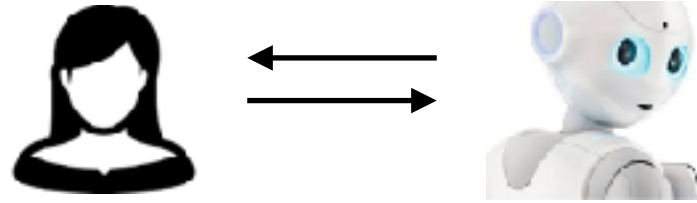


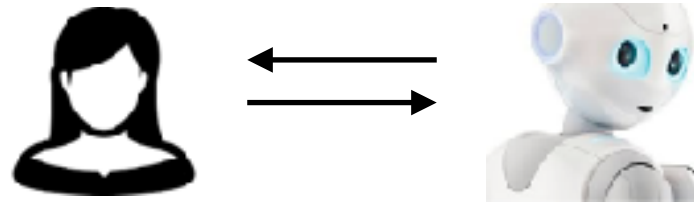
# Learning Agents that Interact with Humans

He He

# Interactive agents



# Interactive agents



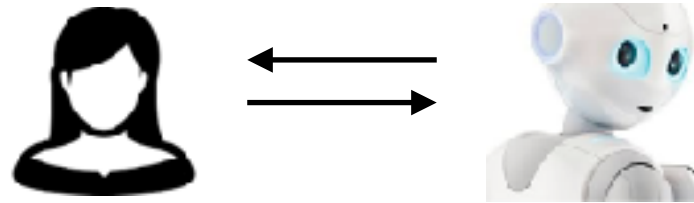
Web search



Select theme:

- time travel
- alternative history
- aliens
- ...

# Interactive agents



## Web search



Select theme:

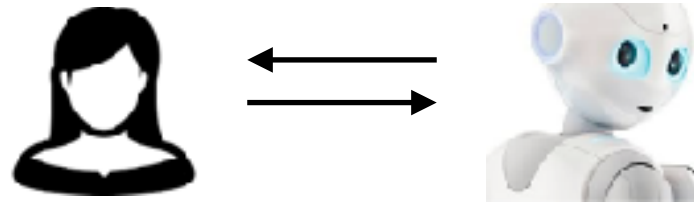
- time travel
- alternative history
- aliens
- ...

## Internet-of-Things



If on phone, turn down TV  
If sleep, turn down AC

# Interactive agents



## Web search



Select theme:

- time travel
- alternative history
- aliens
- ...

## Internet-of-Things



If on phone, turn down TV  
If sleep, turn down AC

## Robotics



What is he trying to build?  
How can I best assist?

# Desired features

# Desired features

- Natural language as the communication interface

# Desired features

- Natural language as the communication interface

**symmetric collaborative dialogue**

(Anusha Balakrishnan, Mihail Eric, Percy Liang)



# Desired features

- Natural language as the communication interface

**symmetric collaborative dialogue**

(Anusha Balakrishnan, Mihail Eric, Percy Liang)

- Adapt to user habits, preference, and intentions

# Desired features

- Natural language as the communication interface

**symmetric collaborative dialogue**

(Anusha Balakrishnan, Mihail Eric, Percy Liang)

- Adapt to user habits, preference, and intentions

**opponent modeling**

(Jordan Boyd-Graber, Kevin Kwok, Hal Daume III)

# Symmetric collaborative dialogue

# Symmetric collaborative dialogue



- Two agents, each with private knowledge

# Symmetric collaborative dialogue



- Two agents, each with private knowledge
- Communicate to achieve a common goal

# The MutualFriends task

# The MutualFriends task

**A**

Name	School	Major	Company
Jessica	Columbia	Computer Science	Google
Josh	Columbia	Linguistics	Google
...	...	...	...

# The MutualFriends task

**A**

Name	School	Major	Company
Jessica	Columbia	Computer Science	Google
Josh	Columbia	Linguistics	Google
...	...	...	...

**B**

Name	School	Major	Company
-	-	-	-
-	-	-	-
-	-	-	-

Hidden



# The MutualFriends task

<b>A</b>	Name	School	Major	Company
	Jessica	Columbia	Computer Science	Google
	Josh	Columbia	Linguistics	Google
	...	...	...	...

<b>B</b>	Name	School	Major	Company
	-	-	-	-
	-	-	-	-
	-	-	-	-

Hidden

*A: Hi! Most of my friends work for Google*

*B: do you have anyone who went to columbia?*

*A: Hello?*

*A: I have Jessica a friend of mine*

*A: and Josh, both went to columbia*

*B: or anyone working at apple?*

*A: SELECT (Jessica, Columbia, Computer Science, Google)*

*B: SELECT (Jessica, Columbia, Computer Science, Google)*

# The MutualFriends task

A	Name	School	Major	Company
	Jessica	Columbia	Computer Science	Google
	Josh	Columbia	Linguistics	Google
	...	...	...	...

B	Name	School	Major	Company
	-	-	-	-
	-	-	-	-
	-	-	-	-

Hidden

*A: Hi! Most of my friends work for Google*

*B: do you have anyone who went to columbia?*

*A: Hello?*

*A: I have Jessica a friend of mine*

*A: and Josh, both went to columbia*

*B: or anyone working at apple?*

*A: SELECT (Jessica, Columbia, Computer Science, Google)*

*B: SELECT (Jessica, Columbia, Computer Science, Google)*

Cross-talks

# Human-human dialogues

# Human-human dialogues

## Who's Our Mutual Friend?

You and another user online have exactly one mutual friend in common. Your goal is to find that mutual friend!

### Instructions

- Please use **natural sentences** as much as possible.
  - **Do:** three of my friends went to ut austin
  - **Don't do:** 3 ut austin
- Avoid simply listing out the names of your friends.
- Look at your **list of friends** at right.
- Use the **chat box below** to find out more about the other user's friends and discover your mutual friend.
- Once you've found out who it is, select them by clicking **Select** in the first column.
- **Please select carefully.** If you select a friend once, the website will not allow you to select another friend for 10 seconds after your first selection.

Time Remaining: 4:54

[10/28/16 09:30:54] <You entered the room.>  
[10/28/16 09:30:55] <Your friend has joined the room.>

Enter your message here



### Your friends

# ▲▼	Name ▲▼	School ▲▼	Major ▲▼	Company ▲▼
Select	Susan	Eastern New Mexico University	Chemical Engineering	IBM
Select	Louis	Fort Lewis College	Horticulture	Tyson Foods
Select	Janice	Fort Lewis College	Geological Sciences	Air Tractor
Select	Susan	Fort Lewis College	Engineering Mechanics	CBS Corporation
Select	Virginia	Eastern New Mexico University	Engineering Mechanics	TreeRing
Select	Ann	Eastern New Mexico University	Materials Engineering	Metro-Goldwyn-Mayer
Select	Arthur	Massachusetts Institute of Technology	Horticulture	Pacific Gas and Electric Company
Select	Kimberly	Eastern New Mexico University	Religious Music	IBM
Select	Abigail	Massachusetts Institute of Technology	Junior Education	Welch's
Select	Kimberly	Eastern New Mexico University	Materials Engineering	TreeRing

amazon mechanical turk™  
Artificial Artificial Intelligence

# Human-human dialogues

## Who's Our Mutual Friend?

You and another user online have exactly one mutual friend in common. Your goal is to find that mutual friend!

### Instructions

- Please use **natural sentences** as much as possible.
  - **Do:** three of my friends went to ut austin
  - **Don't do:** 3 ut austin
- Avoid simply listing out the names of your friends.
- Look at your **list of friends** at right.
- Use the **chat box below** to find out more about the other user's friends and discover your mutual friend.
- Once you've found out who it is, select them by clicking **Select** in the first column.
- **Please select carefully.** If you select a friend once, the website will not allow you to select another friend for 10 seconds after your first selection.

Time Remaining: 4:54

[10/28/16 09:30:54] <You entered the room.>  
[10/28/16 09:30:55] <Your friend has joined the room.>

Enter your message here



### Your friends

# ▲▼	Name ▲▼	School ▲▼	Major ▲▼	Company ▲▼
Select	Susan	Eastern New Mexico University	Chemical Engineering	IBM
Select	Louis	Fort Lewis College	Horticulture	Tyson Foods
Select	Janice	Fort Lewis College	Geological Sciences	Air Tractor
Select	Susan	Fort Lewis College	Engineering	CBS Corporation
Select	Virginia	Eastern New Mexico University		TreeRing
Select	Ann	Eastern New Mexico University		Metro-Goldwyn-Mayer
Select	Arthur	Massachusetts Institute of Technology		Pacific Gas and Electric Company
Select	Kimberly	Eastern New Mexico University	Religious Music	IBM
Select	Abigail	Massachusetts Institute of Technology	Junior Education	Welch's
Select	Kimberly	Eastern New Mexico University	Materials Engineering	TreeRing

Randomly generated

# Human-human dialogues

## Who's Our Mutual Friend?

You and another user online have exactly one mutual friend in common. Your goal is to find that mutual friend!

### Instructions

- Please use **natural sentences** as much as possible.
  - **Do:** three of my friends went to ut austin
  - **Don't do:** 3 ut austin
- Avoid simply listing out the names of your friends.
- Look at your **list of friends** at right.
- Use the **chat box below** to find out more about the other user's friends and discover your mutual friend.
- Once you've found out who it is, select them by clicking **Select** in the first column.
- **Please select carefully.** If you select a friend once, the website will not allow you to select another friend for 10 seconds after your first selection.

Time Remaining: 4:54

5:00

[10/28/16 09:30:54] <You entered the room.>  
[10/28/16 09:30:55] <Your friend has joined the room.>

Enter your message here



### Your friends

# ▲▼	Name ▲▼	School ▲▼	Major ▲▼	Company ▲▼
Select	Susan	Eastern New Mexico University	Chemical Engineering	IBM
Select	Louis	Fort Lewis College	Horticulture	Tyson Foods
Select	Janice	Fort Lewis College	Geological Sciences	Air Tractor
Select	Susan	Fort Lewis College	Engineering	CBS Corporation
Select	Virginia	Eastern New Mexico University		TreeRing
Select	Ann	Eastern New Mexico University		Metro-Goldwyn-Mayer
Select	Arthur	Massachusetts Institute of Technology		Pacific Gas and Electric Company
Select	Kimberly	Eastern New Mexico University	Religious Music	IBM
Select	Abigail	Massachusetts Institute of Technology	Junior Education	Welch's
Select	Kimberly	Eastern New Mexico University	Materials Engineering	TreeRing

Randomly generated

# Human-human dialogues

- **Easy to collect dialogue data**
  - **11K dialogues in less than 15 hours**

## Who's Our Mutual Friend?

You and another user online have exactly one mutual friend in common. Your goal is to find that mutual friend!

### Instructions

- Please use **natural sentences** as much as possible.
  - **Do:** three of my friends went to ut austin
  - **Don't do:** 3 ut austin
- Avoid simply listing out the names of your friends.
- Look at your **list of friends** at right.
- Use the **chat box below** to find out more about the other user's friends and discover your mutual friend.
- Once you've found out who it is, select them by clicking **Select** in the first column.
- **Please select carefully.** If you select a friend once, the website will not allow you to select another friend for 10 seconds after your first selection.

Time Remaining: 4:54

5:00

[10/28/16 09:30:54] <You entered the room.>  
[10/28/16 09:30:55] <Your friend has joined the room.>

Enter your message here



### Your friends

# ▲▼	Name ▲▼	School ▲▼	Major ▲▼	Company ▲▼
Select	Susan	Eastern New Mexico University	Chemical Engineering	IBM
Select	Louis	Fort Lewis College	Horticulture	Tyson Foods
Select	Janice	Fort Lewis College	Geological Sciences	Air Tractor
Select	Susan	Fort Lewis College	Engineering	CBS Corporation
Select	Virginia	Eastern New Mexico University		TreeRing
Select	Ann	Eastern New Mexico University		Metro-Goldwyn-Mayer
Select	Arthur	Massachusetts Institute of Technology		Pacific Gas and Electric Company
Select	Kimberly	Eastern New Mexico University	Religious Music	IBM
Select	Abigail	Massachusetts Institute of Technology	Junior Education	Welch's
Select	Kimberly	Eastern New Mexico University	Materials Engineering	TreeRing

Randomly generated

amazon mechanical turk™  
Artificial Artificial Intelligence

# What are the dialogues like?



# What are the dialogues like?

*A: Hey, we have a friend in common!*

*B: Oh cool!*

*A: Know anyone who worked at Space adventures?*

*B: Yes I do, and they went to Lehigh University?*

*A: I know someone who worked there and went to Lehigh, they're an evening person!*

*A: SELECT Lehigh University, Space Adventures, evening*

*B: Oh, that's not right*

*B: My friend is a morning person*

*A: Gotcha. I do have a few friends from Enterasys*

*A: One's a morning, one's an evening person*

*B: Same here. The morning person went to University of Maryland and the other went to Brigham Young University Hawaii*

*A: We must know the same morning person!*

*A: SELECT University of Maryland, Enterasys Networks, morning*

*B: SELECT University of Maryland, Enterasys Networks, morning*

# What are the dialogues like?

## Chit-chat

A: Hey, we have a friend in common!

B: Oh cool!

A: Know anyone who worked at Space adventures?

B: Yes I do, and they went to Lehigh University?

A: I know someone who worked there and went to Lehigh, they're an evening person!

A: SELECT Lehigh University, Space Adventures, evening

B: Oh, that's not right

B: My friend is a morning person

A: Gotcha. I do have a few friends from Enterasys

A: One's a morning, one's an evening person

B: Same here. The morning person went to University of Maryland and the other went to Brigham Young University Hawaii

A: We must know the same morning person!

A: SELECT University of Maryland, Enterasys Networks, morning

B: SELECT University of Maryland, Enterasys Networks, morning

# What are the dialogues like?

A: Hey, we have a friend in common!

B: Oh cool!

A: Know anyone who worked at Space adventures?

B: Yes I do, and they went to Lehigh University?

A: I know someone who worked there and went to Lehigh, they're an evening person!

A: SELECT Lehigh University, Space Adventures, evening

B: Oh, that's not right

B: My friend is a morning person

A: Gotcha. I do have a few friends from Enterasys

A: One's a morning, one's an evening person

B: Same here. The morning person went to University of Maryland and the other went to Brigham Young University Hawaii

A: We must know the same morning person!

A: SELECT University of Maryland, Enterasys Networks, morning

B: SELECT University of Maryland, Enterasys Networks, morning

Chit-chat  
Coreference

# What are the dialogues like?

A: Hey, we have a friend in common!

B: Oh cool!

A: Know anyone who worked at Space adventures?

B: Yes I do, and they went to Lehigh University?

A: I know someone who worked there and went to Lehigh, they're an evening person!

A: SELECT Lehigh University, Space Adventures, evening

B: Oh, that's not right

B: My friend is a morning person

A: Gotcha. I do have a few friends from Enterasys

A: One's a morning, one's an evening person

B: Same here. The morning person went to University of Maryland and the other went to Brigham Young University Hawaii

A: We must know the same morning person!

A: SELECT University of Maryland, Enterasys Networks, morning

B: SELECT University of Maryland, Enterasys Networks, morning

Chit-chat  
Coreference  
Soft logic

# What are the dialogues like?

A: Hey, we have a friend in common!

B: Oh cool!

A: Know anyone who worked at Space adventures?

B: Yes I do, and they went to Lehigh University?

A: I know someone who worked there and went to Lehigh, they're an evening person!

A: SELECT Lehigh University, Space Adventures, evening

B: Oh, that's not right

B: My friend is a morning person

A: Gotcha. I do have a few friends from Enterasys

A: One's a morning, one's an evening person

B: Same here. The morning person went to University of Maryland and the other went to Brigham Young University Hawaii

A: We must know the same morning person!

A: SELECT University of Maryland, Enterasys Networks, morning

B: SELECT University of Maryland, Enterasys Networks, morning

Chit-chat

Coreference

Soft logic

Cross-talk

# What are the dialogues like?

A: Hey, we have a friend in common!

B: Oh cool!

A: Know anyone who worked at Space adventures?

B: Yes I do, and they went to Lehigh University?

A: I know someone who worked there and went to Lehigh, they're an evening person!

A: SELECT Lehigh University, Space Adventures, evening

B: Oh, that's not right

B: My friend is a morning person

A: Gotcha. I do have a few friends from Enterasys

A: One's a morning, one's an evening person

B: Same here. The morning person went to University of Maryland and the other went to Brigham Young University Hawaii

A: We must know the same morning person!

A: SELECT University of Maryland, Enterasys Networks, morning

B: SELECT University of Maryland, Enterasys Networks, morning

Chit-chat

Coreference

Soft logic

Cross-talk

**Correction:**

Sorry – Embroidery  
friend is named Michelle.

**Coordination:**

go by hobby

# What are the dialogues like?

A: Hey, we have a friend in common!

B: Oh cool!

A: Know anyone who worked at Space adventures?

B: Yes I do, and they went to Lehigh University?

A: I know someone who worked there and went to Lehigh, they're an evening person!

A: SELECT Lehigh University, Space Adventures, evening

B: Oh, that's not right

B: My friend is a morn

A: Gotcha. I do have a few friends from Enterasys

A: One's a morning, one's an evening person

B: Same here. The morning person went to University of Maryland and the other went to Brigham Young University Hawaii

A: We must know the same morning person!

A: SELECT University of Maryland, Enterasys Networks, morning

B: SELECT University of Maryland, Enterasys Networks, morning

## Rich conversation phenomena

Chit-chat

Coreference

Soft logic

Cross-talk

**Correction:**

Sorry – Embroidery friend is named Michelle.

**Coordination:**

go by hobby

# Learning a dialogue agent



# Learning a dialogue agent

**Goal:**  $\text{agent}(\text{KB}, \text{dialogue history}) = \text{next utterance}$

# Learning a dialogue agent

**Goal:**  $\text{agent}(\text{KB}, \text{dialogue history}) = \text{next utterance}$

Seq2Seq?

# Learning a dialogue agent

**Goal:**  $\text{agent}(\text{KB}, \text{dialogue history}) = \text{next utterance}$

Seq2Seq?

Not grounded!

# Learning a dialogue agent

**Goal:** agent(KB, dialogue history) = next utterance

Seq2Seq? **Not grounded!**

Semantic parsing?

# Learning a dialogue agent

**Goal:** agent(KB, dialogue history) = next utterance

Seq2Seq?                      Not grounded!

Semantic parsing?          Not flexible!

# Learning a dialogue agent

**Goal:** agent(KB, dialogue history) = next utterance

Seq2Seq?                      **Not grounded!**

Semantic parsing?       **Not flexible!**

Soft: ***About equal indoor and outdoor friends***

# Learning a dialogue agent

**Goal:** agent(KB, dialogue history) = next utterance

Seq2Seq?                      **Not grounded!**

Semantic parsing?       **Not flexible!**

Soft: ***About equal indoor and outdoor friends***

Conditional: *yes if boston college*

# Learning a dialogue agent

**Goal:** agent(KB, dialogue history) = next utterance

Seq2Seq?                      **Not grounded!**

Semantic parsing?       **Not flexible!**

Soft: ***About equal indoor and outdoor friends***

Conditional: *yes **if** boston college*

Conjunctive: *I have someone who **studied the bible in the afternoon.***



# Learning a dialogue agent

**Goal:** agent(KB, dialogue history) = next utterance

Seq2Seq?                      Not grounded!      Open-ended

Semantic parsing?      Not flexible!

Soft: ***About equal** indoor and outdoor friends*

Conditional: *yes **if** boston college*

Conjunctive: *I have someone who **studied the bible in the afternoon.***

# Learning a dialogue agent

**Goal:** agent(KB, dialogue history) = next utterance

Seq2Seq?                      Not grounded!      Open-ended

Semantic parsing?      Not flexible!      Structured

Soft: ***About equal indoor and outdoor friends***

Conditional: yes ***if boston college***

Conjunctive: *I have someone who ***studied the bible in the afternoon.****

# Learning a dialogue agent

**Goal:** agent(KB, dialogue history) = next utterance

Seq2Seq?                      Not grounded!      Open-ended

Semantic parsing?      Not flexible!      Structured

Soft: ***About equal indoor and outdoor friends***

Conditional: yes ***if boston college***

Conjunctive: *I have someone who ***studied the bible in the afternoon.****

Represent the KB as knowledge graph embedding

# Learning a dialogue agent

**Goal:** agent(KB, dialogue history) = next utterance

Seq2Seq?                      Not grounded!      Open-ended

Semantic parsing?      Not flexible!      Structured

Soft: ***About equal indoor and outdoor friends***

Conditional: yes ***if boston college***

Conjunctive: *I have someone who ***studied the bible in the afternoon.****

Represent the KB as knowledge graph embedding      No context!

# Learning a dialogue agent

**Goal:** agent(KB, dialogue history) = next utterance

Seq2Seq?                      Not grounded!      Open-ended

Semantic parsing?      Not flexible!      Structured

Soft: ***About equal indoor and outdoor friends***

Conditional: yes ***if boston college***

Conjunctive: *I have someone who ***studied the bible in the afternoon.****

Represent the KB as knowledge graph embedding      No context!

*All my friends like ***swimming.****

*None of mine likes ***swimming.****

# Learning a dialogue agent

**Goal:** agent(KB, dialogue history) = next utterance

Seq2Seq?                      Not grounded!      Open-ended

Semantic parsing?      Not flexible!      Structured

Soft: ***About equal*** indoor and outdoor friends

Conditional: yes ***if*** boston college

Conjunctive: I have someone who ***studied the bible in the afternoon.***

**dynamic**

Represent the KB as knowledge graph embedding      No context!

All my friends like ***swimming.***

None of mine likes ***swimming.***

# Learning a dialogue agent

**Goal:** agent(KB, dialogue history) = next utterance

Seq2Seq?                      Not grounded!                      Open-ended

Semantic parsing?                      Not flexible!                      Structured

Soft: ***About equal*** indoor and outdoor friends

Conditional: yes ***if*** boston college

Conjunctive: I have someone who ***studied the bible in the afternoon.***

dynamic

Represent the KB as knowledge graph embedding                      No context!

All my friends like ***swimming.***

None of mine likes ***swimming.***

**Combine structured knowledge and unstructured language**

# Dynamic Knowledge Graph Network



# Dynamic Knowledge Graph Network

A	Name	School	Company
	1 Jessica	Columbia	Google
	2 Josh	Columbia	Google

# Dynamic Knowledge Graph Network

<b>A</b>	Name	School	Company
<b>1</b>	Jessica	Columbia	Google
<b>2</b>	Josh	Columbia	Google

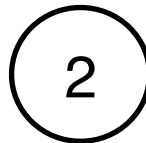
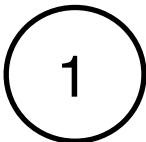
*B: anyone went to columbia?*

# Dynamic Knowledge Graph Network

**A**

	Name	School	Company
<b>1</b>	Jessica	Columbia	Google
<b>2</b>	Josh	Columbia	Google

*B: anyone went to columbia?*

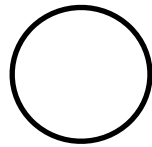
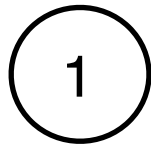
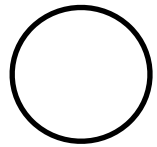


# Dynamic Knowledge Graph Network

<b>A</b>	Name	School	Company
<b>1</b>	Jessica	Columbia	Google
<b>2</b>	Josh	Columbia	Google

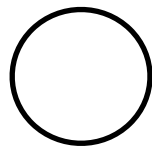
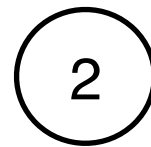
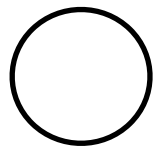
*B: anyone went to columbia?*

**jessica**



**columbia**

**google**



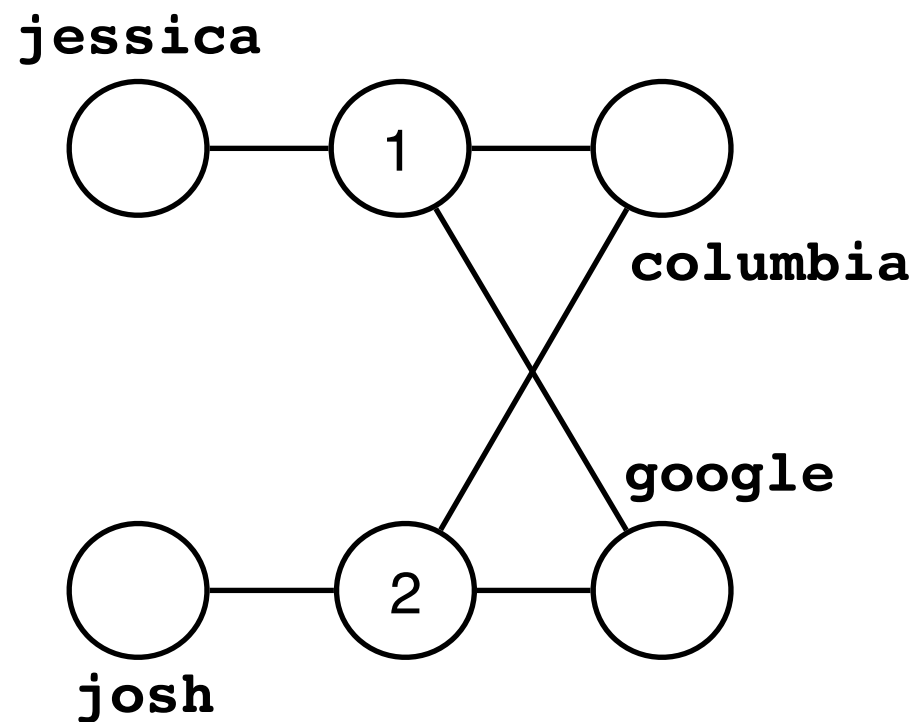
**josh**

# Dynamic Knowledge Graph Network

**A**

	Name	School	Company
1	Jessica	Columbia	Google
2	Josh	Columbia	Google

*B: anyone went to columbia?*

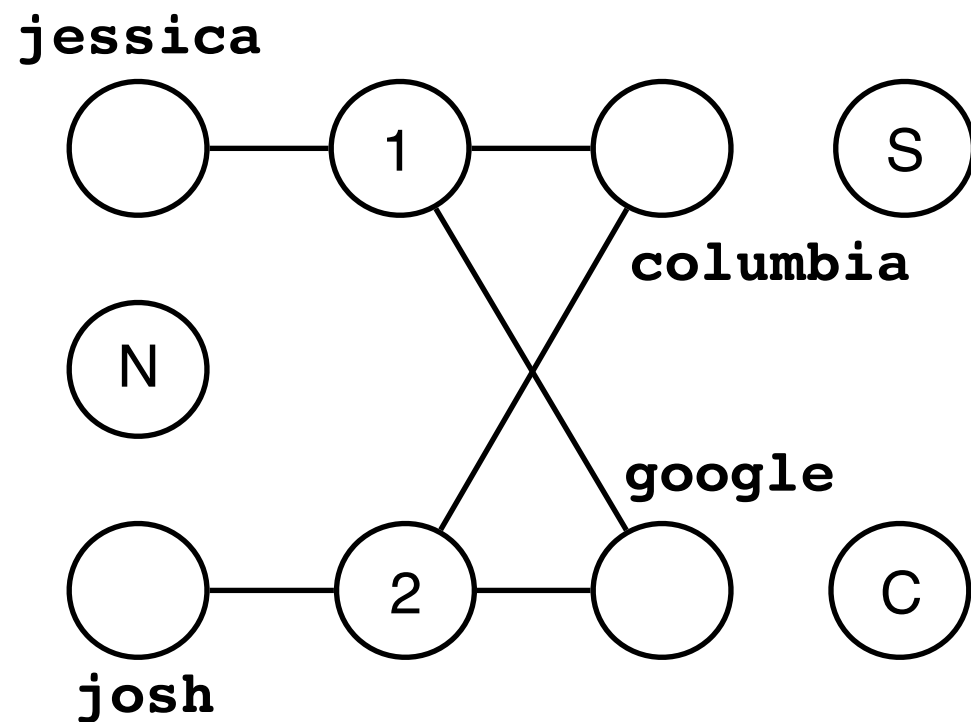


# Dynamic Knowledge Graph Network

**A**

	Name	School	Company
1	Jessica	Columbia	Google
2	Josh	Columbia	Google

*B: anyone went to columbia?*

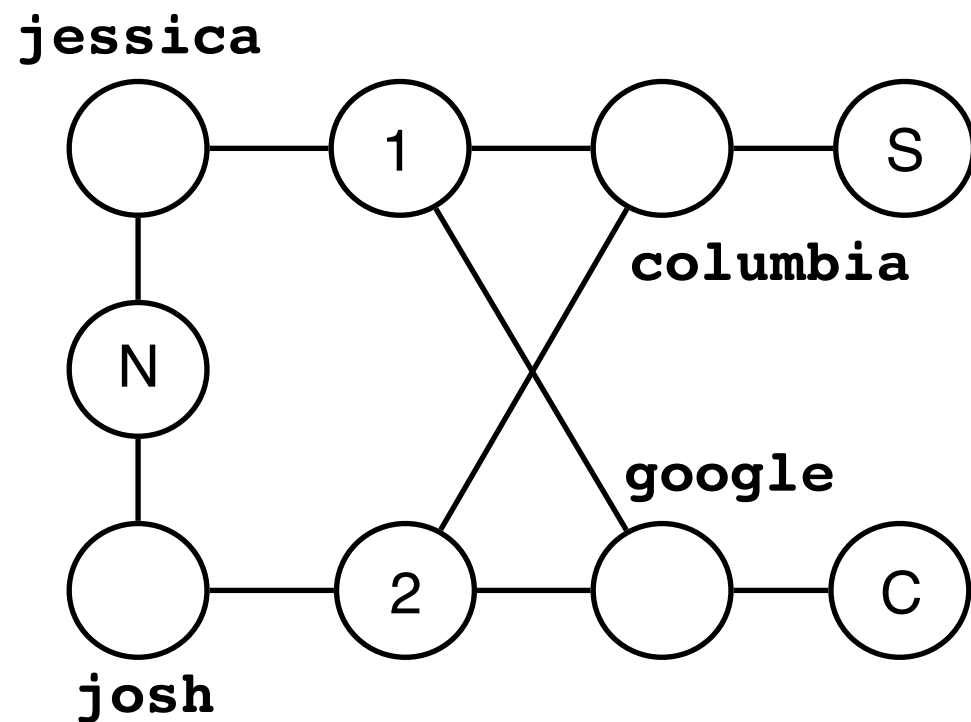


# Dynamic Knowledge Graph Network

**A**

	Name	School	Company
1	Jessica	Columbia	Google
2	Josh	Columbia	Google

*B: anyone went to columbia?*

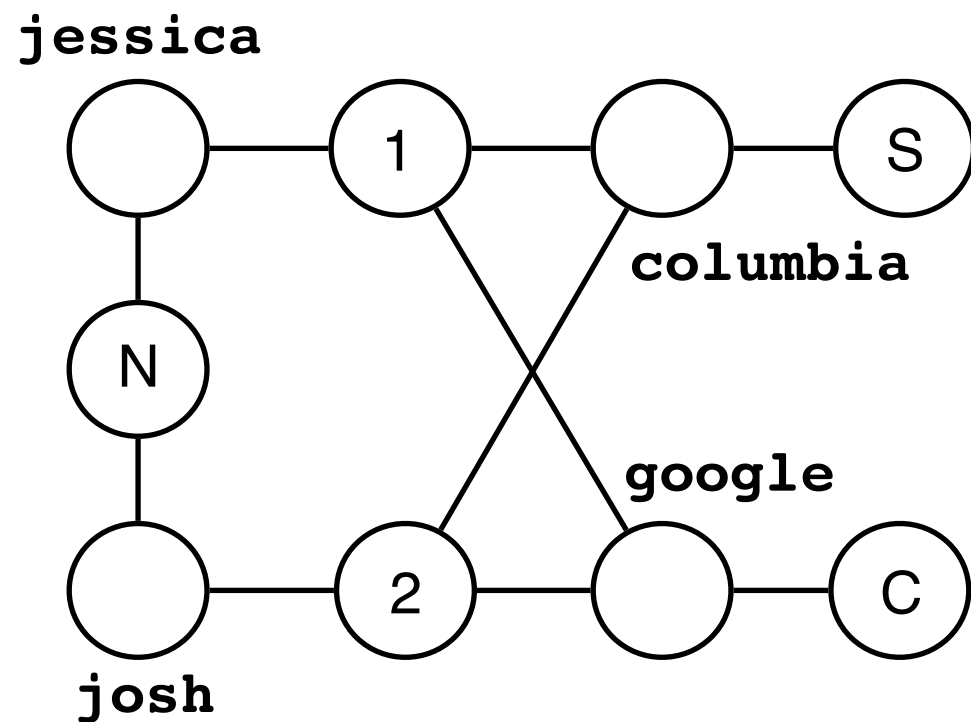


# Dynamic Knowledge Graph Network

A	Name	School	Company
1	Jessica	Columbia	Google
2	Josh	Columbia	Google

*B: anyone went to **columbia**?*

**Lexicon:** entity linking



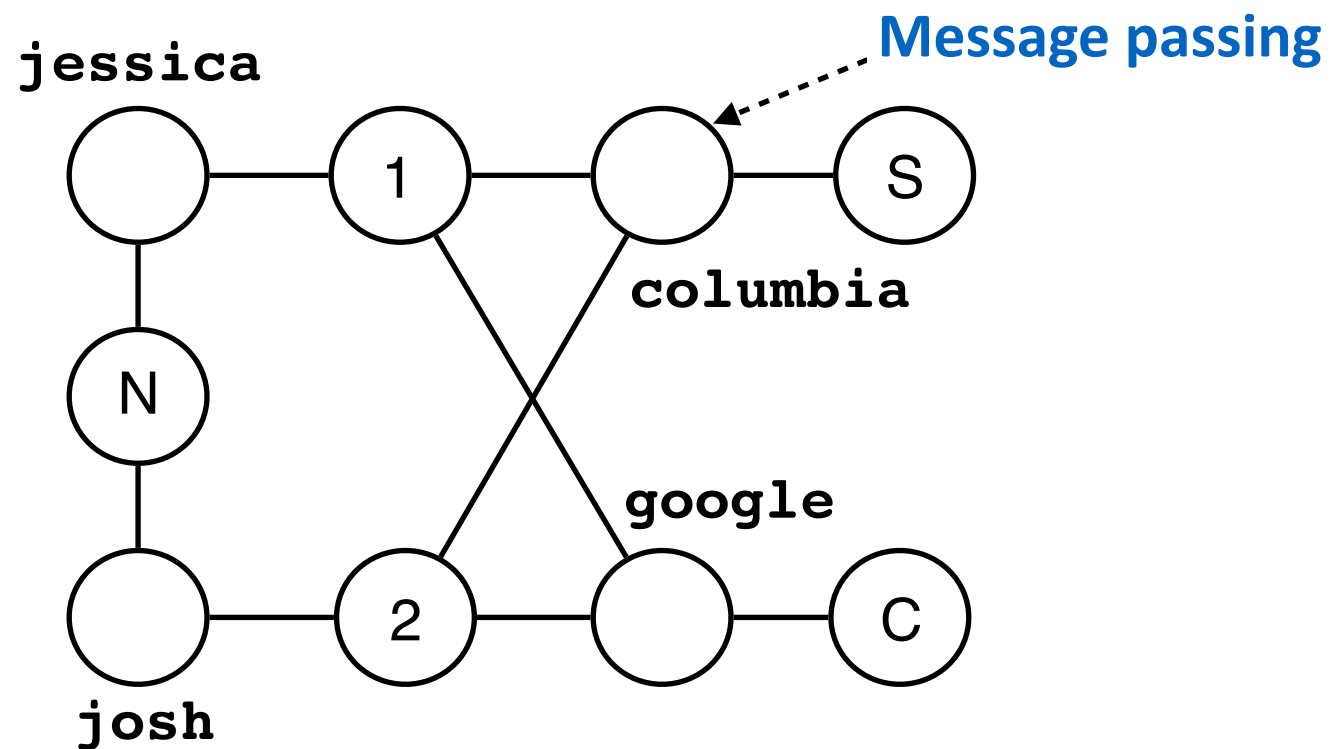
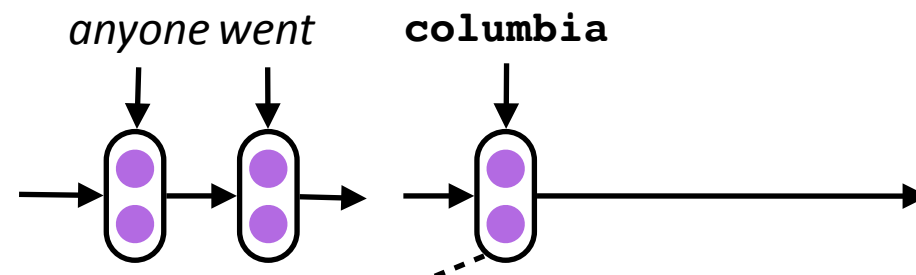


