

Metathesis in Jazani Arabic

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Abstract

This study examines metathesis patterns in Jazani Arabic by examining both adjacent and non-adjacent consonant clusters across three lexical items and their metathesized counterparts. Using acoustic analysis of recordings from a single native speaker, the study evaluates whether these apparent segment reversals reflect categorical phonological reordering or arise from phonetic mechanisms of gestural overlap. Spectrogram inspection, formant tracking, and spectral slicing reveal that, in the metathesized forms, articulatory cues associated with the second consonant in the canonical order frequently appear early, intruding to some degree into the acoustic space of the preceding gesture. This includes premature frication spread, early nasalization, and overlapping velar and rhotic transitions, patterns that are inconsistent with clean, re-sequenced segmental boundaries. These findings suggest that the metathesis observed in both adjacent and non-adjacent clusters in Jazani Arabic is best characterized as a surface phonetic effect resulted from altered gestural timing rather than a true phonological transposition. While the dataset is limited to a small number of tokens from a single speaker, the results provide preliminary evidence supporting a gestural-overlap account of metathesis and highlight the need for broader, multi-speaker investigation to determine the extent and generality of these patterns within the dialect.

1. Introduction

1.1. Related work

Metathesis, the apparent reordering of sounds within a word, is a widely attested phenomenon across languages, including numerous varieties of Arabic. Traditional phonological analyses treat metathesis as a categorical process involving the transposition of segmental order in the phonological representation. This structural perspective continues to be reflected in recent studies of Arabic phonology, where metathesis is often analyzed as a form of segmental reconfiguration within the sound system [1], [2].

In contrast, recent work in laboratory phonology challenges the assumption that phonology can directly transpose segments. Instead, these studies argue that many metathesis-like patterns arise from gradient phonetic mechanisms such as temporal overlap of articulatory gestures, coarticulatory timing shifts, and perceptual reinterpretation of surface cues [3], [4]. Within this framework, surface inversions need not correspond to categorical changes in underlying representations, but may instead reflect the timing and coordination of articulatory gestures during speech production.

This phonetic reinterpretation of metathesis is grounded in Articulatory Phonology, which models speech as a set of

dynamically coordinated articulatory gestures rather than a linear sequence of discrete segments [5].

A well-established typological generalization further supports a gestural account of metathesis: liquids are disproportionately involved in metathesis processes. [6] characterizes the high frequency of liquid-triggered metathesis as “proverbial”. Historical sound changes such as the inversion of stop-rhotic clusters in the prehistory of Classical Armenian illustrate the systematic nature of this tendency. [6] argue that such patterns often originate from phonetic precursors, including elongated or overlapping articulatory cues, rather than discrete phonological operations.

Importantly, [6] document phonetic phenomena in Arabic dialects that exhibit gradient properties typical of coarticulation rather than categorical phonological processes. For example, pharyngealization and tongue backing have been shown to extend across multisyllabic domains in at least two Arabic varieties, providing independent evidence that temporally extended articulatory gestures play a significant role in shaping surface forms. Similarly, [7] emphasizes the role of phonetic variability and perceptual ambiguity in the emergence of metathesis patterns, offering a framework compatible with laboratory-phonological approaches.

Despite these advances, acoustic investigations of metathesis in Arabic dialects remain limited. Jazani Arabic, spoken in southwestern Saudi Arabia, has received little focus attention in this regard, particularly with respect to consonant clusters involving liquids.

The alternations examined in this study provide an opportunity to evaluate whether apparent metathesis in this dialect aligns more closely with traditional segmental analyses or with phonetic accounts based on gestural overlap.

2. Methodology

The present study investigates whether metathesis in Jazani Arabic reflects a process of categorical segment reordering or whether it arises from phonetic mechanisms of coarticulatory gestural overlap. To address this question, a small database consisting of three pairs of nouns (six tokens total) was collected, all of which share a common property: the second gesture of the canonical cluster is a liquid (either [l] or [r]). These items were selected because they display metathesis alternations, involving both adjacent and non-adjacent consonant clusters.

