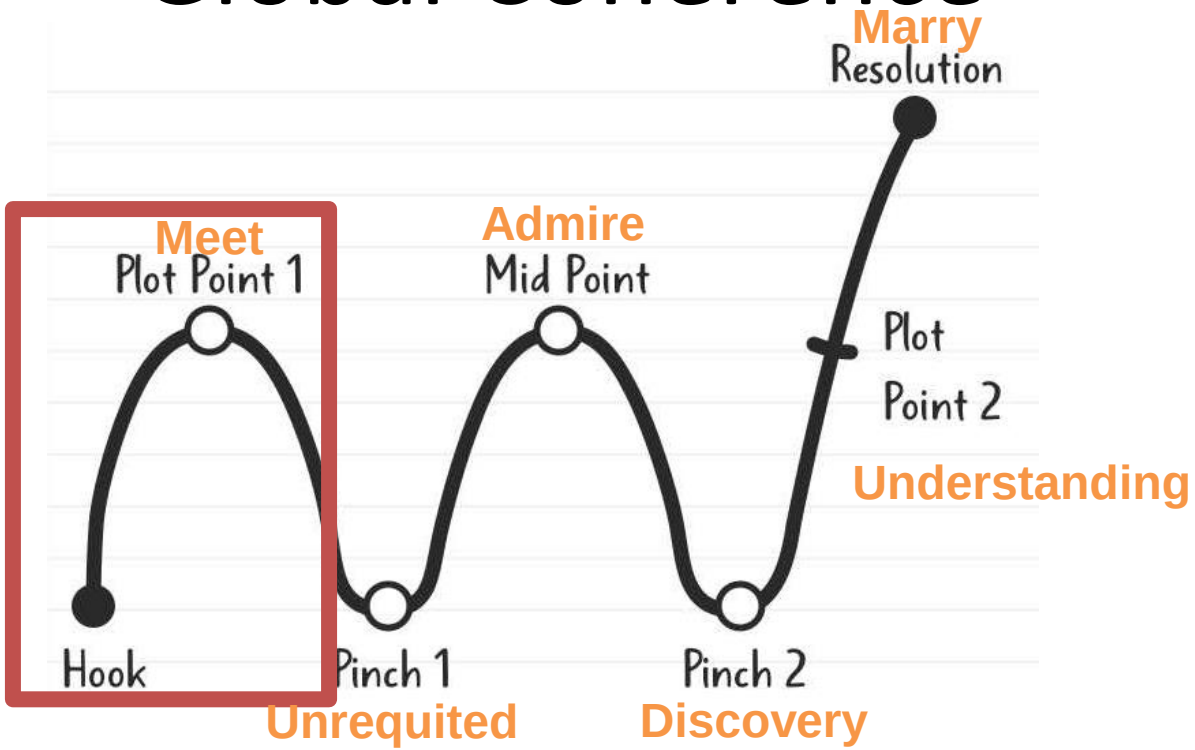


Image source: https://blog.reedsy.com/plot-point/

Outline

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