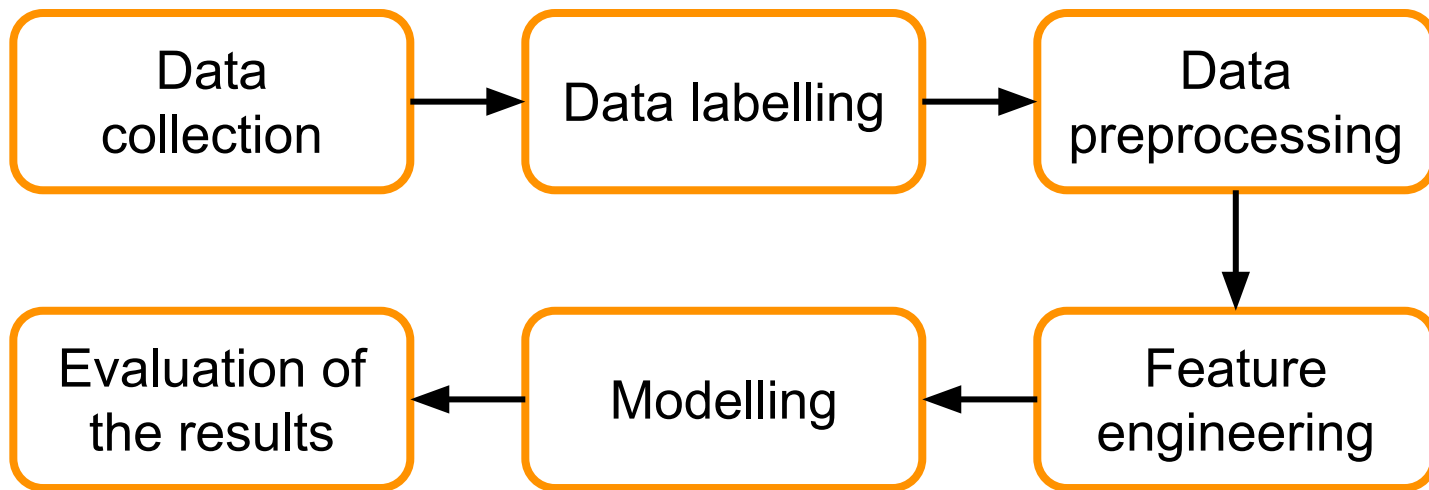# Incorporating cognitive evidence in a computational model for persuasiveness

Zlata Kikteva[1], Jennifer Schumann[2],
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[1]University of Passau, Germany [2]University of Fribourg, Switzerland
SLE 2023, Athens

Prototypical discourse mining pipeline

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│    Data     │ ───► │    Data     │ ───► │    Data     │
│ collection  │      │  labelling  │      │preprocessing│
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│Evaluation of│ ◄─── │  Modelling  │ ◄─── │   Feature   │
│ the results │      │             │      │ engineering │
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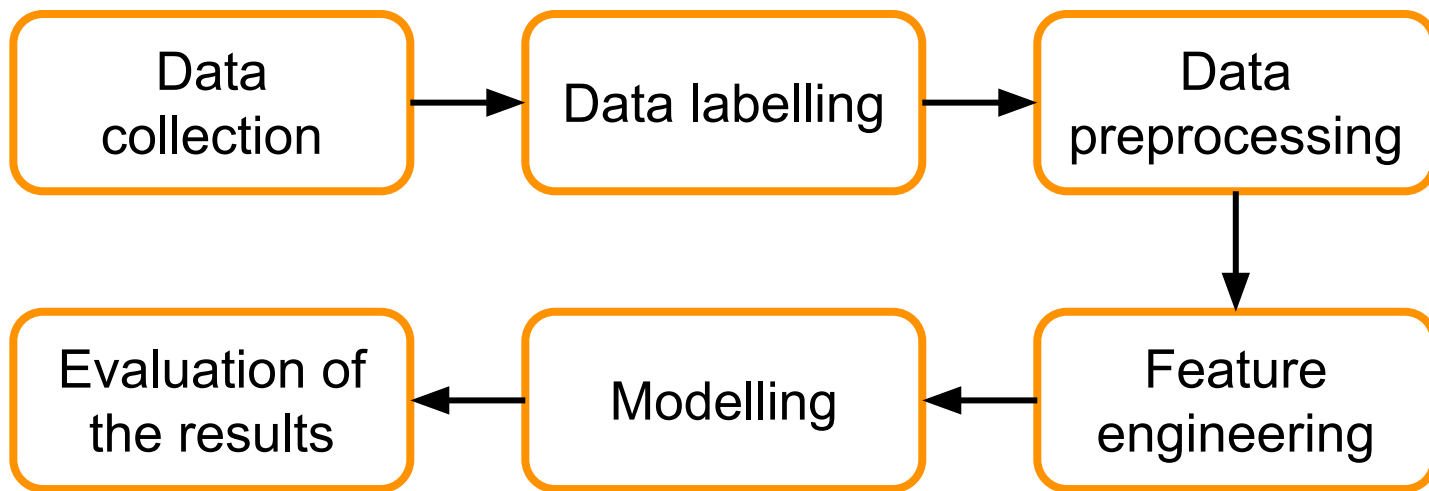
Research so far