The target words were initially identified impressionistically by the researcher during informal conversations with family and community members. Each item was later recorded by a native speaker of Jazani Arabic. Recordings were made in a quiet environment using Praat, ensuring high-quality audio for acoustic analysis. To approximate natural speech while maintaining consistent context, the speaker produced each

token in a fixed carrier phrase (i.e., “I saw _____ in the farm today.”).

Table 1 summarizes the three lexical items, their metathesized counterparts, and the consonant-cluster configurations under investigation.

Table 1: Jazani Arabic tokens and their metathesized counterparts.

Word	Metathesized Counterpart	Consonant Cluster
[nerdʒəs] ‘daffodil’	[rendʒəs] ‘daffodil’	/nr/ ↔ /rn/
[zøhleɪgəh] ‘slide’	[zølhɛɪgəh] ‘slide’	/hl/ ↔ /lh/
[ʔeɣrəb] ‘scorpion’	[ʔɛɣəb] ‘scorpion’	/gr/ ↔ /rg/

These data were then subjected to an acoustic analysis aimed at identifying temporal and spectral cues, such as frication spread, nasal antiformants, and velar pinch, that may indicate whether the perceived metathesis is the product of overlapping articulatory gestures rather than phonological reordering.

3. Results

To test if metathesis in Jazani Arabic is a surface effect of a phonetic gestural overlap, the canonical form [nerdʒəs] was compared with the metathesized form [rendʒəs] (Figure 1).

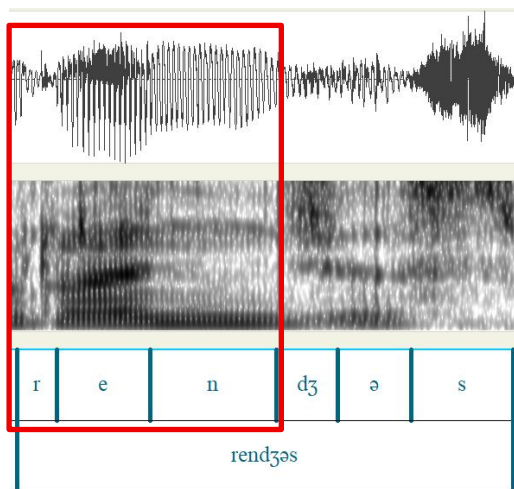


Figure 1: Spectrogram and Waveform of Metathesized Form [rendʒəs].

The F3 trajectory, which typically characterizes the rhotic dip, was tested in the metathesized form to see whether this dip was spread across the nasal portion, but no clear sign of such a drop was found. Given the inclusive F3 data, the evidence for the gestural overlap hypothesis was instead sought in other acoustic correlates.

Analysis of the [rendʒəs] form showed a sign of early nasalization during the rhotic gesture [r]. Spectrogram (Figure 2) reveals a clear drop in acoustic intensity within the [r] gesture preceding the nasal [n]. This reduction in energy is the acoustic sign of nasal coupling, confirming that the velum has lowered. The premature occurrence of these nasal characteristics within the preceding [r] gesture supports the hypothesis that the

apparent metathesis is a surface phonetic phenomenon resulting from the significant temporal advance and overlap of the nasal gesture, rather than a clean phonological transposition of the two gestures.

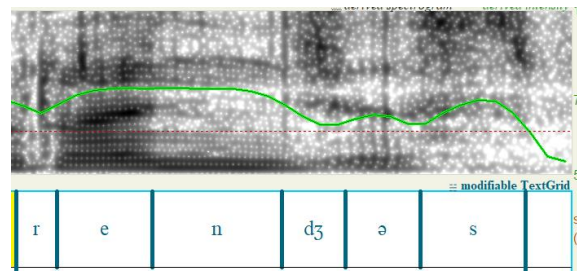


Figure 2: Spectrogram of Metathesized Form illustrating intensity.

Complementary check of the formant tracks revealed a brief instability in the formant curve during this same region (Figure 3). Taken together, these observations suggest that the antiformants associated with the rhotic begins earlier in the metathesized form, supporting the interpretation that the nasal gestures overlap with the rhotic rather than reflecting a clean categorical reordering of segments.