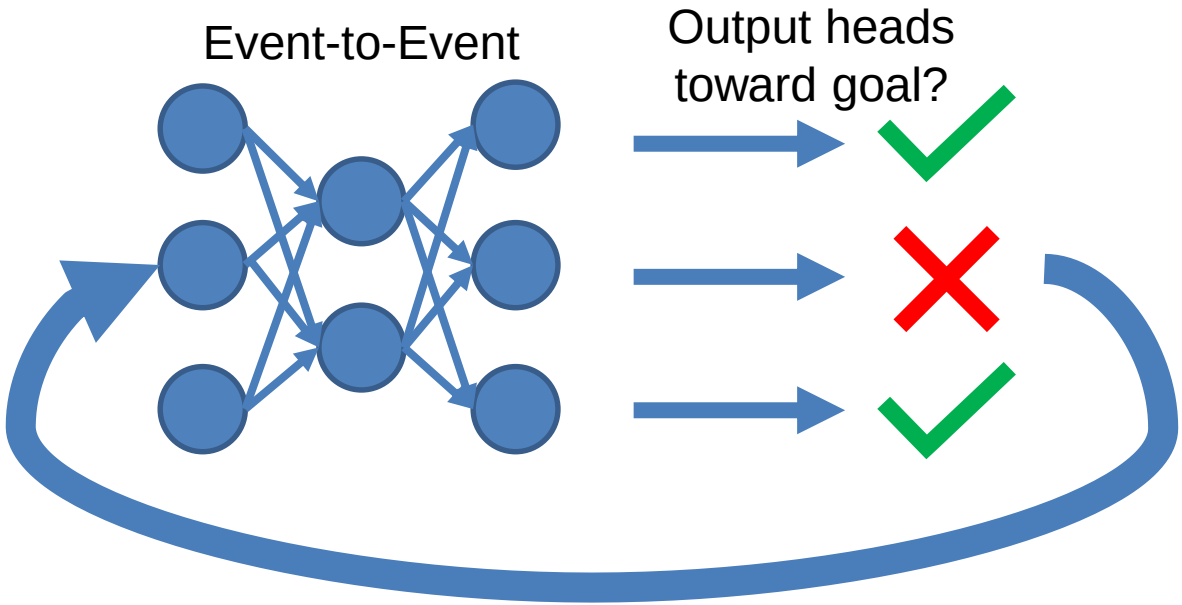
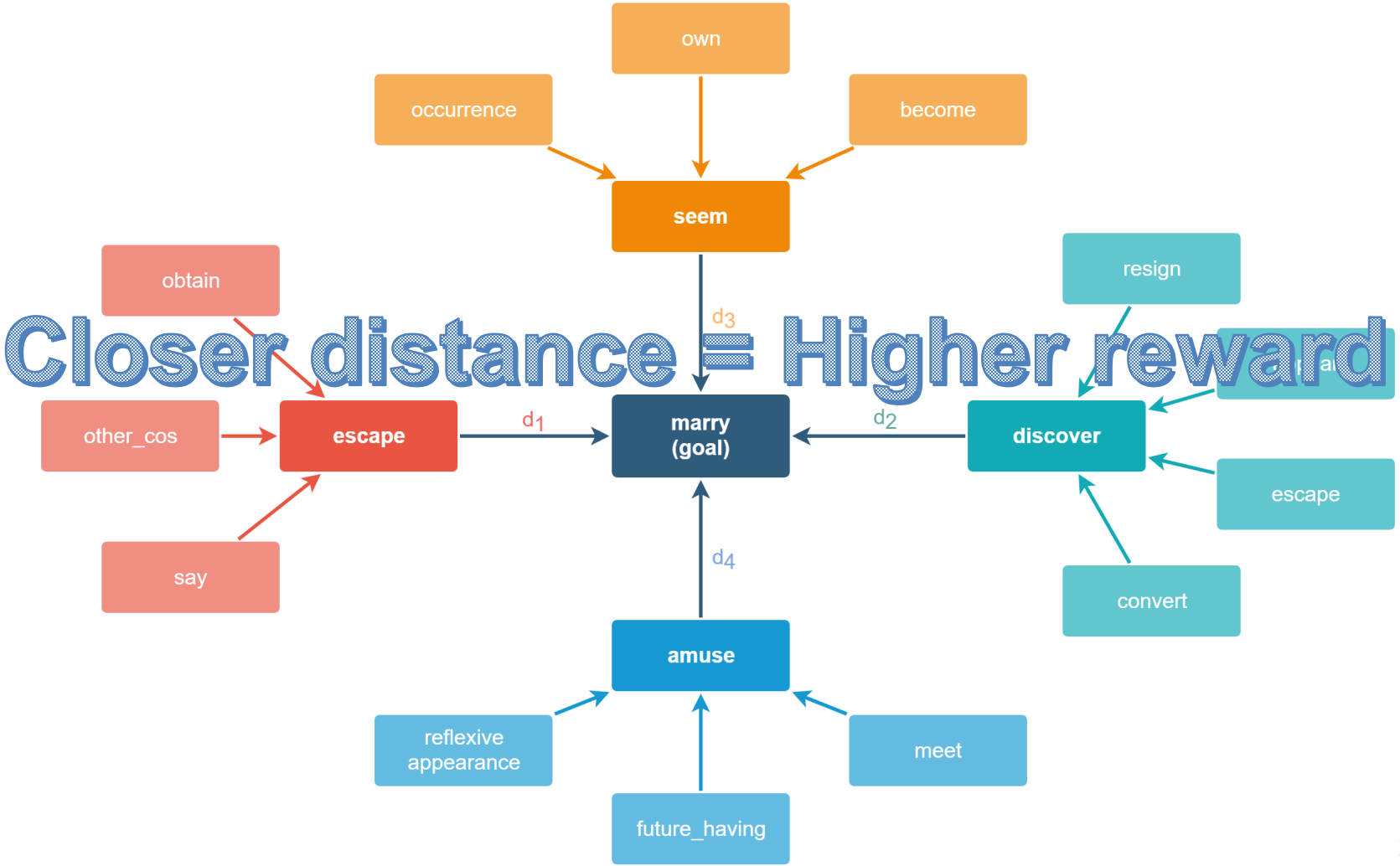
Improving neural networks for storytelling

