Voice onset time and vowel quality in Madurese

The role of gender and dialect

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Madurese exhibits a three-way laryngeal contrast in its plosive inventory, distinguishing voiced, voiceless unaspirated, and voiceless aspirated plosives. Previous studies have investigated some acoustic characteristics of the contrast but have not examined possible dialectal variation in this contrast. The present study aims to discuss the contrast by examining Voice Onset Time (VOT) and vowel quality (F1). Twenty participants (10 Western Madurese speakers and 10 Eastern Madurese speakers) were recruited and instructed to read 150 Madurese words containing plosives. The results showed that an interaction of dialect and gender were significantly correlated with VOT: male Western Madurese speakers produced shorter VOT for voiced and voiceless aspirated plosives than their Eastern counterparts. There was also variation in F1 between gender across dialects: male Western Madurese speakers produced [ə] with a lower F1 than their Eastern counterparts. It was suggested that the variation was possibly due to language contact with Javanese.

Keywords: dialect, gender, VOT, vowel quality, language contact, acoustic measures, Madurese

1. Introduction

Madurese is a Malayo-Polynesian language primarily spoken in Madura and some places in East Java, Indonesia. The number of Madurese speakers who use the language for daily communication is about 7.8 million (Ananta, Arifin, Hasbullah, Handayani, & Pramono, 2015, p. 278). This number includes Madurese speakers living in Madura and on other Indonesian islands. Madurese is also spoken outside Madura in regencies across the north coast of East Java such as Probolinggo, Bondowoso, and Jember. Madurese is taught at elementary schools as part of a

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local language curriculum including in these regencies. Most Madurese speakers also speak Indonesian because of education and mass media exposure, most of which are delivered in Indonesian.

It is widely accepted that Madurese has three main dialects: Western Madurese, spoken in Bangkalan Regency; Central Madurese, spoken in Pamekasan and Sampang Regencies; and Eastern Madurese, spoken in Sumenep Regency (Kiliaan, 1897; Stevens, 1968; Uhlenbeck, 1964). However, the isoglosses used to determine the dialect areas do not always correspond with the administrative regions. In Sampang Regency, for instance, some places may be characterized by having more Western features, and others by showing more Central features, and there is often a mixture of both even in the same village (Soegianto, Soetoko, Soekarto, & Soetarto, 1986; Soetoko, Soegianto, Surani, Sariyono, & Suyanto, 1998).

Madurese has several phonetic and phonological characteristics that are not shared by most of its related languages such as Javanese, Sundanese, and Indonesian. One of its distinct characteristics is its three-way phonemic voicing contrast between voiced, voiceless unaspirated, and voiceless aspirated plosives (Anderson, 1991; Cohn, 1993a, 1993b; Cohn & Lockwood, 1994; Stevens, 1968). In this respect, Madurese differs from both Indonesian (which contrasts phonetically prevoiced with voiceless unaspirated plosives: Adisasmito-Smith, 2004) and Javanese (which contrasts two types of voiceless plosives, 'stiff' and 'slack': Suharno, 1982). Madurese also differs from Javanese and Indonesian in terms of its vowel inventory (Cohn, 1993a, 1993b; Misnadin, 2017; Misnadin & Kirby, 2020b; Stevens, 1968). In particular, Madurese contains two central vowels [ɤ, ɨ] which are absent in both Javanese and Indonesian (as shown in Figure 1). These two vowels and [ə] also overlap considerably in their acoustic realizations (Misnadin, 2016).

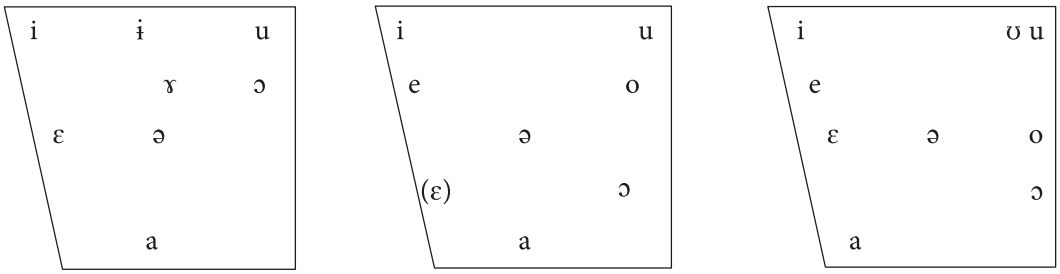

Figure 1. Vowel quadrilaterals for Madurese, Javanese, and Indonesian (Javanese and Indonesian vowel quadrilaterals were adapted from Suharno, 1982)