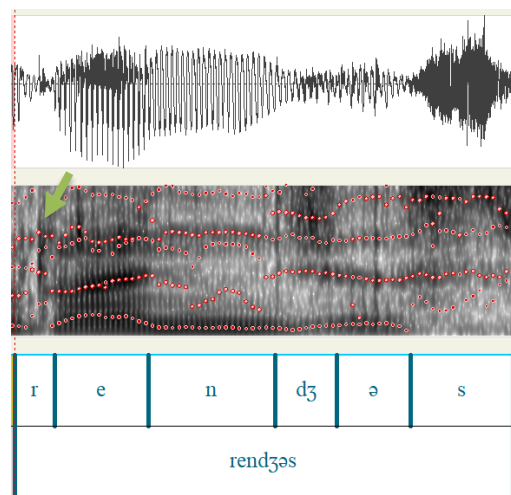


Figure 3: Spectrogram of Metathesized Form illustrating antiformants.

With regards to hl ↔ lh-pair in (zøhleɪgəh → zølhɛɪgəh), the analysis focused on the sequencing of frication associated with [h] and the formant structure of the lateral [l]. In the metathesized form, the spectrogram shows frication energy extending into the preceding gesture (Figure 4), giving the lateral a slightly more fricated appearance than in the standard form. This suggests some degree of gestural blending between the two consonants. Additionally, the F2 of [l] was measured at its midpoint for both tokens to inspect an occurrence of gestural overlap. Although the F2 value in the metathesized form (approximately 1997.76 Hz) is not unusually low, there was no substantial difference between the standard and metathesized production. Thus, while the visual evidence hints at frication spreading from [h] into the lateral, consistent with some

gestural overlap, the formant measurements do not show a clear shift that would strongly distinguish the two forms.

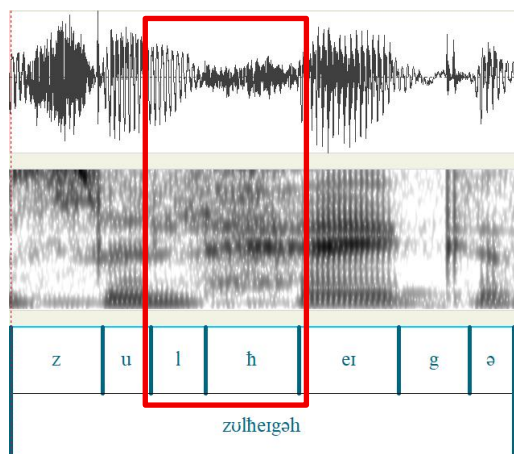


Figure 4: *Spectrogram and Waveform of Metathesized Form [zülheigəh].*

As for the pair $gr \leftrightarrow rg$ in $[ʔegrəb] \rightarrow [ʔergəb]$, the analysis centered on whether the metathesized form exhibits acoustic signs of gestural overlap between the velar stop [g] and the rhotic [r]. In the canonical production $[ʔegrəb]$, the velar closure and burst were observed as discrete events, followed by the characteristic F3 lowering associated with the onset of the rhotic. In contrast, in the metathesized form $[ʔergəb]$, signs of temporal blending emerged. Specifically, the spectrogram (Figure 5) shows the beginning of the rhotic's F3 dip occurring before the velar burst is fully realized. This early appearance of F3 lowering suggests that the rhotic gesture begins while the articulatory posture for the velar stop is still being executed. Additional inspection of the region preceding the velar release revealed a partial velar pinch, a convergence of F2 and F3 typically aligned with velar consonants, occurring simultaneously with the early rhotic transitions. This overlap of acoustic cues, rather than a clean sequential ordering of [r] followed by [g], points to co-occurring constriction gestures rather than categorical metathesis.