- Extracting events from sentences
- **Leading it toward plot points**

Improved Neural Network



Tambwekar, P., Dhuliawala, M., Mehta, A., **Martin, L. J.,** Harrison, B., & Riedl, M. O. (2019). Controllable Neural Story Plot Generation via Reward Shaping. *IJCAI '19.*

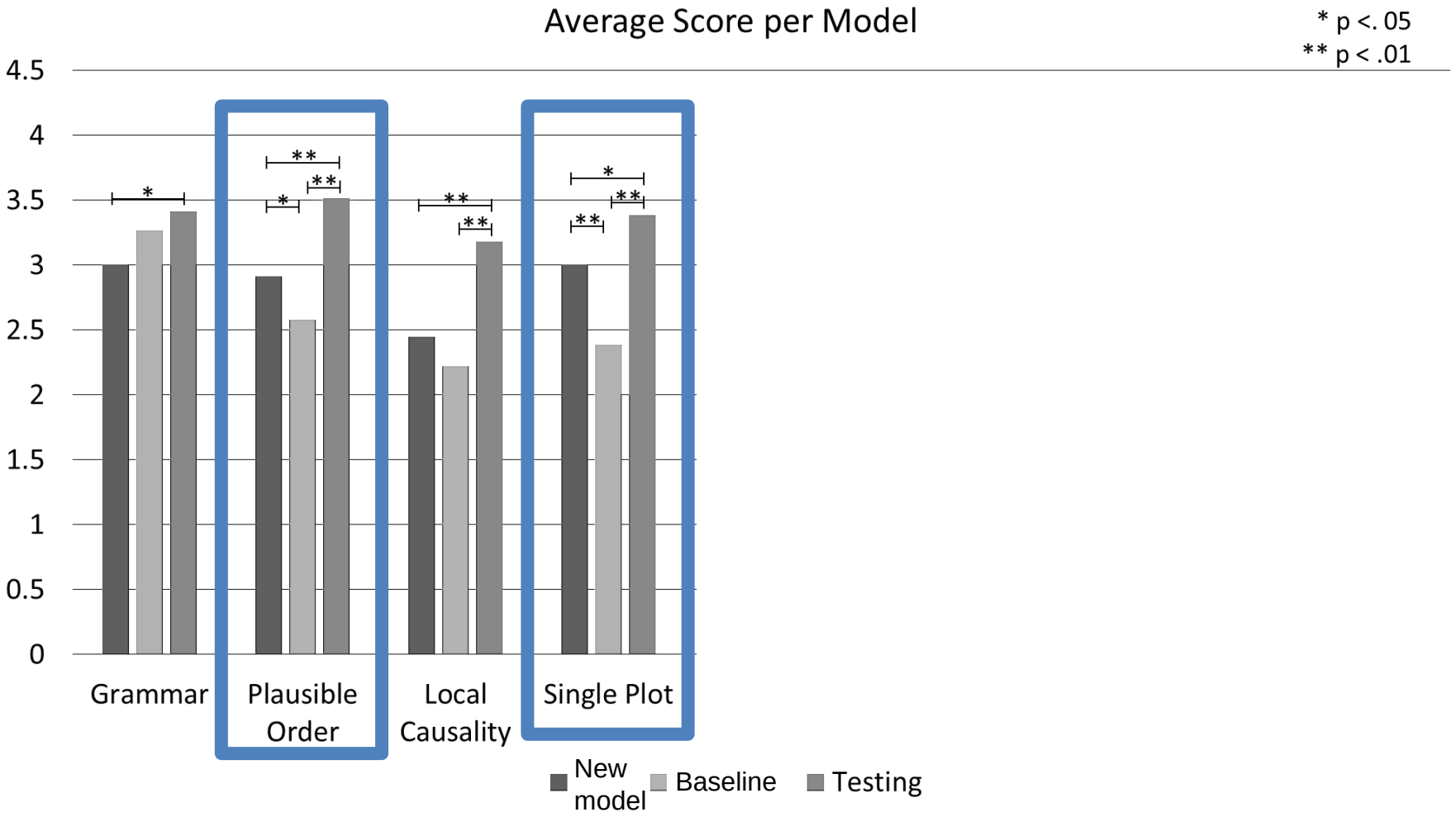

own
occurrence
become
seem
obtain
resign
Closer distance = Higher reward
d3
other_cos
escape
d1
marry
(goal)
d2
discover
escape
say
d4
convert
amuse
reflexive
appearance
meet
future_having

They can hit the goal the majority of the time now!

