

On the Underspecification of Situations in Open-domain Conversational Datasets

NLP for Conversational AI Workshop @ ACL 2023

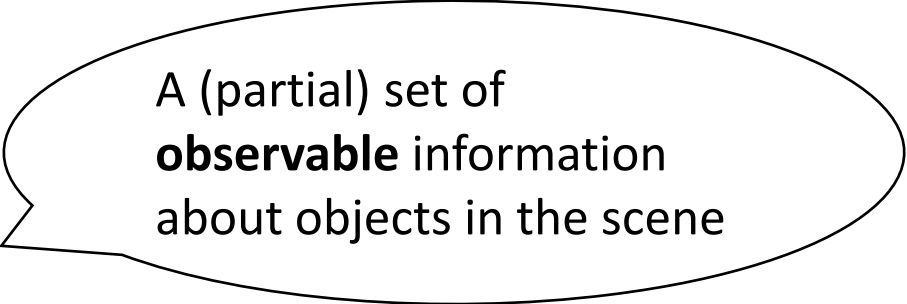
Naoki Otani, Jun Araki, HyeongSik Kim, Eduard Hovy



**Work done at*



Claim:



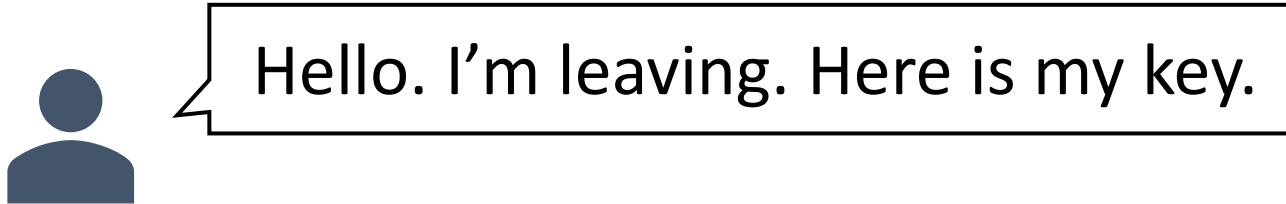
A (partial) set of
observable information
about objects in the scene

We need to talk about **situation**
for enhancing open-domain
conversational agents!

Quick overview:

Meaning of language heavily relies on situation

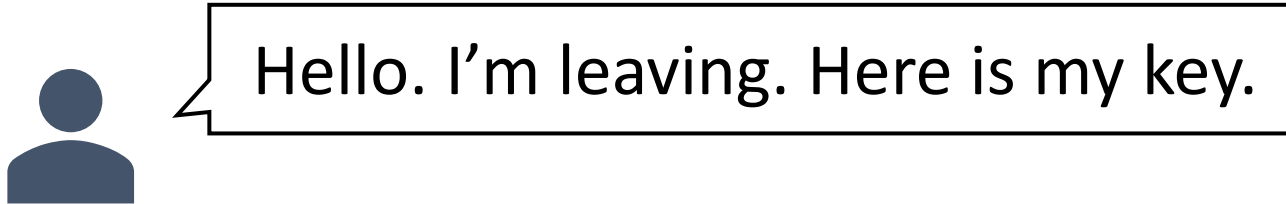
Example: Two persons are having a conversation.



Quick overview:

Meaning of language heavily relies on situation

Let's say...



Quick overview:

Meaning of language heavily relies on situation

Let's say...

Location: Hotel front desk



Hello. I'm leaving. Here is my key.



Quick overview:

Meaning of language heavily relies on situation

Let's say...

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Guest

Hello. I'm leaving. Here is my key.



Staff

Quick overview:

Meaning of language heavily relies on situation

Let's say...

Location: Hotel front desk



Guest

Hello. I'm leaving. Here is my key.

Check-out time: 11am

Current time: 10:30am

[...]



Staff

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Location: Hotel front desk

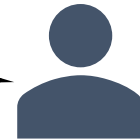


Guest

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Check-out time: 11am
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[...]

Thanks. Have a safe trip.

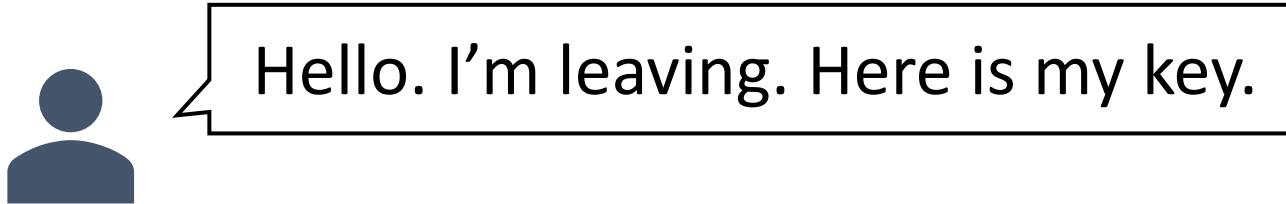


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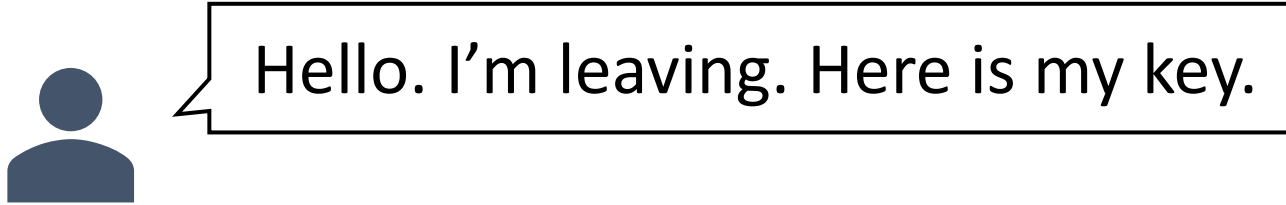


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Location: House




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Hello. I'm leaving. Here is my key.

Pat, going to work




Chris,
cooking in the kitchen

Quick overview:

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Hello. I'm leaving. Here is my key.

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Chris,
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Chris is Pat's housemate.
Chris recently lost their key.

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Location: House



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Thanks. Do you want me to lock the door?



