Phonological Variation
and Sound Change in Atayal[1]

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Three phonological variables in Atayal, (p), (m), and (l), have been identified by Li (1982) as evidencing sound change in progress. Older people tend to retain word-final [-p], [-m], and [-l], while younger people are replacing them with word-final [-k], [-ŋ], and [-n], respectively. In a recent study of Atayalic dialects, Rau (in press) discovered that new variants that do not seem to be determined by the age factor are present in the patterning. The current study explores how age, gender, social class, and social network are related to the use of these three variables in the Mstbon community. The directionality and implicational patterning of the sound change are also explored. The results indicate that the phonological variation in (m) and (l) is correlated with age, but that word-final [-p] has almost completed its change to [-k] in the community. In fact, a new variant [-t] is emerging, led by the highest social class. The direction of sound change for (p) and (m) shifts towards simplification, while the new variant for (l) arises possibly due to language contact. Furthermore, lexical diffusion plays a role in the change. Some lexical items have completed the change to new forms while others contain residues.

1. INTRODUCTION. This study investigates how social factors are related to phonological variation and sound change in progress in the Squliq variety of Atayal spoken in the Mstbon community.[2] Located in Faxiang village, Ren'ai township, Nantou county, where the Atayalic dialects are most diversified (Li 1993), this community is reputed to be the original home of the Atayal. The population of Faxiang village was 935 in 1996, according to the survey conducted by the Office of Family Registrar. More than one-third of these people are in the Ruiyan community (~350), and the male/female ratio is estimated to be 1.5:1.

Li (1982) compared phonological data from 14 Atayalic dialects, not including the Mstbon dialect, and proposed the following four types of linguistic variation for different age groups:

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2. Other spelling variants are Mstbaun and Maustbon. In Chinese, it is called Ruiyan.

(1) p ~ -k, -m ~ -ŋ
(2) -g ~ -w or -g ~ -y
(3) -l ~ -n
(4) -t ~ -c

Older speakers retained the forms on the left of the alternation sign("~"), while younger speakers used the forms on the right. Those in between showed gradual changes and used "free variants." He also observed that gender determined variation in some cases. Males were in the lead in the Skikun dialect whereas females were in the lead in the Inago dialect. Furthermore, the lexical application of a sound change was found to be gradual in the case of Skikun and Inago, where the lexical diffusion was manifested in the speech of different age groups (i.e., "successive generations"), rather than in the speech of the same adult speaker as the speaker gets older. Although Li's methodology is based on historical linguistics and traditional dialectology, he has certainly made several important observations and hypotheses on sound change that await further quantitative analyses based on a methodology of sociolinguistic variation.

Among the phonological variation identified by Li (1982), three phonological variables stand out because they have either been cited as a well-known case of sound change in Atayal or observed in studies of other Atayalic dialects. For example, (p) and (m) were cited as an example of sound change determined by age in a basic linguistics text (Ho 1993:110–111) and (l) was observed to vary between different age groups in Pyasan dialect (Papa 1995:6) and Mabalay dialect (Lambert 1999:5). The three variables were identified as undergoing sound change in progress; older people tend to retain word final [-p], [-m], and [-l], while younger ones are replacing them with word final [-k], [-ŋ], and [-n], respectively. The overall direction of sound change in the Atayalic group was found to move towards simplification or "unmarkedness" (Li 1982).

Nevertheless, in a recent study of Atayalic dialects, Rau (in press) discovered that new variants that do not seem to be determined by the age factor are present in the patterning. In fact, the change from labials to velars is not completed in Mstbon, contrary to what Li (1980:382) reported, citing Shigeru Tsuchida's personal communication. In other words, the preliminary investigation of a few words with final [-p] and [-m] in Mstbon indicates that the occurrence of the new variant [-c] for (p) is not determined by age. Furthermore, a new variant [-ŋ] for (l) was found to occur in a young speaker's data. This had not been reported in any previous study. Thus further investigation is needed to determine the social factors that condition the variation and to trace the course of change. The current study explores how age, gender, social class, and social network influence the use of the three above-mentioned variables. Furthermore, the directionality and implicational patterning of the sound change in progress are investigated.

