Contact-induced Phonological Mergers: Transfer or Approximation

Mahjoub Zirak[1], Peter M. Skaer[2], *Graduate School of Integrated Art and Sciences, Hiroshima University*

Abstract— **Sound changes in a language are considered nearly inevitable consequences of language death. The literature on sound change in obsolescencing languages has focused on whether the changes are internally or externally motivated, between convergent and divergent change and, therefore, the difference between categorical sound shifts and gradient phonetic effects has been overlooked. This paper examines the acoustic correlates of voicing distinctions in the Kurmanji language that investigate the subphonemic variation within a category. The results of a cross-generational acoustic study of Kurmanji showed that unaspirated initial voiceless stops have undergone phonetic change convergent with Persian, the dominant language. This paper argues that sound change in obsolescing languages may manifest substitution or approximation/expansion of phonological categories in the moribund language.**

***Index Terms*—Voice onset time, sound change, transfer, approximation**

I. Introduction

When we consider language contact phenomena, both social and structural factors must always be taken into account ([1]). Social factors influencing mechanisms and outcomes include the reason for the language contact, the dominance of the group speakers, the amount of social and cultural pressure groups exert on each other, and the relative instrumental value of the languages. Instrumental value is a measure of how useful the language is for the economic and social advancement of the speaker [2]. Language change may occur as a result of external influence from a dominant language in the community, or internally-motivated change by virtue of its independence from the influence of the dominant language ([3]). As ([3] and [4]) caution, when change is externally motivated, the obsolescing language may come to approximate features of the dominant language, on the other hand, external influence may cause salient features of the obsolescing language not found in the dominant language, thus further differentiating the two languages. To sum up, externally motivated change may result in either convergence with or divergence from the dominant language ([3], [4], [5]). In a same direction, internally motivated change may incite the features that cause convergence with or divergence from the dominant language. Whether or not the change is convergent or divergent depends upon the nature of languages in contact. [3] states that it is likely for a language to be undergoing changes due to internal pressures at the same time that it is being affected separately by contact with another language. Most endangered language situations involve gradual decline in speaker numbers and speaker fluency.

Large-scale investigations on sound change in obsolescing languages are notably lacking for some languages, in particular the Iranian group. This paper therefore targets one of the languages of the Iranian group, one of the geographically most isolated from its origin, namely the Kurmanji (Northern Kurdish) language in the northeast of Iran. Following recent investigations of obsolescing languages such as [7], we present a study of phonetic and phonological changes in Kurmanji speakers of north-east of Iran based upon recordings of two generations of speakers. This paper focuses on the realization of a sound change to investigate whether these changes are gradual shifts or categorical changes resulting in either convergence with or divergence from the dominant language, Persian. The phonological contrasts of initial voiceless consonants were examined in order to determine the differences of voice onset time as a phonetic correlate of a voicing distinction, and investigates the question: What evidence is there of VOT values of the initial voiceless consonants in the Kurmanji speakers on the process of language change regarding interference from the strong dominant language, Persian?

II. Contact-Induced Phonological Change

For phonology, [8] proposes three hypotheses of change which have long been reported for language-contact situations: (1) the bilingual speaker of a threatened language will make fewer phonological distinctions in his or her use of the language than a fully competent (dominant or monolingual) speaker of the same language would. (2) However, he or she will preserve distinctions common on both his/her languages even while making fewer of the distinctions found only in the threatened language, and; (3) Distinctions with a functional load which is high (in terms of phonology and/or morphology)

[1] Mahjoub Zirak, Graduate School of Integrated Art and Sciences, Hiroshima University 1-7-1 Kagamiyama, Higashi-Hiroshima, 739-8521 Japan (phone: +8180 3881 5547, email: Mahjoob_zirak@yahoo.com)

[2] Peter M. Skaer, Graduate School of Integrated Art and Sciences, Hiroshima University 1-7-1 Kagamiyama, Higashi-Hiroshima, 739-8521 Japan (email: peterskaerjp@yahoo.co.jp)

