NeuGen

Text Generation from Meaning Representations

Yannis Konstas

Joint work with
Mark Yatskar, Luke Zettlemoyer and Yejin Choi (UW)
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Yonatan Bisk and Daniel Marcu (ISI)

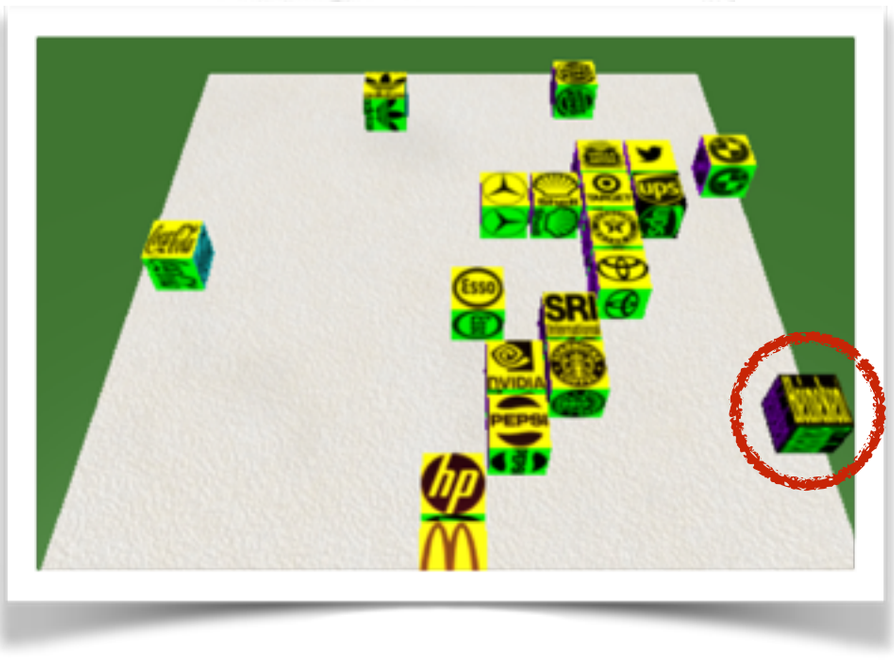
Motivation

Motivation

Machine-generated Representation

Motivation

Machine-generated Representation



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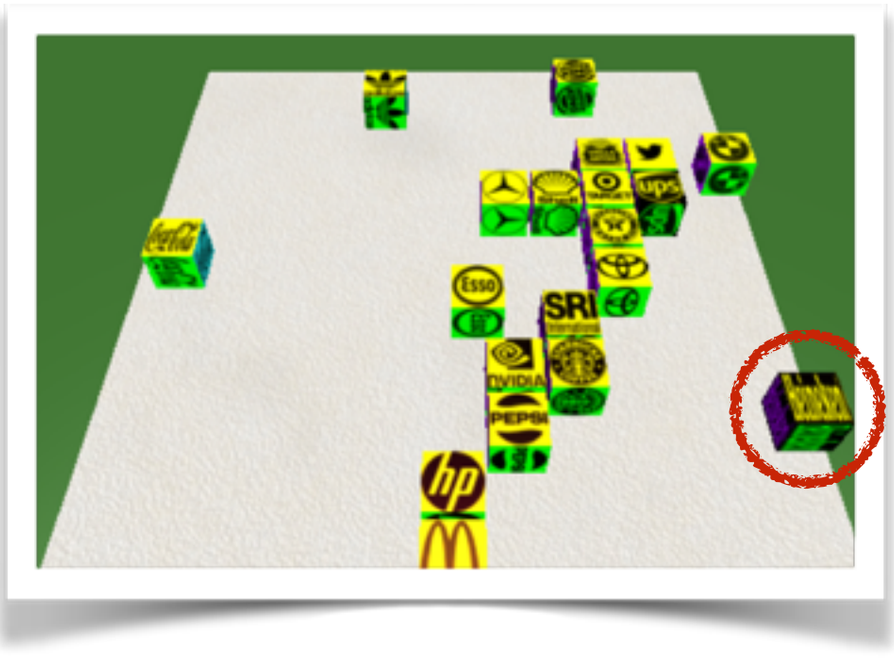

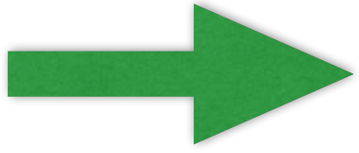

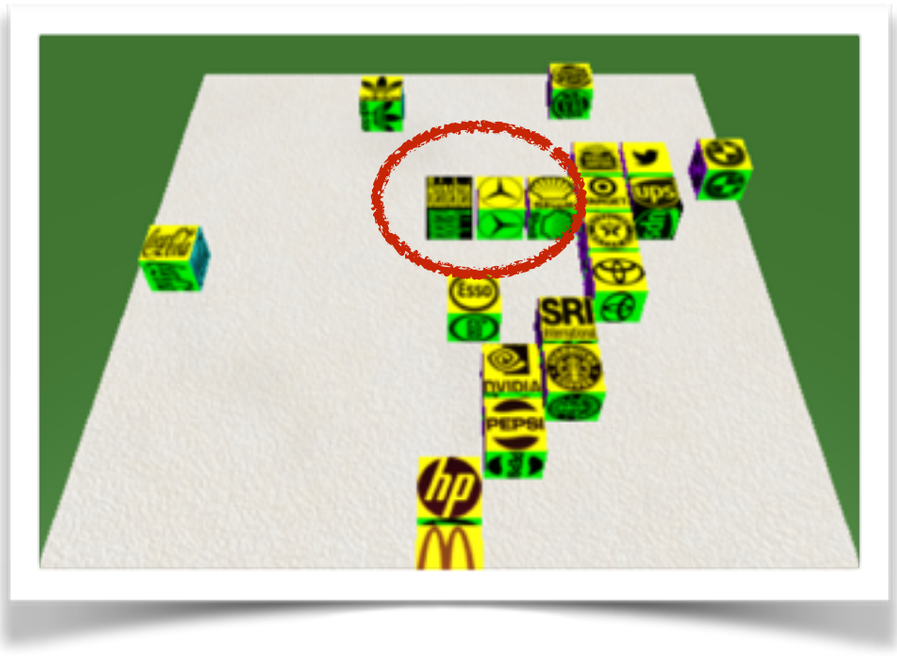

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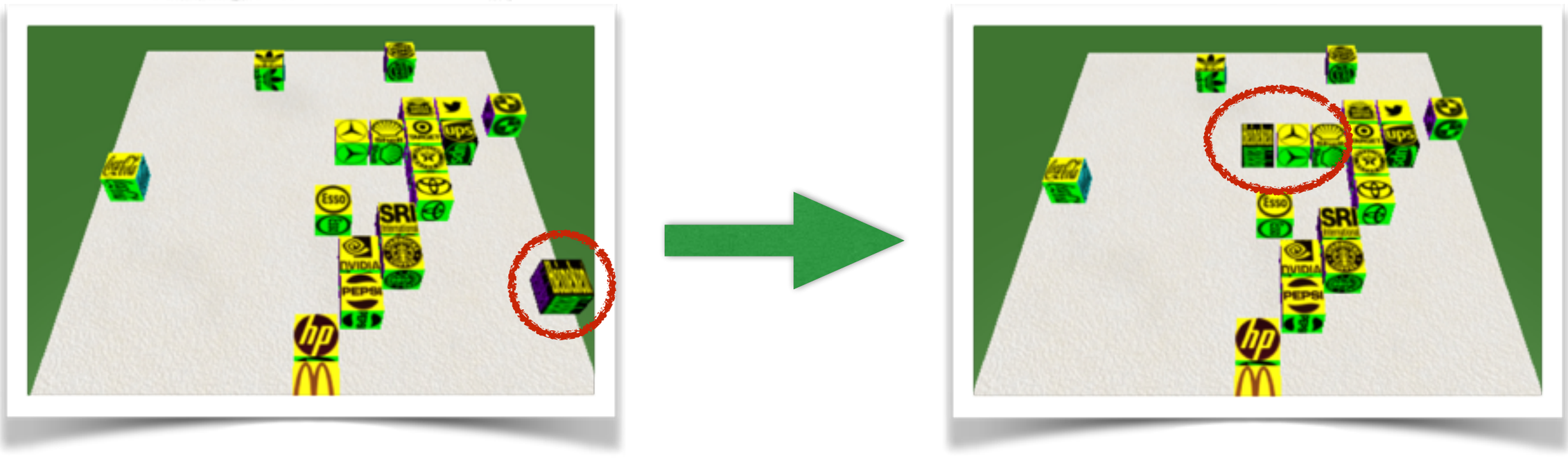
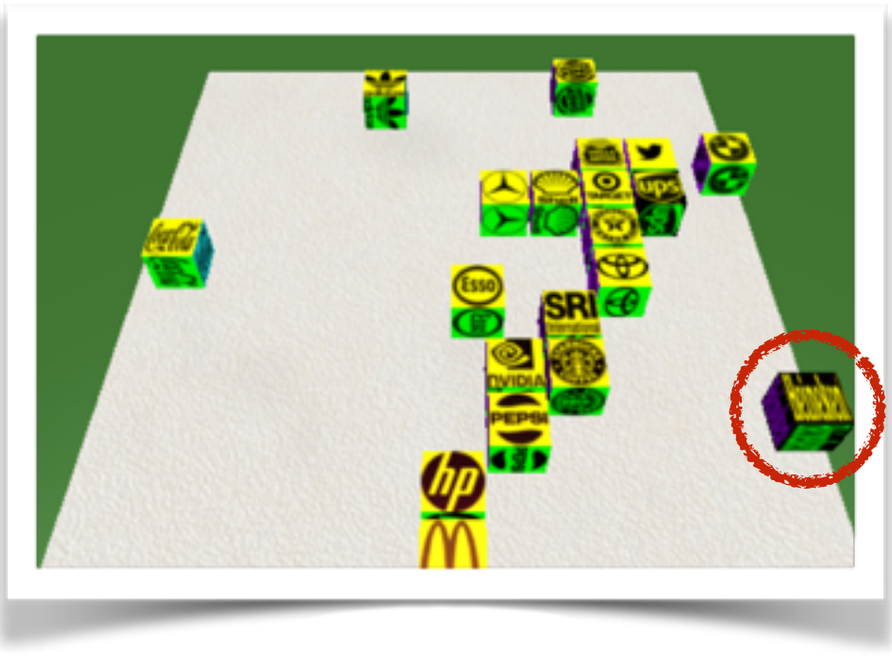
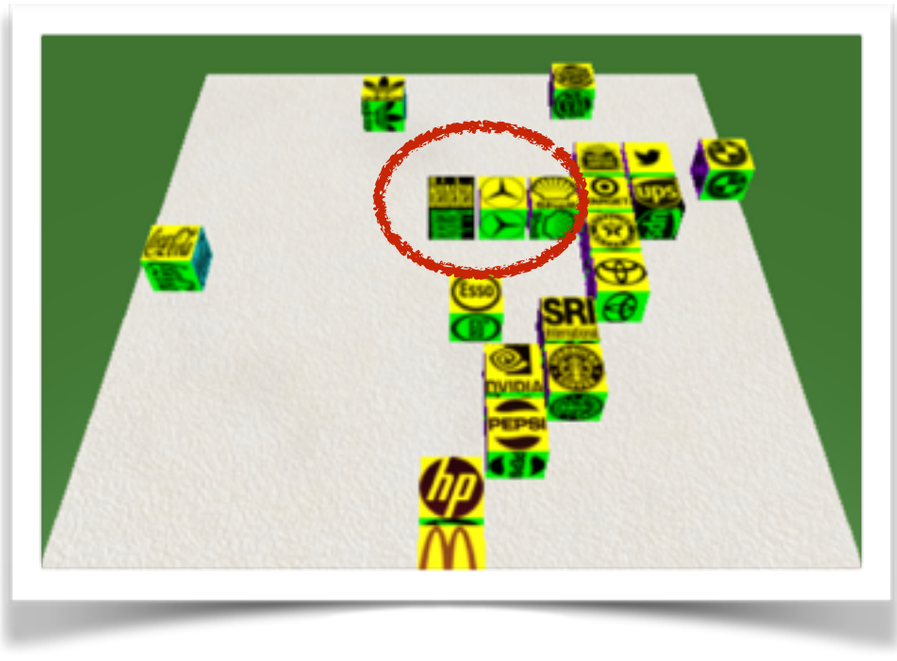


source	block:	hk		
target	block:	ms		
pos	RP:	W	scale:	small

Motivation

Machine-generated Representation



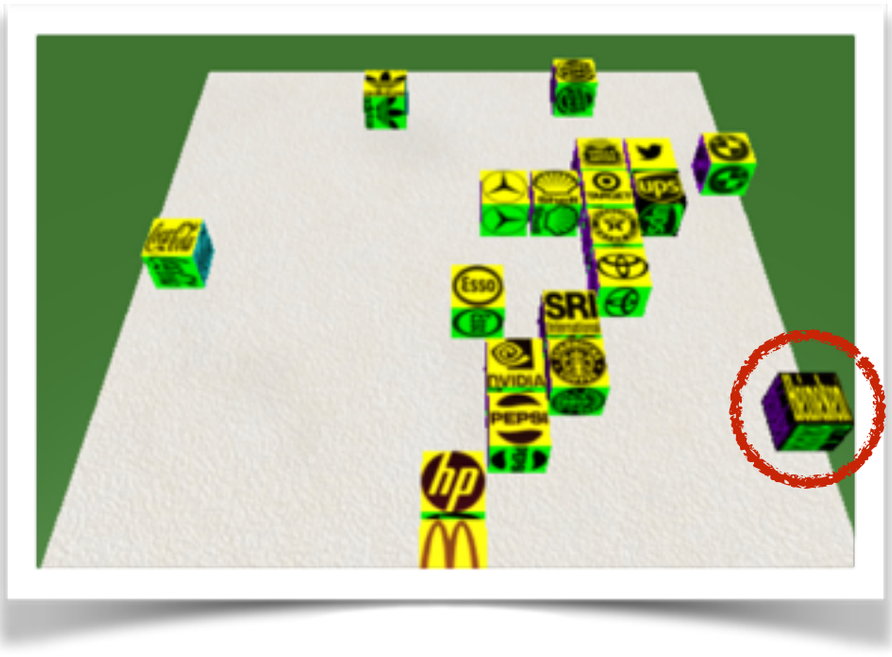


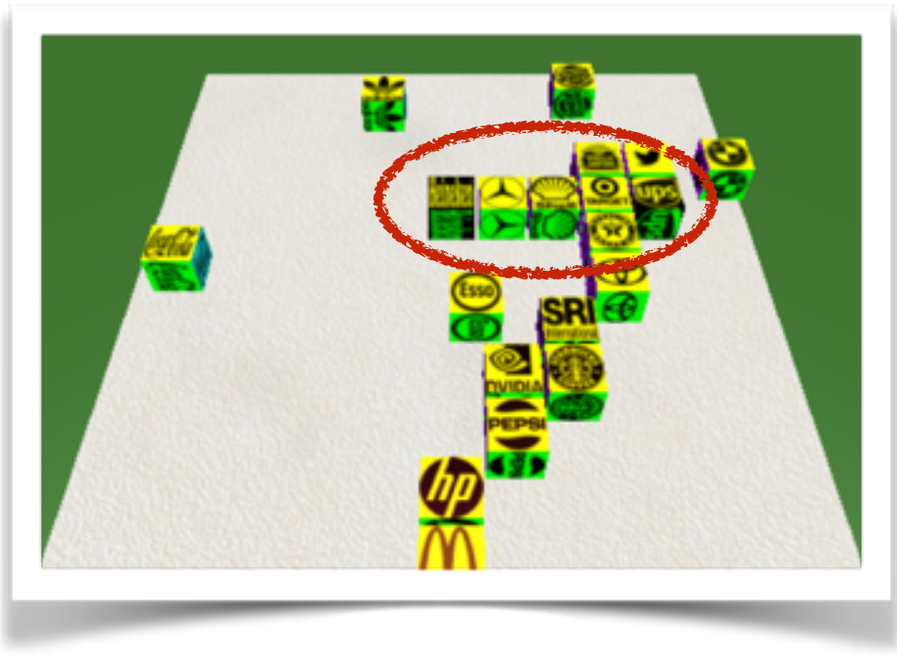
source	block:	hk		
target	block:	ms		
pos	RP:	W	scale:	small

Place the heineken block west of the mercedes block.

Motivation

Machine-generated Representation

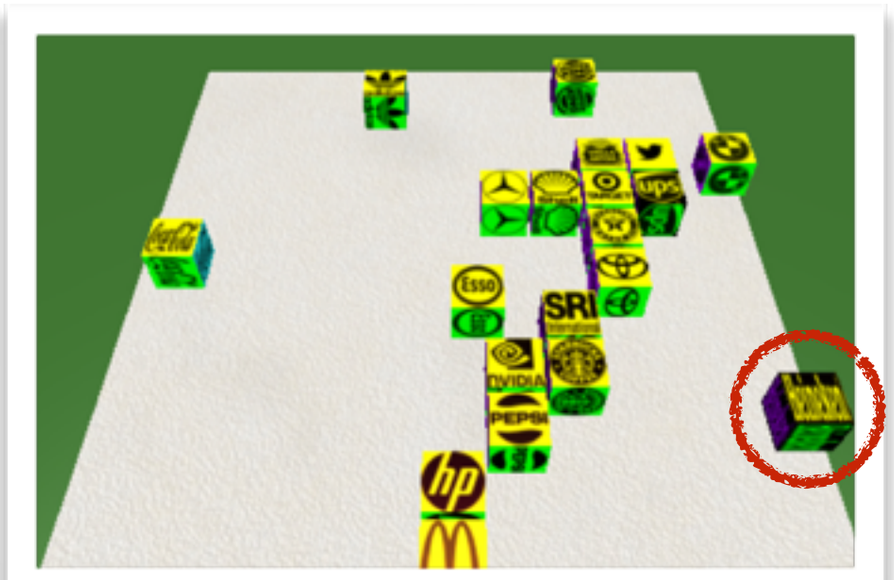


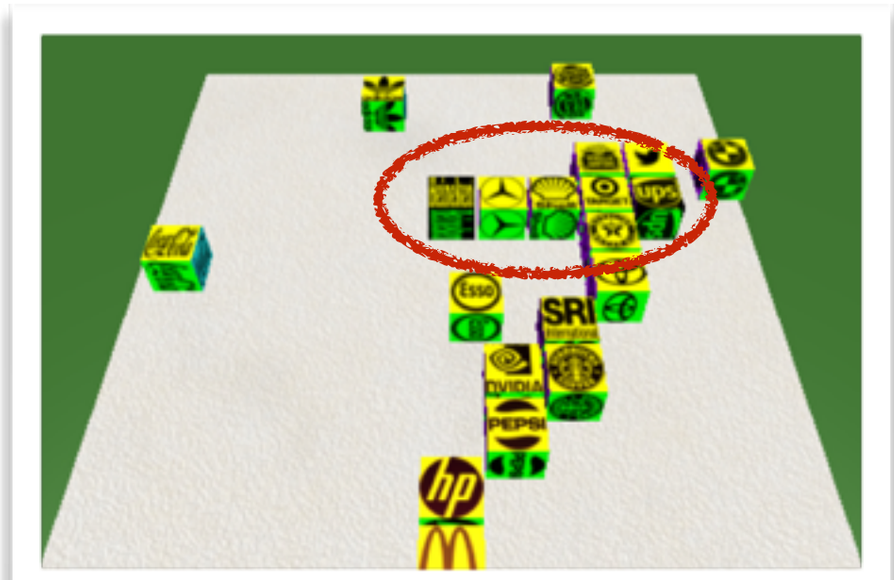


source	block:	hk		
target	block:	**ups**		
pos	RP:	W	scale:	**big**

Motivation

Machine-generated Representation





source	block:	hk		
target	block:	**ups**		
pos	RP:	W	scale:	**big**

Place the heineken block in the first open space to the left of ups block.

