



HAL
open science

A cognitively plausible model for anaphora resolution

Olga Seminck, Pascal Amsili

► **To cite this version:**

Olga Seminck, Pascal Amsili. A cognitively plausible model for anaphora resolution. AMLaP 22, Sep 2016, Bilbao, Spain. 2016. halshs-01831935

HAL Id: halshs-01831935

<https://shs.hal.science/halshs-01831935>

Submitted on 2 Sep 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License

A cognitively plausible model for anaphora resolution

Olga Seminck and Pascal Amsili
 Université Paris Diderot Paris 7

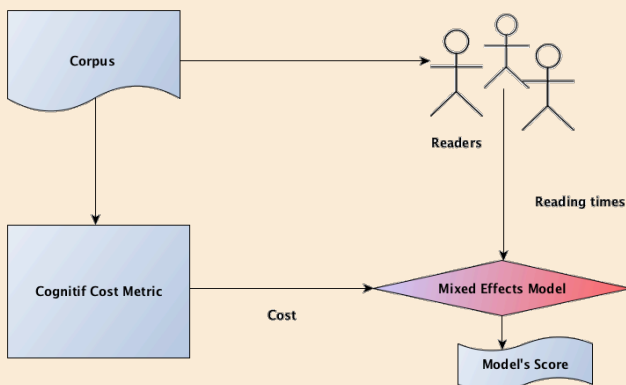


Abstract

Anaphora resolution is a complex problem as it deals with syntax, semantics and discourse. The subject is well studied in field of psycholinguistics, where multiple preferences were discovered, and in the field of computational linguistics, where many systems have been developed to perform anaphora resolution in documents. Nevertheless, the work done in the two fields remains disconnected.

We investigate how we can bridge the gap by exploiting the options for making a cognitively plausible model for anaphora resolution. Such model can be beneficial for both fields as it can inspire computational linguistics with findings about how humans process anaphora, and help the psycholinguistic community developing large coverage, incremental models simulating the human processing of anaphora.

The project



Entropy over the Bell Tree as a cost metric

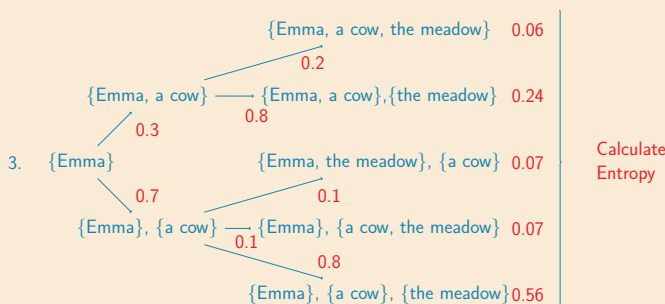
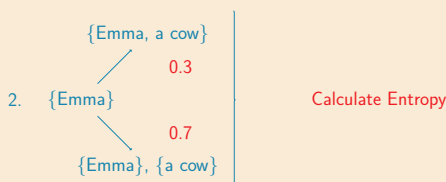
- Entropy reflects the uncertainty of a random variable
- Entropy is maximal when all possible outcomes have equal probabilities.

$$H(X) = - \sum_{i \in X} p(X = i) \cdot \log_2(p(X = i)).$$

- The space of coreference resolution can be presented by the Bell Tree [1].
- The paths of the tree from the root to the leaves can receive probability
 - All the paths form a probability distribution → calculate entropy
- We formulate the cost of an anaphor as the ratio between the entropy over the probability distribution the paths of the Bell Tree and its maximal entropy.**

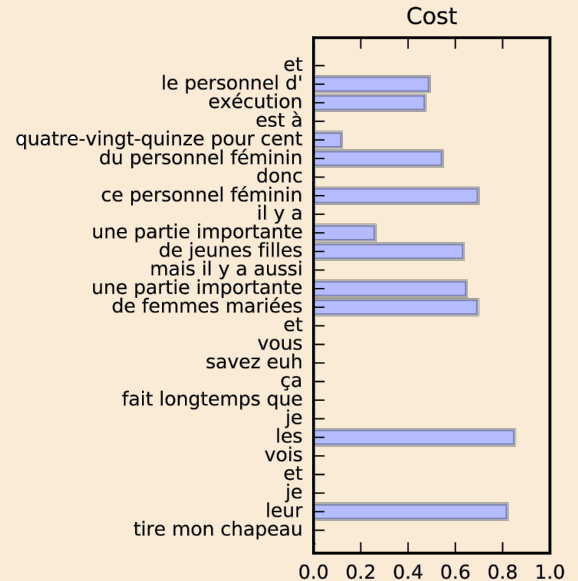
Emma sees a cow in the meadow.

1. {Emma} 1.0



Model's Prediction

- Every referential expression of a text can receive a *difficulty score*.
- Further research can indicate if the cost metric is valuable of all types of coreference, or only certain types of anaphora resolution.



Validation of the Model

- We want to validate our model on reading times on corpus.
 - Dundee Eye-tracking Corpus [2]
 - French Treebank Corpus [3]
- Challenges:
 - Anaphora are often very short (pronouns) and are often not fixated.
 - We need to control for low level factors: word frequency, word length, position on the line...

⇒ We have to build a mixed effect model

Conclusion

Our model of processing cost seems reasonable, but is not yet validated on corpus. A next step in research is to take into account more factors, especially factors coming from syntax. Furthermore, we need to reflect on a way of measuring reading time for anaphora. Once we developed a method for measuring reading time of anaphora, we will try to validate our model with a mixed effect model on a eye-tracking corpus.

References

- Xiaoqiang Luo, Abe Ittycheriah, Hongyan Jing, Nanda Kambhatla, and Salim Roukos. A mention-synchronous coreference resolution algorithm based on the bell tree. In *Proceedings of the 42nd Annual Meeting on Association for Computational Linguistics*, pages 135–143. Association for Computational Linguistics, 2004.
- Alan Kennedy, Robin Hill, and Joël Pynte. The dundee corpus. In *Proceedings of the 12th European conference on eye movement*, 2003.
- Anne Abeillé, Lionel Clément, and François Toussenet. Building a treebank for french. In *Treebanks*, pages 165–187. Springer, 2003.

Acknowledgments

- This work is supported by a public grant overseen by the French National Research Agency (ANR) as part of the 'Investissements d'Avenir' program (reference: ANR-10-LABX-0083).
- This work is supported by the PhD program Frontières du Vivant of the Center for Research and Interdisciplinarity.