Features commonly extracted for persuasion:
-   simple n-gram counts, word-based sentiment scores, argumentative text spans and subjectivity scores (Habernal and Gurevych, 2016; Yang et al., 2019; El Baff et al., 2020; Xiao and Xiao, 2020)

Employ extensive mathematical machinery (Samad et al., 2022) for generating persuasive text
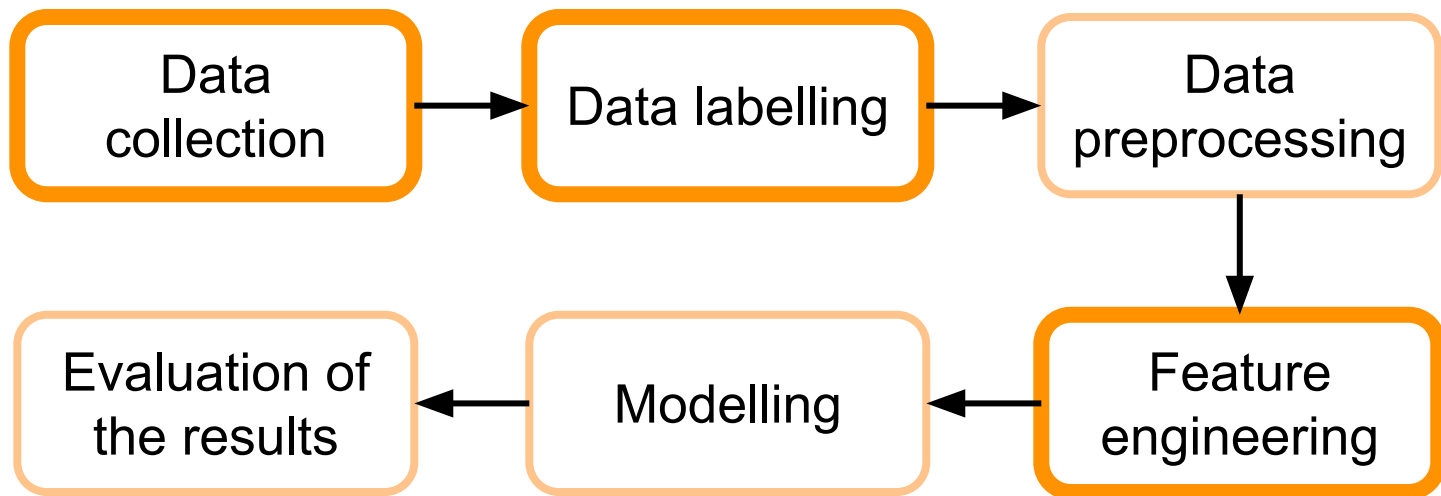
This paper: establish cognitively well-motivated features for modeling persuasion

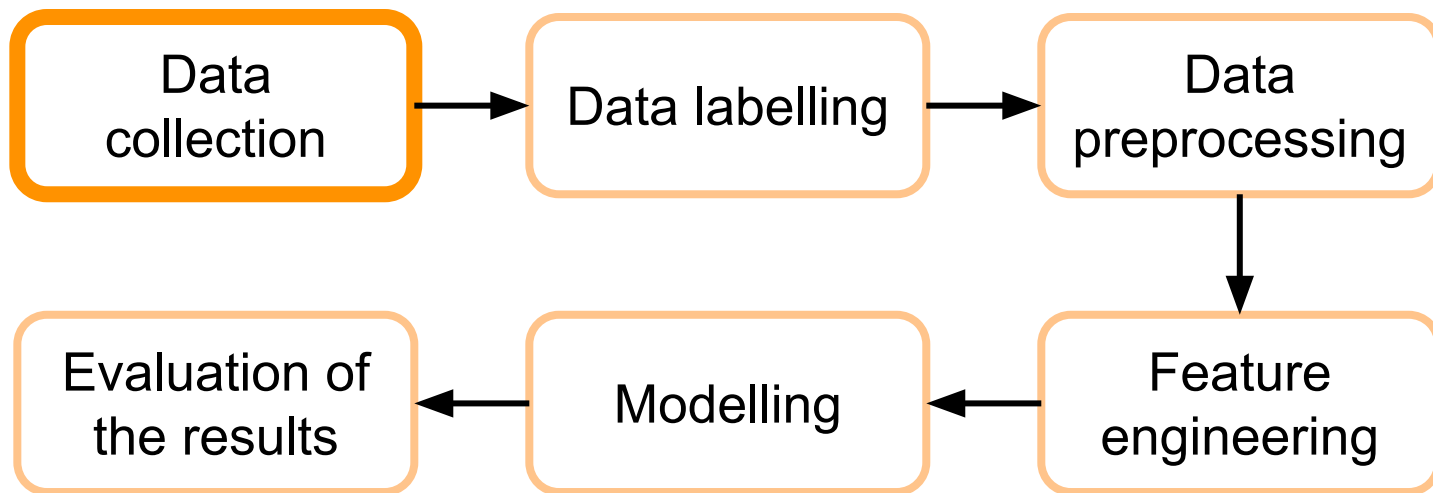# Prototypical discourse mining pipeline

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Cognitively informed!