2. METHODOLOGY. This is a quantitative study of phonological variation and sound change following the methodology of sociolinguistic variation theory

(Chambers 1993, 1995; Labov 1994; Milroy 1987). We examine the relationship between social factors such as age, gender, social class, and social network, and the variation of the three phonological variables: word final (p), (m), and (l). The phonological data were elicited from interviews of 24 speakers by a trained native speaker of Atayal from the same community. Each speaker was asked to say 39 lexical items containing all the relevant phonological variables for this study. SPSS (Statistical Package for Social Sciences) was used for statistical testing.

2.1 SUBJECTS. Our judgment sample constitutes a group of 24 Atayal speakers, stratified according to age and gender. Speakers were divided by age into four levels: 30–40, 41–50, 51–60, and over 60 years of age. The younger generation, that is, anyone under 30 years of age, is not included in this study due to their limited Atayal language proficiency.[3] Men and women are equally represented. The distribution of the subjects by age and gender is shown in table 1.

TABLE 1. DISTRIBUTION OF THE SUBJECTS BY AGE AND GENDER

GENDER/AGE	30–40	41–50	51–60	61–	TOTAL
MALE	3	3	3	3	12
FEMALE	3	3	3	3	12
TOTAL	6	6	6	6	24

2.2 INTERVIEWS. The interviews were conducted by Batu Temu, a pastor in his mid-30s. He was raised in the community and has established good relationships with the local residents. Each interview is composed of two parts: elicitation of word list and of personal information.

2.2.1 Word list. The choice of the lexical items of the word list is based on the results of the previous studies by Li (1981, 1982, 1996) and Rau (in press). The list was checked by the interviewer and adapted to the local dialect before it was put into the final form shown in table 2. It is divided into three categories, according to the three phonological variables, with the possible variants given in the table

Each lexical item is listed with an Atayal form and an English gloss. The Atayal form is transcribed phonemically, with the word-final variable in parentheses, namely (p), (m), or (l). The interviewer was trained to focus on the differences in the word-final consonants and record the variants produced by the interviewees.

The advantage of training a local resident to do word-list elicitation instead of having an outside researcher do it through translation is that one gets enhanced cooperation from the interviewees, and the reliability of the word list is thereby increased. The interviewer wrote down the word-final variants produced by the interviewee on the

3. The Ministry of Education (MOE) of R.O.C. is now promoting vernacular language education by offering aboriginal languages, the Chinese Southern Min dialect, and the Hakka dialect in elementary schools as elective courses. Whether the program will result in better language proficiency in their "mother tongue" awaits further assessment.

TABLE 2. ATAYAL WORD LIST CONTAINING THE PHONOLOGICAL VARIABLES (p), (m), AND (l)

(p): -p, -k, -t, -c	(m): -m, -ŋ, -n	(l): -l, -n, -ŋ
1. imu(p) 'blow'	1. qo(m) 'anteater'	1. taya(l) 'Atayal'
2. kmiya(p) 'catch'	2. lmo(m) 'burn'	2. cyabi(l) 'bat'
3. hmgu(p) 'do magic'	3. mnku(m) 'dark'	3. mhuqi(l) 'die'
4. tala(p) 'eaves'	4. yuhu(m) 'gall'	4. huzi(l) 'dog'
5. miyu(p) 'enter'	5. hlhu(m) 'warm'	5. rhiya(l) 'earth'
6. pne(p) 'to fish'	6. prahu(m) 'lips'	6. mxa(l) 'pain'
7. qmuyu(p) 'fold'	7. ro(m) 'needle'	7. kbhu(l) 'hundred'
8. qmalu(p) 'hunt'	8. sya(m) 'pork'	8. sbi(l) 'lunch box'
9. qsiya(p) 'opposite shore'	9. mtala(m) 'run'	9. gami(l) 'root'
10. qata(p) 'scissors'	10. qmu(m) 'swallow'	10. tbi(l) 'small cucumber'
11. gha(p) 'seed'	11. tmala(m) 'taste'	11. maga(l) 'take'
12. mgo(p) 'share one cup'	12. smo(m) 'wipe'	12. ciwa(l) 'three'
13. msuya(p) 'yawn'	13. mromu(m) 'bend'	13. kneri(l) 'woman'

spot, without the presence of a tape recorder.[4] Nevertheless, the interviewees may have felt that there was something unnatural about the elicitation, when they were asked by the interviewer how to say a word the interviewer had just uttered. This paradox has yet to be overcome when doing word-list elicitation in a community without written language.[5] Notwithstanding, I believe the current method of word-list elicitation of formal speech style can provide data of value for our study.