Motivation

Motivation

Machine-generated Representation

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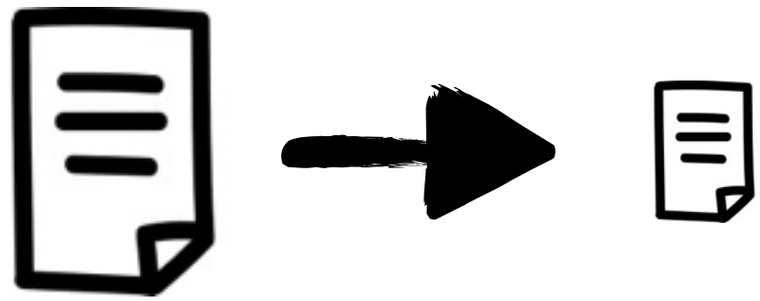
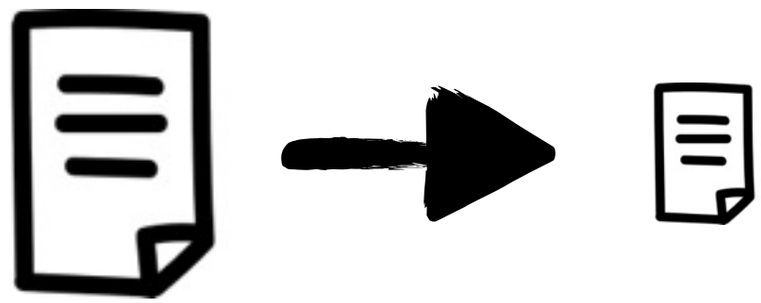
Machine-generated Representation



Sentence Compression

Motivation

Machine-generated Representation



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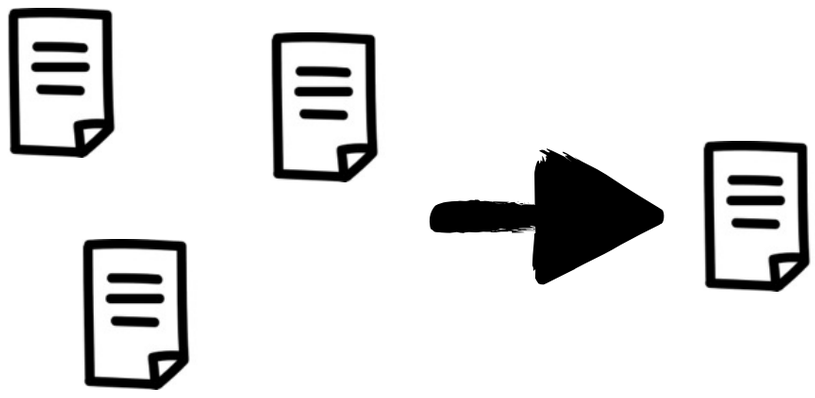
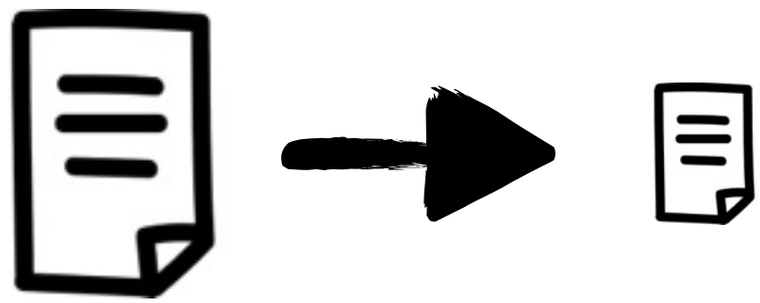


Sentence Fusion

Motivation

Machine-generated Representation



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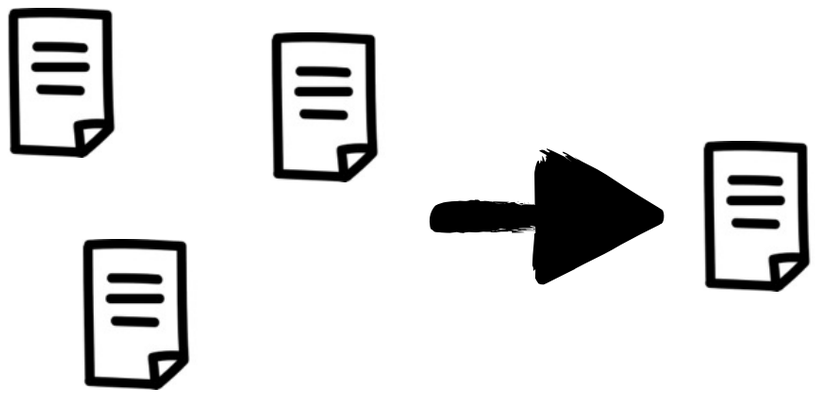

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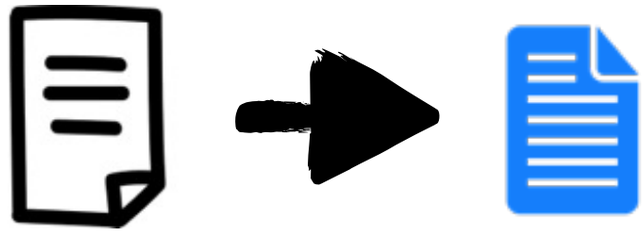
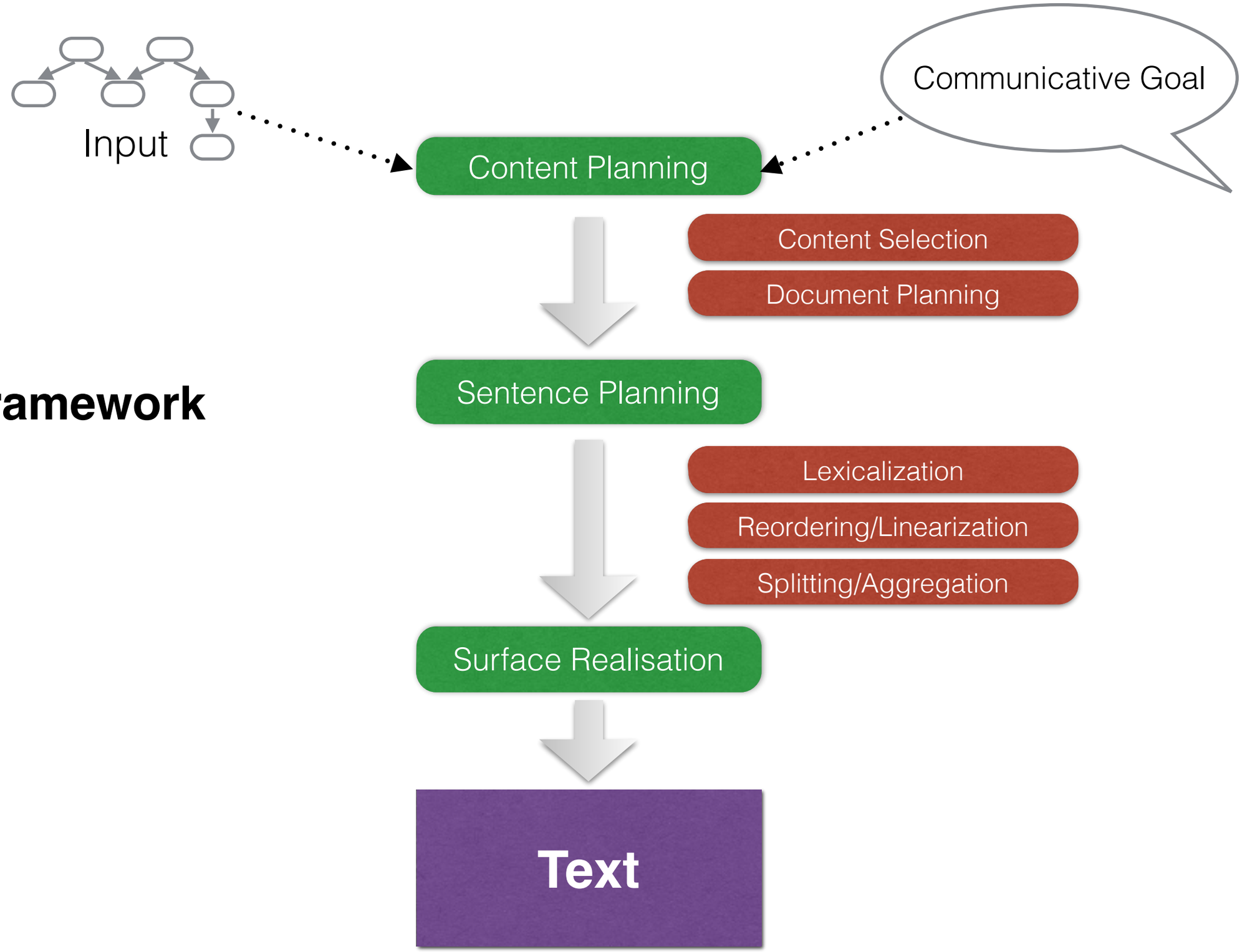


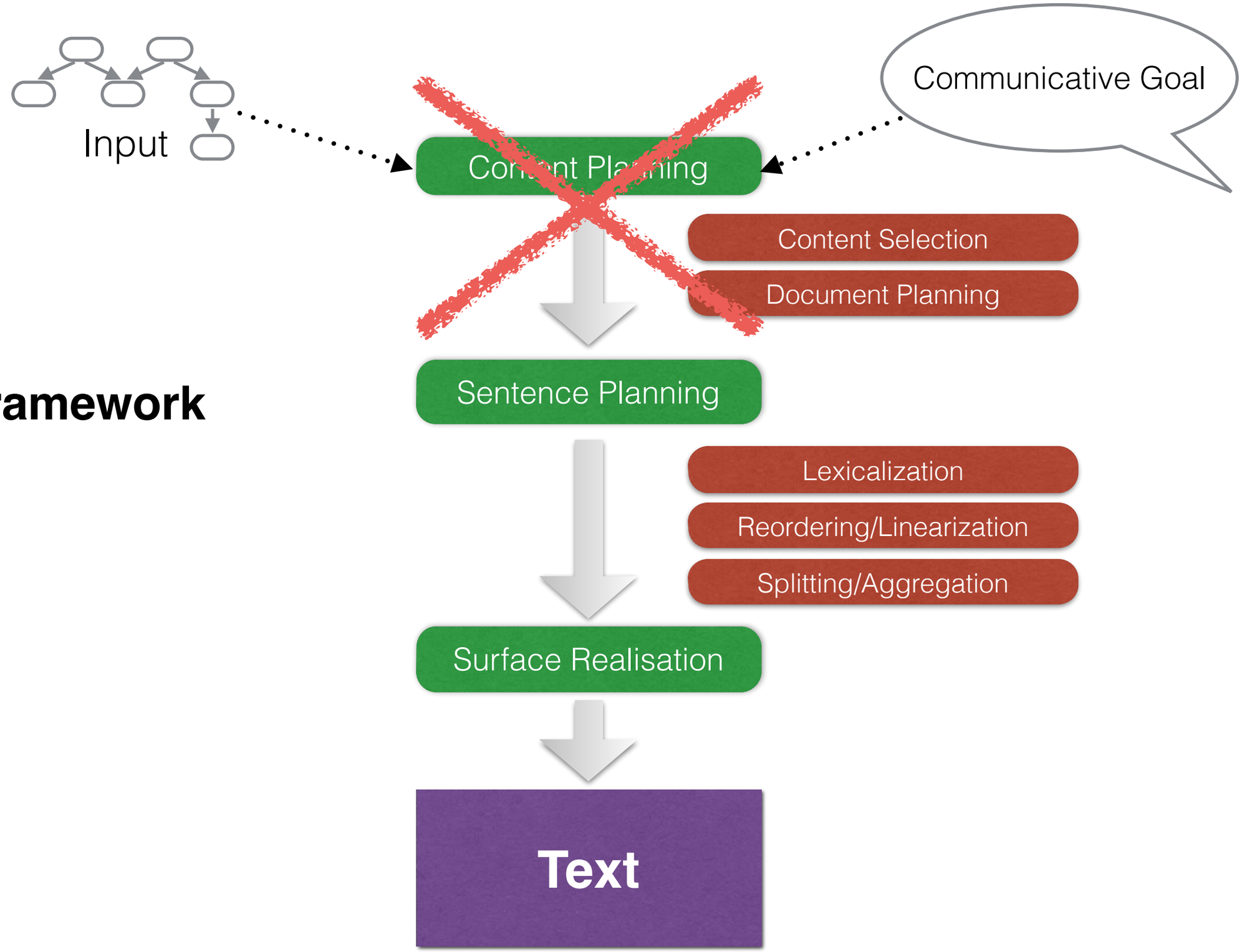
Paraphrasing

NLG Pipeline



Framework

NLG Pipeline



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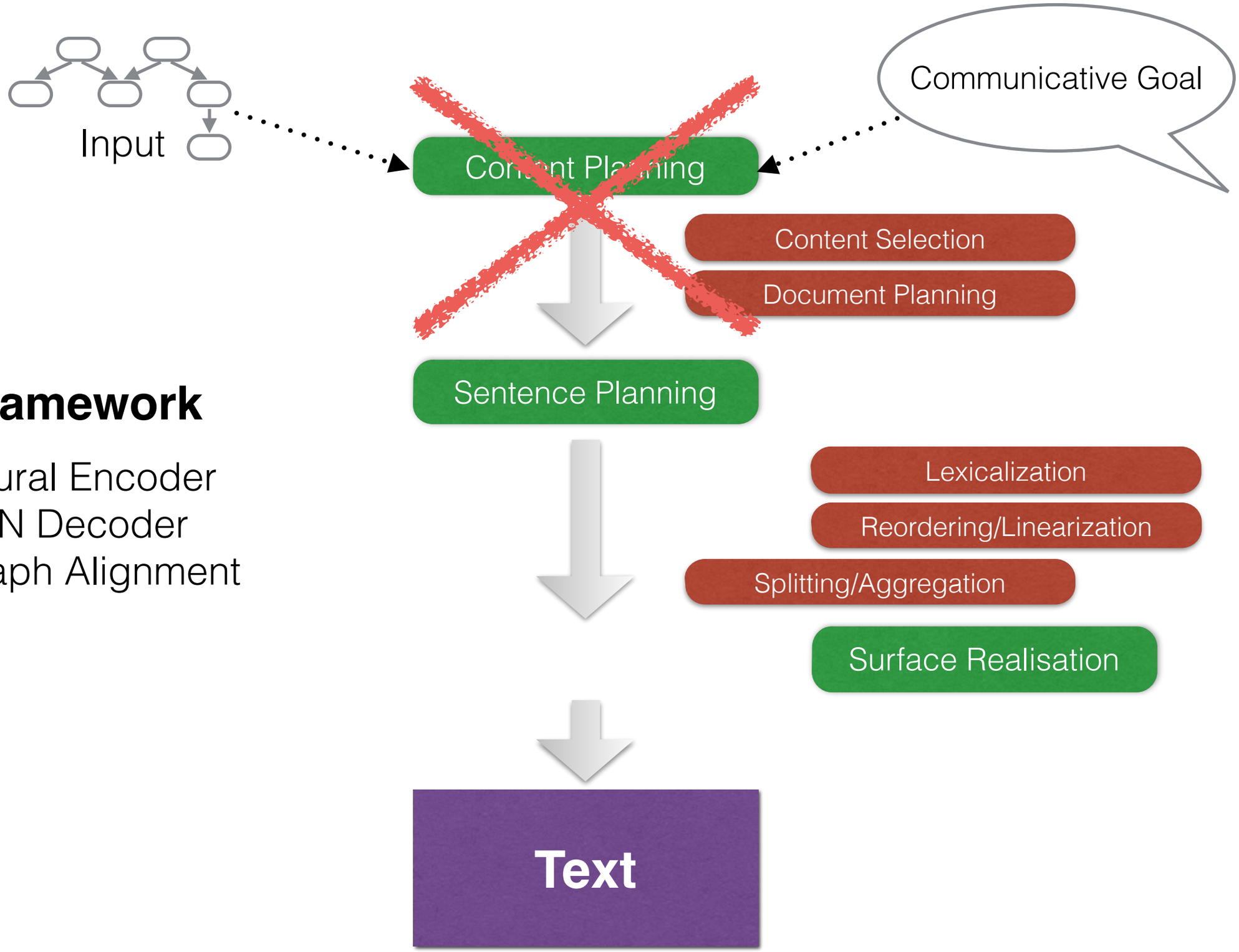


Framework

- Neural Encoder
- RNN Decoder
- Graph Alignment

Joint Generator

Training

Temperature

Time	Min	Mean	Max
06:00-21:00	9	15	21

Cloud Sky Cover

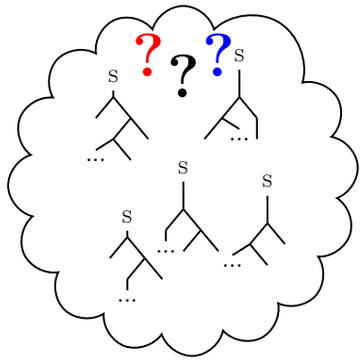
Time	Percent (%)
06:00-09:00	25-50
09:00-12:00	50-75

Wind Speed

Time	Min	Mean	Max
06:00-21:00	15	20	30

Wind Direction

Time	Mode
06:00-21:00	S



Cloudy, with temperatures between 10 and 20 degrees. South wind around 20 mph.