Prototypical discourse mining pipeline

Prototypical discourse mining pipeline

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│ the results │      │             │      │ engineering │
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Question Time (QT)

- Topical debate program
- Broadcast since 1979 on BBC One
- Weekly panel of five
- Moderated
- 4 scheduled questions by audience per episode

One of the most viewed political talk shows in the UK.

The resource: QT30

30 episodes of *Question Time* from 2020-21 (Hautli-Janisz et al., 2022), annotated for arguments and pragmatic structure (speech acts).

The largest corpus of analysed dialogical argumentation ever created:
- 19,842 utterances, 280,000 words
- freely available at http://corpora.aifdb.org/qt30

Question-response pairs

Audience Member 20211028QT30: *As COP26 approaches, could you tell us in the situation of an independent Scotland, would you put the economy or environment first when choosing what to do with the domestic oil industry?*

Heather McGregor: Well, I think it's very sad that we are focusing on the things that divide us, when actually what we should be focusing on are the things that unite us. And I think every single person in this room would want a better planet and a stronger environment. But in my experience, the way to get that is a strong economy. So it's not an either/or, you have to have one and the other.

Question-response pairs

This talk:

- 5 QT episodes from August to October 2021
- 20 questions, 120 responses in total:
  Number of responses per question ranges from 3 to 9 responses

Prototypical discourse mining pipeline
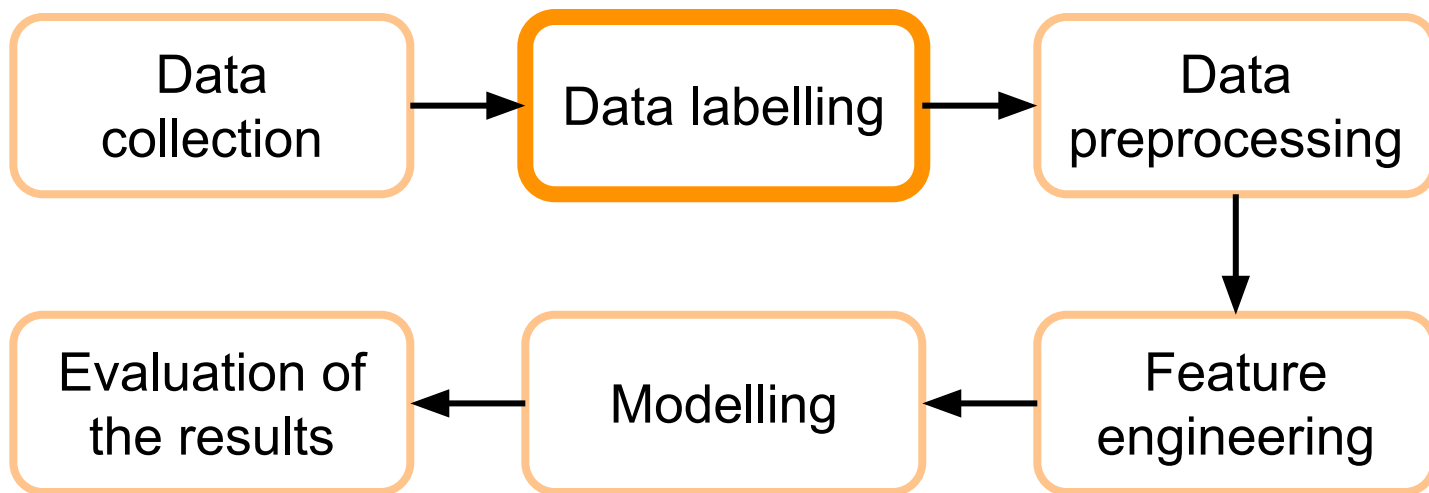
Data labelling: Persuasiveness ranking

Crowdsourced annotation – five judgements per comparison

- Annotators judged if response A is more persuasive than response B
- Pairwise comparisons of responses for each question

20 questions, 102 responses, **185 comparisons**

Data labelling: Persuasiveness ranking

Most rankings adhere to the transitivity rule:

If response A > response B and

response B > response C

then response A > response C

A

B

C

76% of all rankings are transitive

Data labelling: Persuasiveness ranking

In case transitivity does not hold:

Discard the edge that creates maximum contradiction

A>B,C,D,E
B>C,D
C>D, E
D>E
E>B

A

↓

B

↓

C

↓

D

↓

E

Data labelling: Persuasiveness ranking

In case transitivity does not hold:

Discard the edge that creates maximum contradiction

A>B,C,D,E
B>C,D
C>D, E
D>E
~~E>B~~

A

B

C

D

E

Prototypical discourse mining pipeline
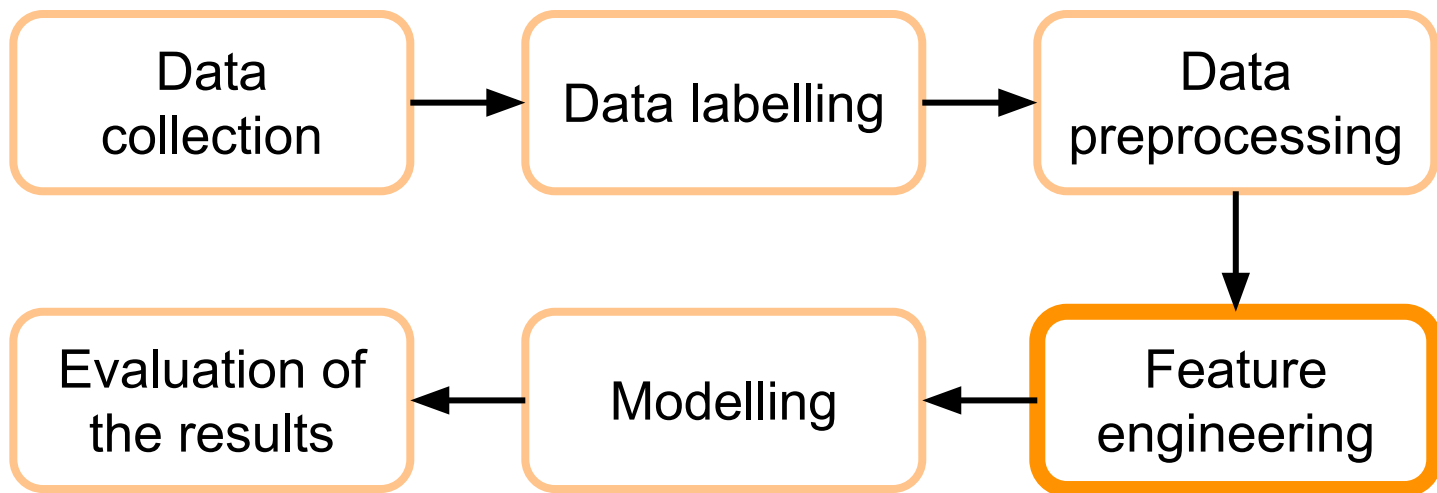
Features in the responses

Audience Member 20211028QT30: *As COP26 approaches, could you tell us in the situation of an independent Scotland, would you put the economy or environment first when choosing what to do with the domestic oil industry?*

Heather McGregor: Well, **I think** it's very sad that we are focusing on the things that divide us, when actually what we should be focusing on are the things that unite us. And **I think** every single person in this room would want a better planet and a stronger environment. **But** in my experience, the way to get that is a strong economy. **So** it's not an either/or, you have to have one and the other.

Argumentative features in responses

Audience Member 20211028QT30: *As COP26 approaches, could you tell us in the situation of an independent Scotland, would you put the economy or environment first when choosing what to do with the domestic oil industry?*
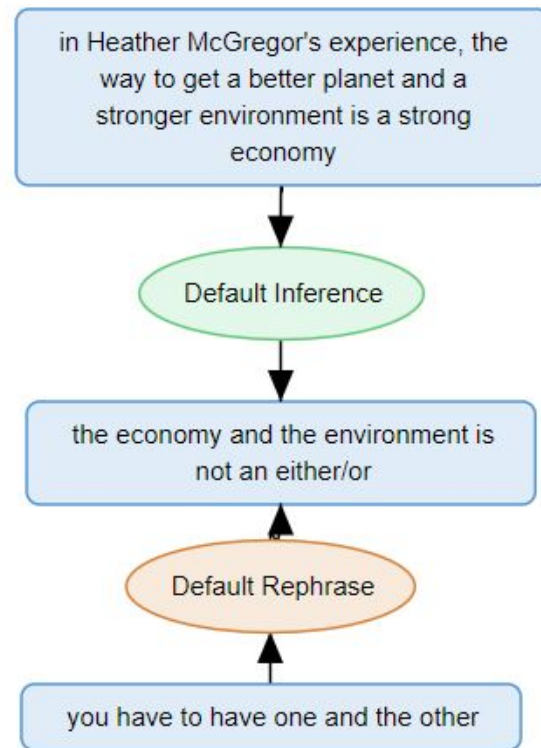
Heather McGregor: Well, I think it's very sad that we are focusing on the things that divide us, when actually what we should be focusing on are the things that unite us. And I think every single person in this room would want a better planet and a stronger environment. But in my experience, the way to get that is a strong economy. **So** it's not an either/or, you have to have one and the other.