Several studies have recently been conducted to identify and establish the phonetic and phonological characteristics of the three voicing categories and their relationship to the vowel phonemes in Madurese, for example, Misnadin (2017), Misnadin and Kirby (2020a), Misnadin and Kirby (2020b), and Misnadin (2020). These studies have established that the voiceless aspirated and unaspirated plosives show small but significant differences in several acoustic properties, including VOT. However, the quality of the following vowel was found to be a much more robust indicator of the voicing contrast; for example, the contrast between voiceless unaspirated and voiceless aspirated plosives is determined by the following vowel in words such as pʰikaŋ 'cake' vs. pɛkaŋ 'pinch'. That is, the vowel [i] is always preceded by a voiceless aspirated plosive and the vowel [ɛ] is always preceded a voiceless unaspirated plosive. Moreover, perceptual studies (Kirby & Misnadin, 2019) have found that listeners primarily pay attention to vowel quality, rather than VOT, when asked to distinguish between voiceless aspirated and unaspirated plosives. This suggests that the phonetic distinction between these consonant types may be unstable.

One possible hypothesis is that the degree of contact with other languages like Javanese may influence the acoustic realization of these Madurese sounds; many Madurese speakers, particularly in Western Madura, have some competency in Javanese. While there is a large body of research showing the influence of first language (L1) characteristics on the acquisition of a second language (L2), there is also work showing that the L2 experience can impact L1 pronunciation as well (e.g., Chang, 2012; Dmitrieva, Jongman, & Serena, 2020; Flege, 1987; de Leeuw, Schmid, & Mennen, 2010), what Chang (2012) calls *phonetic drift*. For example, Flege (1987) shows evidence that the VOTs of French voiceless plosives are longer in the speech of French-English bilinguals than in monolingual French speakers, while the /u/ vowels for the bilinguals were lower than for the monolinguals. That is, both VOT and vowel quality of the French-English speakers were more English-like. We might therefore expect the Madurese voiceless plosive contrast and the typologically unusual mid vowel contrasts to be susceptible to influence by language contact with Javanese.

Of the three main Madurese dialects, two are of particular interest in this respect: Eastern and Western Madurese. Eastern Madurese is considered the prestigious dialect of Madurese; this is probably because it is spoken in the easternmost part of the island where persistent or intense contact with other local languages is rare. Madurese people tend to consider Eastern Madurese well maintained in the sense that it is not yet exposed intensely to contact with other languages. More importantly, the prestigious status of the dialect may also be related to the fact that Sumenep used to be the historical center for the former kingdoms of Madura.

Western Madurese, which is spoken in the westernmost part of the island, presents a quite different picture from Eastern Madurese. Madurese people consider it a non-standard dialect of Madurese. Due to the geographical proximity of Bangkalan to Java, Western Madurese has seen more contact with other local languages, particularly Javanese, and this makes the dialect more susceptible to change. Consequently, it is no longer considered 'pure Madurese'. It is very common to see people from Bangkalan commute from Bangkalan, where Madurese is spoken, to Surabaya (the second biggest city in Indonesia) and Malang (a city which is about 95.4 km from Surabaya), where Javanese is spoken, for work or study. Moreover, there is a large Javanese community living in Bangkalan. Therefore, a possible influence of Javanese on the phonetic features of Madurese would be expected to be greater in Western than in Eastern Madurese speech.

The present study considers the phonetic realizations of plosives and vowels by looking at voice onset time (VOT) in plosives and vowel quality in two different Madurese dialects, namely Eastern Madurese as spoken in Sumenep and Western Madurese spoken in Bangkalan. Due to the greater contact with Javanese, it is expected that Western Madurese speakers may show a greater influence of Javanese on their speech compared to Eastern Madurese speakers, and that this will be reflected in both their VOT distributions and their realizations of the central vowels. Because Javanese lacks a phonetically voiced plosive and a phonetically voiceless aspirated plosive, speakers of Western Madurese may be expected to more frequently devoice their Madurese voiced plosives and they may also realize their voiceless aspirated plosives as similar to unaspirated in terms of VOT. Our expectation is that this will be different from Eastern Madurese, where language contact with Javanese is rare or minimal.

