Active Syllable Average Limit 1,000 (音涯一千)

The phonemic cognitive ability of human

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This paper mainly studies phonemic cognitive ability through the databases of living spoken languages in the Sino-Tibetan languages including 20 Chinese dialects, 6 Tibetan dialects, 5 Miao dialects, Mian, Zhuang, Thai, Li, Dai, Yi, Burmese, Zaiwa, and, Achang. The methods of statistics and information entropy and the concepts of the actual syllabic space, the syllabic theoretical space and redundancy rate are used and proposed in this paper. The results show that: (1) statistical methods can be used in the study of phonemic cognition; (2) the actual syllabic space in spoken Sino-Tibetan languages reflects the man's phonemic cognitive ability; (3) the theoretical syllabic space composed of initial, final, and tone in the Sino-Tibetan languages reflects the dynamic process of a phoneme system in language contact and evolution; (4) a redundancy rate of 60% is the bottom limit in oral communication in the Sino-Tibetan languages. Therefore, the conclusion of this study is that *Active Syllable Average Limit 1,000* not only reflects man's phonemic cognitive ability, but also reflects the interdependence of phonemic cognition and semantic cognition, and reveals an important link in the process of a language chain from semantic to phonemic transformation, which has important theoretical significance in the study of language cognition.

Keywords: syllabic space, theoretical syllabic space, redundancy rate, phonemic cognitive ability

1. Introduction

Language is a unique mode of human communication, which is transmitted through sound. This mode of human communication involves the thinking activities of the brain, a physiological pronunciation mechanism, physical sound characteristics, and a phonetic psychological cognitive process. What, then, is the

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essence of human speech? This is a research hotspot that concerns linguists, phoneticians, and speech scientists.

From the beginning of this century, given the developments in phonetic science, people have begun to use methods of cognition and brain science to study phonemic cognitive ability (Kong 2018), so as to explore the very nature of language. Unfortunately, scientific research requires lots of experimental equipment and funding, which is the linguist's great disadvantage. And so, linguists must resort to common research methods in order to investigate the nature of languages.

At the end of the last century, the widespread availability of the personal computer allowed people to create language databases, enhancing the statistical research of languages, thus leading to explanations for some essential problems of languages. A typical example is Cheng Chin-chuan's use of the Chinese ancient literature database (Cheng 1998; 1999; 2006). Through statistics, he found that a person can master up to 8,000 words, but if a person exceeds this number, some words will be forgotten, thus revealing a cognitive limit of human beings to master words, whence his theory of "Active vocabulary upper limit 8,000". He also found that if one learned another language, such as Chinese, as one's native language, one can learn another 8,000 words in English. Thus literature statistics subtly reveals people's cognitive ability to acquire vocabulary.

Basically, language is transmitted through sound. The basic unit of the phonemic theory is the phoneme. In addition to phoneme segments, we must consider the functions of initial, final, and tone of the syllable in distinguishing meaning. Morphemes may be monosyllabic, disyllabic, or trisyllabic. From the perspective of the combination of sound and meaning, the syllable is the most basic phonemic unit of language, because people all have syllable awareness in the process of natural language acquisition (Lin et al. 2020). According to the theory of phonemics and the theory of information coding (Shannon & Weaver 1949), we can conduct information coding for morphemes of any language. When there are fewer units of phoneme coding, such as segment phonemes, morpheme coding can be relatively long. Conversely, when there are more units of phoneme coding, such as syllables, morpheme coding becomes shorter. The key question is which form of language processing has evolved in the human brain.

Taking the Sino-Tibetan language family as an example, morphemes are mainly composed of monosyllables, which are mainly composed of initial, final, and tone (Compilation group of *Tibetan-Burman phonetics and vocabulary* 1991; Huang 1992). In Sino-Tibetan languages, the ability of the brain to process language is reflected in the single-syllable morpheme, whose basic phonemic unit is monosyllabic, that is to say, in Sino-Tibetan languages, the monosyllable is the most appropriate and basic unit for our brain to process sound and meaning (Lin et al. 2020). But in Austronesian languages, such as Filipino, the basic morphemes are mainly disyllabic and trisyllabic (Xian 2013), and in Hausa, the basic morphemes are either trisyllabic or disyllabic (Lei 2013). Obviously, there are differences in the way people deal with speech units and semantics in various languages. According to current research, the monosyllables of Sino-Tibetan languages are complicated in form, because the initial consonant may be a single consonant or consonant clusters, which can be composed of three consonants. Finals are composed of head vowel, main vowel, vowel ending or consonant ending. Monosyllables can also have tones. Therefore, the structure of this monosyllabic sound is very complex. However, when we look at the syllabic structure of the disyllabic morpheme in the Austronesian languages, it is often simple, mainly composed of one consonant and one vowel, and the structure of compound consonants is rare. All these reflect the essence of man's phonetic processing ability; that is, although the number of syllables is different, there is a tendency towards a stable range in phonemic cognition. Taking Sino-Tibetan languages as examples, this paper statistically discusses the cognitive ability of phonemic system through the actual syllabic space, the theoretical syllabic space, and the redundancy rate.