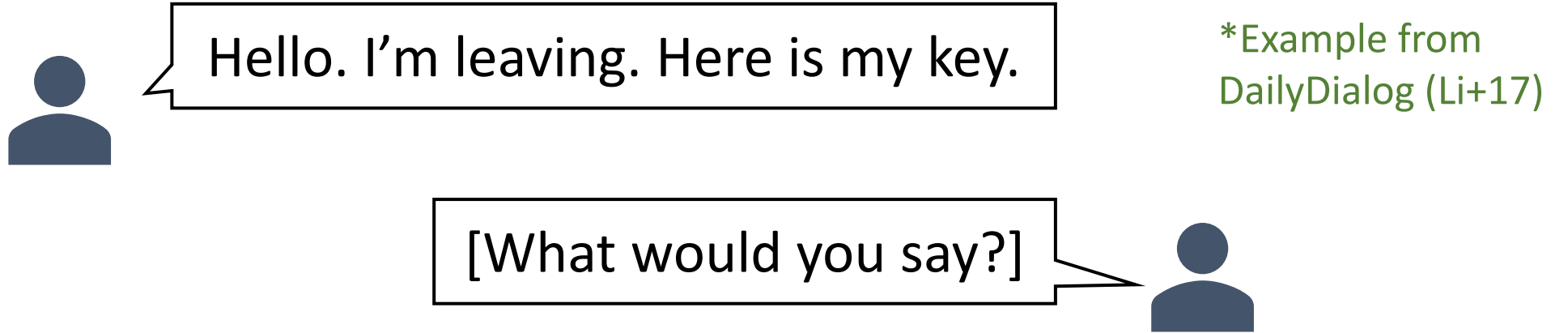
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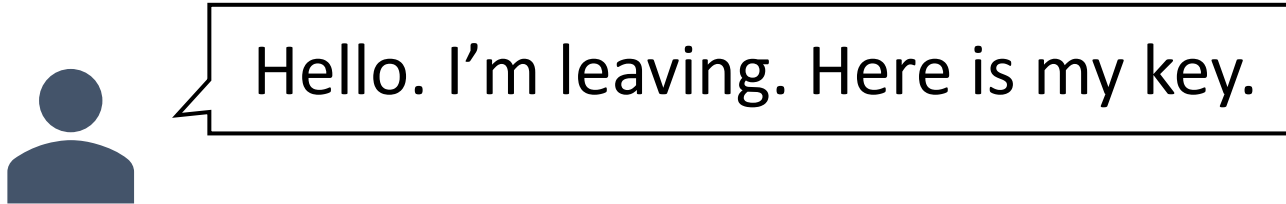


Situation is not specified

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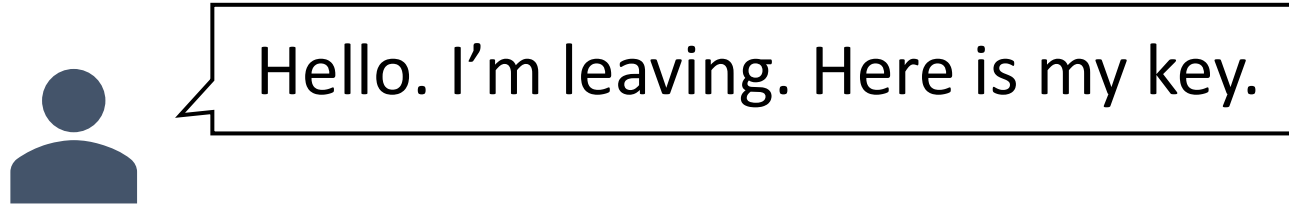
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DailyDialog (Li+17)

Chatbots respond based on **their own assumptions** about the situation.

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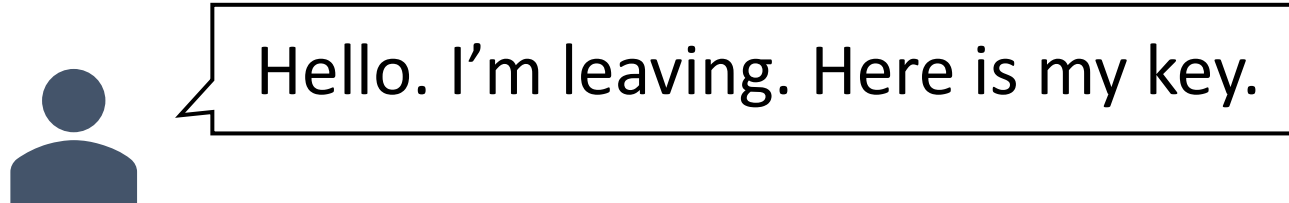
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GPT-3^(Brown+20)

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GPT-3^(Brown+20)

[...] Do you want me to lock the door?

BlenderBot2^(Komeili+22; Xu+22)

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Issues:

(1) **Underspecification of the problem space**

It's often impossible to identify the meaning/intent of an utterance.

(2) **System behavior**

The chatbot's internal assumption is not always correct or socially appropriate.

(3) **Evaluation**

Even human cannot decide which response is correct.

[...] Do you want me to lock the door?

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What is Situation?

What is situation?:

Situation Semantics (1980s~, Jon Barwise, John Perry)

Situation = Entities/eventualities and their properties and relations

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Task-specific: Essential for task-oriented systems

Vocabulary of user request types (e.g., for the restaurant domain, users can request {search, reservation, ...})

Task flow (restaurant → (1) venue, (2) size of party, (3) date/time, (4) ...)

Database/API (list of restaurants, etc.)

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User-specific: Useful for more engaging communication

Persona, Behavior, Preference, Emotion, Intent/Goal, ...

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Scene, Date/time, Sound, Smell,

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Key: **Not always mentioned explicitly** by conversation's participants

→ Prior work developed **dedicated semantic representations**

and/or treat situational information as **extra signals**

Status quo

Background:

The importance of situation has been well-recognized in dialogue studies.

Train station



Traveler



Indirect speech acts (Clark'79;Allen&Perrault'80)

Do you know when the Windsor train leaves?

3:15 at gate 7.



Station attendant

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Location = Station

Behavior = Carrying luggage

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Situation
(Partial information
about the world)

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Situation
(Partial information about the world)

Asking the departure time
→ Goal = To take the train

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Background:

Open-domain

Many recent datasets lack comprehensive situational information

Dataset	Data source	Situational information	Reference:Citation
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Reddit	Reddit	None	(Baumgartner+'20): 484
DailyDialog	ESL learning resources	None	(Li+'17): 783
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Problem: Comprehensive environmental information is missing in many datasets
(when, where, who is speaking, etc.)

SUGAR (Otani et al., ACL2023)

A Textual Dataset of Situated, Goal-aware, Proactive Responses

1.7k single-turn conversations in help-seeking scenarios collected by crowdsourcing

Utterance	Please turn on the TV.
-----------	------------------------

Situations	<p>It is evening now.</p> <p>[user] is home.</p> <p>[user] is in the living room.</p> <p>[user] is sitting on the couch.</p> <p>[user] has a TV in the house.</p> <p>[user] has an outfit on the bed.</p> <p>[user] has drinks and snacks in the kitchen.</p> <p>[user] has game cards on the shelf.</p> <p>The TV is off.</p> <p>[someone]’s birthday is today.</p> <p>There are several sports games available to watch.</p> <p>There is a basketball game scheduled.</p>
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Three response candidates w/ 3-level ratings

- 1/3: Reference response made by workers
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Situational information represented in simple En sentences (12 sents.)

Responses Sure. Would you like me to check today's sports listings? (*Best*)
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Situational information represented in simple En sentences (12 sents.)