DOI: 10.5176/2345-7163_1.1.12

will survive longer in the speaker's use of his or her weaker language than distinctions which have a low functional load. The first pattern, which constitutes a loss of structure, is most often exemplified by changes convergent with the dominant contact language, since the structure lost is usually one not found in the contact language. Thus, convergent change is the type of change most commonly cited in the literature on language obsolescence ([3], [4], [9])

A. Convergent and Divergent Change

[9] described many cases of convergent and divergent phonological change. One example of convergent is the language Pipil (Southern Uto-Aztecan), whose speakers have lost contrastive vowel length not found in the dominant language, Spanish, merging long vowels with short counterparts. [9] explained that these externally motivated changes have a common reason at which the loss of structures in the obsolescing language is not found in the dominant language. Campbell and Muntzel defined the overgeneralization of marked features as divergent change from the dominant language. That is, things that are exotic from the point of view of the dominant language are employed with great frequency by imperfect speakers in ways inappropriate for the healthy version of the same language. For instance, Teotepeque Pipil in its moribund state has overemphasized voiceless *l* employing it everywhere, not just word-finally as it was formerly. Considering these two types of changes, convergent change remains the more commonly attested type of change, often resulting in the merger of phonemes that do not contrast in the dominant language. Mergers evidenced in language change have come to be differentiated from each other by the degree of merger; categorical phonological shift or gradient phonetic effect.

B. Phonological Mergers: Transfer and Approximation

The literature on dialect contact and dialect change can inform our understanding of changes in obsolescing languages. Obsolescing languages are in contact with other more dominant languages, and community shifts to a dominant language can have dramatic effects on the language structure. [7] investigated the distinction between the two paths of sound change, namely the differences between categorical phonological shifts and gradient phonetic effects which is critical as categorical shifts can obliterate phonological contrasts that are present in the traditional, pre-contact varieties of obsolescing languages. [10] introduced the concepts of transfer for 'categorical phonological shift' and approximation for 'gradient phonetic effect' in their analysis of vowel mergers on East Anglia. In the case of transfer, two phonemes merge via the first phoneme categorically changing to the second phoneme in words containing the former phoneme. In the language contact literature, transfer is analogous to substitution where a phoneme from one language replaces a phoneme in another either in one phonological environment or all together ([1], [7], [11]). Traditional views of sound change often consider it a gradual internal process where the phonetic realization of a phonological category is subtly altered until it enters new phonological space ([10], [12]). Gradient phonetic effects, however, may have minimal impact on the native structure of the language. In the case of approximation, however, two phonemes merge as their individual phonetic spaces approach (i.e. approximate) each other ([3]). [13] demonstrated that subphonemic changes occur in Washo, a moribund language, without neutralizing any phonological contrasts. He compared consonant patterns of Washo speakers recorded in the mid-20th century to individuals in their seventies. While he concludes that the young generation has maintained the pattern of the older speakers, [13] found that the contemporary generation of speakers had a less distinct boundary between short and long consonants. He hypothesized that the contrasts based on timing relationships (consonant length) are more likely to undergo approximation, while contrasts that are more categorical in nature (e.g. consonantal place contrasts) are more likely to undergo sound change via categorical shift. The purpose of this paper is to determine the relationship between the subphonemic and phonological inventory effects of moribundity on Kurmanji.

C. Background of the Khorasani Kurmanji Dialect

Khorasani Kurmanji (Northern Kurdish), variety of which is called Kurmanji, spoken in northeast of Iran is an Obsolescing Kurdish Dialect. It is now only spoken by older generations. Persian as the dominant language is the main everyday language of young people and it is the language being acquired by the Kurmanji children. Kurmanji has contrastive aspirated/unaspirated initial stops and affricate consonants ([14]), rarely found in other Iranian Languages, especially Persian. There are 12 voiceless consonants in Kurmanji, and 8 of them include 3 stops and one affricate paired by the aspirated/unaspirated distinction. The four pairs are: [p]/[p^h] , [t]/[t^h] , [k]/[k^h] , [ʧ]/[ʧ^h].