2. Basic statistical characteristics of phonemes and morphemes

According to different definitions, there are about 4,000 or 8,000 languages in the world. Language can be composed of different units, such as segment, initial, final, tone, syllable, word, phrase and sentence. It is generally believed that the smallest unit in a language is segment. In human languages around the world, there are about 1,000 segments (Ladefoged & Maddieson 1996), but in any given language, there are only dozens of segments and phonemes. In oral communication, there are usually 1,000 syllables, 3,000 morphemes presented by 1,000 syllables and 200 syntactic structures. This is the basic case of language units. A morpheme is the unit of combining sound and meaning, which is most closely related to language cognition.

Anyone who has done research on phonemics knows that the investigation method is very important in obtaining the phonemic system, which will vary depending on language and study purpose. The phonemic systems of different languages can be sorted in two ways. In the first form, phonemic systems are acquired through a survey of existing spoken languages, and there are two types. The first type is the completely investigated phonemic system acquired by recording all the sounds of a language including the phonemes of loanwords, and organized according to the principles of phonemics. The second type is the incompletely investigated phonemic system obtained by using a special word list (Wang 2003). In this second form, phonemic systems are acquired from documents or other recorded materials, and there are four types. The first type is a phonemic system across the time domain, which mainly comes from different ages. Therefore, the phonemic system sorted out is often larger than that of a living language. The second type is a phonemic system across different regions, which is mainly based on the literatures from different regions, such as different dialects. The third type is a phonemic system across different time domains and regional phonemic systems, for example, the *Guangyun* (Chen & Qiu 1008) is a phonemic system across different times and regions, because it is based on the *Qieyun* (切韻 by Lu Fayan et al. in Sui dynasty) and the *Tangyun* (唐韻 by Sun Mian in Tang dynasty), whose phonemic system is much larger than that of any living language. The fourth type is a reconstructed phonemic system, which actually involves different times, different regions, and different languages. For example, the phonemic system of the proto-Sino-Tibetan language is a kind of diachronic domain, cross-region, and cross-language phonemic system, whose number of syllables is much larger than that of any living spoken language.

In this study, forty languages and dialects of the Sino-Tibetan language family were investigated by a complete survey method, and the basic cognitive ability of phonemic system in the Sino-Tibetan language is discussed based on the databases. In these databases of forty languages, some of them have been investigated by the author himself, while others have been published by other researchers (Compilation group of *Tibetan-Burman phonetics and vocabulary* 1991; Huang 1992). Each language has about 3,000 words, containing 1,200 to 3,000 monosyllabic morphemes and the number of syllables is about 1,000 obtained by removing duplicates in each language.

There are three research sources. The first is a database of Chinese Mandarin and Chinese dialects, mainly referring to the Chinese vocabulary compiled by the linguistic teaching and research office of the Department of Chinese Language and Literature of Peking University (Wang 2003). The second is a Tibeto-Burman database, which mainly refers to professor Huang Bufan's vocabulary of Tibeto-Burman languages (Huang 1992) and professor Kong Jiangping's word list of Tibetan dialects (Kong et al. 2011). The third is the database of Miao, Yao, Zhuang, and Dai languages, which mainly refers to the Miao language ancient phonetic re-construction by Wang Fushi (1994).

Chinese has twenty points which are Beijing, Suzhou, Xi'an, Chaozhou, Jinan, Shuangfeng, Meixian, Nanchang, Wenzhou, Yangjiang, Guangzhou, Changsha, Taiyuan, Xiamen, Chengdu, Fuzhou, Yangzhou, Wuhan, Jianou. The Tibetan-Burman language database has ten points which are Lhasa Tibetan, Rikaze Tibetan, Dege Tibetan, Yushu Tibetan, Xunhua Tibetan, Xiahe Tibetan, Yi, Burmese, Zaiwa, and Achang. The database of Miao, Yao, Zhuang, and Dai language has ten points, which are Chuanqiandian Miao, Xiangxi Miao, Diandongbei Miao, Bunu Miao, Qiandong Miao, Mian, Zhuang, Thai, Li, and Dai. The databases cover forty language points altogether.

