The status of vowels in Jordanian and Moroccan Arabic: Insights from production and perception.

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Introduction

- Vowels in isolation are often considered as the canonical form of a vowel, (Cohn 1948, Labed 1967 & Backert & Heeschenborn 1977).
- Some researchers considered them as “laboratory artefacts” (Labed 1967 & Liberman 1970): a) generally, they exist when coarticulated with consonants in a specific syllabic structure, b) acoustical vowel information merge with those of consonants, c) formants of vowels are not invariant, due to 2 different sources of variation: inter- and intra-individual variability, and consonant environment.
- So, in different perceptual experiments, isolated vowels were discarded, and dynamic information was considered useful to have more natural stimuli and to help auditors in identification/discrimination tests.
- Different authors described isolated vowels as completely different from those produced in context, so they concluded that indices used by auditors to identify vowels (in isolation and in context) are different. (Turk, A. & Gouds 1991, Fujimura & Okuda 1993, Levina & Maltzer 1977, Shingles A. 1978, 1988, 1998, etc.).

Goals of this research

- Arabic grammarians described vowels as: a) sounds included in consonants and/or b) a facilitator of ‘laboratory artefacts’
- But some researchers considered them as static and dynamic cues in production and perception of Arabic vowels.
- Vowels never occur in isolation, they must be associated to consonantal environment to be produced,
- 3. To study the status of vowels in Arabic dialects, and to help auditors in identification/discrimination tests.
- Some verb categories are marked by a systematic alteration of vowel qualities, without any change in consonant.
- TKB’ (writer, scholar, library, knuckle) used by auditors to identify vowels (in isolation and in context) are different.
- Strange & al. 1976, 1983, 1989, etc. used by auditors to identify vowels (in isolation and in context) are different.

What about vowels in Arabic?

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Discussion & conclusion

In this work, we studied the variability in both production and perception of speech in JA and MA dialects. Results show that:

- Both in JA and MA, there is no significant difference between the production of vowels in Word and in Syllable, but a very significant one when compared with Isolated vowels.
- Both in JA and MA, there is more variability in the production of vowels in Isolation, than when produced in Word or Syllable.
- In production, JA long vowels are more peripheral than those of MA (figures 1 to 4), but no difference in perception (figures 5 & 6).
- In both production and perception, MA is more dynamic (figures 2, 4 & 6).
- JA and MA auditors found the perceptual experiment (figures 5 & 6) very difficult and caused a high degree of variability in the acoustic plan (that can be explained by the fact that isolated vowels are not exist in Arabic).
- To characterize the importance of dynamic cues (in comparison with static ones), a new perceptual task was elaborated. The results displayed in figures 7 to 10 show less variability in the dynamic task than in static one, and auditors found the task easier.
- In production, a Delta Average calculation served to characterize the formant trajectories (figures 4 to 14) that show that isolated vowels, formant trajectories change over time.
- These results indicate that dynamic cues (in production and perception) may be taken into consideration to describe Arabic vowels, but experiments with more consonantal context and more speakers are needed to characterize the vowel status in Arabic.

Methodology

- In paradigm A:
  - 10 speakers in both JA and MA were recorded in 2 experimental protocols, in production and perception of speech.
  - In production, speakers recorded vowels (i, a, u, schwa) in JA and (i, a, u, schwa) in MA, produced in word, syllable and in isolation, in alveolar context (non pharyngealised).
- In paradigm B:
  - 5 auditors from JA and 1 from MA were categorized vowels in a static (static form values = PD) and dynamic (dynamic values = Duration + Dynamic information = onset alveolar consonant) F1/F2 synthetic plane.

Recording & Acoustical Analysis

- Speakers were recorded in an attenuated room, voltages were digitized at 22 KHz, 16 Bits, Mono.
- Recording of 8 JA and 10 MA (2 JA speakers were discarded because of saturation in the signal), were analyzed using Praat and Akustyk.
- LPC acoustical analysis were conducted on vowels produced in word, syllable and in isolation, with a Hamming window, 10 coefficients. Formant values were taken at the mid of the static part of vowel. Onset and offset were taken respectively the first and final pulses.

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