

Use Chi-Square Test to Seek Linguistic Typology Implicational Universals about Tone of Languages in Chinese Mainland

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How to cite this paper: Chen, L. M. (2022). Use Chi-Square Test to Seek Linguistic Typology Implicational Universals about Tone of Languages in Chinese Mainland. *Open Journal of Modern Linguistics*, 12, 510-517. <https://doi.org/10.4236/ojml.2022.124037>

Received: July 26, 2022

Accepted: August 19, 2022

Published: August 22, 2022

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Abstract

This article is based on the Chinese mainland in the 345 kinds of languages and dialects (including the minority national language, Chinese and their dialects). The author collates and conducts research typology. Based on the principle of Greenberg, but propose to use chi-square test method to study implicational universals between some representatives tone type, at last, the article draws some conclusions.

Keywords

Tone Type, Language, Dialects, Implicational Universals, Chi-Square Test

1. Introduction

This paper includes the study of Chinese dialects and minority languages. Earlier research on the typology of the main tone Ian Maddieson's papers named "*Universals of Tone*" (Greenberg, 1978) and Moira Yip's book named "*Tone*" (Yip, 2002) and so on. In her paper, Ian Maddieson considered that one language has five flat tones at most. In tonal languages, the more level tones, the greater the occupied areas of the pitch will be. Mid-pitch is common on the contrary, high-pitch is not common. He also believes that if there is a tortuous tone in a language, then there also will be a flat tone. In her book, Moira Yip thinks that if there are only two tones in some languages, often two opposing flat tone, rather than a rise and fall of the tone type. She also said that in a language, the phenomenon of the High Low (HL), mid low (ML), and High Mid (HM) types of de-motion existence is rare. Mr. Luo Anyuan's book named "*Chinese Language tone Overview*" Research on Chinese territory tone language monographs (Luo, 2006) and so on. He believed that tone can be divided into single tones and complex tones. Single tones have only one tone value, and complex tones make

up the value of two or more tone values. Tortuous tunes can be divided into three forms: gradually sliding, jumping crossing type and the mid-stop type. He believes that the language in China, only a tone value of 214 in La Jia language tune (such as “ton214 Cave”) is part of the stop-style, is a complex tone, both with glottal and a brief pause. Mr. Lu used software to measure the argument. Professor Liu Lili researches Chinese tones as well as Mr. Lu. Her book is named “*Chinese Tone Study*” (Liu, 2004). The book has reviewed the 20th century Chinese tones case studies, but it hasn’t given up the booklist about the research of Chinese Tone in the 20th century at the end of the book. Mr. Guo Jinfu also has studied Chinese tones based on the perspective of the overall experimental phonetics. His book is named “*Chinese tone and intonation explore*” (Guo, 1993). Mr. Xin Shibiao studied the tones of Chinese dialects comparative, too. His book is named “*A Comparative Study of language tones southeast in China*” and so on.

Some previous studies on the application of chi-square test in linguistic research: Zhu (1989), Mai (1999), Wei and Li (2005), and Li (2009) mentioned the application of mathematical statistics in Chinese linguistics, but it is mainly t-test, not involving chi-square test. Liu (2006b) pointed out that chi-square test can be applied to English learning and children’s pronunciation. However, this article mainly reports the results of chi-square test applied by foreign scholars, which is not based on first-hand original research. Liu (2006a) is the same with these contents. The two articles have overlapping contents, and they are not original research based on first-hand materials.

This article summarizes 345 kinds of languages and dialects in Chinese mainland, with some representation. Implicational universals imply an important concept in linguistic typology, it has rich content, and in general, it is to explore the intrinsic relationship between certain language features. Currently, the authors have not seen a similar study overall tone about the languages and dialects on the Chinese mainland.

2. Material Source

Maybe some scholars doubt the reliability of typological research material, so the material collected in this article, is only part of the paper collected papers on core journals, books are only part of the authority to select the national language publishers, then as much as possible to ensure that the referenced material accuracy of the description languages or dialects. Almost all the papers or works based on the materials in this study come from authoritative journals or publishing houses to ensure the reliability of the material sources.

1) Paper materials are from the journal “Dialect”, “Minority Languages of China”, “*Studies in Language and Linguistics*”, for example: Huang (2007) “*Linhai Dialect*”, Dai and Li (2006) “*Le Pragmatic General*”, “Deng (2002)” Hunan dialect Xin Tian Sha Tian Voice Characteristics such as more than one hundred papers, due to space limitations, not individually listed.

2) Book materials were from Dai, Jiang, and Kong (2007), “*Paula language study*” Ethnic Publishing House; Sun, Hu, and Huang (2007), “*Chinese language*”,

the Commercial Press; Yuan et al. (2001) “*Outline of Chinese dialects*”, language Press; Ju (1996) “*Phonological Inventories of Tibeto-burman Languages*”, The Regents of the University of California; Mu (2003) “*Kazhuo language study*”, Ethnic Publishing House, etc.

It is noted that this study only the word of the tune, because Tone Sandhi more complex, due to objective conditions, not involved.