Fig. 1: Map of Iran. "A" points to the location of the targeted language.

III. MATERIALS

The purpose of this study was to investigate the differences of the voice onset time as a phonetic correlate of voicing

distinction in two generations of Kurmanji Speakers and compare it with Persian as a dominant language. The target was the initial voiceless aspirated/unaspirated stops. Our expectations were that the gradual change from initial voiceless unaspirated to voiceless aspirated in Kurmanji Speakers Generation2, was externally motivated, convergent with Persian.

A. VOT Variation

VOT has been defined as the time interval between the onset of release burst and the onset of periodicity that reflects laryngeal vibration [15]. The phonologically identical feature voice in different languages is defined as [±voice], but phonetically implementing, the categories are chosen from a fixed and universally specified set which allows only three discrete phonetic categories: {voice}, {voiceless unaspirated} and {voiceless aspirated}. [16] represents these three discrete phonetic categories in the model displayed in Figure 2. It is interesting to note that these three categories correspond to the division of the VOT continuum [15] have defined into fully voiced stops produced with a negative VOT value (Voicing Lead), voiceless unaspirated stops produced with zero or a slightly positive VOT value (Short Lag) and voiceless aspirated stops produced with a clear positive VOT value (Long Lag). [18] also have schematized these three-way contrastive categories as the significant variation possible of VOT, shown in Figure 3.

In trying to account for what was known about VOT in different languages at the time, [17] believes that various languages use all possible combinations of a universal set of phonetic voicing categories in their implementation of [±voice], while since there seems to be no way to predict voicing categories across environment, the choice of implementation rules must be specified in each language. As necessary evidence she compared English and Polish stops and found that at the first level, various phonetic kinds of /b, d, g/ are defined by the feature [+voice] in both languages. At the second level, in Polish, as in other languages without aspiration such as French, the phonological features [+voice] and [-voice] are realized as {voiced}, {voiceless unaspirated}, respectively whereas the phonological feature [+voice] in English is usually realized as {voiced}, but can be sometimes realized as {voiceless unaspirated}(e.g., word-initially); similarly English [-voice] can be either {voiceless aspirated} or {voiceless unaspirated}, depending on the context.

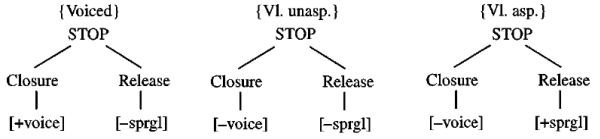

Fig. 2: Voicing categories in stop consonants ([16]).

- *Aspiration as unmarked*

In systems containing three or more series, the short lag series (T) is more constrained than the others in terms of VOT; the voice-lead series (D) can extend quite far in the lead direction and the long lag series (T^h) can extend in the lag direction, but if the short-lag series (T) extends in either direction it will overlap with one of the other series [18]. Thus, it should come as no surprise that it is difficult to implement short lag series which allows less room for dispersion. Since the D:T^h contrast is easier to perceive than the D:T contrast, [18] expected that the former contrast is easier to learn and hence more common over evolutionary time. In order to further verify the effect that less-dispersed systems (D:T, T:T^h) evolve into the more dispersed systems, [18] offered an example of Modern Persian from [19] in which he observed that "the emergence of aspiration (in Persian) was probably caused by the tendency to increase the distance between the voiced and the voiceless members".

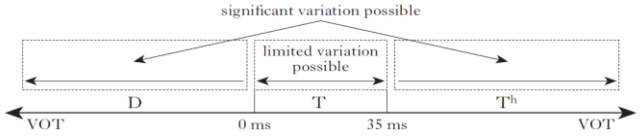

Fig. 3: T constrained along the VOT axis relative to D and T^h ([18]).

