Orthographic and Morphemic Effects on Word Recognition in Arabic

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Introduction

This study examines the effect of the **Orthographic Uniqueness Point (OUP)** - the letter in the word at which there is only one lemma-level continuation - in both Arabic and English, in a speeded lexical decision task performed by **Arabic-English bilinguals**. When comparing reading across these languages, there are important factors to consider:

- In **English monolinguals, later OUP words are recognized faster** (Izura et al 2014)
- Arabic is a right-to-left orthography, meaning **late OUPs occur in the left visual field in Arabic**, the opposite of English.
- In **Arabic, the root morpheme plays a large role in the organization of the mental lexicon** (Boudelaa, S., & Marslen-Wilson, W. D. 2015)

Question 1: Do OUP positions have the same effects in both Arabic and English in Bilinguals?

Question 2: Does OUP position in relation to root morphemes effect lexical decision times?

Experiment Design

Participants performed a timed **lexical decision task** online using pclbex. Stimuli was separated by language, with a short break in between the Arabic and English portions. Participants were randomly assigned to the Arabic-first or English-first conditions. In addition to **length-matched pseudowords**, the following stimuli sets were compared in pairs:

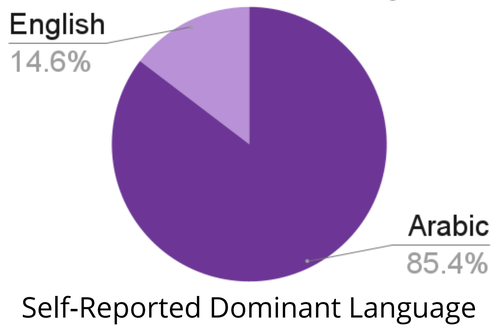
Condition	Example	OUP	Word Length
Arabic Early OUP	design / taṣmīm / تصميم	3	5
Arabic Late OUP	desert / ṣaḥrāʾa / صحراء	5	5
Arabic Root OUP	frozen / mutajamid / متجمد	3	5
Arabic Pattern OUP	busy / muštaġil / مشتغل	3	5
English Early OUP*	darling	3.4	7
English Late OUP*	algebra	7	7

Each condition contained **20 words**. Participants who did not achieve 80% accuracy or above on both English and Arabic portions were excluded from analysis.

Participants completed the Language Experience and Proficiency Questionnaire (LEAP-Q) prior the experimental task. The following criteria were used to filter online participants:

1. First language acquired is Arabic
2. Self-reports Arabic and English as the two primary dominant languages

*Stimuli from Izura et al, 2014



Self-Reported Dominant Language

Analysis

Analysis was a **linear mixed-effects model** implemeted in lme4 in R.

Random Effects:
- Participant (intercept)
- Item (intercept)

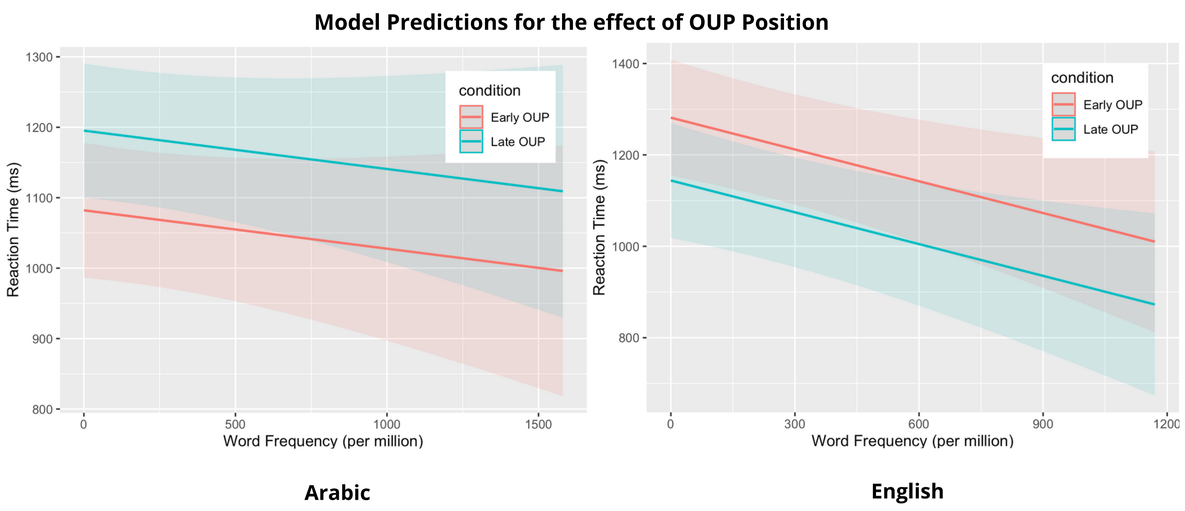
Fixed Effects:
- Condition
- Word Frequency
- Average Levenshtein distance