Similarly, the greater degree of contact between Western Madurese and Javanese may lead Western Madurese speakers to be more likely to produce those vowels which occur in Javanese. In particular, both the [ɤ] and [ɨ] vowels may be realized with higher F1 values, that is, more similar to [ə]. However, it is important to note that [ɨ] and [ɤ] both occur after voiced and aspirated plosives while [ə] only occurs after voiceless unaspirated plosives in Madurese. This is in stark contrast with Javanese and Indonesian as [ə] can appear after any plosive.

Contact with the national language Indonesian is a factor that also needs to be considered. Most Madurese people acquire Indonesian at a young age and speak the language with a good degree of fluency, due to education and mass media exposure through television and newspapers. However, our expectation is that even if there may be variation due to language contact with Indonesian, that variation will be the same across dialects, even while it may be affected by other factors such as education level, language attitudes, age, and gender.

The main focus of the present study is to examine the possible effect of language contact with Javanese on VOT realization and the central vowels of Madurese. Moreover, we expect that if we find differences between Western and Eastern Madurese speakers with respect to these features that there may also be additional social factors at play, including individual differences in age, gender, occupation, and education level. In particular here we will examine gender differences. In line with seminal work on gender and language change (Labov, 1972), we expect that Madurese women will be more likely to lead changes in progress. Specifically in the Indonesian context, Kurniasih (2006) suggests that Javanese girls and boys in Indonesia have different attitudes towards Javanese, with girls being more oriented towards Indonesian whereas boys are towards Javanese. If we assume something similar in Madura, girls may be more likely to show changes in the vowel system. Indeed, in the Madurese context, Misnadin (2016, pp. 100–101) found evidence that female speakers of Madurese have greater VOT overlap than their male counterparts.

Thus, there are three main objectives of the study: first, to know whether the two dialects show variation in the production of VOT and the central vowels; second, to identify whether speaker gender also correlates with differences in the realization of these phonetic features; and third, to provide an explanation of why such variation may occur in the context of Madurese dialects.

2. Methods

Twenty native speakers of Madurese were recruited as participants in this study. The sample consisted of 10 female speakers and 10 male speakers from two regencies in Madura, Sumenep and Bangkalan, which characterize two different dialect areas of Madurese, Eastern Madurese and Western Madurese, respectively. The participants' age ranged from 18–23 years old and they were all studying at Universitas Trunojoyo Madura in Bangkalan at the time of recording. The participants from Sumenep had lived in Bangkalan for about 2–3 years. In addition to Madurese, all of the participants also spoke Indonesian and some English. They mostly used Indonesian when interacting with people from different ethnic groups or during in-class interactions, but they used mostly Madurese when interacting with other Madurese speakers. Four speakers of Western Madurese and one speaker of Eastern Madurese also reported speaking Javanese. Nevertheless, Madurese was for the most part used in their daily life interactions according to the questionnaires they filled in.

The data were collected using a high-quality recorder (Zoom H5) and a head-mounted microphone (Shure SM10A) at a sampling rate of 44100 Hz with 16-bit

resolution. The recordings were made in a quiet room to minimize any unwanted noise that could interfere with the quality of the recordings. Before the recordings were conducted, the participants were asked for their consent and also given a sufficient explanation about what they were expected to do in the study. The participants also filled in a questionnaire asking about their demographic information including their language backgrounds. Each participant was instructed to read 150 Madurese words as naturally as possible with declarative intonation in mind. Each word was read one time. The words are all disyllabic with the syllable shapes of CVCV and CVCVC and contain all possible plosives and vowels in Madurese. All words were embedded in a carrier phrase *Tolèssaghi* _____ *polè* 'Please write _____again'. The words were taken and adapted from the stimuli provided in Misnadin (2016, pp. 224–227).

The results of the recordings were segmented and coded in *Praat* (Boersma & Weenink, 2019). The acoustic parameters measured in this study were voice onset time (VOT) of all plosives and the first formant frequency (F1) of the three central vowels, [ə], [ɤ], and [ɨ]. The extraction of the measurements for each speaker was done using praatsauce, *Praat*-based tools for acoustical analysis (Kirby, 2018). VOT was measured in two different ways depending on its plosive voicing type. Negative VOT was measured from the start of the voice bar up to the beginning of the following vowel. Positive VOT was measured from the burst following oral closure until the start of the following vowel. The first formant was measured across eleven equally distant time points across each vowel and averaged for statistical analysis. To allow for comparisons between gender, F1 values were normalized using z-score normalization. Following the extraction, statistical analyses were conducted in R (R Core Team, 2019) using the packages lme4 (Bates, Maechler, Bolker, & Walker, 2014) and emmeans (Lenth, Singmann, Love, Buerkner, & Herve, 2018).