The frequency of the occurrence of each variant was transformed into an interval scale for statistical testing. In other words, the frequency for each variant for each speaker was divided by the total possible occurrences of the type, namely 13, to form a decimal fraction. For example, if [-p] occurs 7 times in speaker A's data, then the occurrence of [-p] for this speaker is 7/13=.54.

2.2.2 Personal information. Each interviewee was asked to provide two types of personal information in addition to age and gender. One is related to social class and the other to social network. The former concerns one's job, income level, education level, and type of housing. The latter contains questions such as whether one interacts with one's neighbors, attends church services, or goes to work in the community. Table 3 summarizes the 24 speakers' age level, gender, type of job, income level, level of education, and type of housing.

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4. We tried to tape record narratives of personal stories from 10 speakers. The aversion to the machine by the speakers, especially the older females, negatively affected their performance. They either ran away from the interviewer and refused to be interviewed, or practiced telling the same story several times at home before they were willing to come to be taped.

5. An anonymous reader of this paper suggested two possible ways to make future elicitations less awkward. One is to ask the respondent to repeat the word but in a sentential frame, e.g., "I am going to say ___ back to you." The other is to give the target word in a short list of three words and ask the respondent to repeat the list back in reverse order.

TABLE 3. SUMMARY OF SPEAKERS' PERSONAL INFORMATION

SPKR	AGE	GENDER	JOB	INCOME	EDUCATION	HOUSING*
I	30–40	male	gov't employee	mid	high school	wood w/ design†
2	30–40	male	patrol guard	mid	some high school	single-floor brick
3	30–40	male	evangelist	low	high school	wood w/ design†
4	30–40	female	housekeeper	low	high school	wood w/ design†
5	30–40	female	shop owner	mid	farming school	steel/concrete
6	30–40	female	laborer	low	elementary school	steel/concrete
7	41–50	male	laborer	mid	elementary school	wood
8	41–50	male	electric worker	mid	elementary school	steel/concrete
9	41–50	male	laborer	mid	high school	steel/concrete
10	41–50	female	farmer	low	elementary school	steel/concrete
11	41–50	female	shop owner	mid	elementary school	steel/concrete
12	41–50	female	laborer	mid	elementary school	steel/concrete
13	51–60	male	electric worker	mid	farming school	steel/concrete
14	51–60	male	policeman	mid	farming school	steel/concrete
15	51–60	male	farmer	low	farming school	single-floor brick
16	51–60	female	farmer	low	elementary school	wood w/ design†
17	51–60	female	farmer	low	elementary school	steel/concrete
18	51–60	female	farmer	low	elementary school	steel/concrete
19	61–	male	farmer	low	farming school	wood w/ design†
20	61–	male	farmer	low	elementary school	steel/concrete
21	61–	male	pastor	low	Bible college	steel/concrete
22	61–	female	farmer	low	elementary school	wood w/ design†
23	61–	female	farmer	low	elementary school	steel/concrete
24	61–	female	farmer	low	elementary school	wood

* In Taiwan, wood houses, made from inexpensive plywood prone to damage from typhoons and termites, are considered the least desirable. Single floor brick houses are the traditional construction, often old and in poor condition. Wood with interior design implies money has been spent on interior decoration. Steel/concrete are the most expensive and longlasting, thus the most desirable.

† Wood with interior design.

2.3 ASSIGNMENT OF SOCIAL CLASS AND SOCIAL NETWORK.
The speaker's social status and network relationship are determined by index numbers calculated based on a set of criteria. The division of categories in the criteria is based on the distribution of the sample.