QT episode from 28 October 2021
Json map ID: 23571

Argumentative features in responses

Audience Member 20211028QT30: *As COP26 approaches, could you tell us in the situation of an independent Scotland, would you put the economy or environment first when choosing what to do with the domestic oil industry?*

Heather McGregor: Well, I think it's very sad that we are focusing on the things that divide us, when actually what we should be focusing on are the things that unite us. And I think every single person in this room would want a better planet and a stronger environment. But in my experience, the way to get that is a strong economy. So it's not an either/or, you have to have one and the other.
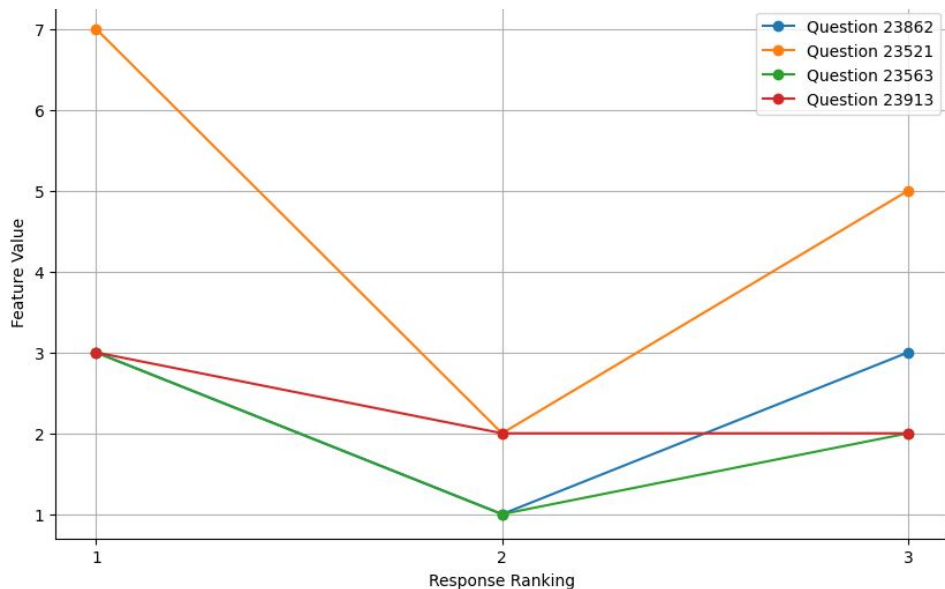
Argumentative features in responses

QT30 annotated with Inference Anchoring Theory (Budzynska et al., 2014, 2016):

- Inference: support of a standpoint
- Rephrase: reformulation of a standpoint

in Heather McGregor's experience, the way to get a better planet and a stronger environment is a strong economy

Default Inference

the economy and the environment is not an either/or

Default Rephrase

you have to have one and the other

QT episode from 28 October 2021
Json map ID: 23571

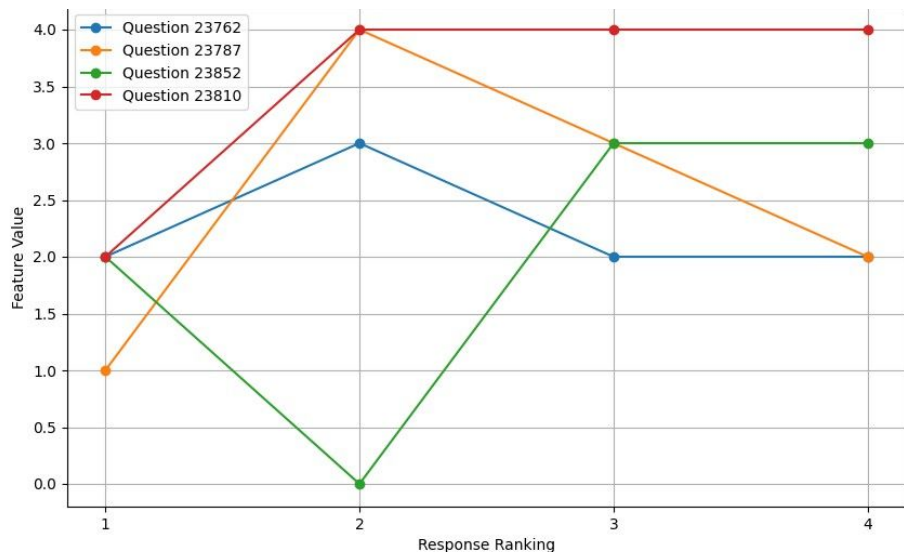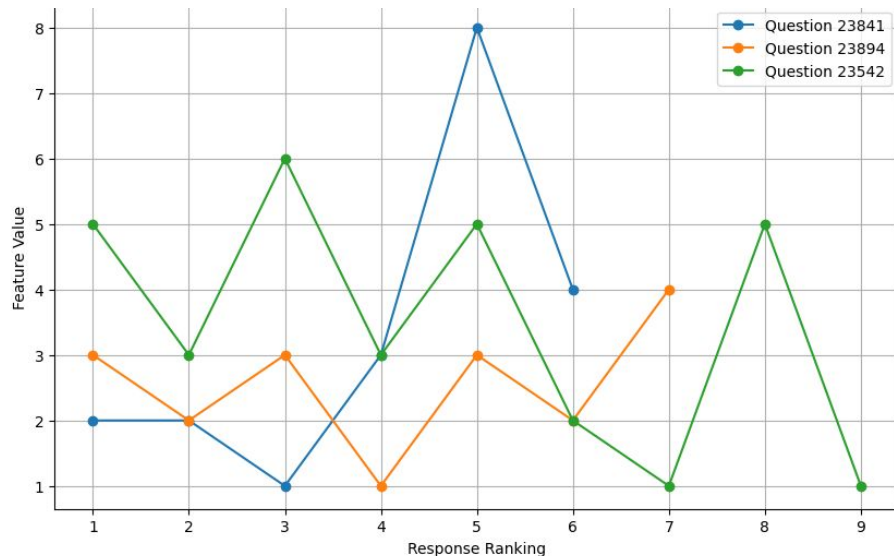# Argumentative features in responses