# Dynamic Knowledge Graph Network

A	Name	School	Company
1	Jessica	Columbia	Google
2	Josh	Columbia	Google

*B: anyone went to **columbia**?*

**Lexicon:** entity linking

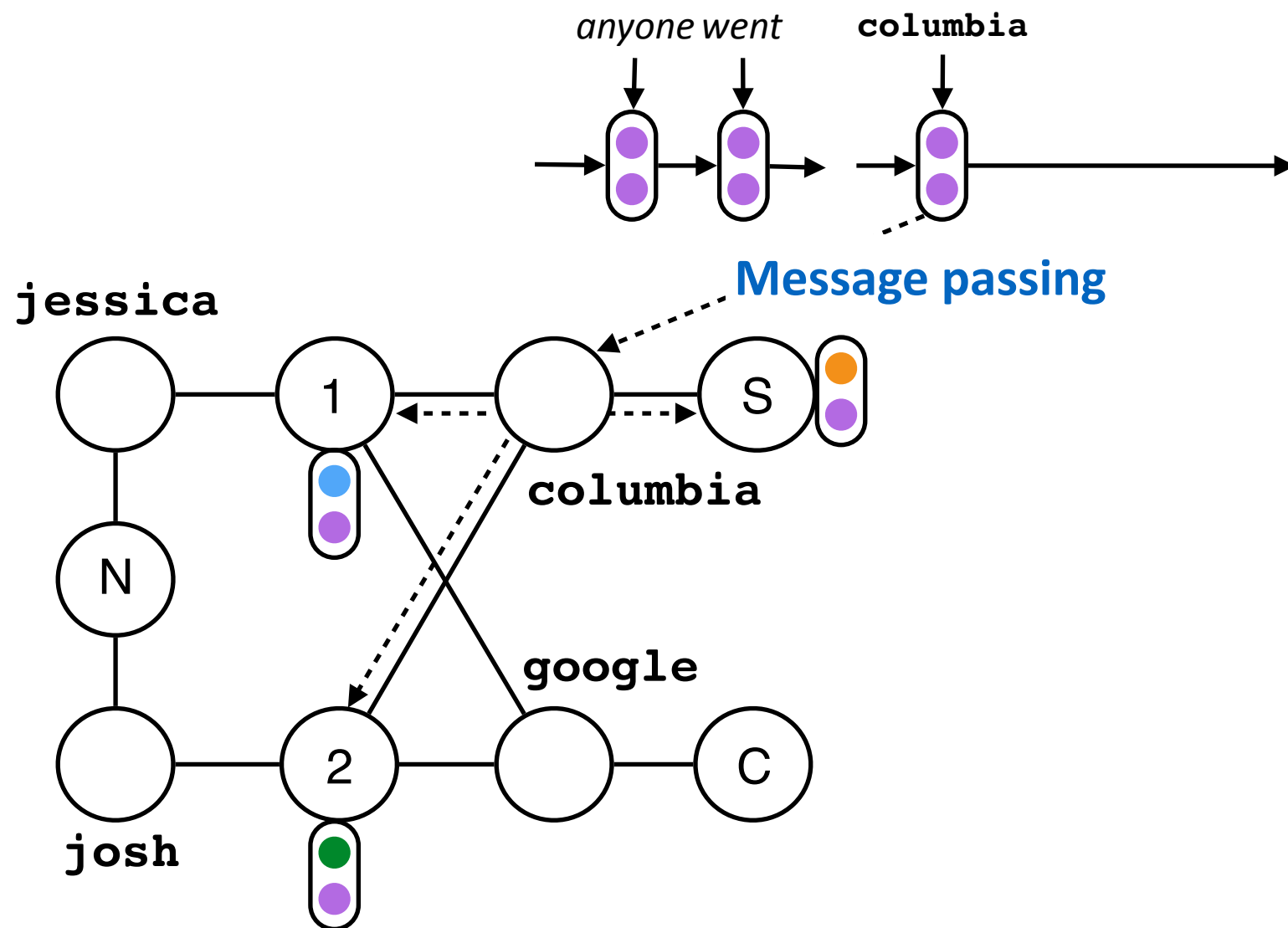


# Dynamic Knowledge Graph Network

A	Name	School	Company
1	Jessica	Columbia	Google
2	Josh	Columbia	Google

*B: anyone went to **columbia**?*

**Lexicon:** entity linking

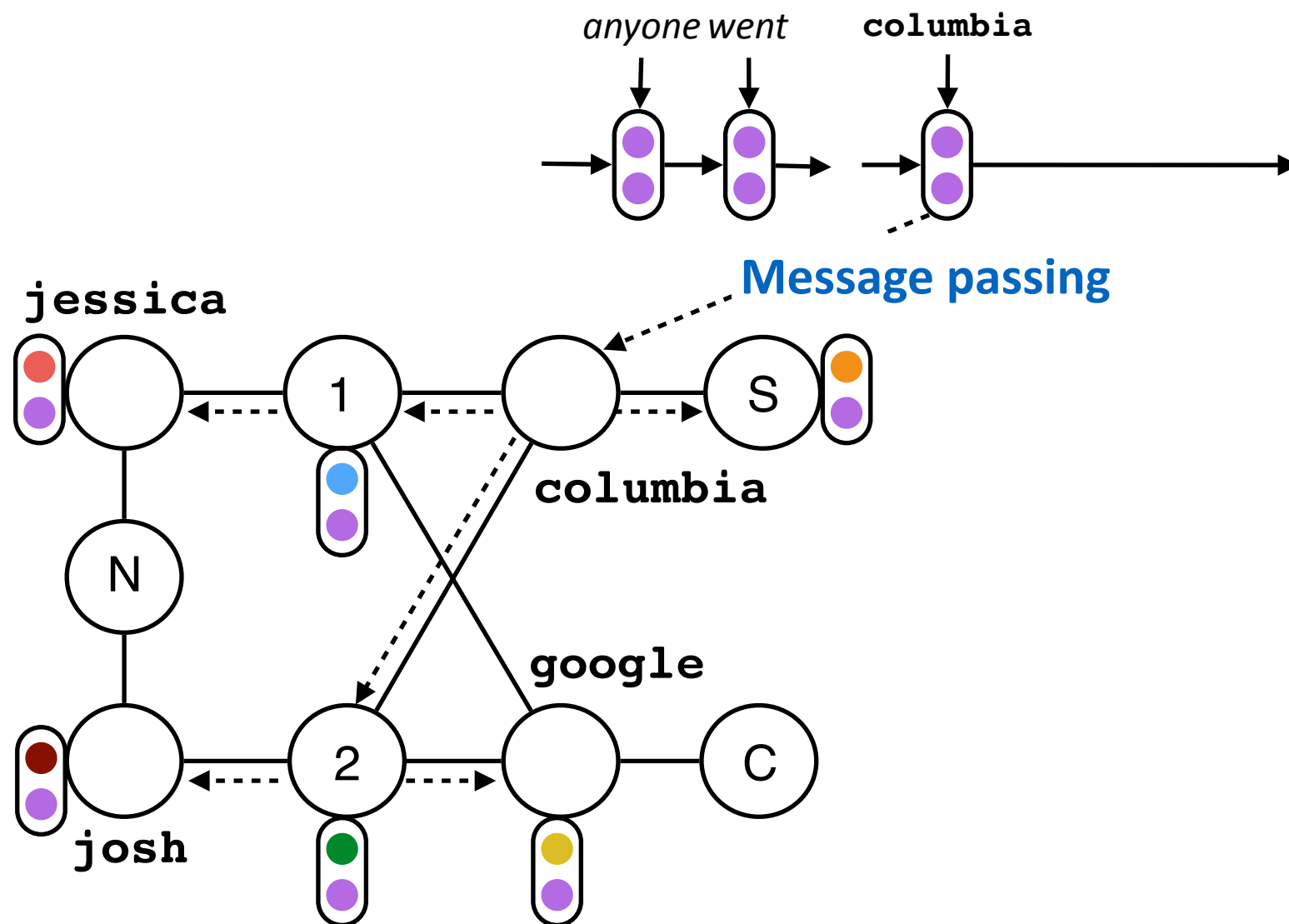


# Dynamic Knowledge Graph Network

A	Name	School	Company
1	Jessica	Columbia	Google
2	Josh	Columbia	Google

*B: anyone went to **columbia**?*

**Lexicon:** entity linking



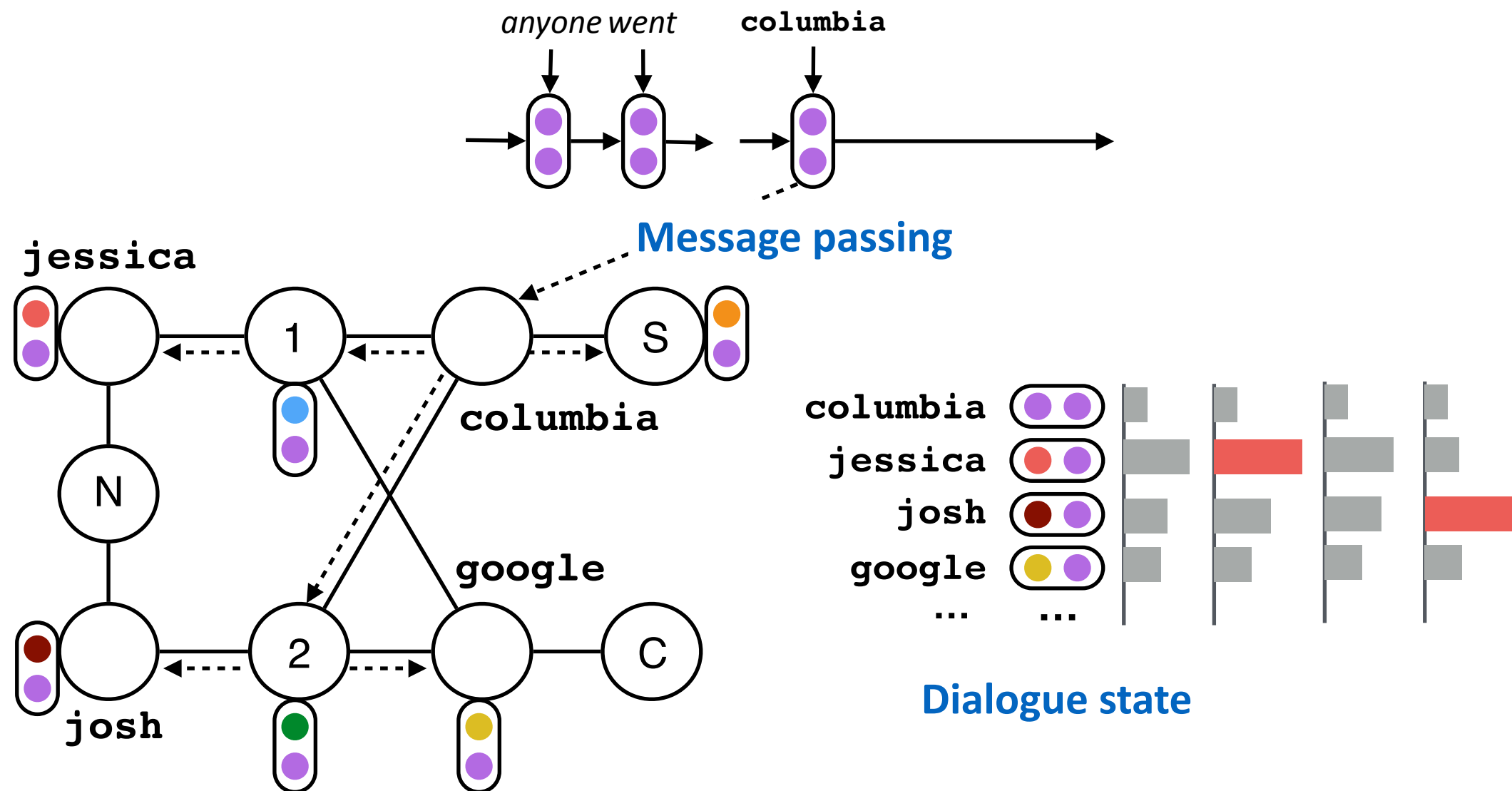
# Dynamic Knowledge Graph Network

**A**

	Name	School	Company
1	Jessica	Columbia	Google
2	Josh	Columbia	Google

*B: anyone went to **columbia**?*

**Lexicon:** entity linking

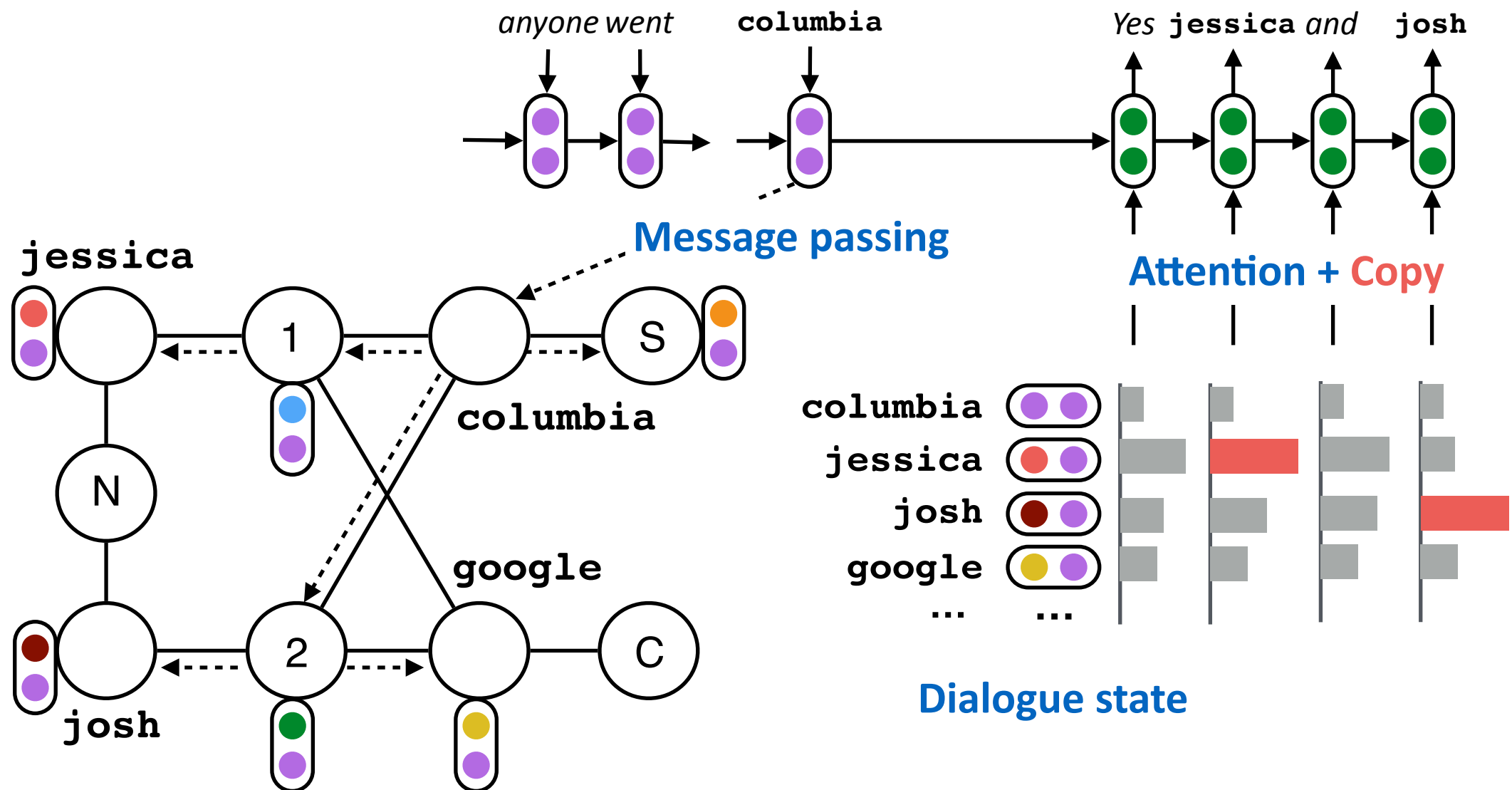


# Dynamic Knowledge Graph Network

**A**

	Name	School	Company
1	Jessica	Columbia	Google
2	Josh	Columbia	Google

*B: anyone went to columbia?*      **Lexicon:** entity linking



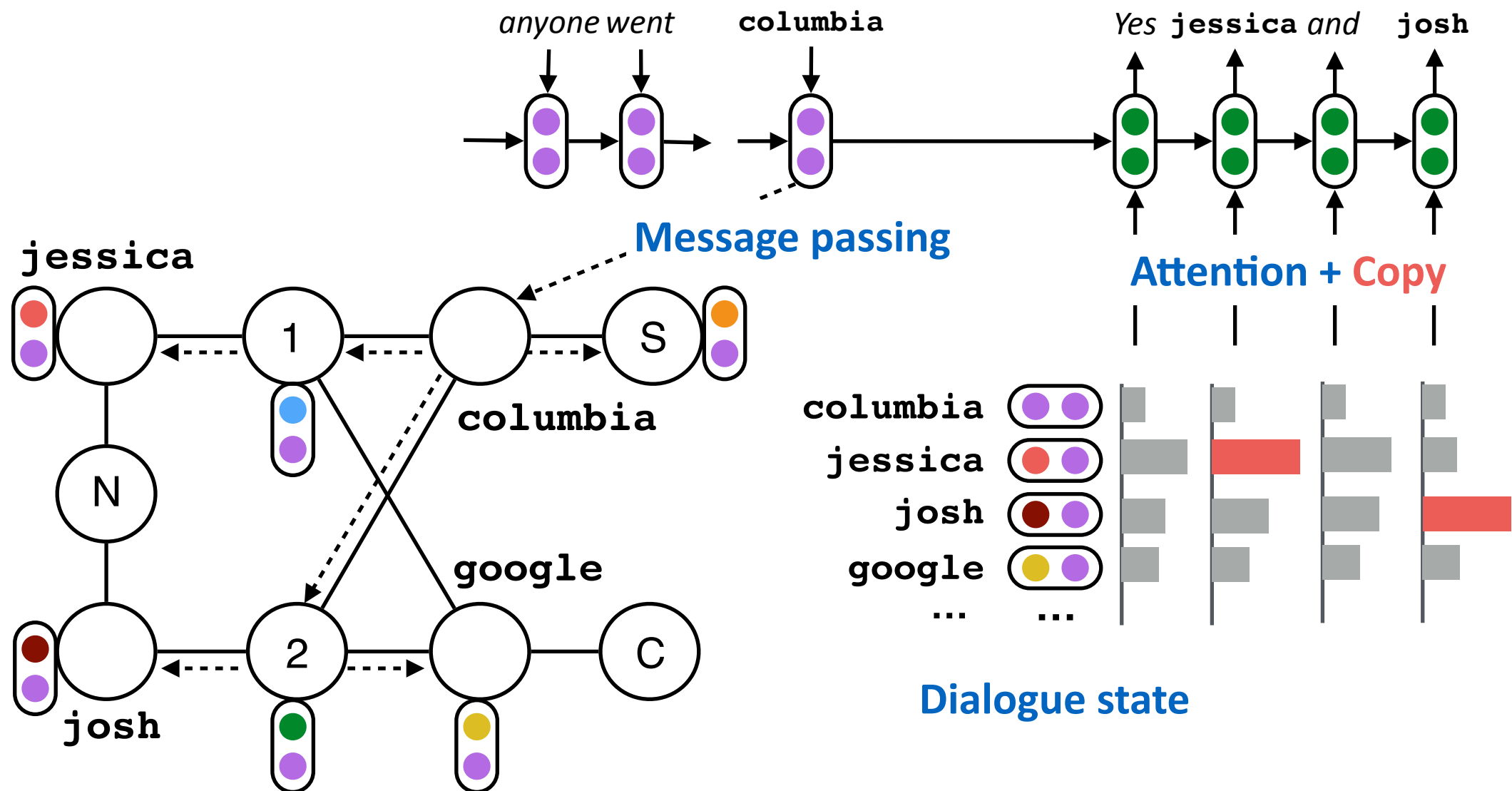
# Dynamic Knowledge Graph Network

A	Name	School	Company
1	Jessica	Columbia	Google
2	Josh	Columbia	Google

B: anyone went to **columbia**?

**Lexicon**: entity linking

A: Yes. **jessica and josh**.



# Dynamic Knowledge Graph Network

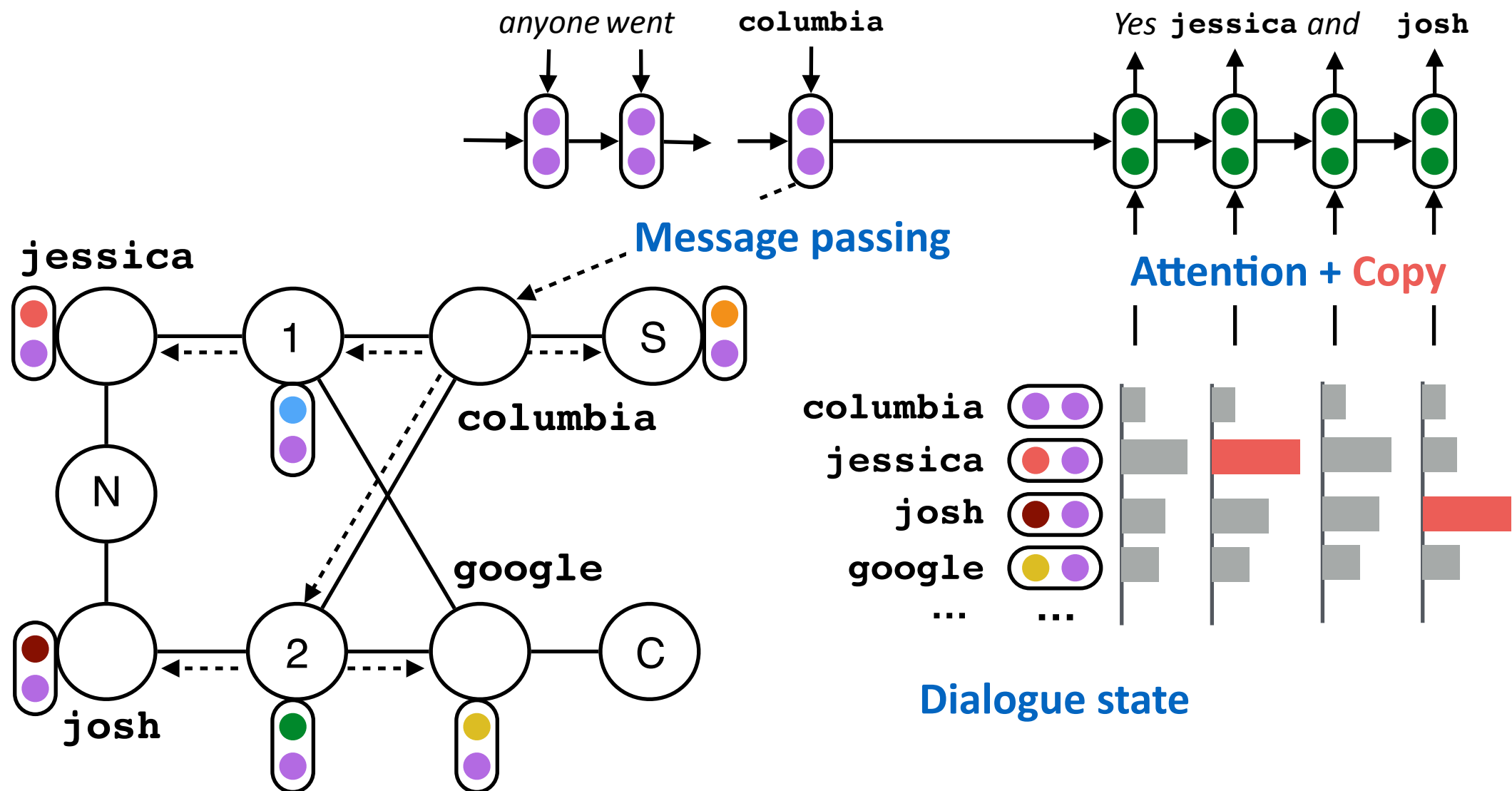
A	Name	School	Company
1	Jessica	Columbia	Google
2	Josh	Columbia	Google

B: anyone went to **columbia**?

A: Yes. Jessica and Josh.

**Lexicon**: entity linking

**Realizer**: entity realization







Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hiya

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

hey

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hiya

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

hey

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hiya

I have 1 indoors and kathleen.

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

hey

Most of mine are indoors.

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hiya

I have 1 indoors and kathleen.

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hey

Most of mine are indoors.

hiya

I have 1 indoors and kathleen.

SELECT (Justin, New Era Tickest, morning, indoor)

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hiya

hey

I have 1 indoors and kathleen.

Most of mine are indoors.

SELECT (Justin, New Era Tickest, morning, indoor)

I have one morning and rest afternoon.

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hiya

hey

I have 1 indoors and kathleen.

Most of mine are indoors.

SELECT (Justin, New Era Tickest, morning, indoor)

I have one morning and rest afternoon.

Do you have any friend working at I hawaiian?



Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hiya

hey

I have 1 indoors and kathleen.

Most of mine are indoors.

SELECT (Justin, New Era Tickest, morning, indoor)

I have one morning and rest afternoon.

Do you have any friend working at I hawaiian?

I don't know Justin

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hiya

hey

I have 1 indoors and kathleen.

Most of mine are indoors.

SELECT (Justin, New Era Tickest, morning, indoor)

I have one morning and rest afternoon.

Do you have any friend working at I hawaiian?

I don't know Justin

I have 1 alexander.

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hiya

hey

I have 1 indoors and kathleen.

Most of mine are indoors.

SELECT (Justin, New Era Tickest, morning, indoor)

I have one morning and rest afternoon.

Do you have any friend working at I hawaiian?

I don't know Justin

I have 1 alexander.

I don't him either.

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hiya

hey

I have 1 indoors and kathleen.

Most of mine are indoors.

SELECT (Justin, New Era Tickest, morning, indoor)

I have one morning and rest afternoon.

Do you have any friend working at I hawaiian?

I don't know Justin

I have 1 alexander.

I don't him either.

Do you have any gloria or advance auto parts?

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hiya

hey

I have 1 indoors and kathleen.

Most of mine are indoors.

SELECT (Justin, New Era Tickest, morning, indoor)

I have one morning and rest afternoon.

Do you have any friend working at I hawaiian?

I don't know Justin

I have 1 alexander.

I don't him either.

Do you have any gloria or advance auto parts?

We work at Dollar General

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hiya

hey

I have 1 indoors and kathleen.

Most of mine are indoors.

SELECT (Justin, New Era Tickest, morning, indoor)

I have one morning and rest afternoon.

Do you have any friend working at I hawaiian?

I don't know Justin

I have 1 alexander.

I don't him either.

Do you have any gloria or advance auto parts?

We work at Dollar General

I have 1 friend named anna.

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hiya

hey

I have 1 indoors and kathleen.

Most of mine are indoors.

SELECT (Justin, New Era Tickest, morning, indoor)

I have one morning and rest afternoon.

Do you have any friend working at I hawaiian?

I don't know Justin

I have 1 alexander.

I don't him either.

Do you have any gloria or advance auto parts?

We work at Dollar General

I have 1 friend named anna.

...

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor



hey

Most of mine are indoors.

I have one morning and rest afternoon.

I don't know Justin

I don't him either.

We work at Dollar General

...

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hiya



I have 1 indoors and kathleen.

SELECT (Justin, New Era Tickest, morning, indoor)

Do you have any friend working at I hawaiian?

I have 1 alexander.

Do you have any gloria or advance auto parts?

I have 1 friend named anna.



Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor



hey

Most of mine are indoors.

I have one morning and rest afternoon.

I don't know Justin

I don't him either.

We work at Dollar General

...

hiya



I have 1 indoors and kathleen.

SELECT (Justin, New Era Tickest, morning, indoor)

Do you have any friend working at I hawaiian?

I have 1 alexander.

Do you have any gloria or advance auto parts?

I have 1 friend named anna.

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor



hey

Most of mine are indoors.

I have one morning and rest afternoon.

I don't know Justin

I don't him either.

We work at Dollar General

...

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hiya



I have 1 indoors and kathleen.

SELECT (Justin, New Era Tickest, morning, indoor)

Do you have any friend working at I hawaiian?

I have 1 alexander.

Do you have any gloria or advance auto parts?

I have 1 friend named anna.

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor



hey

Most of mine are indoors.

I have one morning and rest afternoon.

I don't know Justin

I don't him either.

We work at Dollar General

...

**Rule-based:**  
templated, not cooperative

hiya



indoors and kathleen.

SELECT (Justin, New Era Tickest, morning, indoor)

Do you have any friend working at I hawaiian?

I have 1 alexander.

Do you have any gloria or advance auto parts?

I have 1 friend named anna.

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Hello

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Hello

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hi

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Hello

Hello

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hi

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Hello

Hello

I have one morning person.

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hi



Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Hello

Hello

I have one morning person.

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hi

all of my friends like mornings

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Hello

Hello

I have one morning person.

My friend prefers afternoon works at trt holdings.

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hi

all of my friends like mornings

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Hello

Hello

I have one morning person.

My friend prefers afternoon works at trt holdings.

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hi

all of my friends like mornings

What is their name?

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Hello

Hello

I have one morning person.

My friend prefers afternoon works at trt holdings.

Likes indoors.

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hi

all of my friends like mornings

What is their name?

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Hello

Hello

I have one morning person.

My friend prefers afternoon works at trt holdings.

Likes indoors.

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hi

all of my friends like mornings

What is their name?

what is your fiend who likes morning name?

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Hello

Hello

I have one morning person.

My friend prefers afternoon works at trt holdings.

Likes indoors.

They work for trt holdings.

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hi

all of my friends like mornings

What is their name?

what is your fiend who likes morning name?

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Hello

Hello

I have one morning person.

My friend prefers afternoon works at trt holdings.

Likes indoors.

They work for trt holdings.

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hi

all of my friends like mornings

What is their name?

what is your fiend who likes morning name?

SELECT (Kathleen, TRT Holdings, morning, indoor)

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Hello

Hello

I have one morning person.

My friend prefers afternoon works at trt holdings.

Likes indoors.

They work for trt holdings.

SELECT (Kathleen, TRT Holdings, morning, indoor)

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hi

all of my friends like mornings

What is their name?

what is your fiend who likes morning name?

SELECT (Kathleen, TRT Holdings, morning, indoor)



Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor



Hello

Hello

I have one morning person.

My friend prefers afternoon works at trt holdings.

Likes indoors.

They work for trt holdings.

SELECT (Kathleen, TRT Holdings, morning, indoor)

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hi



all of my friends like mornings

What is their name?

what is your fiend who likes morning name?

SELECT (Kathleen, TRT Holdings, morning, indoor)

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor



Hello

Hello

I have one morning person.

My friend prefers afternoon works at trt holdings.

Likes indoors.

They work for trt holdings.

SELECT (Kathleen, TRT Holdings, morning, indoor)

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hi



all of my friends like mornings

What is their name?

what is your fiend who likes morning name?

SELECT (Kathleen, TRT Holdings, morning, indoor)

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor



Hello

Hello

I have one morning person.

My friend prefers afternoon works at trt holdings.

Likes indoors.

They work for trt holdings.

SELECT (Kathleen, TRT Holdings, morning, indoor)

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

hi



all of my friends like mornings

What is their name?

what is your fiend who likes morning name?

SELECT (Kathleen, TRT Holdings, morning, indoor)

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor



Hello

Hello

I have one morning person.

My friend prefers afternoon works at trt holdings.

Likes indoors.

They work for trt holdings.

SELECT (Kathleen, TRT Holdings, morning, indoor)

**StanoNet** (DynoNet - graph update):  
good start, failed to follow

hi



all of my friends like mornings

What is their name?

what is your fiend who likes morning name?

SELECT (Kathleen, TRT Holdings, morning, indoor)

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

hi

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

hi

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

Hello

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

hi

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

Hello

all of my friends prefer morning



Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

hi

1 of my morning likes the outdoors

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

Hello

all of my friends prefer morning

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

hi

1 of my morning likes the outdoors

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

Hello

all of my friends prefer morning

And all like indoor except one

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

hi

1 of my morning likes the outdoors

do they work for trt holdings?

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

Hello

all of my friends prefer morning

And all like indoor except one

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

hi

1 of my morning likes the outdoors

do they work for trt holdings?

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

Hello

all of my friends prefer morning

And all like indoor except one

Kathleen?

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

hi

1 of my morning likes the outdoors

do they work for trt holdings?

SELECT (Kathleen, TRT Holdings, morning, indoor)

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

Hello

all of my friends prefer morning

And all like indoor except one

Kathleen?

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

hi

1 of my morning likes the outdoors

do they work for trt holdings?

SELECT (Kathleen, TRT Holdings, morning, indoor)

SELECT (Kathleen, TRT Holdings, morning, indoor)

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

Hello

all of my friends prefer morning

And all like indoor except one

Kathleen?

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor



hi

1 of my morning likes the outdoors

do they work for trt holdings?

SELECT (Kathleen, TRT Holdings, morning, indoor)

SELECT (Kathleen, TRT Holdings, morning, indoor)

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

Hello



all of my friends prefer morning

And all like indoor except one

Kathleen?

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor



hi

1 of my morning likes the outdoors

do they work for trt holdings?

SELECT (Kathleen, TRT Holdings, morning, indoor)

SELECT (Kathleen, TRT Holdings, morning, indoor)

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

Hello



all of my friends prefer morning

And all like indoor except one

Kathleen?



Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor



hi

1 of my morning likes the outdoors

do they work for trt holdings?

SELECT (Kathleen, TRT Holdings, morning, indoor)

SELECT (Kathleen, TRT Holdings, morning, indoor)

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

Hello



all of my friends prefer morning

And all like indoor except one

Kathleen?

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor



hi

1 of my morning likes the outdoors

do they work for trt holdings?

SELECT (Kathleen, TRT Holdings, morning, indoor)

SELECT (Kathleen, TRT Holdings, morning, indoor)

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

Hello



all of my friends prefer morning

And all like indoor except one

Kathleen?

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor



hi

1 of my morning likes the outdoors

do they work for trt holdings?

SELECT (Kathleen, TRT Holdings, morning, indoor)

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor

Hello



all of my friends prefer morning

And all like indoor except one

Kathleen?

SELECT (Kathleen, TRT Holdings, morning, indoor)

Name	Company	Time	Locatio
Kathy	TRT Holdings	afternoon	indoor
Jason	Dollar General	afternoon	indoor
Johnny	TRT Holdings	afternoon	outdoor
Frank	SFN Group	afternoon	indoor
Catherine	Dollar General	afternoon	indoor
Catherine	Weis Markets	afternoon	indoor
Kathleen	TRT Holdings	morning	indoor
Lori	TRT Holdings	afternoon	indoor
Frank	L&L Hawaiian Barbecue	afternoon	outdoor

Name	Company	Time	Locatio
Justin	New Era Tickets	morning	indoor
Kathleen	TRT Holdings	morning	indoor
Gloria	L&L Hawaiian Barbecue	morning	indoor
Kathleen	Advance Auto Paris	morning	outdoor
Justin	Dollar General	morning	indoor
Anna	Arctic Cat	morning	indoor
Steven	Dollar General	morning	indoor
Wayne	R.J. Corman Railroad	morning	indoor
Alexander	R.J. Corman Railroad	morning	indoor



hi

**DynoNet:**

cooperative, can be incorrect

Hello



ends prefer morning

1 of my morning likes the outdoors

And all like indoor except one

do they work for trt holdings?

Kathleen?

SELECT (Kathleen, TRT Holdings, morning, indoor)

SELECT (Kathleen, TRT Holdings, morning, indoor)

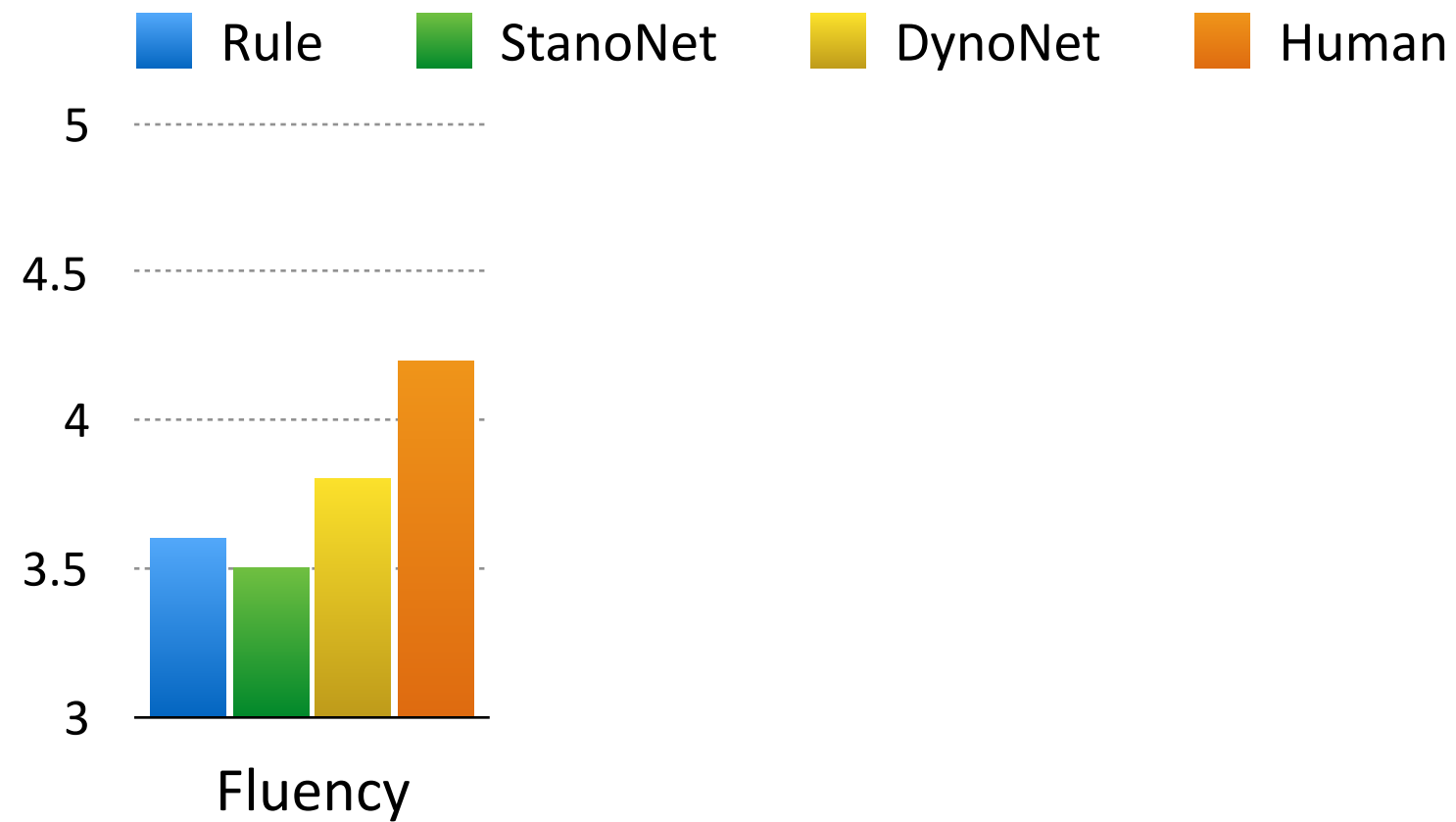
# Partner evaluation

# Partner evaluation

- 1 (very bad) to 5 (very good), optional comments

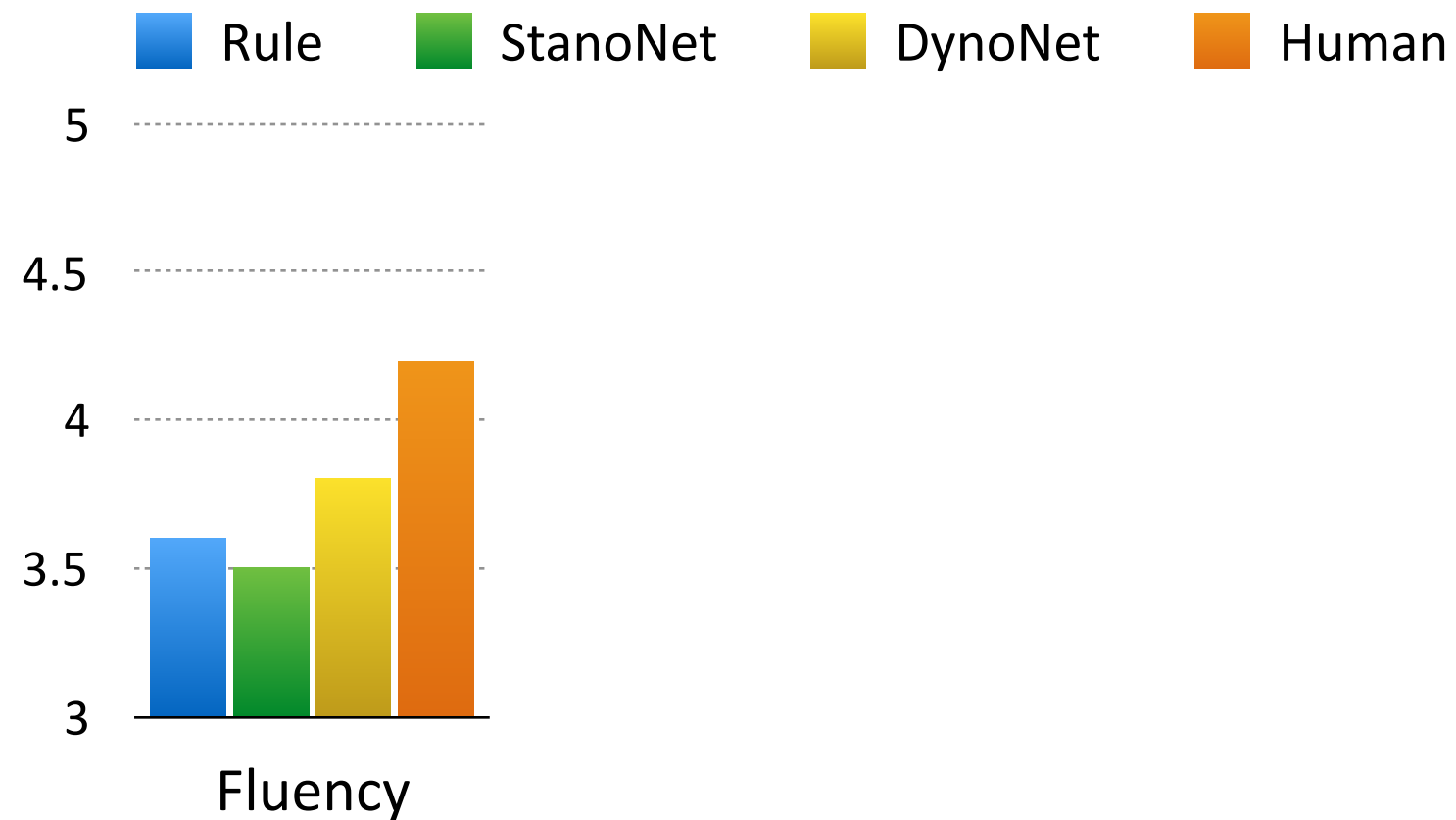
# Partner evaluation

- 1 (very bad) to 5 (very good), optional comments



# Partner evaluation

- 1 (very bad) to 5 (very good), optional comments

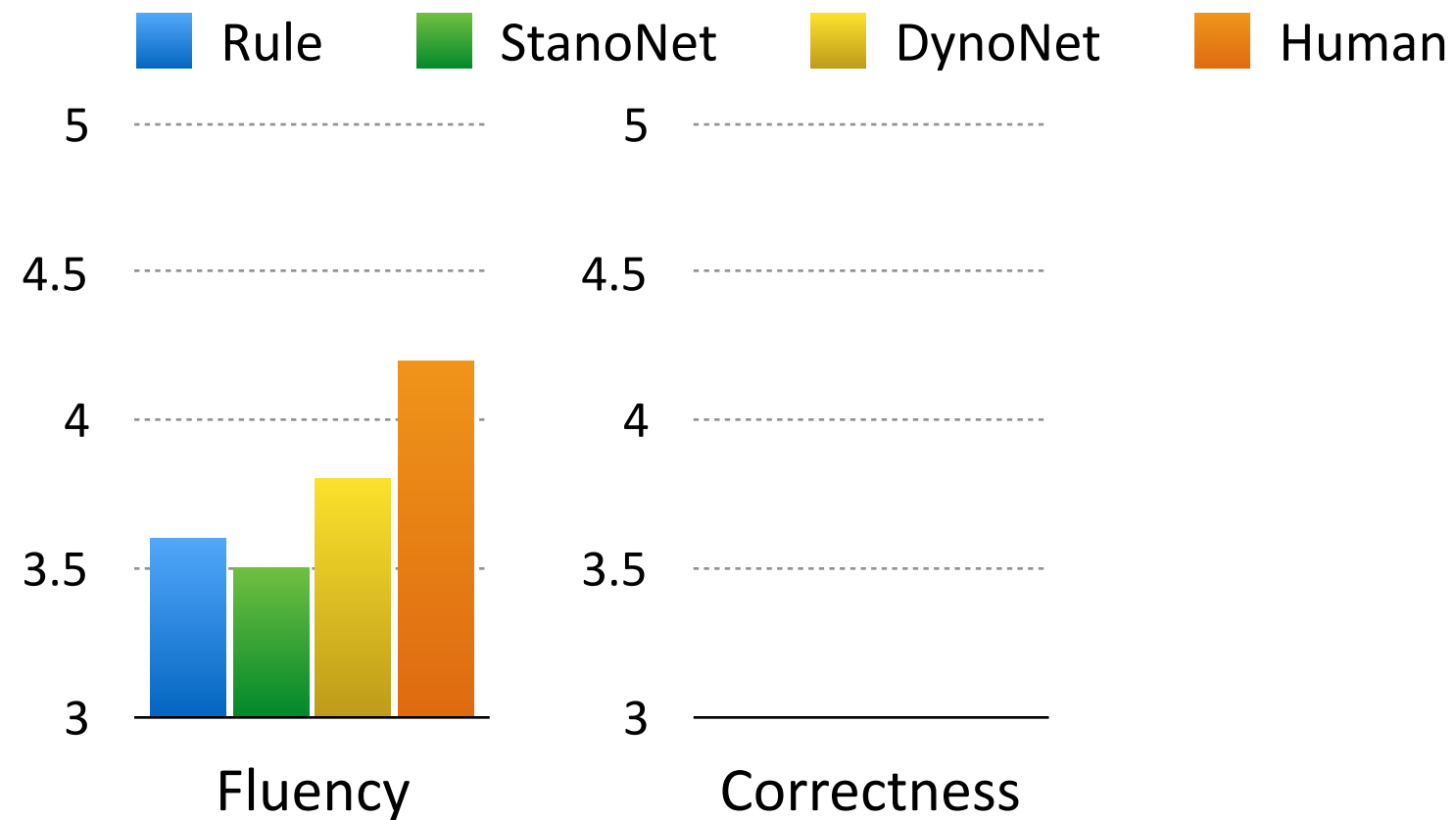


- Similar fluency



# Partner evaluation

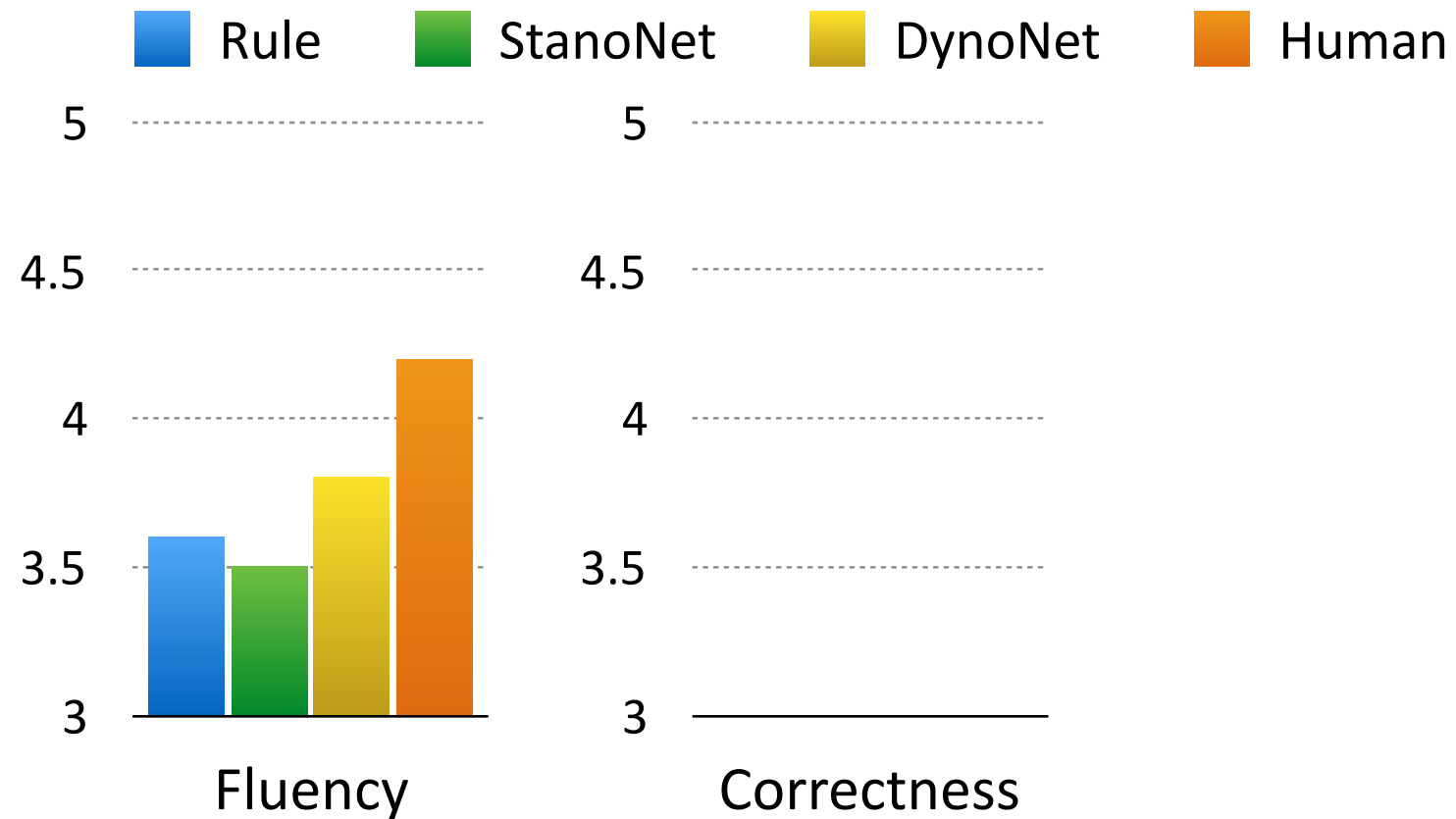
- 1 (very bad) to 5 (very good), optional comments



- Similar fluency

# Partner evaluation

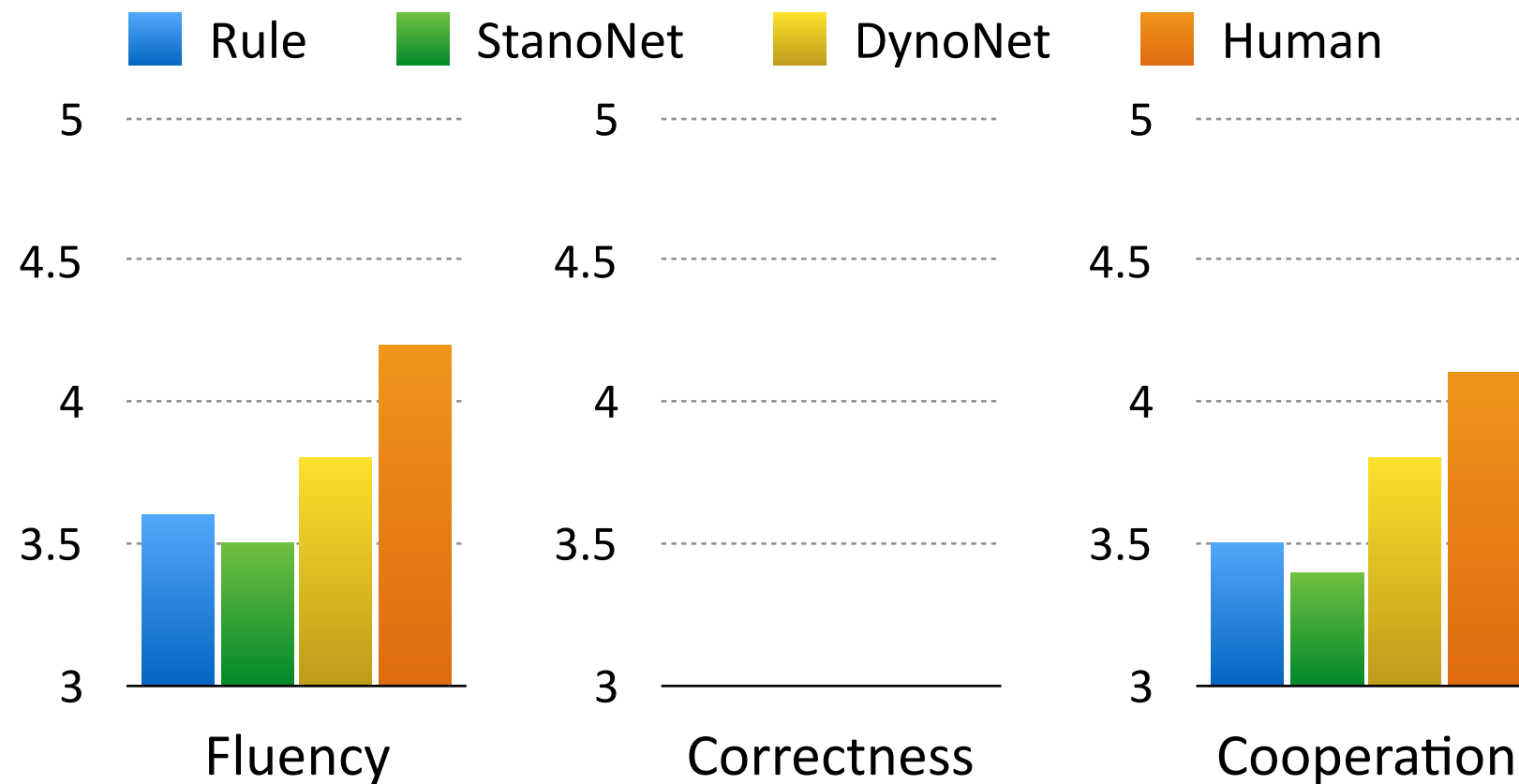
- 1 (very bad) to 5 (very good), optional comments



- Similar fluency
- Correctness ratings are not reliable

# Partner evaluation

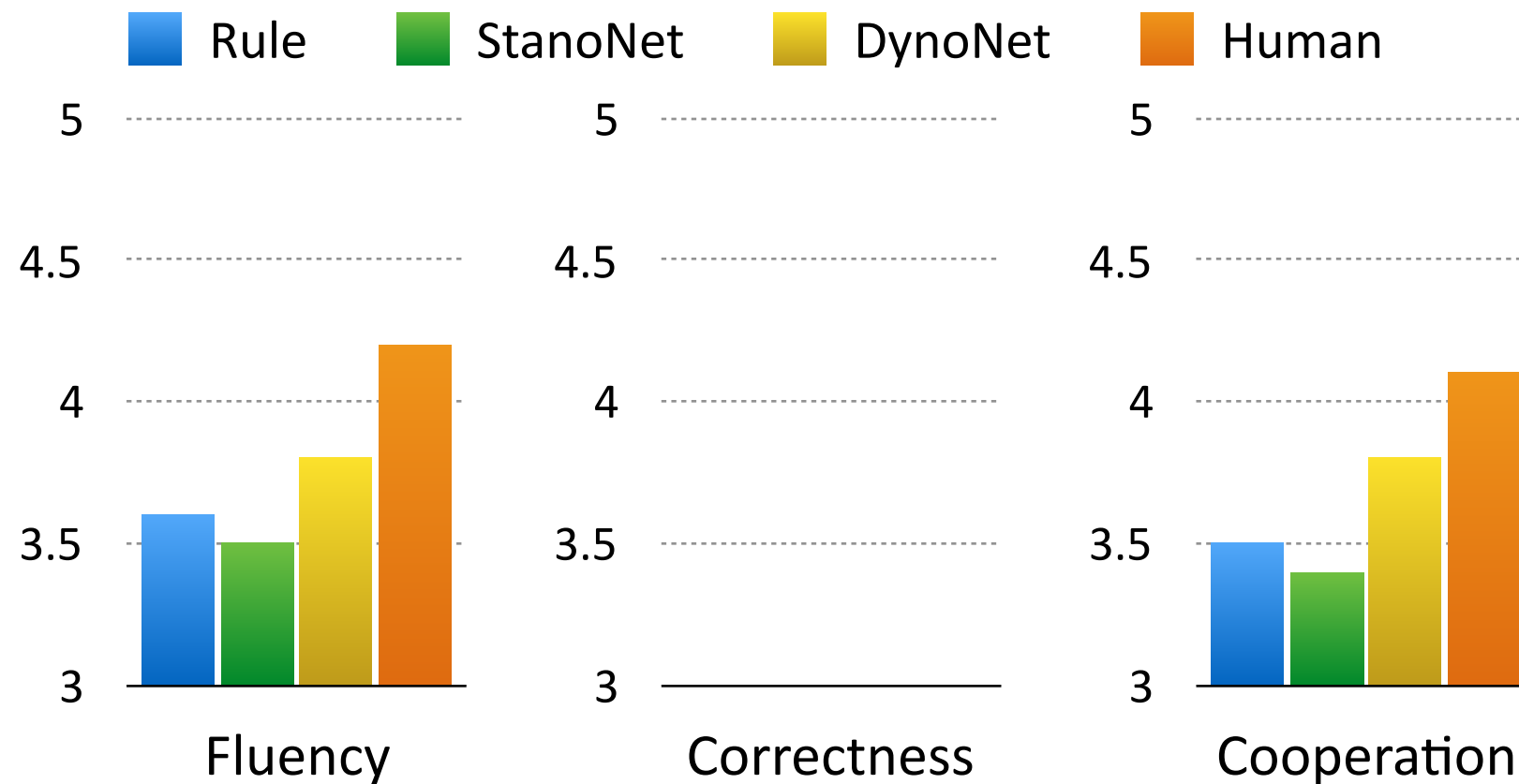
- 1 (very bad) to 5 (very good), optional comments