But are the stories actually any *good*?

Human-Participant Questionnaire

1. This story exhibits CORRECT GRAMMAR.
2. **This story's events occur in a PLAUSIBLE ORDER.**
3. **This story's sentences MAKE SENSE given sentences before and after them.**
4. **This story AVOIDS REPETITION.**
5. This story uses INTERESTING LANGUAGE.
6. This story is of HIGH QUALITY.
7. This story is ENJOYABLE.
8. This story REMINDS ME OF A SOAP OPERA.
9. This story FOLLOWS A SINGLE PLOT.


Average Score per Model
* p <. 05
** p < .01
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Grammar
Plausible Order
Local Causality
Single Plot
New model
Baseline
Testing

So far…

We have a neural network

that is more accurate (because of events)

and is now goal driven

But the stories still aren't causally coherent…

Example (Goal: hate/admire)

Our sister died.

Greggory executed during the visit.

Greggory adopted the girl.

The girl looked like her mom.

She was appalled.

Penelope detested the jungle gym.

Outline

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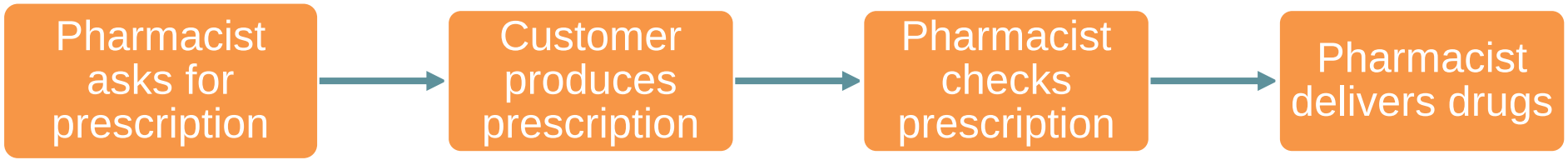
Improving neural networks for storytelling

Joint Model

Back to Causal Chains



Using VerbNet

Jen sent the book to Remy from Atlanta.

ROLES Agent Theme Destination Initial_Location

has_location(e1, book, Atlanta)
do(e2, **Jen**)
cause(e2, e3)
motion(e3, book)
!has_location(e3, book, Atlanta)
has_location(e4, book, Remy)

PREDICATES

Initial_Location : location

Theme : concrete

Agent : animate or organization

Using VerbNet

Jen sent the book to Remy from Atlanta.

Causes

has_location(e1, book, Atlanta)

do(e2, **Jen**)

cause(e2, e3)

motion(e3, book)

!has_location(e3, book, Atlanta)

has_location(e4, book, Remy)