- *Persian vs Kurmanji VOT's*

Comparing the two target languages investigated in this study which contrast [+voice] and [-voice] in initial position, we follow [20] who proposed that in Persian the two voicing categories are differentiated in production by the presence or absence of aspiration for most of the place of articulation in initial position. In this way the voicing contrast, [+voice] and [-voice], in stop consonants in initial position can be realized as {voiceless unaspirated} and {voiceless aspirated} respectively.

Compared to Persian, the phonological features [+voice] in Kurmanji is realized as {voiced}, similarly [-voiced] is considered as {voiceless unaspirated} and {voiceless aspirated}.

IV. Methods

A. Participants

This study is based on archival recordings of 5 male speakers from Generation1. Managing the study, 5 male speakers from Generation2 were also investigated in the study by recording the target stimuli. Both Generations lived in northeast of Iran for most of their lives. Participants were bilingual of Persian and Kurmanji.

B. Stimuli

A corpus was constructed from Archival and original recordings of Kurmanji speakers to compare word forms across two generations. The Generation2 word lists were recorded based upon the archived recordings of Generation1 word lists to manage the word tests. Finally, 40 Kurmanji words in which the onset covers the full set of Kurmanji oral voiceless aspirated and unaspirated stops /p, t, k, tʃ/ were produced by the 10 speakers representing two generations of

Kurmanji speakers. Persian data were selected based on data in [19]. The VOT values of each sample were segmented in Praat. VOT measurements were made from the signal by measuring the time between the release burst and the onset of voicing marked by the first visible sign of periodic acoustic activity. Figure 3 lists examples of aspiration forms in initial position in Kurmanji.

Table 1: Comparison of initial stop aspiration forms in Kurmanji

	p	t	k	tʃ
Unaspirated	palis (Carpet)	tav (Sun)	kal (Old man)	tʃav (Eyes)
Aspirated	pʰir (Old)	tʰin (Thirst)	kʰar (Work)	tʃʰar (Four)

C. *Statistical Analysis*

Statistical testing was carried out in SPSS: The General Linear Model (GLM) univariate analysis of variance (ANOVA) was used to assess the differences of VOT values between aspirated/unaspirated voiceless consonants in Generation1 and Generation2 versus Persian. Two separate univariate analysis of variance were utilized to investigate the effect of place of articulation and voicing distinction. A univariate ANOVA was used to examine the effect dominant Persian on two generations in Kurmanji. An alpha level of .05 was set as the level of significance.

V. Results

The VOT values in ms for the voiceless stop and affricate consonants in initial position are displayed in Table 2. Mean, Standard Deviation (SD) and number (N) of tokens are shown for each sound. Each consonant represented the different values for VOT when produced by different Generations of Kurmanji or by Persian speakers. As the results indicated in Table 2, Regardless of the place of articulation, the VOT values of aspirated consonants were higher in Persian (89.24 ms) than their cognates in Generation1 (50.336 ms) and in Generation2 (74.749 ms) of Kurmanji. The VOT values of unaspirated and aspirated voiceless consonants produced by Kurmanji speakers in Generation1 and 2 did show the longer VOT in Generation2 (59.34 ms and 74.74 ms respectively).

As a preliminary screening, a 2 × 3 × 4 (Aspiration × Generation × Consonant type) univariate analysis of variance (ANOVA) was run to the mean VOT values. The ANOVA returned significant main effects of Aspiration, Consonant type, Generation as well as significant interactions between Consonant type and Generation (Table 3).