3. Results

This section reports the results of the study and presents descriptive and, where appropriate, inferential statistics for each of the acoustic parameters investigated, namely VOT and F1.

3.1 Voice onset time (VOT)

Figure 2 shows the VOT distributions of Madurese plosives grouped by regency/dialect area (Western and Eastern) and gender (female and male). Each color represents different voicing categories (red for voiced, light blue for voiceless unaspi-

rated, and dark blue for aspirated). As seen in the figure, male and female speakers in both regencies appear to show similarities in the distribution of their VOT production. That is, female and male speakers of Western and Eastern Madurese appear to have the same patterns in which the VOT values for voiced plosives look clearly separated from the VOT values for voiceless unaspirated and aspirated plosives. In contrast, the VOT values for voiceless unaspirated and aspirated plosives overlap considerably, which makes them appear to be within the same voicing category. This visualization is consistent with previous findings on VOT distributions of the three-way voicing categories in Madurese in which their VOT values are significantly different even though they overlap considerably (e.g., Cohn & Lockwood, 1994; Misnadin & Kirby, 2020a).

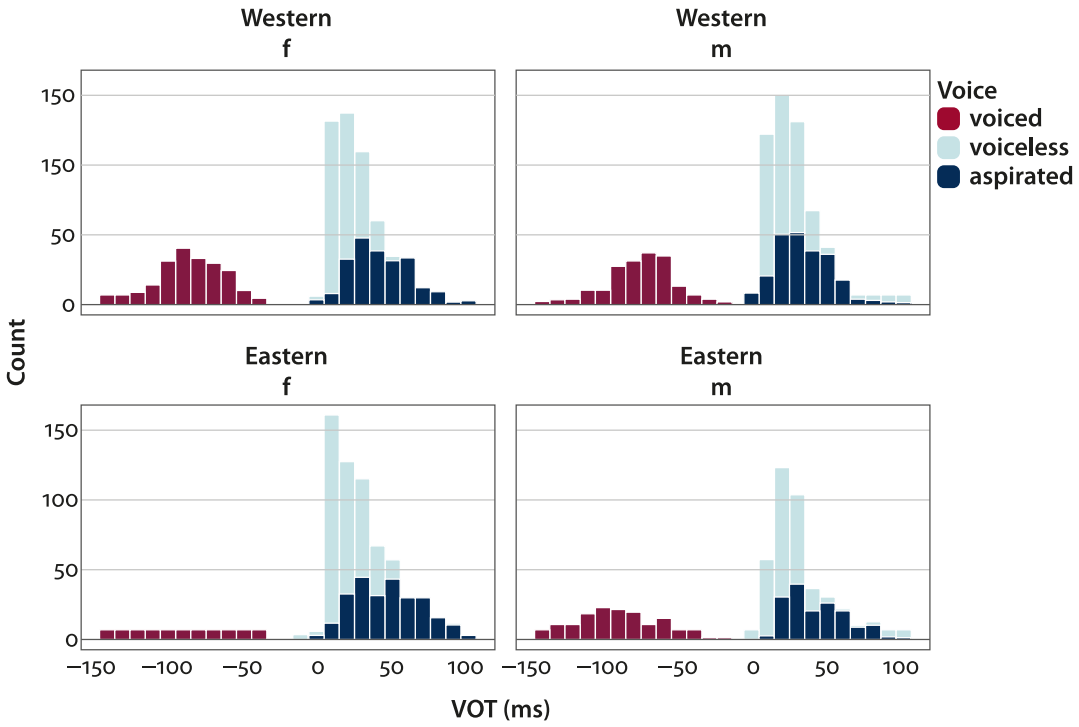

Figure 2. VOT of Madurese plosives by regency and gender

Because the focus in the present study was to assess whether there were differences in VOT values as a function of regency/dialect and gender, a mixed model was fit with factors place (with levels bilabial, coronal, palatal, velar), voice (with levels voiced, voiceless, aspirated), gender (with levels female and male), and regency (with levels Western and Eastern) and all their four-way interactions, along with by-speaker slopes for voice and by-item intercepts. This model was selected since it is the maximal model justified by the present data.

