

What do you mean by *negotiation*?

Annotating social media discussions about word meaning

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Background

Formal interaction model

Annotation study

Protocol

Agreement results & Error analysis

What is Word Meaning Negotiation?

Word meaning negotiation (WMN) is a conversational routine in which participants explicitly discuss the meaning of a word or phrase.

- ▶ often negotiating in-context meanings
- ▶ along side implicit semantic alignment/learning
- ▶ in dyadic or multiparty conversations
- ▶ takes place across various dialogue modalities

Example 1: WMN

- A: Messi doesn't have up to 5 long range goals. Put your money.
- B: They will just eat your money. Better define what you mean by long range ... cos if it's "outside the box" messi has more than him.
- A: Long range is long range. Outside the box is not long range.
- B: Lemaooo says who ? You ?

Example 1: WMN

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- B: Lemaooo says who ? You ?

What results from this exchange?

Why are we interested in Word Meaning Negotiation?

- ▶ Its explicit nature makes it easy to identify
- ▶ WMNs may give us insight into semantic alignment & lexical acquisition more generally
- ▶ We would like to study WMN as a contributor to community-level semantic change
- ▶ WMN would make dialogue systems more flexible
 - ▶ Adapting to a user's lexicon
 - ▶ Teaching users words or word usages they don't know

Non-understanding vs. Disagreement

- ▶ WMNs can originate in either non-understanding of— or disagreement about the meaning of a word or phrase in context (Myrendal, 2015)
- ▶ This is not a hard-line distinction: What starts as non-understanding can evolve into disagreement; disagreements can involve non-understanding

Structure of WMNs

The T-I-R model (Varonis and Gass, 1985):

- ▶ Developed to model non-understanding WMNs between pairs of adult language learners
- ▶ Three essential elements:
 - ▶ **Trigger** – An utterance containing a lexical item (the *trigger word*) which is not understood by another participant
 - ▶ **Indicator** – In which the participant explicitly indicates their non-understanding
 - ▶ **Response** – In which the speaker of the trigger utterance overtly acknowledges the non-understanding

WMN contributions

Myrendal (2019):

- ▶ **generic and specific explication**(partial definition)
- ▶ **exemplification**
- ▶ **contrasting**
- ▶ **metalinguistic objections**

Dialogue acts (Larsson and Myrendal, 2017):

- ▶ Formalizes *exemplification*, *partial definition*, and *contrasting* as dialogue acts that act on the dialogue game board
- ▶ Defines meaning update functions in terms of TTR record types

Formal interaction model

We can think of WMNs as a dialogue game (Wittgenstein's sense). To model that, we should define:

- ▶ A **game state**
- ▶ The possible **moves** that agents can take (and when they are possible, given the game state)
- ▶ The **effect** of given a move on the game state

$$\text{WMN} = \langle s_i, A_i, R_i \rangle_{i \leq N} \quad (1)$$

- ▶ s_i is the speaker at turn i
- ▶ A_i is the set of anchors introduced by s_i in turn i
- ▶ R_i is the set of relations between anchors that s_i commits to in turn i

Anchors

- ▶ An *anchor* is a set (equivalence class) of co-referring expressions whose meaning can be put in relation to that of other anchors (including the trigger word).
- ▶ The *meaning* of an anchor is not (necessarily) grounded, what is (assumed to be) grounded is:
 - ▶ The anchor's status as a discourse referent
 - ▶ The *coreferingness* of all the expressions included in the anchor (including anaphora, abbreviations, etc.)

$$\mathbf{A}_i = \bigcup_{j \leq i} A_j \quad (2)$$

Example 2: Anaphoric reference to an anchor

A: Obviously West wants to destabilise the region.

Have have logic, China has made good health care system, education system, farming everything in the region. And that is the region where BRI also goes.

Have some logic

B: It can have done all that while also having **totalitarian** tendencies. Is that not possible? I'm well aware of the strong anti-corruption, the safety nets and the decrease in poverty in the country, but it is not relevant to this point

A: What do you mean by **Totalitarian** ?

A country where people doesn't accept Government.

The acceptance of Chinese govt is 80%, while in USA is under 30%.

So ask that question to USA.

B: **That** is not the definition of **totalitarian**. Can someone start their own political party in China?