This study firstly asked whether VOT values vary according to consonant types. A GLM univariate analysis of variance compared four targeted consonants in initial position, /p, t, k, tʃ/. As expected, the results illustrated the high significant difference between the 4 consonant types [$F(3,480) = 598.75$, $p<0.000$, effect size = 0.789]. Based on bonferroni post hoc test VOT was significantly longer for /tʃ/ than for /k/, /t/ and /p/ ($p<0.05$). Significant differences in the VOT values according to Generation were confirmed by the same test for aspirated consonants [$F(2,480) = 692.860$, $p<0.000$, effect size = 0.743], as well as for unaspirated consonants [$F(1,480) = 540.321$, $p<0.000$, effect size = 0.530]. Bonferroni post hoc test revealed that VOT was significantly higher for Persian compared to Kurmanji Generations, and higher for Generation2 than Generation1 ($p<0.05$).

Table 2: Mean and Standard Deviation of VOT values (ms) for aspirated and unaspirated initial stops and affricate according to Generation (N=Number of test words).

	Aspiration	Generation	Mean	SD	N
p	unaspirated	Generation1	22.914	4.262	25
		Generation2	43.437	3.918	25
		Total	33.175	11.129	50
	aspirated	Persian	67.541	10.706	25
		Generation1	39.559	3.563	25
		Generation2	59.859	4.255	25
		Total	55.653	13.725	75

	Aspiration	Generation	Mean	SD	N
t	unaspirated	Generation1	24.492	3.481	25
		Generation2	52.971	4.261	25
		Total	38.731	14.889	50
	aspirated	Persian	77.292	11.685	25
		Generation1	39.038	6.046	25
		Generation2	63.399	6.142	25
		Total	59.911	17.937	75

	Aspiration	Generation	Mean	SD	N
k	unaspirated	Generation1	40.677	5.624	25
		Generation2	58.679	10.639	25
		Total	49.678	12.394	50
	aspirated	Persian	95.117	9.388	25
		Generation1	54.826	4.831	25
		Generation2	78.837	6.954	25
		Total	76.261	18.158	75

	Aspiration	Generation	Mean	SD	N
tʃ	unaspirated	Generation1	51.040	7.959	25
		Generation2	82.277	10.263	25
		Total	66.659	18.207	50
	aspirated	Persian	117.038	10.598	25
		Generation1	67.922	7.775	25
		Generation2	96.902	7.076	25
		Total	93.954	22.005	75

Table 3: ANOVA results for the mean VOT values based on Aspiration, Consonant types and Generation.

Tests of Between-Subjects Effects

Source	df	F	Sig.	$P\eta 2$
Aspiratation	1.00	429.43	0.00	0.47
Consonant Type	3.00	590.00	0.00	0.79
Generation	2.00	963.02	0.00	0.80
Aspiratation * Cons. Type	3.00	1.93	0.12	0.01
Aspiratation * Generation	1.00	0.01	0.92	0.00
Cons. Type* Generation	6.00	11.97	0.00	0.13
Aspirate * Cons. Type * Gen	3.00	2.17	0.09	0.01

(Adjusted R Squared = .910)

The interaction of consonant types and Generation was also significant in both aspirated and unaspirated items. Tables 4 and 5 represent the results of univariate ANOVA to investigate the VOT contrast distinction in detail. There is a significant difference between the means of aspirated items in each consonant type according to Generation. Bonferroni post hoc test revealed that mean differences of VOT between Generation1 and Persian are significantly higher than between Generation2 and Persian in each aspirated consonants (38.912 ms and 14.498 ms respectively, P<05). Moreover, the differences between the VOT values of Generation1 and 2 (24.414 ms, P<05) also indicates that Generation2 tend to produce long lag VOTs compared to Generation1. The same result found for unaspirated stops in which the VOT produced by Generation2 was higher than Generation1 (mean difference = 24.559 ms p<0.05). The observed data analysis indicates that however the VOT differences between Generation2 and Persian is decreased, the contrast is still significant.

