Chapter 6

Conclusions and implications for further studies

6.1 Introduction

This dissertation highlights the impact of vowel space and pharyngealized consonants on V-to-V coarticulation in the three dialects of Yemeni Arabic. Experiment 1 investigated the acoustic vowel space of the three Yemeni Arabic dialects to see whether these dialects have comparable vowel space. Experiment 2 examined the impact of vowel space on V-to-V coarticulation in the three dialects. Experiment 3 investigated the impact of pharyngealized consonants on V-to-V coarticulation in the three Yemeni Arabic dialects.

The results of the three experiments provide a clear picture of V-to-V coarticulation in the three Yemeni Arabic dialects (AYA, HYA, and TYA). The results of the second and third experiment show that vowel space and pharyngealized consonants do not play a role in V-to-V coarticulation in the three dialects. An important question for V-to-V coarticulation is: which is the primary factor that affects V-to-V coarticulation in Yemeni Arabic dialects? Hence, if vowel space and pharyngealized consonants do not impact on the degree of V-to-V coarticulation in the three dialects, then what is the primary factor that impacts V-to-V coarticulation in Yemeni Arabic?

A brief summary of the findings of the study is given in Section 6.2 and the implications for further studies are proposed in Section 6.3.
6.2 Summary of the findings

The findings of Experiment 1 show that the size of the phonemic inventory has an effect on the acoustic vowel space. Since the phonemic inventory is small for all the three dialects, the acoustic vowel space is comparable for the three dialects. The results of the statistical tests reveal that there is no significant difference in the acoustic vowel space of the three dialects. Additionally, the F1 and F2 z-scores for each vowel identity, except the F1 z-score for /i:/, are not the same among the three dialects.

The results of Experiment 2 show that the three Yemeni Arabic dialects differed in the degree of V-to-V coarticulation, though the three dialects have a comparable acoustic vowel space. Hence, we argue that there is no correlation between the vowel space and the degree of V-to-V coarticulation in the three Yemeni Arabic dialects because the three dialects exhibit different degrees of V-to-V coarticulation.

Figure 6.1 summarizes the results of Experiment 2 that investigates the effect of vowel space on the degree of V-to-V coarticulation in the three Yemeni Arabic dialects. In TYA, the low vowels, /a/ and /a:/, are the most sensitive to V-to-V coarticulation compared to the high vowels. The high back vowels, /u:/ and /u/, are the least sensitive and the high front vowels, /i:/ and /i/, are less sensitive to V-to-V coarticulation. These findings support Hussein (1990). The vowel positions of the five sets show that the degree of overlap between V1 and V2 is less in TYA, causing in less V-to-V coarticulation compared to the other two dialects HYA and AYA. The results of the lmerTest also reveal that there is a significant difference in the F1 and
F2 values between the V1 and V2 of all the five data sets. Hence, we argue that TYA has the lowest V-to-V coarticulation compared to HYA and AYA.

Figure 6.1: Comparison between V1 and V2 position in AYA (left side), HYA (middle) and TYA (right side) respectively
The positions of vowels in the acoustic vowel space indicate the sensitivity of the vowels in AYA to V-to-V coarticulation. The vowels are either fully superimposed on each other or partly superimposed on each other. The lmerTest also reveals that all the F1 values are significantly different, whereas the F2 values, except for the F2 value between (/a/ and /i:/) and (/a/ and /u:/), are not statistically significant. So based on the higher degree of overlapping between the vowel positions and the F2 values that are not statistically significant (i.e., V1=V2), we conclude that AYA has the highest degree of V-to-V coarticulation compared with HYA and TYA. The vowels in HYA display a lesser degree of overlapping than AYA, and a higher degree of overlapping than TYA. The lmerTest also shows that all formant values, except for the F2 value between V1 /i/ and V2 /a/, are significantly different. The p-values in the lmerTest attest to the highest degree of V-to-V coarticulation in AYA, compared to the other two dialects.

The question to be addressed here: why AYA has the highest degree of V-to-V coarticulation compared to the other two Yemeni Arabic dialects? To answer this question, we measured the duration of the short vowels of the three dialects. The results of the one-way ANOVA test and post hoc Tukey test reveal that there is a significant difference in the duration of the short vowels between AYA-HYA and AYA-TYA, whereas there is no significant difference between HYA and TYA. AYA speakers produced vowels with short duration, compared to the speakers of the other two dialects. Hence, we suggest that vowel duration is one of the primary factors that affect V-to-V coarticulation in the three dialects. These findings do not support Mok’s (2011) findings that short vowel duration does not have an impact on V-to-V coarticulation.
The findings of Experiment 3 report that the presence of pharyngealized consonants does block or reduce the degree of V-to-V coarticulation in Yemeni Arabic disyllabic words. The findings of this experiment also reveal that AYA displays the highest degree of V-to-V coarticulation in the pharyngealized and nonpharyngealized contexts, compared to HYA and TYA (except at vowel onset, where HYA exhibits the highest degree of V-to-V coarticulation than AYA and TYA). Based on the lmerTest p-values, we find that TYA shows the lowest degree of V-to-V coarticulation in the pharyngealized and nonpharyngealized contexts, compared to AYA and HYA. Hence, we claim that the presence of pharyngealized consonants is not the primary factor which reduces or block the degree of V-to-V coarticulation since the same findings hold true in the nonpharyngealized consonants.

The findings of the study are encapsulated as thus: the vowel space and pharyngealized consonants are not the most important factors that affect the degree of V-to-V coarticulation in the three Yemeni Arabic dialects. There might be other factors that affect the degree of V-to-V coarticulation, such as, vowel duration, speech rate, stress, syllable duration, syllable structure, speaker and dialect.

### 6.3 Implications for further studies

The present study has taken only one small step in the pursuit of broadening research on V-to-V coarticulation in the three Yemeni Arabic dialects: AYA, HYA and TYA. Many suggestions remain for future investigations, and we mention some of them here.

- Allophonic differences among Yemeni Arabic dialects should be investigated to show, whether the three Yemeni Arabic dialects exhibit similar allophones or if there are some allophonic differences among them.
• An acoustic study should be undertaken to examine whether the allophonic vowel space of the three Yemeni Arabic dialects are similar, i.e., whether the allophonic vowel space is crowded or sparse in the three dialects.

• An acoustic study should be carried out to investigate the effect of the allophonic vowel space on V-to-V coarticulation in Yemeni Arabic dialects.

• Since Mok (2007, 2010) found that languages with more syllable structure complexity, allow more V-to-V coarticulation than languages with simple syllable structure, an acoustic experiment on syllable structure should be carried out, to test whether the three Yemeni Arabic dialects exhibit the same syllable structure or not. If the three dialects differ in their syllable structure, the effect of the syllable structure on V-to-V coarticulation among the three dialects should be examined.

• Studies have found that stressed vowels seem to be more resistant to V-to-V coarticulation, than unstressed vowels which are more tolerant to V-to-V coarticulation. Therefore, an acoustic experiment should be conducted to test the effect of the stressed vowels on V-to-V coarticulation in the three Yemeni Arabic dialects.

• Dialectal variation in a read speech data should be investigated in the three Yemeni Arabic dialects, because we assume that speech rate might be one of the factors that affect V-to-V coarticulation in the three Yemeni Arabic dialects.

• More dialects/languages need to be analyzed and with more speakers, to delve deeper into the V-to-V coarticulation in Yemeni Arabic dialects.