Example 3: Variation in anchor-referring expressions

- A: The most effective way to keep men (who work in trades and use and die alone at home) safe is not to tell them not to use alone. Instead, ensure they have full access to a **#safesupply** of pharmaceutical alternatives to toxic street drugs.
- B: In Victoria opioid users can easily get free Dillies, Dilloutid. Is this what you mean by **SAFE SUPPLY** ??
- A Yes. That is one of the options but not the preferred one for most people.

Semantic relations

As part of the WMN, agents propose, accept, reject, question different *semantic relations* between anchors. We model this with a set of possible relations (*example of and partial definition of*):

$$\mathcal{R} = \{\text{Exa}, \text{Def}\} \tag{3}$$

and *polarities*, which track the agents' stated disposition towards those relations, with respect to pairs of anchors.

$$\mathcal{O} = \{+, -, ?\} \tag{4}$$

Semantic relations

Recall that R_i gives us the semantic relation(s) that s_i commits to in turn i . We can recover s_i 's current public commitments by simply taking the most recent polarity they committed to with respect to a given relation.

$$R_{s,0} = \begin{cases} R_0 & \text{if } s = s_0 \\ \emptyset & \text{otherwise} \end{cases} \quad (5)$$

and

$$R_{s,i+1} = \begin{cases} R'_{s,i} \cup R_{s,i+1} & \text{if } s = s_i \\ R_{s,i} & \text{otherwise} \end{cases} \quad (6)$$

where

$$R'_{s,i} = \{R^o(a, b) \in R_{s,i} \mid \neg \exists o'. R^{o'}(a, b) \in R_s\} \quad (7)$$

Semantic relations

Finally, we can define the **common ground relations** as those relations to which all speakers have committed:

$$R_i = \bigcap_{s \in S} R_{s,i} \quad (8)$$

Semantic update

For $a \in A_N$, let

$$\{R_1^{o_1}(b_1, a), \dots, R_n^{o_n}(b_n, a)\} \subseteq R_N$$

be the common ground relations anchoring a at turn N .

The semantic update given by WMN for a is defined as:

$$\Delta(a) = [I(R_1, o_1, \Delta(b_1)) \circ \dots \circ I(R_n, o_n, \Delta(b_n))](\llbracket a \rrbracket) \quad (9)$$

Data: Twitter conversations

- ▶ We collected candidate indicators by searching for reply tweets that included the words “you”, “mean” and “by” and filtering with a regex to allow for various ways to phrase questions like “what do you mean by X?”
- ▶ Searched upwards and downwards in the twitter thread to reconstruct a two-way conversation between the indicator poster and the person they were replying to
- ▶ 671 threads total after 24 hours (indicator tweets) then 48 hours (threads)
- ▶ annotated 150 threads

Annotation setup

- ▶ 150 twitter exchanges
- ▶ Each exchange is annotated by two of the authors (round robin setup)
- ▶ BRAT annotation tool (Stenetorp et al., 2012)

Annotation instructions

1. Identify the WMN type
 - ▶ Is it a WMN at all?
 - ▶ Is it originating in non-understanding or disagreement?
2. Identify the trigger and all co-referring expressions
3. Identify other anchors (examples and definitions) and link co-referring non-trigger anchors
4. Where relevant, link anchors to previously mentioned anchors, according to the polarity (+/-/?) of the relation expressed by the speaker
5. Identify spans of text that explicitly ground previously proposed relations and link the grounding relation to the head anchor in that relation

We instruct annotators go about annotating in this order, but advise that it's OK to go back and revise previous steps.

Example 4: Annotation (0/5)

1 ----- @Rx_Deyholar · 11:00 AM · May 04, 2021 · ID 1389535319280734211 -----

2 Messi doesn't have up to 5 long range goals. Put your money. <https://t.co/8veCWDFR7B>

4 ----- @davidbankys · 11:55 AM · May 04, 2021 · ID 1389549291782479872 -----

Indicator (DIS)

5 They will just eat your money. Better define what you mean by long range ... cos if it's "outside the box" messi has more than him.

7 ----- @Rx_Deyholar · 11:58 AM · May 04, 2021 · ID 1389549978637508609 -----

8 Long range is long range. Outside the box is not long range.

10 ----- @davidbankys · 12:00 PM · May 04, 2021 · ID 1389550592687751169 -----

11 Lemaaaao says who ? You ?

Example 4: Annotation (1/5)

1 ----- @Rx_Deyholar · 11:00 AM · May 04, 2021 · ID 1389535319280734211 -----

Trigger

2 Messi doesn't have up to 5 long range goals. Put your money. <https://t.co/8veCWDFR7B>

4 ----- @davidbankys · 11:55 AM · May 04, 2021 · ID 1389549291782479872 -----

Indicator (DIS)

Trigger

5 They will just eat your money. Better define what you mean by long range ... cos if it's "outside the box" messi has more than him.