3 ranked responses
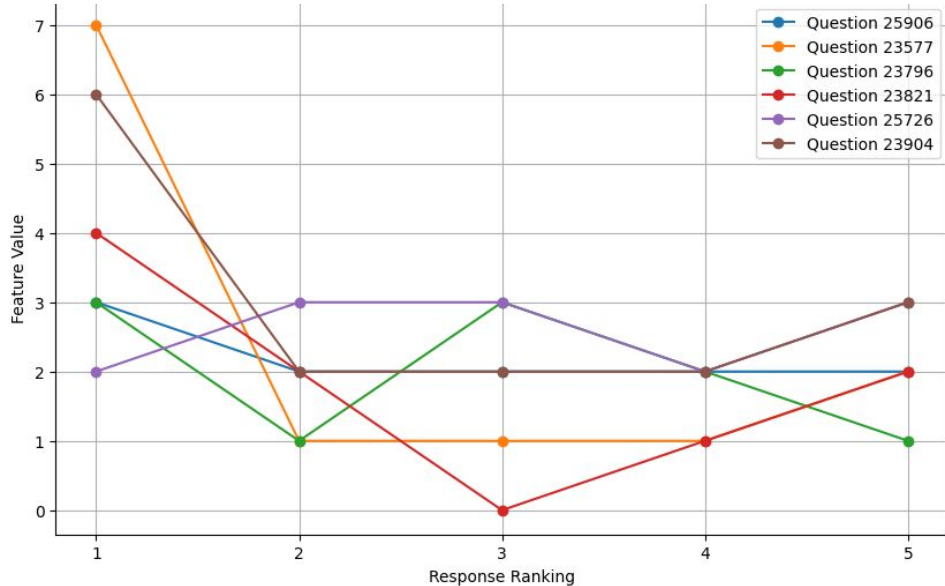
5 ranked responses

Number of inferences and rephrases per response (normalised per word)
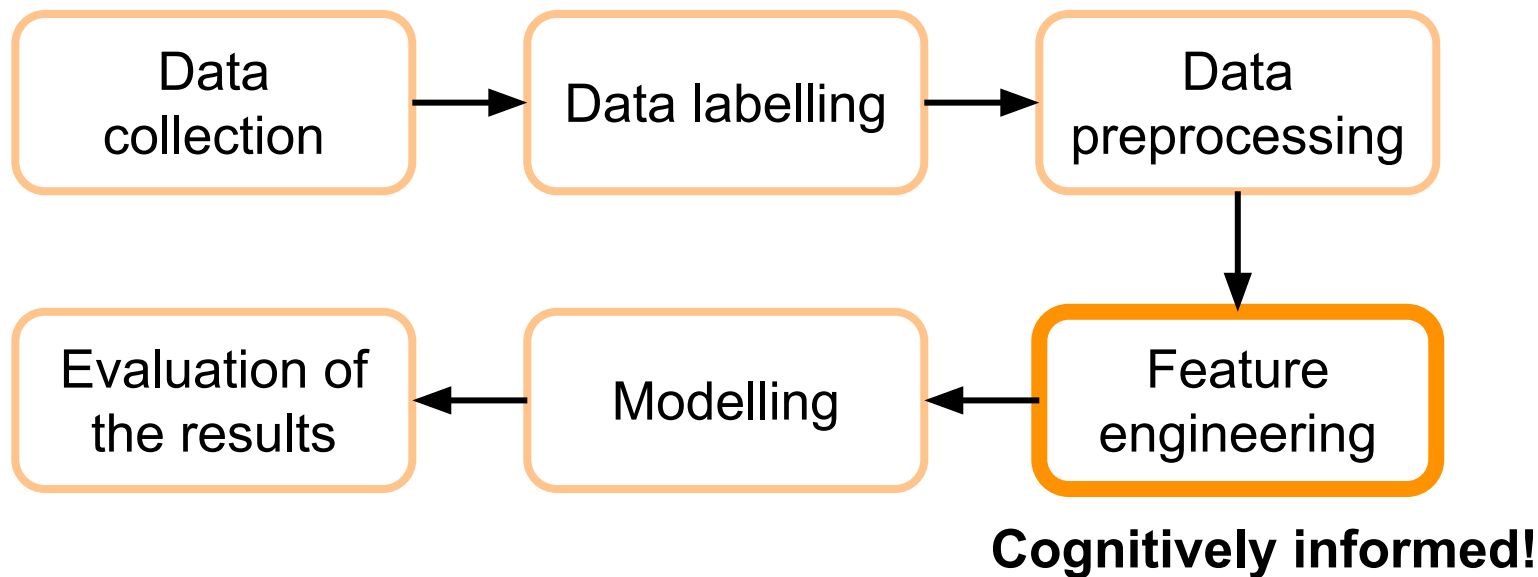
Argumentative features in responses