- Similar fluency
- Correctness ratings are not reliable

# Partner evaluation

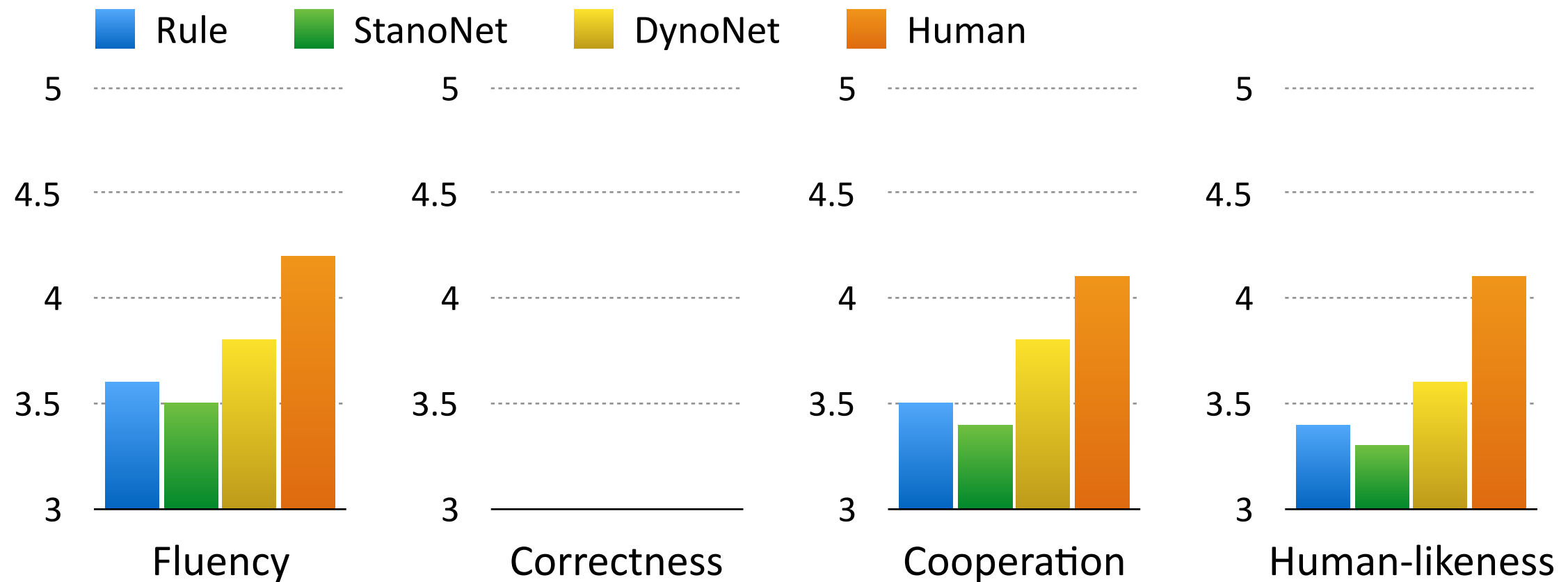
- 1 (very bad) to 5 (very good), optional comments



- Similar fluency
- Correctness ratings are not reliable
- Rule is not very cooperative:
  - *Wasn't catching cues, ignoring my input.*

# Partner evaluation

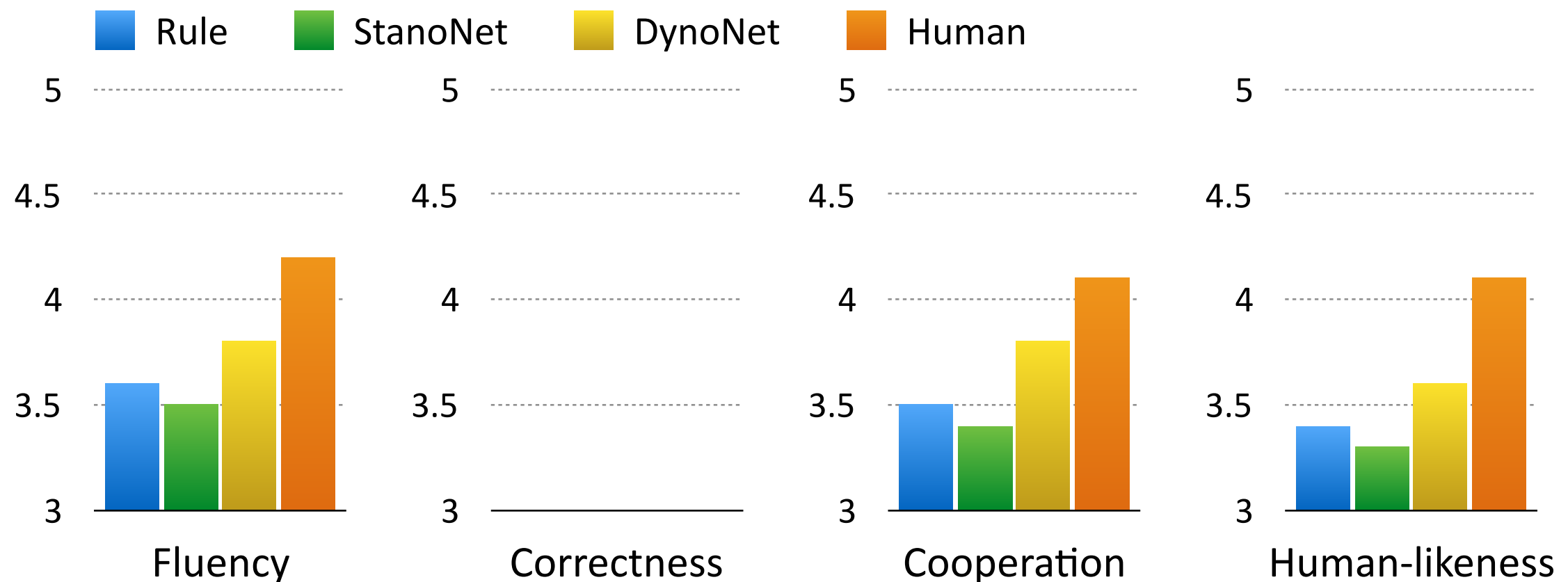
- 1 (very bad) to 5 (very good), optional comments



- Similar fluency
- Correctness ratings are not reliable
- Rule is not very cooperative:
  - *Wasn't catching cues, ignoring my input.*

# Partner evaluation

- 1 (very bad) to 5 (very good), **optional comments**



- Similar fluency
- Correctness ratings are not reliable
- Rule is not very cooperative:
  - *Wasn't catching cues, ignoring my input.*
- DynoNet mostly finish the task smoothly but can **repeat** itself:
  - *Pretty sure this conversation was a bot due to repeated sentences.*

# Third-party evaluation

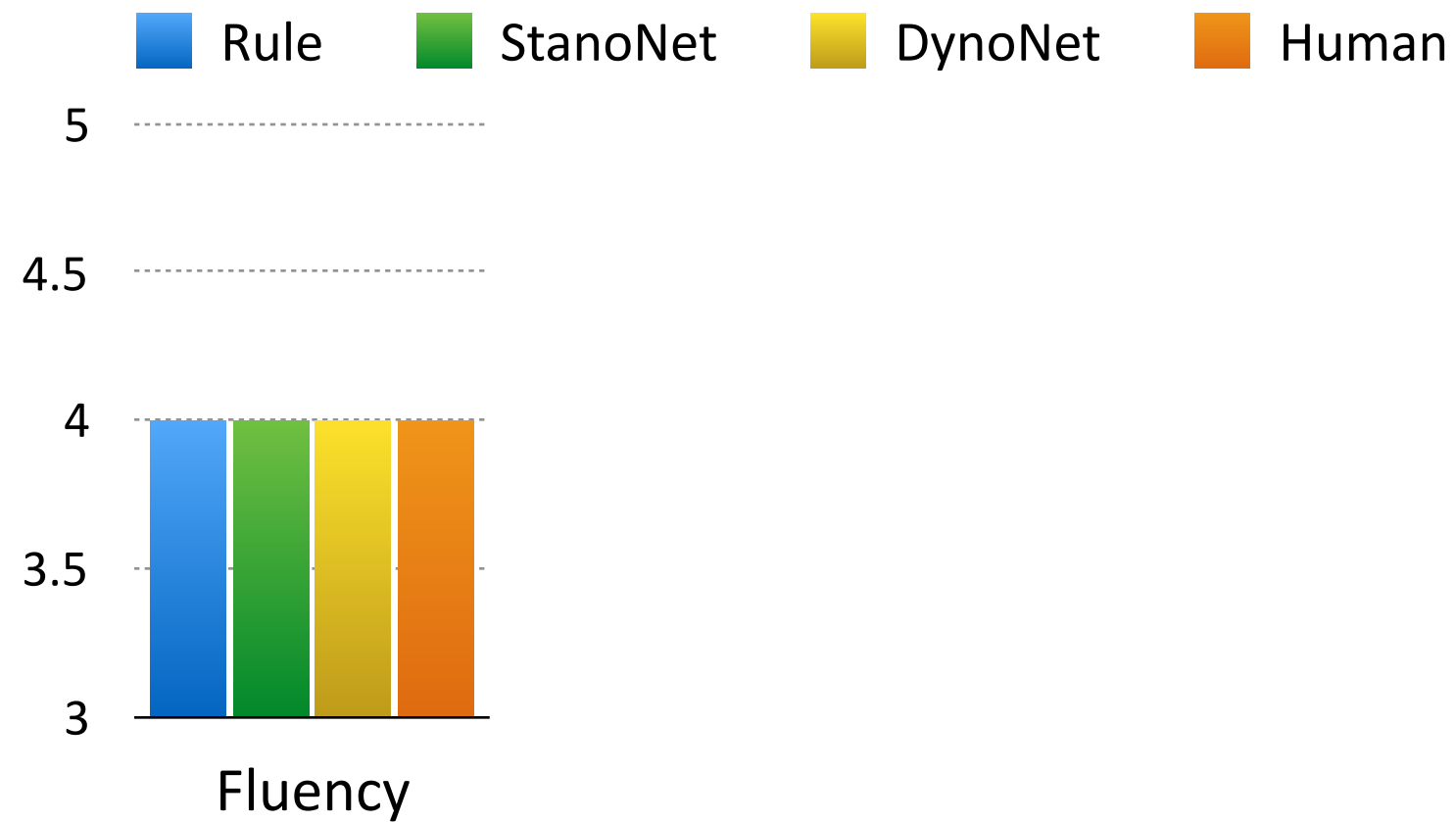
# Third-party evaluation

- 1 (very bad) to 5 (very good), [justification](#)



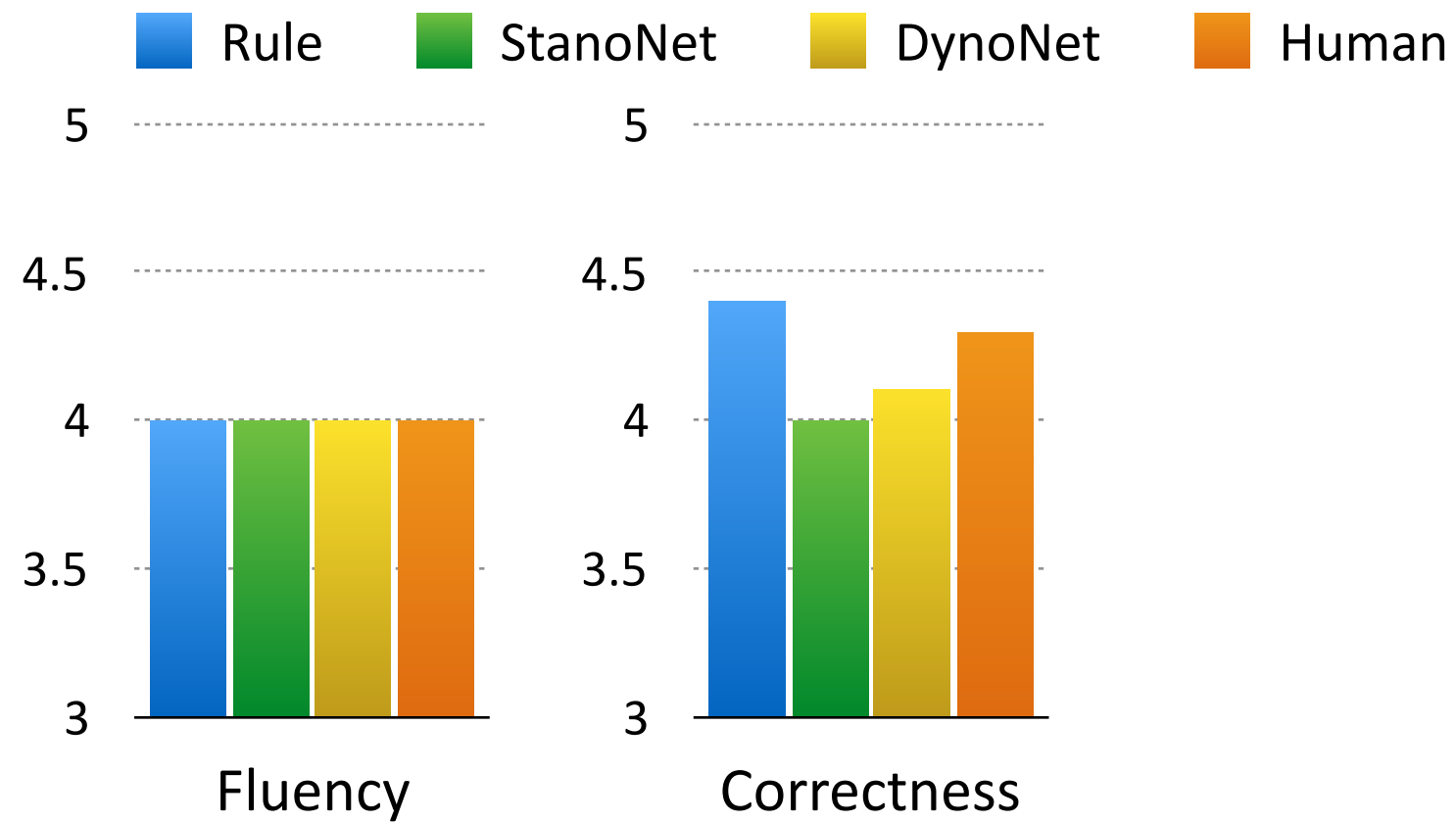
# Third-party evaluation

- 1 (very bad) to 5 (very good), [justification](#)



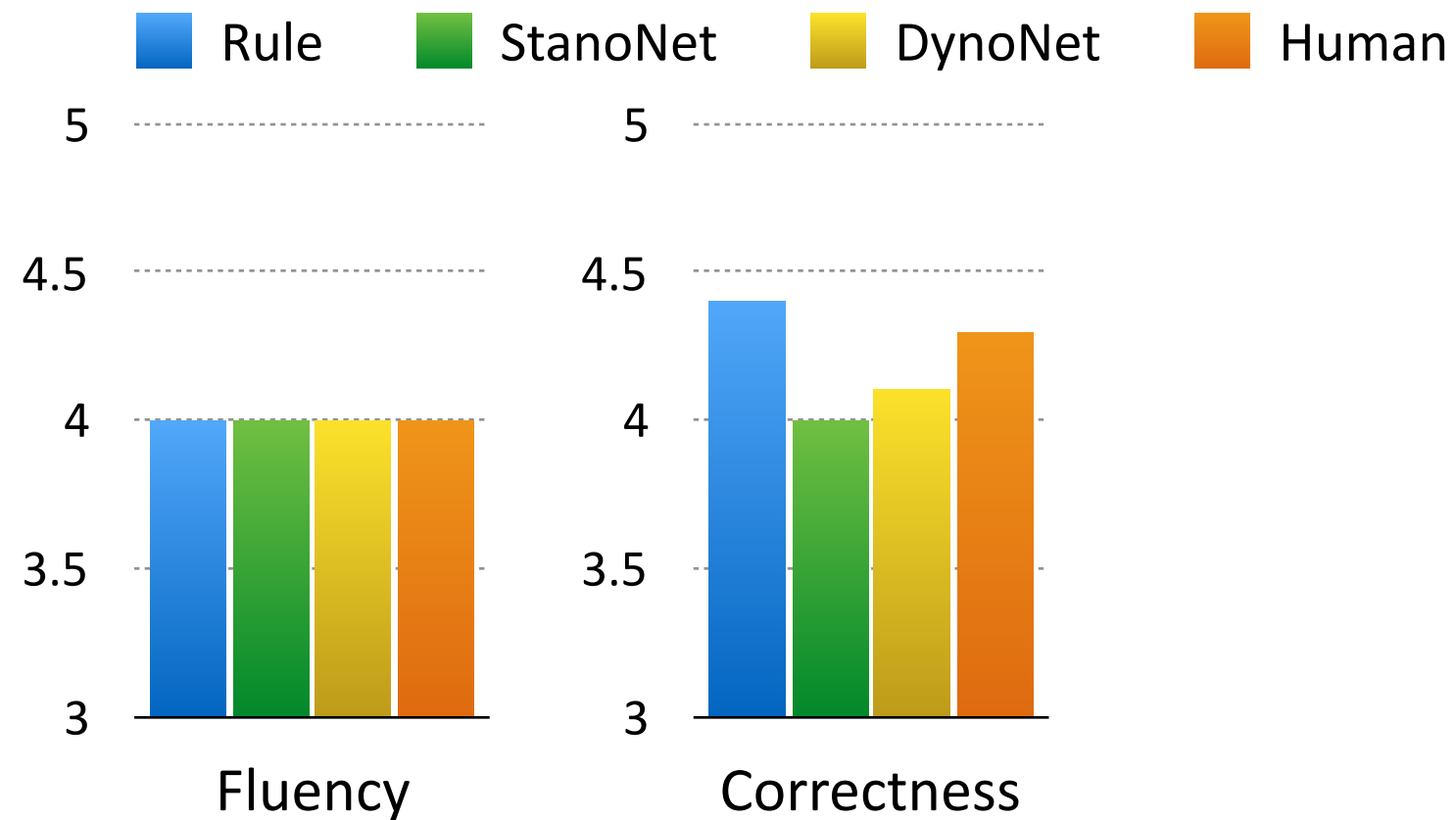
# Third-party evaluation

- 1 (very bad) to 5 (very good), [justification](#)



# Third-party evaluation

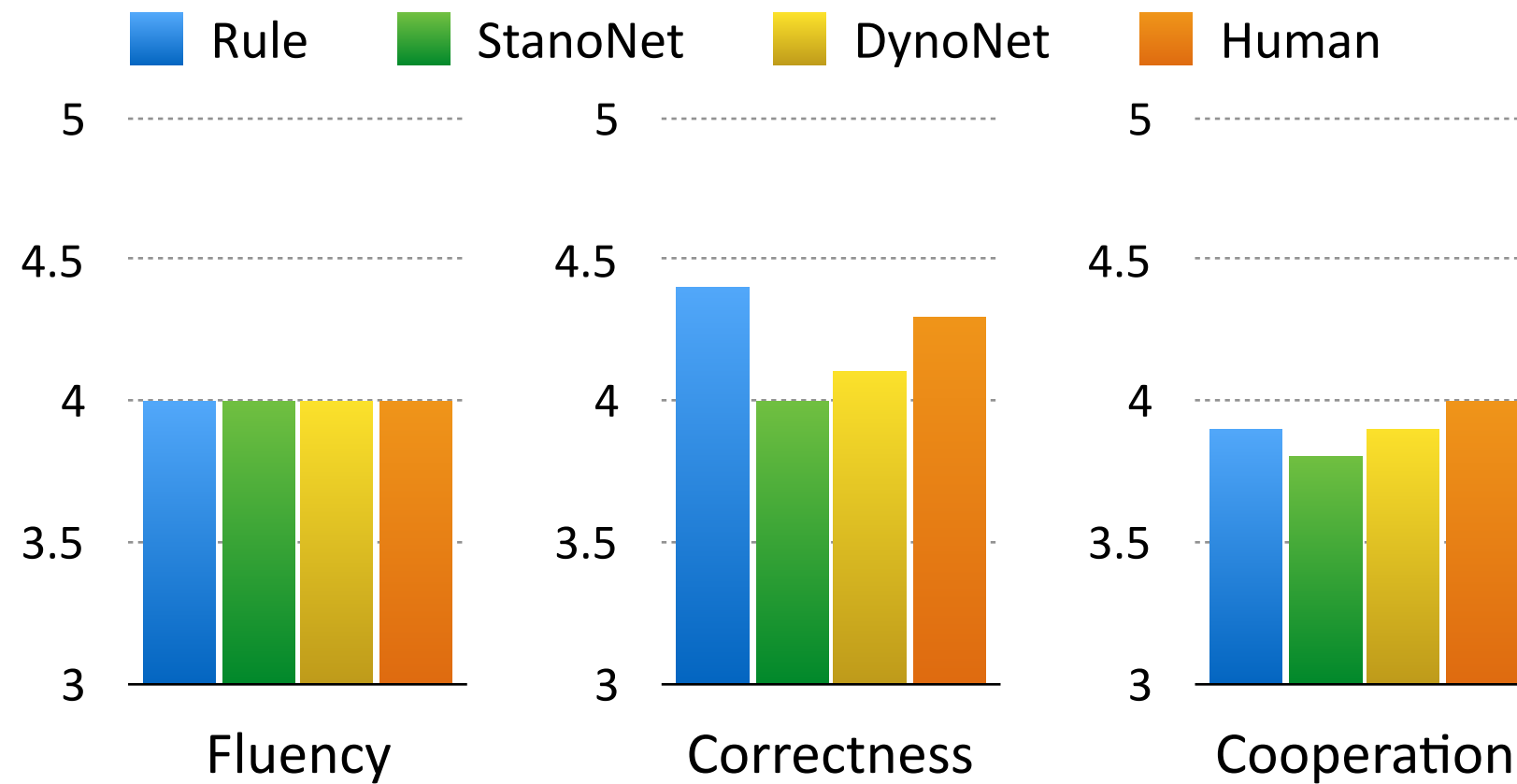
- 1 (very bad) to 5 (very good), [justification](#)



- Rule is almost always correct

# Third-party evaluation

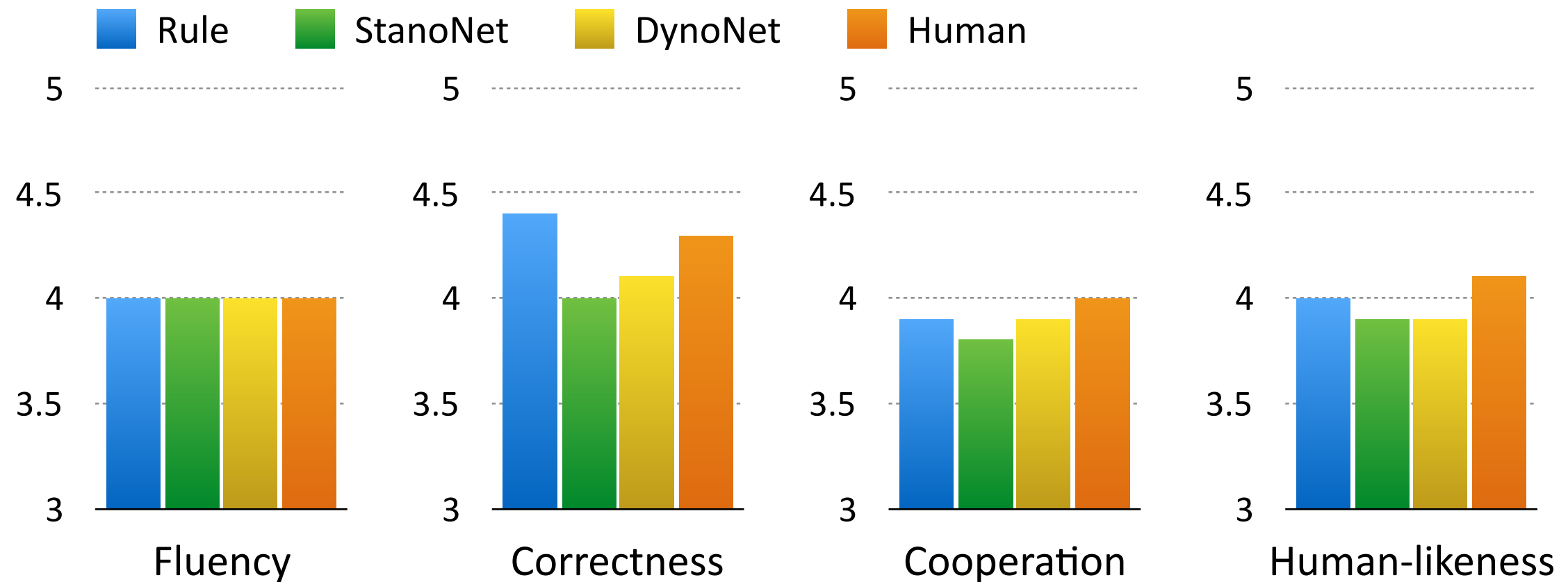
- 1 (very bad) to 5 (very good), [justification](#)



- Rule is almost always correct

# Third-party evaluation

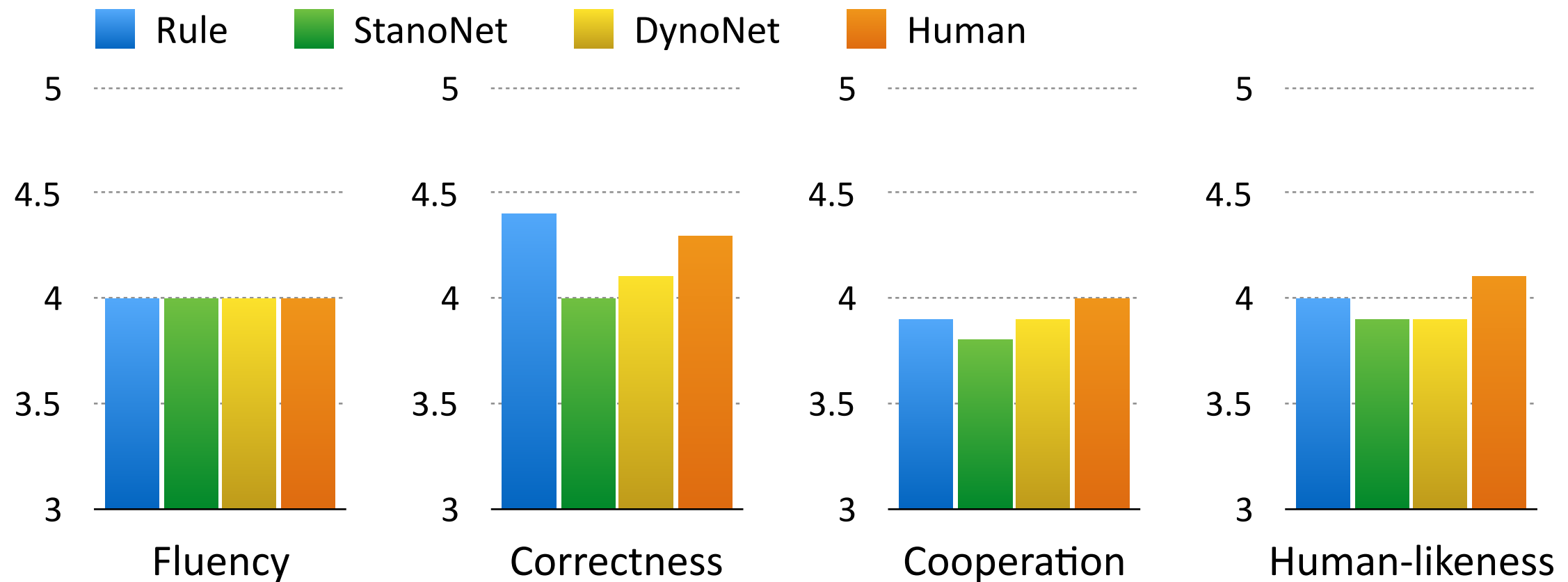
- 1 (very bad) to 5 (very good), [justification](#)



- Rule is almost always correct

# Third-party evaluation

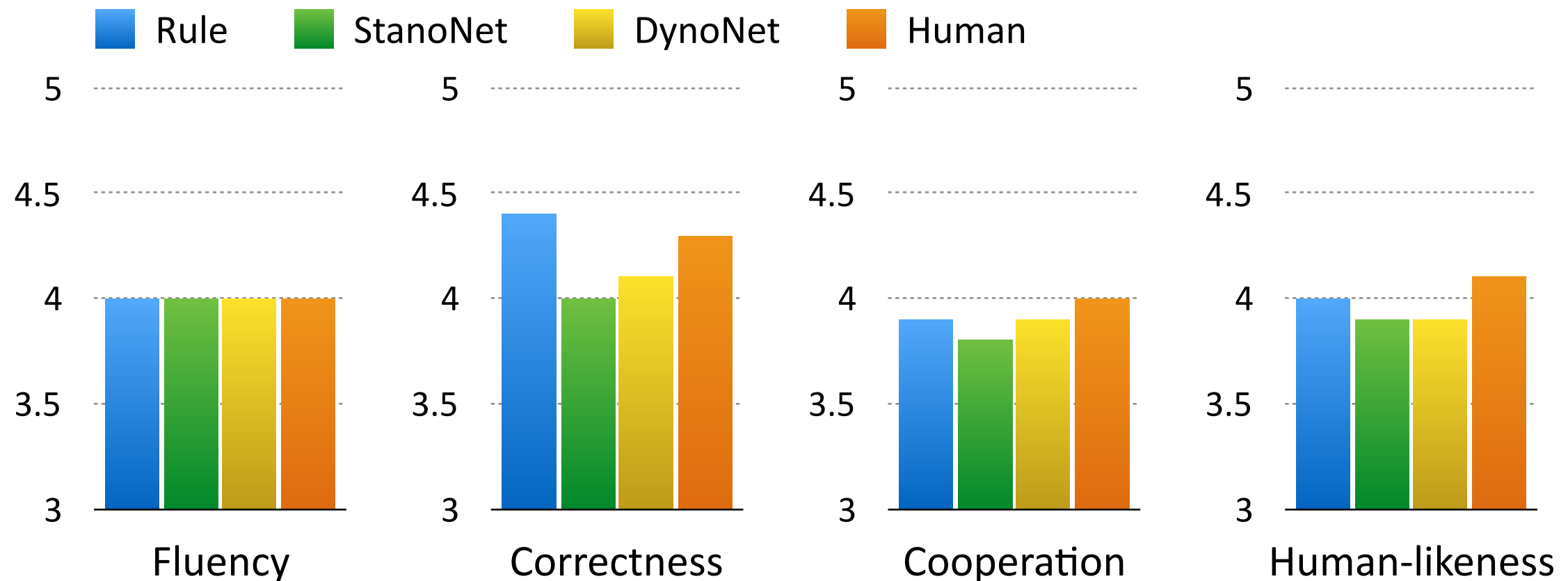
- 1 (very bad) to 5 (very good), [justification](#)



- Rule is almost always correct
- Human cues are very different from partner eval:

# Third-party evaluation

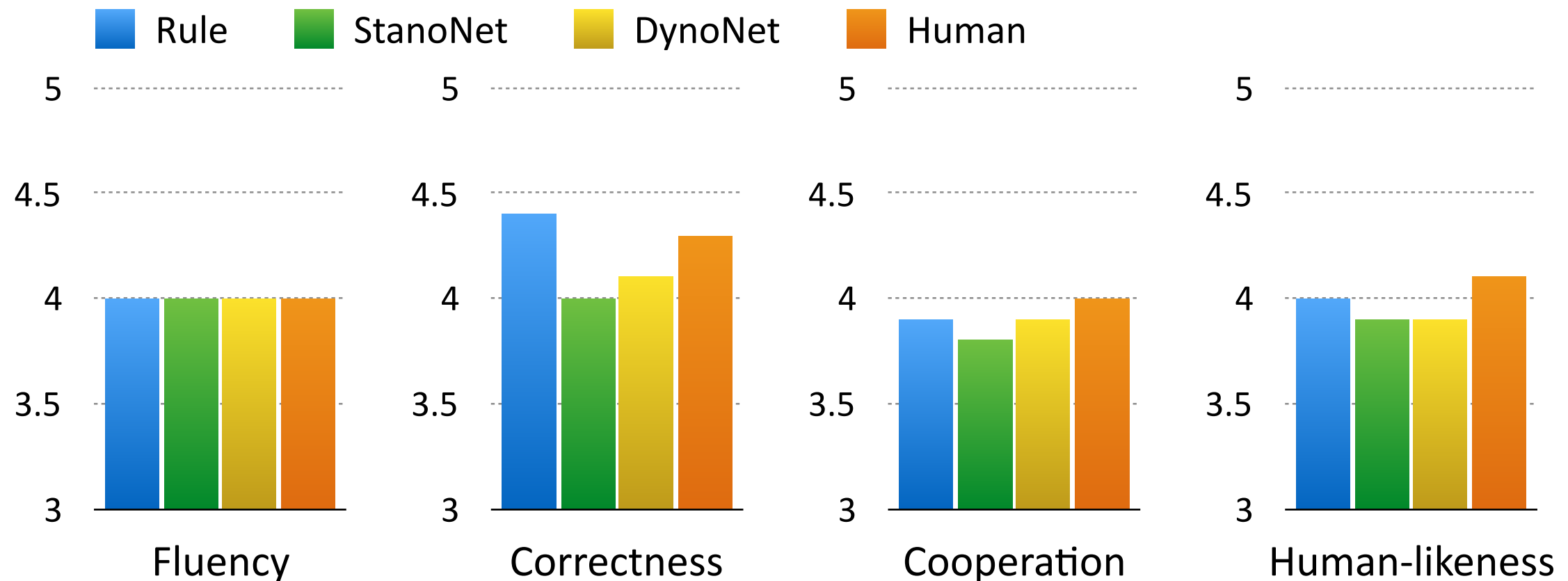
- 1 (very bad) to 5 (very good), *justification*



- Rule is almost always correct
- Human cues are very different from partner eval:
  - *Agent 1: No, I don't know , sorry Agent 2: Lay-Z Boy, I mean. - **Correction** seems to humanize the dialogue.*

# Third-party evaluation

- 1 (very bad) to 5 (very good), *justification*

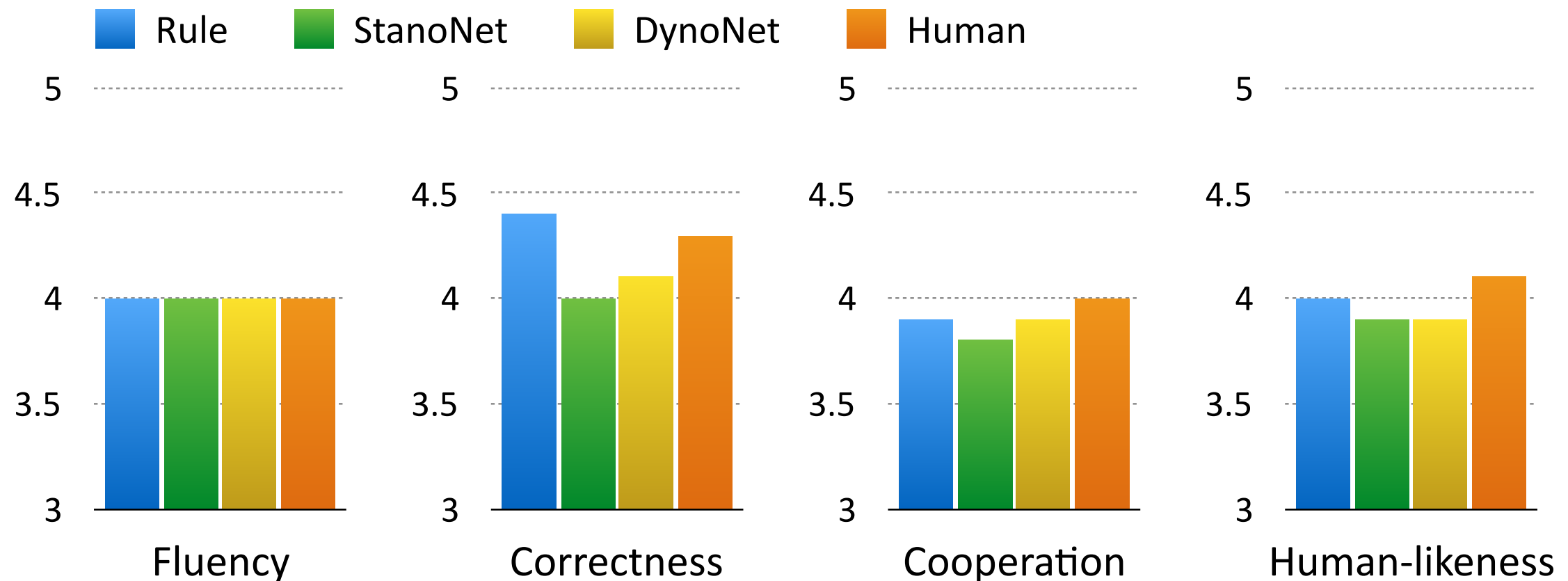


- Rule is almost always correct
- Human cues are very different from partner eval:
  - *Agent 1: No, I don't know , sorry Agent 2: Lay-Z Boy, I mean. - **Correction** seems to humanize the dialogue.*
  - ***Apologizes** with "No, I don't know, sorry", which seems very humanlike.*



# Third-party evaluation

- 1 (very bad) to 5 (very good), **justification**



- Rule is almost always correct
- Human cues are very different from partner eval:
  - *Agent 1: No, I don't know , sorry Agent 2: Lay-Z Boy, I mean. - **Correction** seems to humanize the dialogue.*
  - **Apologizes** with "No, I don't know, sorry", which seems very humanlike.
  - *hiya* -Very typical demonstration of a humanlike, **casual** wording.

# Automatic evaluation: bot-bot chat

# Automatic evaluation: bot-bot chat

## Language variation

	Utterance length	Unigram Entropy
Human	5.10	4.57
DynoNet	3.37	3.90
StanoNet	4.01	4.05
Rule	7.53	3.37

# Automatic evaluation: bot-bot chat

## Language variation

	Utterance length	Unigram Entropy
Human	5.10	4.57
DynoNet	3.37	3.90
StanoNet	4.01	4.05
Rule	7.53	3.37

Neural models generate **short, informal, more diverse** utterances:

- *like, prefer, into*

- *Do you have...? Any friends like...? What about...?*

# Automatic evaluation: bot-bot chat

# Automatic evaluation: bot-bot chat

**Effectiveness**

# Automatic evaluation: bot-bot chat

## Effectiveness

Human
DynoNet
StanoNet
Rule

# Automatic evaluation: bot-bot chat

## Effectiveness

	Success rate
Human	0.82
DynoNet	<b>0.96</b>
StanoNet	0.78
Rule	0.90



# Automatic evaluation: bot-bot chat

## Effectiveness

	Success rate	Success rate per turn
Human	0.82	0.07
DynoNet	<b>0.96</b>	<b>0.06</b>
StanoNet	0.78	0.04
Rule	0.90	0.05

# Automatic evaluation: bot-bot chat

## Effectiveness

	Success rate	Success rate per turn	Success rate per select
Human	0.82	0.07	0.38
DynoNet	<b>0.96</b>	<b>0.06</b>	0.25
StanoNet	0.78	0.04	0.18
Rule	0.90	0.05	<b>0.3</b>

# Automatic evaluation: bot-bot chat

## Effectiveness

	Success rate	Success rate per turn	Success rate per select	#Attributes
Human	0.82	0.07	0.38	2.6
DynoNet	<b>0.96</b>	<b>0.06</b>	0.25	<b>2.5</b>
StanoNet	0.78	0.04	0.18	2.9
Rule	0.90	0.05	<b>0.3</b>	3.1

# Automatic evaluation: bot-bot chat

## Effectiveness

	Success rate	Success rate per turn	Success rate per select	#Attributes	#Entities
Human	0.82	0.07	0.38	2.6	6.1
DynoNet	<b>0.96</b>	<b>0.06</b>	0.25	<b>2.5</b>	<b>5.2</b>
StanoNet	0.78	0.04	0.18	2.9	7.1
Rule	0.90	0.05	<b>0.3</b>	3.1	9.7

# Automatic evaluation: bot-bot chat

## Effectiveness

	Success rate	Success rate per turn	Success rate per select	#Attributes	#Entities
Human	0.82	0.07	0.38	2.6	6.1
DynoNet	<b>0.96</b>	<b>0.06</b>	0.25	<b>2.5</b>	<b>5.2</b>
StanoNet	0.78	0.04	0.18	2.9	7.1
Rule	0.90	0.05	<b>0.3</b>	3.1	9.7

# Automatic evaluation: bot-bot chat

## Effectiveness

	Success rate	Success rate per turn	Success rate per select	#Attributes	#Entities
Human	0.82	0.07	0.38	2.6	6.1
DynoNet	<b>0.96</b>	<b>0.06</b>	0.25	<b>2.5</b>	<b>5.2</b>
StanoNet	0.78	0.04	0.18	2.9	7.1
Rule	0.90	0.05	<b>0.3</b>	3.1	9.7

Rule's effectiveness is mainly due to large amounts of **unselective** information

# Automatic evaluation: bot-bot chat

## Effectiveness

	Success rate	Success rate per turn	Success rate per select	#Attributes	#Entities
Human	0.82	0.07	0.38	2.6	6.1
DynoNet	<b>0.96</b>	<b>0.06</b>	0.25	<b>2.5</b>	<b>5.2</b>
StanoNet	0.78	0.04	0.18	2.9	7.1
Rule	0.90	0.05	<b>0.3</b>	3.1	9.7

Rule's effectiveness is mainly due to large amounts of **unselective** information

*“My partner in this round really did not sound like a real conversation. He just listed traits.”* — partner comments

# Summary



# Summary

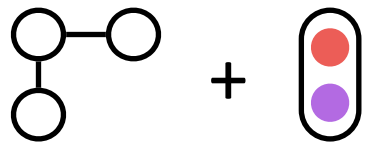


Collaboration is an effective way to collect data.

# Summary



Collaboration is an effective way to collect data.

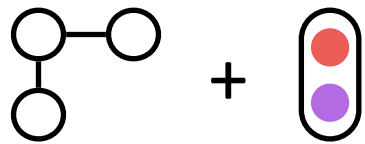


Efficient interaction requires both structured and unstructured knowledge.

# Summary



Collaboration is an effective way to collect data.



Efficient interaction requires both structured and unstructured knowledge.

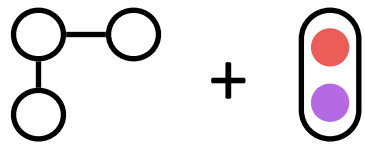


Humans have different criteria on their conversation partners.

# Summary



Collaboration is an effective way to collect data.



Efficient interaction requires both structured and unstructured knowledge.



Humans have different criteria on their conversation partners.

**Can we adapt to different users?**

# Quiz bowl



# Quiz bowl

Moderator reads  
a question



# Quiz bowl

Moderator reads  
a question

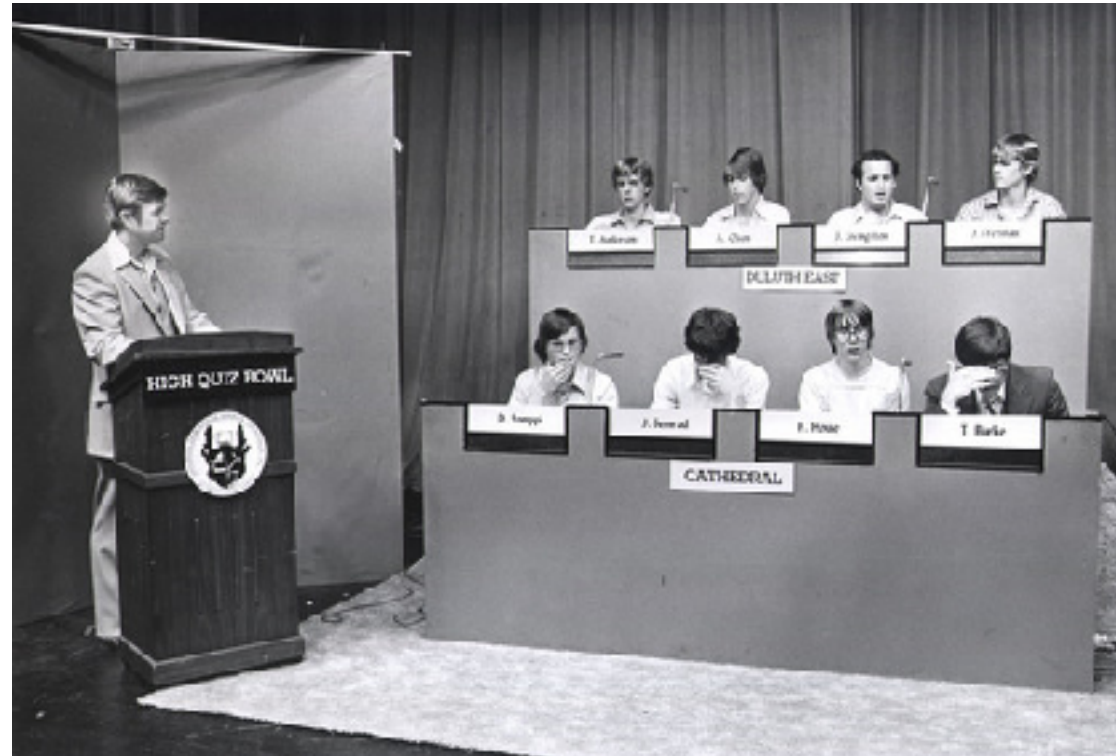


Two teams compete  
to answer



# Quiz bowl

Moderator reads  
a question



Two teams compete  
to answer



Points given to the team who **buzzes in first**  
and answers correctly



# Protobowl: Realtime multiplayer online quiz bowl by Kevin Kwok

- **1K+ daily** players each staying for **0.5h** on average

The screenshot shows the Protobowl game interface. At the top, the Protobowl logo is on the left, and 'Sign In' and 'New Room' buttons are on the right. Below the header, there are buttons for 'Chat', 'Skip', and 'Pause'. A 'Buzz' button is also present. The main area displays a list of questions with their categories and authors. Questions include '2005 Maryland Spring Classic / HS / History', '2009 HSAPQ NASAT Tryout Set / HS / History / Edit', '2005 PACE NSC / HS / History / Edit', '2004 Illinois Earlybird / HS / Literature / Edit', '2010 NASAT / HS / History / Edit', and '2011 BDAT I / HS / Literature / Edit'. Each question has a 'Buzz' button and a 'Correct' or 'Wrong' status. A timer on the right shows '00:18.3'. A leaderboard on the right lists players and their scores. The 'Settings' panel on the bottom right shows options for 'Points earned in last 50 questions', 'Enable distraction free mode', 'Show chat messages while typing', 'Enable audio chat with others', and 'Play sound on successful buzz'.