- **Relevant information:** about 6 sentences
 - (Written by crowd workers to support the *Best* response)

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Situational information represented in simple En sentences (12 sents.)

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- **Irrelevant information** (distractors)
 - (Sampled from the other examples)

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Three response candidates w/ 3-level ratings

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Representation of Situation:

Short English statements describing the world states

Situational statements – short sentences describing *observable* facts of the current situation

Category	Definition	Example
Location	Information about [user]'s current location.	[user] is home. / [user] is at the entrance of a house.
Possession	Information about what [user] possesses.	[user] owns a car. / There are apples in the kitchen.
Time	Information about time.	It's midnight. / It's morning.
Date	Information about date and season.	It's [user]'s birthday. / It's summer.
Behavior	Information about [user]'s behavior.	[user] just woke up. / [user] came back from jogging.
Environment	Information about non-user entities (person, objects, etc.).	The room temperature is hot. / [user]'s car has a flat tire.

A Case Study

How does the inclusion of situational information matter?

Question:

Chat bots works better or worse with situation?

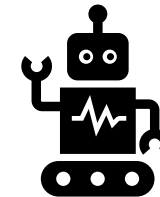
Conv. history (taken from CICERO^(Ghosal+22)):

A: Hi, Mike! how are you feeling now?

B: How did you know I was here? is it Tom?

A: I was talking with Bob yesterday and I learnt your right leg had been injured. How did it happen?

B: [System output]



Chat bot

(Response generation system)

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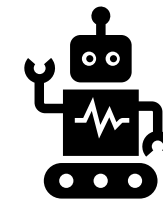
Situation (our work; 10-12 statements)

Person B's leg **had a surgery** last night.

Person A and Person B are **in the hospital**.

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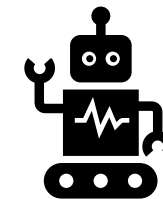
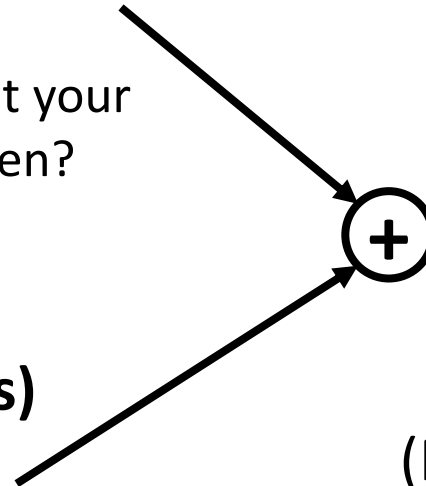
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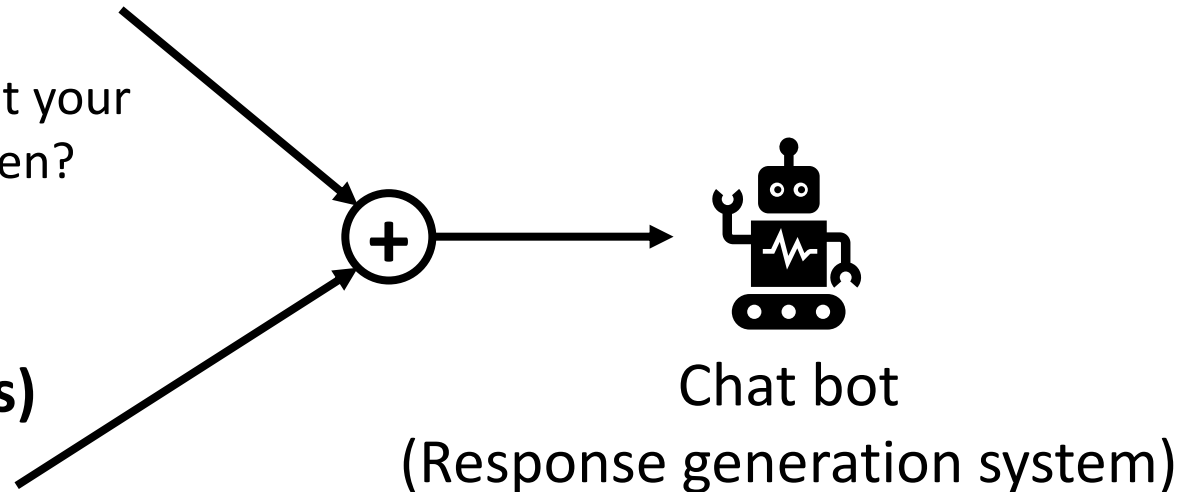
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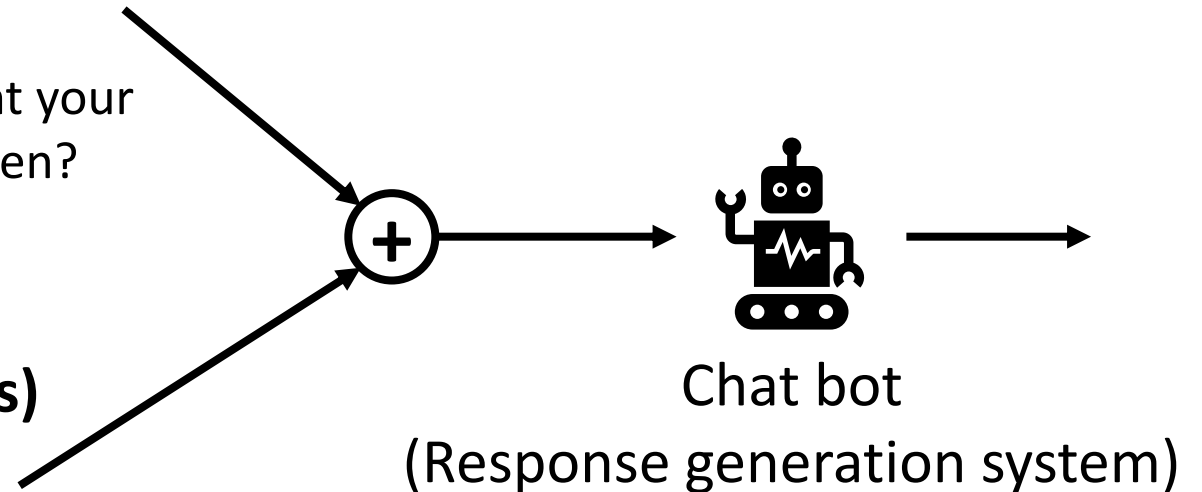
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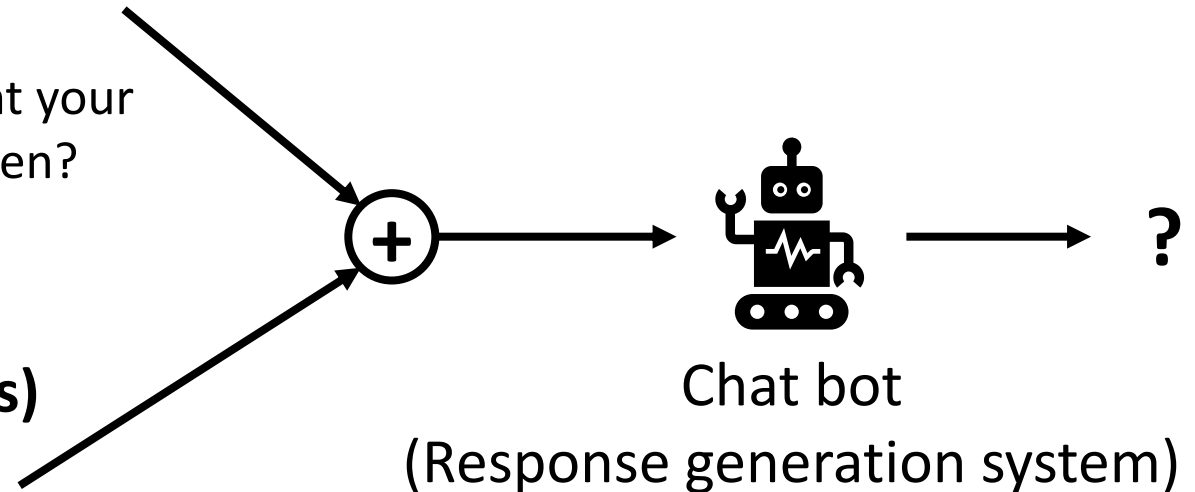
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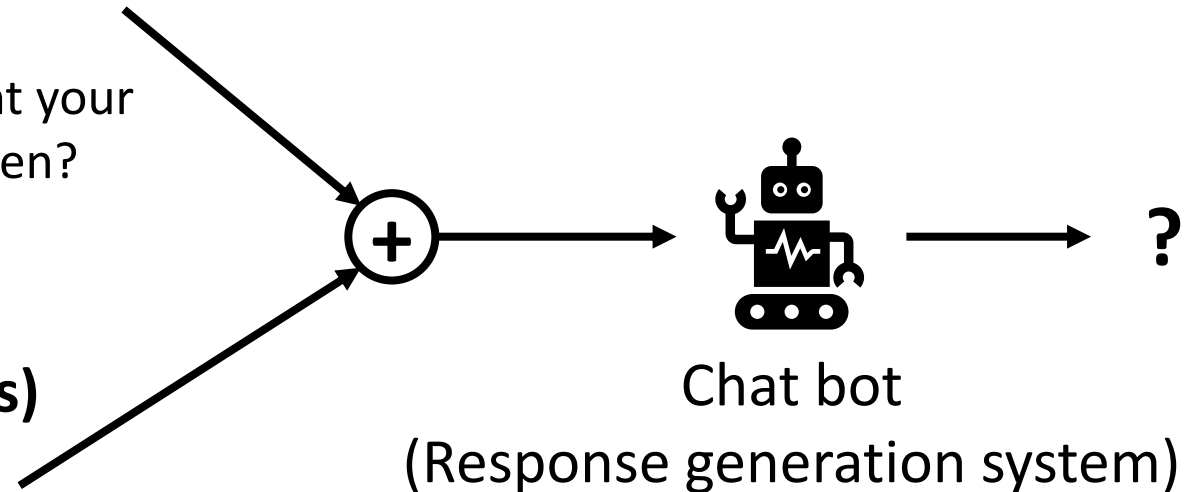
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Hypothesis: Systems produce **more context-specific and meaningful** responses.