4 ranked responses

6-9 ranked responses

Number of inferences and rephrases per response (normalised per word)

Prototypical discourse mining pipeline

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│     Data     │ ───> │Data labelling│ ───> │     Data     │
│  collection  │      │              │      │preprocessing │
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│ Evaluation of│ <─── │  Modelling   │ <─── │   Feature    │
│  the results │      │              │      │ engineering  │
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Cognitively informed!

Taking stock

- What we know so far: responses with **many inferences and rephrases** seem to be **quite persuasive**.

- What we want to know: **why**?

- What we need to do: **dig deeper** into the formulation of these inferences

Cognitively-driven experiments

- Discourse markers have been studied in argumentation
  - Argumentation-within-language (e.g, Anscombre & Ducrot, 1983): **words of discourse**
  - Pragma-dialectics (e.g., van Eemeren et al., 2007): **argumentative indicators**
- Previous work on causal connectives in argumentation (Schumann, 2022)
  - Role of **causal connectives** for the **acceptability** of fallacious arguments (French: *puisque*, *étant donné que*, *vu que*, *comme;* English: *since*, *given that*, *as;* Spanish: *ya que*, *puesto que*, *como;* German: *da*)
  - Not equivalent **within** the same language (see also e.g., Pit, 2007; Simon & Degand, 2007; Zufferey, 2012)
  - Not equivalent **across** languages (see also, e.g., Pit, 2007; Simon & Degand, 2012; Zufferey, 2012)

RQs for the cognitive experiment

- Does the **perception of the inference change**, when it is introduced with a **connective** or not?

- What about **other types** of discourse markers, e.g., epistemic markers?

- Does adding a **conjunction to structure** the segments preceding the inference make a difference?

Selecting markers

- Conclusions: **forward** causal connective
- **Real-life** debates corpora: choice for more oral connective ***so***
- **Emphasis** on conclusion: epistemic marker ***clearly***
- **Conjunction** to link segments preceding inference: ***and***

Hypotheses

- Markers do **influence the perception** of the inference as it should be perceived as more coherent when introduced with a marker.

- *Clearly* should affect the perception of the inference **more strongly** compared to *so*, as a stronger emphasis is put on the **validity** of the conclusion.

- The conjunction *and* should **emphasise the link** between the segments preceding the inference and thus lead to **increased coherence**.

Experimental items

With conjunction with marker

*The manager's daughter-in-law lives in the UK **and** she is from Singapore. **So/Clearly**, she deals with racism every day.*

With conjunction without marker

*The manager's daughter-in-law lives in the UK **and** she is from Singapore. She has to deal with racism every week.*

Without conjunction with marker

*The manager's daughter-in-law lives in the UK. She is from Singapore. **So/Clearly**, she has to deal with racism every week.*

Without conjunction without marker

The manager's daughter-in-law lives in the UK. She is from Singapore. She has to deal with racism every week.

Measure

Previous studies → perceived coherence as **indirect indicator** for persuasiveness

Do you think the last sentence follows from what the speaker said right before?