Protobowl *doing one thing and doing it acceptably well* Sign In New Room

Chat Skip Pause Buzz

2005 Maryland Spring Classic / HS / History

They

2009 HSAPQ NASAT Tryout Set / HS / History / Edit

the WPA [or Works Progress Administration; or Work Projects Administration]

Among this program's achievements were oral histories of slave life and the Astronomers Monument outside Griffith Observatory.

**Buzz** blippo blippo wpa **Correct**

closed tortoise joined the room

Haleaka whoa

2005 PACE NSC / HS / History / Edit Second Vatican Council (accept Vatican II)

**Buzz** benign kitty vatican ii **Correct**

2004 Illinois Earlybird / HS / Literature / Edit Franz Kafka

**Buzz** blippo blippo kafka **Correct**

2010 NASAT / HS / History / Edit Golda Meir [or Golda Mebiovitz]

**Buzz** blippo blippo golda meir **Correct**

**Buzz** benign kitty thatcher **Wrong**

2011 BDAT I / HS / Literature / Edit Rabindranath "Gurudev" Tagore

**Buzz** benign kitty tagore **Correct**

00:18.3 Done

#	Name	Negs
1	relativistic mongoose	22
2	benign kitty	6
3	Try Protobowl for Pro castination!	22
(13 hidden) 5 active 20 users		
14	sublime hare	5
15	Bob	0
15	vituperative porcupine	0
15	BOBAMAN :D	0

Settings

vituperative porcupine

Individual

☐ Points earned in last 50 questions

☐ Enable distraction free mode

☒ Show chat messages while typing

☐ Enable audio chat with others

☐ Play sound on successful buzz

# Protobowl: Realtime multiplayer online quiz bowl by Kevin Kwok

- **1K+ daily** players each staying for **0.5h** on average

The screenshot displays the Protobowl game interface. At the top, the Protobowl logo is visible with the tagline "doing one thing and doing it acceptably well". Navigation links for "Sign in" and "New Room" are in the top right. The main interface is divided into several sections:

- Game Controls:** Includes buttons for "Chat", "Skip", "Pause", and a red "Buzz" button.
- Question Queue:** A list of questions with their categories and sources, such as "2005 Maryland Spring Classic / HS / History" and "2009 HSAPQ NASAT Tryout Set / HS / History / Edit".
- Question Display:** The current question is shown in a large box. The question text is partially obscured by a grey box, but the answer "the WPA [or Works Progress Administration; or Work Projects Administration]" is visible.
- Player Activity:** A list of players who have buzzed, including "blippo blippo wpa" (Correct) and "benign kitty vatican ii" (Correct).
- Timer:** A digital timer showing "00:18.3" with a "Done" button.
- Leaderboard:** A table showing the top players and their scores.
- Settings:** A panel on the right side with various options for game play.

#	Name	Negs
1	relativistic mongoose	22
2	benign kitty	6
3	Try Protobowl for Pro castination!	22
(13 hidden) 5 active 20 users		
14	sublime hare	5
15	Bob	0
15	vituperative porcupine	0
15	BOBAMAN :D	0

**Settings**

- ☐ Points earned in last 50 questions
- ☐ Enable distraction free mode
- ☒ Show chat messages while typing
- ☐ Enable audio chat with others
- ☐ Play sound on successful buzz

# What are the questions like?

# What are the questions like?

After the death of this man, The Liberators' Civil War was fought in Macedonia. This man introduced the concept of leap year in his namesake calendar, and he claimed "The die is cast" before crossing the Rubicon river. For 10 points, name this Roman Emperor who legendarily asked, "Et tu, Brute?" while being assassinated.

# What are the questions like?

After the death of this man, The Liberators' Civil War was fought in Macedonia. This man introduced the concept of leap year in his namesake calendar, and he claimed "The die is cast" before crossing the Rubicon river. For 10 points, name this Roman Emperor who legendarily asked, "Et tu, Brute?" while being assassinated.

Julius Caesar

# What are the questions like?

At **Hard** death of this man, The Liberators' Civil War was fought in Macedonia. This man introduced the concept of leap year in his namesake calendar, and he claimed "The die is cast" before crossing the Rubicon river. For 10 points, name this Roman Emperor who legendarily asked, "Et tu, Brute?" while being assassinated.

Julius Caesar

# What are the questions like?

At **Hard** death of this man, The Liberators' Civil War was fought in Macedonia. This man introduced the concept of leap year in his namesake calendar, and he claimed "The die is cast" before crossing the Rubicon river. For 10 points, name this Roman Emperor who legendarily asked, "Et tu, Brute?" who **Easy** assassinated.

Julius Caesar

# What are the questions like?

At **Hard** death of this man, The Liberators' Civil War was fought in Macedonia. This man introduced the concept of leap year in his namesake calendar, and he claimed "The die is cast" before crossing the Rubicon river. For 10 points, name this Roman Emperor who legendarily asked, "Et tu, Brute?" who **Easy** assassinated.

Julius Caesar

- Later cues are more indicative



# What are the questions like?

At **Hard** death of this man, The Liberators' Civil War was fought in Macedonia. This man introduced the concept of leap year in his namesake calendar, and he claimed "The die is cast" before crossing the Rubicon river. For 10 points, name this Roman Emperor who legendarily asked, "Et tu, Brute?" who **Easy** assassinated.

Julius Caesar

- Later cues are more indicative
- Speed-accuracy tradeoff

# What are the questions like?

At **Hard** death of this man, The Liberators' Civil War was fought in Macedonia. This man introduced the concept of leap year in his namesake calendar, and he claimed "The die is cast" before crossing the Rubicon river. For 10 points, name this Roman Emperor who legendarily asked, "Et tu, Brute?" who **Easy** assassinated.

Julius Caesar

- Later cues are more indicative
- Speed-accuracy tradeoff
- Multiple categories: history, literature, fine arts, science etc.

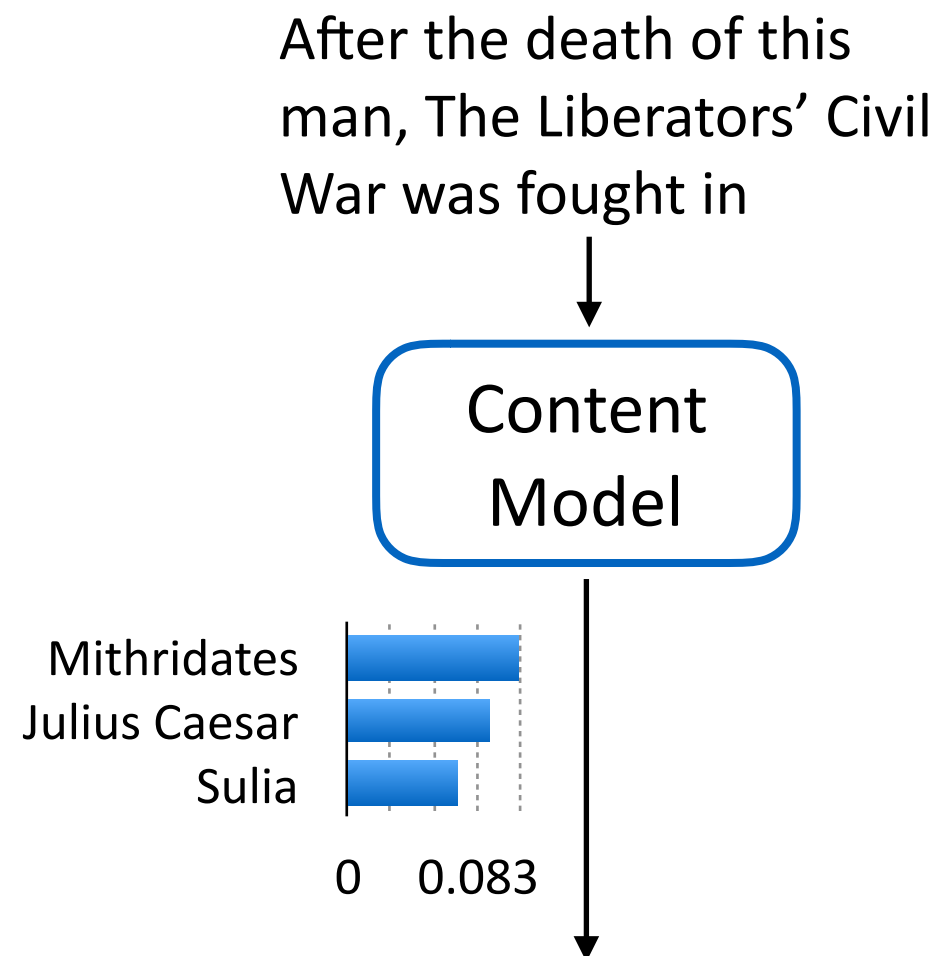
# Quiz bowl as incremental text classification

# Quiz bowl as incremental text classification

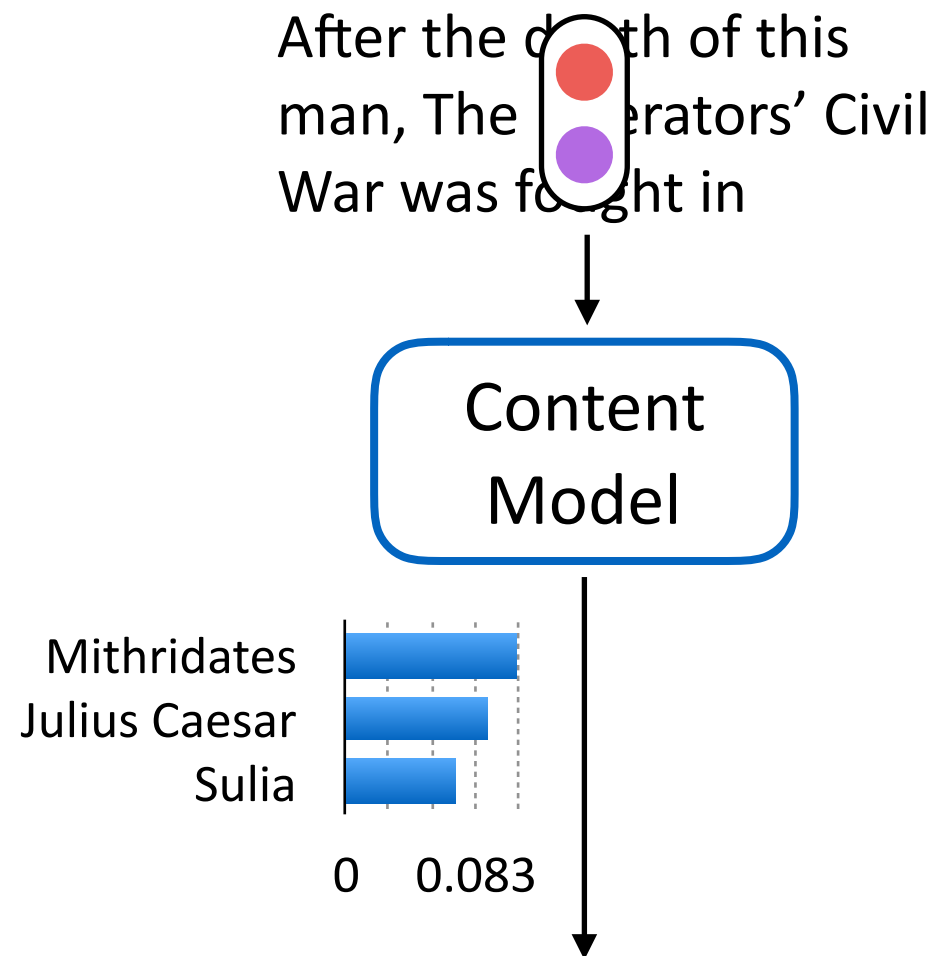


Content  
Model

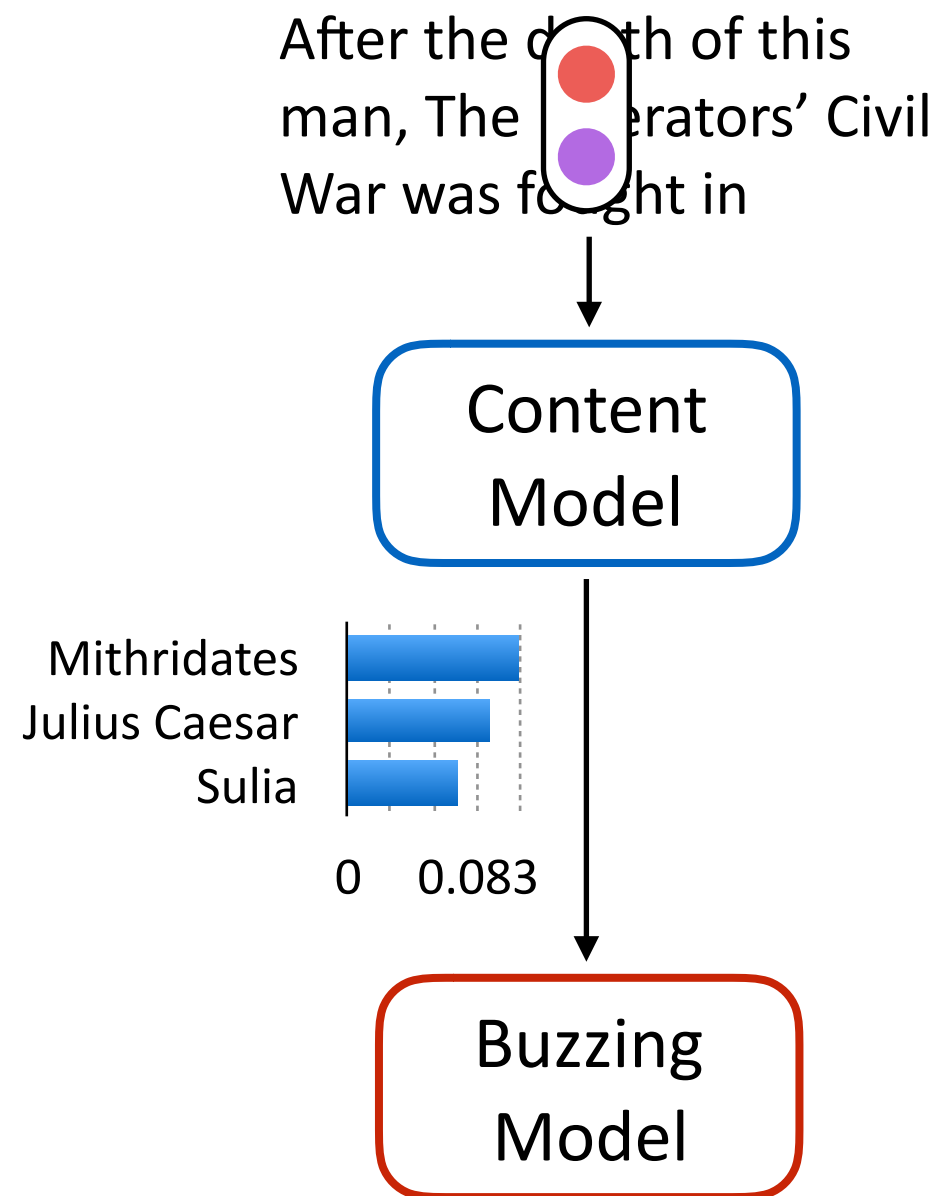
# Quiz bowl as incremental text classification



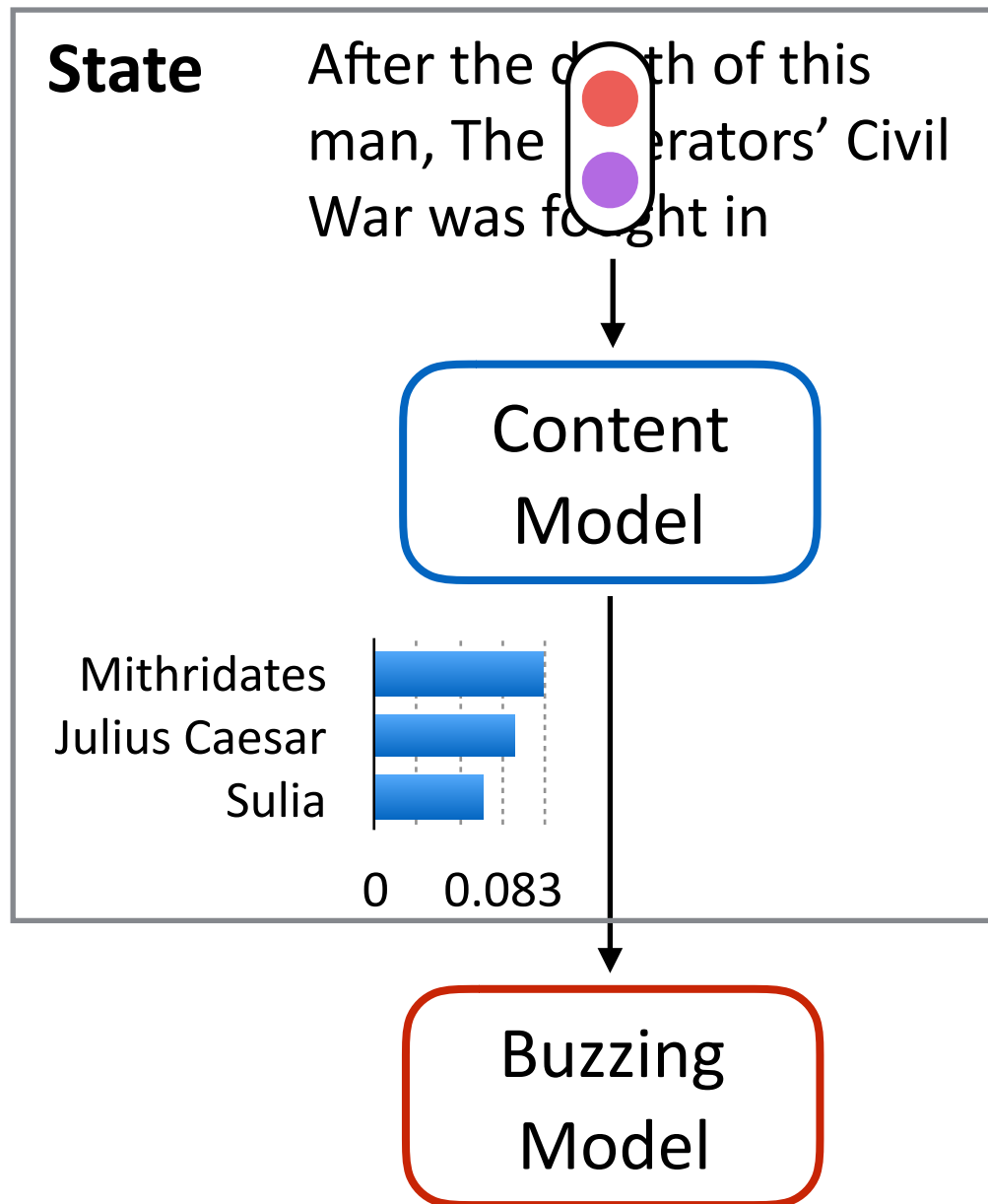
# Quiz bowl as incremental text classification



# Quiz bowl as incremental text classification

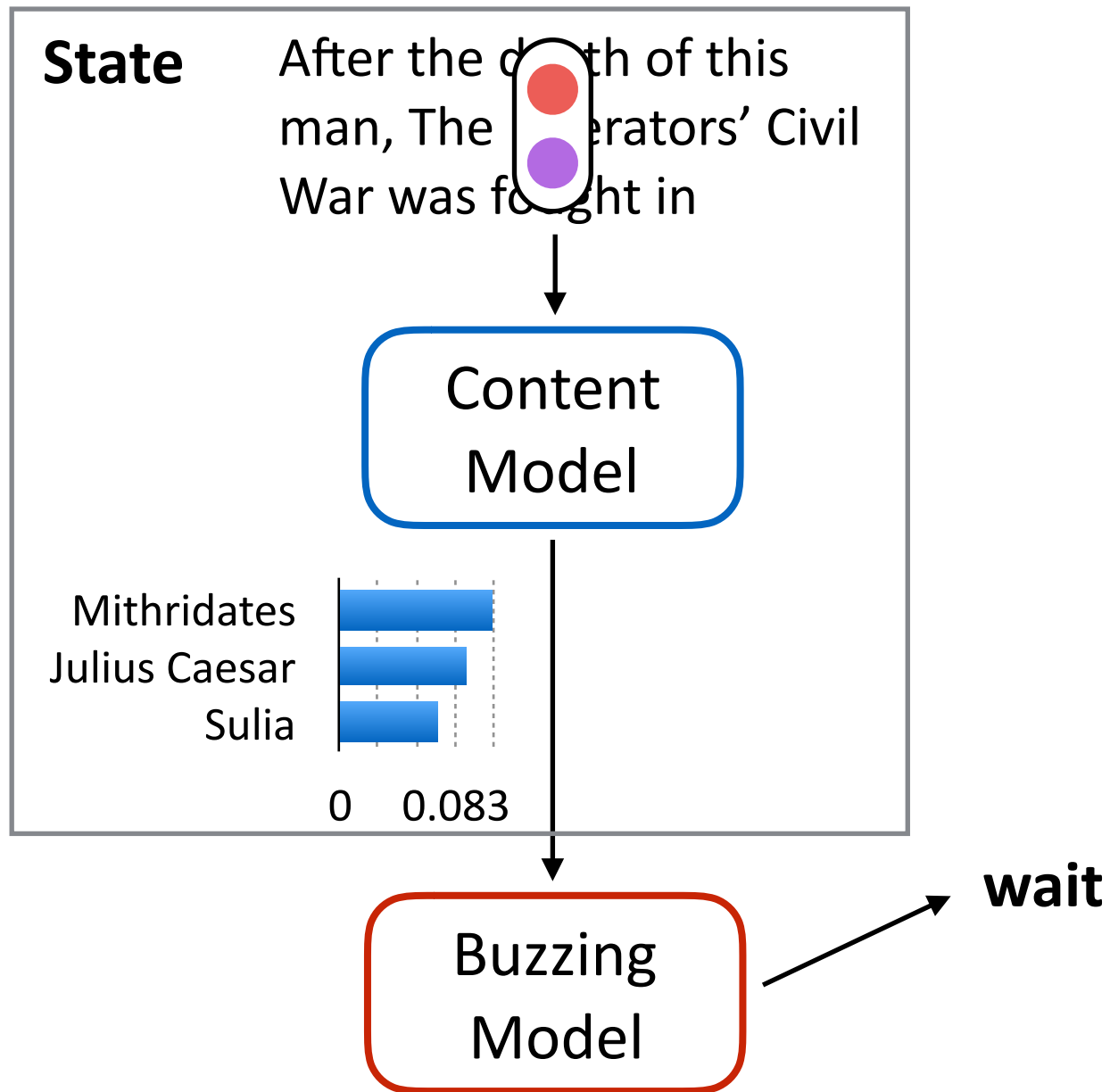


# Quiz bowl as incremental text classification

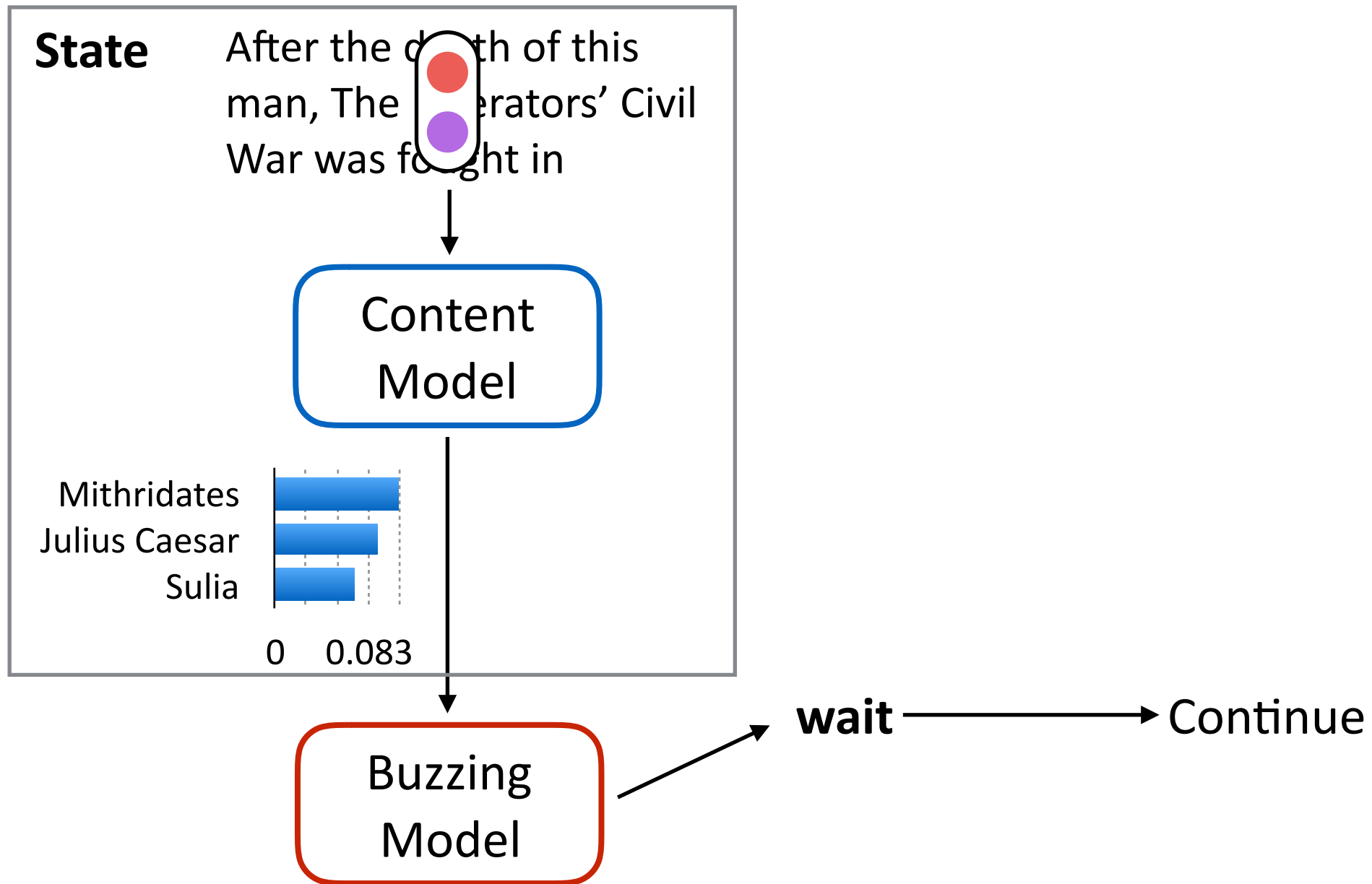




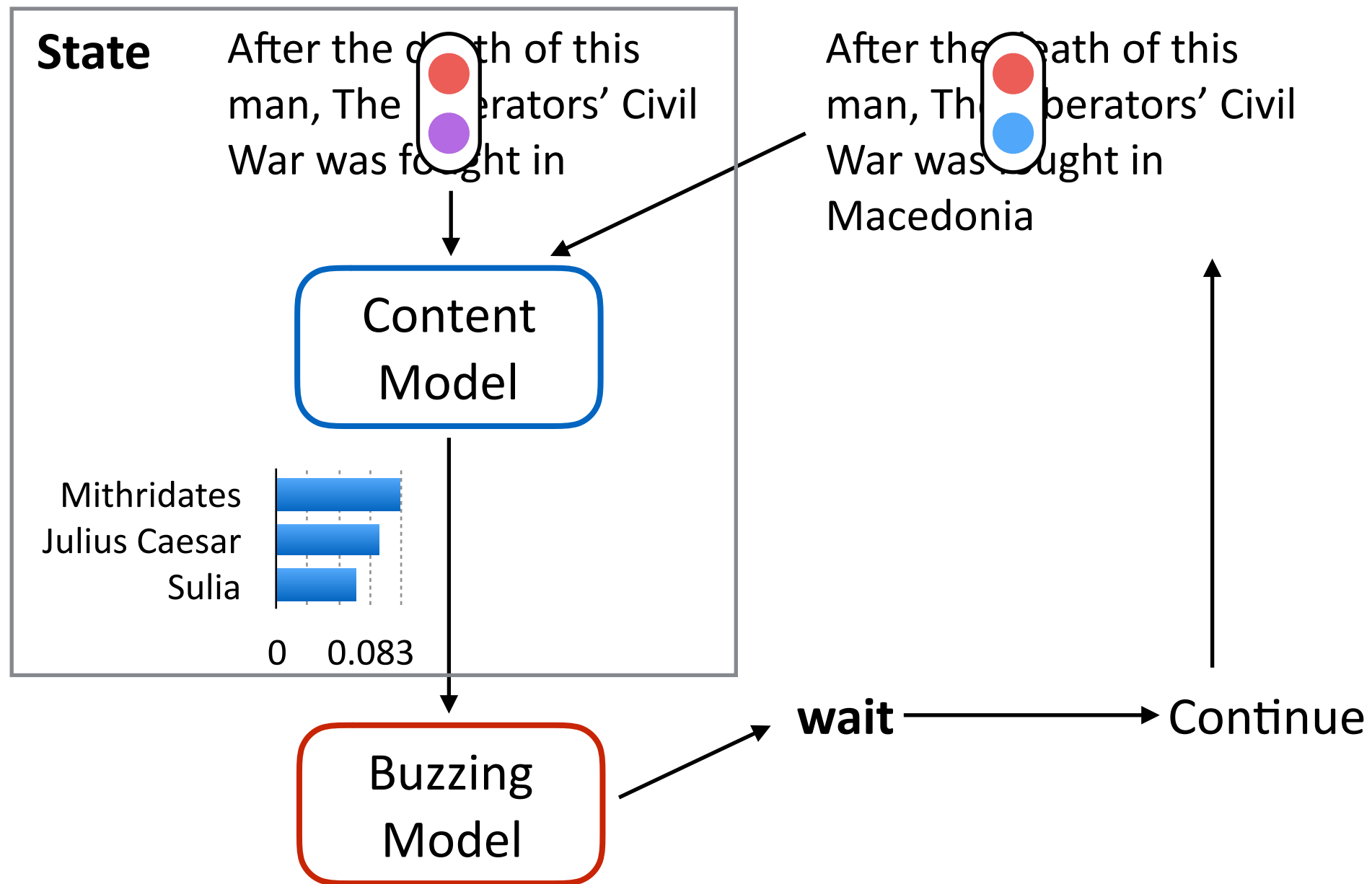
# Quiz bowl as incremental text classification



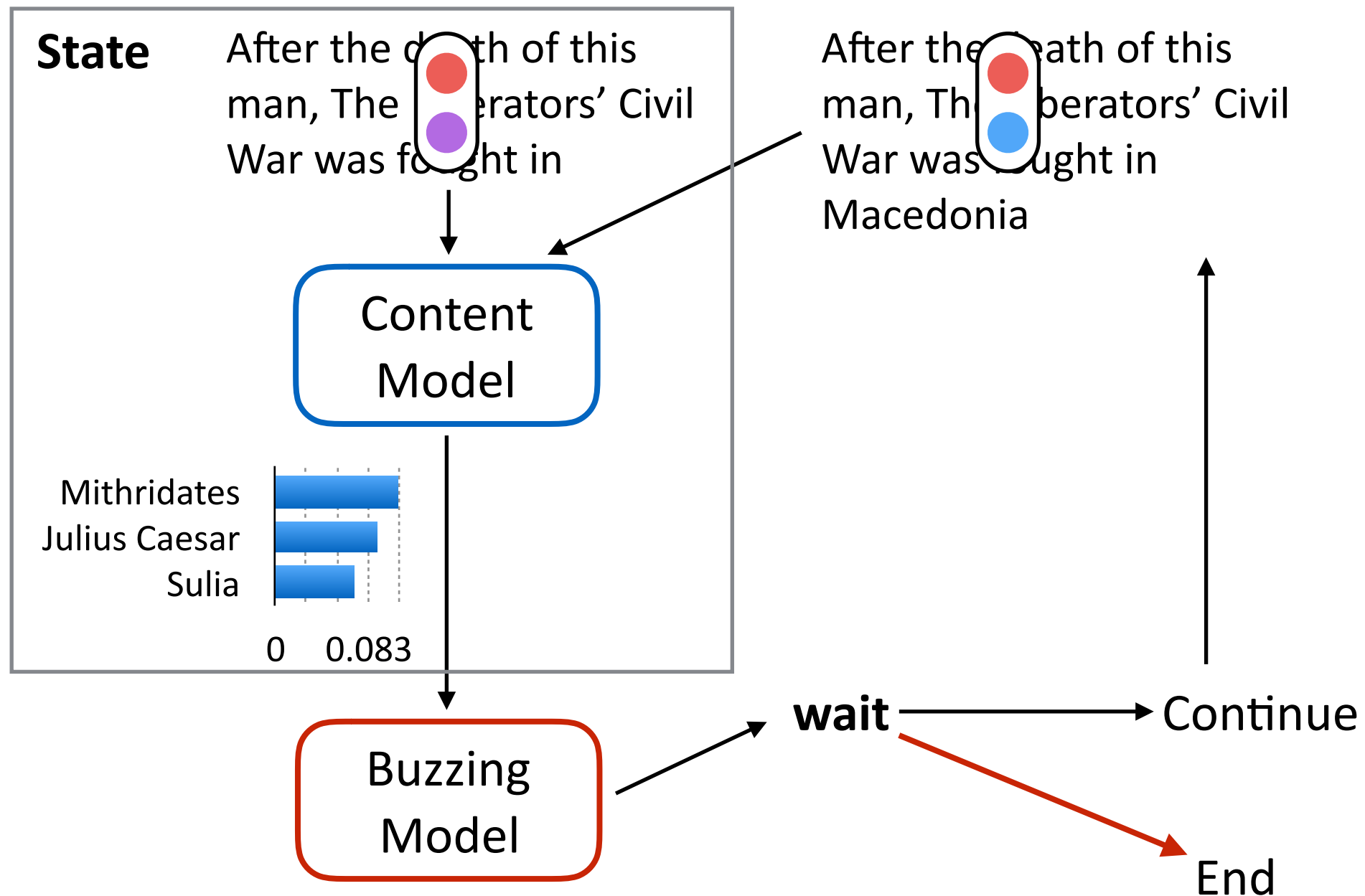
# Quiz bowl as incremental text classification



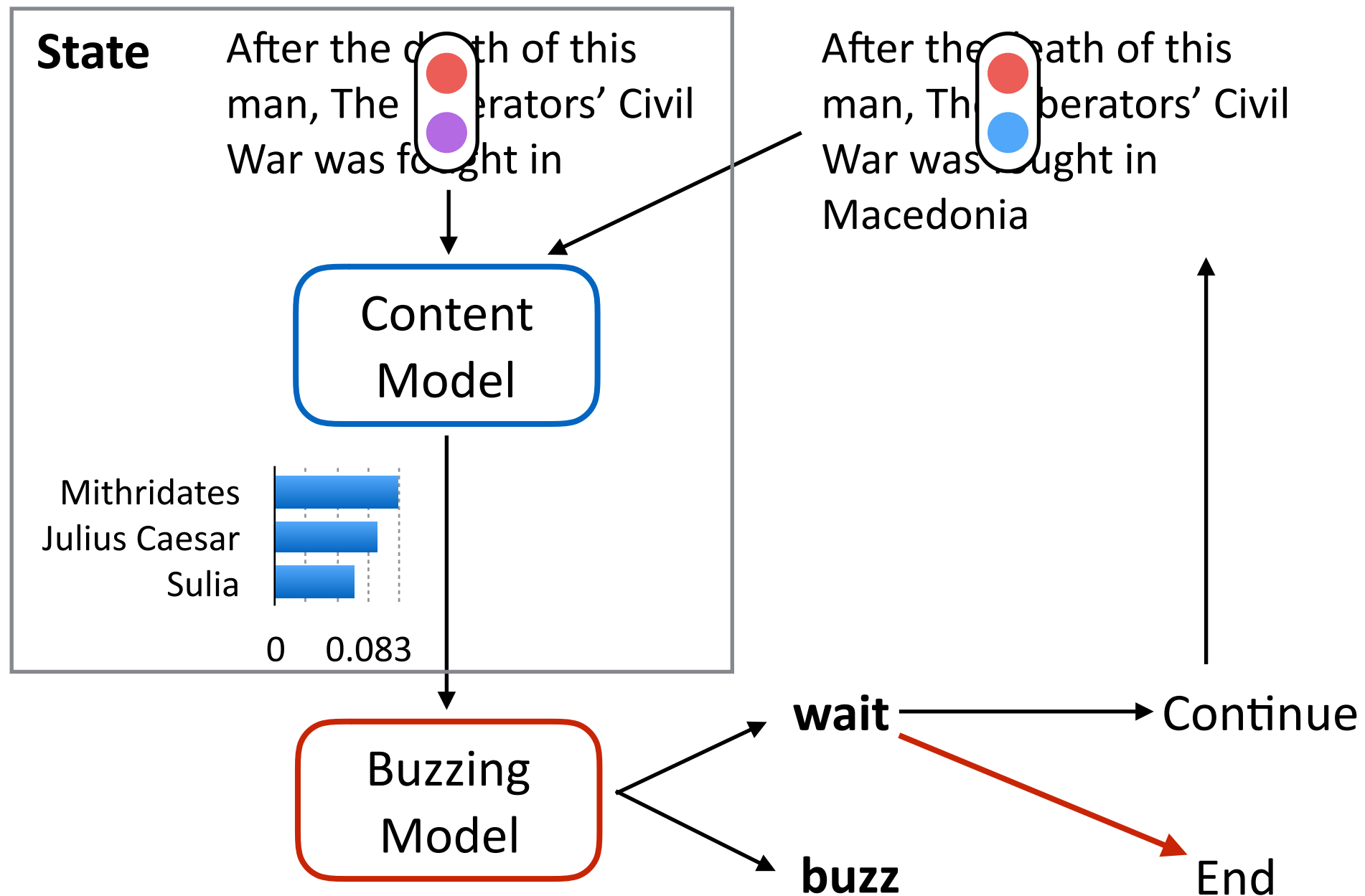
# Quiz bowl as incremental text classification



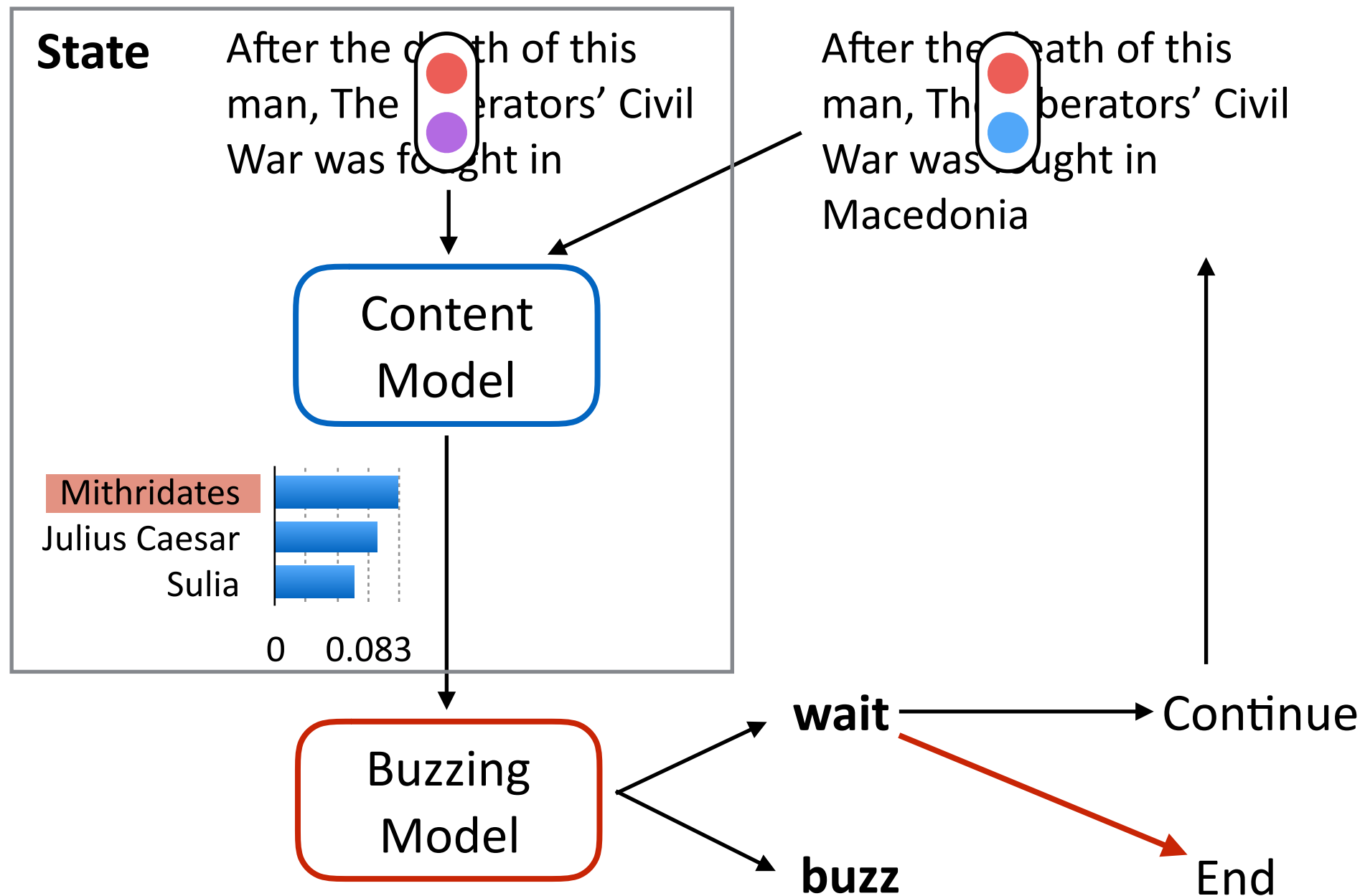
# Quiz bowl as incremental text classification



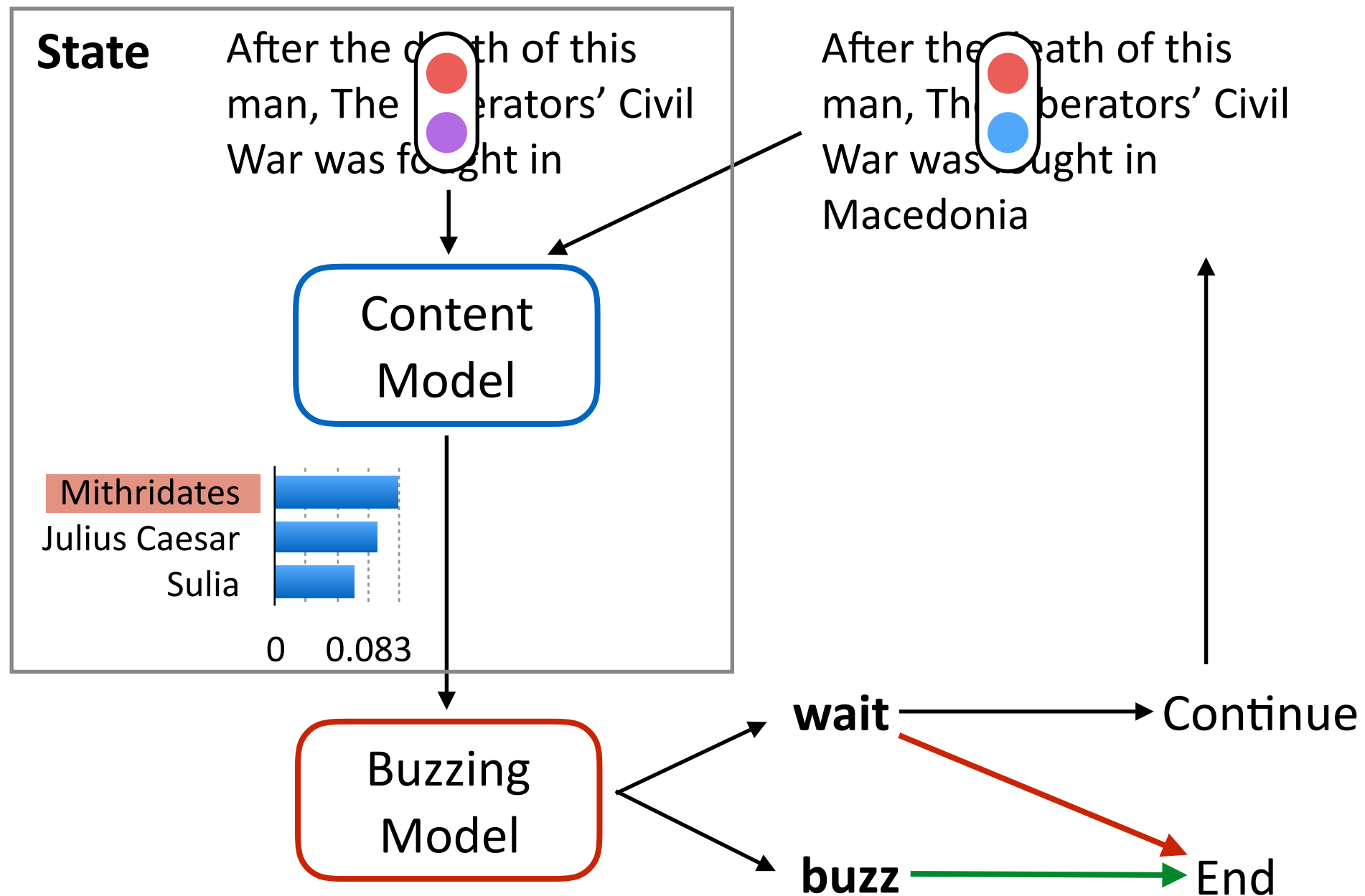
# Quiz bowl as incremental text classification