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We created a dataset with situational statements semi-automatically.

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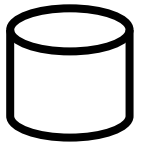
Person B's leg **had a surgery** last night.

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SUGAR^(Otani+23)



Parings of a conversation and situational statements.

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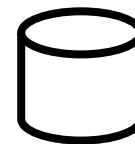
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Fine-tuning



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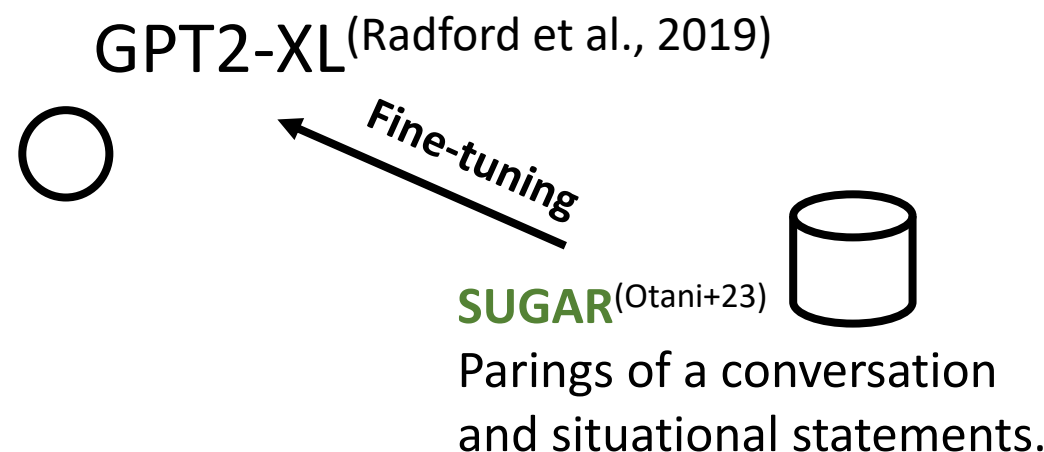
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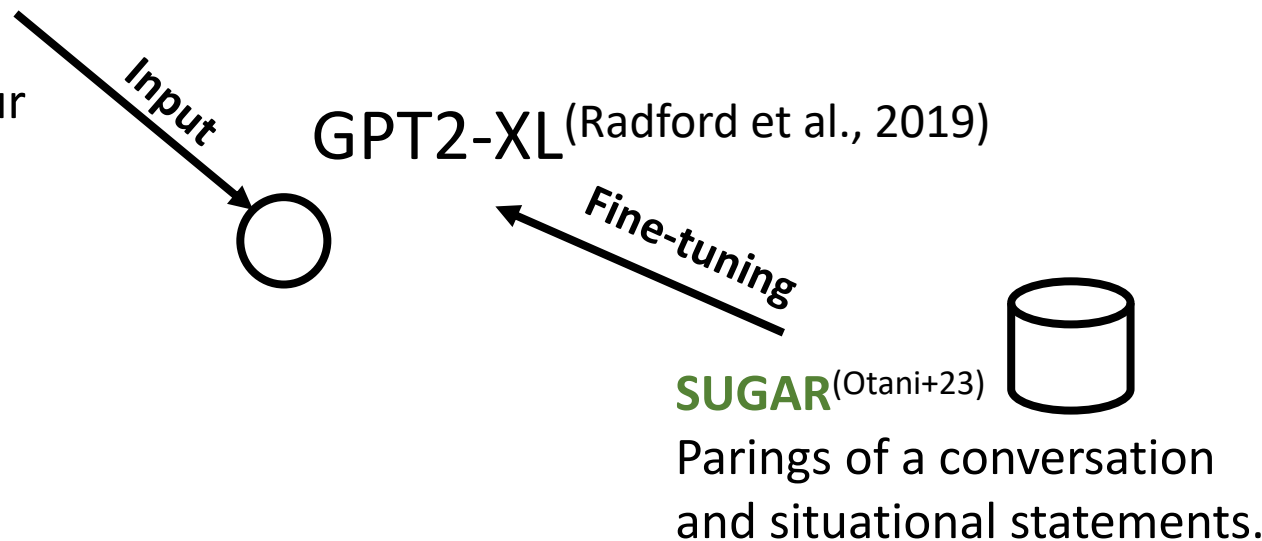
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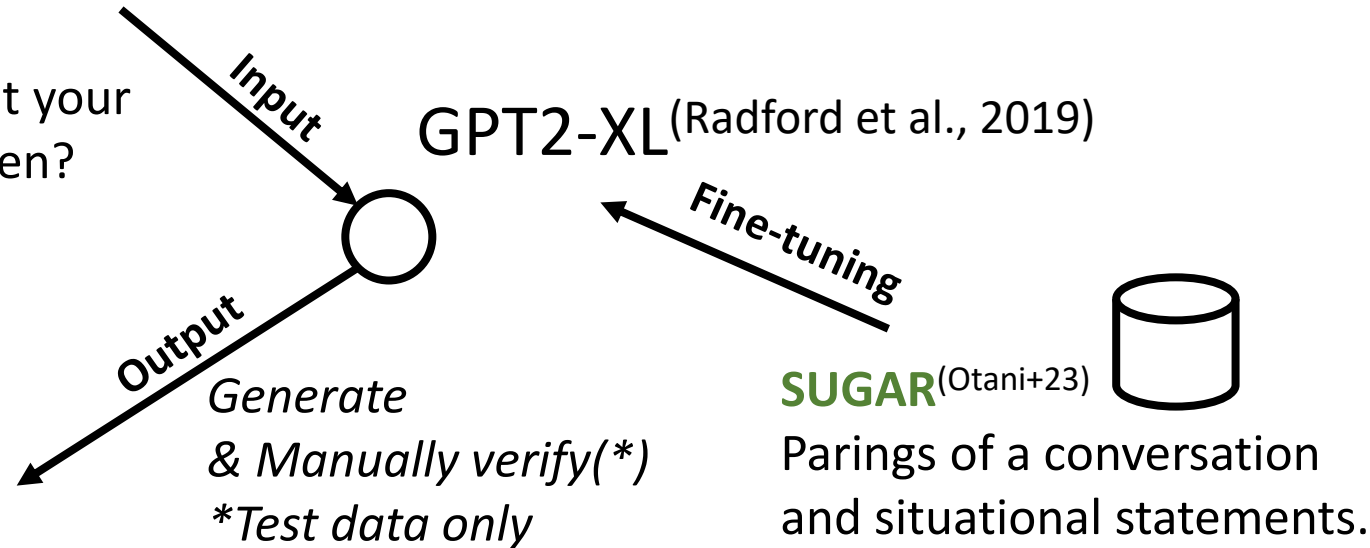
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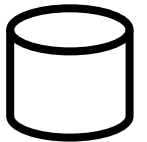
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	Training	Validation	Test	Avg. turn
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ConvAI2	16,878	1,000	25	4.7

(Ford et al., 2019)

-tuning

SUGAR^(Otani+23)



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α mutually verified

**Test data only*

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Feeding situational knowledge in text as extra input

