# The Role of Pragmatics in Solving the Winograd Schema Challenge

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November 7, 2017

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# Outline

# The Winograd Schema Challenge

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- The Winograd Schema Challenge [Levesque et al., 2012] was conceived as a **new benchmark in artificial intelligence**
- The task is a particular type of **pronoun disambiguation problem**
- Sentences with **one pronoun** and **two candidate referents** are given. The task is to find the correct referent of the pronoun

## The Winograd Schema Challenge

Example:

> *The large ball crashed right through the table because* it
> *was made of [steel/styrofoam]. What was made of*
> *[steel/styrofoam]?*
> *Answers: The ball/the table.*[1]

The pronoun 'it' refers to either the ball or the table depending on
whether 'steel' or 'styrofoam' is used

Resolution: Steel is harder than materials that tables are often
made from and is likely to be able to break through a (wooden) table
while a steel table would be hard to break

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[1]Taken from www.cs.nyu.edu/faculty/davise/papers/WinogradSchemas/
WSCollection

The sentences are constructed as pairs. In both cases the syntactic structure remains the same — **syntactic constraints do not aid the resolution**

If clear **semantic preferences** relating 'steel' and 'crashing through things' cannot be easily learned from mining a large corpus, it is hoped that any system which resolves the pronoun must use some sort of genuine understanding

*The racecar zoomed by the school bus because it was going so [fast/slow]. What was going so [fast/slow]?*
*Answers: The racecar/the school bus [Levesque et al., 2012]*

A statistical technique may answer this correctly by associating 'fast' with 'racecar' but without understanding or reasoning about the mechanics of the described situation

# Commonsense

How should an agent tackling the challenge act?

Are 'commonsense rules' appropriate?

'a steel object crashing through something' is more likely than 'a steel object object being crashed through'

There exist techniques for mining these sorts of relations from large corpora [Peng et al., 2015], [Rahman and Ng, 2012]

# Pragmatics

# Pragmatics

What is pragmatics?

- Debate around the distinction between semantics and pragmatics, or if any meaningful boundary even exists
- Generally understood as field concerned with understanding a speaker's **intended** meaning.

Consider the following example:

> *Tom threw his school bag down to Ray after he$_x$ reached the top of the stairs. Who reached the top of the stairs? Answer: Tom.*[2]

How should a system resolve this?

Idea: A throwing down to B implies A is above B. x reaching the top of the stairs implies x is above the other character

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[2]Taken from www.cs.nyu.edu/faculty/davise/papers/WinogradSchemas/WSCollection

# Ambiguity

Nothing is initially made explicit about the locations of both Tom and Ray.

What if Tom is on some balcony above the stairs and waits for Ray to reach the top of the stairs before throwing the bag down to Ray?

We appear then to have **two opposing possibilities**.

*— 'semantic interpretation can[not] deliver something as determinate as a truth-evaluable proposition'*
*— 'pragmatic interpretation is needed to determine an utterance's truth conditions'[Recanati, 2004]*

Example:

*'He wasn't wearing his glasses and he mistook his wife for a hat-stand'[Carston, 2008]*

No linguistic element in this utterance encodes the obvious causal relation.

**We need to account for the intention of the speaker in order to attain the genuine truth conditions** — that he mistook his wife for a hat stand and he did this *because* he wasn't wearing his glasses.

How do we address the underdeterminacy described above?

Tentative Assumption: Similarly typed objects have the same initial relation to any given described landmarks

This is in some way motivated pragmatically:

Grice's Quantity Maxim [Grice, 1975]

- 'Make your contribution as informative as required'
- 'Do not make your contribution more informative than is required'

To consider an example where we break this assumption:

*Tom threw his school bag down to Ray after he$_x$ swam to the top of the swimming pool. Who reached the top of the swimming pool?*
*Answer: Ray.*

# Conversational Implicature

Grice's Conversational Implicature [Grice, 1975]: While saying *p* has implicated *q* has *conversationally implicated q* if:

1. The speaker is presumed to be observing Grice's maxims for co-operative communication
2. The speaker thinks that *q* is required in order to make saying *p* consistent with (1)
3. The speaker think that it is within the competence of the hearer to work out the supposition in (2)

## Conversational Implicature

How does this apply?

*p*= The original sentence *q*= 'Tom and Ray are not both in the swimming pool'

There is a plausible inference that Tom and Ray are not both located in the swimming pool — if they both were neither could throw a school bag down to the other

Suppose we interpret 'down to' as horizontally.

This changes the disambiguation and also keeps the 'initial position' assumption.

There is then a **conflict**. Should terms be interpreted in the usual way while flouting assumptions or vice versa?

Maybe here is an appropriate place (in line with commonsense) for statistical methods?

# Conclusion

- At this level of detail pragmatics has a fundamental place in this challenge
- Complexities and conflicts arise which can't be dealt with by hard-coded rules or preferences
- As a result, legitimate opposing interpretations exist — highlighting the importance of explanations

📄 Carston, R. (2008).
*Thoughts and utterances: The pragmatics of explicit communication.*
John Wiley & Sons.

📄 Grice, H. P. (1975).
Logic and conversation.
In *Syntax and Semantics, Vol. 3, Speech Acts*, pages 41–58.
Academic Press, New York.

📄 Levesque, H., Davis, E., and Morgenstern, L. (2012).
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In *Thirteenth International Conference on the Principles of Knowledge Representation and Reasoning.*

Peng, H., Khashabi, D., and Roth, D. (2015).
**Solving hard coreference problems.**
In *Proceedings of NAACL*, pages 809–819.

Rahman, A. and Ng, V. (2012).
**Resolving complex cases of definite pronouns: the winograd schema challenge.**
In *Proceedings of the 2012 Joint Conference on Empirical Methods in Natural Language Processing and Computational Natural Language Learning*, pages 777–789. Association for Computational Linguistics.

Recanati, F. (2004).
**Pragmatics and Semantics.**
In *Handbook of Pragmatics*, pages 442–462. Oxford: Blackwell.

Extra example: I couldn't put the pot on the shelf because it was too high. What was too high? Answer: The shelf.

The dog chased the cat, which ran up a tree. It waited at the top. Which waited at the top? Answers: The cat.

Grice's Maxims:

- Quality: Make your contribution one that is true
- Quantity: Make your contribution as informative as is required and do not make your contribution more informative than is required
- Relation: Be relevant
- Manner: Be perspicuous (be brief, orderly, avoid ambiguity or obscurity of expression)