Content Planning for Neural Story Generation with Aristotelian Rescoring

Seraphina Goldfarb-Tarrant, Tuhin Chakrabarty, Ralph Weischedel, Nanyun Peng
Motivation

Prompt: *Earth has gained a new season, unlike anything currently known.*

**Human Written Story:**
Giant concrete monoliths peaking as high as mountains across the desert plains. Fire and sand whipping across night and day, day and night. You can't sleep there. Every night, the sound of fire etching away at the walls like some schizophrenic in a jail cell. Getting closer, and closer, and closer. Waking up in cold sweats. The light from the fire is too bright. Can't breathe on the tops of the walls. The air is too hot. It'll fry your lungs, scorch your skin, and melt your hair. We found that out the hard way. We're not scientists. Just slaves. Trapped in concrete cells, lined with lead to keep the radiation out, to keep them out.
Motivation

Prompt: *Earth has gained a new season, unlike anything currently known.*

Generated (BART) Story*:

I was in my bed, in my own room, in the middle of a forest, when the world stopped.

It was the first time in my life that I had felt I had a sense of peace. My family and me, myself, were gone, we had all been taken from us. The only thing our family had left were the three children and my world, but my wife and I were the only survivors. There were we, the three of us. But ourselves, our children were all gone. And the only reason why me and our family survived was because ours had become ourselves..... No longer were you and I to be each other. Now we were just two. All our memories of us, all ours. Nothingness. Only all of us, and my children, each of us...

*Lewis et al (2019)*
It was the first time in my life that I had felt I had a sense of peace.

The only thing our family had left were the three children and my world.

my wife and I were the only survivors.

There were we, the three of us.

Now we were just two.
It was the first time in my life that I had felt I had a sense of peace.

The only thing our family had left were the three children and my world.

my wife and I were the only survivors.

There were we, the three of us

Now we were just two
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The only thing our family had left were the three children and my world.

my wife and I were the only survivors.

There were we, the three of us.

Now we were just two.
my wife and I were the only survivors.

There were we, the three of us

Now we were just two

my wife and I were the only survivors.
in my own room

in the middle of the forest

It was the first time in my life that I had felt I had a sense of peace.

my wife and I were the only survivors.
My wife and I were the only survivors.

It was the first time in my life that I had felt I had a sense of peace.

In the middle of the forest.

In my own room.
Structuring Story Generation

Fan et al (2019)
Story Structure

Yao et al. (2019), Martin et al. (2017), Fan et al. (2019)
Plot Structure Representations

<table>
<thead>
<tr>
<th>Fan et al. (2019)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I opened my eyes. Looking to my razor-sharp claws, I found that they were now neatly clipped. My ears flopped on either side of my head lazily, too soft and formless to hunt properly. Most of all, the hunger was gone. Confusion clouded my mind and I tilted my head instinctively. I approached a nearby puddle and looked in.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Yao et al. (2019)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storyline (Extracted) Carrie → bike → sneak → nervous → leg</td>
</tr>
<tr>
<td>Story (Human Written) Carrie had just learned how to ride a bike. She didn’t have a bike of her own. Carrie would sneak rides on her sister’s bike. She got nervous on a hill and crashed into a wall. The bike frame bent and Carrie got a deep gash on her leg.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input (Previously Unseen)</th>
</tr>
</thead>
<tbody>
<tr>
<td>He reaches out to Remus Lupin, a Defence Against the Dark Arts teacher who is eventually revealed to be a werewolf.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Martin et al. (2017)</th>
</tr>
</thead>
<tbody>
<tr>
<td>〈male. n.02 get-13.5.1 〈NE&gt;0〉, 〈ORGANIZATION say-37.7-1 monster. n.01 〈NE&gt;0〉</td>
</tr>
</tbody>
</table>
Giant concrete monoliths peaking as high as mountains across the desert plans. Fire and sand whipping across night and day, day and night. You can't sleep there. Every night, the sound of fire etching away at the walls like some schizophrenic in a jail cell. Getting closer, and closer, and closer.

Waking up in cold sweats. The light from the fire is too bright. Can't breathe on the tops of the walls. The air is too hot. It'll fry your lungs, scorch your skin, and melt your hair. We found that out the hard way.

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Aristotelian Principles (from *Poetics*)

1. event choice and event arrangement
2. character
3. relevant content
4. diction
Write the most beautiful end to the universe that you can imagine.


It was the end of the universe. The light filled the sky. The galaxy. All the light in all the worlds, and all the stars. A bright flash ..... all the galaxies began to fade.