Table 4: Significant VOT differences of unaspirated consonants: Effect of Generation

	F(1,480)	p	*Pη2*
p	94.324	0.00	0.164
t	181.613	0.00	0.274
k	72.547	0.00	0.131
tʃ	218.511	0.00	0.313

Table 5: Significant VOT differences of aspirated consonants: Effect of Generation

	F(2,480)	p	*Pη2*
p	93.622	0.00	0.281
t	167.952	0.00	0.412
k	184.013	0.00	0.434
tʃ	273.08	0.00	0.532

Figure 3 contains interaction plots between Consonant types, Aspiration and Generation factors which affect the VOT values. The first interaction plot shows the mean VOT of Geneartion1 compared to dominant Persian, whereas the second interaction plot indicates the increases of VOT value as Generation2 progress, as predicted. The observed differences in Figure 3 were also confirmed statistically.

The data presented above illustrates that all speakers in generation2 maintain the contrast between aspirated and unaspirated initial stops, using a combination of phonetic features. The distribution of the data does not indicate a categorical shift to the Persian category, but rather suggests the approximation of the unaspirated and aspirated categories. These findings supports the assertion made in [9] in which the authors predict that variability in production increases the function of the level of language obsolescence. [7] had similar results with his data from Northern Paiute.

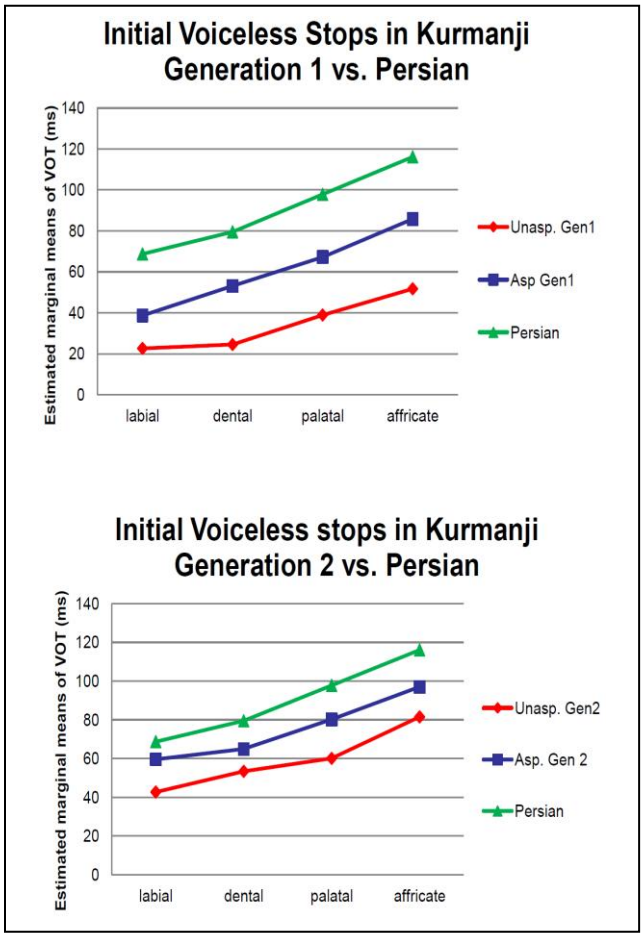

Fig. 4: Interaction plots representing the mean VOT changes (ms) between generations and the effect of Persian aspirated stops.

The youngest speaker maintained the phonological patterns of the deceased generation, but the categories were less distinct. This trend suggests that later generations of speakers of obsolescing languages may not necessarily lose contrasts but exhibit increased subphonemic variation, causing the category boundaries less discrete ([7]).

VI. Discussion

This paper has examined the sound change in Khorasani Kurmanji Dialect, an obsolescing variety of Northern Kurdish, in northeast of Iran. VOT value in Kurmanji exhibited the expected pattern of drift from short lag to long lag VOT with the significant increase occurring between Generation1 and Geneartion2. This is likely because Generation2 speakers in northeast of Iran do not form a cohesive Kurmanji community compared to Generation1 and therefore have no opportunity to talk casually outside home, thus, they merge into the dominant Persian and the VOT value of Generation2 speakers is rapidly pulled through the VOT value of the dominant Persian.