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User request

+ Situational statements



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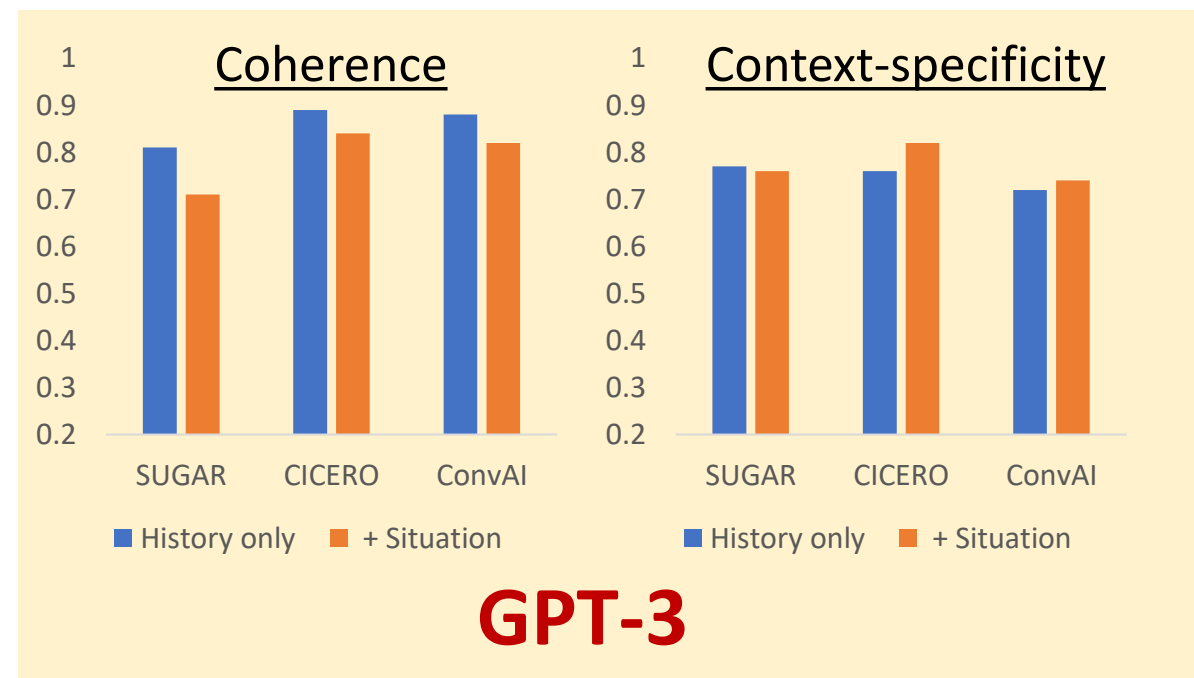