Effects

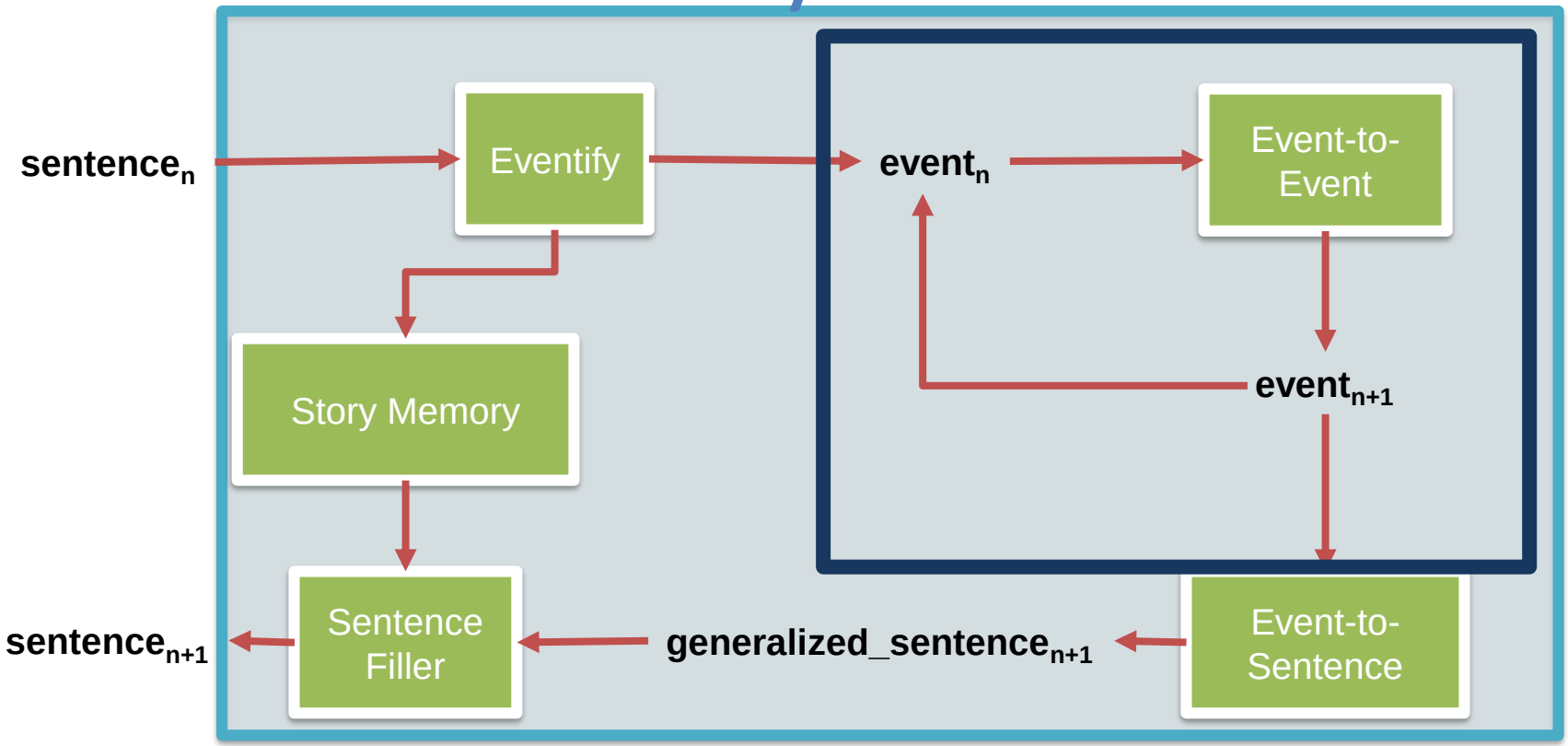
~~Atlanta : location~~

~~book : concrete~~

Jen : animate or organization

How does this fit into the joint system?

Joint System



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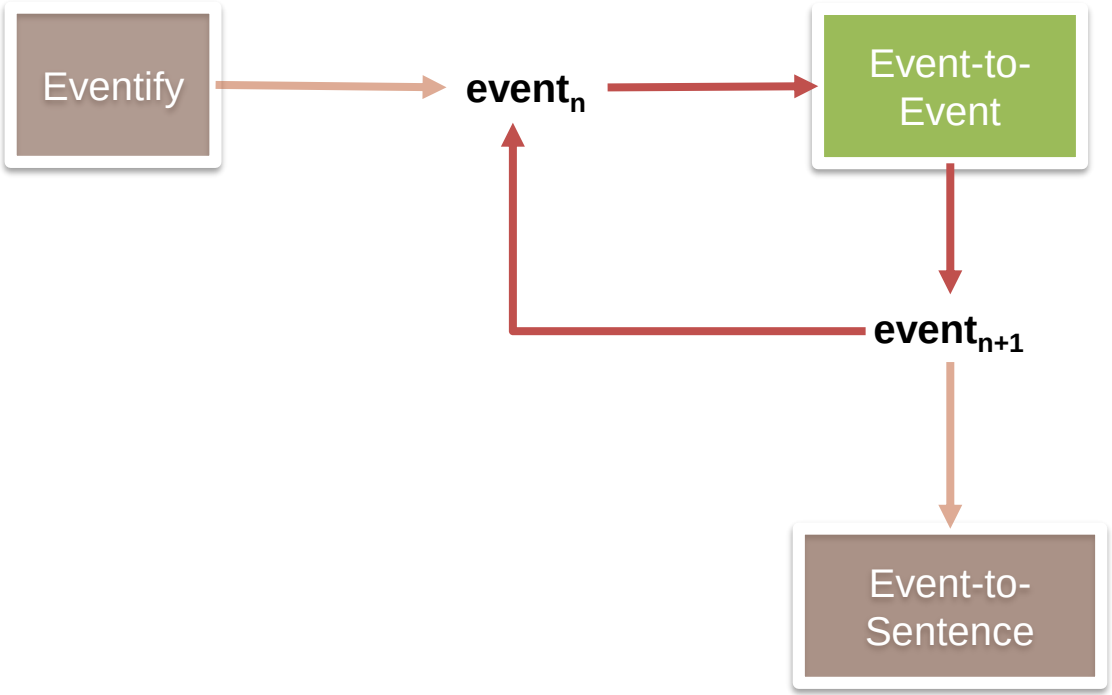
Joint System