As shown in Table 1, there were no significant differences in VOT values within voicing categories for female speakers between the dialect areas. In con-

Table 1. Results of post-hoc within-voicing pairwise comparison for VOT by gender

Gender	Voice	Contrast	Estimate	SE	df	z. ratio	*p*-value
Female	voiced	Western – Eastern	−0.971	6.52	Inf	−0.149	0.8815
	voiceless	Western – Eastern	−1.242	2.14	Inf	−0.580	0.5623
	aspirated	Western – Eastern	−4.818	4.22	Inf	−1.142	0.2236
Male	voiced	Western – Eastern	14.796	7.20	Inf	2.056	**0.0398**
	voiceless	Western – Eastern	−1.349	2.39	Inf	−0.565	0.5720
	aspirated	Western – Eastern	−9.113	4.68	Inf	−1.948	**0.0514**

trast, there were significant differences in VOT values for voiced and voiceless aspirated plosives for male speakers between dialects indicated by p-values all less than 0.05. Specifically, male Western Madurese speakers produced shorter negative VOT values for voiced plosives (i.e., less prevoicing) and shorter positive VOT values for voiceless aspirated plosives (i.e., more like voiceless unaspirated) than their Eastern counterparts. However, male speakers from both regencies produced similar VOT values for voiceless unaspirated plosives.

3.2 First formant frequency (F1)

Vowels in most of the world's languages can generally be distinguished by the first two formant frequencies; the first formant (F1) indicates vowel height (the higher the F1 the lower the vowel is) and the second formant (F2) indicates vowel frontness or backness (the higher the F2 the more front the vowel is). Given the hypothesis that contact with Javanese, which has only one central vowel [ə], may promote merger of the Madurese central vowels ([ə], [ɤ], and [ɨ]), the realizations of the three vowels were examined.

Figure 3 plots the normalized F1 values for the three central vowels (ə, ɤ, ɨ) for the Western Madurese and Eastern Madurese speakers. The plot shows that the F1 values for these three central vowels appear to vary with gender and regency. That is, female speakers in both dialect areas appear to show lower F1 values than male speakers. One interesting thing to see in Figure 3 is that the vowels [ə] and [ɤ] for male speakers of Western Madurese in particular do not look well separated compared to the other groups.

To assess whether there were differences in F1 values between male and female speakers within and across regencies, a mixed-effects model was fit with factors place (with levels bilabial, coronal, palatal, velar), vowel (with 3 levels ə, ɤ, ɨ), gender (with levels female and male), and regency (with levels Western and Eastern) and three-way interactions between vowel, gender, and regency along

