Maltese auditory word comprehension explained through discriminative learning

Jessica Nieder[a], Ruben van de Vijver[a] & Adam Ussishkin [b]
nieder@phil.hhu.de, Ruben.Vijver@hhu.de & adam.ussishkin@gmail.com
[a]Department of Linguistics, Heinrich-Heine-Universität Düsseldorf, Germany &
[b]Department of Linguistics, University of Arizona, USA

A central question of word recognition is the role of morphology for lexical processing. Some suggest a morphological decomposition (Taft & Forster, 1975; Wurm, 2000) as a crucial component of lexical access, others attribute processing differences to the word as a full form (Tyler et al., 1988). Yet, the role of meaning is left unspecified.

With the Discriminative Lexicon (DL), Baayen et al. (2019) propose a model of the mental lexicon that uses a computational implementation of W&P Morphology (Blevins, 2016) stating that whole words and their paradigms are the basic units of morphology. Within DL, comprehension is seen as a mapping of phonology onto meaning and production as a mapping of meaning onto phonology, with meaning playing an explicit role in both processes.

In this study, we use the DL model to model the production and comprehension of Maltese verbs, and we use measures from the model (Nieder et al., accepted) to explain the results of a subliminal priming study on Maltese verbs reported in Ussishkin et al. (2015). 10.127 verb forms from the MLRS Korpus Malti (Gatt & Čéplö, 2013) represented our phonological forms, 300-dimensional word-embeddings (Joulin, Grave, Bojanowski, Douze, et al., 2016; Joulin, Grave, Bojanowski, & Mikolov, 2016) represented their meaning.

Our model learned mappings between phonology and meaning with a high accuracy: 80.04% for comprehension and 81.08% for production. In addition, 1) the extent to which the prime pre-activates the meaning of the target and 2) how well the form of the prime matches its meaning, improved the fit of a statistical model fitted to the experimental data, suggesting that processing differences between priming conditions can be attributed to differences in meaning of prime-target pairs.

Going beyond the world of forms by computationally including meaning, this study arrives at a successful classification of Maltese verbs and their lexical processing.

References

Baayen, R. H., Chuang, Y.-Y., Shafaei-Bajestan, E., & Blevins, J. P. (2019). The discriminative lexicon: A unified computational model for the lexicon and lexical processing in comprehension and production grounded not in (de) composition but in linear discriminative learning. Complexity, 2019.

Blevins, J. P. (2016). The minimal sign. In A. Hippisley & G. Stump (Eds.), The Cambridge Handbook of Morphology (pp. 50–69). Cambridge University Press.

Gatt, A., & Čéplö, S. (2013). Digital corpora and other electronic resources for maltese. Proceedings of the International Conference on Corpus Linguistics.

Joulin, A., Grave, E., Bojanowski, P., Douze, M., Jégou, H., & Mikolov, T. (2016). Fasttext.zip: Compressing text classification models. arXiv. https://arxiv.org/abs/1612.03651

Joulin, A., Grave, E., Bojanowski, P., & Mikolov, T. (2016). Bag of tricks for efficient text classification. arXiv. https://arxiv.org/abs/1607.01759

Nieder, J., Chuang, Y.-Y., van de Vijver, R., & Baayen, R. H. (accepted). A Discriminative Lexicon Approach to Word Comprehension, Production and Processing: Maltese Plurals. Language. https://psyarxiv.com/rkath/

Taft, M., & Forster, K. I. (1975). Lexical storage and retrieval of prefixed words. Journal of Verbal Learning and Verbal Behavior, 14(6), 638–647. https://doi.org/https://doi.org/10.1016/S0022-5371(75)80051-X

Tyler, L. K., Marslen-Wilson, W., Rentoul, J., & Hanney, P. (1988). Continuous and discontinuous access in spoken word-recognition: The role of derivational prefixes. Journal of Memory and Language, 27(4), 368–381. https://doi.org/https://doi.org/10.1016/0749-596X(88)90062-9

Ussishkin, A., Dawson, C. R., Wedel, A., & Schluter, K. (2015). Auditory masked priming in maltese spoken word recognition. Language, Cognition and Neuroscience, 30(9), 1096–1115. https://doi.org/10.1080/23273798.2015.1005635

Wurm, L. H. (2000). Auditory processing of polymorphemic pseudowords. Journal of Memory and Language, 42(2), 255–271. https://doi.org/https://doi.org/10.1006/jmla.1999.2678