2.3.1 Social class. The speaker's social class is assigned according to his/her occupation, income, education, and style of housing. An index number is calculated from the following scale, based on conversations with members of the community:

- Type of job: pastor/evangelist, 5; government employee, 4; policeman/patrol guard, 3; shop owner/skilled worker, 2; laborer/farmer/house wife, 1;

- Level of income: middle , 3, low, 1;
- Level of education: Bible college diploma, 5; high school diploma, 4; farming school diploma, 3; attended high school , 2; elementary school diploma, 1;
- Style of housing: steel/concrete, 4; wooden house with interior design, 3; single, floor house, 2; wooden house without interior design, 1.

Based on the scale, a pastor receiving low income, with a Bible school diploma, living in a steel/concrete house, is assigned a score of 15 (i.e., 5+1+5+4=15), which is classified as the highest social class in the community. In contrast, a farmer with low income, only elementary schooling, and living in a wooden house without any interior design is assigned a score of 4 (i.e., 1+1+1+1=4), which is on the lowest end of the social class.

The level of social class is divided into four categories: class A with an index range from 11–15; class B, 9–10; class C, 7–8; and class D, 4–6. The distribution of social classes among the 24 speakers is presented in table 4.

TABLE 4. DISTRIBUTION OF SOCIAL CLASSES

SOCIAL CLASS	NUMBER	PERCENTAGE
A	4	16.7%
B	5	20.8%
C	8	33.3%
D	7	29.2%
TOTAL	24	100%

A comparison between the social status of males and females indicates that men have higher social class than do women in the community (independent t-test, $t = 2.82$, $df = 22$, $p < .05$). In other words, class and sex may not be entirely independent factors.

2.3.2 Social network. Each subject's social network index is constructed based on the scores assigned to the answers to the following three questions:

Do you go to church? Frequently: 3, Occasionally: 2, Rarely: 1

Is your work in this community? Always: 3, Sometimes: 2, No: 1

Do you interact with your neighbors? Frequently: 3, Occasionally: 2, Rarely: 1

A person who goes to church frequently, has a job locally, and has frequent interactions with his/her neighbors is scored 9, which indicates he/she has a dense and complex social network, whereas those who answered the three questions above negatively demonstrate a looser network relationship.

The types of social network can be divided into three levels: strongly dense and complex network with an index number 9, moderately dense and complex with a range of index numbers from 6 to 8, and very loose network with an index number of 4. Table 5 presents the distribution of social network relationship among the 24 speakers.

TABLE 5. DISTRIBUTION OF SOCIAL NETWORK RELATIONSHIP

SOCIAL NETWORK	NUMBER	PERCENTAGE
STRONG	9	37.5%
MODERATE	14	58.3%
LOOSE	I	4.2%
TOTAL	24	100%

3. RESULTS AND DISCUSSION

3.1 FACTORS IN THE CONSTRUCT OF SOCIAL CLASS. The construct of social class is shown to be correlated with three of the four factors in our design, namely, type of job, level of education, and level of income. The values of correlation coefficients (Pearson correlation) are shown in table 6.[6] A person's job and education determine to a large extent their social class. In fact, one's level of education is highly correlated with one's type of job ($r = .64**$, $p < .01$). Thus a pastor who graduated from a Bible college enjoys the highest social class in the community. The type of housing does not seem to have any relationship with the assignment of one's social class. In summary, job and education (which in themselves are not independent) account for most of the social class weightings, and income and housing the least.

TABLE 6. SIGNIFICANT CORRELATION OF FACTORS WITH SOCIAL CLASS

FACTORS/FACTOR GROUP	SOCIAL CLASS	SIGNIFICANCE LEVEL
TYPE OF JOB	.81**	$p < .01$
LEVEL OF EDUCATION	.78**	$p < .01$
LEVEL OF INCOME	.50*	$p < .05$

3.2 FACTORS IN THE CONSTRUCT OF SOCIAL NETWORK. One's social network is correlated with one's interactive level with the neighbors, the Christian church, and local employment. Table 7 summarizes the correlation coefficients of the factors correlated with social network.