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Trigger

Trigger

8 Long range is long range. Outside the box is not long range.

10 ----- @davidbankys · 12:00 PM · May 04, 2021 · ID 1389550592687751169 -----

11 Lemaooo says who ? You ?

Example 4: Annotation (2/5)

1 ----- @Rx_Deyholar · 11:00 AM · May 04, 2021 · ID 1389535319280734211 -----

Trigger

2 Messi doesn't have up to 5 long range goals. Put your money. <https://t.co/8veCWDFR7B>

4 ----- @davidbankys · 11:55 AM · May 04, 2021 · ID 1389549291782479872 -----

Indicator (DIS)

Trigger

Definition

Coreference

5 They will just eat your money. Better define what you mean by long range ... cos if it's "outside the box" messi has more than him.

Coreference

7 ----- @Rx_Deyholar · 11:58 AM · May 04, 2021 · ID 1389549978637508609 -----

Coreference

Definition

Trigger

Definition

Trigger

8 Long range is long range. Outside the box is not long range.

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Example 4: Annotation (3/5)

1 ----- @Rx_Deyholar · 11:00 AM · May 04, 2021 · ID 1389535319280734211 -----

Trigger

2 Messi doesn't have up to 5 long range goals. Put your money. <https://t.co/8veCWDFR7B>

4 ----- @davidbankys · 11:55 AM · May 04, 2021 · ID 1389549291782479872 -----

Indicator (DIS)

Trigger

Definition

Question ← Coreference →

5 They will just eat your money. Better define what you mean by long range ... cos if it's "outside the box" messi has more than him.

Coreference ← →

7 ----- @Rx_Deyholar · 11:58 AM · May 04, 2021 · ID 1389549978637508609 -----

Coreference ← →

Definition

Trigger

Definition

Trigger

Negative →

8 Long range is long range. Outside the box is not long range.

10 ----- @davidbankys · 12:00 PM · May 04, 2021 · ID 1389550592687751169 -----

11 Lemaooo says who ? You ?

Example 4: Annotation (4/5)

1 ----- @Rx_Deyholar · 11:00 AM · May 04, 2021 · ID 1389535319280734211 -----

Trigger

2 Messi doesn't have up to 5 long range goals. Put your money. <https://t.co/8veCWDFR7B>

4 ----- @davidbankys · 11:55 AM · May 04, 2021 · ID 1389549291782479872 -----

Indicator (DIS)

Trigger

Question

Definition

Coreference

5 They will just eat your money. Better define what you mean by long range ... cos if it's "outside the box" messi has more than him.

Coreference

7 ----- @Rx_Deyholar · 11:58 AM · May 04, 2021 · ID 1389549978637508609 -----

Coreference

Definition

Trigger

Definition

Trigger

Negative

8 Long range is long range. Outside the box is not long range.

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Example 4: Annotation (5/5)

1 ----- @Rx_Deyholar · 11:00 AM · May 04, 2021 · ID 1389535319280734211 -----

Trigger

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Indicator (DIS)

Trigger

Question

Definition

Coreference

5 They will just eat your money. Better define what you mean by long range ... cos if it's "outside the box" messi has more than him.

Coreference

7 ----- @Rx_Deyholar · 11:58 AM · May 04, 2021 · ID 1389549978637508609 -----

8 Long range is long range. Outside the box is not long range.

Negative

Coreference

Definition

Trigger

Definition

Trigger

Negative

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Negative

11 Lemaooo says who ? You ?

Grounding

Reasons for disagreement

- (1) Different annotations that map to the same thing in the formalism
- (2) The dialogue is ambiguous and the annotators choose different interpretations
- (3) Annotators disagree about the correct interpretation of the dialogue
- (4) Annotators disagree about how the same interpretation should be represented in the annotation scheme

Annotator agreement: WMN type

	A_0	π	κ
WMN/Not	0.71	0.40	0.40
NON/DIN	0.79	0.47	0.48

- ▶ A_0 – proportion agreement (between two annotators)
- ▶ π – Scott's pi
- ▶ κ – Cohen's kappa¹

¹Similar values for π and κ suggest that annotators have similar priors for the different classes (Artstein and Poesio, 2008).

Annotator agreement: Span type

For a given token, do the annotators agree about what kind of span it is?