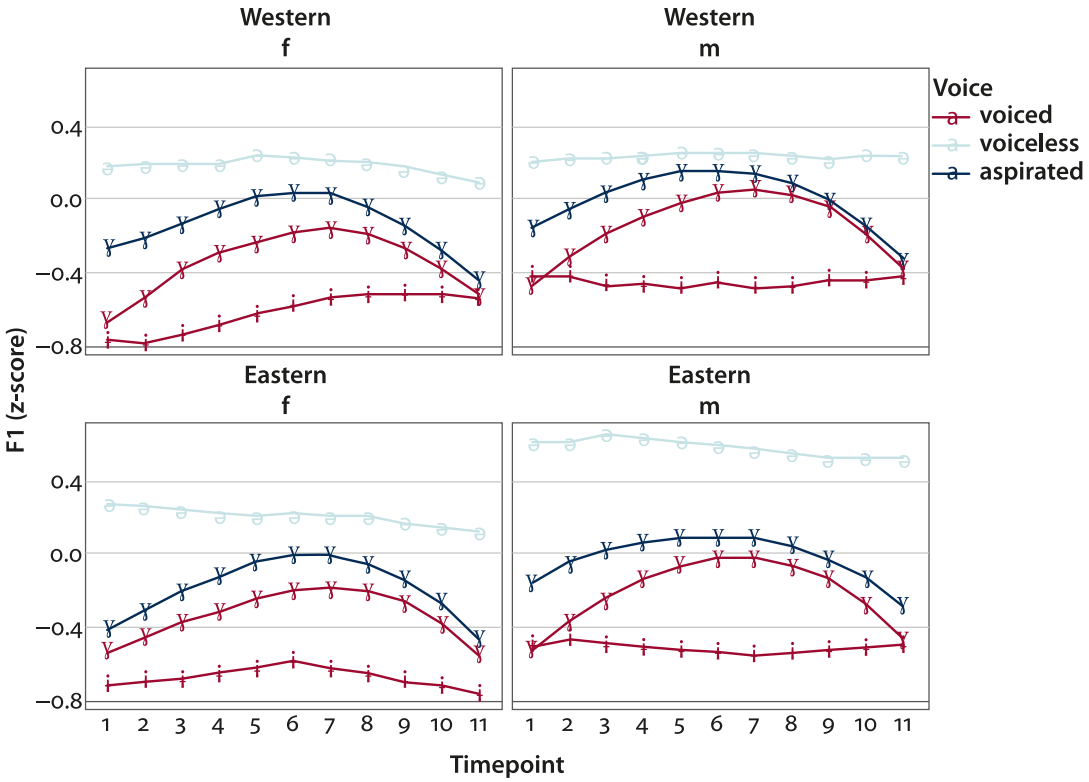

Figure 3. F1 values of the three central vowels in Madurese by regency and gender

with by-speaker and by-item intercepts. This model was chosen because it is the maximal model that was justified by the data.

The first question to ask is whether the F1 values for the three central vowels significantly differ for each gender and regency. That is, whether female and male speakers of Western and Eastern Madurese show differences in their F1 values for each vowel. As shown in Table 2, all of the vowels show significant differences in their F1 values for each gender and regency with p-values all lesser than 0.05. The results indicate that the three central vowels can be distinguished from each other in height.

The second question to ask is whether the F1 values for the central vowels also significantly differ within gender across regency. That is, whether female and male speakers of Western and Eastern Madurese show differences in their F1 values. Using the same model as above, a significant difference was found in the F1 values between male speakers for the vowel [ə] with a p-value of less than 0.05, as shown in Table 3. That is, male speakers of Western Madurese produced the vowel [ə] with the F1 values lower than those produced by male speakers of Eastern Madurese. This indicates that in terms of height, Western Madurese speakers have a higher [ə] compared to Eastern Madurese speakers. Other than this, no significant differences were found for the other two vowels, suggesting all else being

Table 2. Results of post-hoc within-dialect and within-gender pairwise comparison for F1

Dialect	Gender	Contrast	Estimate	SE	df	z. ratio	*p*-value
Western	female	ə – ɤ	0.420	0.076	Inf	5.525	**<.0001**
		ə – ɨ	0.759	0.096	Inf	7.875	**<.0001**
		ɤ – ɨ	0.339	0.075	Inf	4.495	**<.0001**
	male	ə – ɤ	0.364	0.076	Inf	4.775	**<.0001**
		ə – ɨ	0.717	0.097	Inf	7.417	**<.0001**
		ɤ – ɨ	0.353	0.076	Inf	4.666	**<.0001**
Eastern	female	ə – ɤ	0.483	0.075	Inf	6.472	**<.0001**
		ə – ɨ	0.852	0.095	Inf	8.945	**<.0001**
		ɤ – ɨ	0.370	0.075	Inf	4.923	**<.0001**
	male	ə – ɤ	0.688	0.078	Inf	8.825	**<.0001**
		ə – ɨ	1.072	0.099	Inf	10.825	**<.0001**
		ɤ – ɨ	0.384	0.078	Inf	4.939	**<.0001**

Table 3. Results of post-hoc within-gender and across-dialect pairwise comparison for F1

Gender	Vowel	Contrast	Estimate	SE	df	z. ratio	*p*-value
Female	ə	Western – Eastern	−0.0289	0.061	Inf	−0.474	0.6358
	ɤ	Western – Eastern	0.0337	0.049	Inf	0.688	0.4917
	ɨ	Western – Eastern	0.0644	0.062	Inf	1.039	0.2989
Male	ə	Western – Eastern	−0.2878	0.068	Inf	−4.239	**<.0001**
	ɤ	Western – Eastern	0.0366	0.054	Inf	0.673	0.5009
	ɨ	Western – Eastern	0.0676	0.068	Inf	0.993	0.3207

equal, female and male speakers from both dialect areas produce [ɤ] and [ɨ] with approximately similar heights.

4. General discussion

The present study has looked at voice onset time (VOT) of plosives and the F1 values of the three central vowels (ə, ɤ, ɨ) in Madurese to examine variation

in their phonetic realizations and to determine whether the differences, if any, can be attributed to dialect and speaker gender. To achieve this, two dialect areas of Madurese, namely Eastern Madurese, spoken in Sumenep, and Western Madurese, spoken in Bangkalan, were purposefully chosen.