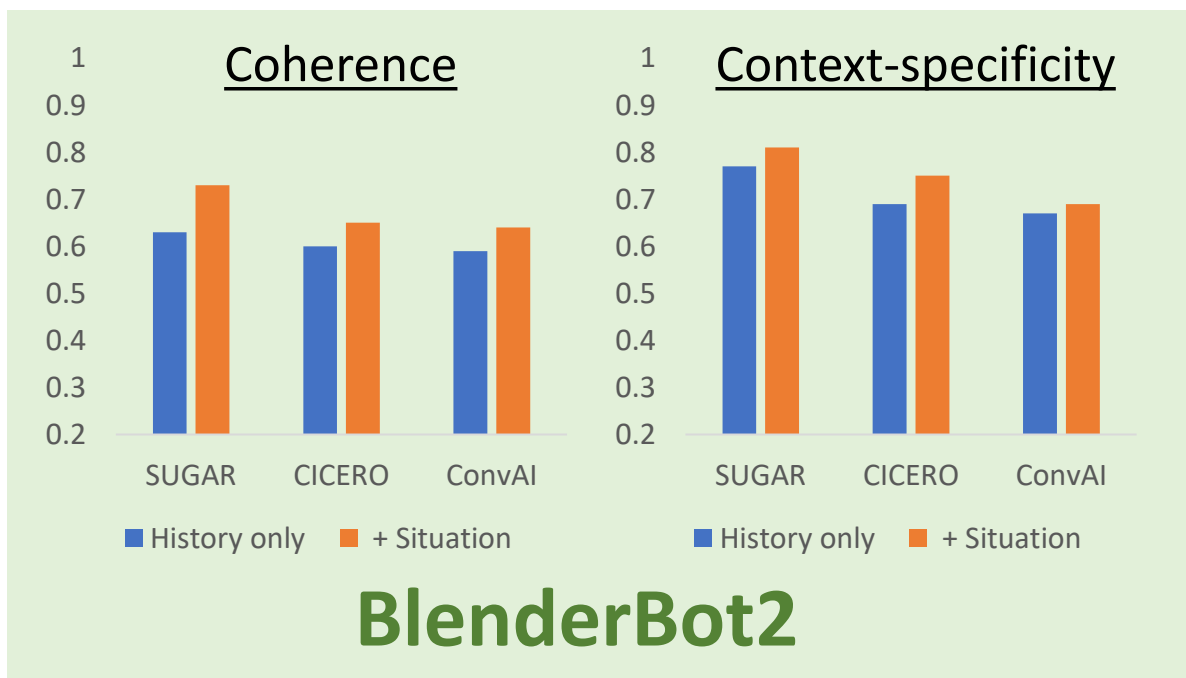
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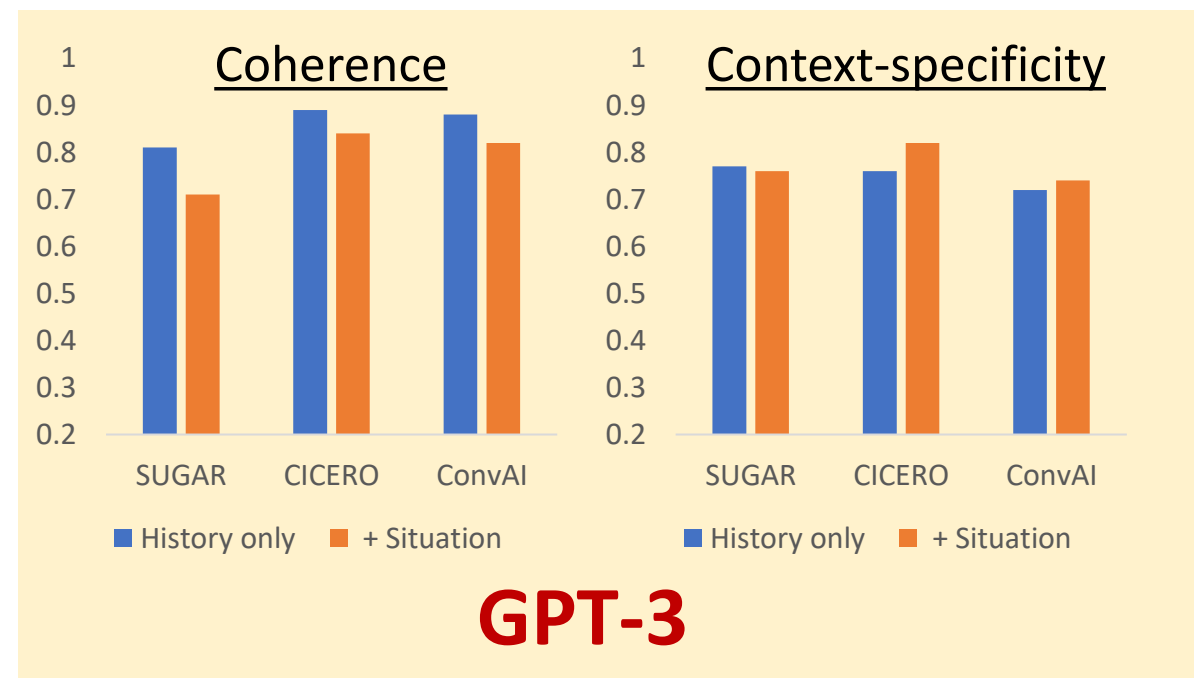
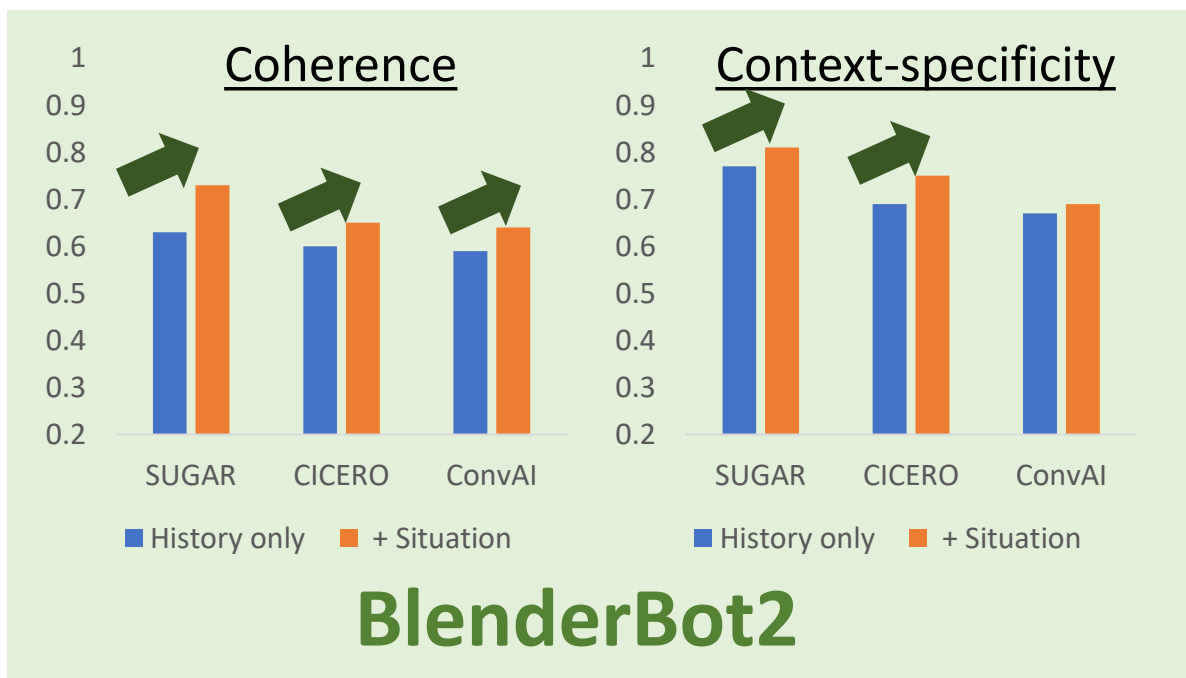