Age and style of housing are also related to the strength of social network by Pearson correlation, as shown in table 7. The older lifetime residents of the community have stronger social networks mostly because they interact frequently with their neighbors (correlation between age and neighbor, $r = .58**$, $p < .01$). But the

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6. Because an index number is assigned to each level of a category, the data can be treated as continuous. In other words, the correlated categories contain scores rather than ranks. For example, the range of the index number assigned to class is between 15 (the highest) and 4 (the lowest) rather than the four ranks. Furthermore, the index number assigned to social network ranges between 9 (strong) and 4 (loose) instead of only three ranks. This justifies the use of Pearson correlation as an appropriate tool for statistical testing for relationship between various social factors with the categories in class and network.

TABLE 7. FACTORS CORRELATED WITH SOCIAL NETWORK

FACTORS/FACTOR GROUP	SOCIAL NETWORK	SIGNIFICANCE LEVEL
INVOLVEMENT IN CHURCH	.66**	P < .01
INTERACTION WITH NEIGHBORS	.63**	P < .01
LOCAL EMPLOYMENT	.63**	P < .01
AGE	.50*	P < .05
STYLE OF HOUSING	.47*	P < .05

older people also have lower incomes ($r = -.45^*$, p < .05) than the younger ones. People whose income is based on local employment are not as well-to-do as those who find employment outside of the community (correlation between income and local employment, $r = -.58^{**}$, p < .01).

Those who have stronger houses made of steel and concrete are also more locally bound. They tend to interact more with their neighbors ($r = .64^{**}$, p < .01) and attend church more frequently ($r = .56^{**}$, p < .01).

3.3 IMPLICATIONAL SCALE OF WORD LIST.
The results of the word-list elicitation are presented in tables 8–10. All the speakers are ordered along the *y*-axis according to age range, with the youngest placed at the top and the oldest at the bottom. All the words are numbered and cross-referenced with the word list presented in table 2. Except for the last two columns, there is a lexical continuum along the *x*-axis. All the lexical items near the left end of the table are more likely to retain the old forms, while those near the right end change to the new forms. In other words, the sound change demonstrates lexical diffusion.

3.3.1 Distribution of (p).
Table 8 presents the distribution of the 4 phonetic variants for word-final (p) by the 24 speakers, presented as an implicational scale. All the speakers are ordered along the *y*-axis according to age, while all the lexical items are ordered along the *x*-axis according to the frequency of the new forms. All the lexical items near the left end of the table are more likely to retain the old forms, while those near the right end change to the new forms.

The table can be divided into two sections, with word #4 serving as the dividing column. The scalability of the table is 100%, excluding the last two columns and regarding [-ŋ] as missing data.

The table shows almost complete change from word final [-p] to [-k], except for one older female speaker (# 23) who still retains [-p]. However, the variation in the last two columns, that is, (6) *pne(p)* 'to fish' and (7) *qmuyu(p)* 'fold', can be interpreted as indicating lexical diffusion, leading a new change to [-t]. The final (p) in *pne(p)* has two variants: [-t] and [-c], whereas the final (p) in *qmuyu(p)* has been replaced by the variants: [-k], [-t], or [-c]. The results indicate that the change from *-p* to *-k* is close to completion and may be starting a new course in its development from *-k* to *-t*. This hypothesis and the variation between [-t] and [-c] as well await further research, although preliminary observation indicates that [-c] may occur more frequently than [-t].