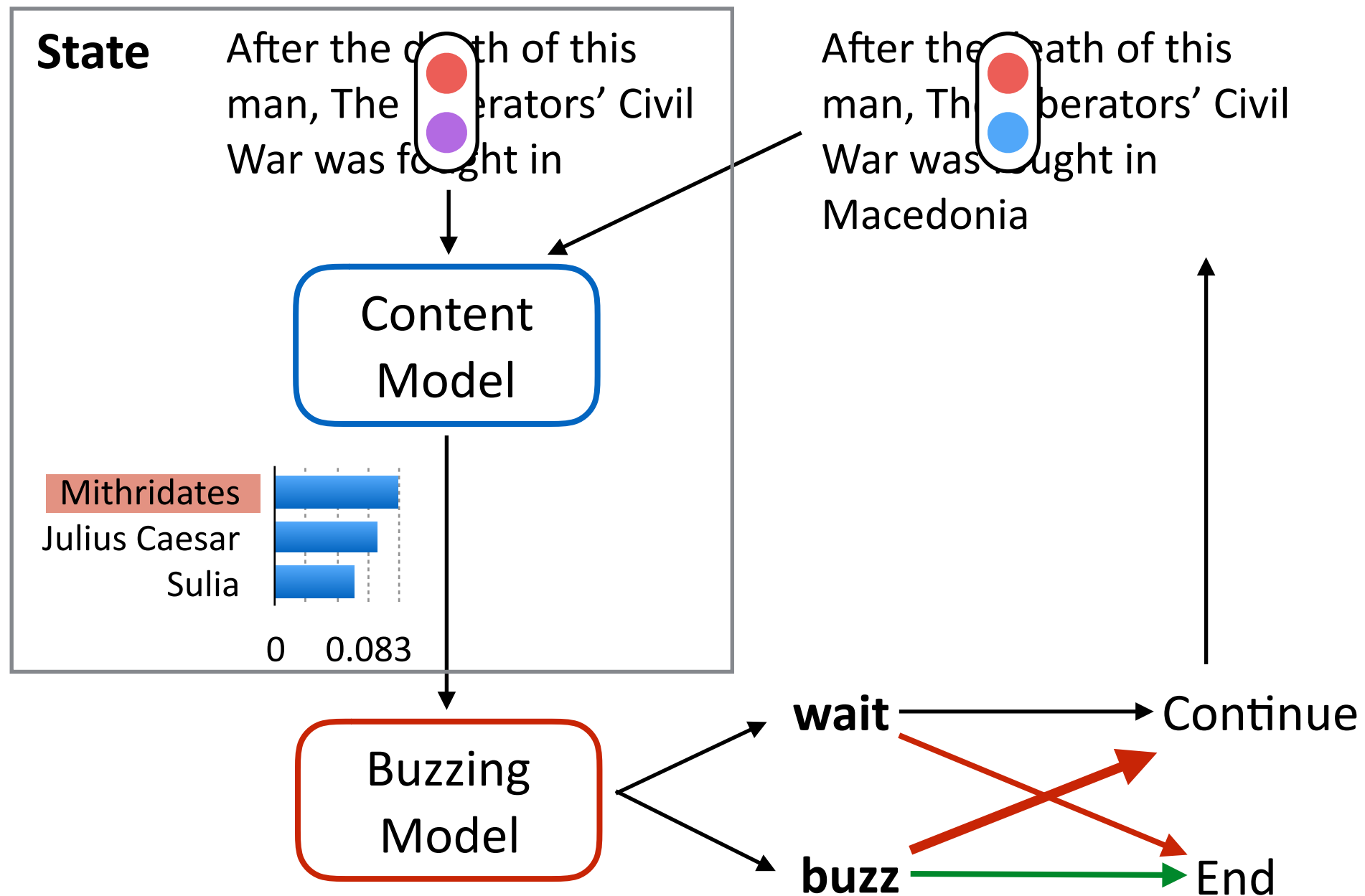
# Quiz bowl as incremental text classification



# Quiz bowl as incremental text classification

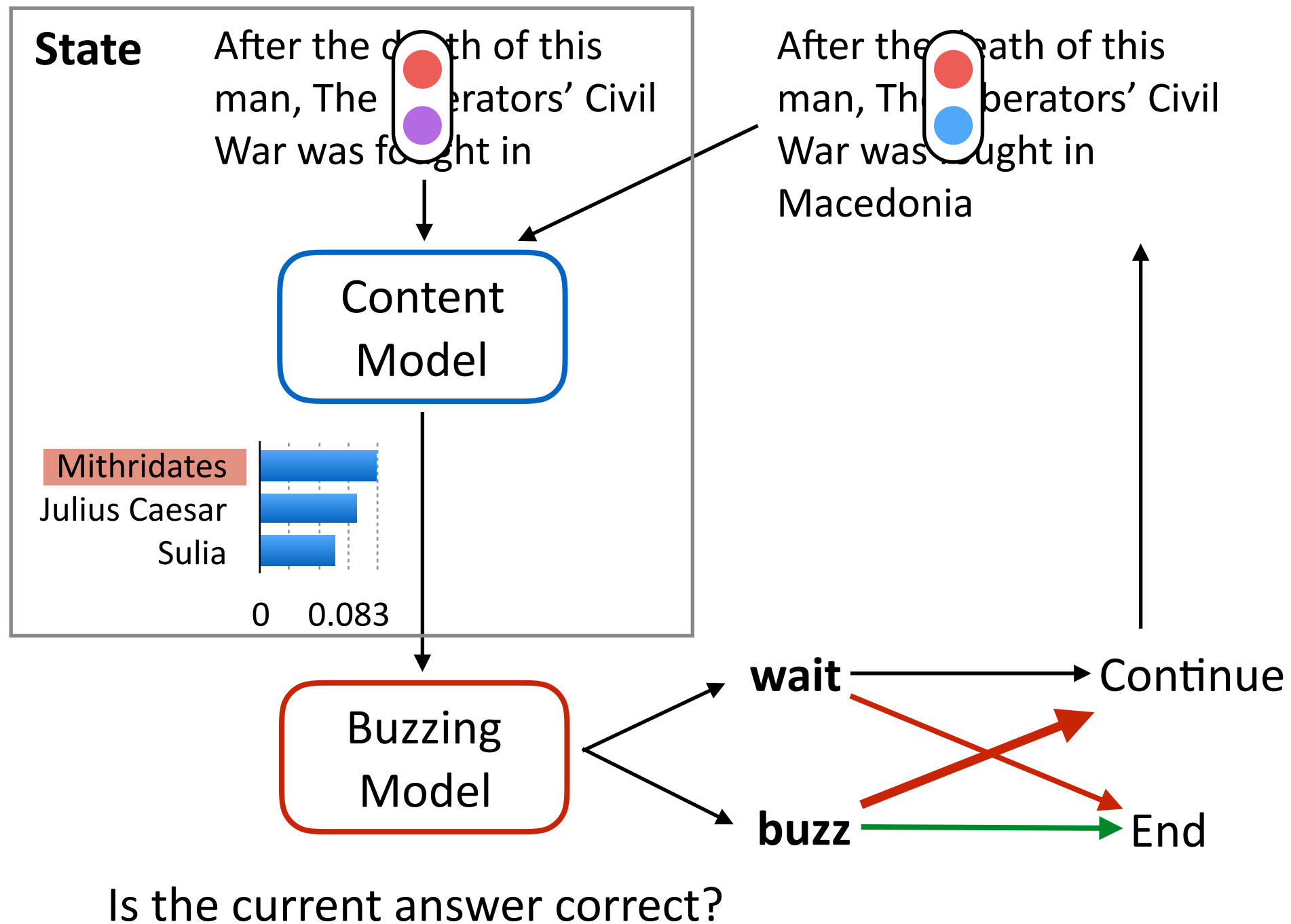


# Quiz bowl as incremental text classification

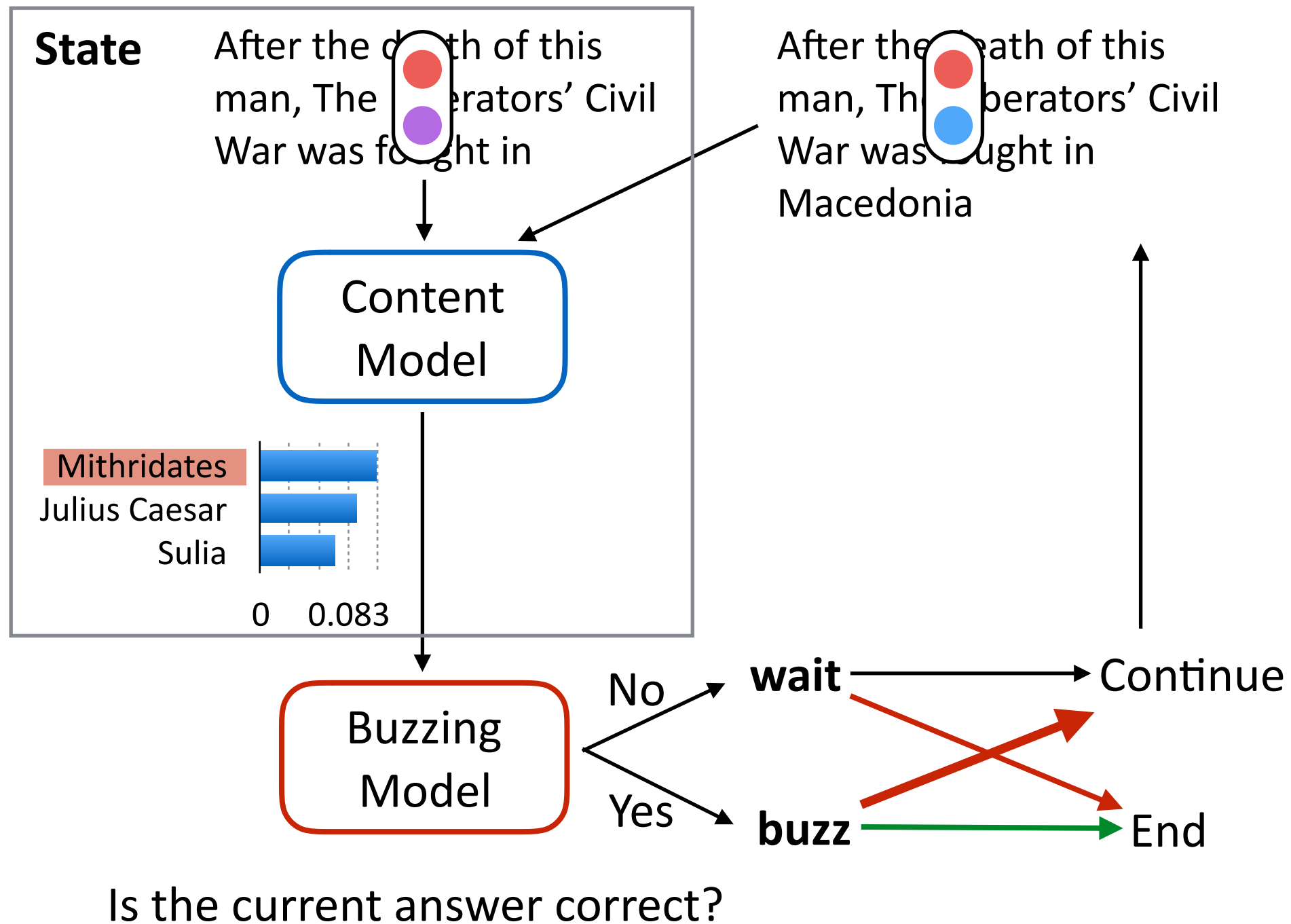




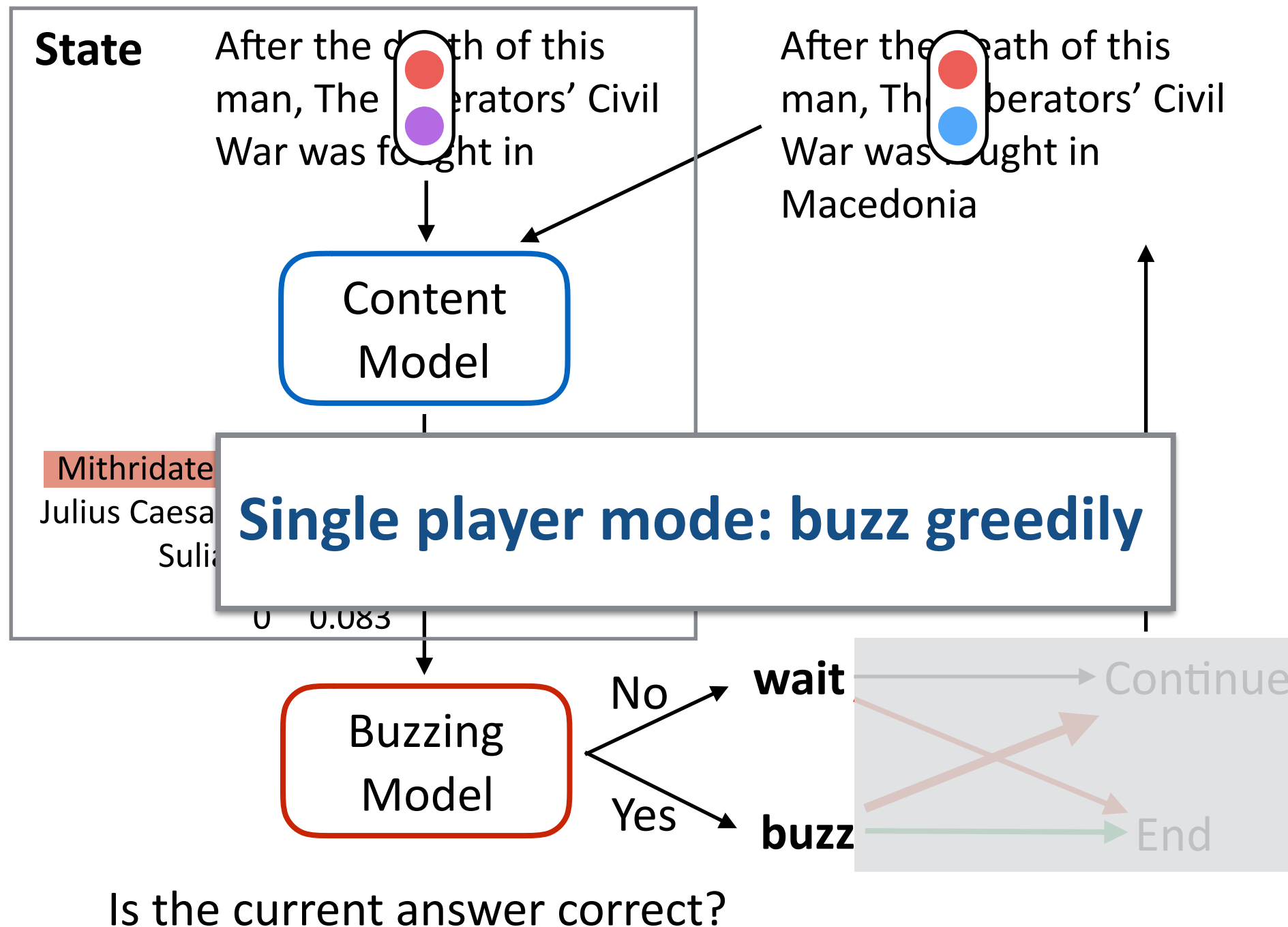
# Quiz bowl as incremental text classification



# Quiz bowl as incremental text classification



# Quiz bowl as incremental text classification




# Where does it fail

# Where does it fail


at its start , it skirts the selkirk mountains and passes through the upper and lower arrow lakes . the spokane , willamette and the snake are major tributaries , and the grand coulee dam and the bonneville dam lie on it . FTP — name this river , formerly known as the oregon river , that forms the border of washington and oregon .

# Where does it fail

at its start , it skirts the selkirk mountains and ses through the upper and lower arrow lakes . the spokane , willamette and the snake are major tributaries , and the grand coulee dam and the bonneville dam lie on it . FTP — name this river , formerly known as the oregon river , that forms the border of washington and oregon .





# Where does it fail

## Premature buzz

at its start , it skirts the selkirk mountains and ses through the upper and lower arrow lakes . the spokane , willamette and the snake are major tributaries , and the grand coulee dam and the bonneville dam lie on it . FTP — name this river , formerly known as the oregon river , that forms the border of washington and oregon .

# Where does it fail





## Premature buzz

at its start , it skirts the selkirk mountains and sses throh the upper and lower arrow lakes . the spokane , willamette and the snake are mar tributaries , and the grand coulee dam and the bonneville dam lie on it . FTP — name this river , formerly known as the oregon rier , that forms the border of washington and oregon .









# Where does it fail

## Premature buzz

at its start , it skirts the selkirk mountains and sses throh the upper and lower arrow **Wait here is fine** ie , willamette and the snake are mar tributaries , and the grand coulee dam and the bonneville dam lie on it . FTP — name this river , formerly known as the oregon rier , that forms the border of washington and oregon .







# Where does it fail

## Premature buzz

at its start , it skirts the selkirk mountains and sses throh the upper and lower arrow **Wait here is fine**ie , willamette and the re are mar tributaries , and the grancoulee dam and the bonneville dam lie on it . FTP — name this river , formerly known as the oregon rier , that forms the border of washington and oregon .







# Where does it fail

## Premature buzz

at its start , it skirts the selkirk mountains and sses throh the upper and lower arrow **Wait here is fine** ie , willamette and the sne are mar tributaries , and the grancoulee dam and the bonneville dam lie on it . FTP — **Better to buzz after the** ly known as the oregon rier , that forms th**opponent's mistake** nd oregon .

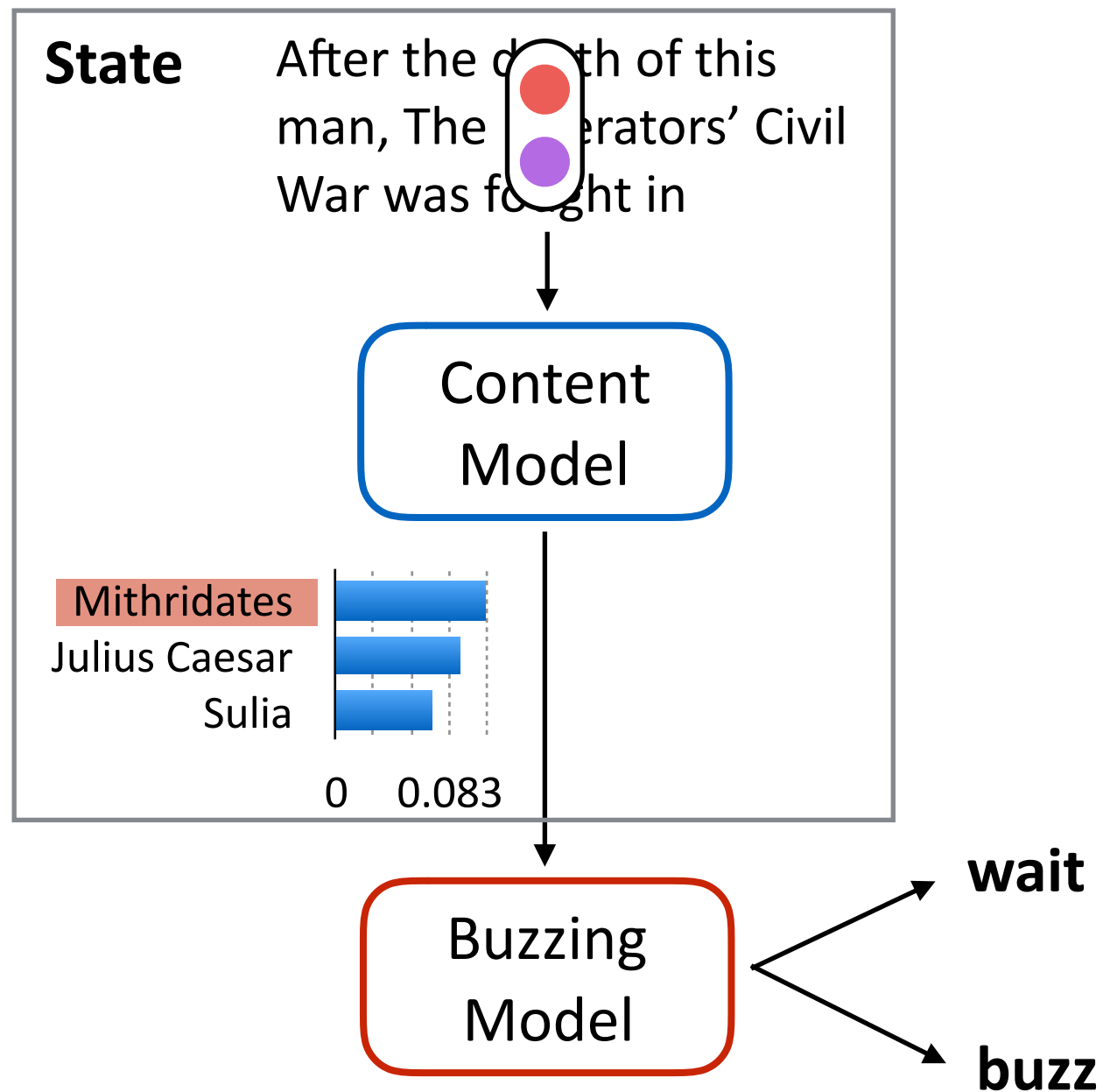
# Where does it fail

## Premature buzz

at its start , it skirts the selkirk mountains and sses throh the upper and lower arrow **Wait here is fine**ie , willamette and the sne are maor tributaries , and the grancoulee dam and the bonneville dam lie on it . FTP — **Better to buzz after the** ly known as the oregon rier , that forms th**opponent's mistake** nd oregon .

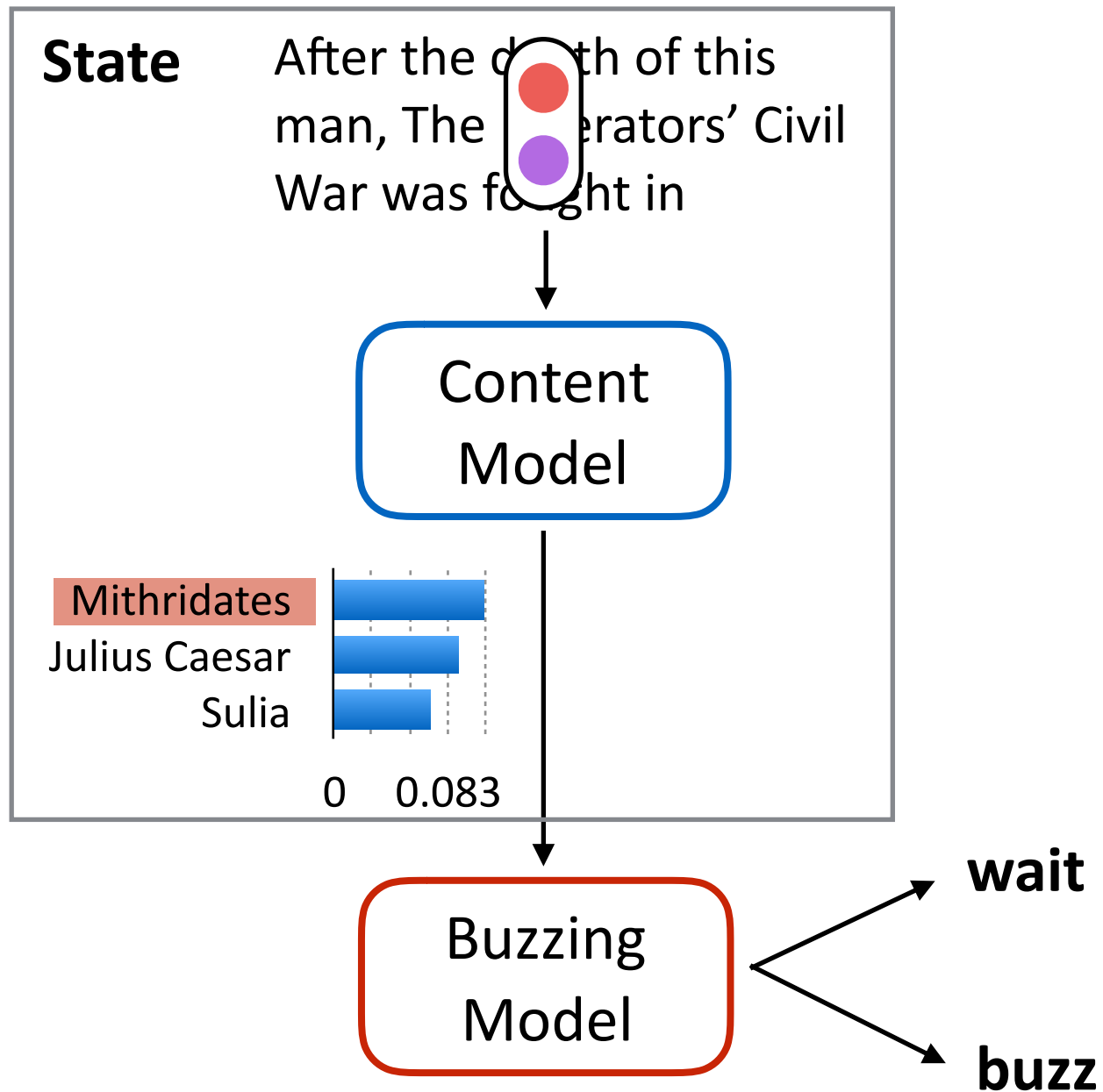
**The Result of an action depends on the opponent**

# (Deep) Reinforcement learning



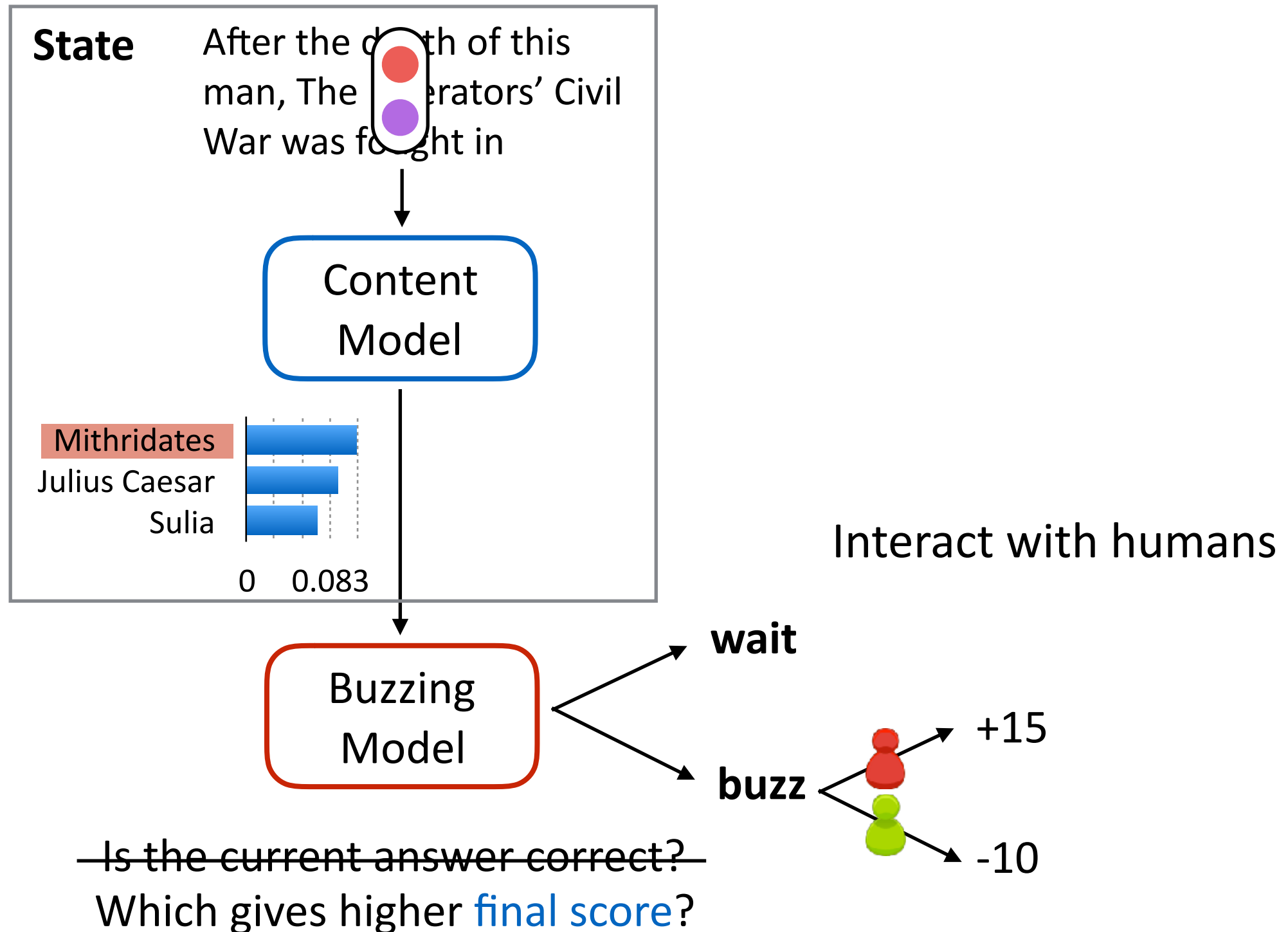
Is the current answer correct?

# (Deep) Reinforcement learning

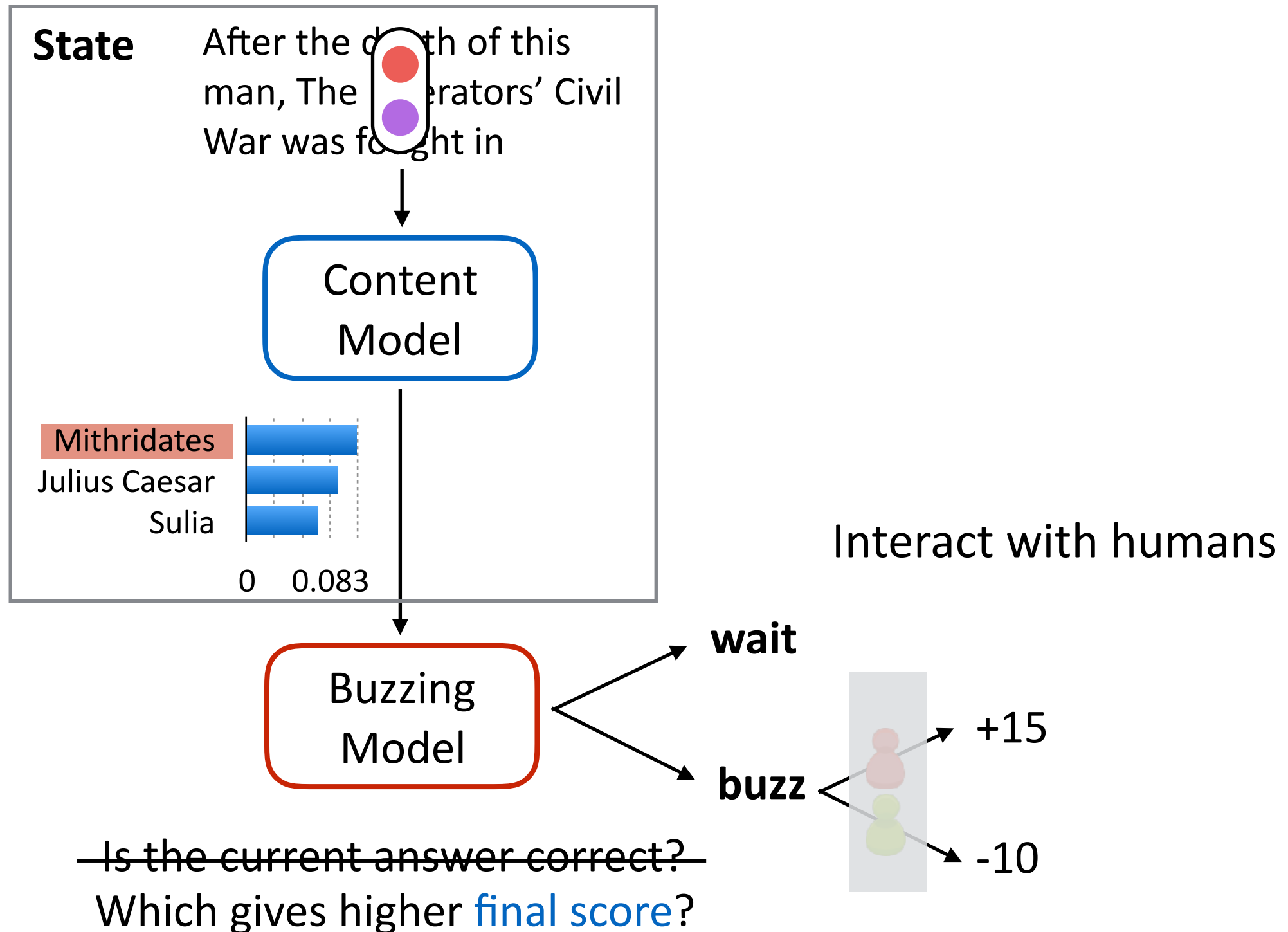


~~Is the current answer correct?~~  
Which gives higher **final score**?