(1) PCFG Grammar

$S \rightarrow R(start)$
$R(r_i.t) \rightarrow FS(r_j, start)R(r_j.t)$
$R(r_i.t) \rightarrow FS(r_j, start)$
$FS(r, r.f_i) \rightarrow F(r, r.f_j)FS(r, r.f_j)$
$FS(r, r.f_i) \rightarrow F(r, r.f_j)$
$F(r, r.f) \rightarrow W(r, r.f)F(r, r.f)$
$F(r, r.f) \rightarrow W(r, r.f)$
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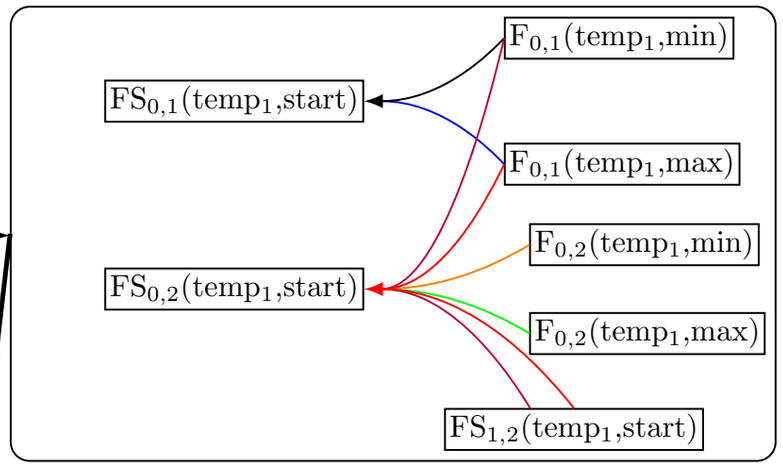
(2) Hypergraph Representation



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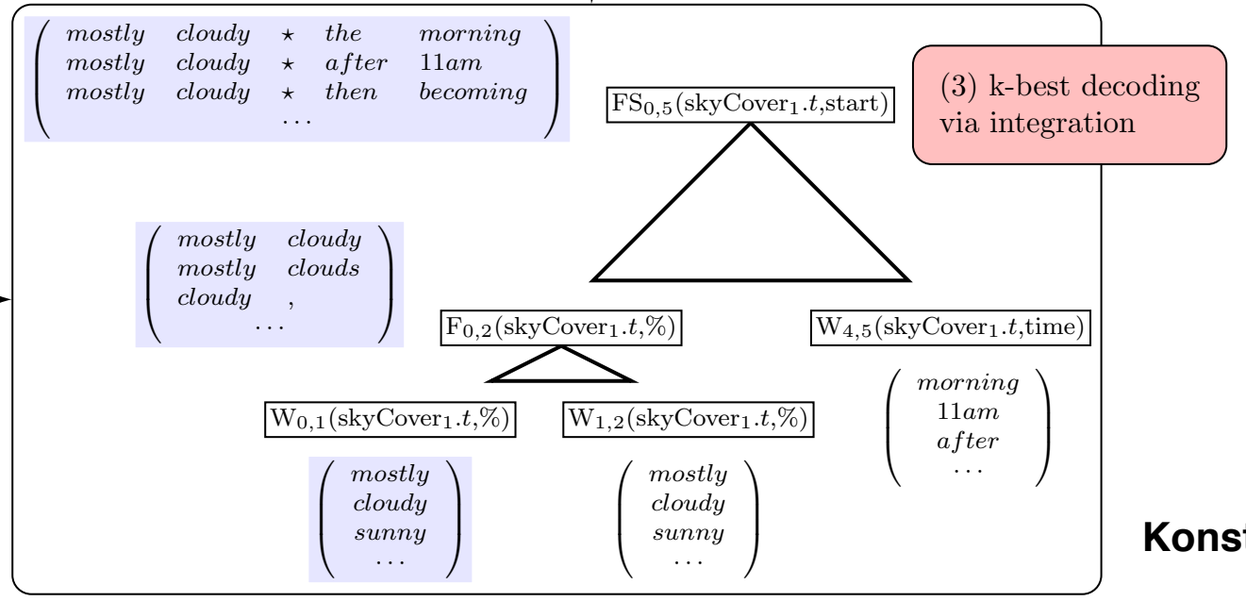

(3) k-best decoding via integration

Konstas and Lapata, 2012, 2013

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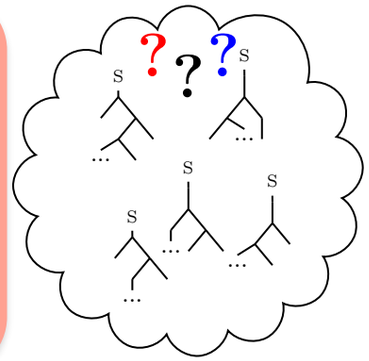

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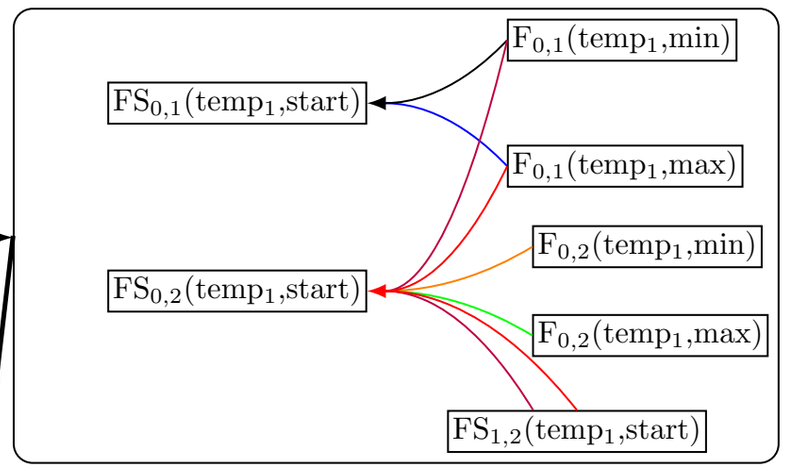

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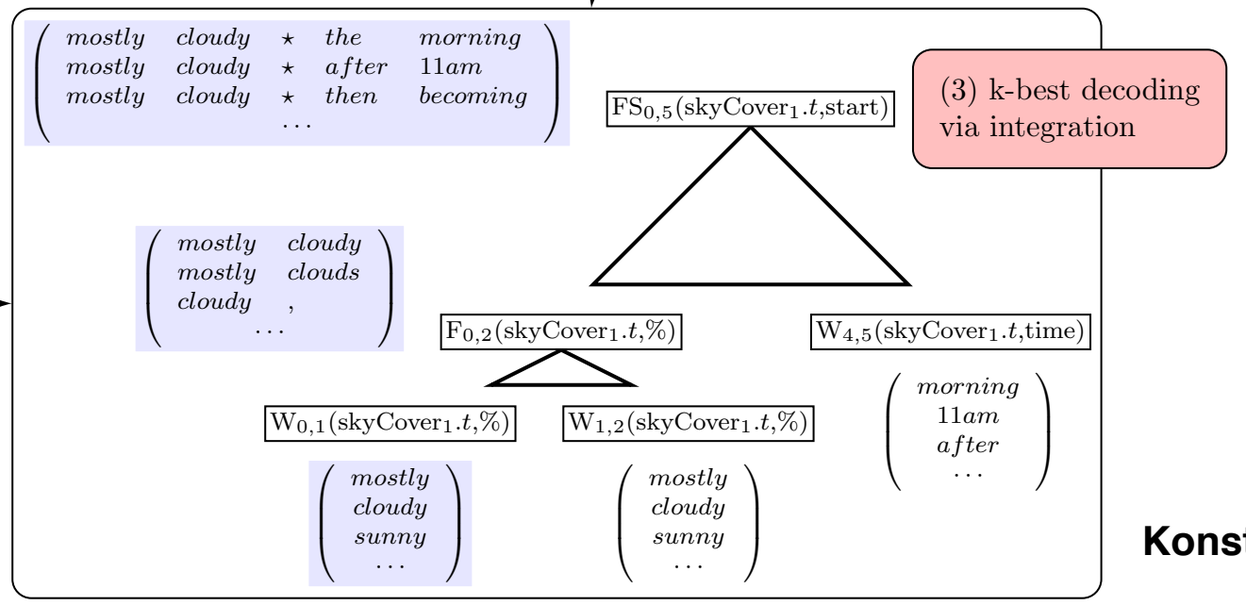

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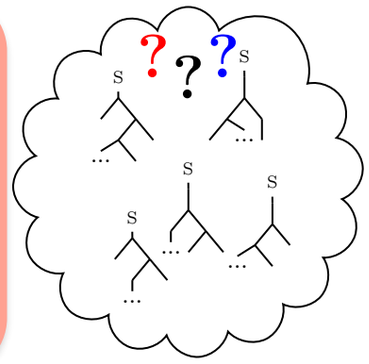

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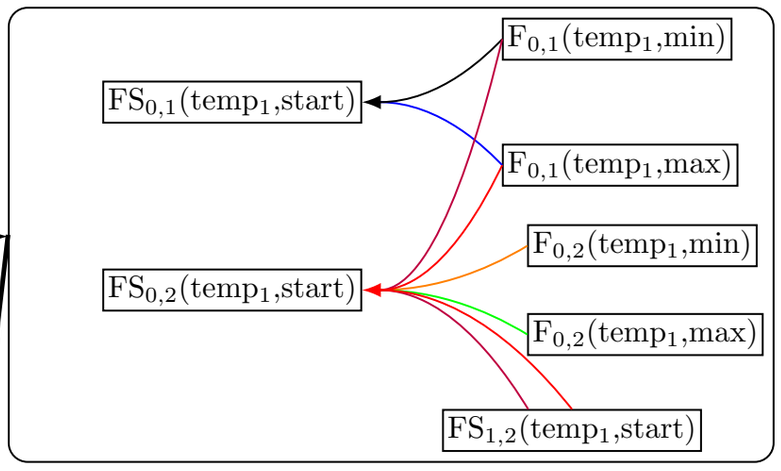
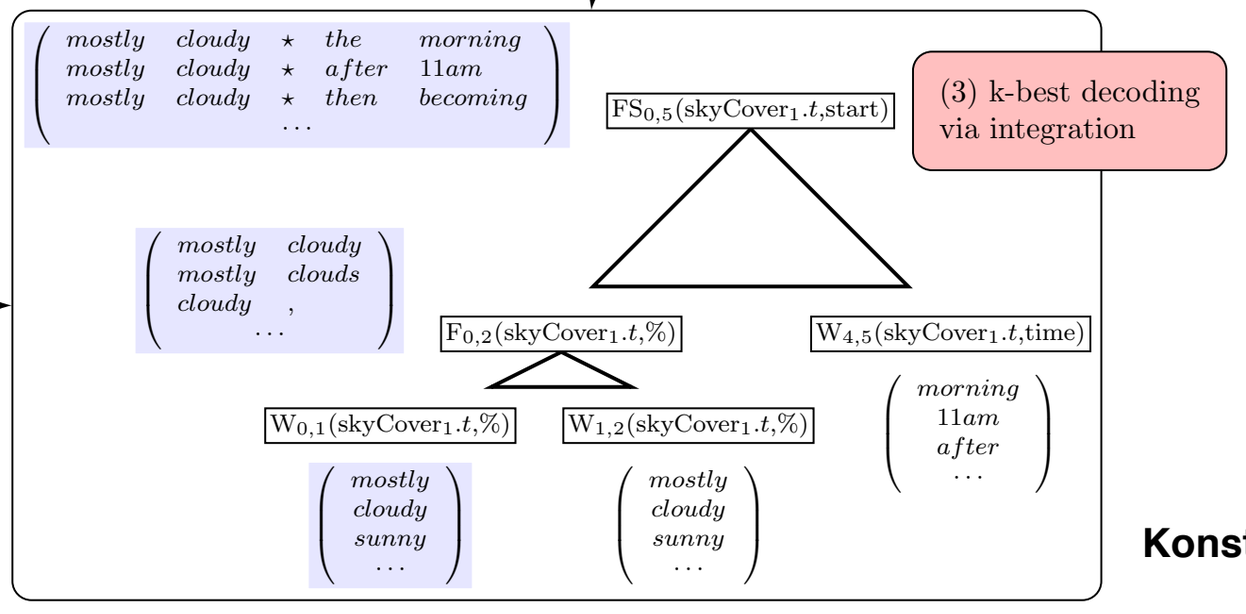


Testing



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More Complex Structure

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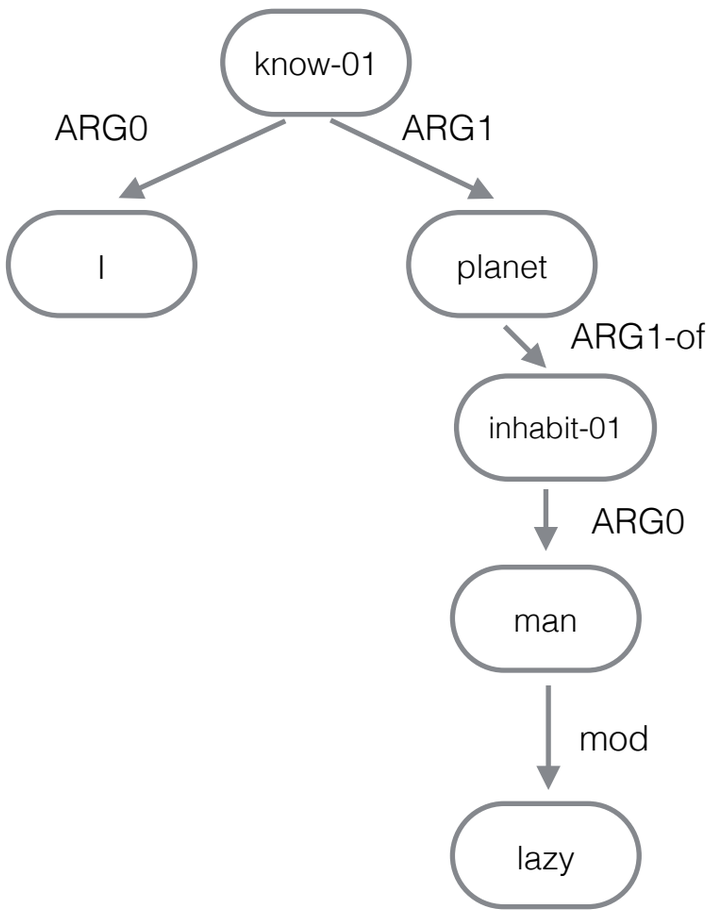
Input (Graph or Tree)



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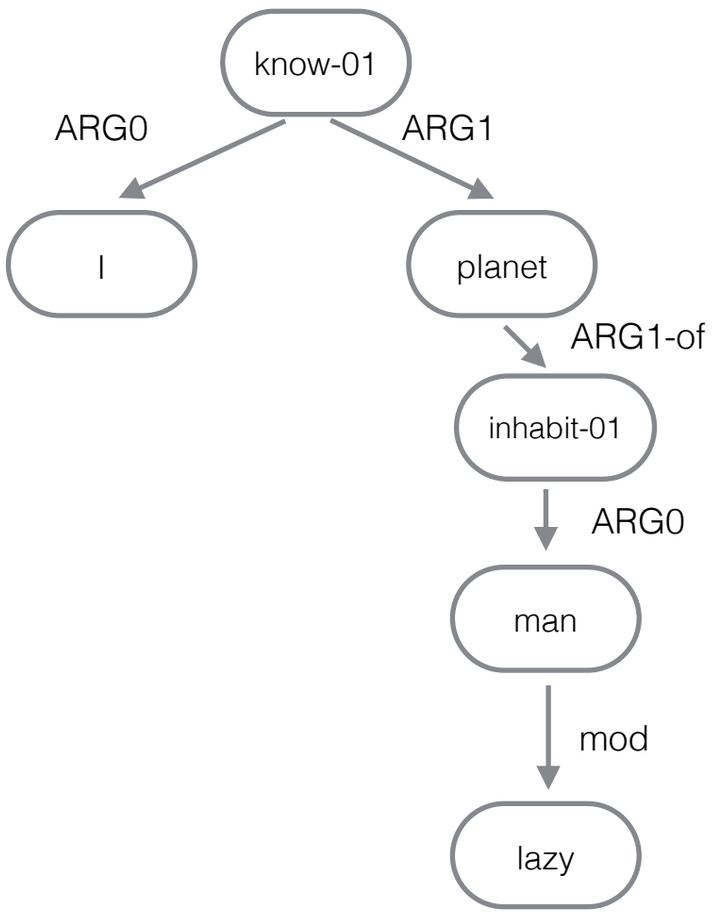

AMR	DAG

More Complex Structure

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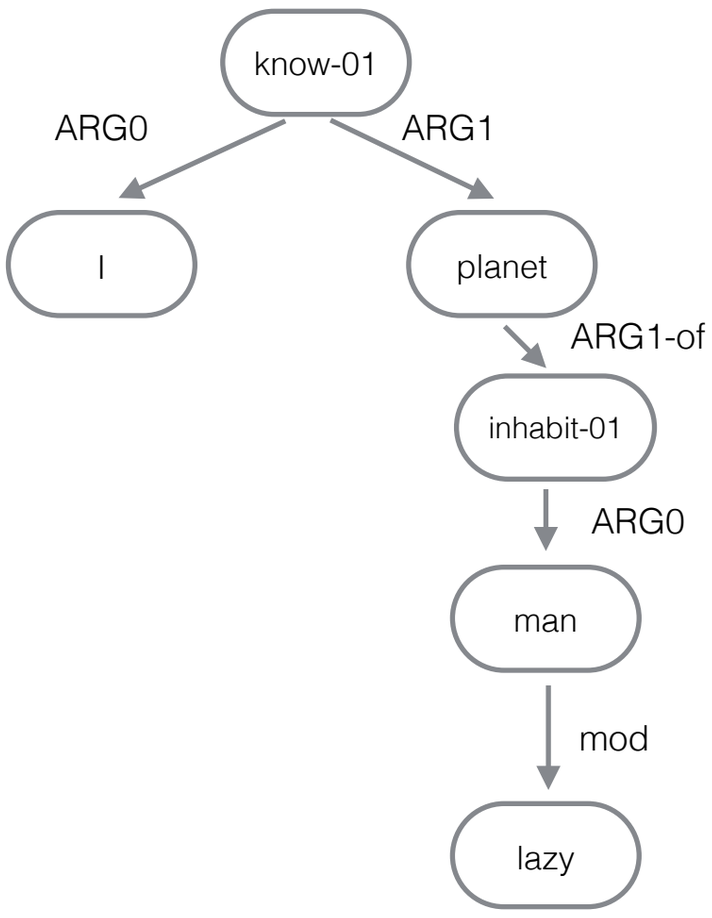
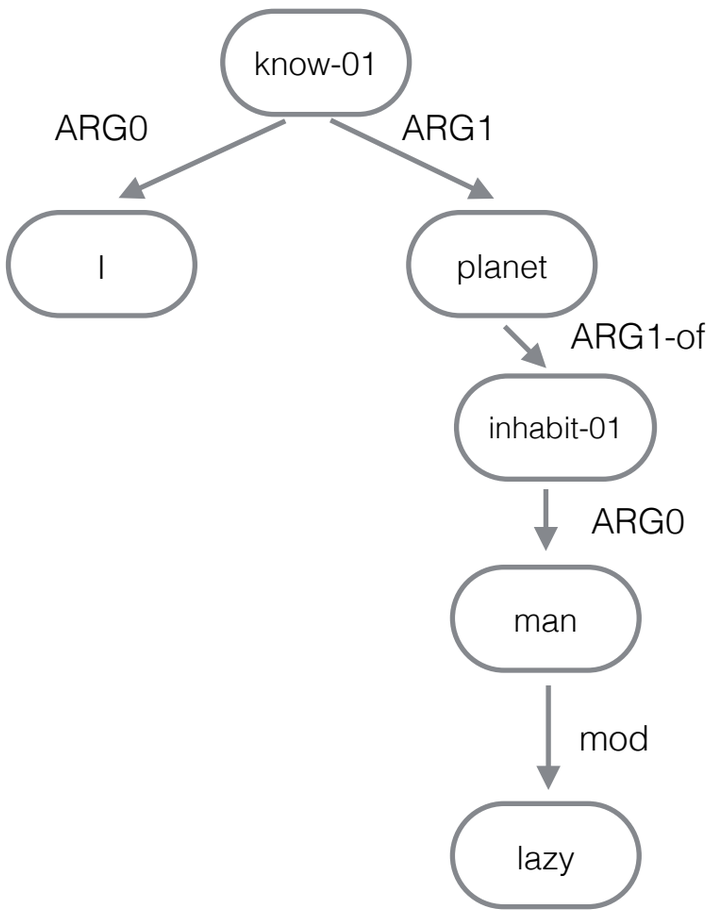


AMR	DAG
λ-calculus Expression	Tree

More Complex Structure

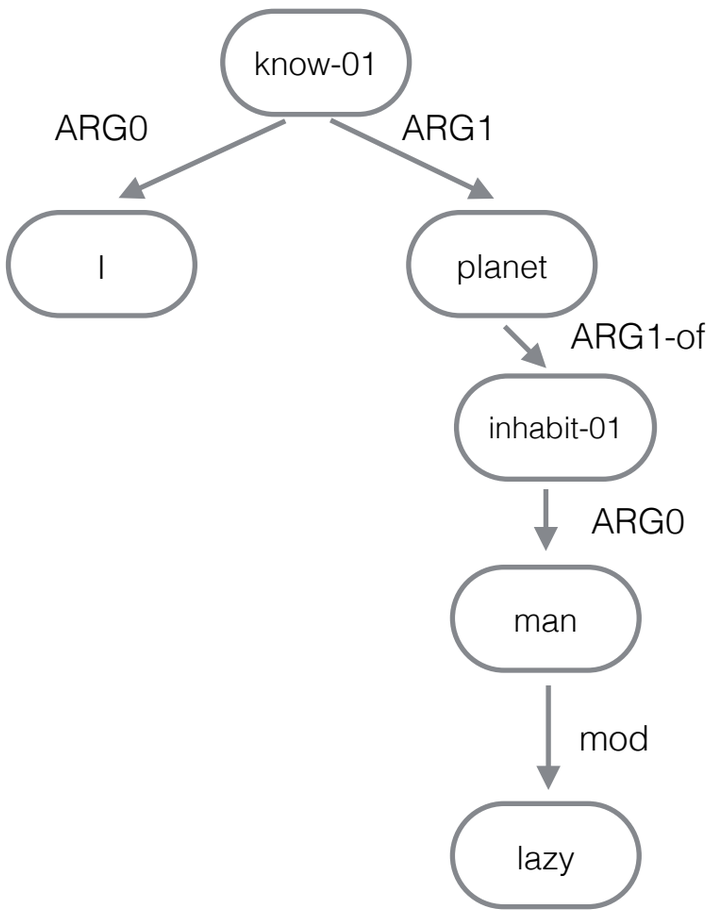
Input (Graph or Tree)



AMR	DAG
λ-calculus Expression	Tree
ECIs	Tree

More Complex Structure

Input (Graph or Tree)



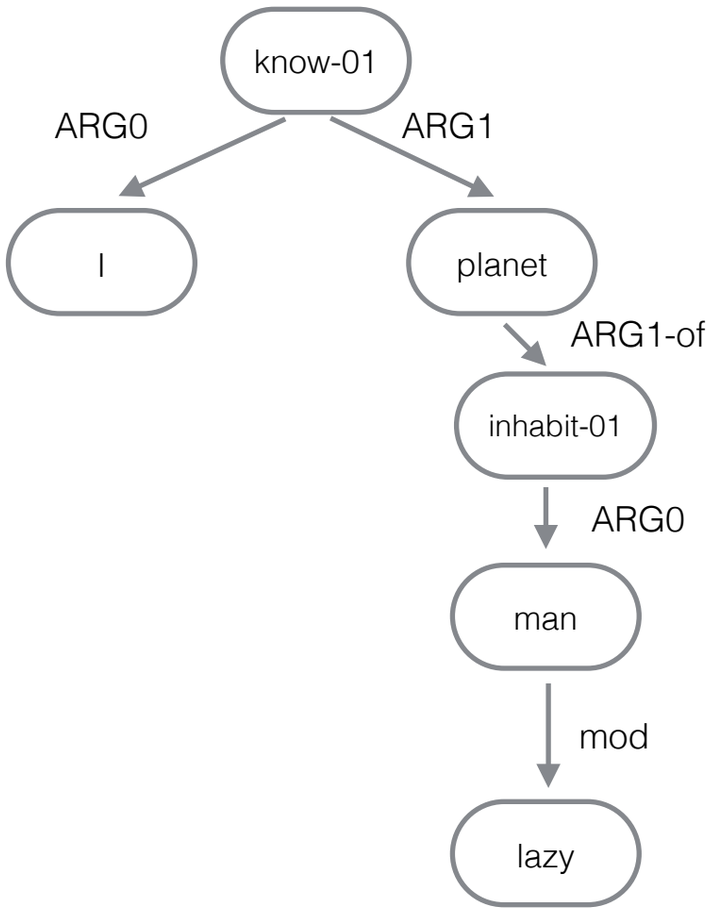
Output (Text)

I know a **planet** that is **inhabited** by a **lazy man**.