The differences in VOT values in these two dialect areas are of interest to discuss. The initial hypothesis was that there would be dialect differences between Western and Eastern Madurese due to differing contact with Javanese. Indeed, there were differences between the two dialects only if we also consider gender. Specifically, the male speakers of Western Madurese, who have more contact with Javanese both as individuals and due to their dialect region, appear to be the most different from the other speakers in their VOTs for voiced and voiceless aspirated plosives in Madurese. The acoustic results show that male speakers of Western Madurese produced VOT values for voiced and voiceless aspirated plosives lower than male speakers of Eastern Madurese (see Table 1). It raises the questions of why male speakers of Western Madurese have lower VOT values for both types of voicing categories in comparison to speakers of Eastern Madurese and why this does not apply to voiceless unaspirated plosives as well.

One reason why voiceless unaspirated plosives may be stable in their VOT values in the sense that this category does not show variation in terms of gender and dialect is that the VOT values for voiceless unaspirated plosives are between voiced and voiceless aspirated plosives. On the one hand, they cannot be shorter otherwise this will make them difficult to be distinguished from voiced plosives. On the other hand, they cannot be longer either because this will make them sound like voiceless aspirated plosives which are now apparently becoming shorter for male speakers of Western Madurese.

One possible explanation for why VOT values for voiced and voiceless aspirated plosives produced by male speakers of Western Madurese are becoming shorter than those produced by male speakers of Eastern Madurese is language contact. Western Madura is geographically closer to Java. It is also common to find Madurese speakers from Bangkalan who are able to speak Javanese and many Javanese people reside permanently in Bangkalan. This linguistic situation might contribute to the variation or change in VOT values for voiced and voiceless aspirated plosives in Western Madurese.

Furthermore, if we look at the current participants, three out of five male speakers of Western Madurese also spoke Javanese in addition to Madurese and Indonesian. However, this is not the case for male speakers of Eastern Madurese, all of whom only spoke only Madurese and Indonesian. And only one out of five female speakers of Western Madurese and Eastern Madurese spoke Javanese besides Madurese and Indonesian. Again, this might partly explain why male speakers of Western Madurese have lower VOT values for voiced and voiceless

aspirated plosives. The fact that the group of participants with the highest number of speakers of Javanese were the ones with the lower VOT values lends credence to the suggestion that there is a possible influence of Javanese on Western Madurese with respect to plosive voicing.

Unlike Madurese, Javanese only possesses two voicing categories and it notably does not have voiceless aspirated plosives in its phonological system. More importantly, the so-called voiced plosives in Javanese are not voiced (Adisasmito-Smith, 2004; Brunelle, 2010; Fagan, 1988; Hayward, 1995; Hayward & Muljono, 1991). The phonetic realization of the Western Madurese voiceless aspirated plosive may be changing due to intensive contact with Javanese. It is important to bear in mind that speakers of Western Madurese have both shorter negative VOT values for voiced plosives (less prevoicing) and shorter positive VOT values for voiceless aspirated plosives (less aspiration). This looks rather consistent with the prediction that there is a possible Javanese influence as Javanese does not have these two plosive types. The fact that Western Madurese speakers produce less voiced plosives and less voiceless aspirated plosives may provide an early indication that the production of VOT in Western Madurese may be leading to plosive voicing types which are approximately similar to those commonly found in Javanese.

In addition to the fact that the male speakers of Western Madurese were more likely to be Javanese speakers than their female counterparts, there may be other reasons for the demonstrated gender differences in the VOT values for voiced and voiceless aspirated plosives. One speculation is that female speakers may be more 'conservative' due to the more traditional role they play in the Madurese society; for example, as role models for their children. In the context of the patriarchal Madurese society where women are traditionally expected to show good behavior and attitudes including in how they speak to others, female speakers may demonstrate more carefulness with the utterances they produce in order to not be judged badly by society. This contrasts interestingly with the sociolinguistic situation in some Western countries, where adolescent and post-adolescent girls are frequently the leaders of sound change (Eckert, 2011). Future work will examine whether the observed variation seems to be ongoing change in progress by recording speakers in different age groups.[1]

It is also possible that male speakers of Western Madurese may be leading the change because of their higher mobility, frequently traveling back and forth from

1. Unfortunately, I have not had the opportunity to record older speakers outside of the urban areas due to the outbreak of Covid-19 that has also affected Indonesia. However, based on previous studies on language change and variation, it can be predicted that there will be differences in the realizations of the phonetic features between younger and older speakers.

