

**Schwa in French and Moroccan Arabic:
An optimality theoretic approach to phonological and phonetic features**
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Phonological systems with schwa in their inventory usually display high variation with regard to this unstable vowel. Departing from numerous systematic differences between Moroccan Arabic and French schwa (Dell 1973, Maas 2001), Moroccan learners' pronunciations of French items are investigated for interactions between the two systems.

An experiment was conducted in order to capture the identity of schwa. The corpus comprises productions of ten female speakers at an early stage of French acquisition. The data have been gathered principally from two tasks: the repetition of phrases and the description of a map. It was thus possible to elicit schwa in different phonological contexts. The same experiment was repeated with a control group consisting of ten female native French speakers.

A statistical analysis in the framework of *mixed-effects models* (Baayen 2008) provides an adequate tool to test the influences on schwa. This method has the potential to combine *fixed effects*, i.e. the expected independent variables, with *random effects* such as speaker and item. Thus, idiosyncratic and lexicon-based differences do not interfere with the results. The analysis focuses on three aspects: the presence (vs. absence) of schwa, the formant values of F2 (i.e. the 'frontness' of the vowel) and the duration of the vowel. The independent variables comprise different phonological settings, e.g. the position of the schwa syllable in the word, the structure of the syllable and the number and quality of the surrounding consonants. Moreover, the native language itself is tested for an effect on each of the three criteria.

The results show that, while effects on the phonological level are less prominent than it had been expected, there are differences in the acoustic quality. The factors position and syllable structure have been confirmed to favour the presence of schwa. With regard to F2, learner schwa displays a broader formant spectrum. Also when looked at in more detail, dispersion in learner values is higher than in native French schwa. The place of articulation of the preceding and following consonants has a highly significant influence on F2 for the learners. However, the comparable French data yield the same results, so that coarticulation alone cannot be the responsible factor for formant variability. As to duration, Moroccan learner schwa is significantly longer than French schwa.

In a final step, these findings are modelled in the framework of Optimality Theory. The *BiPhon-Model* (Boersma/Hamann 2008) offers the possibility to provide a thorough analysis of both the phonological and the phonetic findings. While the phonological behaviour of schwa can be modelled in terms of markedness and faithfulness constraints, cue constraints represent the acoustic side of schwa. This constraint family links the surface form with an auditory form and provides cues on different numeric scales. Altogether, the constraints should be able to represent the answer to the following question: Under which conditions is schwa present, and if it is present, how is it realised acoustically in learner and native French?

References

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