PROMPT TO PLOT (BART)

ARISTOTELIAN RESCORERS (RoBERTa)

EVENT

RELEVANCE

PLOT TO STORY (BART)

ent 0 [V] asked: √ ent 1 x ent 0
Training Rescorers: Event - Inter Shuffle

Prompt: People gather around a campfire to tell the story of a legend, who actually sits among them

Positive

<A1> ent 0 orange glow <V> stood <A2> ent 6 night </s>
<A1> ent 3 <V> emanating <A2> ent 3 </s> <A0> ent 2 <V> felt <A1> the cold <A2> ent 2 their backs # <A0> ent 2 <V> faced <A1> ent 3 </s> <A1> ent 2 eyes <V> stayed <A2> upon the saving light # <A0> ent 4 <V> stared </s>...

Negative

<A1> ent 3 <V> emanating <A2> ent 3 </s>
<A1> ent 8 <V> grew <A2> quieter, darker </s>
<A2> ent 5 some <A1> ent 5 <V> came # <A0> a bearded, old man <V> drawing <A1> ent 11 <A2> close # <A1> ent 13 <V> burn </s>
<A0> orange <V> glow # <A1> ent 1 <V> sat # <A1> ent 1 <V> paralyzed </s> ...
## Training Rescorers: Event - Intra Shuffle

**Prompt:** People gather around a campfire to tell the story of a legend who actually sits among them

<table>
<thead>
<tr>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>&lt;A0&gt; ent 2 &lt;V&gt; felt &lt;A1&gt; the cold &lt;A2&gt; ent 2 their backs # &lt;A0&gt; ent 2 &lt;V&gt; faced &lt;A1&gt; ent 3 &lt;/s&gt;</code></td>
<td><code>&lt;A0&gt; ent 2 &lt;V&gt; faced &lt;A1&gt; ent 3 # &lt;A0&gt; ent 2 &lt;V&gt; felt &lt;A1&gt; the cold &lt;A2&gt; ent 2 their backs &lt;/s&gt;</code></td>
</tr>
<tr>
<td><code>&lt;A1&gt; ent 2 eyes &lt;V&gt; stayed &lt;A2&gt; upon the saving light # &lt;A0&gt; ent 4 &lt;V&gt; stared &lt;/s&gt;</code></td>
<td><code>&lt;A0&gt; ent 4 &lt;V&gt; stared # &lt;A1&gt; ent 2 eyes &lt;V&gt; stayed &lt;A2&gt; upon the saving light &lt;/s&gt;</code></td>
</tr>
</tbody>
</table>
Prompt: People gather around a campfire to tell the story of a legend, who actually sits among them

Positive

<A0> ent 9 <V> roamed <A1> the woods # <A0> ent 9 <V> consumed <A1> ent 6 of the night </s>
<A0> The wind <V> began <A1> to blow with cold intention # <A1> The wind <V> blow # <A0> ent 7 <V> danced # <A1> ent 7 <V> shimmered # <A1> moonlight <V> began ...

Negative

<A0> ent 9 <V> consumed <A1> the woods # <A0> ent 9 <V> roamed <A1> ent 6 of the night </s> <A0> The wind <V> shimmered <A1> to blow with cold intention # <A1> The wind <V> blew # <A0> ent 7 <V> danced # <A1> ent 7 <V> moonlight # <A1> moonlight <V> began ...

Training Rescorers: Event - Verb Shuffle
Training Rescorers: Character (Entity)

**Prompt:** People gather around a campfire to tell the story of a legend, who actually sits among them.

**Context:**

<A0> ent 0 <V> saw <A1> the light of a campfire </s> <A1> ent 2 <V> laying <A2> there </s> <A1> horses <V> surrounding <A2> ent 2 # <A1> light <V> bouncing </s> <A0> ent

<table>
<thead>
<tr>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>
Training Rescorers: Relevance

Prompt: People gather around a campfire to tell the story of a legend, who actually sits among them.

Positive:
<ent 0> ent 0 <v> saw <ent 1> the light of a campfire
<s> <ent 1> ent 2 <v> laying <ent 2> there <s> <ent 1> horses <v> surrounding <ent 2> ent 2 # <ent 1> light <v> bouncing <s> <ent 0> ...