AMR	DAG
λ-calculus Expression	Tree
ECIs	Tree

More Complex Structure

Input (Graph or Tree)



AMR	DAG
λ-calculus Expression	Tree
ECIs	Tree

Output (Text)

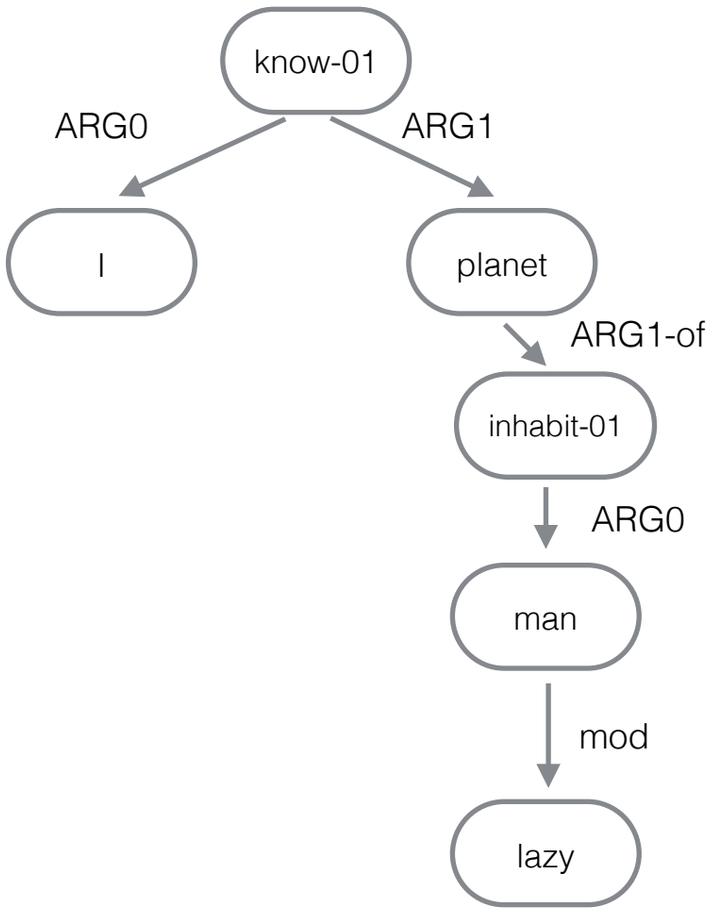
I know a **planet** that is **inhabited** by a **lazy man**.

I knew a **planet** that was **inhabited** by a **lazy man**. **(lpp_1943.249)**

I have **known** a **planet** that was **inhabited** by a **lazy man**.

More Complex Structure

Input (Graph or Tree)



AMR	DAG
λ-calculus Expression	Tree
ECIs	Tree

Output (Text)

I know a **planet** that is **inhabited** by a **lazy man**.

I knew a **planet** that was **inhabited** by a **lazy man**. **(lpp_1943.249)**

I have **known** a **planet** that was **inhabited** by a **lazy man**.

I know about a **planet.** It is **inhabited** by a **lazy man**.

NEUGEN Framework

NeuGen Framework

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Encoder

- Bag of Words: Concepts and roles
- Attention mechanism

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- Bag of Words: Concepts and roles
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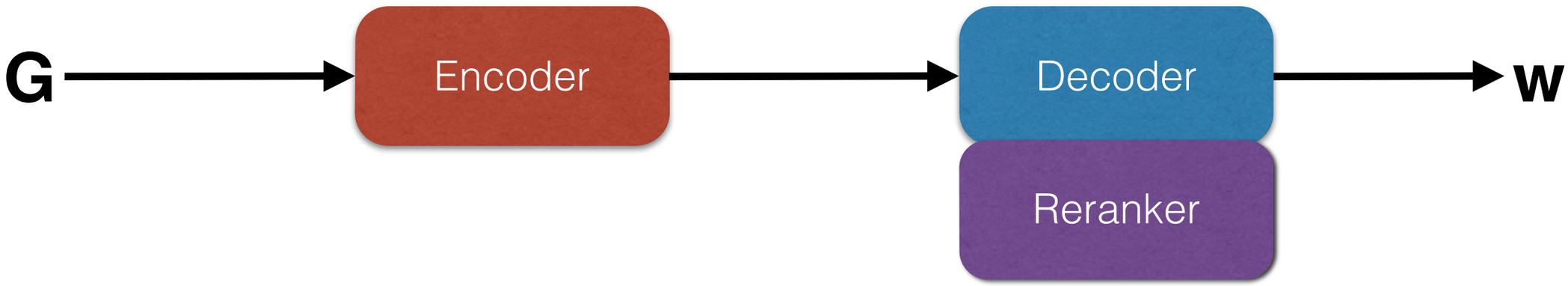
Decoder

- Left-to-right word LSTM
- Greedy beam search

NeuGen Framework



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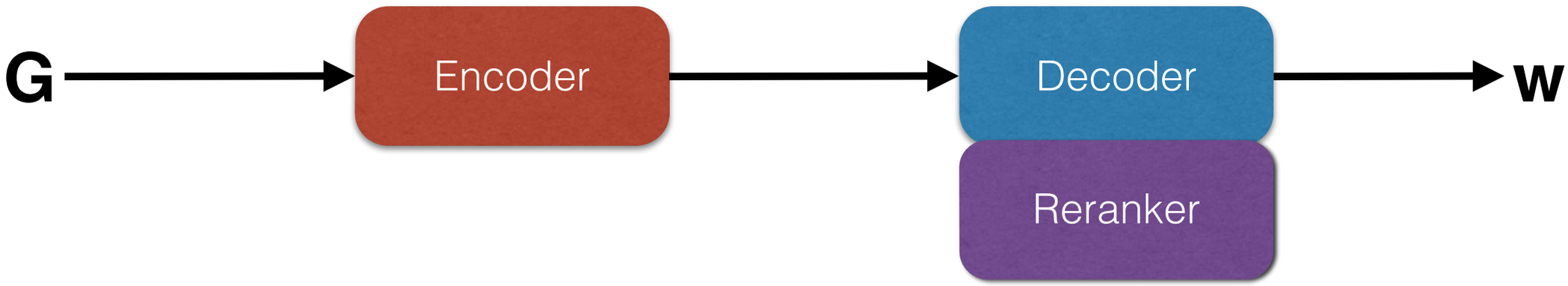

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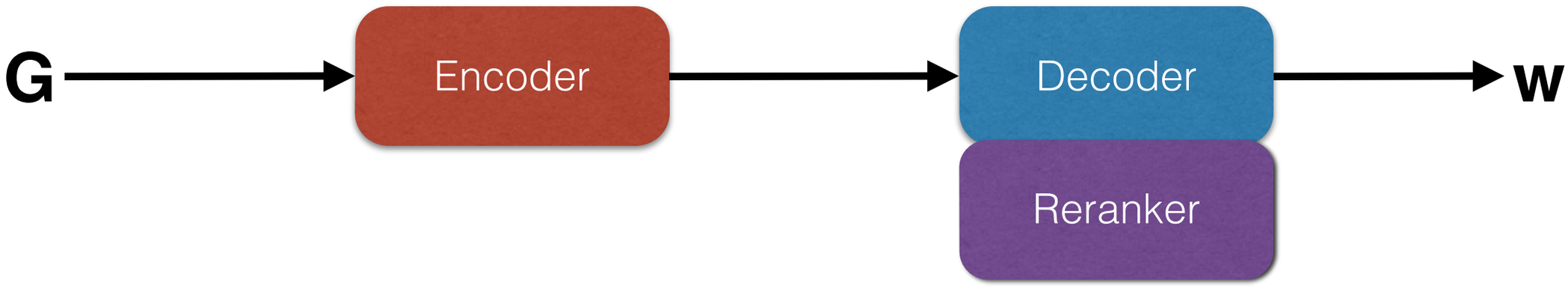
Reranker

NeuGen Framework



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Decoder

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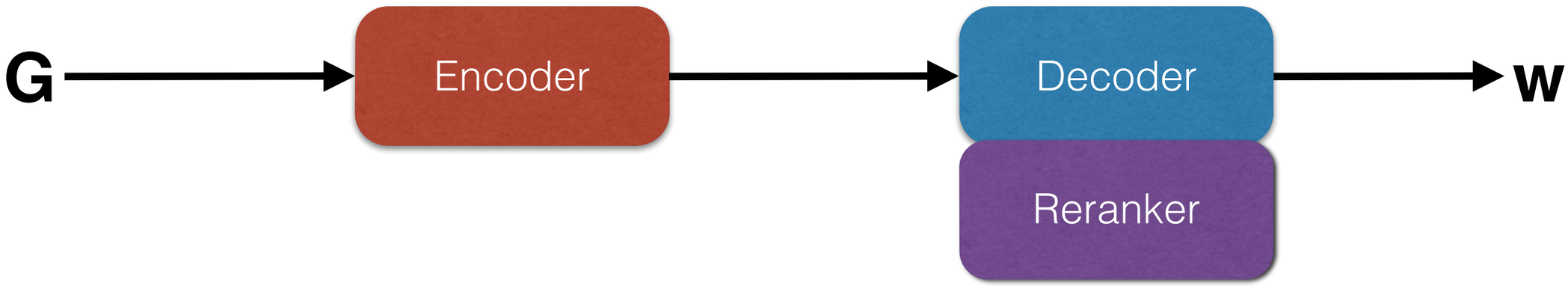
Reranker

- CCG parser -> semantics

NeuGen Framework



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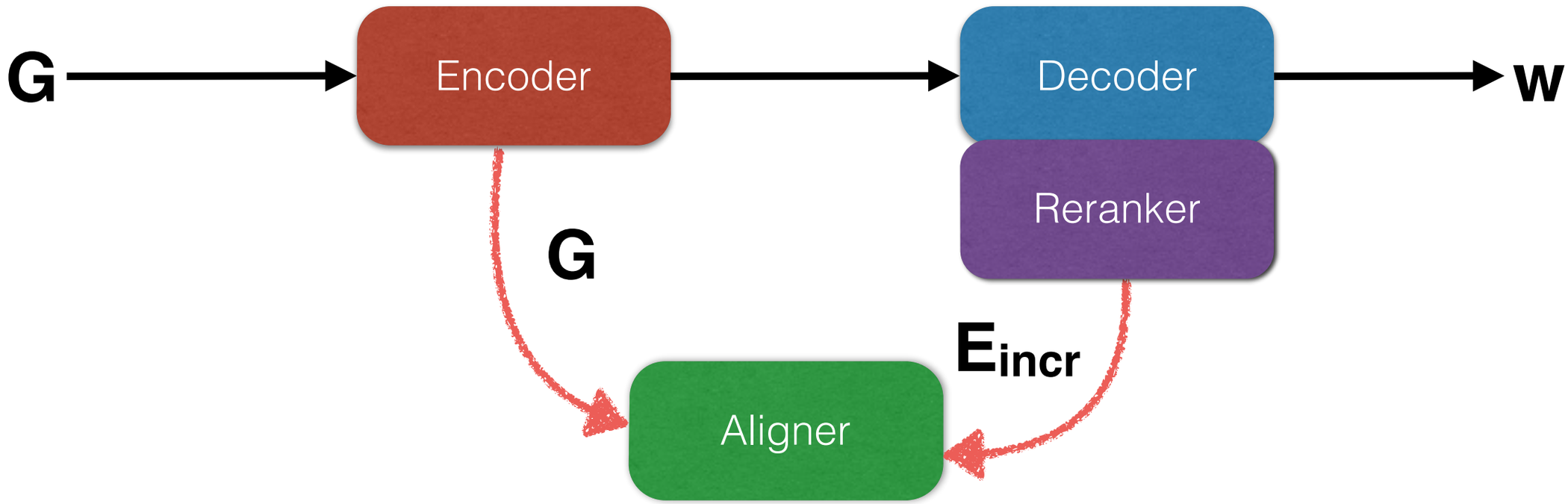
- Partial propositions graph $\mathbf{E_{incr}}$

NEUGEN Framework



Encoder
- Bag of Words: Concepts and roles
- Attention mechanism

Aligner
- Feed-forward NN with attention

Decoder
- Left-to-right word LSTM
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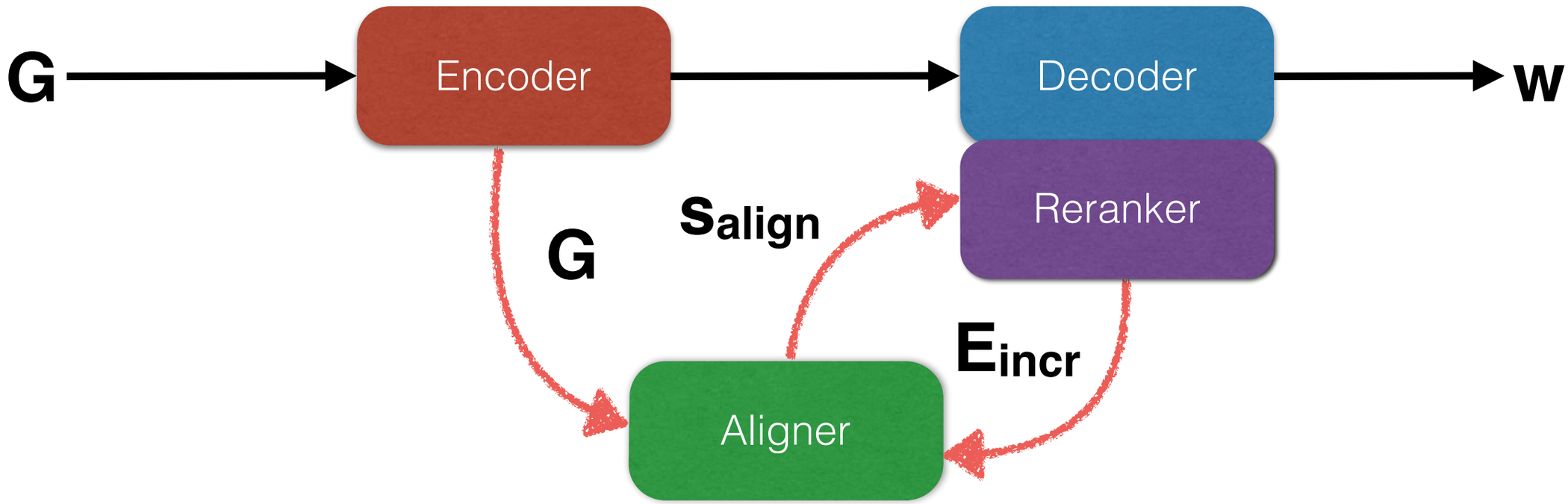

Encoder
- Bag of Words: Concepts and roles
- Attention mechanism

Aligner
- Feed-forward NN with attention
- $\mathbf{S}_{\mathbf{align}} = \mathit{fit}(\mathbf{G}, \mathbf{E}_{\mathbf{incr}})$

Decoder
- Left-to-right word LSTM
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Alignment

Alignment

w: A **man inhabited** a **planet**

Alignment

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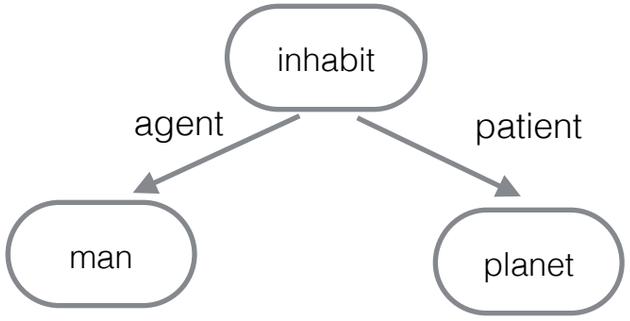
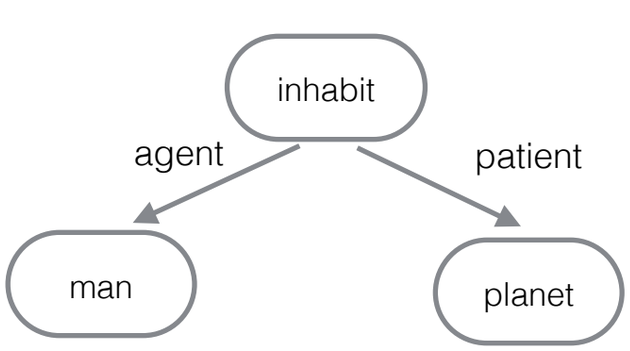