# (Deep) Reinforcement learning

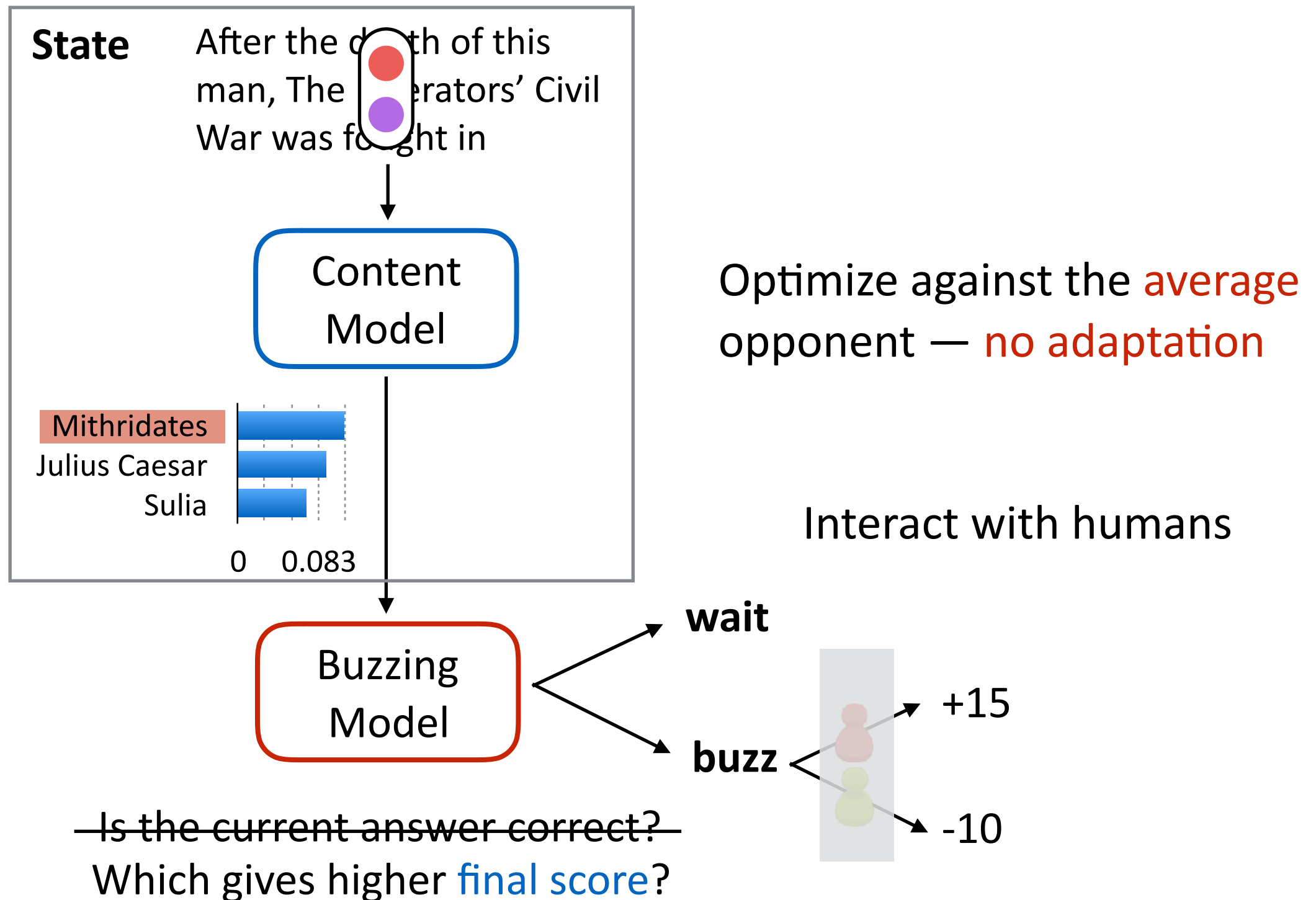


# (Deep) Reinforcement learning



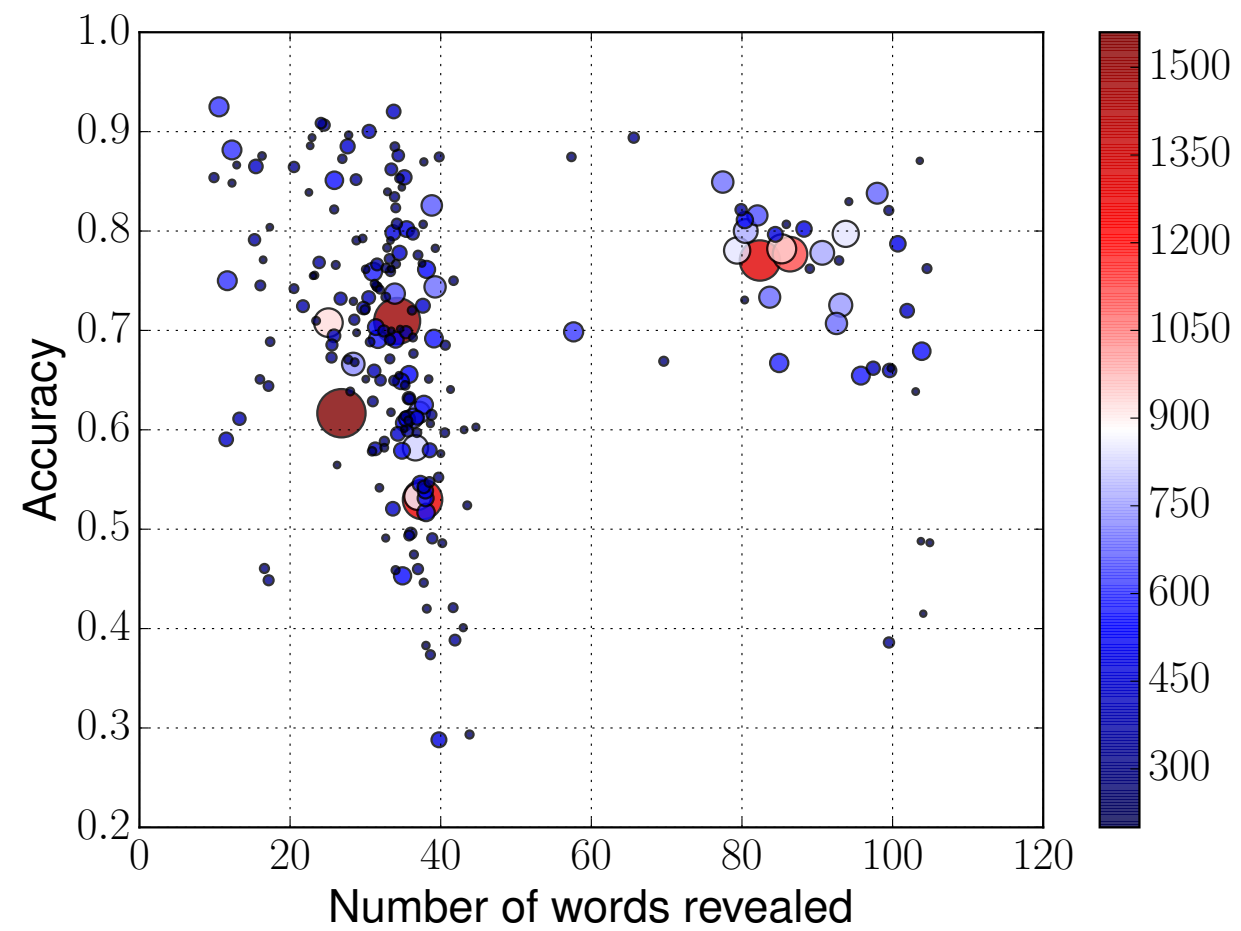


# (Deep) Reinforcement learning

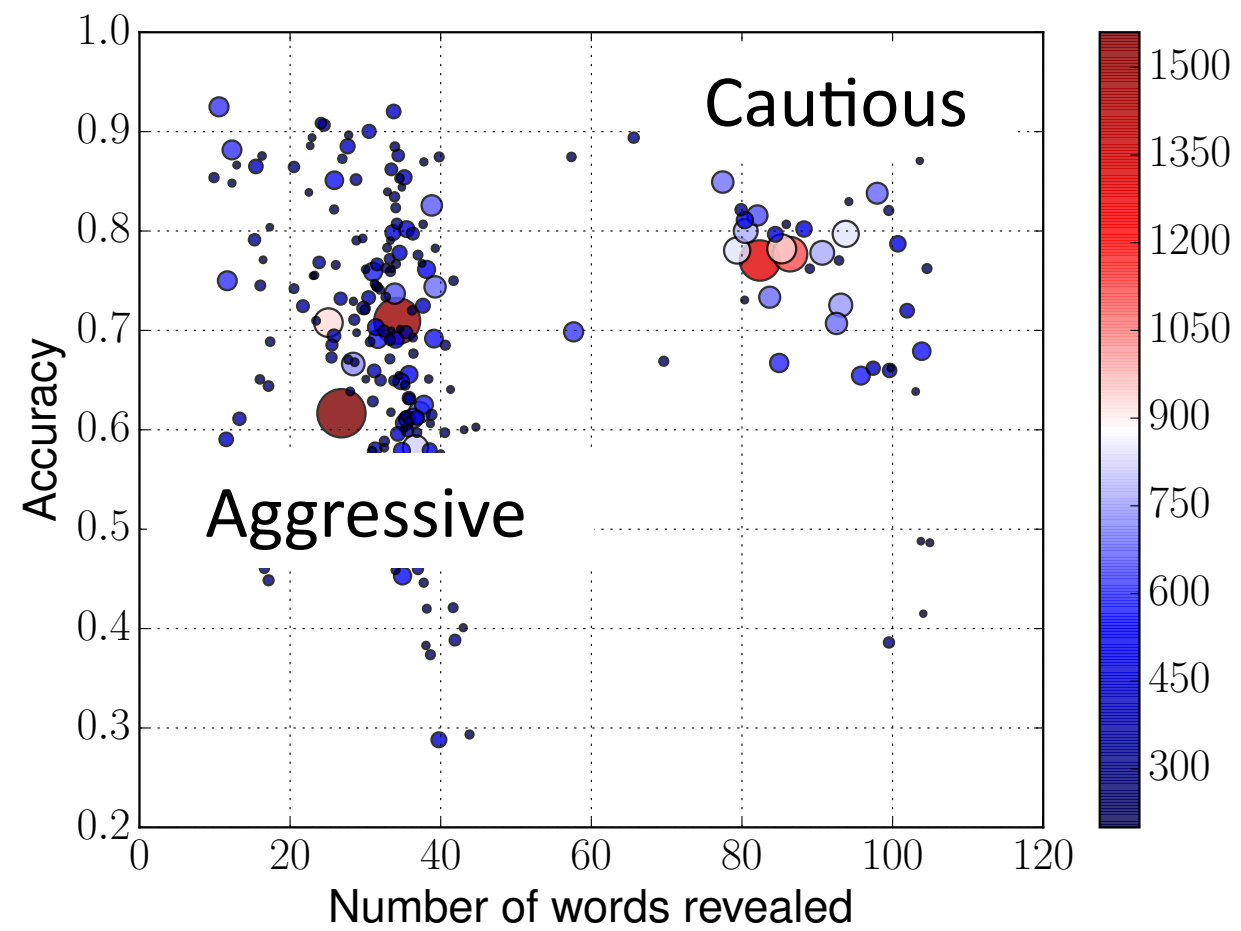


# Exploit the opponent

# Exploit the opponent



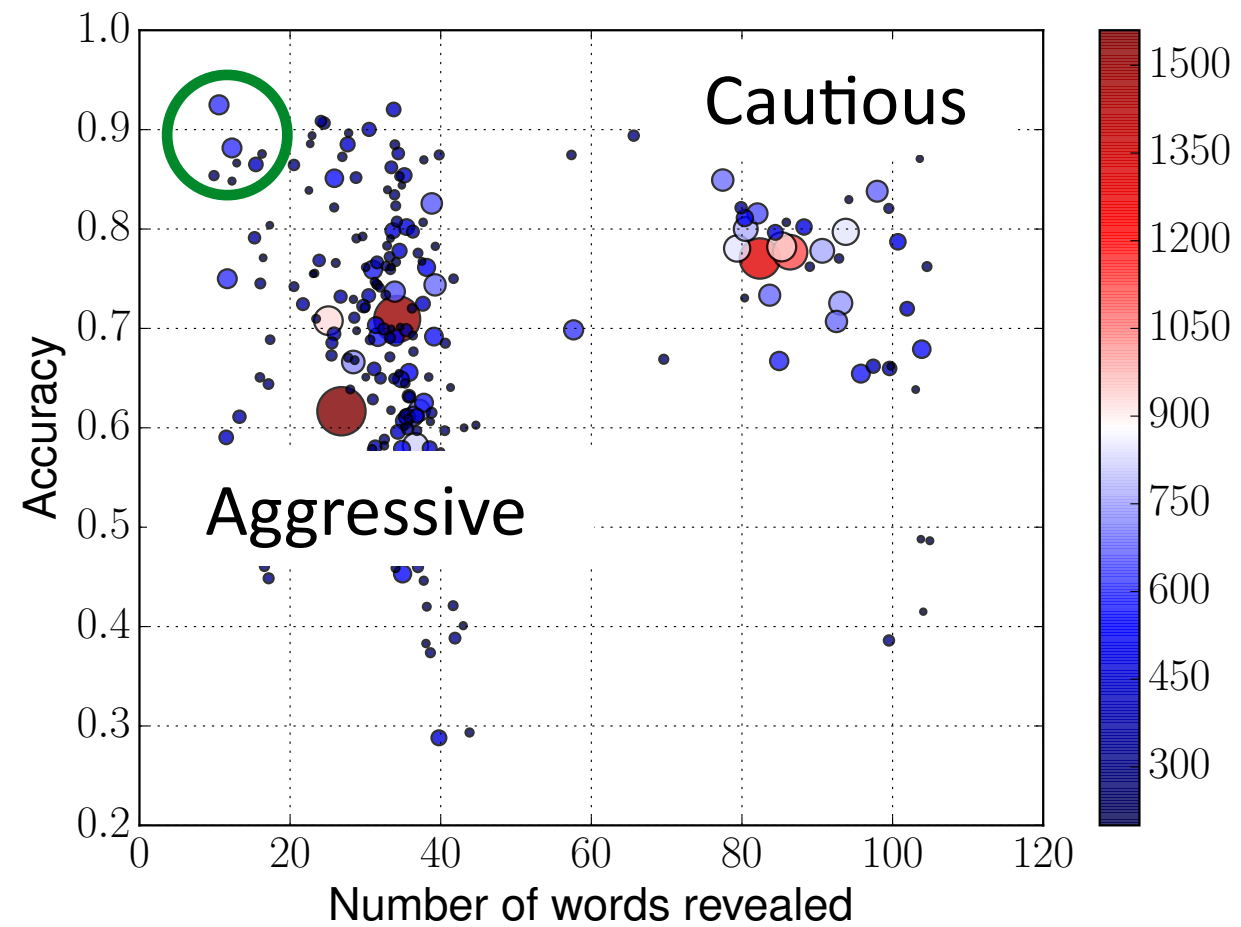
# Exploit the opponent



# Exploit the opponent



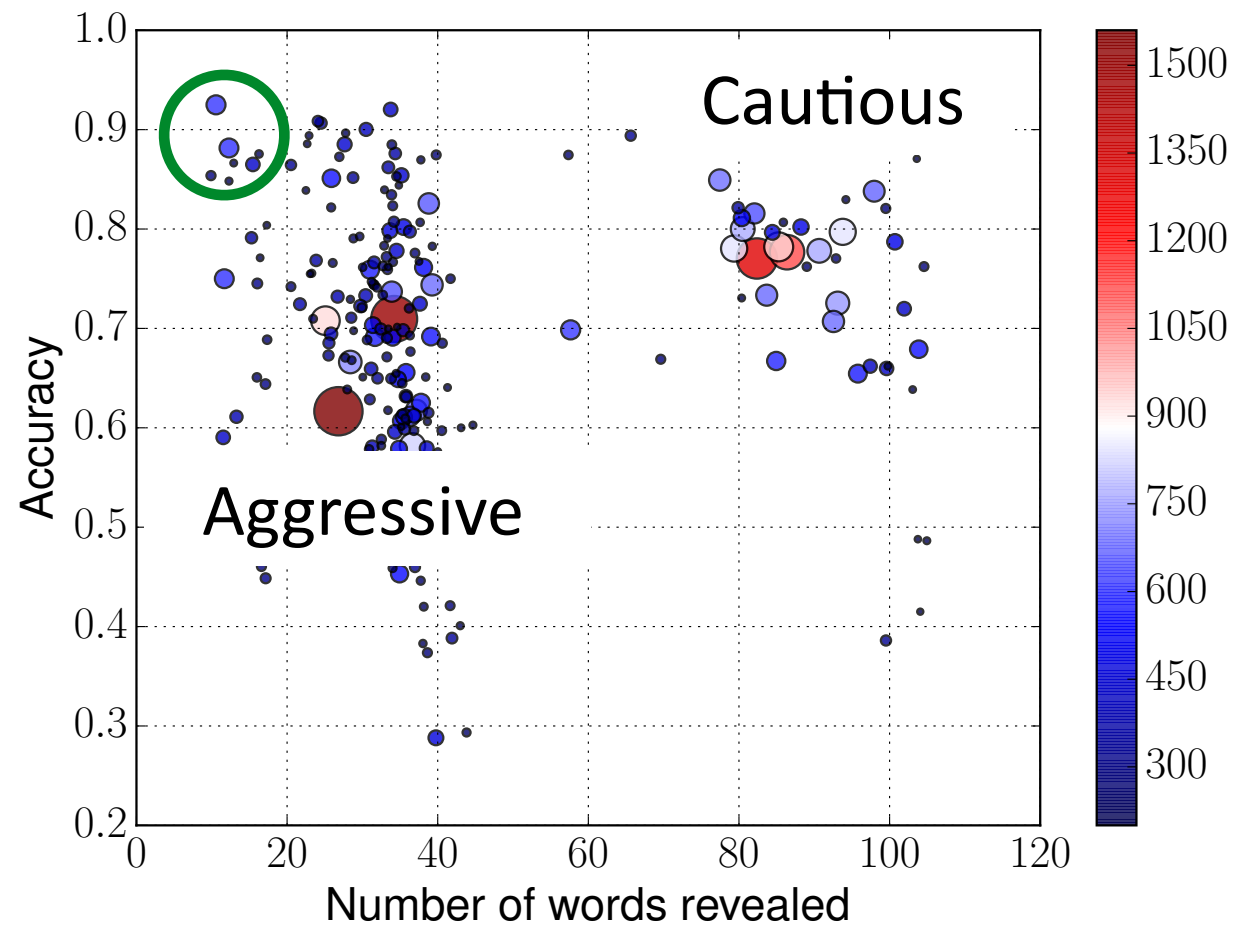
Fast and good



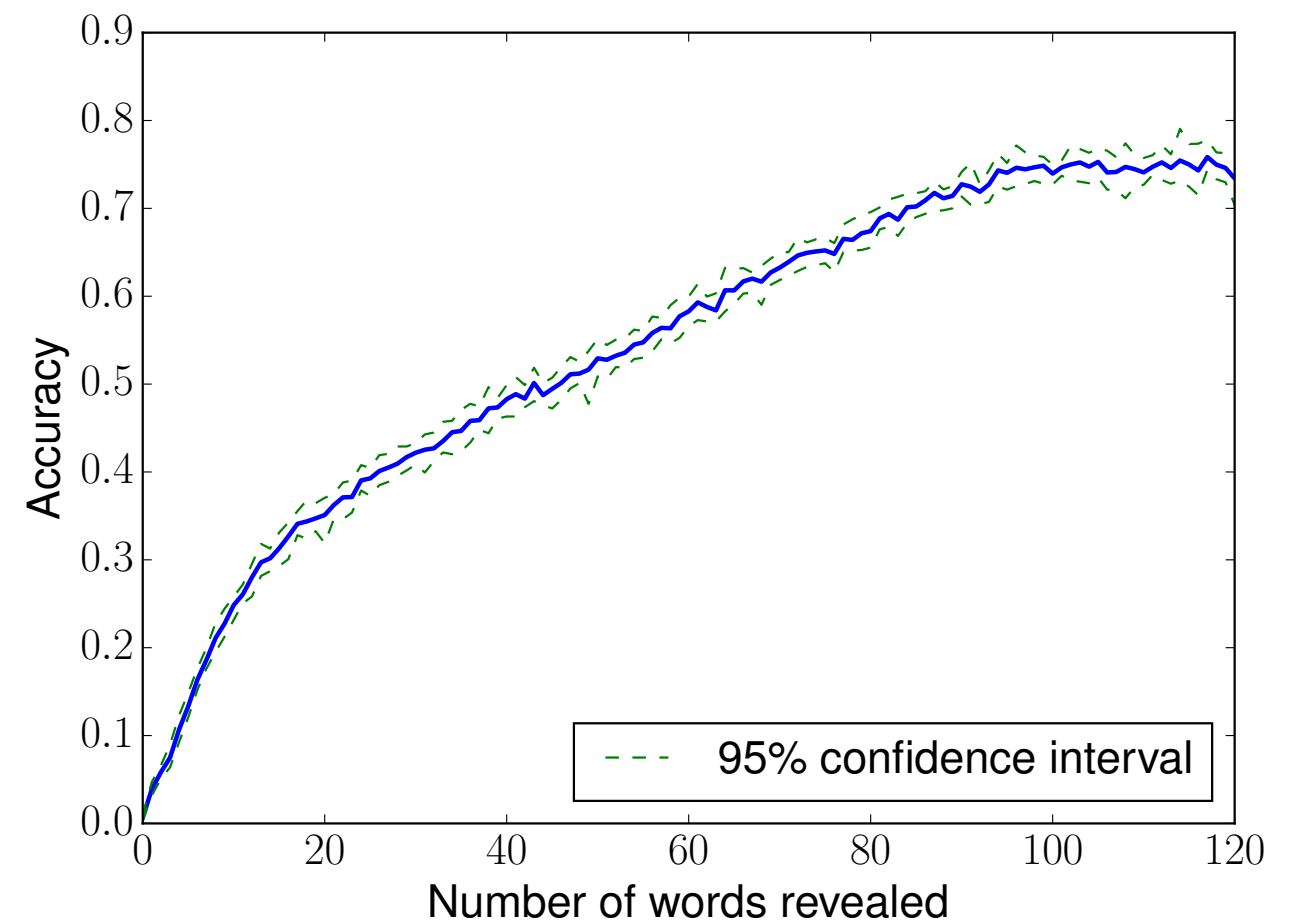
# Exploit the opponent



Fast and good



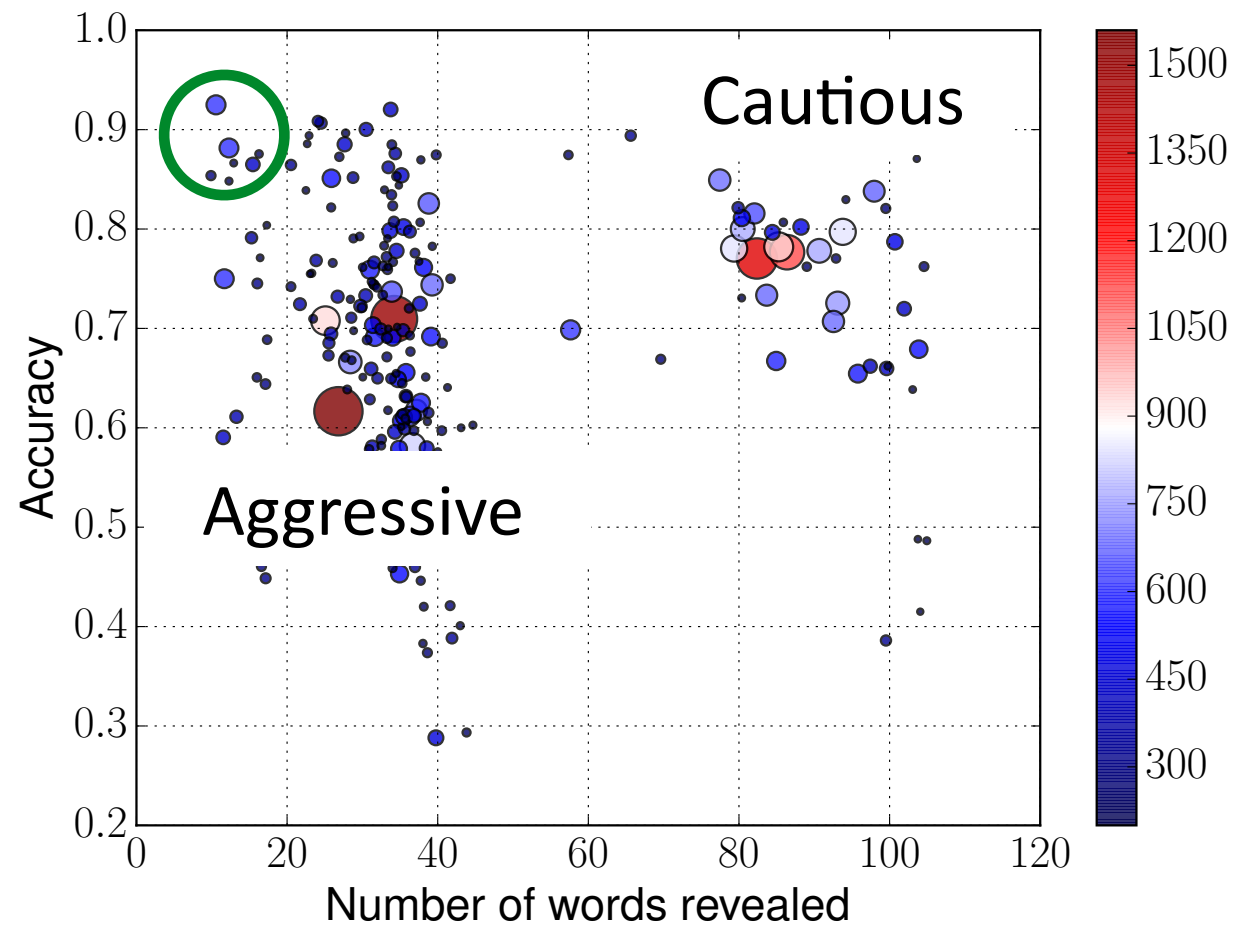
More words seen, higher accuracy



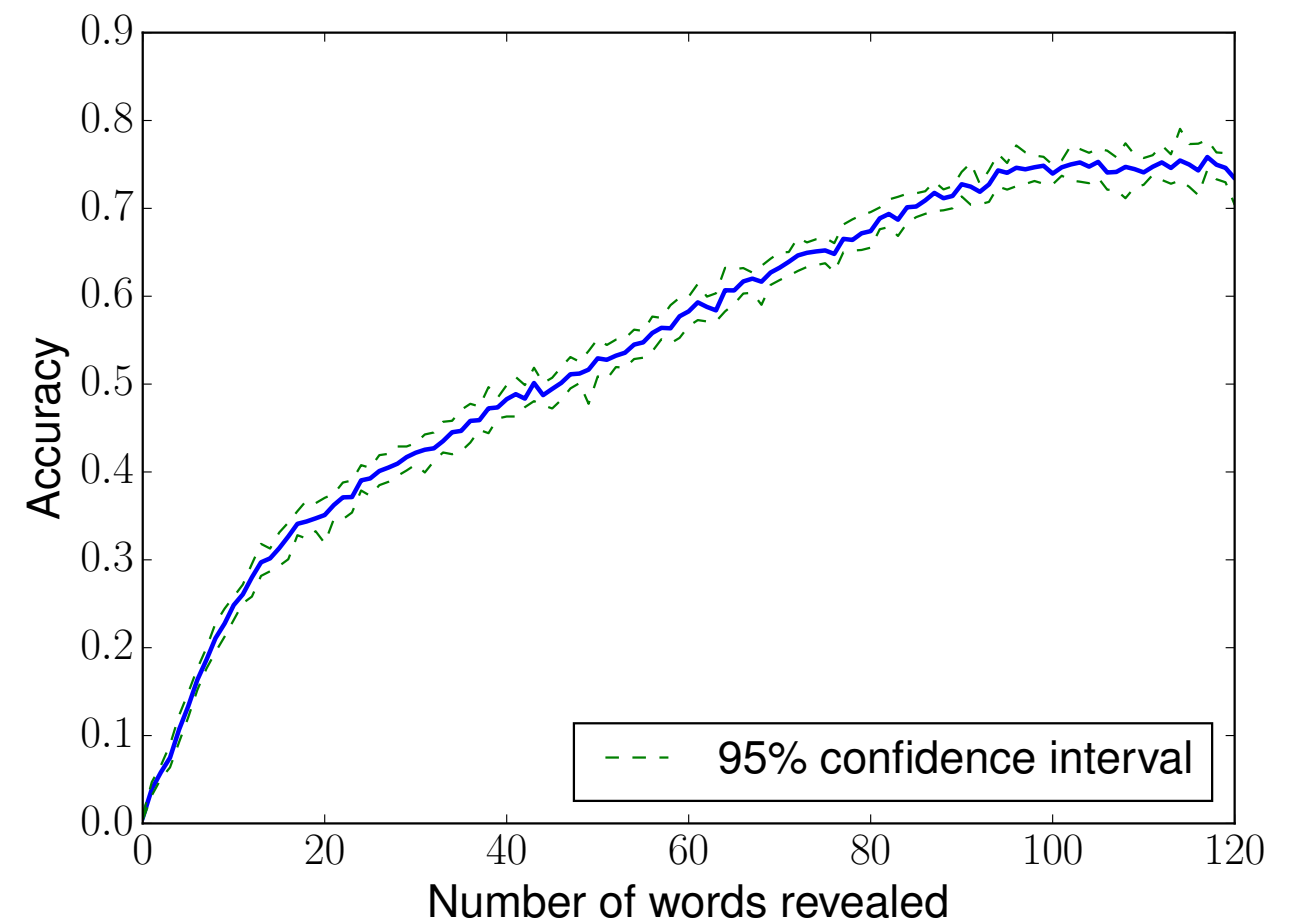
# Exploit the opponent



Fast and good



More words seen, higher accuracy



**Adapt the buzzing decision to different players**

# Deep reinforcement opponent network

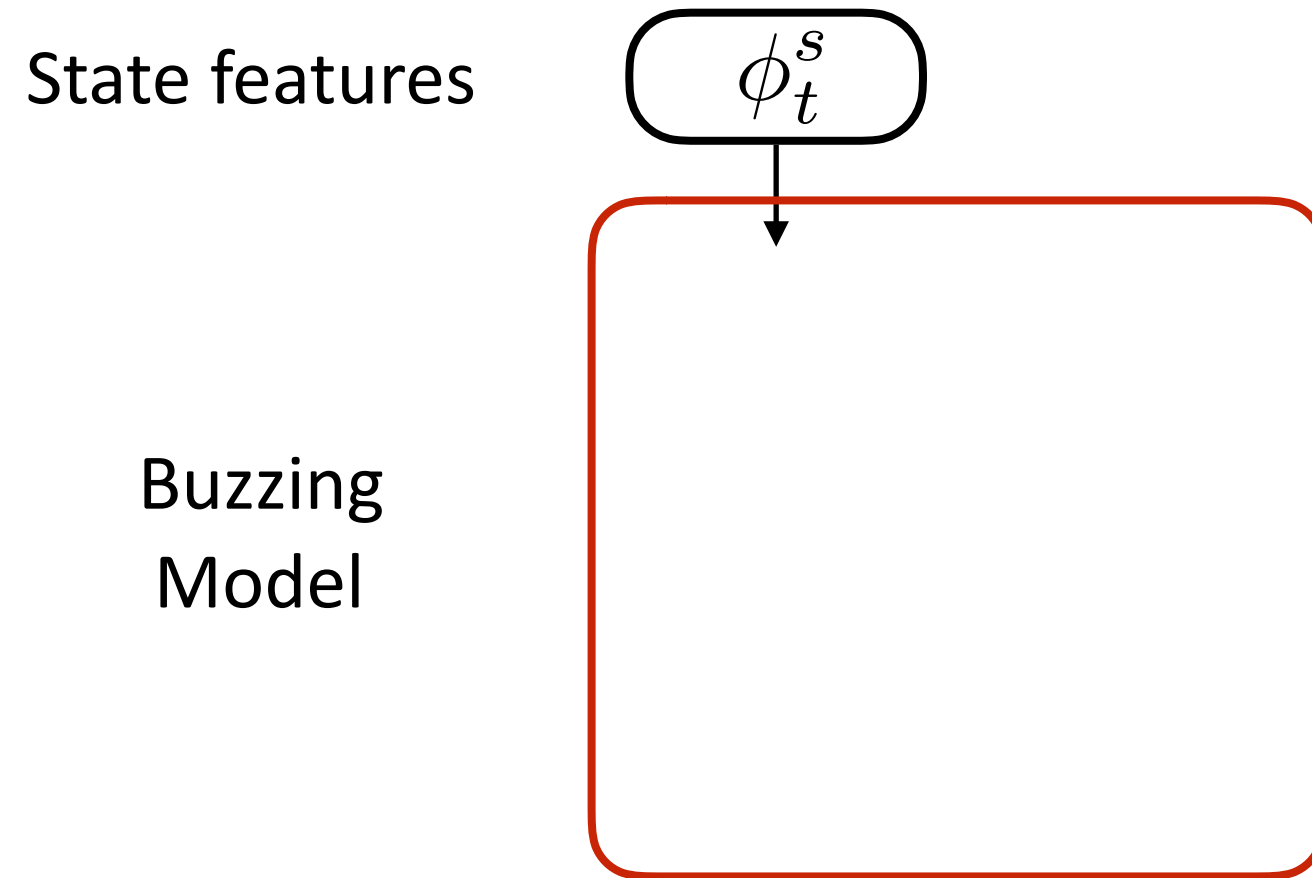


# Deep reinforcement opponent network

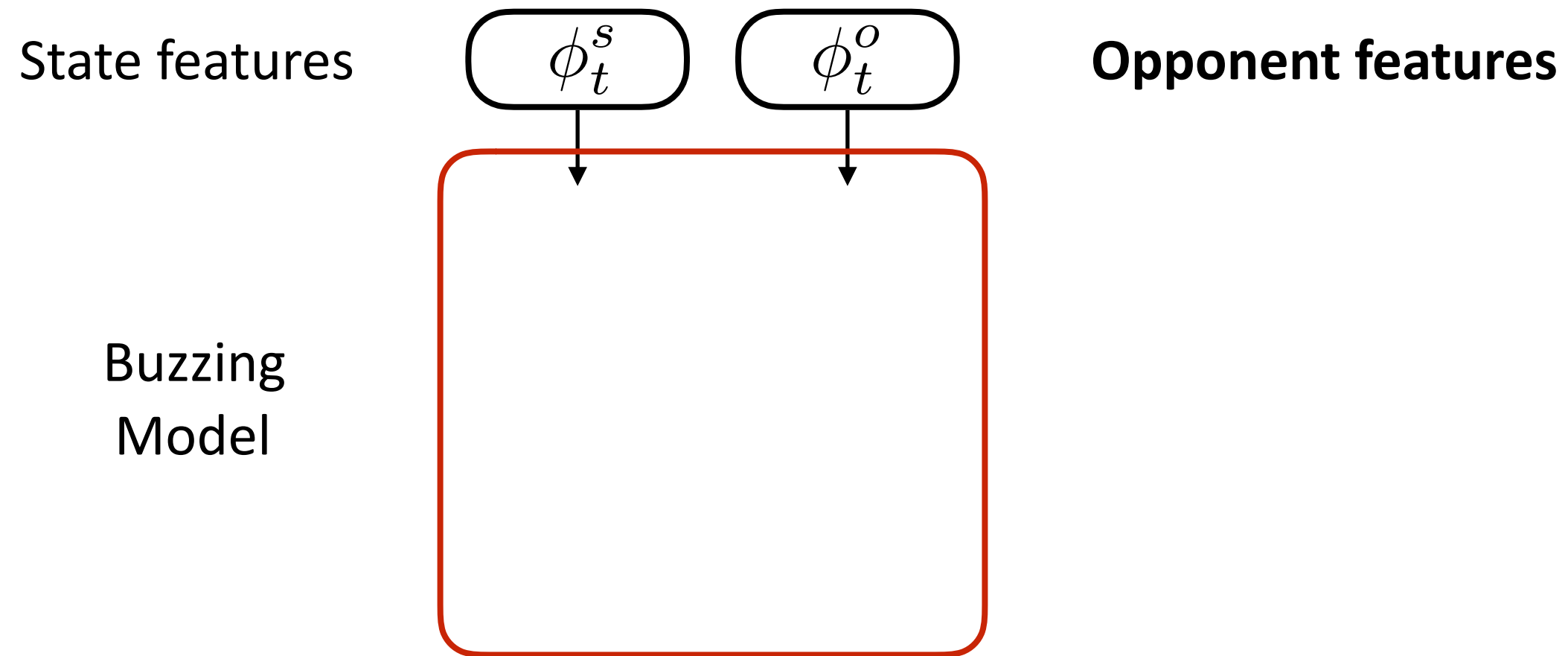
Buzzing  
Model



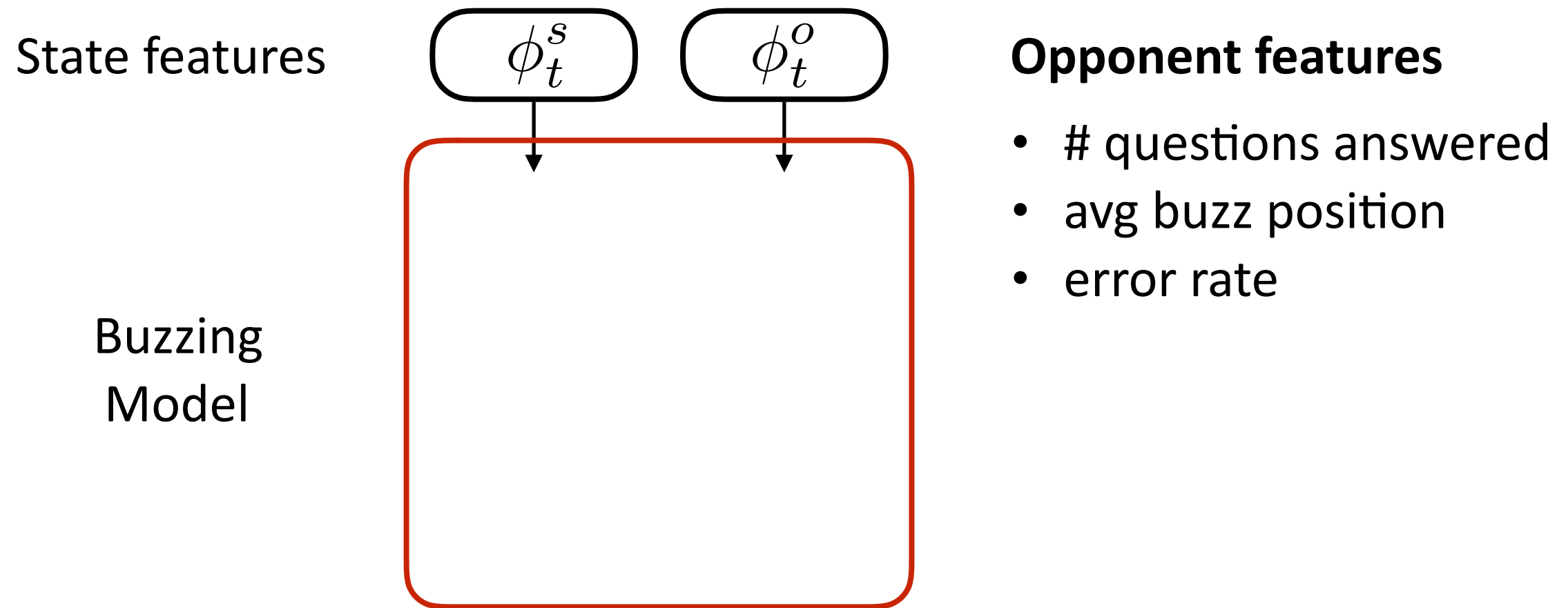
# Deep reinforcement opponent network



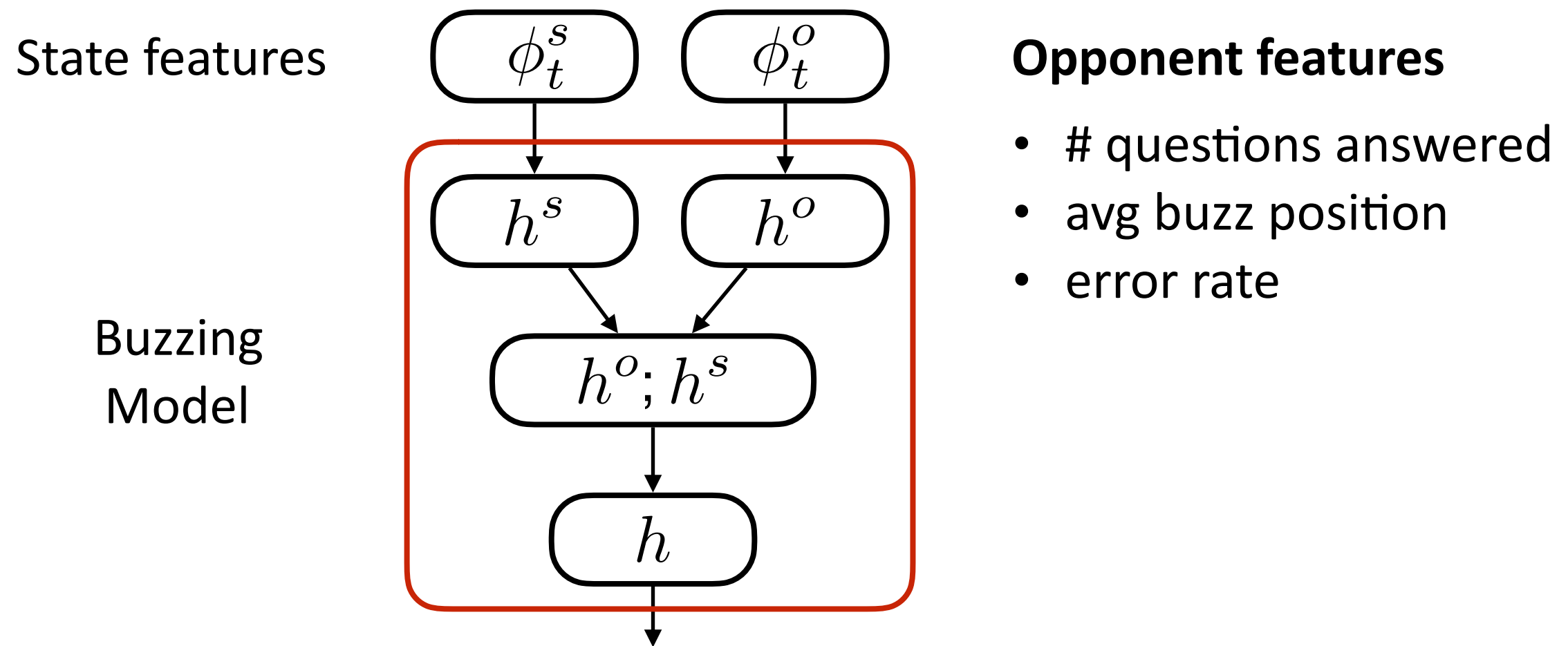
# Deep reinforcement opponent network



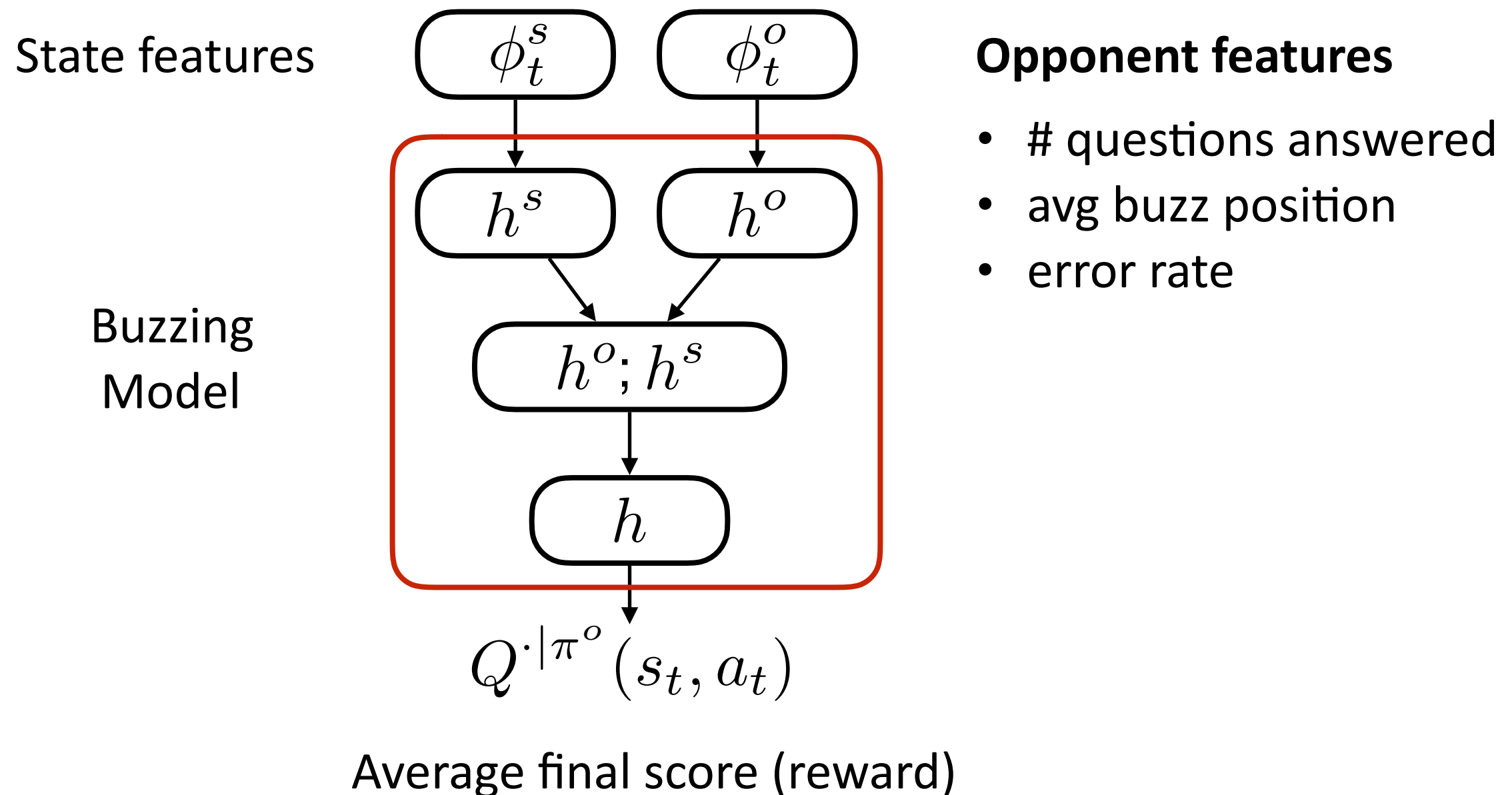
# Deep reinforcement opponent network



# Deep reinforcement opponent network

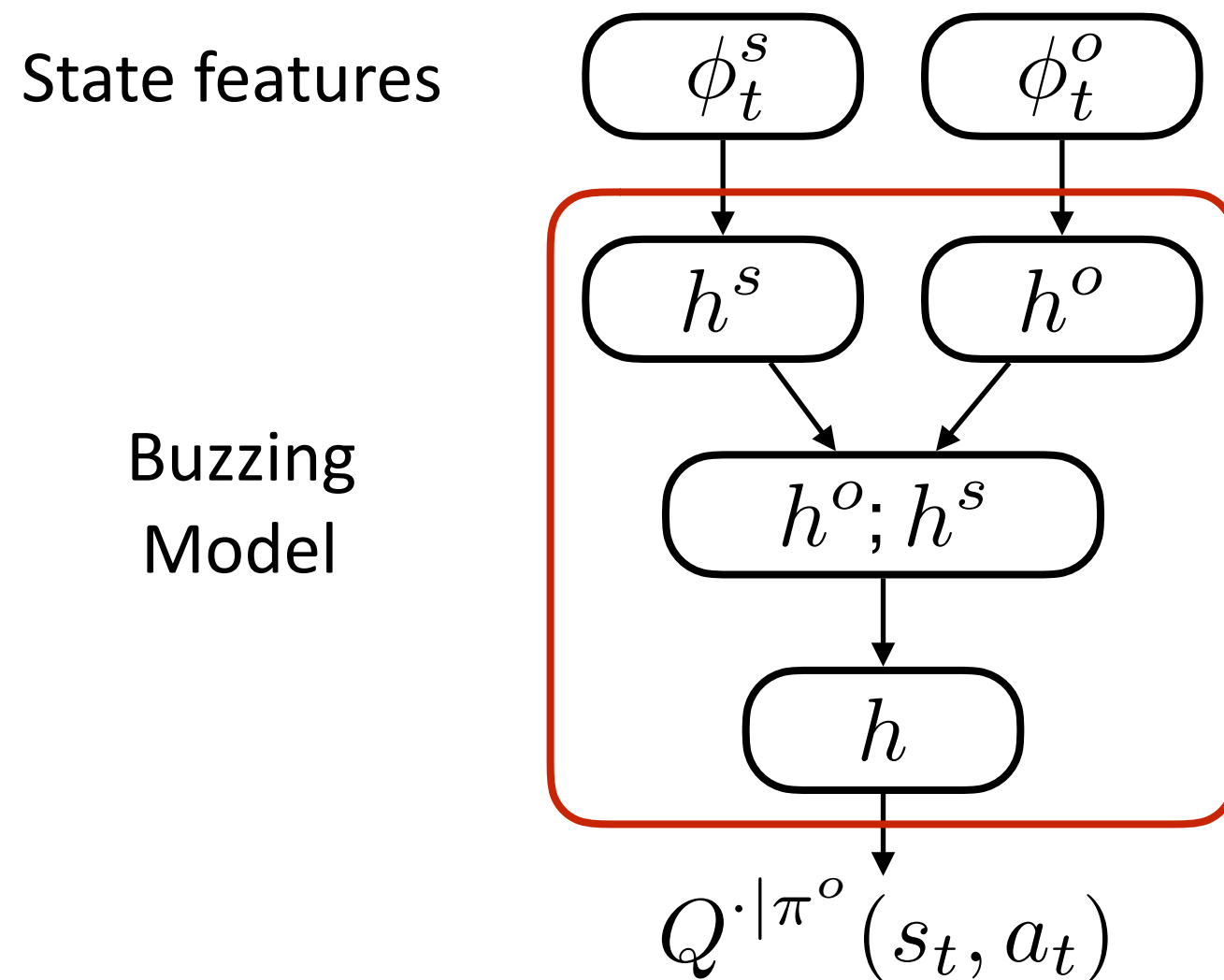


# Deep reinforcement opponent network



# Deep reinforcement opponent network

## DRON-concat



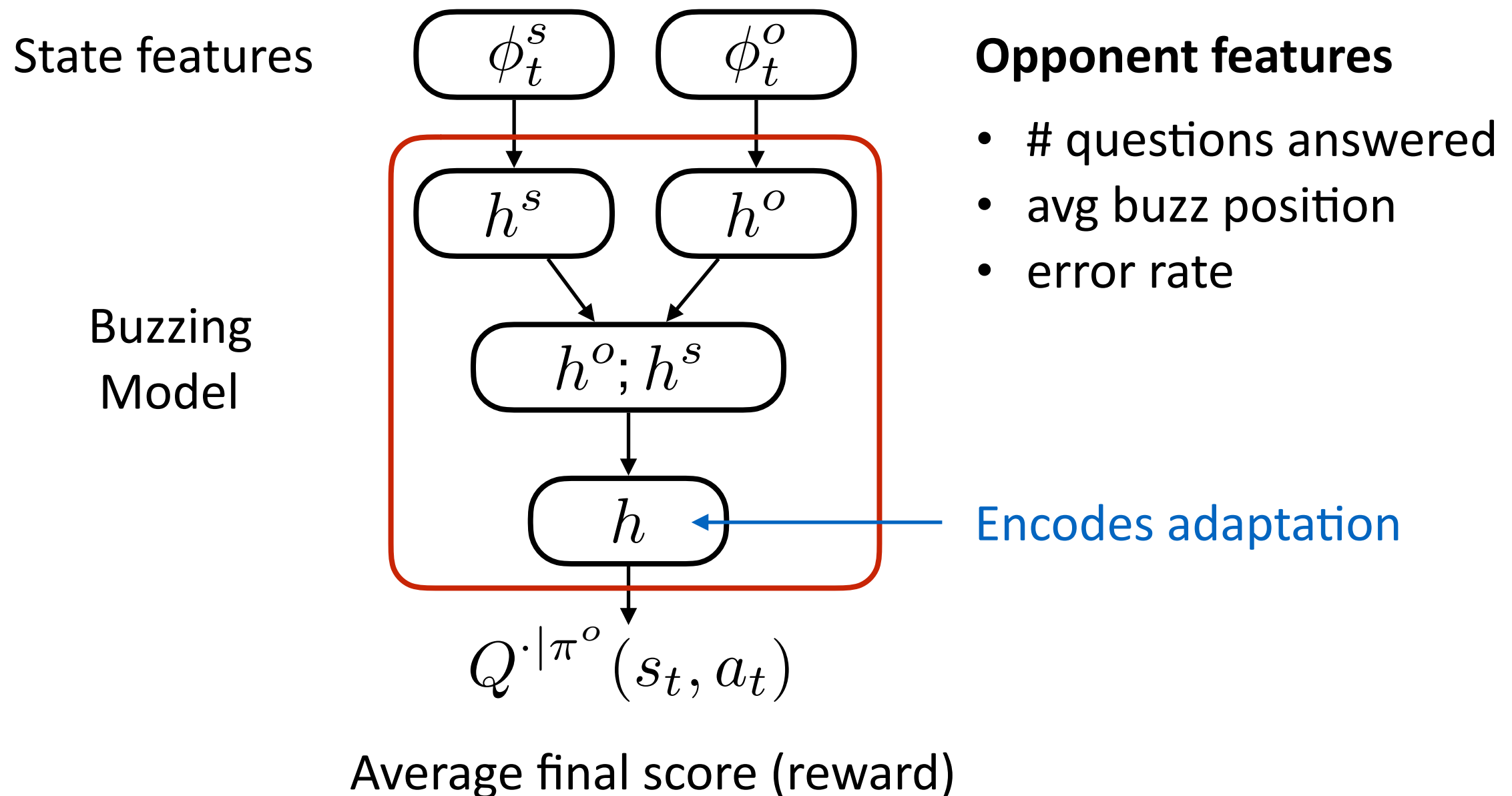
## Opponent features

- # questions answered
- avg buzz position
- error rate

Average final score (reward)

# Deep reinforcement opponent network

## DRON-concat





# Deep reinforcement opponent network

# Deep reinforcement opponent network

$$Q(s, a) = \sum_o Prob(o|s)Q(s, a, o) \quad (s: \text{state} \quad a: \text{action} \quad o: \text{opponent action})$$

# Deep reinforcement opponent network

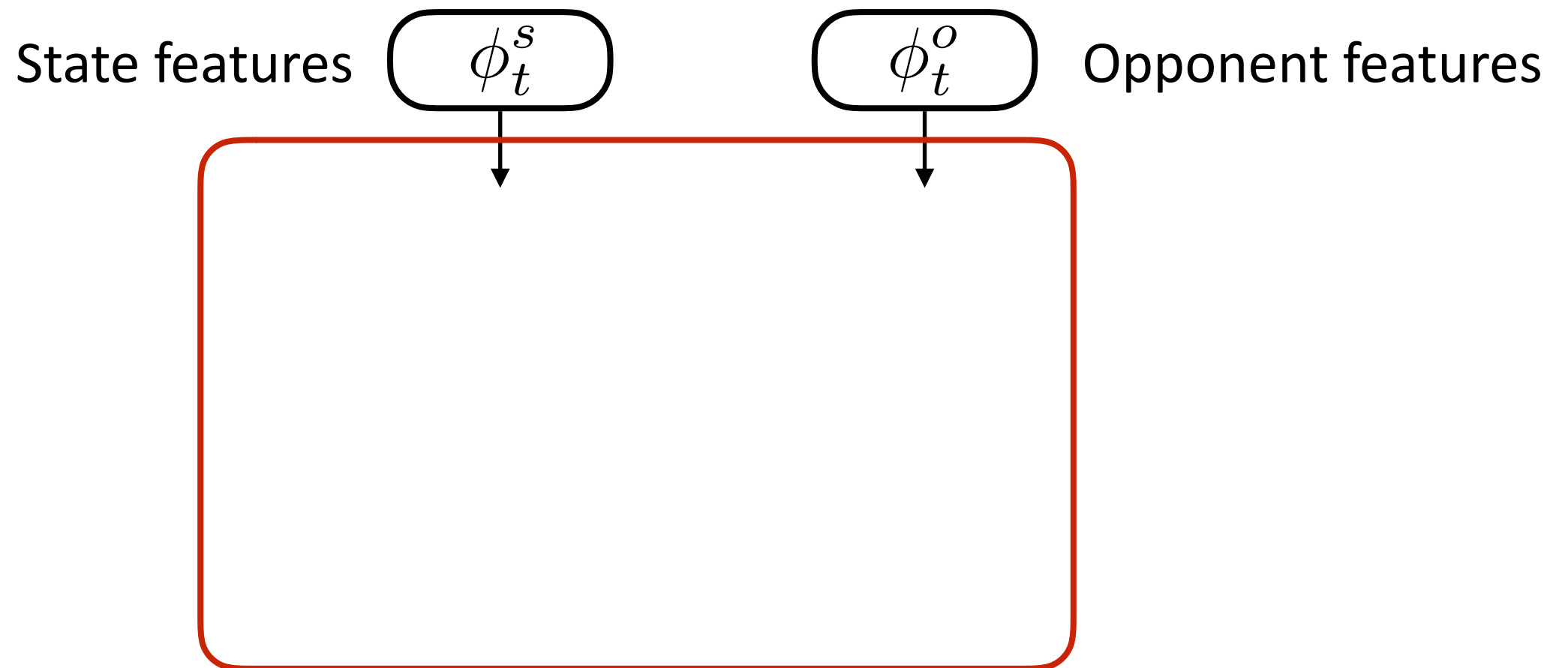
## **DRON-MoE** (Mixture of Experts)

$$Q(s, a) = \sum_o Prob(o|s) Q(s, a, o) \quad (s: \text{state} \quad a: \text{action} \quad o: \text{opponent action})$$

# Deep reinforcement opponent network

## DRON-MoE (Mixture of Experts)

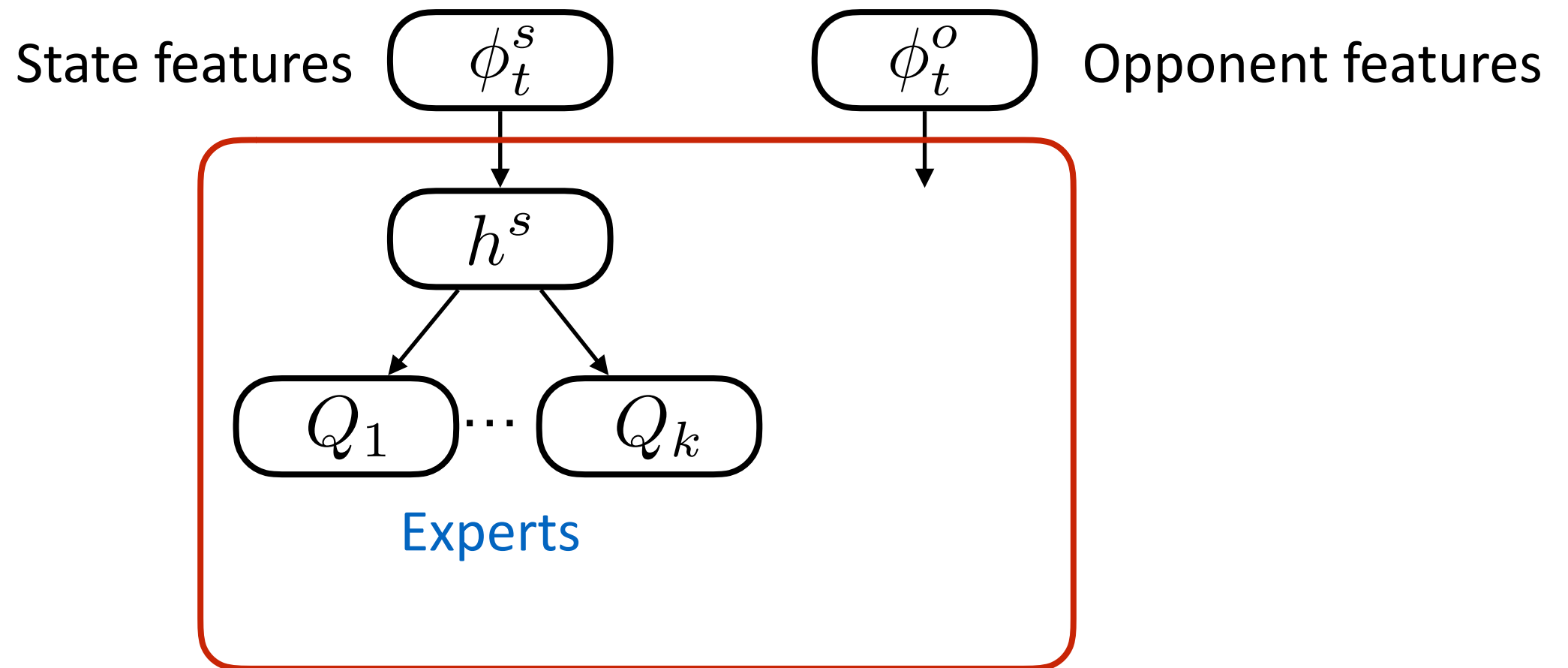
$$Q(s, a) = \sum_o Prob(o|s) Q(s, a, o) \quad (s: \text{state} \quad a: \text{action} \quad o: \text{opponent action})$$