	A_0	π	κ
Anchor (non-trigger)	0.93	0.59	0.60
Trigger	0.98	0.63	0.63
Grounding	0.98	0.22	0.22
Overall	0.87	0.64	0.64

Annotator agreement: Relation target/polarity

Do the annotators agree on the polarity of a given relation or grounding statement?

	A_0	π	κ
Relation	0.93	0.69	0.69
Grounding	0.88	0.58	0.59

Example 5: Annotator disagreement

1 ---- @Rx_Deyholar · 11:00 AM · May 04, 2021 · ID 1389535319280734211 ----

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<https://t.co/8veCWDFR7B>

Trigger

3 ---- @davidbankys · 11:55 AM · May 04, 2021 · ID 1389549291782479872 ----

4 They will just eat your money. Better define what you mean by long range ... cos if

Indicator (DIS) Trigger Question

5 it's "outside the box" messi has more than him.

Definition

6 Long range is long range. Outside the box is not long range.

Definition Trigger Definition Negative

7 ---- @Rx_Deyholar · 11:58 AM · May 04, 2021 · ID 1389549978637508609 ----

8 Long range is long range. Outside the box is not long range.

Definition Trigger Definition Negative

9 ---- @davidbankys · 12:00 PM · May 04, 2021 · ID 1389550592687751169 ----

10 Lemaaaao says who ? You ?

Negative

Grounding

1 ---- @Rx_Deyholar · 11:00 AM · May 04, 2021 · ID 1389535319280734211 ----

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3 ---- @davidbankys · 11:55 AM · May 04, 2021 · ID 1389549291782479872 ----

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Indicator (DIS) Trigger Question

5 it's "outside the box" messi has more than him.

Definition

6 Long range is long range. Outside the box is not long range.

Trigger Definition Definition Negative

7 ---- @Rx_Deyholar · 11:58 AM · May 04, 2021 · ID 1389549978637508609 ----

8 Long range is long range. Outside the box is not long range.

Trigger Definition Definition Negative

9 ---- @davidbankys · 12:00 PM · May 04, 2021 · ID 1389550592687751169 ----

10 Lemaaaao says who ? You ?

Negative

Negative

Grounding



Example 6: Annotator disagreement

5 ---- @GavinAyling · 10:41 AM · May 05, 2021 · ID 1389892959924101128 ----

Trigger
Positive

6 We're need central funding of education.
Positive Definition

A certain \$ per student, then an additional amount if the average income for a school's stu
At the moment we do the opposite.

8 ---- @pt35mm · 10:53 AM · May 05, 2021 · ID 1389896020277055489 ----

Indicator(DIS) Trigger Positive

9 What do you mean by central? Can tell you school choice would never work. The
Positive

parents would and do destroy that.

11 ---- @GavinAyling · 11:27 AM · May 05, 2021 · ID 1389904689945321473 ----

Positive

12 I would
Positive Definition

fund education from federal tax and provide every city or town with, say, \$1,000 per studen
That way, poor districts have better funding for schools that wealthy ones. But no,
school choice has been shown to fail.

5 ---- @GavinAyling · 10:41 AM · May 05, 2021 · ID 1389892959924101128 ----

Trigger
Positive

6 We're need central funding of education. A certain \$ per student, then an additional amount if the average income for a school's students' parents is low. At the moment we do the opposite.

8 ---- @pt35mm · 10:53 AM · May 05, 2021 · ID 1389896020277055489 ----

Indicator(NON) Trigger Positive

9 What do you mean by central? Can tell you school choice would never work. The
Positive

parents would and do destroy that.

11 ---- @GavinAyling · 11:27 AM · May 05, 2021 · ID 1389904689945321473 ----

Positive

12 I would
Positive Example

fund education from federal tax and provide every city or town with, say, \$1,000 per
That way, poor districts have better funding for schools than wealthy ones. But no,
school choice has been shown to fail.

14 ---- @pt35mm · 11:35 AM · May 05, 2021 · ID 1389906496474001408 ----

Conclusion

- ▶ Reasonably ok agreement scores suggest the WMN model is on the right track
- ▶ Improvements to the protocol should make it possible for non-expert annotators
- ▶ WMNs are often ambiguous:
 - ▶ Contextual scope of the negotiation
 - ▶ Is the question under discussion the *speaker meaning* or *token meaning*? (related to non-understanding vs. disagreement)
- ▶ Interpretation often relies on cultural context

Thank you!

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