TABLE 8. VARIANTS OF WORD FINAL (p): 13 WORDS BY 24 SPEAKERS

S/W	1	2	3	5	11	12	4	8	9	10	13	6	7
1	k	k	k	k	k	k	k	k	k	k	k	p	t
2	k	k	k	k	k	k	k	k	k	k	k	p	t
3	k	k	k	k	k	k	k	k	k	k	k	c	t
4	k	k	k	k	k	k	k	k	k	k	k	t	c
5	ŋ*	k	k	k	k	k	k	k	k	k	k	c	c
6	k	k	k	k	k	k	k	k	k	k	k	c	c
7	k	k	k	k	k	k	k	k	k	k	k	p	c
8	k	k	k	k	k	k	k	k	k	k	k	c	c
9	k	k	k	k	k	k	k	k	k	k	k	c	c
10	k	k	k	k	k	k	k	k	k	k	k	c	c
11	k	k	k	k	k	k	k	k	k	k	k	c	c
12	k	k	k	k	k	k	k	k	k	k	k	p	c
13	k	k	k	k	k	k	k	k	k	k	k	p	t
14	k	k	k	k	k	k	k	k	k	k	k	t	c
15	k	k	k	k	k	k	k	k	k	k	k	c	c
16	k	k	k	k	k	k	k	k	k	k	k	t	c
17	k	k	k	k	k	k	k	k	k	k	k	c	c
18	k	k	k	k	k	k	k	k	k	k	k	t	c
19	k	k	k	k	k	k	k	k	k	k	k	t	c
20	k	k	k	k	k	k	k	k	k	k	k	p	c
21	k	k	k	k	k	k	k	k	k	k	k	t	c
22	k	k	k	k	k	k	k	k	k	k	k	c	c
24	k	k	k	k	k	k	k	k	k	k	k	c	c
23	p	p	p	p	p	p	k	k	k	k	k	p	k

* The form given by speaker 5 for the word "enter" is *yupaŋ*, thus -ŋ was entered in the table. But this is the local passive *-an* (Rau 1992), or transversal voice (Huang 1993), or location focus (Rau 1997) suffixed to the root *iyup* 'enter'. The final alveolar nasal [-n] is changed to velar nasal [-ŋ]. In our analysis, this form was not included in our calculation and was counted as missing data.

3.3.2 Distribution of (m). Table 9 presents the distribution of the three phonetic variants for the variable (m). The last two columns are separated from the rest of the table due to the occurrences of the variant [-n]. Again, all speakers are ordered along the *y*-axis according to age, while all lexical items are ordered along the *x*-axis according to the frequency of the new forms, except for the last two columns. All the lexical items near the left end of the table are more likely to retain the old forms, while those near the right end change to the new forms. The scalability of the table, excluding the last two columns, is 96%. The symbol * stands for deviation.

Table 9 also indicates a completed change from [-m] to [-ŋ] except for the words in the first four columns. Even these four words show different rates of change, with the first word *qo(m)* 'anteater' retaining the older form [-m] the most. The phonetic

TABLE 9. VARIANTS OF WORD FINAL (m): 13 WORDS BY 24 SPEAKERS

S/W	I	7	10	12	2	3	4	6	8	9	11	13	5
I	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ
2	ŋ	ŋ	ŋ	*m	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	m	ŋ
3	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ
4	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ
5	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ
6	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ
7	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ
8	m	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	n
9	*ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	n
10	*ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ
11	*ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ
12	m	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ
13	*ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ
14	*ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ
15	m	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ
16	*ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	n
17	*ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ
18	*ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	n
19	m	m	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ
20	m	*ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ
21	m	*ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ
22	m	*ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	n	n
23	m	m	m	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	m	ŋ
24	m	m	m	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ

variant [-m] rarely exists in the data provided by the speakers under 40, except for Speaker #2. This outlier's behavior requires further study of his background.

A new variant [-n] appears in the words of the last two columns, that is, (5) *hlhu(m)* 'warm' and (13) *mromu(m)* 'bend'. We speculate that the final [-ŋ] might be competing with [-n]; however, the data for this new variant are too few for any meaningful analysis.

3.3.3 Distribution of (l). Table 10 indicates the distribution of the 3 variants for the variable (l). The last two columns are separated from the rest of the table because of the occurrence of the variant [-ŋ]. All speakers are ordered along the *y*-axis according to age, while all lexical items are ordered along the *x*-axis according to the frequency of the new forms, except for the last two columns. Table 10 also shows a complete change from [-l] to [-n], except for the words in the first three columns, where the word *tbi(l)* 'small cucumber' retains the final [-l] the most. The older form [-l] does not occur in the data of those speakers under 50 years of age. The scalability of the table is almost 100%, excluding the last two columns.