The formula in R is:

reaction time ~ condition + frequency + lev dist + (1|participant) + (1|item)

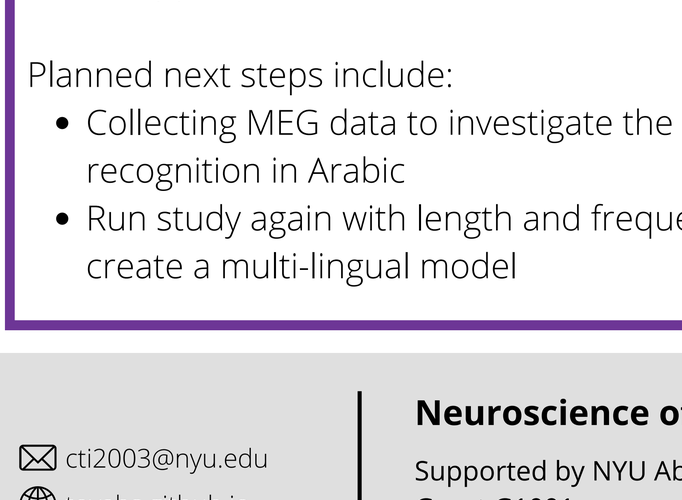
To achive this model, we started with a maximal model which included additional lexical statistics such as character bigram frequency as fixed effects, in addition to a by-subject random slope, and then simplified the model until the model converged but was not overfitted.

Results



Speakers were faster in recognizing early OUP words in Arabic compared to late OUP words in Arabic. (β=-113, SE=32, z=3.465, p=0.001). **Conversely, early OUP words in English were recognized slower** than corresponding late OUP words (β=137, SE=54, z=-2.544, p=0.016).

Model Predictions for the effect of OUP in or out of Root



Speakers were faster in recognizing words when the OUP was a root consonant, compared to a pattern consonant. (β=123, SE=59, z=-2.06, p=0.04),

Discussion & Next Steps

We have extended the results of Izura et al (2014) in Arabic-English bilinguals. Specifically, this OUP position effect is reversed between Arabic and English, showing an effect of visual field lateralization. Additionally, we show support for the role of the Arabic root in aiding word recognition.

Planned next steps include:
- Collecting MEG data to investigate the role of lateralization in word recognition in Arabic
- Run study again with length and frequency matched English stimuli to create a multi-lingual model

Citations

- Izura, C., Wright, V. C., & Fouquet, N. (2014). Hemispheric asymmetries in word recognition as revealed by the orthographic uniqueness point effect. Front. Psychol., 5. https://doi.org/10.3389/fpsyg.2014.00244
- Boudelaa, S., & Marslen-Wilson, W. D. (2015). Structure, form, and meaning in the mental lexicon: evidence from Arabic. Language, Cognition and Neuroscience, 30(8), 955–992. https://doi.org/10.1080/23273798.2015.1048258

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