

## On the Rhyming of pre-Middle Chinese: A Statistical Study on the Verse in the Wei-Chin Period

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The phonological system before Middle Chinese has long been a mystery since the realisation of language evolution. The reason behind is not only the lack of inherited rhyming dictionaries, phonetic alphabets and audio-recording devices in that era, but more importantly, the application of ideographic writing system, which provides little phonetic information to each symbol. Consequently, the progress of study in this area is far less productive than that of Early Middle Chinese.

The pioneer who conducted systematic investigations into the phonological system of historical Chinese by verse is Duàn Yùcái in the Ch'ing dynasty. Simple descriptive statistics was applied to the rhymes in the *Classic of Poetry* for the categorisation of the rhyming groups in Archaic Chinese. The introduction of phonetic alphabets by Bernhard Karlgren provided a means of estimating the phonetic values of the rhymes. However, the categorisation of rhyming groups by verse is still an important step. (Zhu 2006)

On the study of rhyming, Luo Ch'ang-P'ei, Zhōu Zǔmó, *et cetera* applied descriptive statistics to test the merging of rhymes. However, simple comparison of a fixed threshold to the ratio of rhyming distinctions weakens the objectiveness of their study. After that, Lù Zhìwěi first applied inferential statistics to study the initials in Archaic Chinese by phonograms. Recently, Zhū (1989) made use of inferential statistics and developed a scheme to study the rhyming in North Sung Dynasty.

In Zhū's study, "separated/mixed index" (SMI, *hereinafter*), which is the ratio *between* the ratio of the rhyming of two potentially mixed rhymes in the same rhyming group *and* that expected by chance, is applied to determine the probability of mixing rhymes. After that, null hypothesis is made and the "T-test", which is a common statistical test, is used to verify the result. Similarly, the mixing of the rhyming groups can also be determined in a similar way. By applying inferential statistics on the verse, not only can the corpus be used as circumstantial evidence, but concrete evidence. In this way, the valuable historical documents can be fully utilised while the influence of random errors due to the writers of verse and compilers of collections can also be extensively eliminated in the analysis. For instance, the result of analysis of the *Gēng* 耕 category is shown as below:

5636		耕庚梗映	耕耕耿諍	耕清靜勁	耕青迥徑
1612	耕庚梗映	241	108	97	94
107	耕耕耿諍	35	2	95	78
2430	耕清靜勁	663	44	525	101
1487	耕青迥徑	390	22	662	201
	Others	42	2	11	11

Table 1 The separated/mixed index of category *Gēng* 耕

In Table 1, the left column shows the total amount of rhyming characters as observed from the corpus for each rhyme while the top-left one is the total number of rhyming characters in *Gēng* 耕 category. On the right, the unshaded cells show the rhyming contacts while the shaded cells show the SMI between the rhymes. In general, SMI shows the relationship between the rhymes. In other words, the higher the index, the closer the relationship, so it can be seen that the relationship between most of the

rhymes (named as the corresponding ones in EMC) is rather close. According to the scheme, with SMI higher than 90, the two rhymes can be considered as mixed rhyming, which implies that the phonetic values of those rhymes are probably very close if not equivalent; otherwise T-test has to be done to verify. After further testing, it is also found with high confidence that the rhymes *Qīng* 青 and *Gēng* 耕 also rhyme freely. In conclusion, the phonetic values of the rhymes in the *Gēng* 耕 category are basically the same, which also agrees with the reconstruction by Ting (1975)

Although Luo Ch'ang-P'ei, Ting Pang-Hsin, *et cetera* have made tremendous contributions to the research on the verse of pre-Middle Chinese, different conclusions were often drawn from the same material since subjective experience is inevitably involved. More importantly, although it is generally agreed that the existing oldest rhyming dictionary found — *Qièyùn*, preserved some phonemic distinctions that generally vanished at the era of compilation, its nature is still not studied and known very well so the phonological system of pre-Middle Chinese is crucial to the understanding of its nature.

In this research, a systematic investigation using the methodology developed by Zhū was applied in the investigation of the rhyming categories in pre-Middle Chinese so that the verse in that period can be strictly and fully utilised while the phonological system reconstructed by the scholars can be verified with an objective measure. In addition, the nature of *Qièyùn* can be further studied and comprehended in an alternative way.

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## 上古漢語末期之押韻概況：魏晉韻文之數理統計研究

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自意識到語言之歷時變化以來，上古漢語之音韻系統頓成疑團，蓋因缺乏傳世韻書，且當時亦無萬國音標及錄音器材可用；更甚者，傳統用以記錄漢語之文字系統，以表義為主，表音為輔，更加劇了研究之困難，故上古漢語音韻之研究遠比中古漢語來得要慢，更無論其他倚賴音韻學之學科，如形態學矣。

系統地研究上古音韻之開山鼻祖——清儒段玉裁曾運用算術統計分析《詩經》之材料，把古韻歸納為六類十七部；後高本漢氏更引進萬國音標以供擬測音值之用。不過，無論如何，利用古代韻文去劃分韻部依然是一項重要工作（朱曉農 2006）。

就古音分部而論，羅常培及周祖謨等曾運用算術統計來確立古韻分合；可是使用簡單之比例統計及固定之閾值削弱了研究之客觀性。因此，陸志韋就利用概率統計來解決此問題，並以此探求上古音之聲母系統。最近，朱曉農（1989）更運用數理統計發展一方案以研究北宋之韻部。

朱曉農運用了“離合指數”，即兩韻實際相押比值與理論上相押概率之比，以決定分韻之概率，並設立零假設及借助T分佈假設檢驗以確定兩韻是否已合併。由是，運用數理統計於古韻文上，那研究材料不單單是旁證，更可用作本證。由於有了此方案，利用韻文作為材料之價值遂大大提高，而且人為的隨機錯誤之影響更可大大地減低。今以魏晉韻文中之“耕部”為例：

5636		耕庚梗映	耕耕耿諍	耕清靜勁	耕青迥徑
1612	耕庚梗映	241	108	97	94
107	耕耕耿諍	35	2	95	78
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	他部韻	42	2	11	11

表格 1 “耕部”內之韻離合指數

表格 1 之左欄為各韻字出現之字次，而左上角則為此部字次之總和。表右無底色之格顯示兩韻之韻次；有底色者為韻離合指數。一般而言，韻離合指數顯示兩小韻之親疏關係，數字愈大，關係愈密切。由表觀之，耕部中大部份小韻關係密切；按朱曉農（2006），當韻離合指數大於九十時，可認為合韻，就是說其韻基音值即使不相同亦極為接近；否則就要以T分佈假設檢驗來確定是分是合。經檢驗後，我們有很大把握說耕韻與青韻亦為合韻。總括而言，耕部內小韻之韻基基本上相同，與丁邦新先生（Ting 1975）之結論無異。

雖羅常培及丁邦新等曾對前中古時期之韻文研究作重大貢獻，然由於此等研究始終離不開主觀經驗之判斷，即使運用相同材料，不同學者所得之結論往往不同。此外，一般認為傳世之最早編成的韻書——《切韻》，具存古性質，但其本質還未為人所透徹認識，故前中古時期之音韻系統對深切瞭解其性質極為重要。

因此，本研究運用朱曉農發展之方案以全面系統地探討古韻分部，令研究材料亦可充份且嚴謹地利用。此外，前人之所構擬之古音系統亦得以用客觀之方法

驗證，而《切韻》之性質亦可以全新方法研究及理解。

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