Selection Criteria:

Chinese dialects each including a large dialect, and several dialects times dialect income, while the national language is based on “Chinese language” directory, combined with Jiang Zhi and Ju Namkung series “Phonological Inventories of Tibeto-burman Languages” (Ju, 1996), combined with reports of each language papers, including dialects of all ethnic language groups.

Some people might ask, for a variety of investigative materials, how screening? Author’s screening principles as follow:

- 1) The same place when there is a language or dialect survey materials to repeat, select the latest survey materials.
- 2) The same place when there is a language or dialect survey materials to repeat, but a considerable period of time, choose a relatively detailed description of equipment.
- 3) Various languages investigation materials, complement each other.

3. Seeking the Implicational Universals by Chi-Square Test

In this context, the introduction of mathematical statistics, independence chi-square test in the way of attempts to authors in another paper, the introduction of independent chi-square test methods using SPSS (Statistical Product and Service Solutions) software for mathematical statistics inspection, as this approach to test whether the correlation between two or more elements. There may be a question: hypothesis testing data processing requirements for multi-continuous data, why is that it is available in this chi-square test? To be noted that there are three kinds of chi-square test were no difference assuming chi-square test, chi-square test assuming a normal distribution and independence chi-square test, chi-square test of independence which is for count data, the so-called count data refers to data obtained by enumeration, such as a group of students to get out of the statistical quantity. Perhaps it was the question: with the assignment approach, the resulting data is not necessarily rendered normal, why can chi-square test? In fact, this paper, chi-square test of independence assumption, the object does not have to comply with the applicable normal. The specific principle of chi-square test is detailed in the relevant works of mathematical statistics.

Measure: If the existence of a language or dialect of the tone type, that is, to assign one, otherwise assign 0 to the last after all the assignments completed, respectively, of the total number of statistical value, then the chi-square test.

Such as:

- 1) If the same tone type appears twice in the language or dialect, or more than

twice as Qinghai Ledu Dialect type of tune up tune appears twice, adjusted values were 13, 34, on assignment, only Qinghai Ledu dialect to tune up the assignment in this column is 1, the other similar case is also handled like this.

2) No longer falling tone down subdivided into high, medium drop, low-down, etc. because of falling tone is more common in various languages or dialects, and the same language or dialect is often at the same time there are several falling tone, and taking into account rising and falling tone may occur due to various investigators, such as differences in the sense of hearing large error, so this is no longer subdivide.

3) For the tortuous tune, the authors were divided they into falling rising tone, falling flat tone, rising flat tone, flat falling tone, flat rising tone, rising falling tone.

After the assignment was: low flat tone A133 B212, mid flat tone A207 B138, high flat tone A284 B61, rising tone A297 B48, falling tone A326 B19, falling-rising tone A72 B273, falling flat tone A7 B338, rising flat tone A2 B343, flat falling tone A8 B337, flat rising tone A15 B330, rising falling tone A29 B316, and fall flat tone, flat tone, flat falling tone, flat rising tone, rising falling tone assignment obtained totality are less than 30, taking into account to achieve a certain number, get out before reliable conclusions, it is discarded.

So, these are some testing about low flat tone, mid flat tone, high flat tone, rising tone, falling tone, falling rising tone six kinds of tone:

The first group

Low Flat Tone and Mid Flat Tone

Hypotheses:

The emergence of low flat tone isn't related to the emergence of mid flat tone in the H₀.

The emergence of low flat tone is related to the emergence of mid flat tone in the H_a.

Treatment of spss as follows:

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
low flat tone * mid flat tone	345	100.0%	0	.0%	345	100.0%

Low Flat Tone * Mid Flat Tone Crosstabulation

Count

		mid flat tone		Total
		exist	without	
low flat tone	exist	86	47	133
	without	121	91	212
Total		207	138	345

Chi-Square Tests.

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.960 (b)	1	.162		
Continuity Correction (a)	1.656	1	.198		
Likelihood Ratio	1.972	1	.160		
Fisher's Exact Test				.176	.099
Linear-by-Linear Association	1.954	1	.162		
N of Valid Cases	345				

(a) Computed only for a 2×2 table; (b) 0 cells (.0%) have expected count less than 5. The minimum expected count is 53.20.

This is the chi-square test results table, and the related research, mainly to see the first line of "Pearson Chi-Square" final calculated chi-square (Chi-Square) value of 1.960. As pearson chi-square test was used for two-dimensional table row and column variables perform hypothesis testing independence. Degrees of freedom (df) is 1, 1.960, it is less than .05 level of significance table value 3.84, so it refuses to agree with that the emergence of low flat tone isn't relate to the emergence of mid flat tone in the H₀, but it receives that the emergence of low flat tone is relate to the emergence of mid flat tone in the H_a.

Conclusion: the emergence of low flat tone is related to the emergence of mid flat tone.

The second group

Low Flat Tone and High Flat Tone

Hypotheses:

The emergence of low flat tone isn't related to the emergence of high flat tone in the H₀.

The emergence of low flat tone is related to the emergence of high flat tone in the H_a.