Bangkalan to Java especially to Surabaya and Malang for work or study. This condition may have gradually exposed them to other languages such as Javanese and made contact with more languages even more intensive. Besides, there are several Javanese communities in Bangkalan and this may also contribute to and facilitate language contact even further throughout this particular dialect area.

The second phonetic feature examined in this study is F1, a correlate of vowel height. Despite the prediction that we would see evidence of vowel merger in the central vowels under the influence of contact with Javanese, it was found that the three central vowels, [ə], [ɤ], and [ɨ], are still distinct from one another in both dialects (Table 2). Counter to our expectations, the [ɤ] and [ɨ] vowels were not realized with higher F1, that is, more similar to the Javanese [ə], and there were not dialect differences between Eastern and Western Madurese with respect to the maintenance of a three-way vowel distinction.

An important result to discuss concerning vowel height is that there was a significant interaction between gender and dialect. It was found that male speakers of Western Madurese had a lower F1 for [ə] while their Eastern Madurese counterparts had a higher F1 for [ə], as shown in Table 3. This result becomes clearer if we particularly look at Figure 3 in which there is a less acoustic separation between [ə] and [ɤ] in speakers of Western Madurese. This is not the case for speakers of Eastern Madurese where there is a distinct separation between the vowels. The less acoustic separation results from the fact that [ə] is higher in Western Madurese. This is consistent with possible movement towards a merger of these two vowels and also consistent with previous work which sometimes suggests schwa is not a distinct vowel.

The results for VOT and F1 in this study are quite consistent in the sense that the variation in terms of these phonetic features were found only for male speakers. Specifically, we can see that male speakers of Western Madurese appear to lead the change both in VOT and F1 realizations. This consistency in results may provide an early indication that the variation is correlated with certain sociolinguistic aspects as well. For example, male speakers are more mobile while female speakers are more conservative due to societal demands, and Western Madura is geographically closer to Java which facilitates language contact. These are intriguing findings that will be examined in more detail in future research.

5. Concluding remarks

This study has discussed two phonetic features (VOT and F1) in an attempt to uncover if there were differences in their realizations based on gender and dialect. It can be tentatively concluded that the observed differences may be related to

both gender and dialect to a certain extent. It has also been suggested that the differences between Western Madurese and Eastern Madurese may be due to language contact between Western Madurese and Javanese.

Future work will consider this sociolinguistic variation more closely by looking at more variables, including age, education, and place of residence (rural versus urban areas). An important next step will be to record speakers in more naturalistic settings and from different age groups to determine whether the observed variation represents an ongoing change in progress, currently led by Western Madurese men. In order to further investigate the current claim that the differences between Eastern and Western Madurese are due to language contact between Western Madurese and Javanese, future research also needs to collect data from a balanced sample of bilingual Javanese and Madurese speakers and Eastern Madurese speakers who do not speak Javanese.

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Abstract (Indonesian)

Bahasa Madura membedakan tiga jenis bunyi hambat, yaitu bunyi hambat bersuara, tak bersuara beraspirasi, dan tak bersuara tak beraspirasi. Studi sebelumnya telah menyelidiki beberapa karakteristik akustik dari ketiga jenis bunyi tersebut tetapi belum meneliti kemungkinan variasi dialek dalam perbedaannya. Penelitian ini bertujuan membahas perbedaan ketiga bunyi tersebut dengan mengkaji *Voice Onset Time* (VOT) dan kualitas vokal (F1). Dua puluh

partisipan (10 penutur Madura Barat dan 10 penutur Madura Timur) direkrut dan diinstruksikan membaca 150 kata Madura yang mengandung bunyi hambat. Hasil penelitian menunjukkan bahwa interaksi dialek dan gender berkorelasi signifikan dengan VOT: penutur laki-laki Madura Barat memiliki VOT lebih pendek untuk bunyi hambat bersuara dan tak bersuara beraspirasi daripada penutur laki-laki Madura Timur. Ada juga variasi dalam F1 antara gender di seluruh dialek: penutur laki-laki Madura Barat menghasilkan vokal [ə] dengan F1 lebih rendah dibandingkan penutur laki-laki Madura Timur. Variasi tersebut diduga timbul karena kontak dengan bahasa Jawa.

Kata kunci: dialek, gender, VOT, kualitas vokal, kontak bahasa, ukuran akustik, bahasa Madura

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