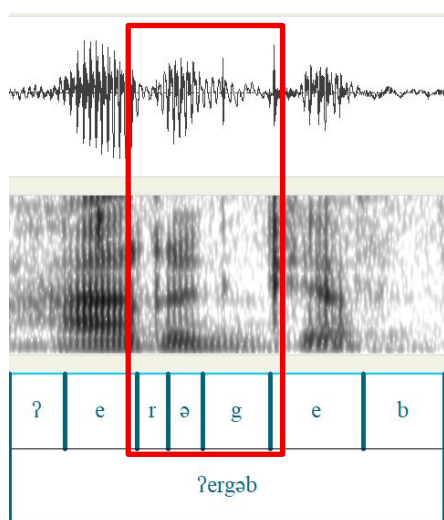


Figure 5: *Spectrogram and Waveform of Metathesized Form [ʔergəb].*

4. Discussion

Across the tree consonant-cluster pairs examined, the acoustic patterns point toward gestural overlap rather than categorical segment reordering as the source of the apparent metathesis in Jazani Arabic. While each pair presents its own gesture-specific cues, a broader pattern emerges: in the metathesized forms, the acoustic characteristics of the second sound in the canonical sequence begin early, blending with the acoustic space of the preceding consonant. This pattern of gestural timing is compatible with a phonetic explanation of surface reversals and contrasts with expectations under a full phonological transposition account.

The $nr \leftrightarrow rn$ pair provides the first indication of this phenomenon. The rhotic in the metathesized form shows early nasal influence: a drop in acoustic intensity and the presence of antiformants begin within the [r] itself, prior to the onset of the nasal. These signs confirmed through spectral slices, reveal that nasal coupling begins prematurely, before the rhotic interval has concluded. This early nasalization provides evidence for overlapping gestures, since categorical segment reordering should not produce nasal resonances inside a rhotic segment. Moreover, the brief instability in the formant track during the rhotic further supports temporal overlap rather than discrete reconfiguration.

The $hl \leftrightarrow lh$ pair further illustrates how overlapping articulatory gestures can give rise to metathesis-like surface patterns. The metathesized form shows frication energy associated with [h] extending into the lateral interval, giving [l] a slightly more fricated appearance than in the canonical form. Although measurements of F2 at the midpoint of the lateral did not show a clear numerical shift, the spectrogram nonetheless reveals evidence of articulatory blending between the two gestures. Such blending is inconsistent with a clean linear reordering of segments, which would predict more sharply defined boundaries between frication and lateral articulation.

The $gr \leftrightarrow rg$ pair reinforces this pattern. In the metathesized form $[ʔergəb]$, however, the F3 lowering associated with the rhotic begins before the velar burst has fully surfaced, indicating that the rhotic gesture is initiated while the velar closure is still being maintained. Additionally, a partial velar pinch is present at the same time as the early rhotic formant transitions, again pointing to overlapping constrictions rather than a reversed linear ordering. This blending of acoustic cues mirrors the pattern observed in the other two pairs.

Taken together, these findings demonstrate a consistent cross-pair pattern: the metathesized forms display anticipatory activation of the second consonant's articulatory gestures, which intrude into the acoustic space of the first consonant. This anticipatory behavior is what is predicted under the gestural-overlap account [4], in which surface reordering arises from changes in the timing and coordination of articulatory gestures rather than from categorical phonological restructuring. In contrast, a true phonological metathesis would be expected to produce clean segmental boundaries corresponding to the reversed sequence, without the gradient spectral overlap, premature formant transitions, or early nasal/velar cues observed here.

Thus, within the scope of this study, the cumulative evidence across all three-word pairs suggests that the apparent metathesis in Jazani Arabic may be better understood as a surface phonetic effect driven by gestural timing rather than as a categorical phonological process. This interpretation is consistent with a growing body of cross-linguistic research indicating that the patterns resembling segmental reordering often emerge from gradient, temporally overlapping articulatory gestures rather than from structural reorganization of the phonological representation.

5. Conclusions

The present study examined three consonant-cluster pairs in Jazani Arabic to evaluate whether their apparent metathesis reflects categorical phonological reordering or phonetic gestural overlap. Despite the highly limited dataset, six tokens produced by a single speaker in a controlled carrier-phrase environment, the acoustic patterns across all word pairs consistently revealed early activation and temporal spreading of the gestures associated with the second consonant in the canonical order. Evidence such as frication blending, premature nasal, formant-trajectory instability, and early F3 lowering suggests that these surface reversals arise from gradient articulatory overlap rather than discrete segment transposition. Although the restricted sample prevents any broad generalizations about the dialect as a whole, the findings offer preliminary acoustic support for a phonetic account of metathesis aligned with gestural-timing models.

Given these limitations, future research should expand the dataset substantially, incorporating multiple speakers, varied speaking styles, and additional lexical items to test the robustness of the observed patterns.

6. References

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