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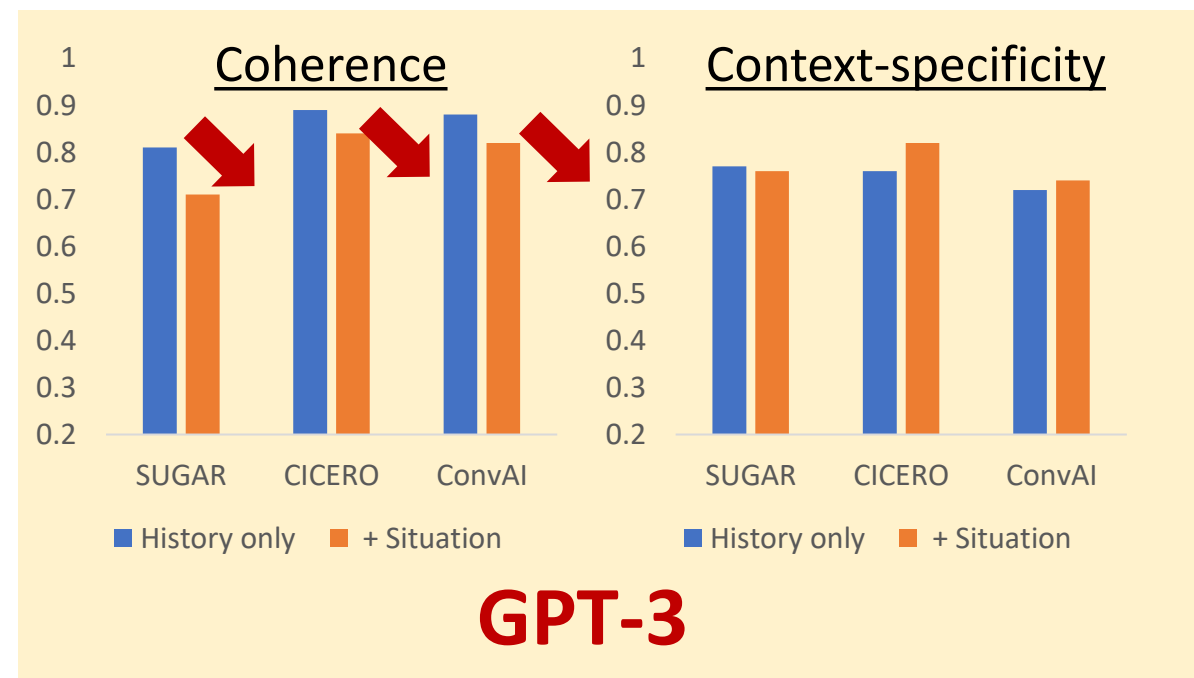
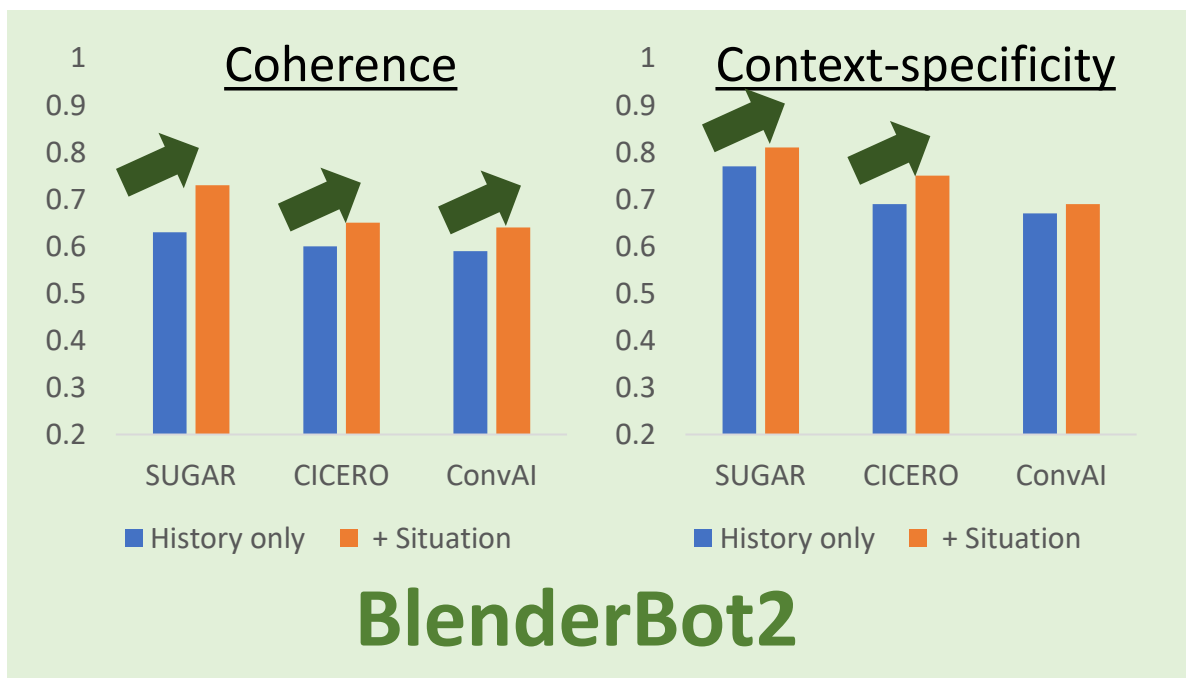


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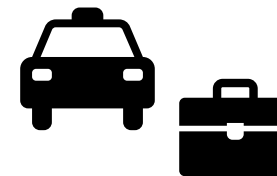
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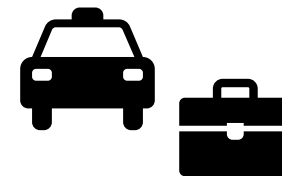
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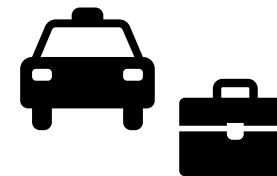
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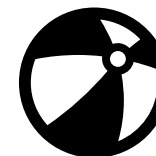


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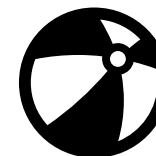


“Absolutely. Let me know which muscles you want to focus on and I can show you some stretches.”