# Deep reinforcement opponent network

## DRON-MoE (Mixture of Experts)

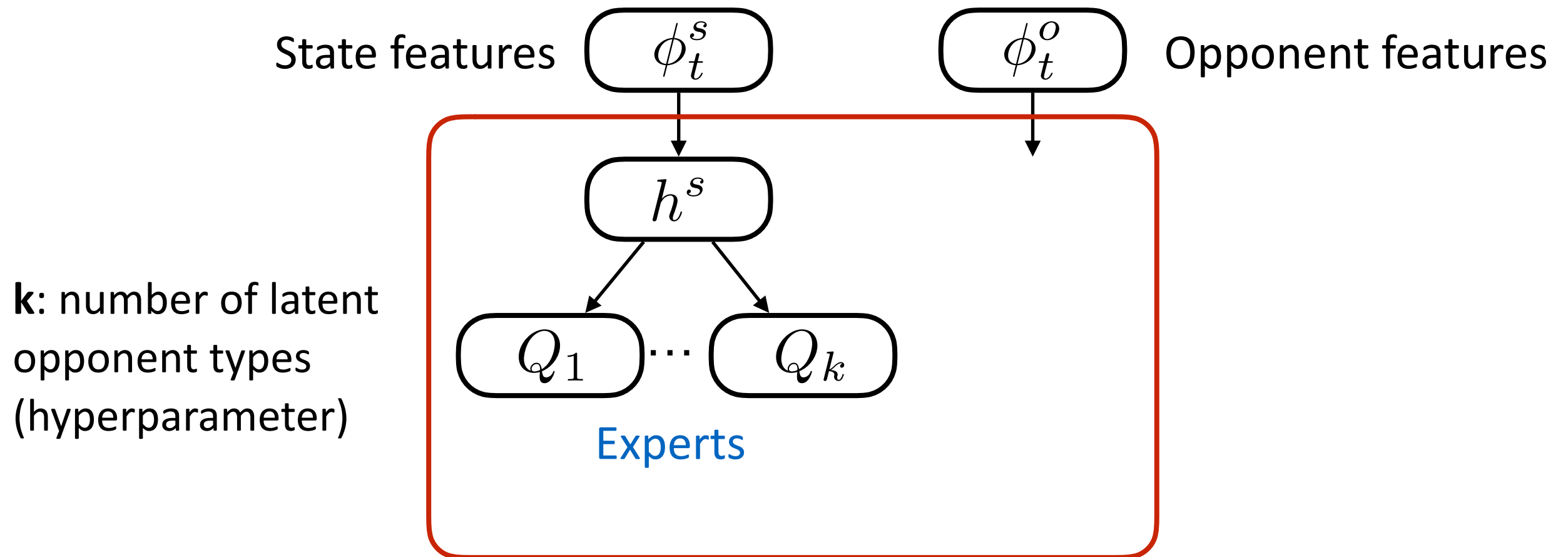
$$Q(s, a) = \sum_o Prob(o|s) Q(s, a, o) \quad (s: \text{state} \quad a: \text{action} \quad o: \text{opponent action})$$



# Deep reinforcement opponent network

## DRON-MoE (Mixture of Experts)

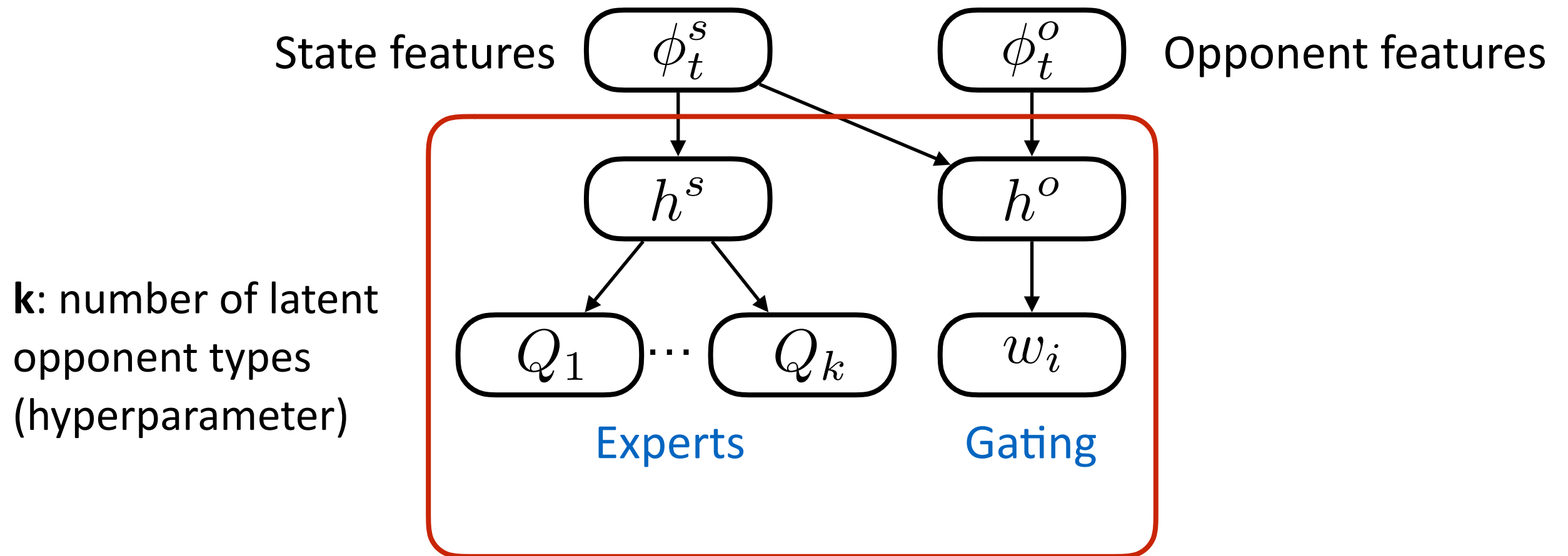
$$Q(s, a) = \sum_o Prob(o|s) Q(s, a, o) \quad (s: \text{state} \quad a: \text{action} \quad o: \text{opponent action})$$



# Deep reinforcement opponent network

## DRON-MoE (Mixture of Experts)

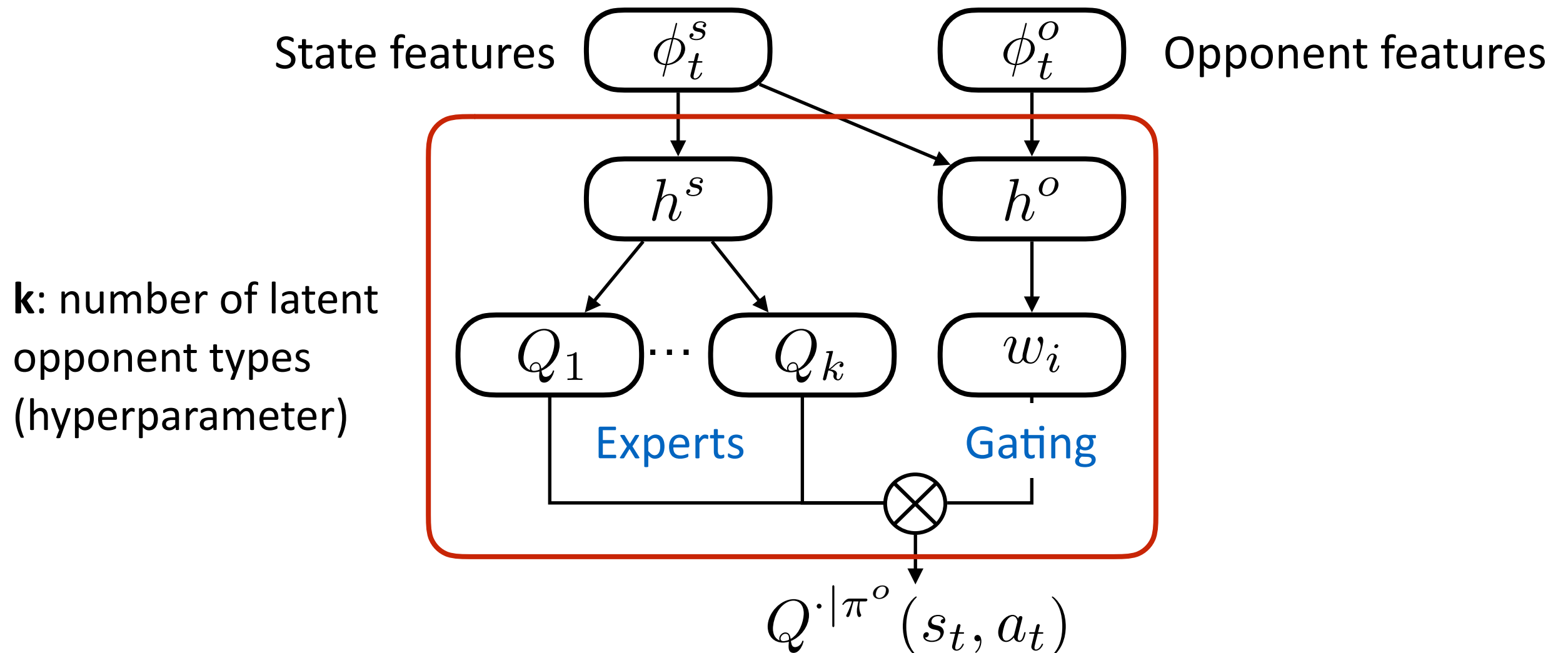
$$Q(s, a) = \sum_o Prob(o|s) Q(s, a, o) \quad (s: \text{state} \quad a: \text{action} \quad o: \text{opponent action})$$



# Deep reinforcement opponent network

## DRON-MoE (Mixture of Experts)

$$Q(s, a) = \sum_o Prob(o|s) Q(s, a, o) \quad (s: \text{state } a: \text{action } o: \text{opponent action})$$

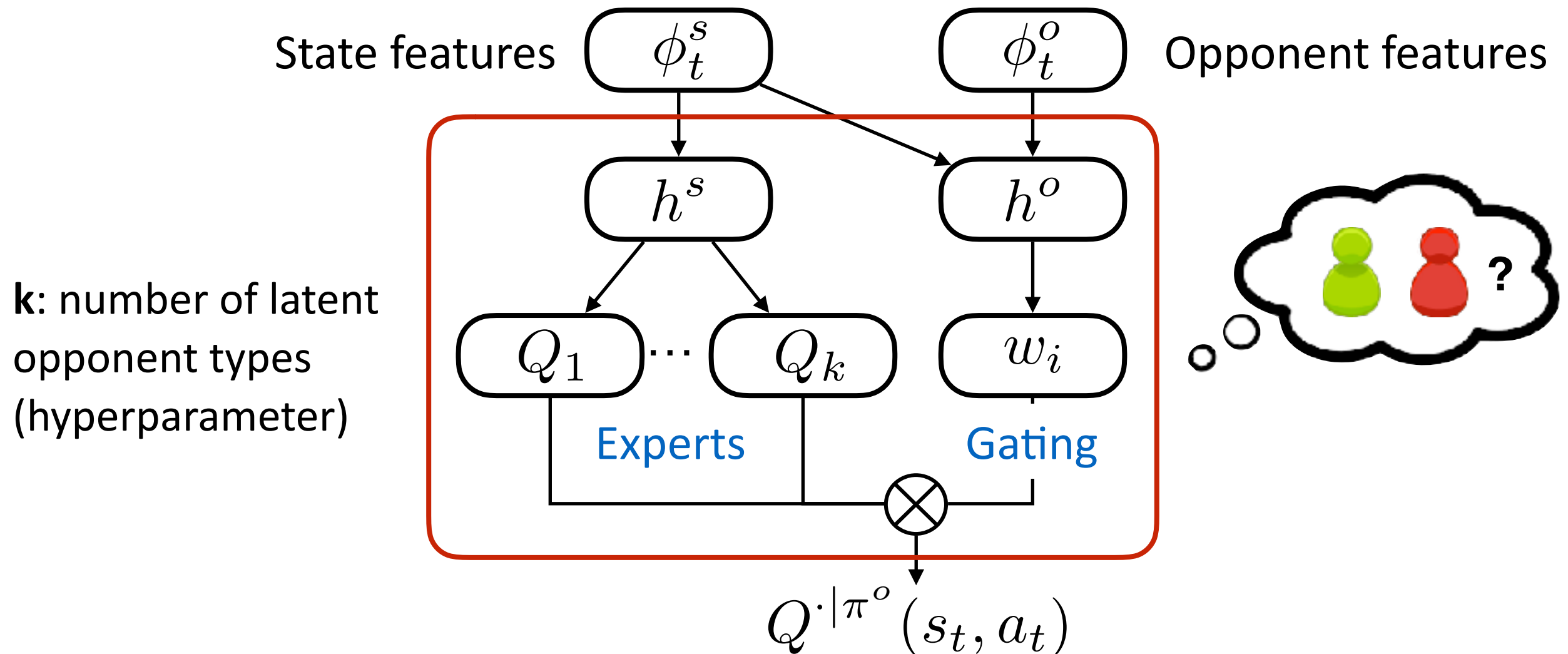




# Deep reinforcement opponent network

## DRON-MoE (Mixture of Experts)

$$Q(s, a) = \sum_o Prob(o|s) Q(s, a, o) \quad (s: \text{state} \quad a: \text{action} \quad o: \text{opponent action})$$



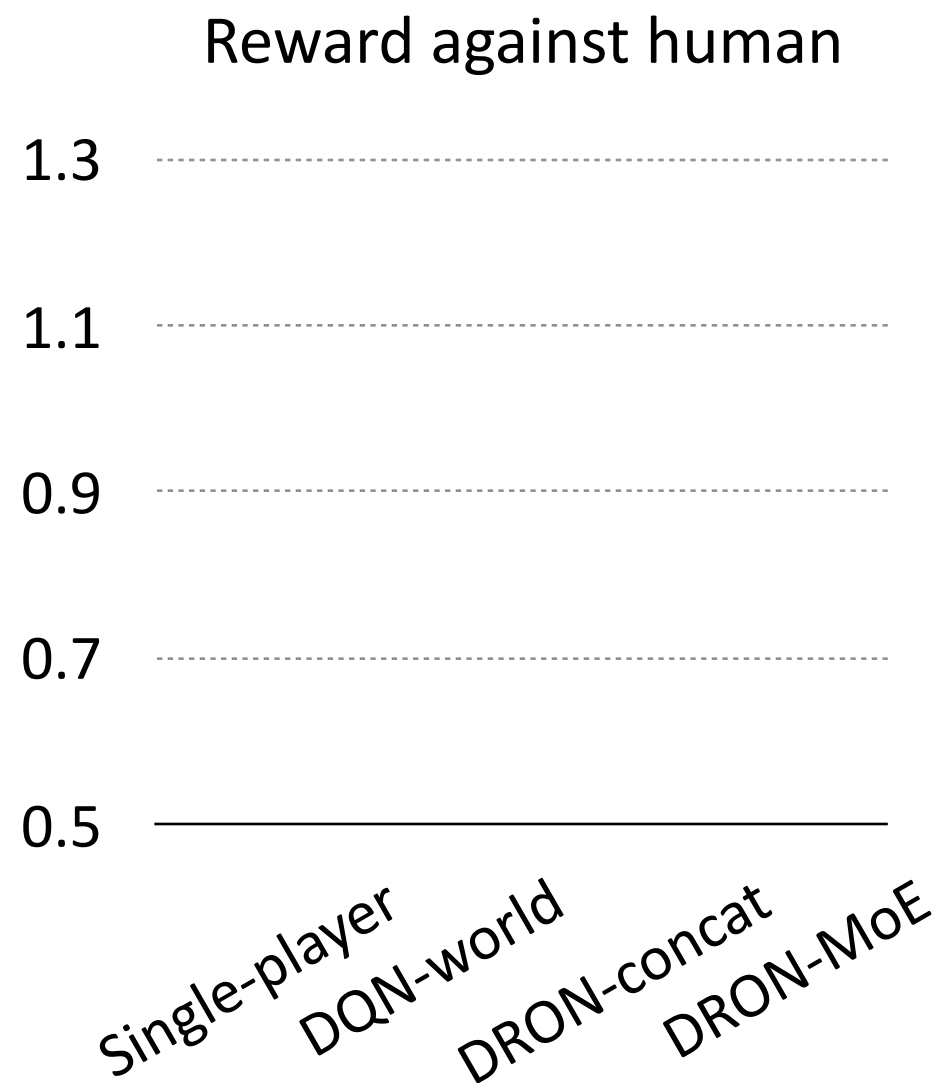
# Experiments

# Experiments

- 3610 users, 37.7K questions
- Offline training with human data

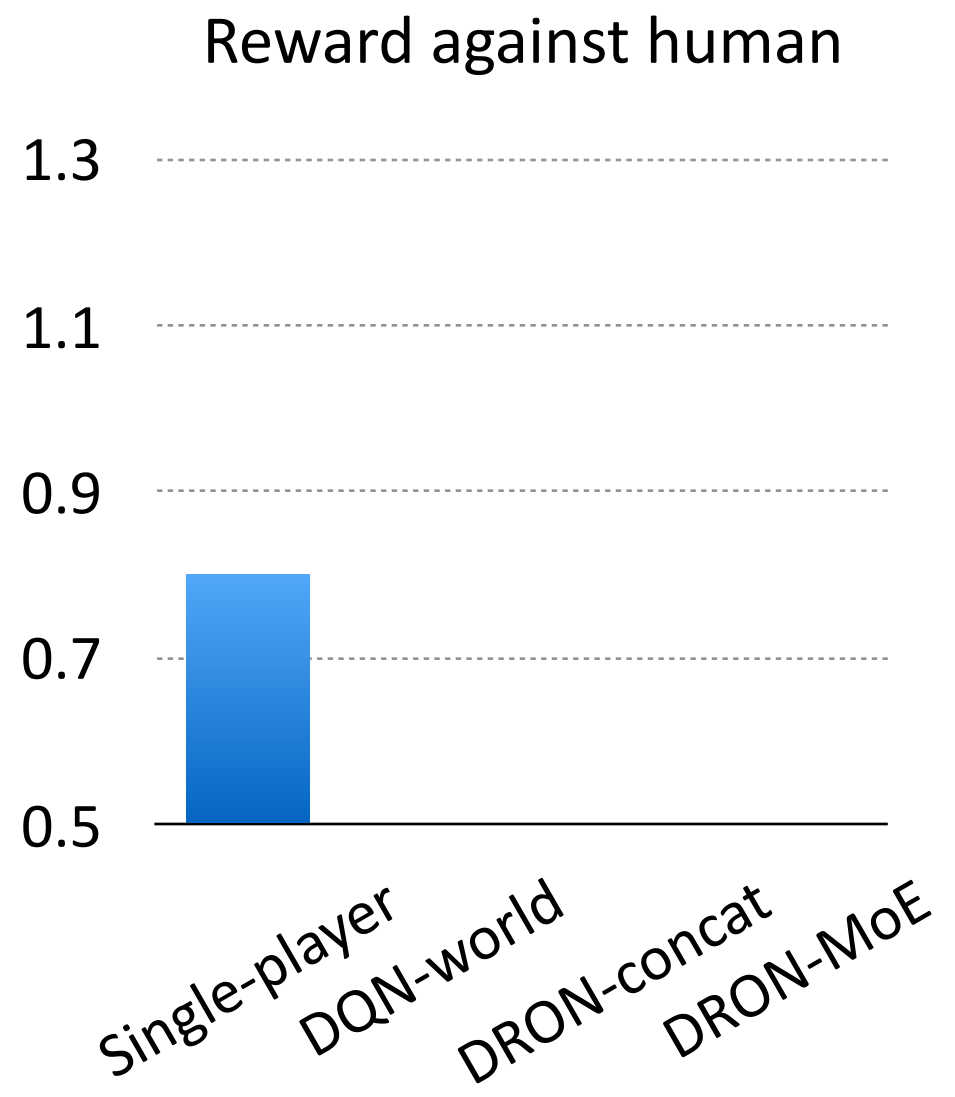
# Experiments

- 3610 users, 37.7K questions
- Offline training with human data



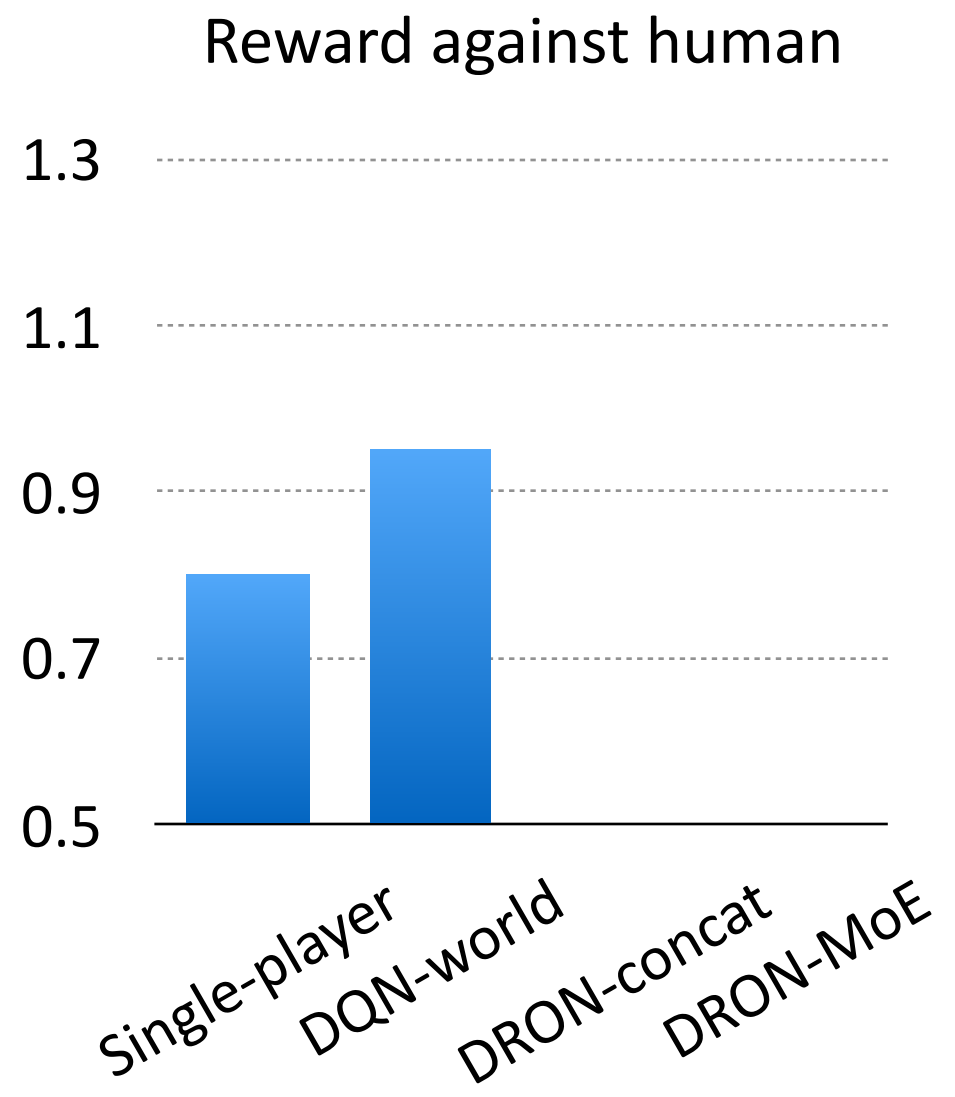
# Experiments

- 3610 users, 37.7K questions
- Offline training with human data



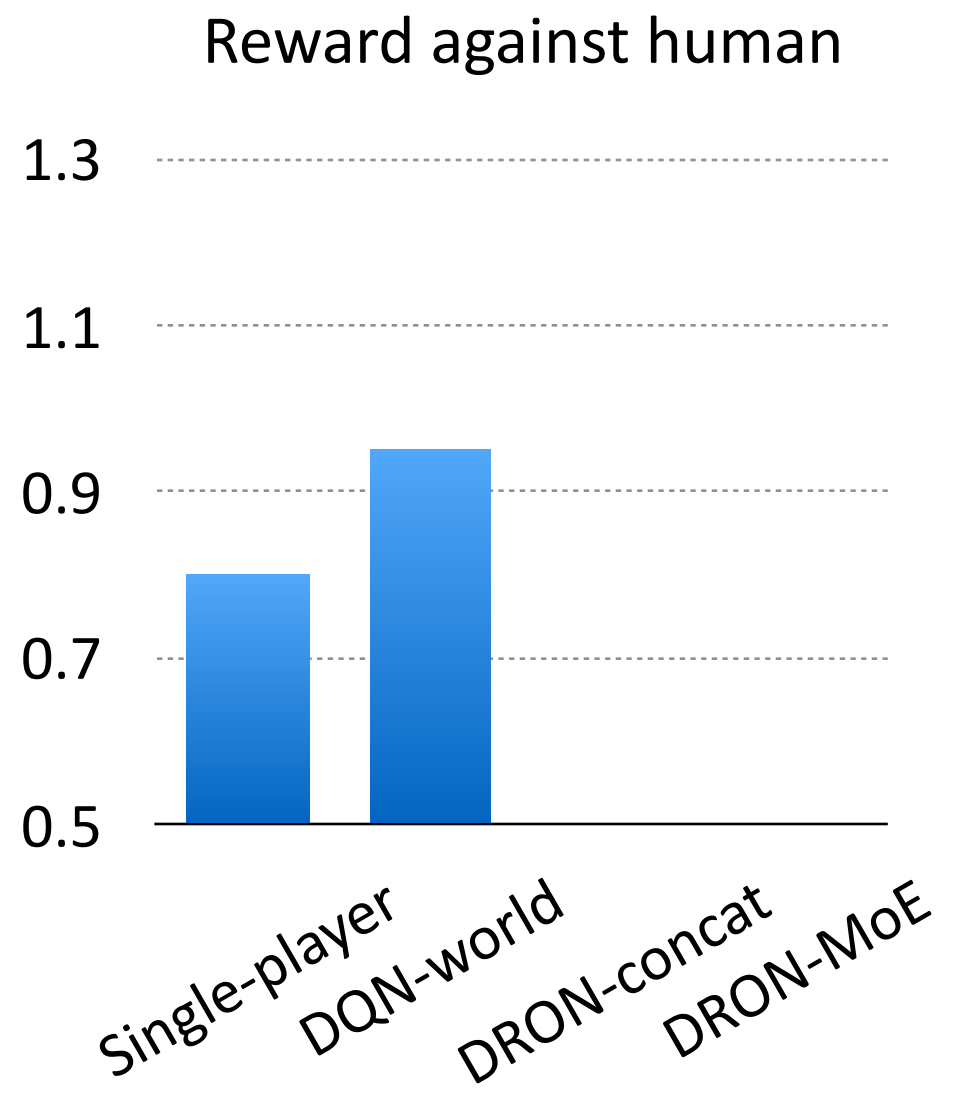
# Experiments

- 3610 users, 37.7K questions
- Offline training with human data



# Experiments

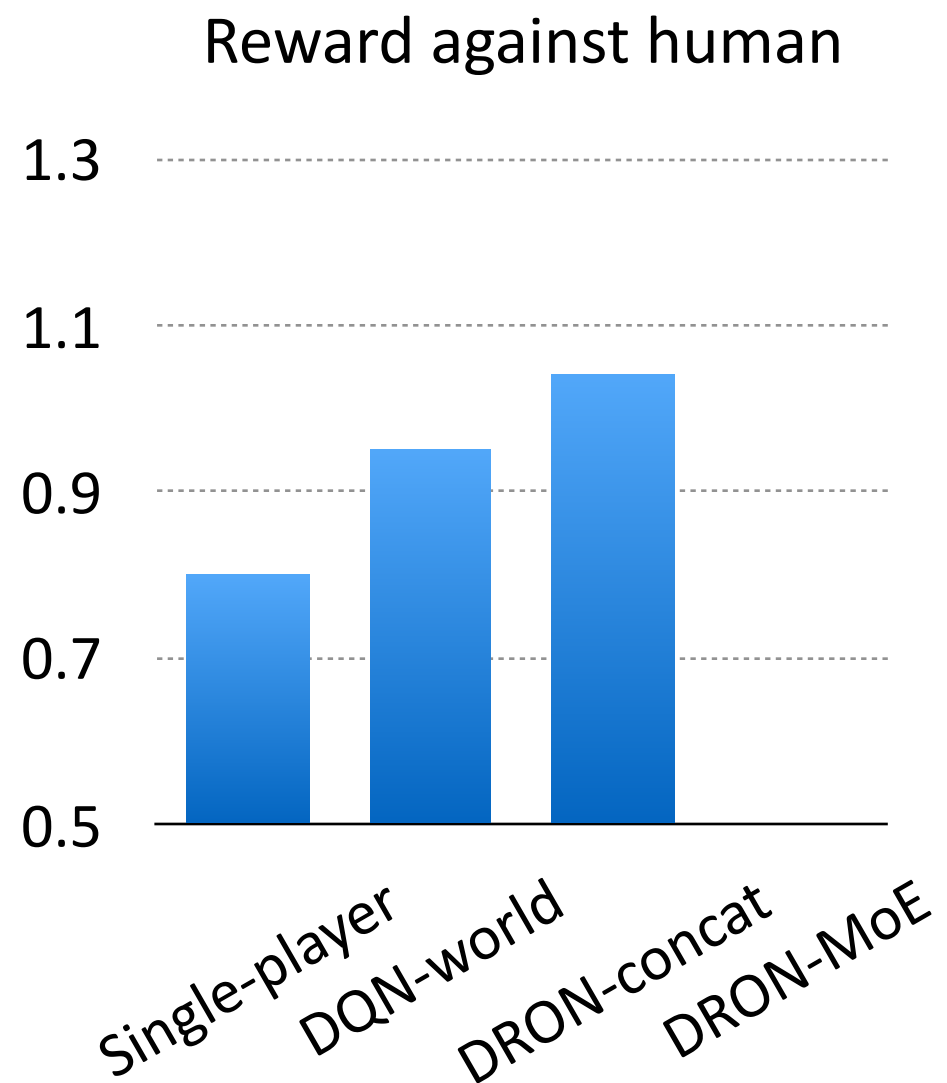
- 3610 users, 37.7K questions
- Offline training with human data



- DQN-world > Single-player:  
Opponent-sensitive score helps

# Experiments

- 3610 users, 37.7K questions
- Offline training with human data

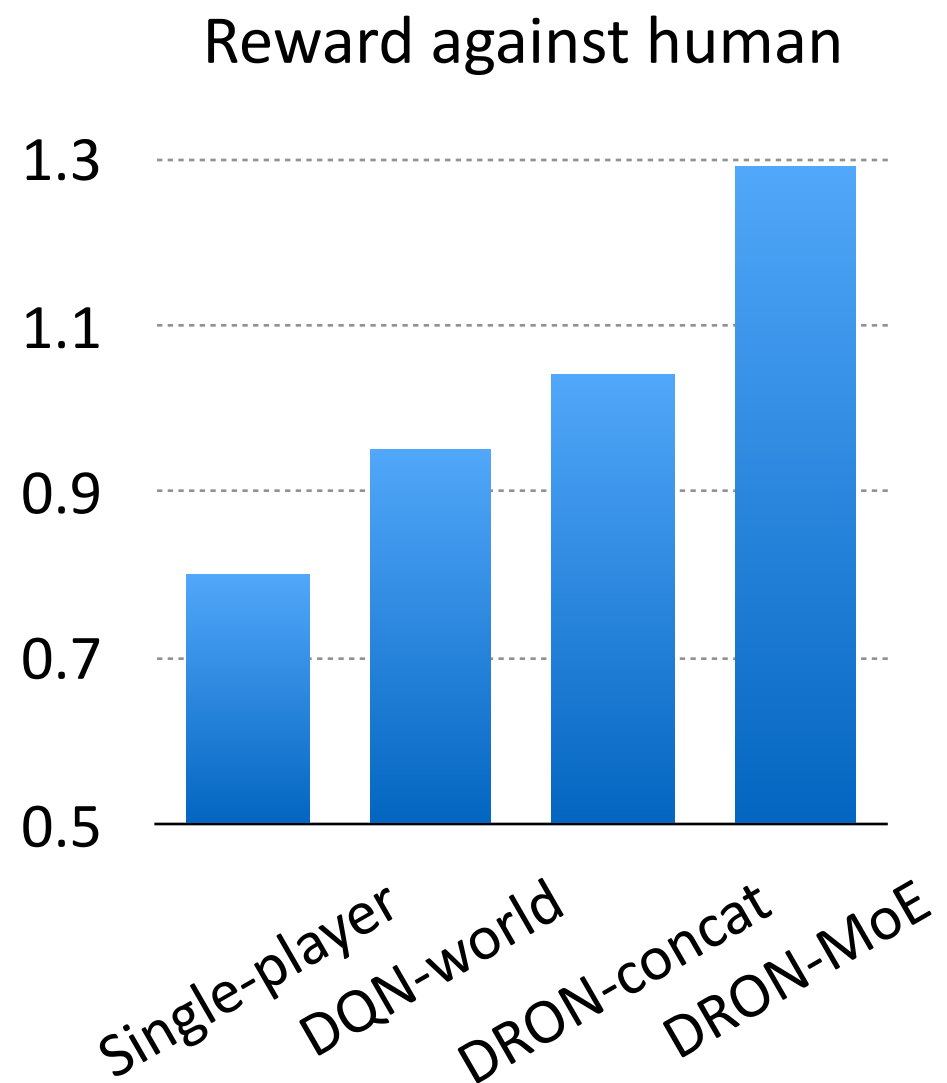


- DQN-world > Single-player:  
Opponent-sensitive score helps



# Experiments

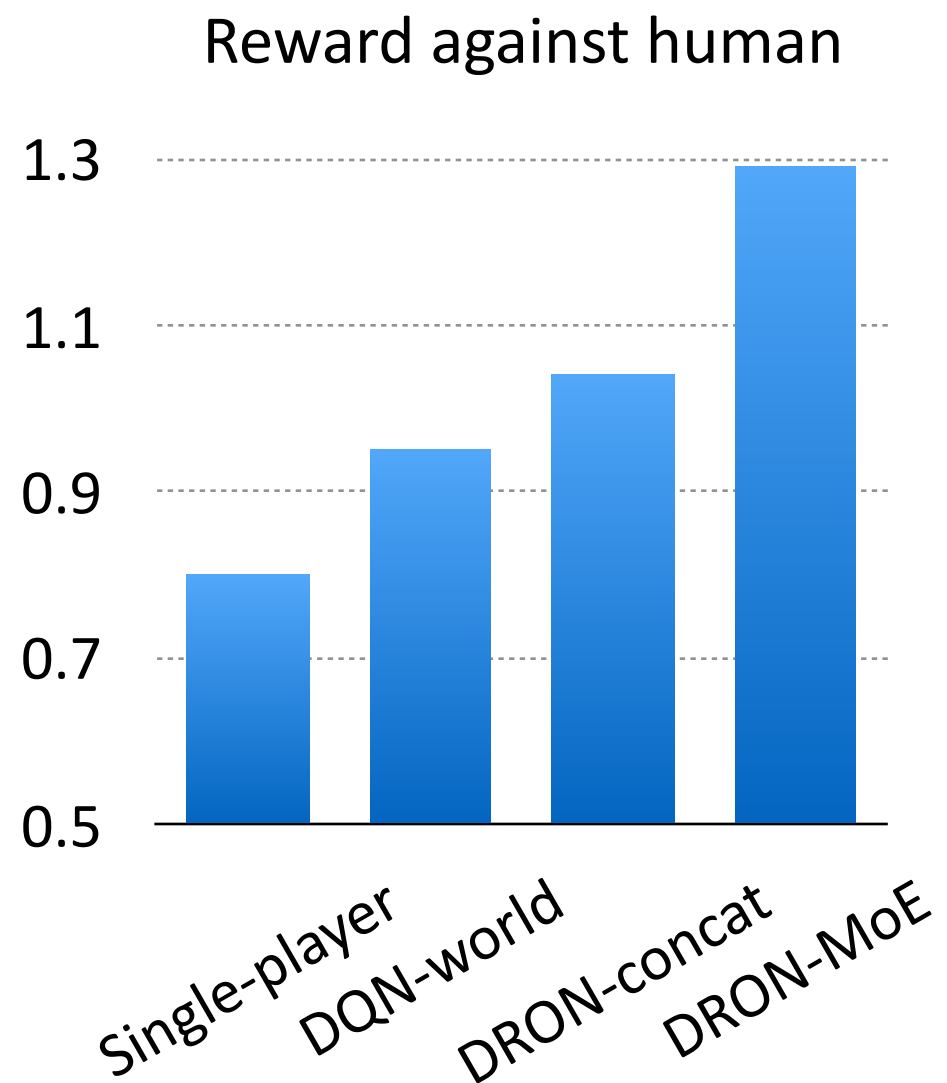
- 3610 users, 37.7K questions
- Offline training with human data



- DQN-world > Single-player:  
Opponent-sensitive score helps

# Experiments

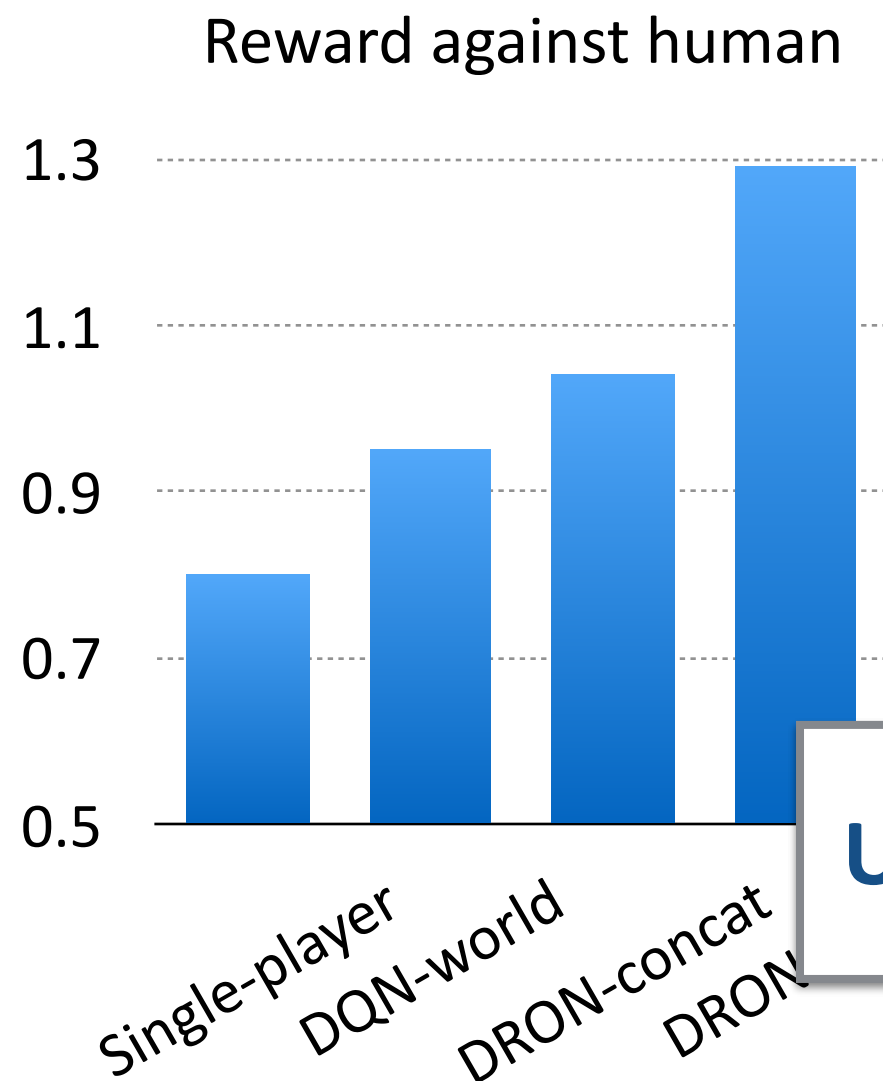
- 3610 users, 37.7K questions
- Offline training with human data



- DQN-world > Single-player:  
Opponent-sensitive score helps
- DRON > DQN  
Explicitly modeling opponents helps

# Experiments

- 3610 users, 37.7K questions
- Offline training with human data



- DQN-world > Single-player:  
Opponent-sensitive score helps
- DRON > DQN  
Explicitly modeling opponents helps

**Using user-specific signal is beneficial**

# Play against different humans

# Play against different humans



The antibiotic erythromycin works by disrupting this organelle , which contains E , P , and A sites on its large subunit . The parts of this organelle are assembled at nucleoli , and when bound to a membrane , these create the rough ER . Codons are translated at this organelle where the tRNA and mRNA meet . For 10 points , name this organelle that is the site of protein synthesis .

# Play against different humans

The antibiotic erythromycin works by disrupting this organelle , which contains E , P , and A sites on its large subunit . The parts of this organelle are assembled at nucleoli , and when bound to a membrane , these create the rough ER . Codons are translated at this organelle where the tRNA and mRNA meet . For 10 points , name this organelle that is the site of protein synthesis .

△ DRON-MoE

# Play against different humans

The antibiotic erythromycin works by disrupting this organelle , which contains E , P , and A sites on its large subunit . The parts of this organelle are assembled at  nucleoli , and  when bound to a membrane , these create the rough ER . Codons are translated at this organelle where the tRNA and mRNA meet . For 10 points , name this organelle that is the site of protein synthesis .

 DRON-MoE

# Play against different humans

The antibiotic erythromycin works by disrupting this organelle , which contains E , P , and A sites on its large subunit . The parts of this organelle are assembled at nucleoli , and when bound to a membrane , these create the rough ER . Codons are translated at this organelle where the tRNA and mRNA meet . For 10 points , name this organelle that is the site of protein synthesis .

△ DRON-MoE



# Play against different humans

The antibiotic erythromycin works by disrupting this organelle , which contains E , P , and A sites on its large subunit . The parts of this organelle are assembled at nucleoli , and when bound to membrane , these create the rough ER . Codons are translated at this organelle where the tRNA and mRNA meet . For 10 points , name this organelle that is the site of protein synthesis .









△ DRON-MoE

# Play against different humans

The antibiotic erythromycin works by disrupting this organelle ,  
which contains E , P , and A sites on its large subunit . The parts of  
this organelle are assembled at nucleoli , and when bound to a  
membrane , these create the rough ER . Codons are translated at  
this organelle where the tRNA and mRNA meet . For 10 points ,  
name this organelle that is the site of protein synthesis .










△ DRON-MoE

# Play against different humans

The antibiotic erythromycin works by disrupting this organelle ,  
which contains  P , and A sites on its large subunit  the parts of    
this organelle are  assembled at nucleoli , and  when bound to   
membrane , these create the rough ER . Codons  are translated at  
this organelle where the tRNA and mRNA meet . For 10 points ,  
name this organelle that is the site of protein synthesis .

 DRON-MoE












# Play against different humans

The antibiotic erythromycin works by disrupting this organelle ,  
which contains  P , and A sites on its large subunit  the points of     
this organelle are  assembled at nucleoli , and  when bound to   
membrane , these create the rough ER . Codons  are translated at  
this organelle where the tRNA and mRNA meet . For 10 points ,  
name this organelle that is the site of protein synthesis .

 DRON-MoE

 Single-player

# Play against different humans






The antibiotic erythromycin works by disrupting this organelle ,  
which contains  P , and A sites on its large subunit  the ports of     
this organelle are  assembled at nucleoli , and  when  und to    
membrane , these create the rough ER . Codons are translated at  
 this organelle where the tRNA and mRNA meet . For 10 points ,  
name this organelle that is the site of protein synthesis .

 DRON-MoE

 Single-player







 DQN-world

# Error analysis

The antibiotic erythromycin works by disrupting this organelle , which contains  P , and A sites on its large subunit  the parts of this organelle are  assembled at nucleoli , and  when bound to a membrane  , these create the rough ER . Codons are translated at this organelle where the tRNA and mRNA meet . For 10 points , name this organelle that is the site of protein synthesis .







# Error analysis

Group user by buzzing positions

The antibiotic erythromycin works by disrupting this organelle ,  
which contains  P , and A sites on its large subunit  the parts of   
this organelle are  assembled at nucleoli , and  when bound to a  
membrane  , these create the rough ER . Codons are translated at  
this organelle where the tRNA and mRNA meet . For 10 points ,  
name this organelle that is the site of protein synthesis .

# Error analysis

Group user by buzzing positions

The antibiotic erythromycin works by disrupting this organelle ,  
which contains  P , and A sites on its large subunit  the parts of   
this organelle are  assembled at nucleoli , and  when bound to a  
membrane  , these create the rough ER . Codons are translated at  
this organelle where the tRNA and mRNA meet . For 10 points ,  
name this organelle that is the site of protein synthesis .







0—25%





# Error analysis

Group user by buzzing positions

The antibiotic erythromycin works by disrupting this organelle ,  
which contains  P , and A sites on its large subunit  the parts of   
this organelle are  assembled at nucleoli , and  when bound to a  
membrane  , these create the rough ER . Codons are translated at  
this organelle where the tRNA and mRNA meet . For 10 points ,  
name this organelle that is the site of protein synthesis .

0—25%









25—50%



# Error analysis

Group user by buzzing positions

The antibiotic erythromycin works by disrupting this organelle ,  
which contains  P , and A sites on its large subunit  the parts of   
this organelle are  assembled at nucleoli , and  when bound to a  
membrane  , these create the rough ER . Codons are translated at  
this organelle where the tRNA and mRNA meet . For 10 points ,  
name this organelle that is the site of protein synthesis .

0—25%



25—50%









75—100%



# Error analysis

Group user by buzzing positions

The antibiotic erythromycin works by disrupting this organelle ,  
which contains  P , and A sites on its large subunit  the parts of   
this organelle are  assembled at nucleoli , and  when bound to a  
membrane  , these create the rough ER . Codons are translated at  
this organelle where the tRNA and mRNA meet . For 10 points ,  
name this organelle that is the site of protein synthesis .