Experimental design

- Materials & procedure
  - 32 items (2 groups, 4 conditions)
  - Latin square design, randomized order
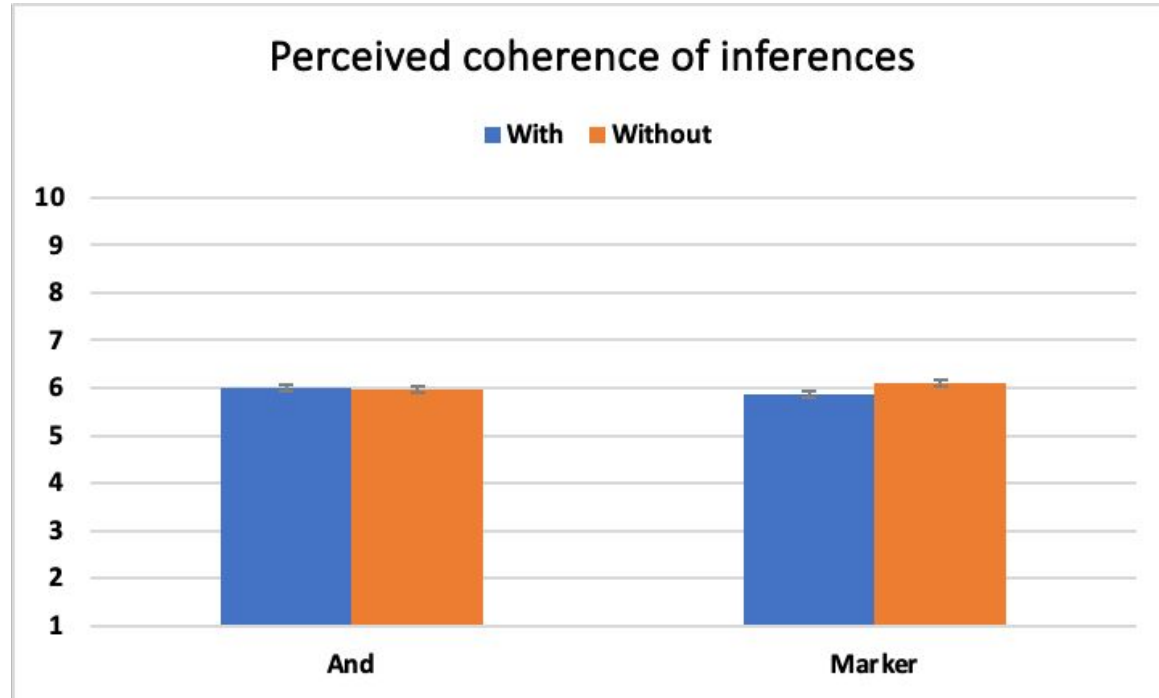 - 1 assessment question per item, 10-point slider scale
- Participants
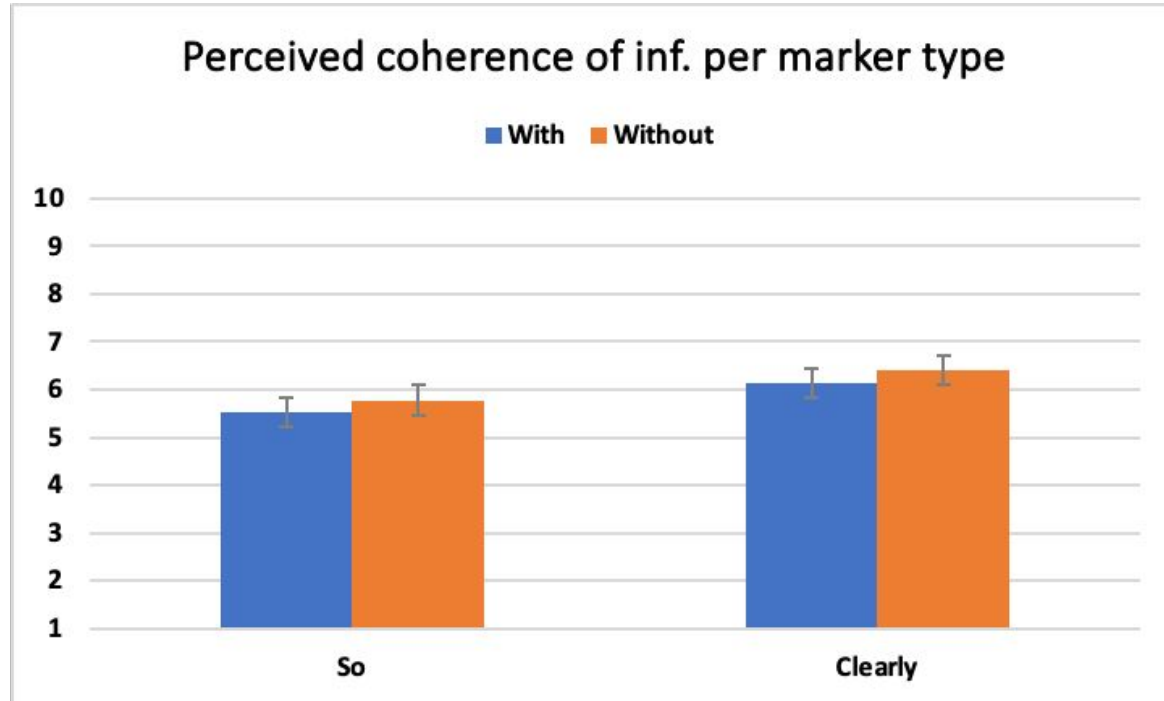 - 96 English speakers (L1, fluent), mean age (range), balanced sample
- Analysis
  - Mixed subject design: 1 between (*so* or *clearly*), 2 within-subject factors (presence or absence of *and* / presence or absence of marker)
  - Mixed ANOVA

Results

Perceived coherence of inferences

Results

Discussion

- **No effect** for the presence or absence of *and*
  - Why? Not sure, we'll have to look into that
- **Effect** for presence or absence of marker
  - Inferences are perceived as **more coherent**, when **markers** are absent
    - People are **more alert** to the content following the marker
    - Triggers epistemic vigilance filters
  - Effect much stronger with *clearly* than with *so*
    - *Clearly* is strongly linked to the evidential marking (see Gonzales et al., 2017)
- Overall: markers might to some degree play a **different role in argumentation**

Conclusions

- Next step: extend the cognitive experiments to cover different discourse markers
- Integrate their impact on persuasiveness in the computational model: higher impact on the weighting of a feature if cognitive experiments have shown a strong correlation with persuasiveness

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