TABLE 10. VARIANTS OF WORD FINAL (l): 13 WORDS BY 24 SPEAKERS

S/W	10	2	1	3	5	6	7	8	11	12	13	9	4
1	n	n	n	n	n	n	n	n	n	n	n	n	n
2	n	n	n	n	n	n	n	n	n	n	n	n	n
3	n	n	n	n	n	n	n	n	n	n	n	n	n
4	n	n	n	n	n	n	n	·n	n	n	n	n	n
5	n	n	n	n	n	n	n	n	n	n	n	ŋ	n
6	n	n	n	n	n	n	n	n	n	n	n	n	n
7	n	n	n	n	n	n	n	n	n	n	n	n	n
8	n	n	n	n	n	n	n	n	n	n	n	n	n
9	n	n	n	n	n	n·	n	n	n	n	n	n	n
10	n	n	n	n	n	n	n	n	n	n	n	n	n
12	n	n	n	n	n	n	n	n	n	n	n	n	n
13	n	n	n	n	n	n·	n	n	n	n	n	n	n
14	n	*l	n	n	n	n	n	n	n	n	n	n	n
15	n	·n	n	n	n	n	n	n	n	n	n	n	n
16	n	n	n	n	n	n	n	n	n	n	n	n	n
17	n	n	n	n	n	n	n	n	n	n	n	n	n
22	n	n	n	n	n	n	n	n	n	n	n	n	ŋ
11	l	n	n	n	n	n	n	n	n	n	n	n	n
18	l	n	n	n	n	n	n	n	n	n	n	n	n
20	l	n	n	n	n	n	n	n	n	n	n	n	n
23	l	n	n	n	n	n	n	n	n	n	n	n	n
24	n	*l	n	n	n	n	n	n	n	n	n	n	n
19	l	l	n	n	n	n	n	n	n	n	n	l	n
21	l	l	l	n	n	n	n	n	n	n	n	n	n

The variation between final [-ŋ] and [-n] might be a language-contact phenomenon from Mandarin. Lin (1988) proposes that the phonemic merging direction appears to be from the alveolar to the velar nasal in Mandarin, not the opposite as suggested by Kubler (1985: 94). Thus the new direction of change from [-n] to [-ŋ] in Atayal is possibly due to language contact with Mandarin.

3.4 RELATIONSHIP BETWEEN SOCIAL FACTORS AND PHONO-LOGICAL VARIATION.

Two social factors, age and social class, were correlated with the occurrences of the different variants, but gender and social network show no correlation.

The phonological variation of (m) is related to age. The older speakers are likely to use [-m] (r = .51*, p < .05), while the younger ones favor [-ŋ] (r = –.57**, p < .01). The age factor also shows significant correlation with the variable (l). Older people tend to use [-l] more (r = .60**, p < .01) while younger ones prefer [-n] (r = –.61**, p < .01).

A new variant [-t] is emerging from the data for the variable (p) and is related to social class (r = .47*, p < .05). People with higher social class tend to use this

variant more. Thus a sound change from above led by class A might be in progress. The fact that well-established variables and novel variables are determined by different social factors is widely attested by almost all the sociolinguistic literature on chain shifts. As individual variables within the larger picture of the chain shift become more and more established, the social factors they index alter (see, for example, Eckert 1989 and Labov 1994).

3.5 DIRECTION OF CHANGE. The direction of change among the three variables, although treated separately, can be divided into two types. The new variants of [-t] and [-n] for (p) and (m) respectively are shifting towards simplification as a general direction of sound change in Atayal, as suggested by Li (1982). This can also be called a shift towards underspecification of word-final consonants,[7] because alveolar is considered the underspecified or default place of articulation (Rice and Avery 1991, Rice 1993). The new variant [-ŋ] for (l), on the other hand, is a possible case of language contact with Mandarin. However, lexical diffusion plays a role in the sound change. Some lexical items have completed the change to new forms while others show residues.

4. CONCLUSION. This study indicates that although the variables (m) and (l) still demonstrate variation due to age, the variable (p) has almost completed its change from [-p] to [-k] and a new variant [-t] might be emerging, led by the higher social class. Because (p) is so close to completion, the new variants are analyzed as being independent of the initial shift to [-k]. However, the variation between the new variants [-t] and [-c] is a topic that requires future investigation.

The variable (m) and (l) also indicate new variants. The former shows a change from [-ŋ] to [-n], the latter from [-n] to [-ŋ]. The competition between alveolar and velar nasals is another topic for future study.

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7. As suggested by an anonymous reviewer.

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