+ **Situation:**

“The speaker is wearing a jogging suit.”

... “There is a beach ball at home.” ...



“Of course! Let’s go to the beach
and play with the beach ball while we stretch.”

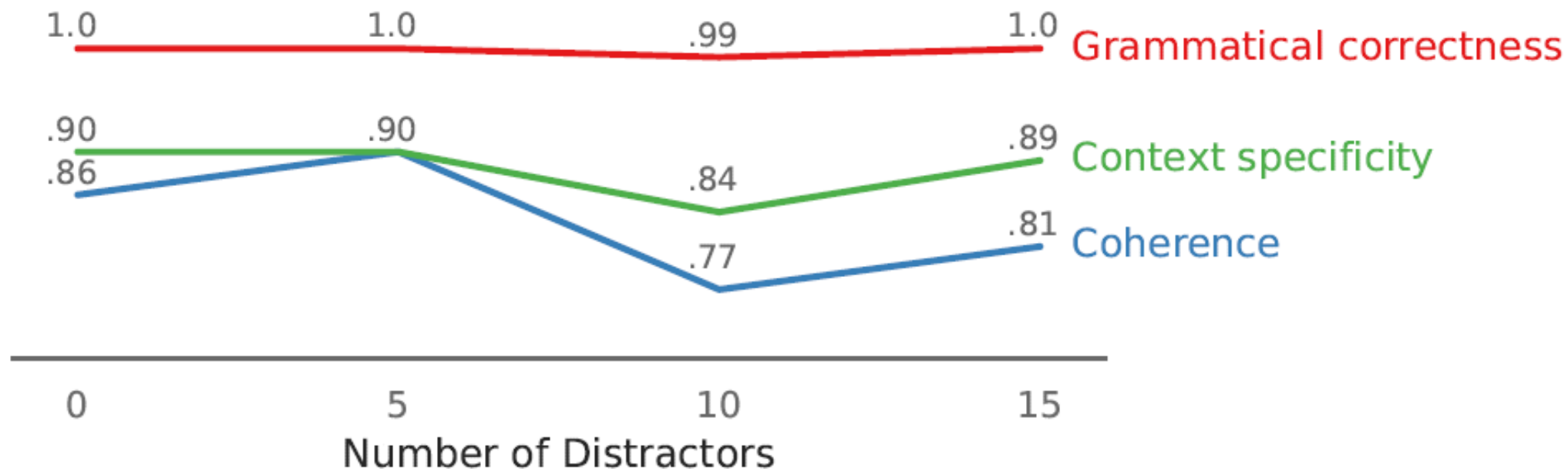


Controlled experiments:

GPT-3 was also misled by distractors

Evaluation on SUGAR

SUGAR has 5-15 irrelevant situational statements.



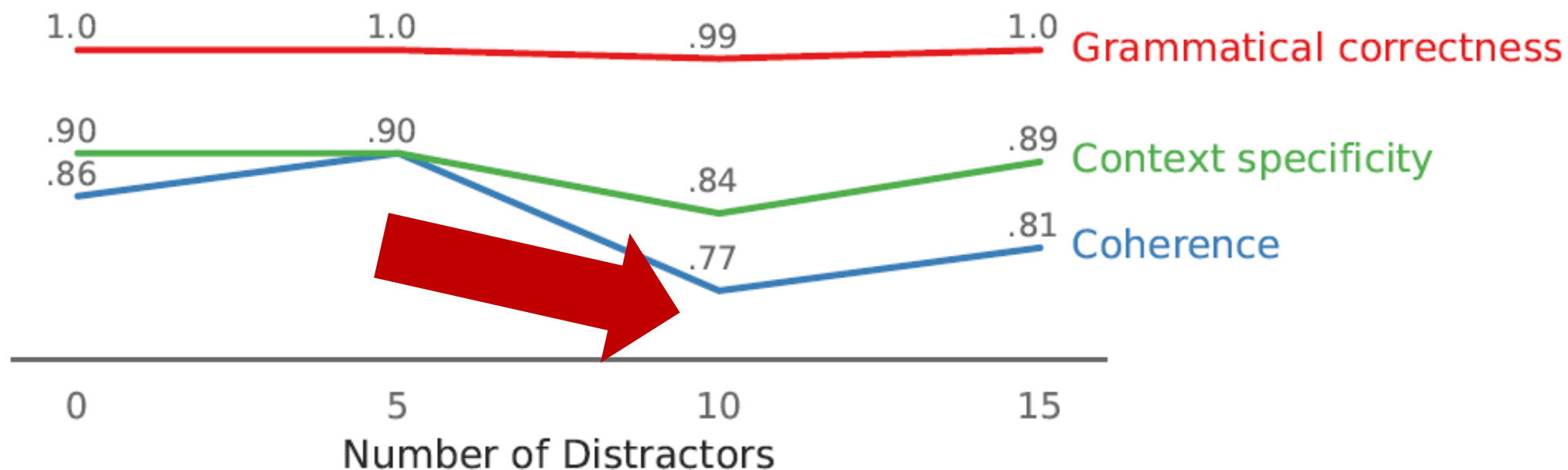
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Conclusion and Future Work

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Conversations heavily rely on situation

Claim: We need to talk about situation in open-domain conversations!

- Many datasets don't have situational information.
- **Problems:** (1) underspecification, (2) system behavior, and (3) evaluation
- Finding from our case study: situation is sometimes useful, but picking up relevant information is not easy → Room for future research!

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- **Adequacy:** Humans process an enormous amount of information.
 - How much should we put into the development/evaluation data?
- **Resource:** Human annotation is costly.
 - Maybe language generation models can facilitate annotation work.

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How much is shared with Person A?



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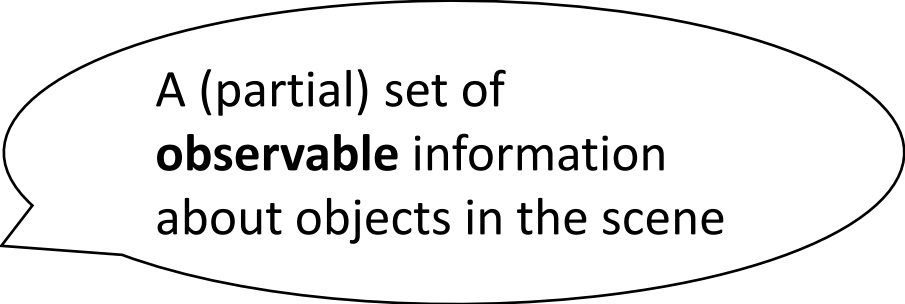
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Person A

Claim:



A (partial) set of
observable information
about objects in the scene

We need to talk about **situation**
for enhancing open-domain
conversational agents!

On the Underspecification of Situations
in Open-domain Conversational Datasets

Naoki Otani naoki@megagon.ai

Jun Araki, HyeongSik Kim, and Eduard Hovy