Treatment of spss as follows: "Pearson Chi-Square" final calculated chi-square value of 7.562, it is greater degrees of freedom (df) .05 1:00 significance level of table values 3.84, so it refuses to agree with that the emergence of low flat tone is relate to the emergence of high flat tone in the H₀, but it receives that the emergence of low flat tone isn't relate to the emergence of high flat tone in the H_a.

Conclusion: the emergence of low flat tone isn't related to the emergence of high flat tone.

The third group

Low Flat Tone and Rising Tone

Hypotheses:

The emergence of low flat tone isn't related to the emergence of rising tone in the H₀.

The emergence of low flat tone is related to the emergence of rising tone in the H_a.

Treatment of spss as follows: "Pearson Chi-Square" final calculated chi-square value of 3.095, it is fewer than the degrees of freedom (df) 1:00 .05 level of significance table value 3.84, so it refuses to agree with the emergence of low flat tone isn't relate to the emergence of rising tone in the H0, but it receives that the emergence of low flat tone is relate to the emergence of rising tone in the Ha.

Conclusion: the emergence of low-lying and rising tone appears relevant.

The fourth group

Low Flat Tone and Falling Tone

Hypotheses:

The emergence of low flat tone isn't related to the emergence of falling tone in the H0.

The emergence of low flat tone is related to the emergence of falling tone in the Ha.

Treatment of spss as follows: "Pearson Chi-Square" final calculated chi-square (Chi-Square) is .107, it is fewer degrees of freedom (df) 1:00 .05 significance level table values 3.84, so it refuses to agree with that the emergence of low flat tone isn't relate to the emergence of falling tone in the H0, but it receives that the emergence of low flat tone is relate to the emergence of falling tone in the Ha.

Conclusion: the emergence of low flat tone is related to the emergence of falling tone.

The fifth group

Low Flat Tone and Falling Rising Tone

Hypotheses:

The emergence of low flat tone isn't related to the emergence of falling rising tone in the H0.

The emergence of low flat tone is related to the emergence of falling rising tone in the Ha.

Treatment of spss as follows, "Pearson Chi-Square" final calculated chi-square (Chi-Square) is .229, it is fewer degrees of freedom (df) is 1.05 level of significance table value 3.84, so it refuses to be agree with that the emergence of low flat tone isn't relate to the emergence of falling rising tone in the H0, but it receives that the emergence of low flat tone is relate to the emergence of falling rising tone in the Ha.

Conclusion: the emergence of low flat tone is related to the emergence of falling rising tone.

4. Conclusion

To see more clearly, the relevant conclusions are put together as follows:

- 1) The emergence of low flat tone is related to the emergence of mid flat tone.
- 2) The emergence of low flat tone isn't related to the emergence of high flat tone.

- 3) The emergence of low-lying and rising tones appears relevant.
- 4) The emergence of low flat tone is related to the emergence of falling tone.
- 5) The emergence of low flat tone is related to the emergence of falling rising tone.

It can be found out something like this: During the 5 conclusions, 4 of them are concerned, 1 of them aren't unconcerned.

Concerned:

- 1) Low flat tone and mid flat tone; 2) Low flat tone and rising tone; 3) Low flat tone and falling tone; 4) Low flat tone and falling rising tone;

Unconcerned:

Low Flat Tone and High Flat Tone

Discussion: why do that low flat tone isn't related to high flat tone, however, they are familiar with the language. It needs to be further studied.

The above conclusions can enlighten us in at least two aspects: firstly, languages or dialects are objective phenomena, which are not disorderly, but contain objective laws. In fact, some seemingly unrelated language forms may be related at a deeper level. Some language forms that seem to be relevant may not necessarily have some relevance at a deeper level. Secondly, it is to adopt new methods to intervene in research, which may lead to new findings. Chi-square test is a method of mathematical statistics, which belongs to the category of mathematics. This method has been introduced by scholars to study Chinese phonology. However, no scholar has introduced this method to study the tone types of languages or dialects in China before. Therefore, this study introduces the method of mathematical statistics into language typology, which is novel. It is precise because of the introduction of the new method that we have found some laws that have not been found before. As mentioned above, there is a related implication relationship between some tonal patterns, but also found that there is no correlation between tonal patterns. Whether the conclusions are relevant or not, it is of positive significance to promoting the study of language typology.

Fund Projects

The "Yanling Excellent Young Teacher Program of Lingnan Normal University" (No.: YL20200101), the Ministry of Education Project (No.: 18YJC740008), School Project of Lingnan Normal University (No.: ZW2021021), this research is supported by Guangdong Coastal Economic Belt Development Research Center, Lingnan Normal University (the Guangdong Coastal Economic Belt Development Research Center Project of Lingnan Normal University No.: 20203L03), the Teaching Reform Project of Lingnan Normal University "Curriculum Reform and Practice of Etiquette and Folk Culture in ASEAN Countries Based on Access Database", Zhanjiang Social Science Project (No.: ZJ22YB20), the Guangdong Education Society Project (No.: GDES14076), the China and ASEAN Educational and Cultural Development Research Center of Lingnan Normal University Project (No.: 2017YB02).

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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