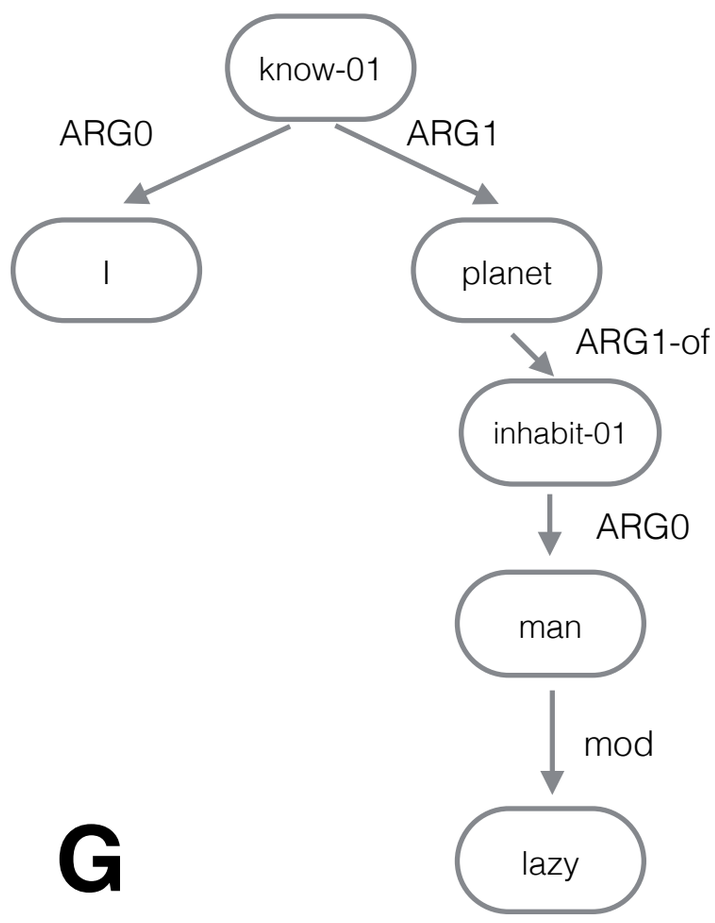
E_{incr}

Alignment

w: A **man inhabited** a **planet**



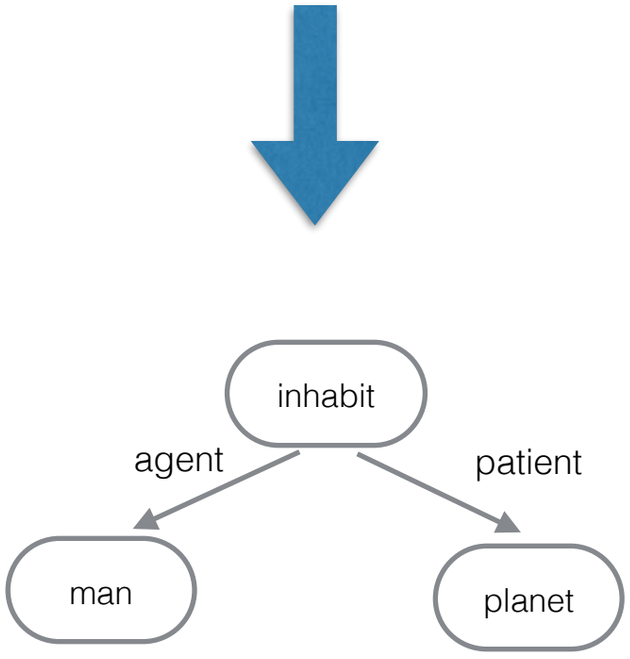
E$_{\textbf{incr}}$



G

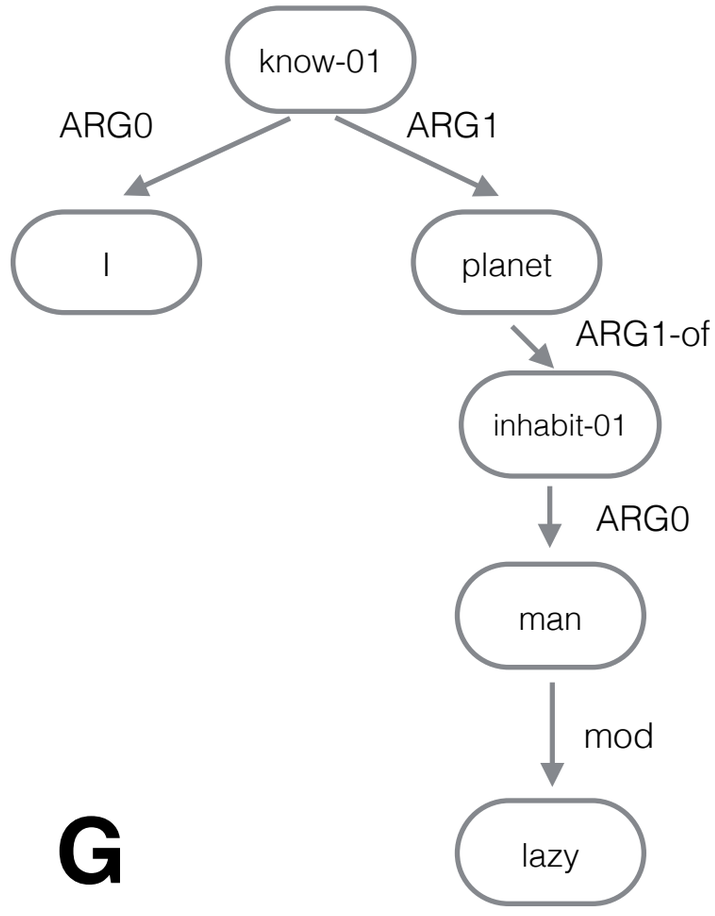
Alignment

w: A **man inhabited** a **planet**



E$_{\textbf{incr}}$

fit(**G**, **E**$_{\textbf{incr}}$)



G

Alignment

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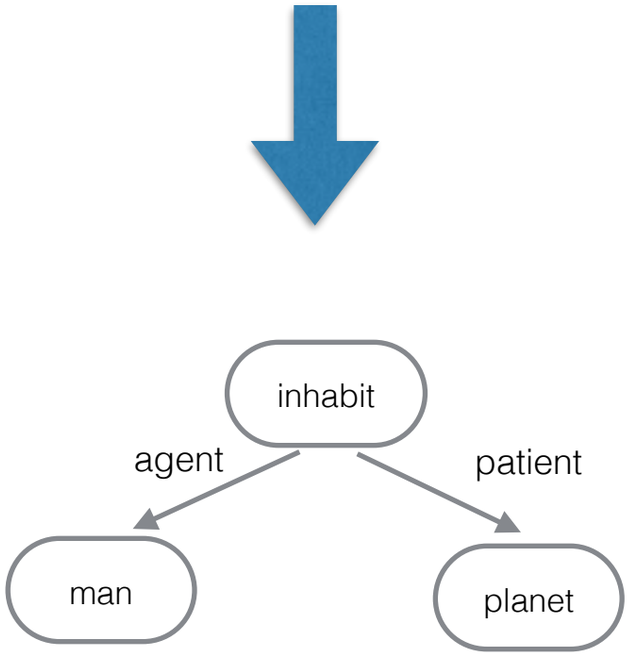
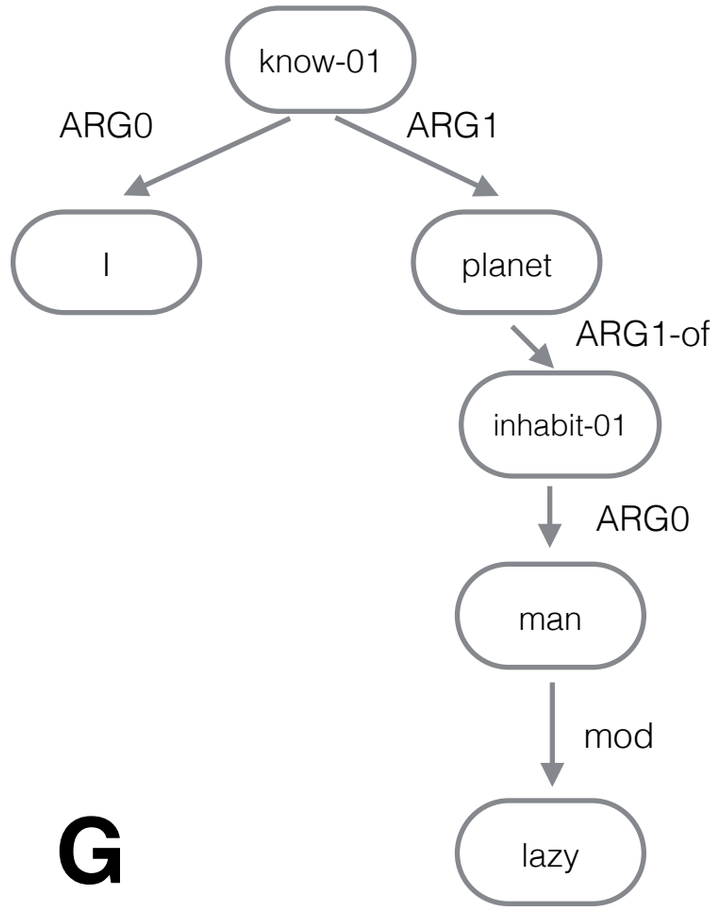


E$_{\textbf{incr}}$

```
<inhabit, man, agent>
<inhabit, planet, patient>
```

fit(**G**, **E**$_{\textbf{incr}}$)

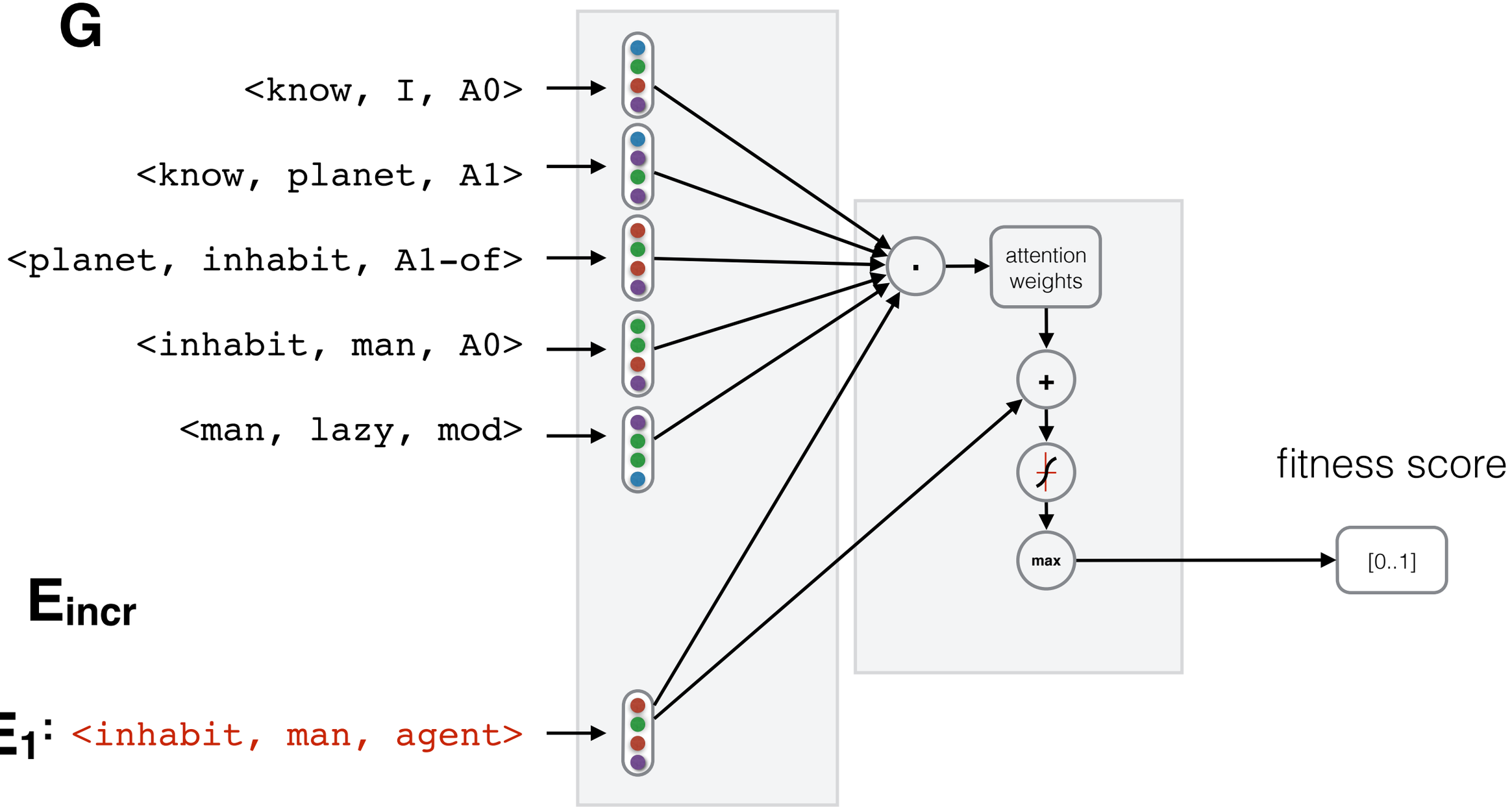


G

```
<know-01, I, A0>
<know-01, planet, A1>
<planet, inhabit-01, A1-of>
<inhabit-01, man, A0>
<man, lazy, mod>
```

Alignment

G



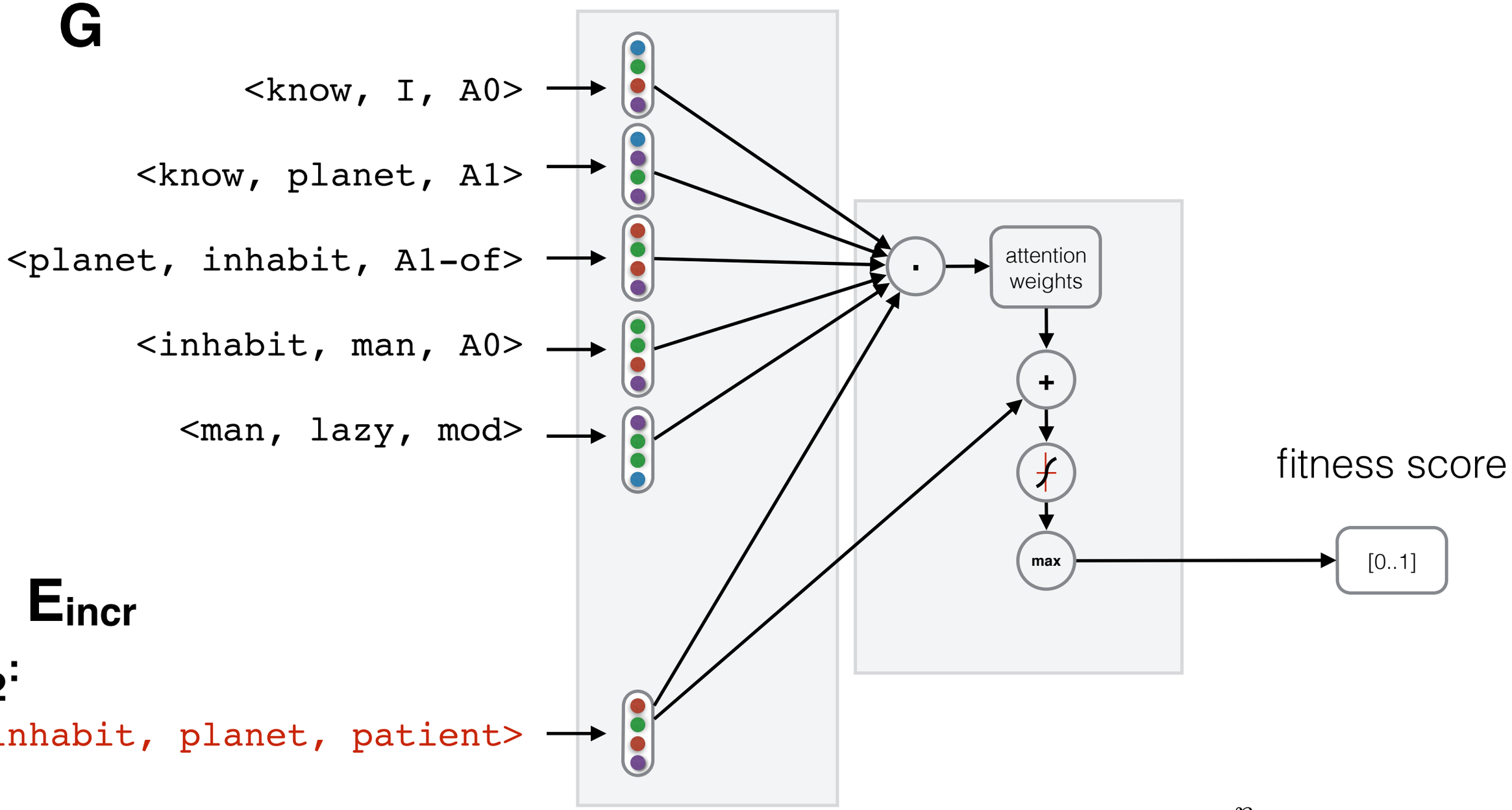
E_{incr}

E_1: <inhabit, man, agent>

<inhabit, planet, patient>

Alignment

G



E_{incr}

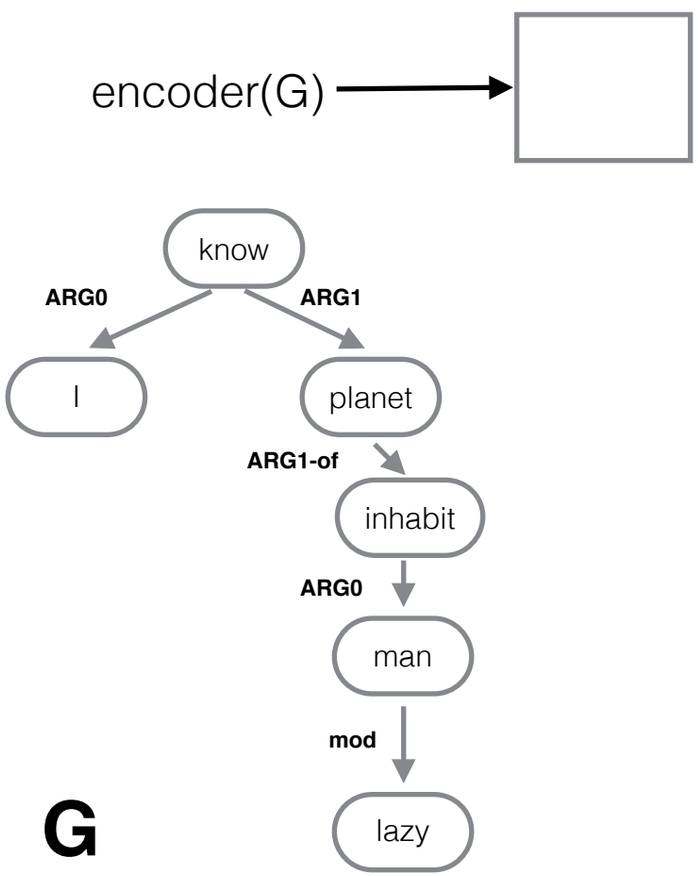
E_2:

<inhabit, planet, patient>

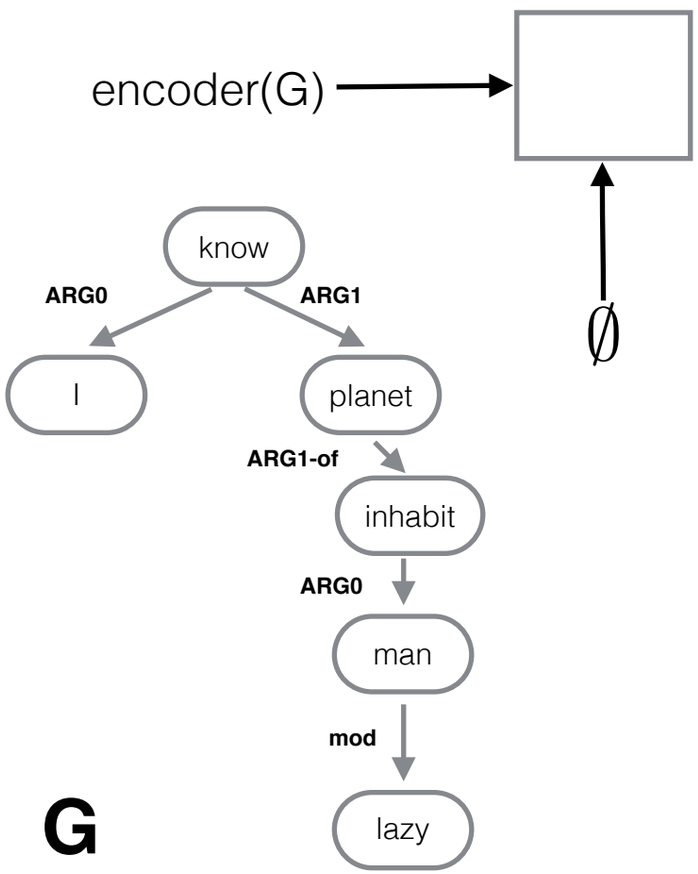
<inhabit, man, agent>

$$fit(G, E_{incr}) = \frac{1}{n} \sum_{i=0}^{n} fit(G, E_i)$$

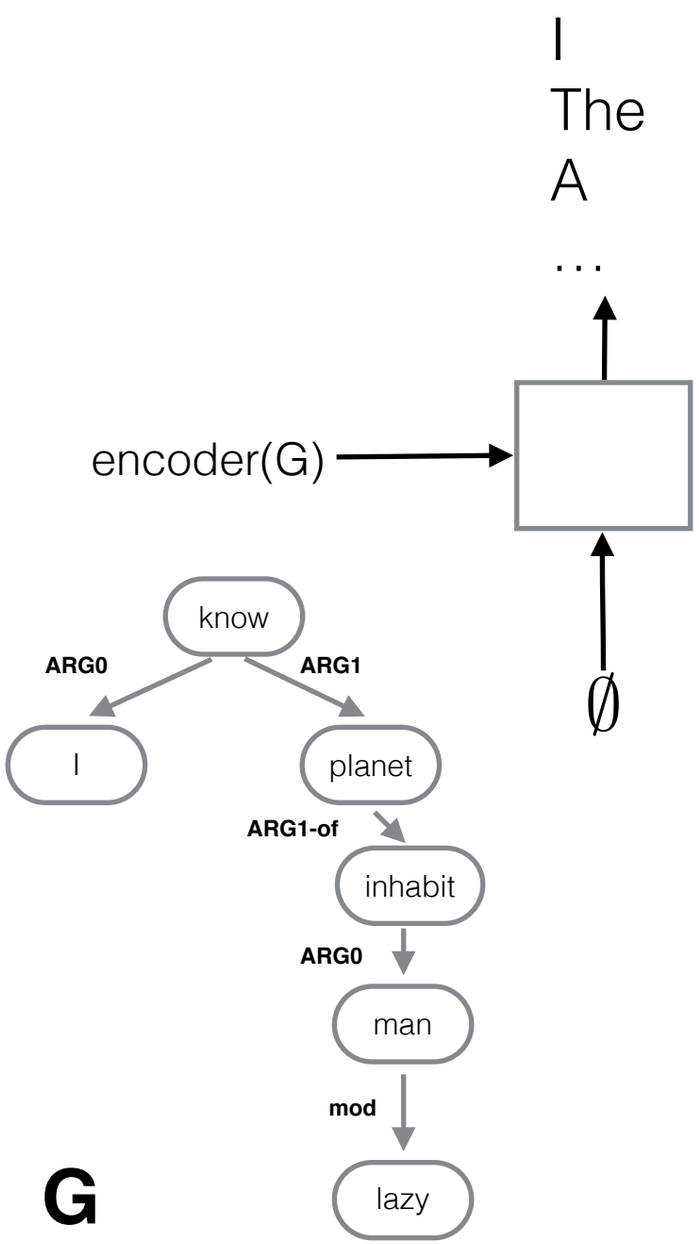
Decoding


encoder(G)
know
ARG0
ARG1
I
planet
ARG1-of
inhabit
ARG0
man
mod
lazy
G

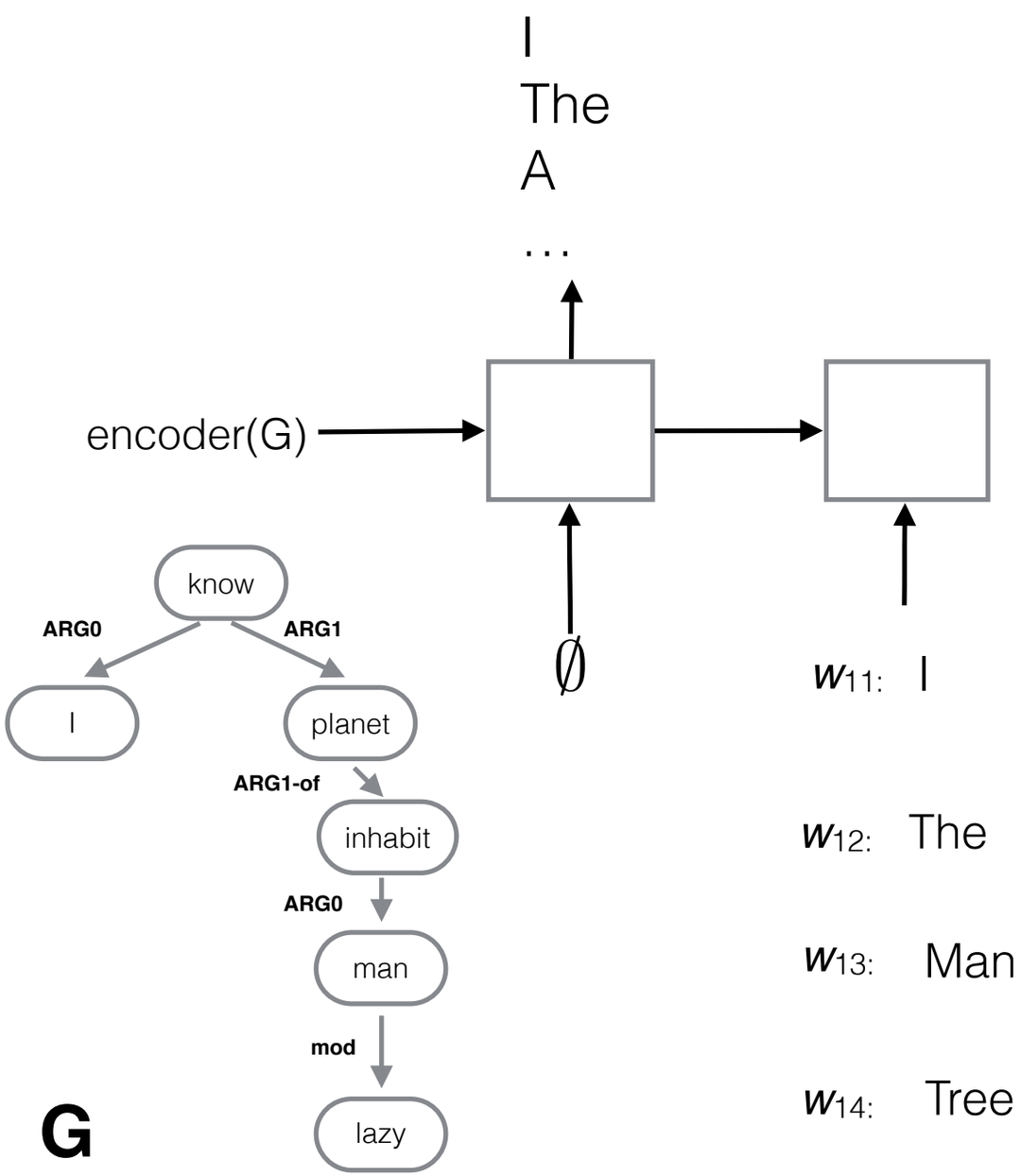
Decoding


encoder(G)
Ø
know
ARG0
ARG1
I
planet
ARG1-of
inhabit
ARG0
man
mod
lazy
G

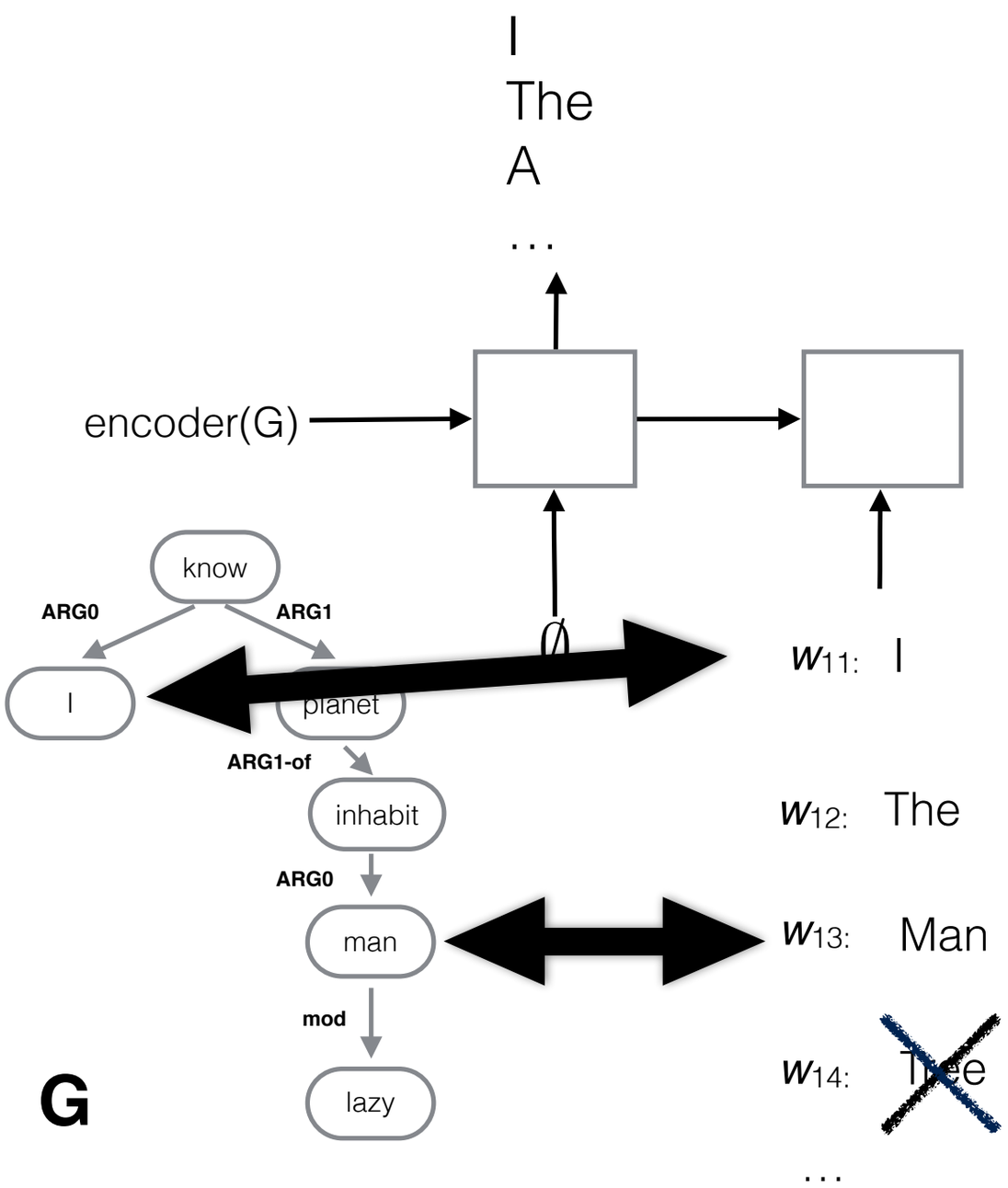
Decoding


I
The
A
…
encoder(G)
Ø
know
ARG0
ARG1
I
planet
ARG1-of
inhabit
ARG0
man
mod
lazy
G

Decoding

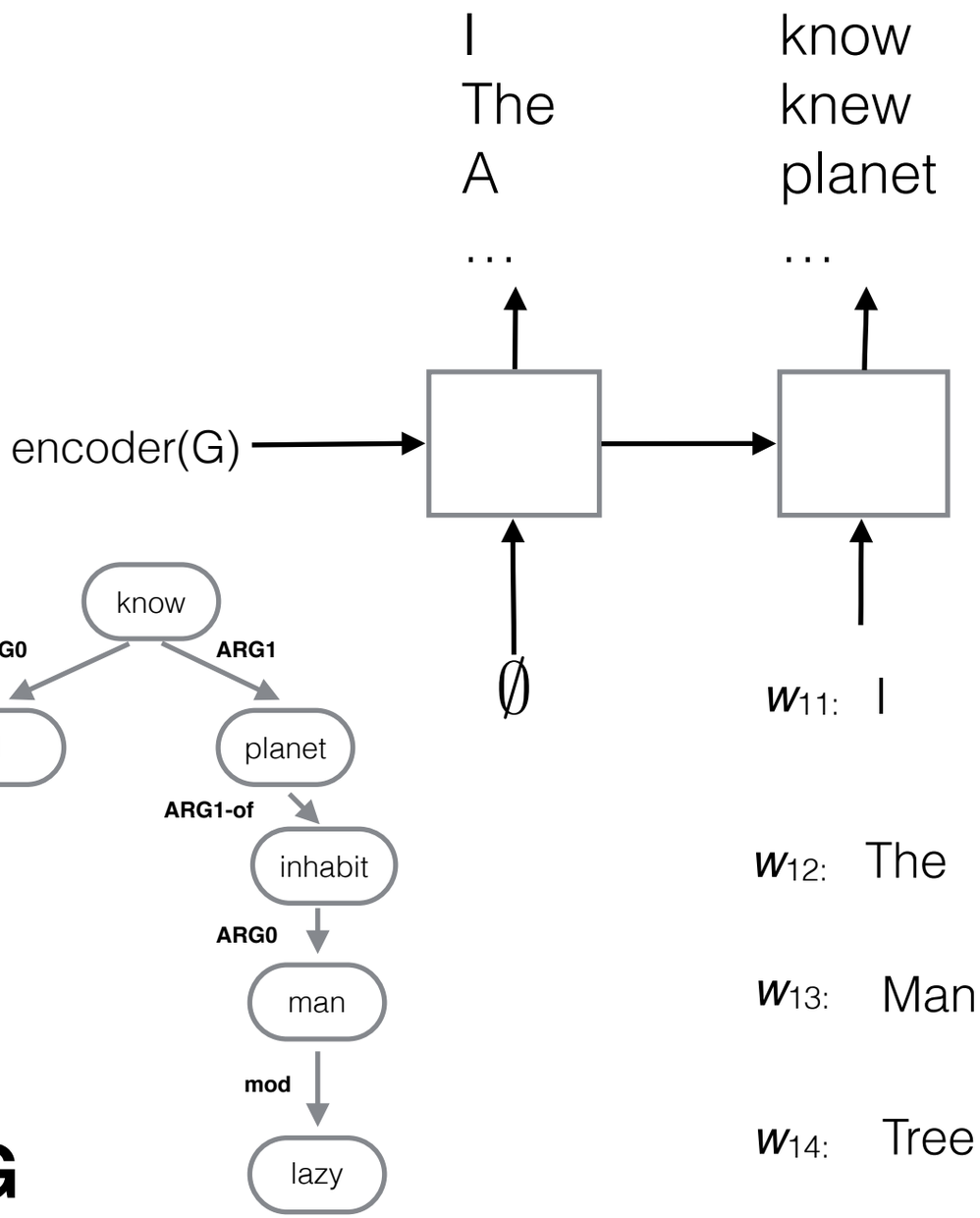

I
The
A
…
encoder(G)
know
ARG0
ARG1
I
planet
ARG1-of
inhabit
ARG0
man
mod
lazy
G
Ø
w_{11}: I
w_{12}: The
w_{13}: Man
w_{14}: Tree
…