0—25%



25—50%



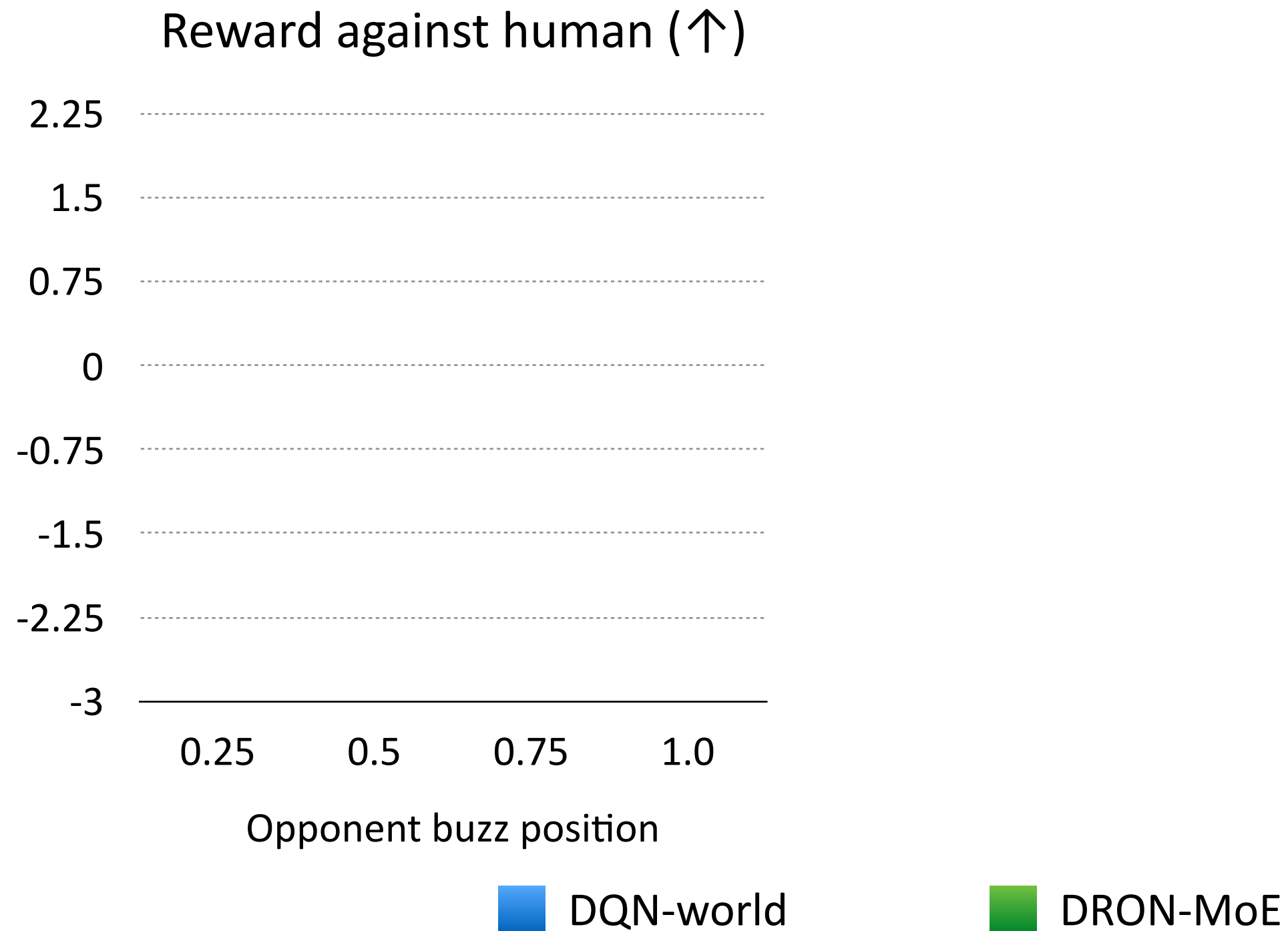
75—100%



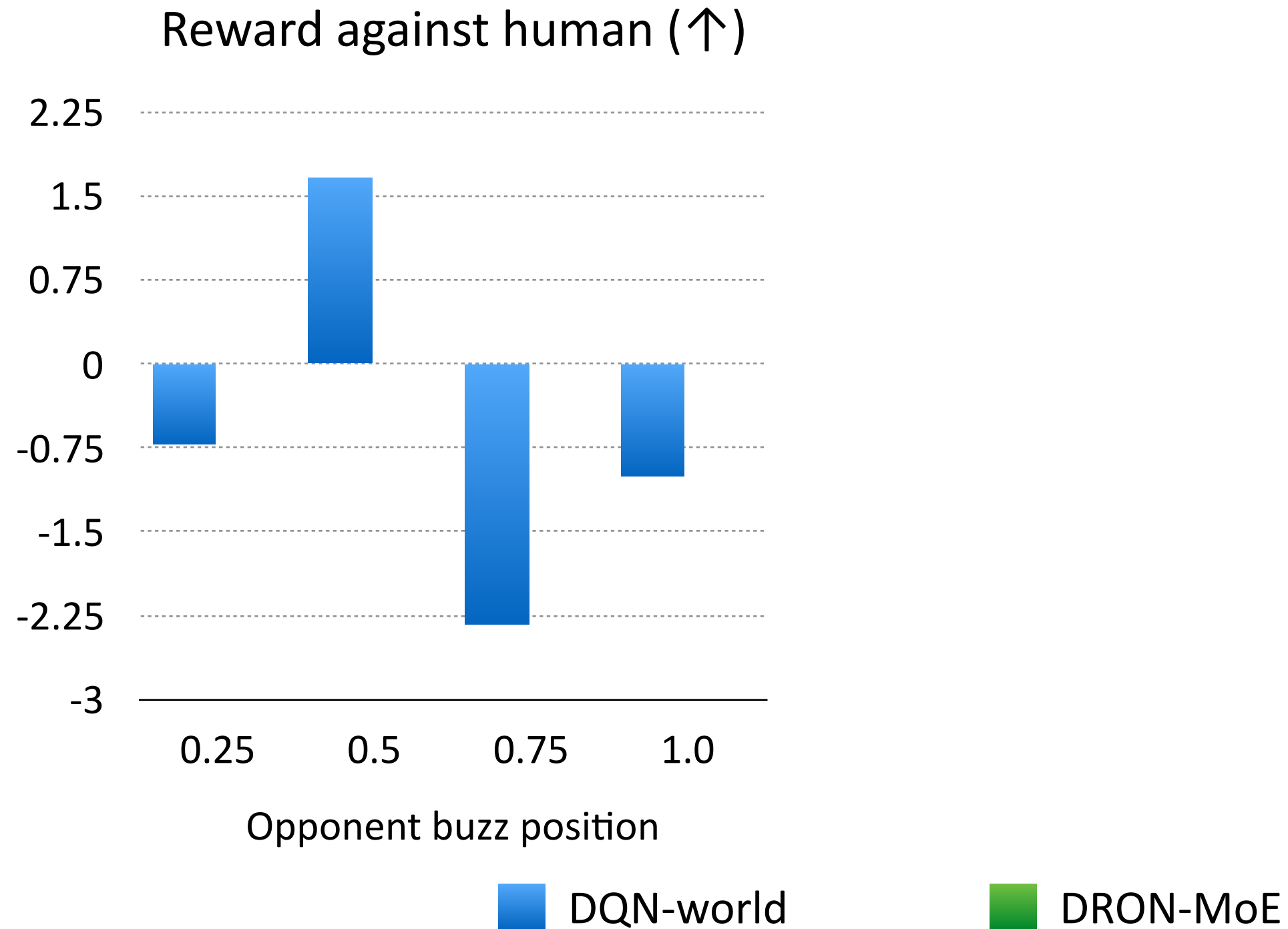
50—75%

# Error analysis

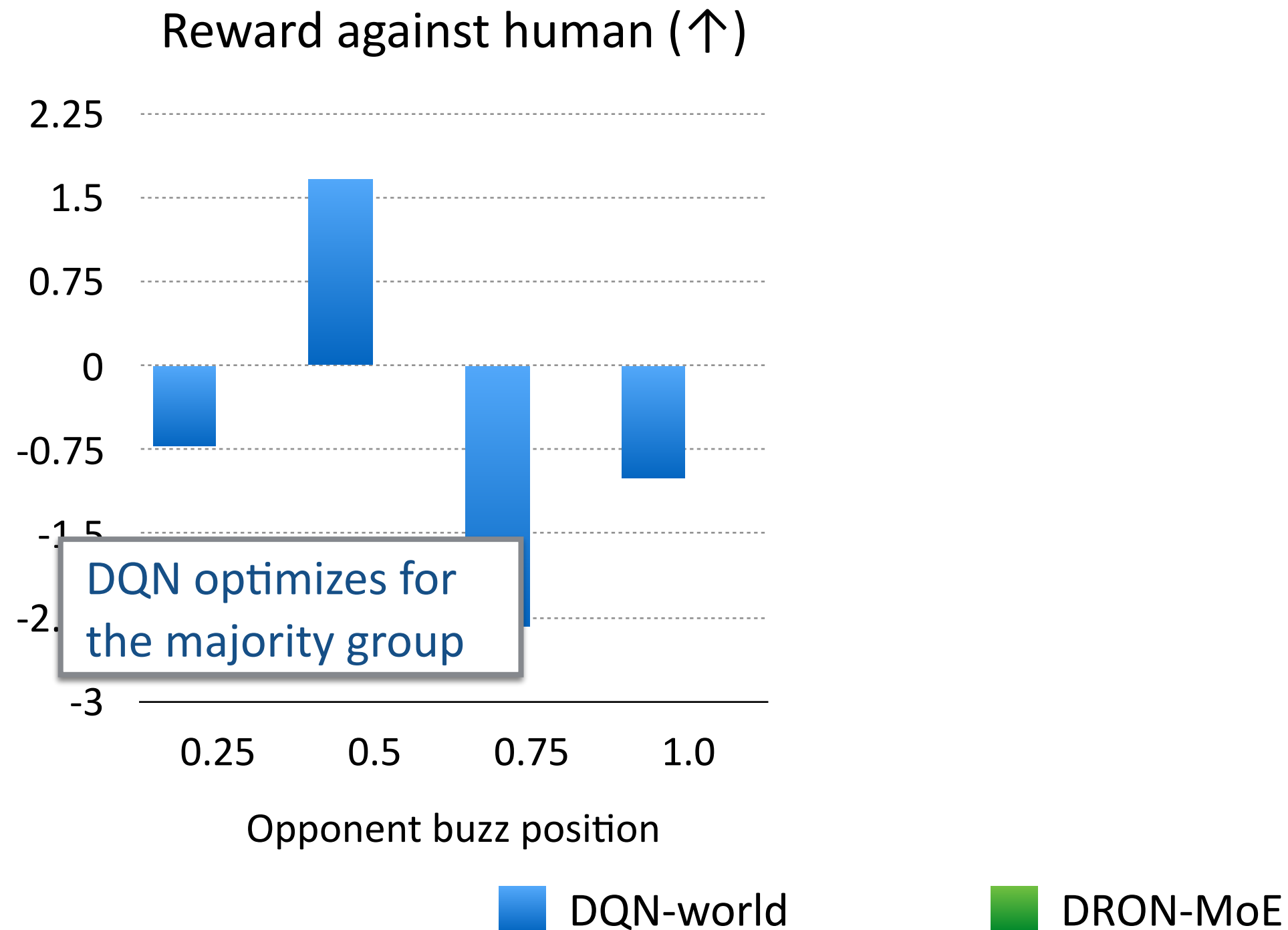
# Error analysis



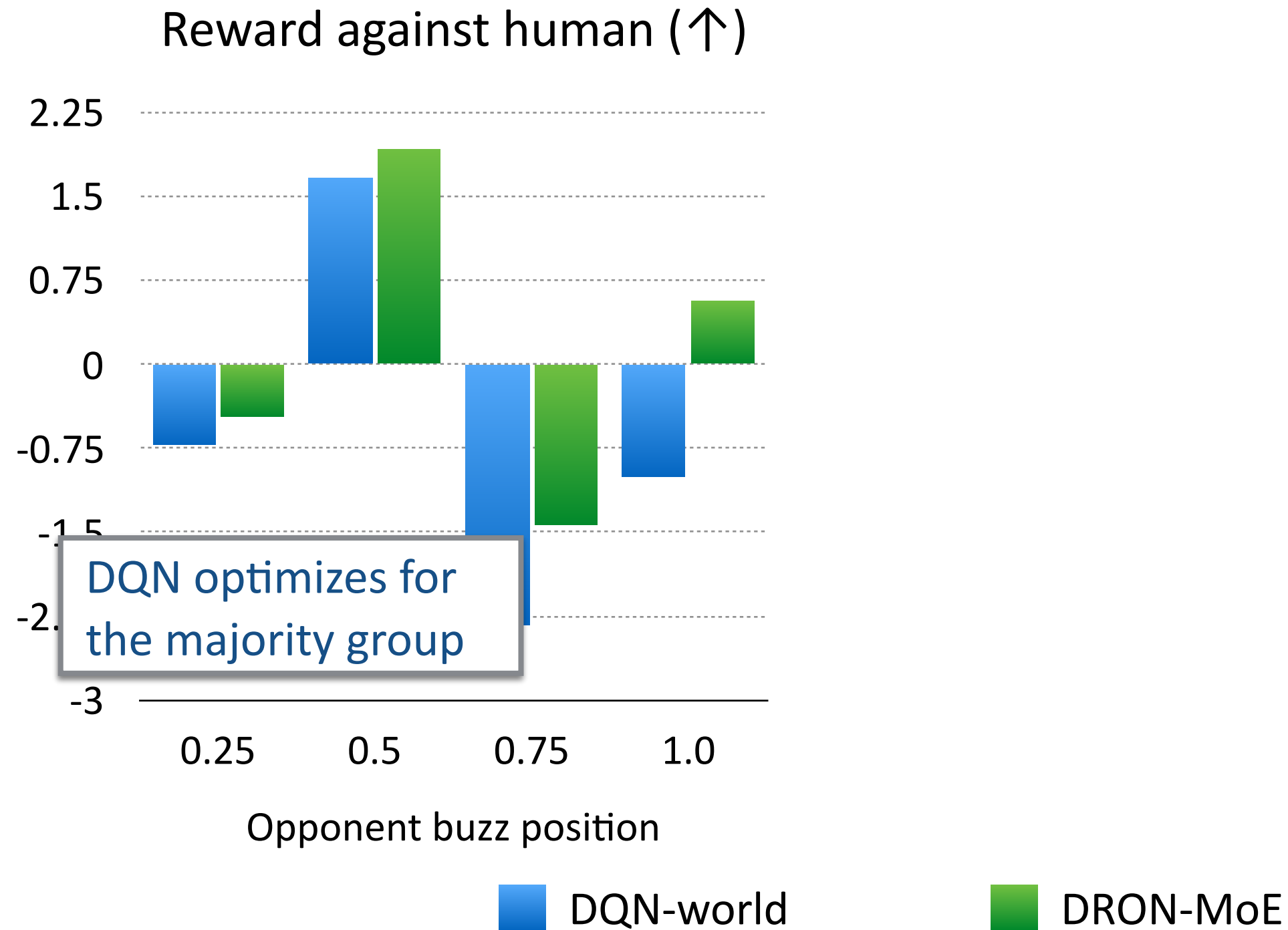
# Error analysis



# Error analysis

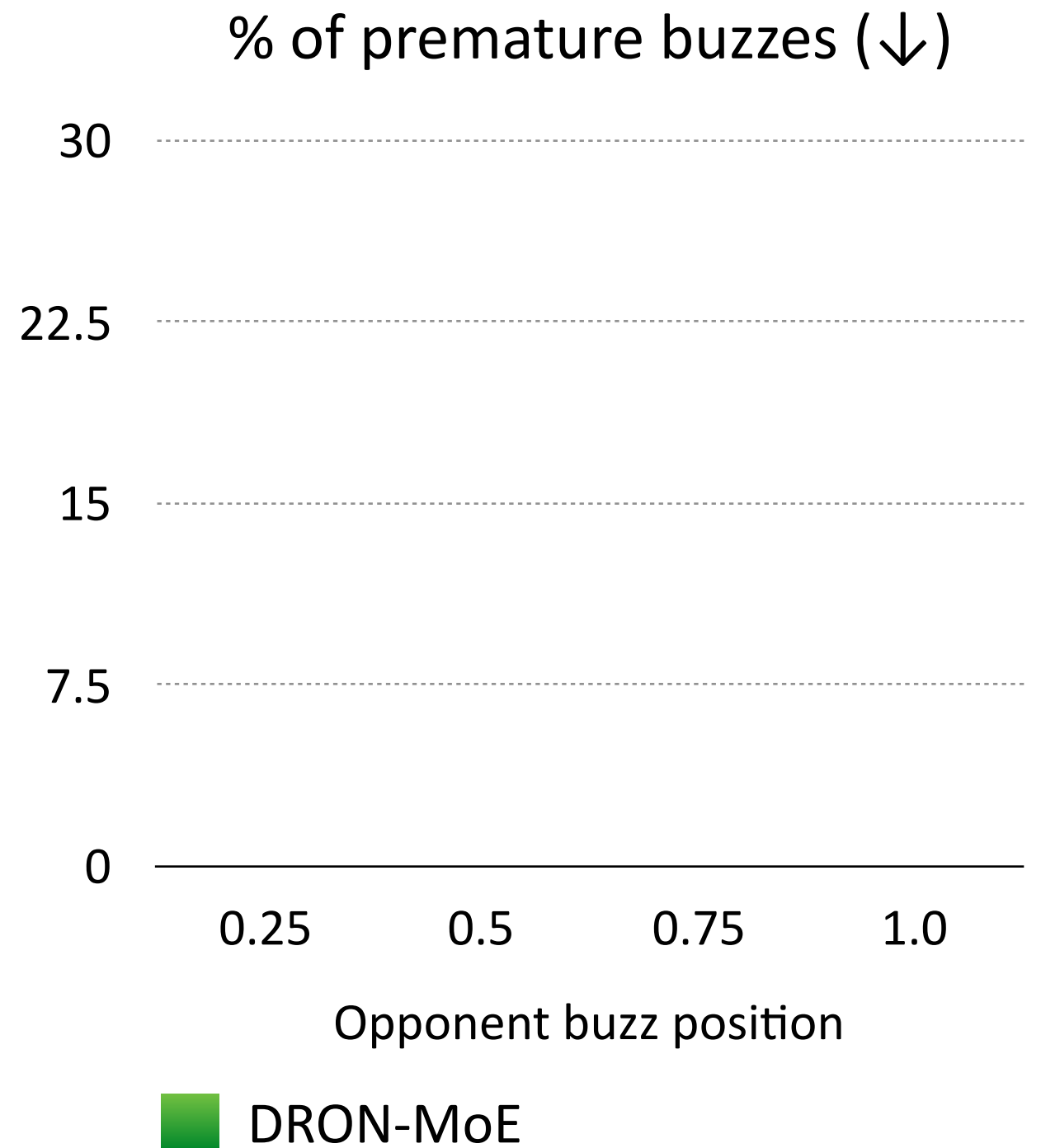
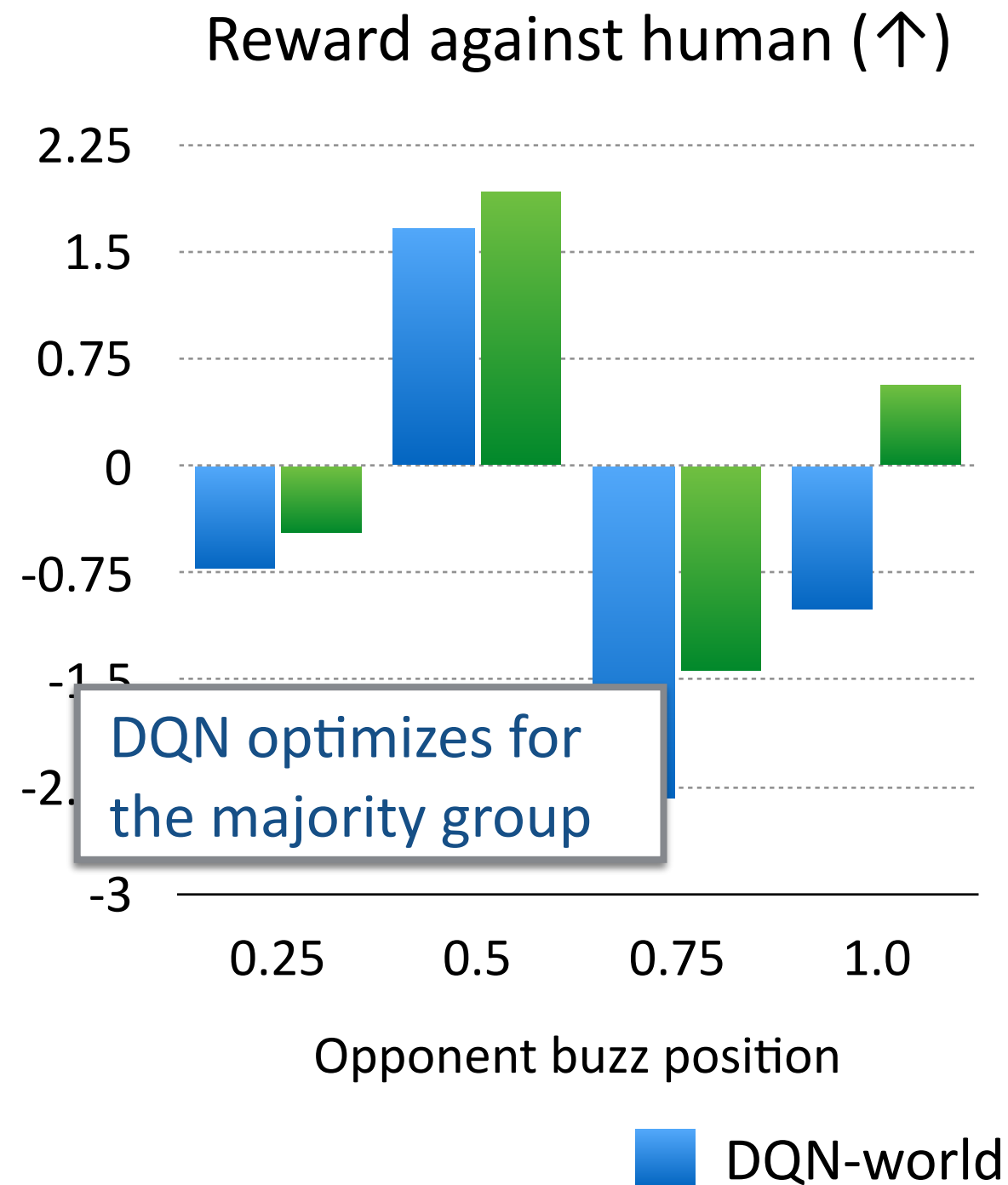


# Error analysis



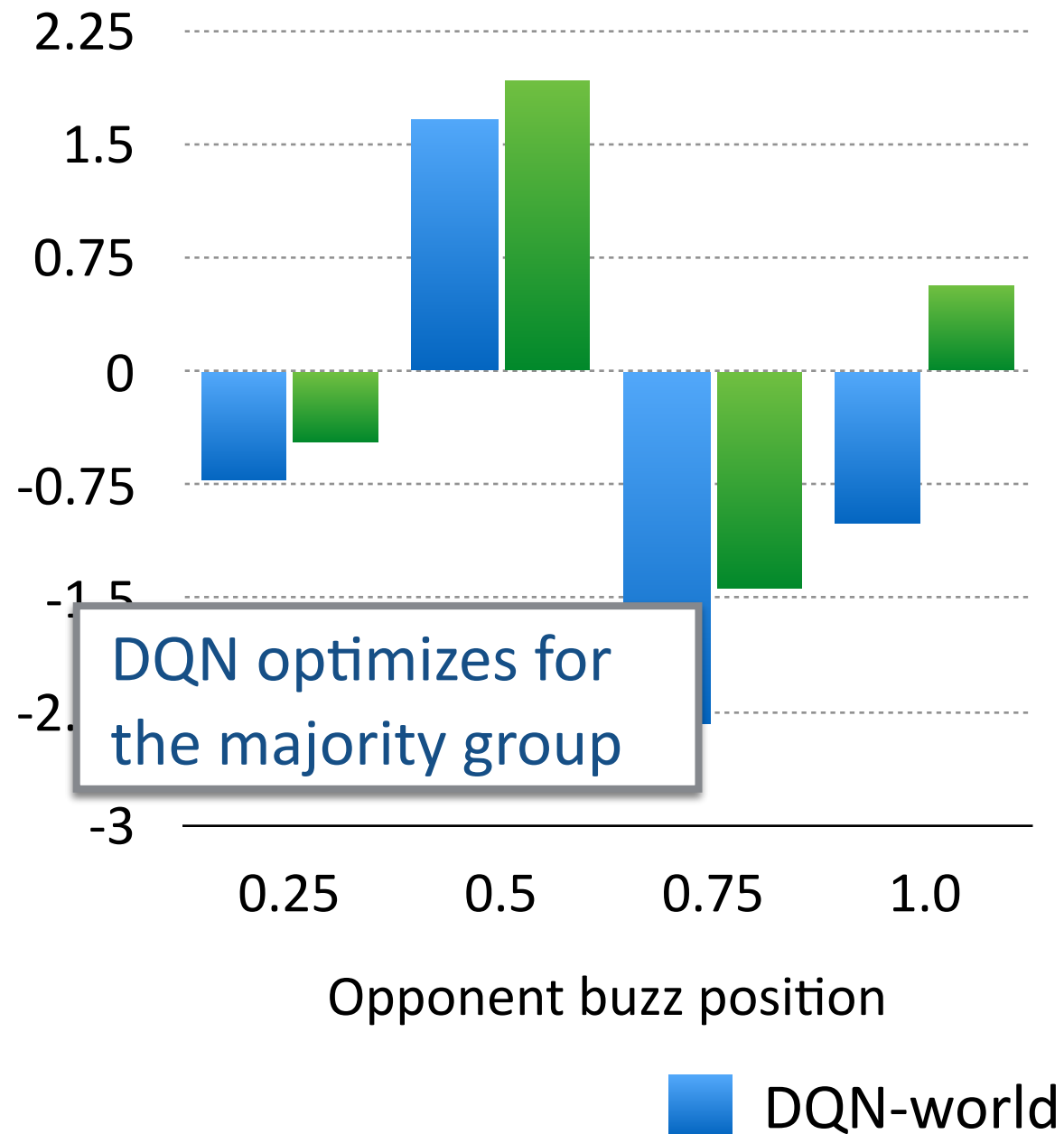


# Error analysis

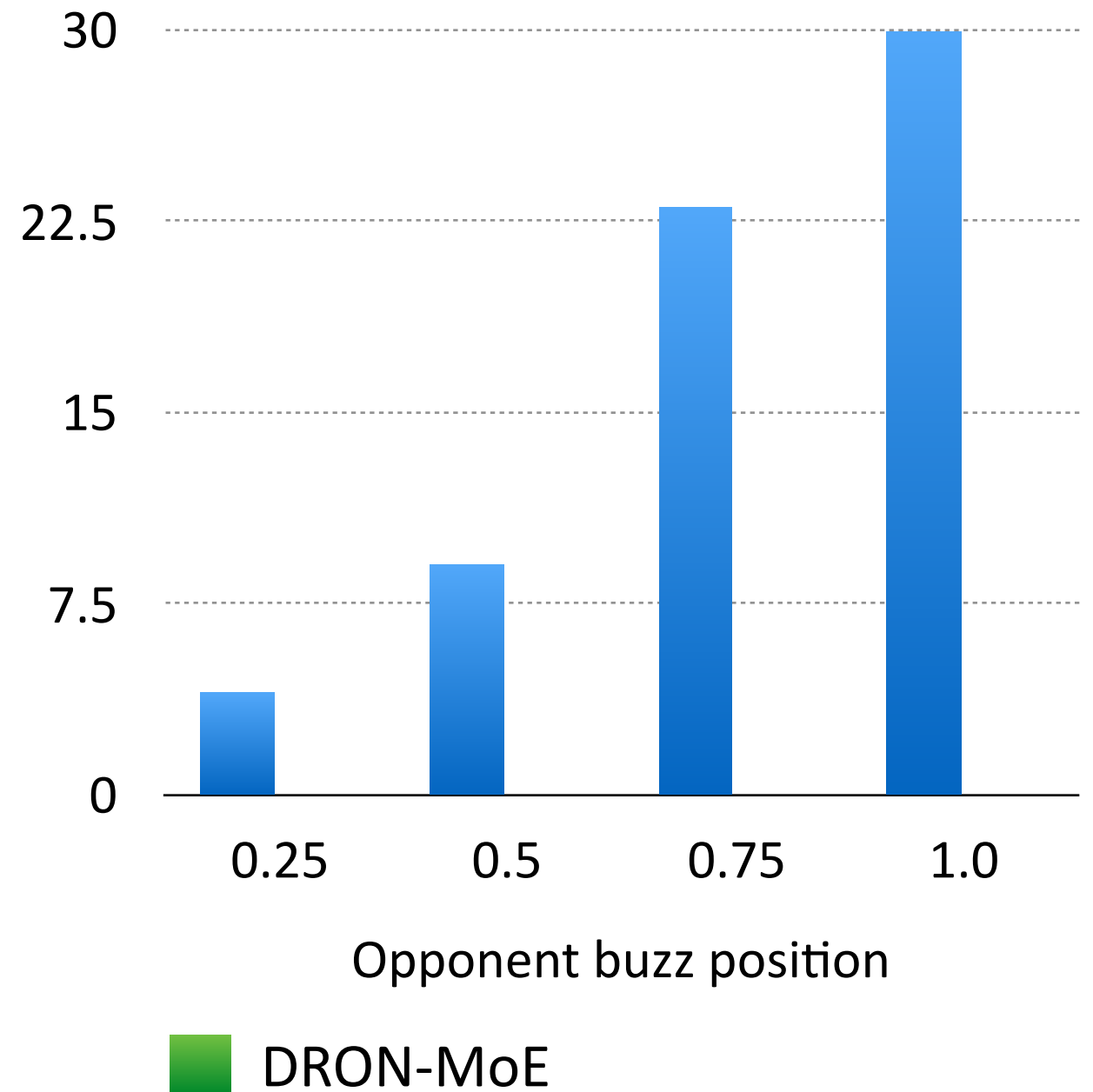


# Error analysis

Reward against human (↑)

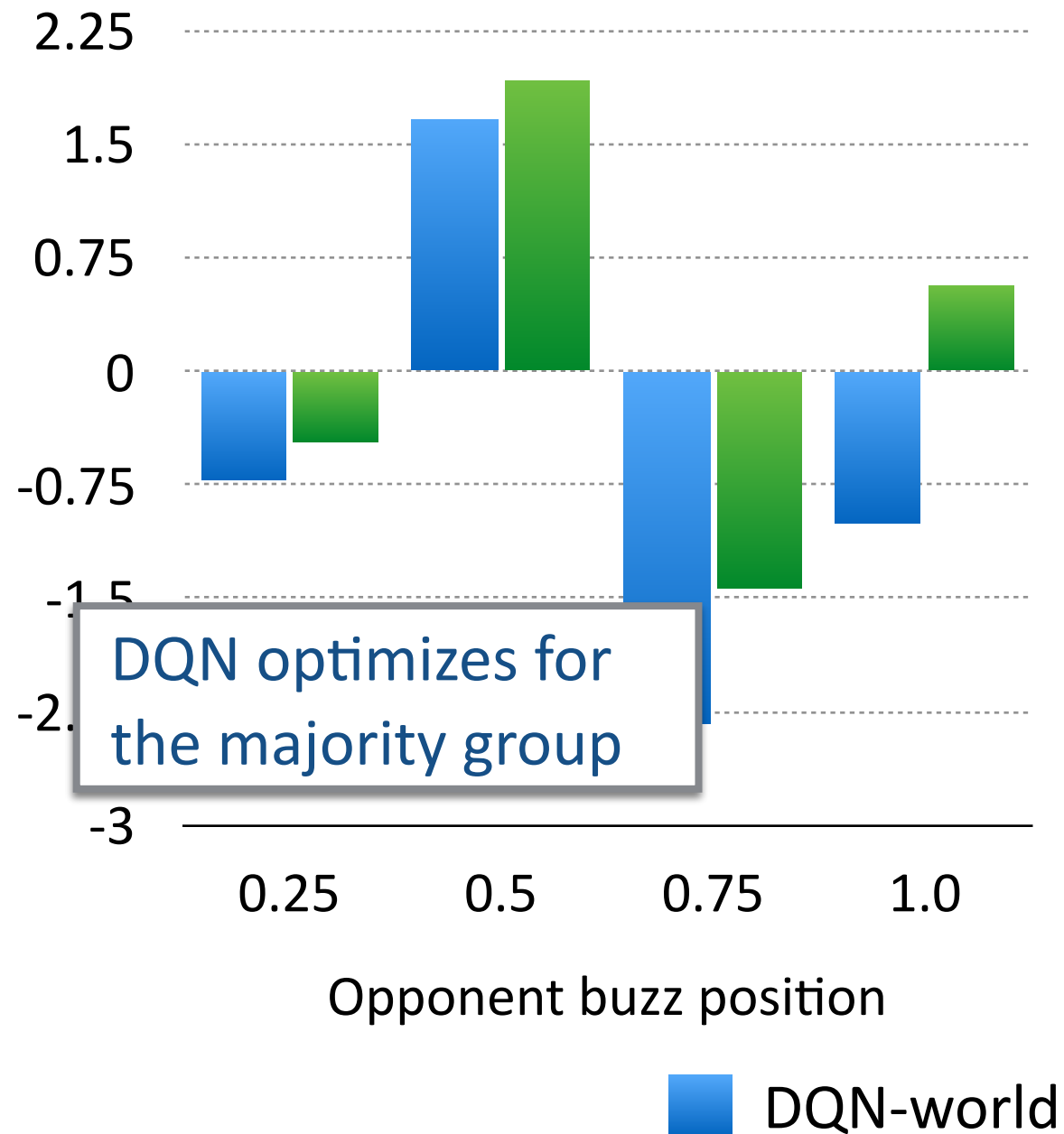


% of premature buzzes (↓)

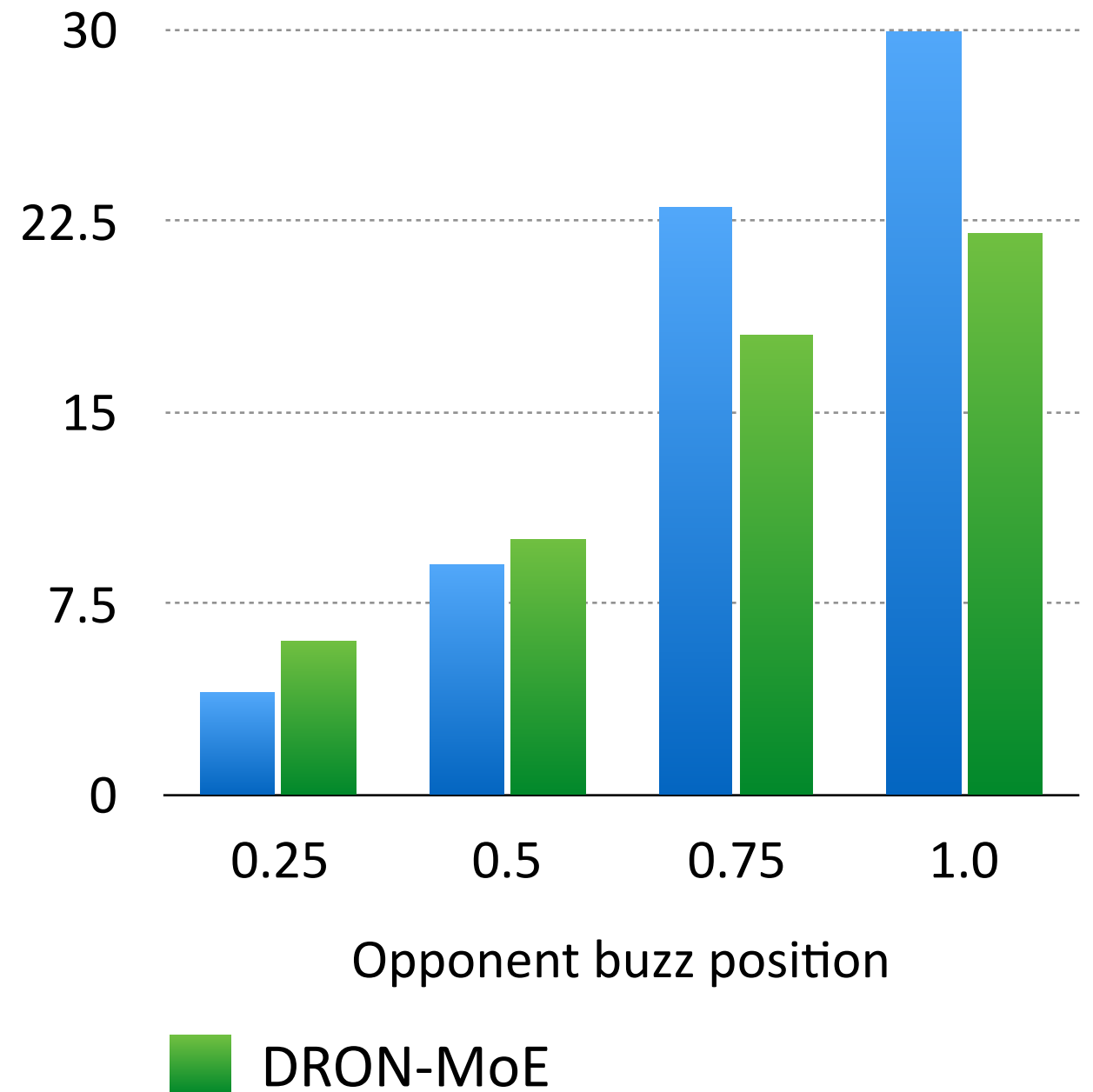


# Error analysis

Reward against human (↑)

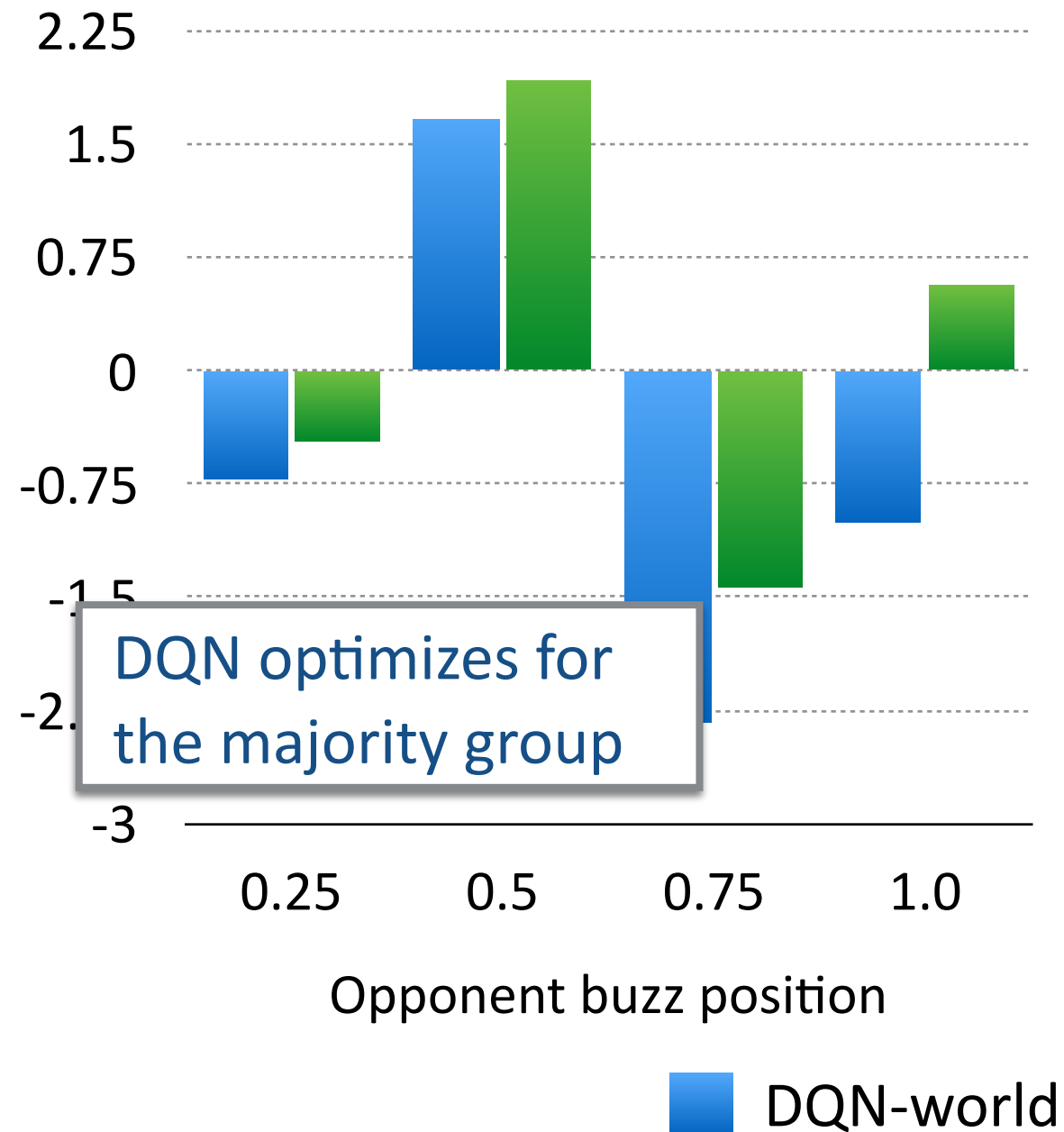


% of premature buzzes (↓)

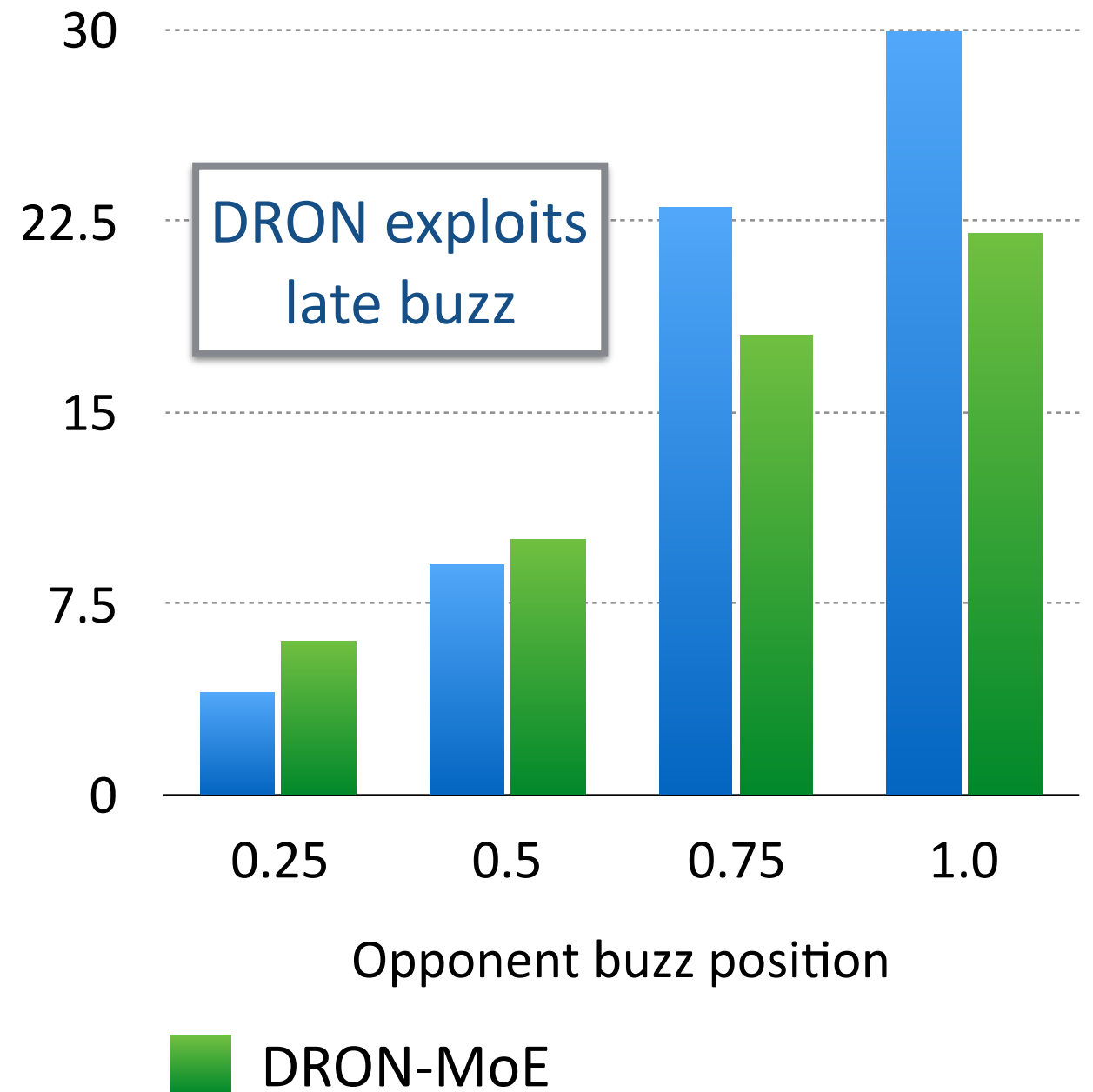


# Error analysis

Reward against human (↑)



% of premature buzzes (↓)



# Summary

# Summary

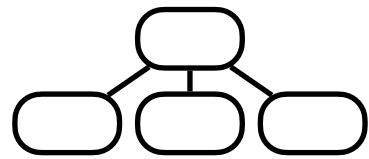


Learning user adaptation in a game environment

# Summary



Learning user adaptation in a game environment

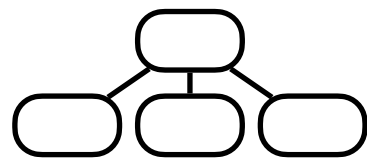


RL + factored user representation for adaptation

# Summary



Learning user adaptation in a game environment



RL + factored user representation for adaptation



**Transfer knowledge among users?**



# Discussion

# Discussion

- Agents that learn from and work with humans
  - Human-computer collaboration through **communication**
  - User **adaptation** through reinforcement learning

# Discussion

- Agents that learn from and work with humans
  - Human-computer collaboration through **communication**
  - User **adaptation** through reinforcement learning



# Discussion

- Agents that learn from and work with humans
  - Human-computer collaboration through **communication**
  - User **adaptation** through reinforcement learning



# Discussion

- Agents that learn from and work with humans
  - Human-computer collaboration through **communication**
  - User **adaptation** through reinforcement learning



# Discussion

- Agents that learn from and work with humans
  - Human-computer collaboration through **communication**
  - User **adaptation** through reinforcement learning



## Environment

- Simulated user
- Simulated world (but real human)



# Discussion

- Agents that learn from and work with humans
  - Human-computer collaboration through **communication**
  - User **adaptation** through reinforcement learning



## Environment

- Simulated user
- Simulated world (but real human)



## Objective

- Both user-driven and task-driven
- Robustness



# Discussion

- Agents that learn from and work with humans
  - Human-computer collaboration through **communication**
  - User **adaptation** through reinforcement learning



## Environment

- Simulated user
- Simulated world (but real human)



## Objective

- Both user-driven and task-driven
- Robustness



## Evaluation

- Close-loop system