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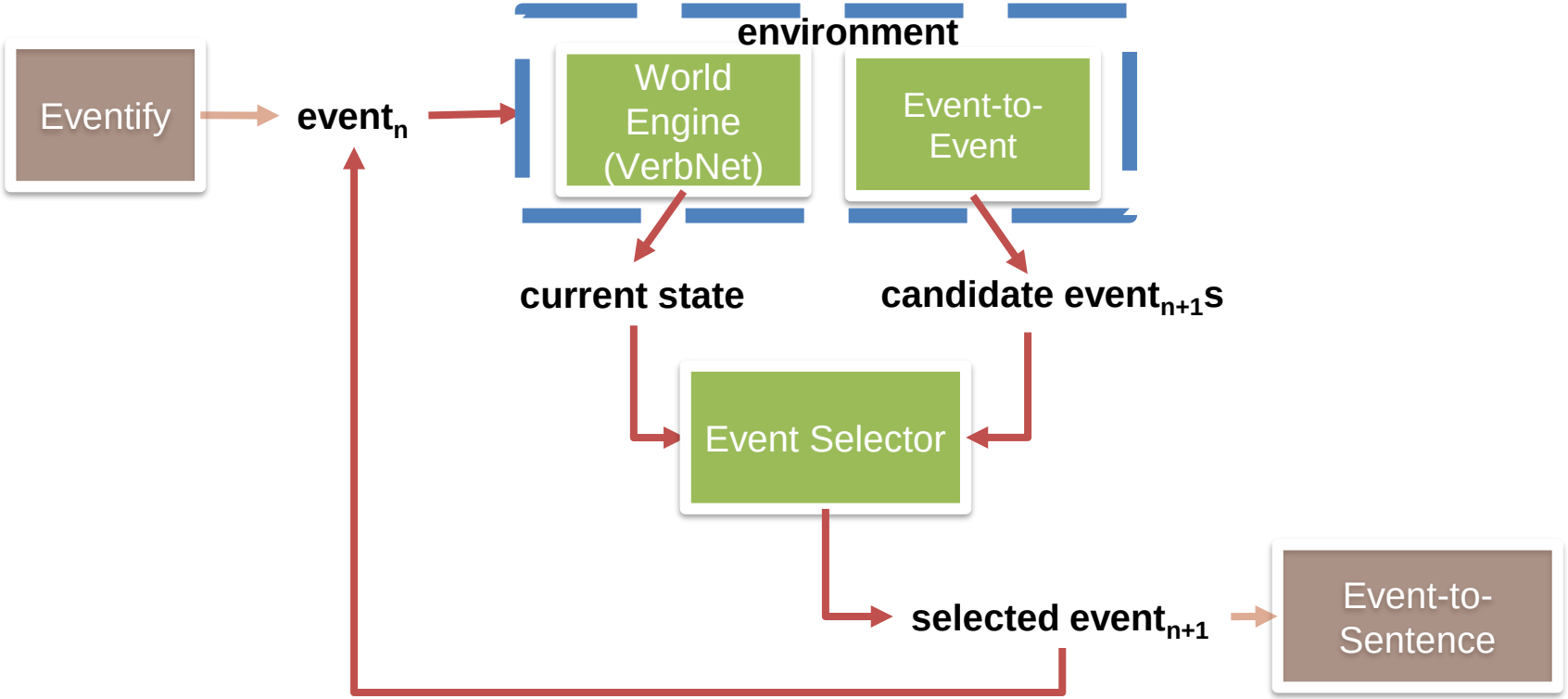
Joint System



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Conclusion

- Storytelling systems are important!
- Causal systems are too cumbersome to make but create stories that make sense
- Neural network systems can create stories about many topics but don't always make sense
- I hypothesize that a hybrid system can create more *novel* **coherent** **open-domain** stories

Thank you!

Questions?

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