Decoding



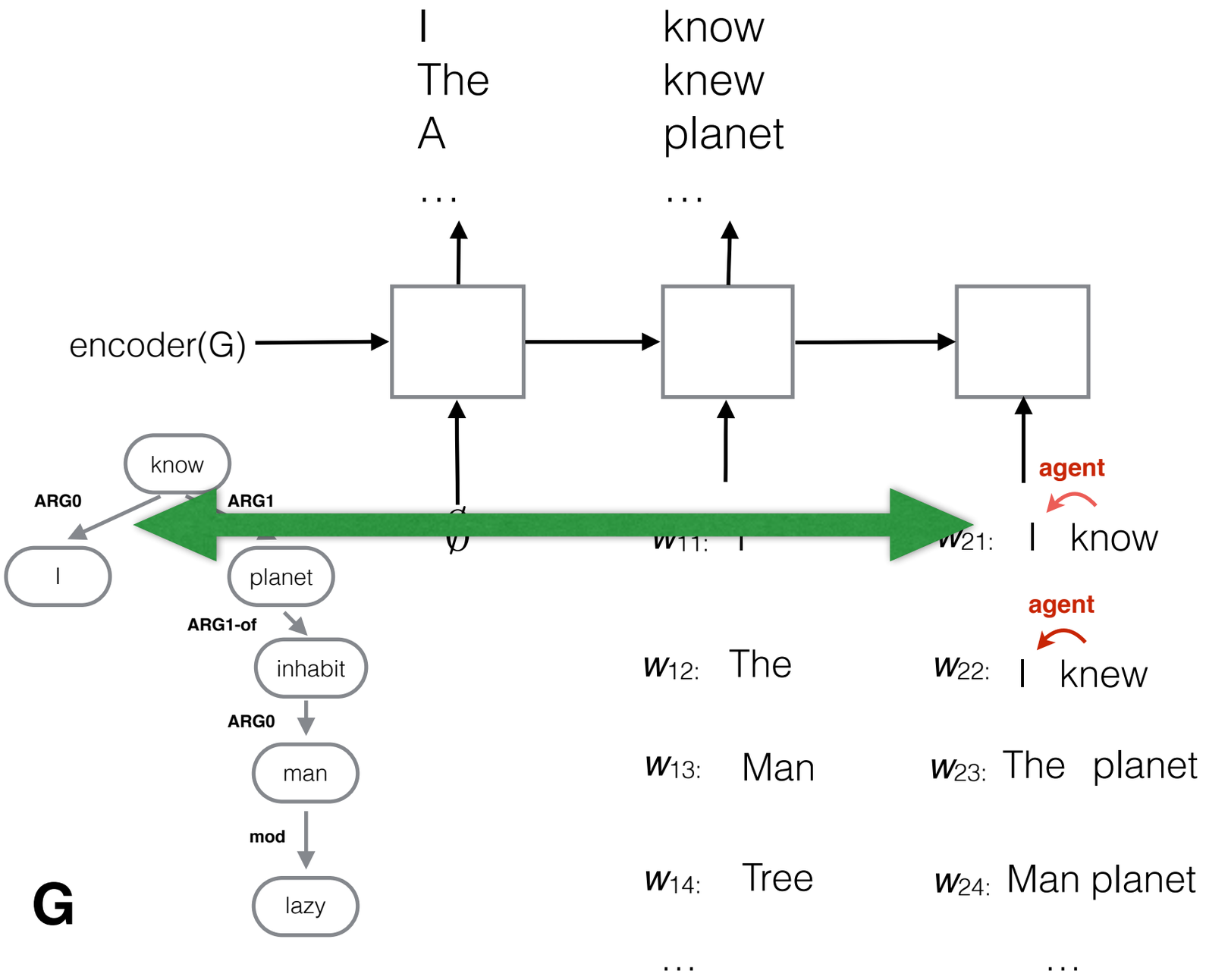
re-score: $\mathbf{S_{LSTM}}$

Decoding



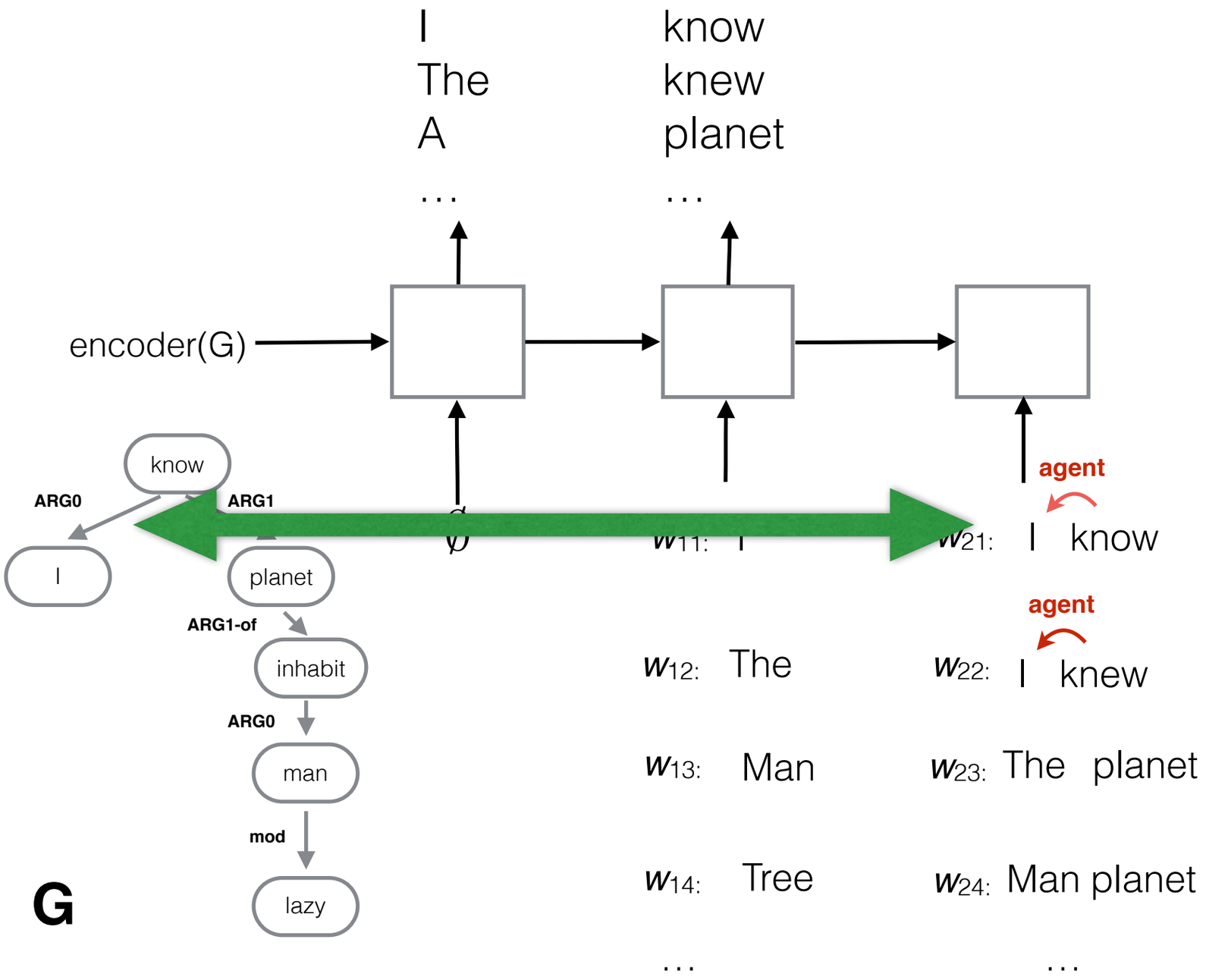
re-score: $\mathbf{S_{LSTM}}$

Decoding



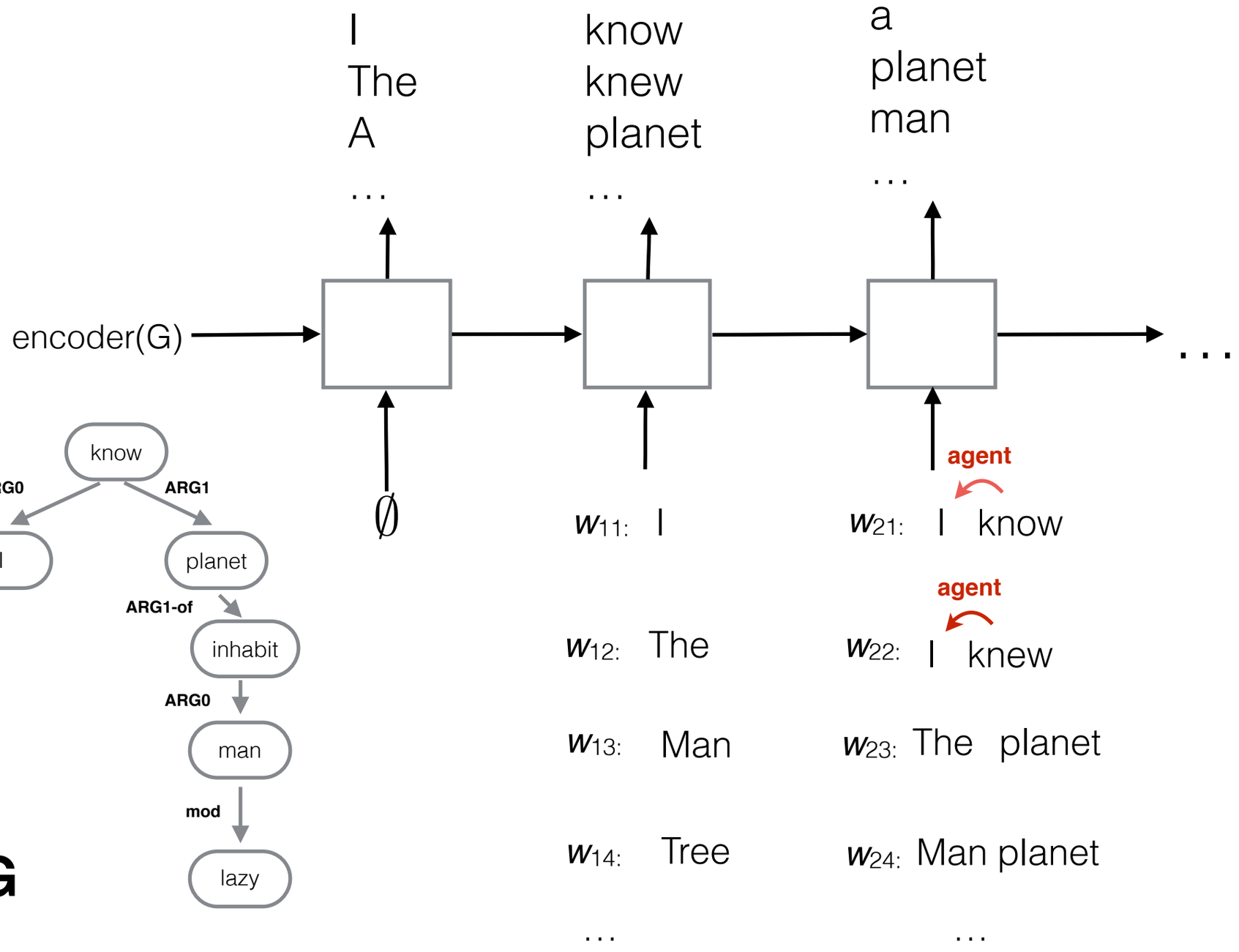
re-score: S_{LSTM} + S_{align}

Decoding



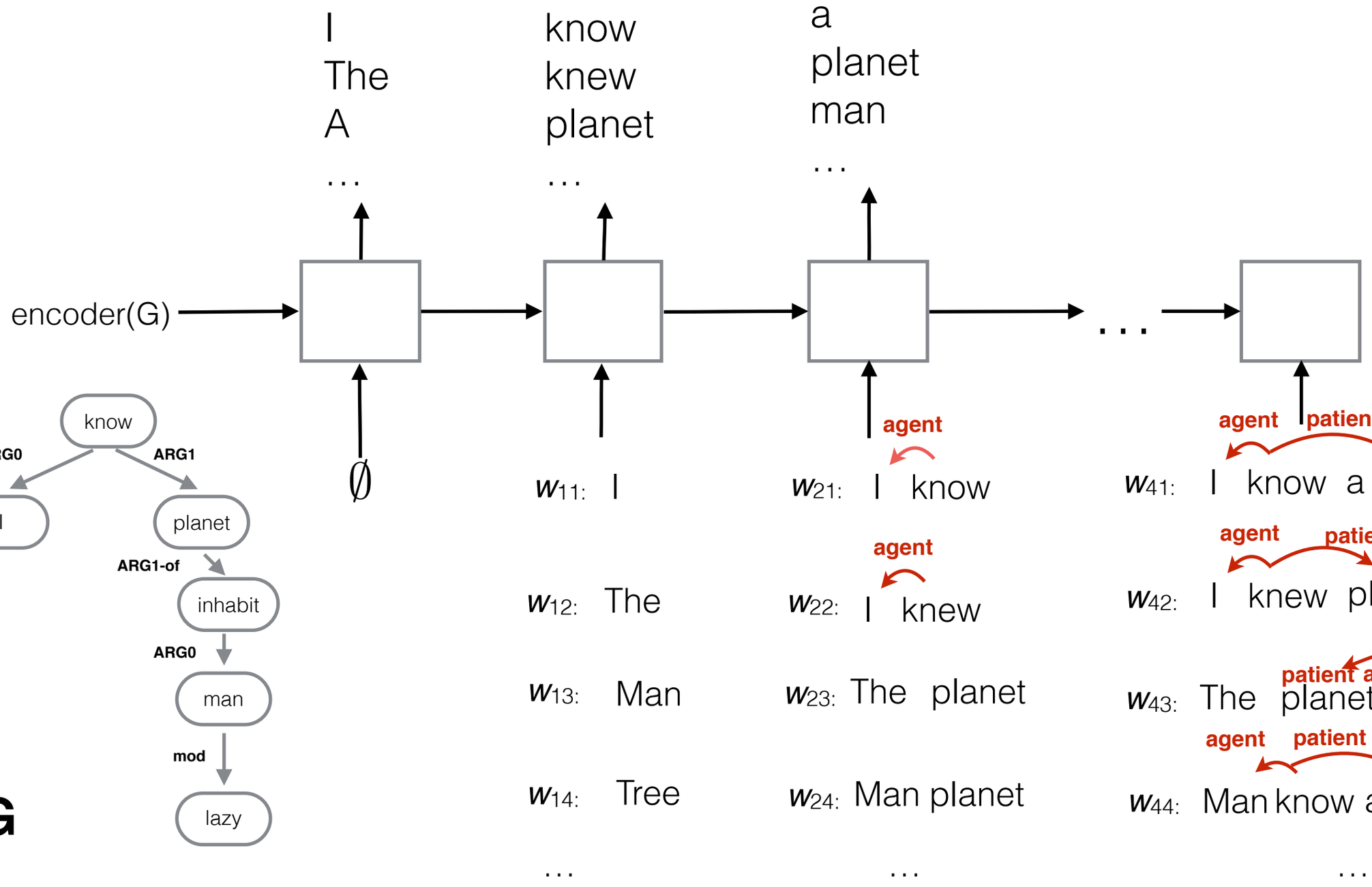
re-score: S_{LSTM} + S_{align}

Decoding



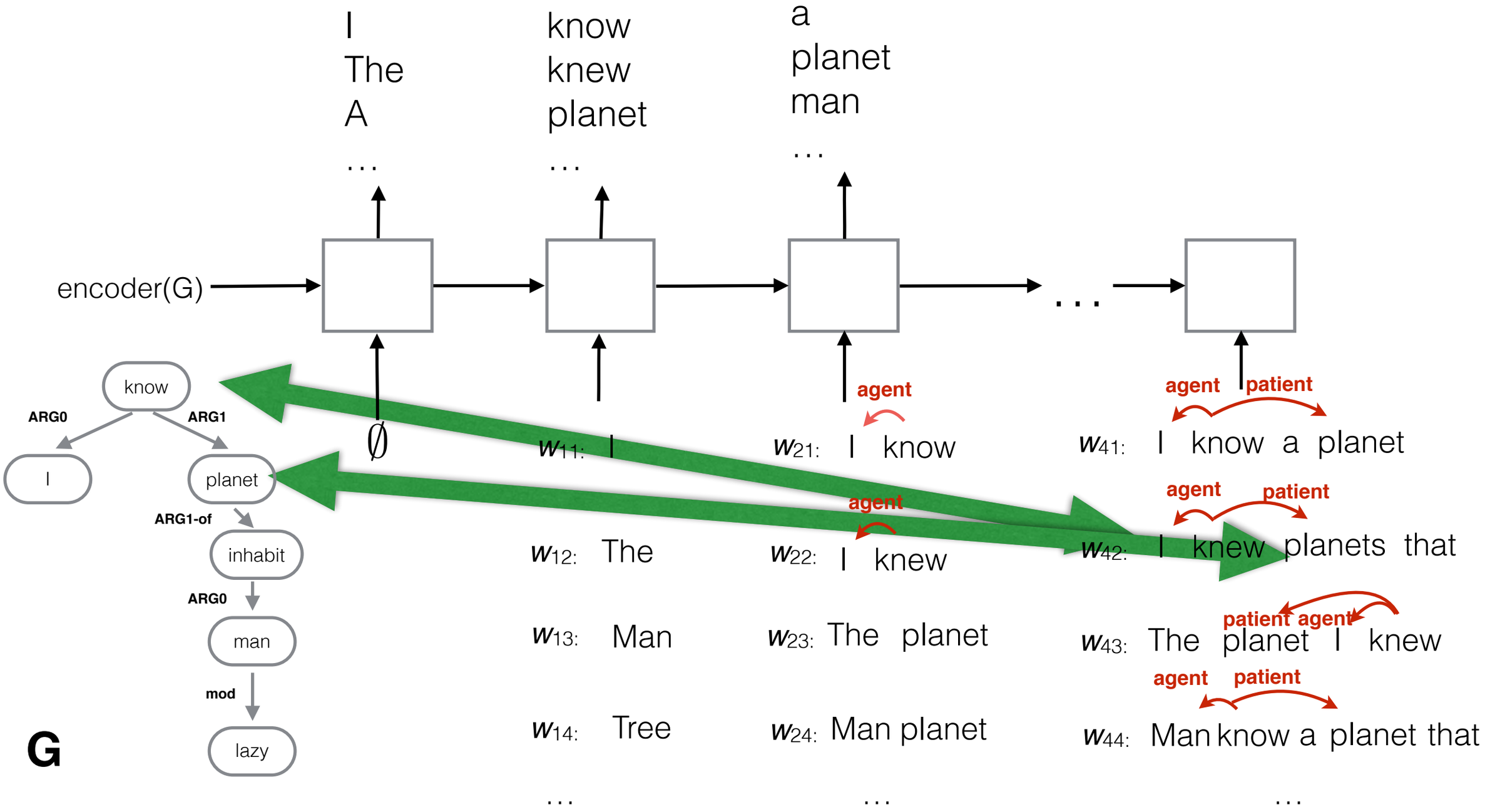
re-score: $\mathbf{S_{LSTM}} + \mathbf{S_{align}}$

Decoding



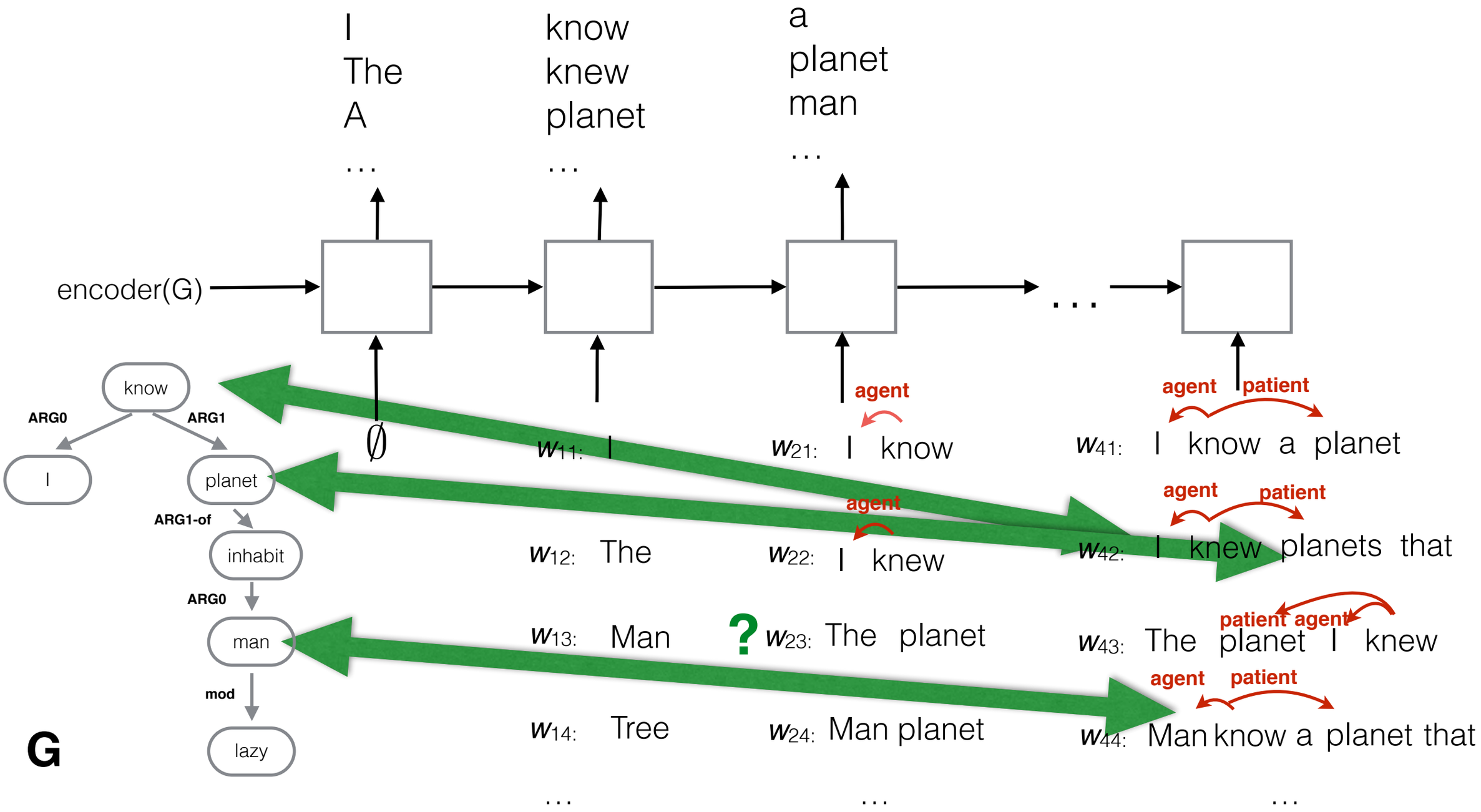
re-score: $\mathbf{S_{LSTM}}$ + $\mathbf{S_{align}}$