Approximation occurs when two phonologically distinct phonological shift in the direction of each other until they are acoustically indistinct. Sound changes involving approximation are comprised of gradual subphonemic changes

prior to the completion of the change. A phonological category is transferred when one phonological category is adopted and implemented into a lexical item as a form of lexical diffusion until it completely replaces the previously existing category. Approximation represents an underlying path of gradient, subphonemic variation. Conversely, transfer assumes that the sound change was a categorical shift or an articulatory leap. This terminology will be adopted below in the discussion of sound change in Kurmanji.

Considering the fact that speakers of an obsolescing language are expected to make fewer phonological distinctions, yet maintain distinctions in the obsolescing language that also exist in the dominant language, and phonological distinctions with a low functional load are to be lost prior to those with a high functional load ([6], [8]) offers two feasible approaches to the investigation of sound change in the present study. This point of view emphasizes the effect of the phonological structure of the dominant Persian as the causal factor in the loss of oppositions in Kurmanji (external motivation): There is no similar contrast in voiceless initial stops in Persian consequently; this contrast in Kurmanji is left more vulnerable to loss. This contrast is in fact maintained in Generation2, the distance between categories simply decrease. The markedness view, on the other hand, suggests that the marked nature (unnaturalness due to the difficulty of pronunciation) may contribute to its merger with the unmarked feature: Considering the voiceless aspirates (T^h) as less marked than plain voiceless stops (T) and the fact that aspiration contrasts D/T:T^h are less marked than voicing contrasts D:T, (T) in Kurmanji tends to change to (T^h).

Thus the lack of aspirated/unaspirated distinctions in dominant Persian and the tendency to reduce markedness conceivably could have worked in concert, jointly leading to the loss in Kurmanji through convergence with Persian. These findings support the assertion made in [9] in which the authors mentioned examples of previously obligatory rules becoming optional in obsolescence and resulting in free variation. This situation fits well into the notion of an obsolescing language being imperfectly learned in that it is subtractive: a language structure is forgotten or omitted.

It is clear that categorical changes, loss of allophones, and sub-phonemic variation are all characteristics of sound change in obsolescing languages. The extent to which sound changes have occurred in the Kurmanji language based on Generation is considered through instrumental phonetic investigation in this paper. Acoustic correlates of the voicing distinction showed that the voicing contrast can be viewed as a three way distinction in the timing of vocal fold vibration. Subtle changes in these timing relationships cause increasingly gradient subphonemic effects in younger generations compared to older generations. It can be predicted that phonological changes in obsolescing languages that rely on specific timing relationships, like the narrowing of the aspirated/unaspirated contrast in younger generations of Kurmanji speakers suggest that later generations of Kurmanji speakers may not necessarily lose contrasts, but may exhibit approximation-like sound changes, not categorical phonological transfer.

VII. Conclusion

In the present study we have presented the evidence of either categorical phonological shifts or gradient phonetic effects in "Kurmanji" by investigating the VOT distinctions in initial stops produced by Kurmanji speakers of two generations and compare it to Persian. Considering the kinds of variation and change in obsolescing and endangered languages, it may be difficult to distinguish the changes due to the language attrition process from the consequences of other kinds of language contact. It is clear from the Kurmanji data that the path of gradient phonetic changes in obsolescing languages may end with the categorical phonological merger. This consideration shows the importance of documenting and describing obsolescing languages and the contributions that findings from these languages can make to linguistic theory.

References

[1] U. Weinreich, *Languages in contact: Findings and Problems*. Berlin: Mouton Publishers, 1958.

[2] C. O'Shannessy, "Language contact and change in endangered languages," in *The Cambridge Handbook of Endangered Languages*, ed. P. K. Austin and J. Sallabank, Cambridge University Press, 2011, pp. 78-99.