Negative:
<ent 0> ent 2 <v> asks <ent 2> ent 0 </s> <ent 1> I <v> ' <ent 2> sorry # <ent 0> I <v> think <ent 1> ent 0 can help you # <ent 0> I <v> help <ent 1> ent 0 </s> </s> <v> colored <ent 1> toys <s> ...
### Important Background Work:

#### Rescorer Performance

<table>
<thead>
<tr>
<th>Plot Elements</th>
<th>XGB</th>
<th>CNN</th>
<th>RoBERTa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relevance</td>
<td>55.2</td>
<td>56.0</td>
<td>89.3</td>
</tr>
<tr>
<td>Entity</td>
<td>64.1</td>
<td>76.0</td>
<td>92.3</td>
</tr>
<tr>
<td>Event</td>
<td>Inter-Shuffled</td>
<td>55.4</td>
<td>53.0</td>
</tr>
<tr>
<td></td>
<td>Intra-Shuffled</td>
<td>58.5</td>
<td>75.0</td>
</tr>
<tr>
<td></td>
<td>Verb-Shuffled</td>
<td>76.1</td>
<td>75.0</td>
</tr>
</tbody>
</table>

Table 2: Accuracy for training Rescorers using three different architectures.
Important Background Work:

Mixture Weight Training & Ranking Accuracy*

<table>
<thead>
<tr>
<th>Rescorer</th>
<th>RA ↑</th>
<th>V:T ↑</th>
<th>E ↑</th>
</tr>
</thead>
<tbody>
<tr>
<td>All 5</td>
<td>0.43</td>
<td>2.07</td>
<td>7.15</td>
</tr>
<tr>
<td>All 4 (-intra)</td>
<td>0.35</td>
<td>1.72</td>
<td>8.78</td>
</tr>
<tr>
<td>Inter-event</td>
<td>0.37</td>
<td>1.76</td>
<td>8.87</td>
</tr>
<tr>
<td>Intra-event</td>
<td>0.16</td>
<td>2.01</td>
<td>6.58</td>
</tr>
<tr>
<td>Verb-event</td>
<td>0.15</td>
<td>1.66</td>
<td>8.89</td>
</tr>
<tr>
<td>Entity</td>
<td>0.17</td>
<td>1.68</td>
<td>9.18</td>
</tr>
<tr>
<td>Relevance</td>
<td>0.17</td>
<td>1.71</td>
<td>8.89</td>
</tr>
</tbody>
</table>

Table 3: Ranking accuracy (RA) and generated plot metrics i.e Verb:Token ratio (V:T), Entities(E) for rescorer ablations

*Details and math for rescorer implementation and mixture weight training in the paper!
### Evaluation Setup:

<table>
<thead>
<tr>
<th>Train Prompts</th>
<th>Test Prompts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>An alien invasion</strong> happens during an alien invasion.</td>
<td>A reverse alien invasion. Humanity invades a alien planet from the point of view the aliens.</td>
</tr>
<tr>
<td>You are defending your home world from the alien invasion. The aliens are from Planet Earth. You are not.</td>
<td>An alien invasion occurs, but the alien technology and weaponry is ... different to what we would expect.</td>
</tr>
<tr>
<td>Write an alien invasion story as us as the aliens.</td>
<td>A alien invasion somehow managed to cripple the younger generations preventing them from fighting back. Now it is up to the forgotten, old and infirm to fight back.</td>
</tr>
<tr>
<td>Tell the story of how a baby stopped an alien invasion.</td>
<td></td>
</tr>
<tr>
<td>You are taken prisoner in an alien invasion of Earth</td>
<td></td>
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Evaluation Setup:

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Evaluation Setup:

Test Prompts

Write about a villain who goes through trauma and becomes an insane hero.

You are stranded on a desert island with a zombie. You decide you need to work together if you are going to escape.

You are a detective whose olfactory nerves are displaced in time - you smell the environment you're in as it was exactly 24 hours ago.

Death accidently kills the wrong person. That person files a lawsuit.

Attention Checks

The protagonist should be a villain → True

The protagonist should start out happy → False

The protagonist has some special powers or skills → True

The story is about death → True
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~15% failed

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Results: Likert Evaluation (5 systems, 110 stories)
Results: Inconclusive!
Results: Pairwise Evaluation

Chart 1: Overall Pairwise Evaluation
- ARISTOTALEAN PLOT
- PROMPT TO STORY
- NAIVE PLOT

- **Overall Pairwise**
  - PROMPT TO STORY VS ARISTOTALEAN PLOT
  - NAIVE PLOT VS ARISTOTALEAN PLOT

Chart 2: Relevance Pairwise Evaluation
- ARISTOTALEAN PLOT
- PROMPT TO STORY
- NAIVE PLOT

- **Relevance Pairwise**
  - PROMPT TO STORY VS ARISTOTALEAN PLOT
  - NAIVE PLOT VS ARISTOTALEAN PLOT
Thank You!