Decoding



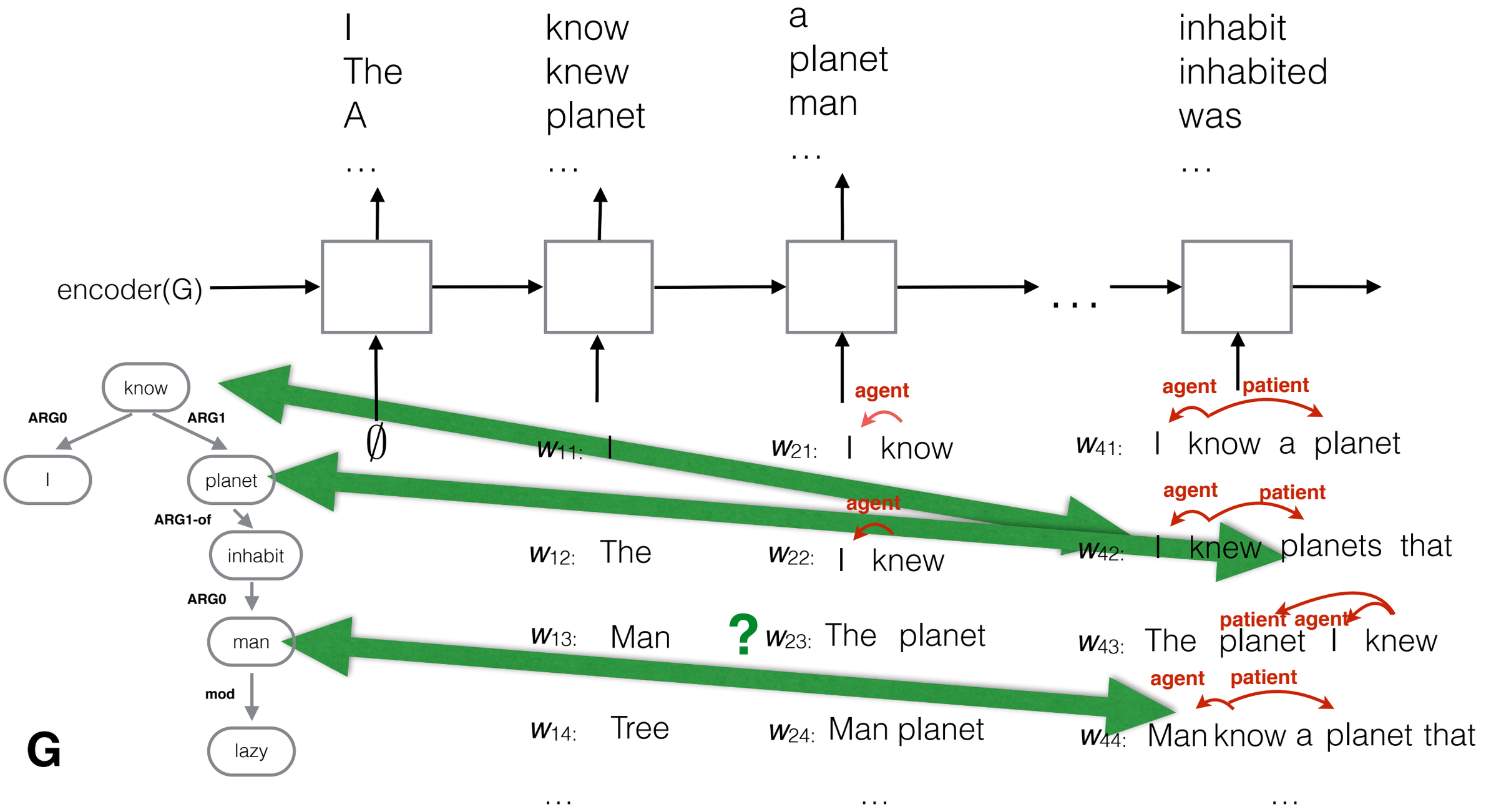
re-score: S_{LSTM} + S_{align}

Decoding



re-score: $\mathbf{S_{LSTM}} + \mathbf{S_{align}}$

Decoding



re-score: $\mathbf{S_{LSTM}} + \mathbf{S_{align}}$

Preliminary Results

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Experimental Setup

Preliminary Results

Experimental Setup

- Baseline RNN w/o alignment
- NeuGen

Preliminary Results

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Dataset

Preliminary Results

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- Baseline RNN w/o alignment
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Dataset

- AMR LDC2015E86
- Train: 15k, Dev: 1.2k, Test: 1.2k

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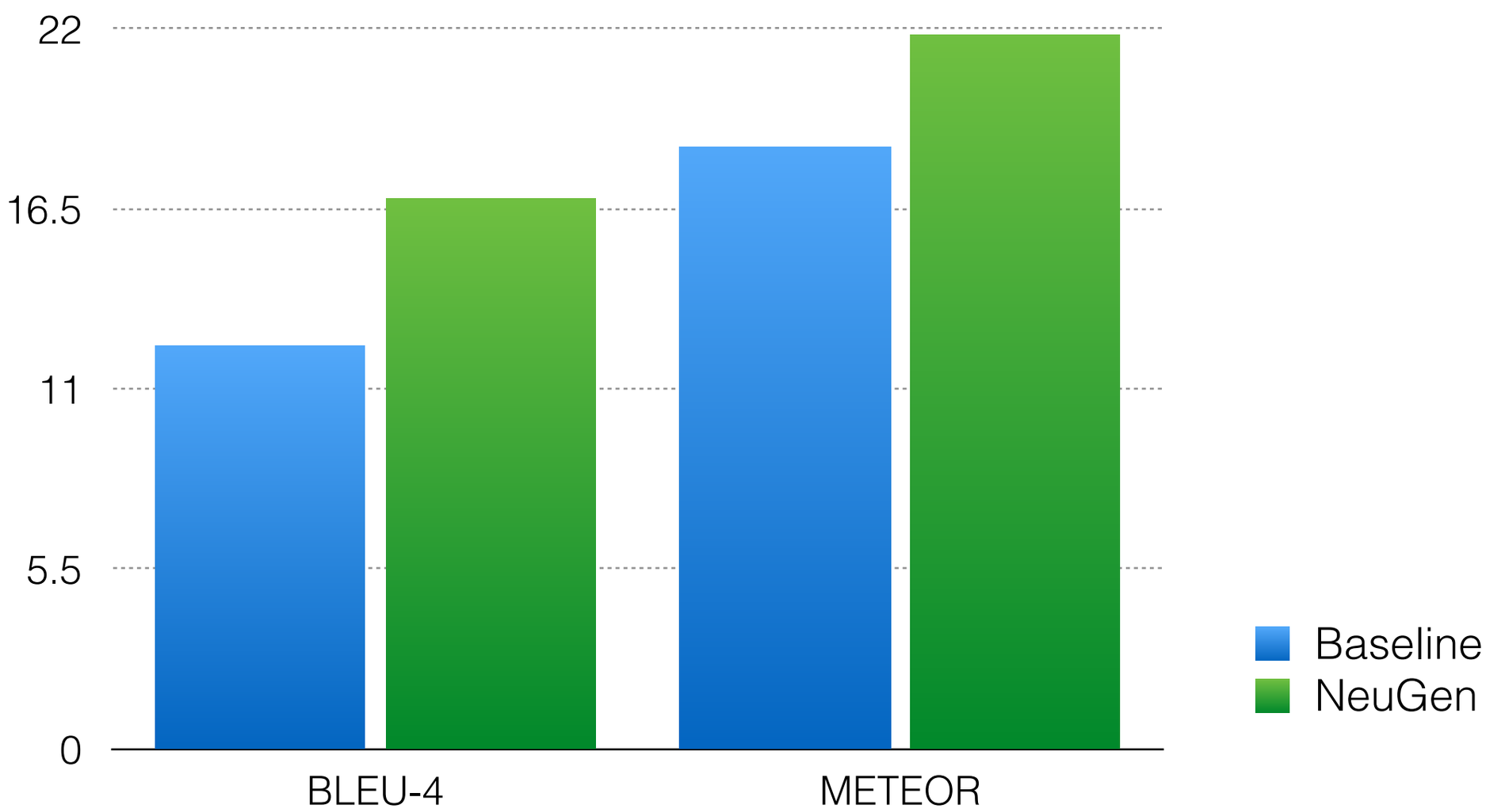
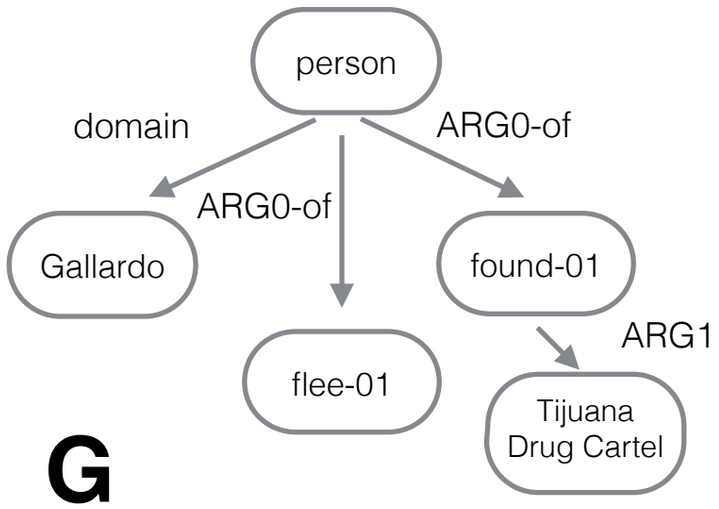


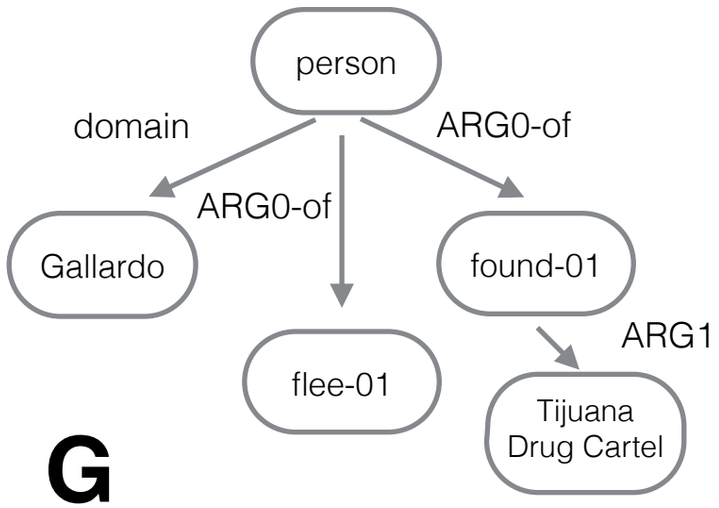
Example Output

Example Output



G

Example Output



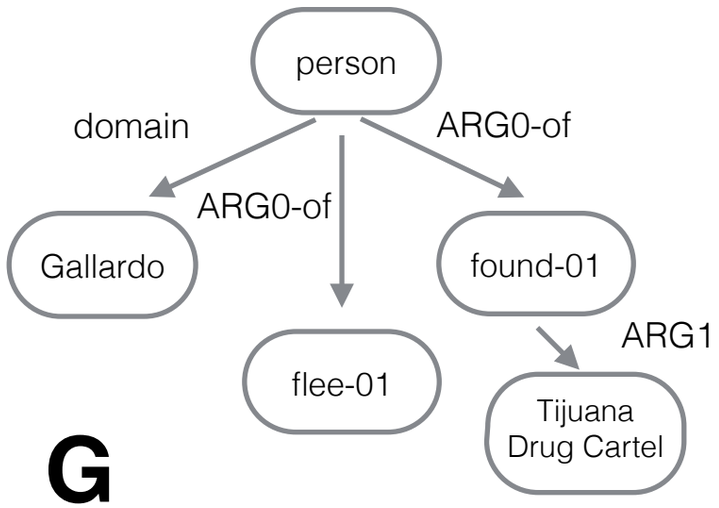
G

Gold: `Gallardo is the fugitive founder of Tijuana Drug Cartel.`

Baseline: `Gallardo is the founder of Tijuana Drug Cartel.`

NeuGen: `Tijunana Drug Cartel is the founder of Gallardo.`

Example Output



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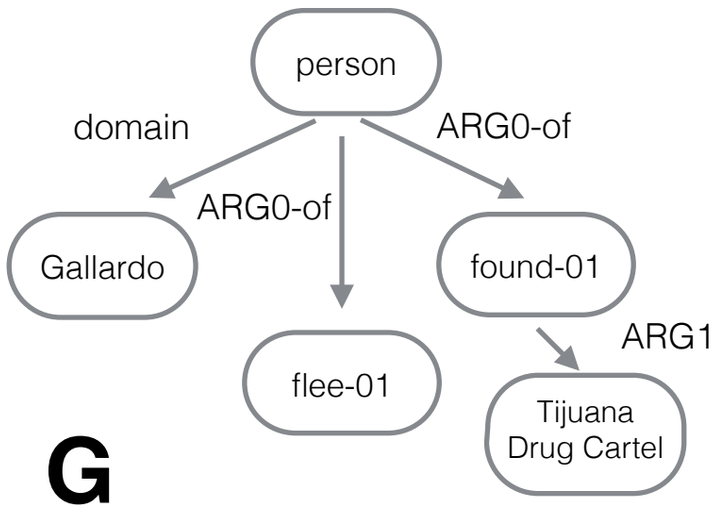
```
Gallardo

Tijuana Drug Cartel

State

Country

…
```

Example Output



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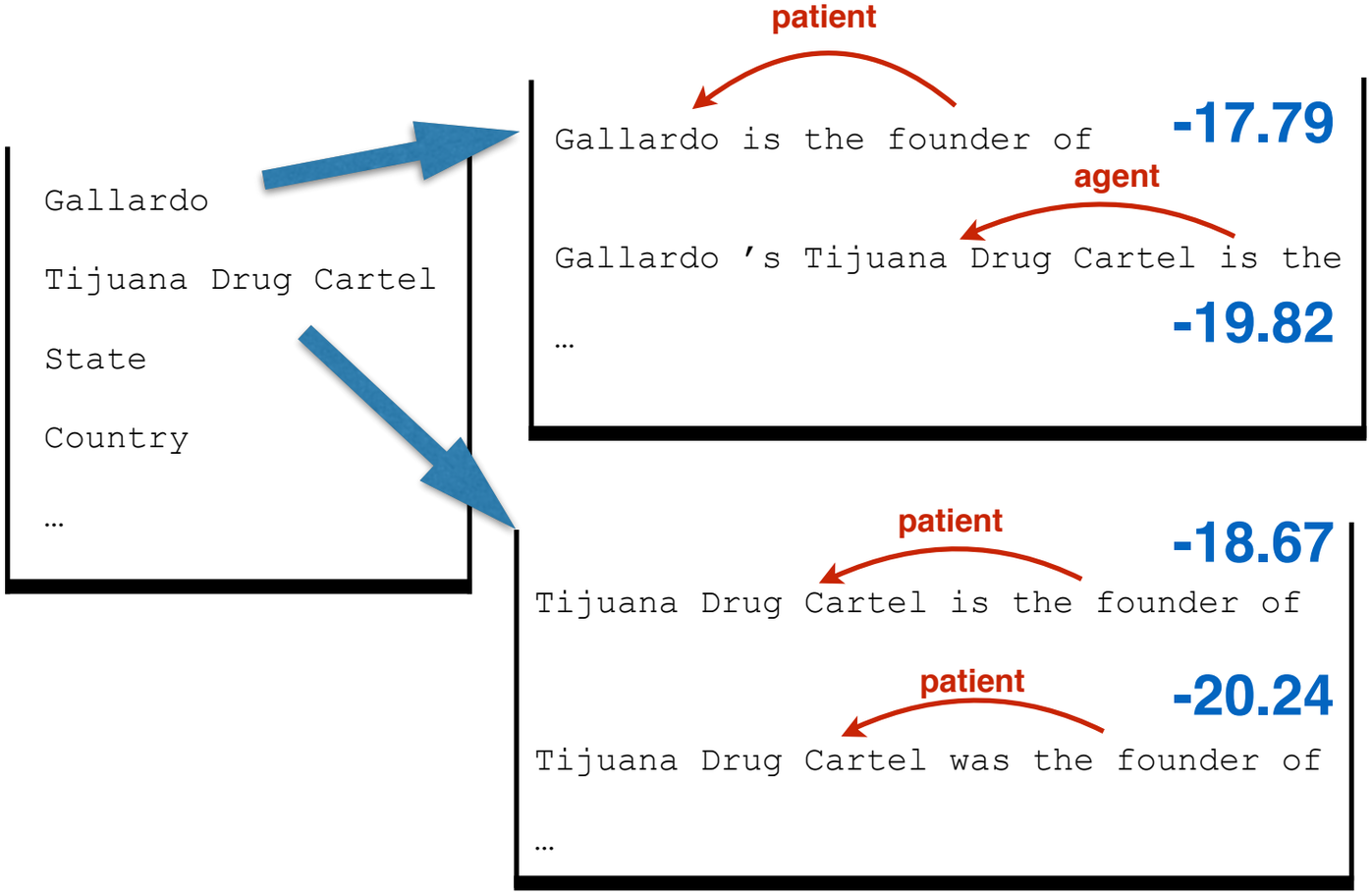
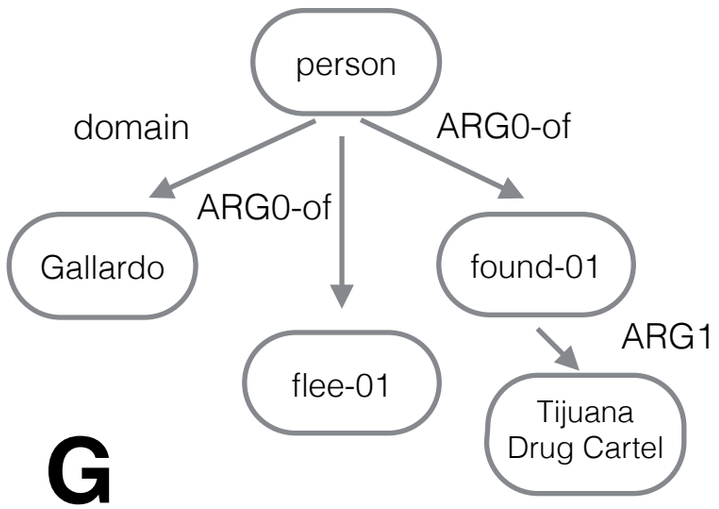


Example Output



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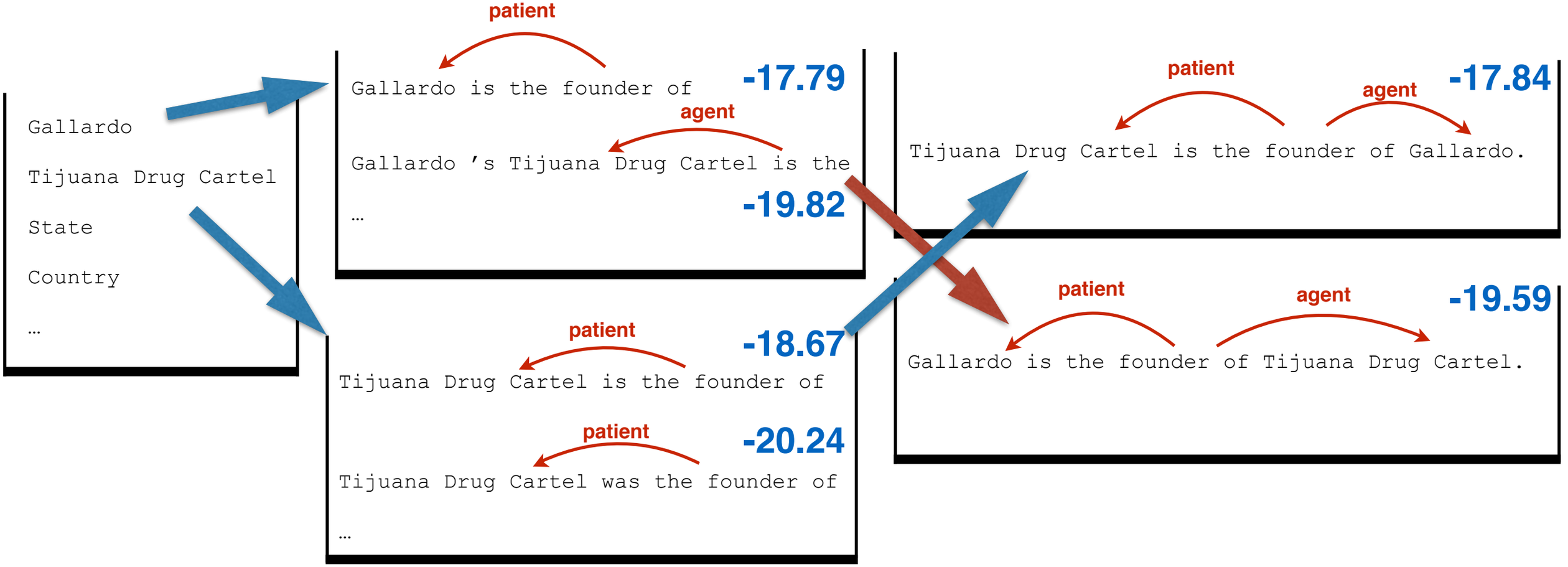

Next Steps

Next Steps

- “Machine-generated” representations
  - λ-calculus (ATIS)
  - Blocks World complex descriptions (from ISI)

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- “Machine-generated” representations
  - λ-calculus (ATIS)
  - Blocks World complex descriptions (from ISI)
- Downstream Text-to-Text Applications

Thank You