[3] C. B. Chang, "Convergence and Divergence in Obsolescence: On sound change in Southern Pomo," in *US Berkely Phonology Lab Annual Report*, 2007, pp. 597-629.

[4] N. Dorian, "Internally and Externally motivated change in language contact settings: doubts about the dicotomy." In *Historical Linguistics: Problems and Perspectives*, ed. C. Jones, Longman Publishing, 1993: pp. 131-155.

[5] W. Labov. *Principles of Linguistic Change, Volume 3: Cognitive and Cultural Factors*, Wiley-Blackwell Publishers, 2011.

[6] N. Palosaari and L. Campbell, "Structural aspects of language endangerment," in *The Cambridge Handbook of Endangered Languages*, ed. P. K. Austin and J. Sallabank, Cambridge University Press, 2011, pp. 101-119.

[7] M. Babel, "The phonetic and phonological effects of moribundity," in *Pennsylvania Working Papers in Linguistics*, vol. 14.2, 2008, pp. 24–34.

[8] R.W. Andersen, "Determining the linguistic attributes of language attrition". In *The Loss of Language Skills*, ed. R. Lambert and B. Freed. Rowley, Mass.: Newbury House Publishing, 1982, pp. 83-118.

[9] L. Campbell and M. C. Muntzel, "The structural consequences of language death" in *Investigating Obsolescence*, ed. N. Dorian, Cambridge University Press, 1989, pp. 181-196.

[10] P. Trudgill and T. Foxcroft, "On the sociolinguistics of vocalic mergers: transfer and approximation in East Anglia," In *Sociolinguistic Patterns in British English*, ed. P. Trudgill, Willmer Brothers Limited, 1978, pp. 69-79.

[11] S. G. Thomason and T. Kaufman, *Language Contact, Creolization and Genetic Linguistics*. Berkely: University of California Press, 1988.

[12] K. A. Woolard, "Language convergence and language death as a social process" in *Investigating Obsolescence*, ed. N. Dorian, Cambridge University Press, 1989, pp. 355-368.

[13] A. Yu, "The phonetics of quality alternation in Washo," in *Journal of Phonetics* 36, 2008, pp. 508-520.

[14] G. Haig, and Y. Matras. "Kurdish Linguistics: A brief overview," In *Sparchtypol, University Forsch* (STUF), Berlin 55/1, 2002, pp. 3-14.

[15] L. Lisker and A.S. Abramson, "A cross-language study of voicing in initial stops," in *Acoustical Measurements, Word*, vol. 20, 1964, pp. 384-422.

[16] P. A. Keating, "Phonetic representations in a generative generative grammar," in *Journal of Phonetics* 18, 1990, pp. 321-334.

[17] P. A. Keating, "Phonetic and Phonological representations of consonant voicing," in *Language* 60, 1984, pp. 286-319.

[18] B. Vaux and B. Samuels, "Laryngeal markedness and aspiration," in *Phonology* 22, 2005, pp. 395-436.

[19] M. Bijankhan and M. Nourbakhsh, "Voiced onset time in Persian initial and intervocalic stop production," in *Journal of International Phonetic Association* 39, 2009, pp. 335-364.

[20] A. Pisowicz, "Developmental tendencies in the voiced-voiceless opposition of stop consonants (on the basis of data from Persian and Armenian)," In *Problems of Asian and African languages*, Stanislaw Pilaszewicz & Jerzy Tulisow (eds.), Warsaw: Polish Academy of Sciences, 1987, pp. 233-238.

Mahjoub Zirak is Ph.D student in linguistics in the department of language sciences, Graduate School of Integrated Art and Sciences, Hiroshima University. She received her Master of Arts in Linguistics from Alzahra University, Tehran, Iran. Her research interests include Phonetics, Phonology, Sociophonetics, Language Change, Endangered Languages, among others.