Through the study of these databases, we found that the number of monosyllables in spoken language is a relatively stable value, about 1,000. Scholars with experience in language field investigation know that it is very hard work to survey all the syllables and monosyllabic morphemes in a language. If a language does not have writings, the material investigated is basically spoken, and the number of morphemes will be less than 3,000 in oral communication. As is well known, there are more morphemes than syllables in a language, composed of homophones and compound words. Why does the human brain not use more syllables for different morphemes, rather than the same syllable for different morphemes? This may reflect the different mechanisms by which the human brain processes language with speech units subject to sound perception and cognitive categories.

The basic 1,000 syllables in the Sino-Tibetan language reflect the basic ability of phonemic cognition. Morphemes are related to human semantic categories and reflect man's cognitive ability. From this point of view, this paper proposes the concept of *Active Syllable Average Limit 1,000* to study the theoretical basis of human phonemic cognitive ability and conceptual cognitive ability. In the following part, we shall explain why *Active Syllable Average Limit 1,000* can reflect the basic phonemic cognitive ability of speech sound from three aspects: the actual syllabic space, the theoretical syllabic space and the redundancy rate.

3. *Active Syllable Average Limit 1,000*

From the perspective of the origin and evolution of language, the production of speech sound is mainly based on the physiological evolution of the vocal organs, while the emergence of language is mainly based on the evolution of human cognition, and the emergence of speech sounds is earlier than the emergence of language. Man's speech organs and articulatory facility could produce more than 1,000 syllables. But why do we use only about 1,000 syllables in any given language for oral communication? This is not accidental, but determined by man's phonemic cognitive ability and semantic cognitive ability. What follows is a discussion of phonemic cognitive ability based on the data of various Sino-Tibetan languages.

Table 1 shows the data of twenty Chinese dialects. Taiyuan has the fewest syllables, with only 772, Chaozhou has the most syllables, with 1,483; the average number of syllables is 1,021. Jianou has the fewest initials, with only 15, Suzhou and Wenzhou have the most initials, with 28 initials each and the average number of initials is 20.7. Taiyuan and Wuhan have the fewest finals, with 36 each, Chaozhou has the most finals with 78 initials, and the average number of finals is 46. Wuhan, Chengdu, Jinan, Xi'an and Beijing have the fewest tones, with 4 tones each, Guangzhou and Yangjiang have the most tones, with 9 tones each and the average number of tones is 6.

Table 1. Parameters of Chinese syllable, initial, final, and tone

Language	Syllable	Initial	Final	Tone
Taiyuan	772	21	36	5
Wuhan	807	19	36	4
Changsha	810	20	40	6
Shuangfeng	871	27	32	5
Chengdu	875	20	36	4
Yangzhou	895	17	45	5
Hefei	912	21	41	5
Suzhou	923	28	46	7
Wenzhou	935	28	30	8
Jinan	1,000	24	38	4
Nanchang	1,000	19	58	7
Xi'an	1,018	27	40	4
Beijing	1,036	22	38	4
Jian'ou	1,069	15	33	6
Fuzhou	1,145	16	54	7
Xiamen	1,159	17	53	7
Meixian	1,195	18	68	6
Yangjiang	1,249	19	54	9
Guangzhou	1,269	18	60	9
Chaozhou	1,483	18	78	8

As we all know, there are more than 1,200 syllables in Beijing dialect, but there are only 1,036 monosyllables in 3,000 words, so there are more than 160 infrequently used syllables. According to the data of 20 Chinese dialects, 9 dialects have less than 1,000 syllables, and Taiyuan has only 772 syllables. Based on the parameters of Chinese dialects, we determined that only languages with syllables above 700 are used in this study, because some minority languages without writings may not be adequately investigated.

Table 2. Parameters of syllable, initial, final, and tone in Tibeto-Burman languages

Language	Syllable	Initial	Final	Tone
Yi	723	77	37	5
Achang	726	43	90	6
Dege	763	74	46	6
Lasa	882	35	78	6
Xunhua	885	59	36	0
Mian	913	69	53	4
Rikaze	922	30	69	6
Yushu	924	54	43	6
Zaiwa	934	19	145	3
Xiahe	986	70	78	0

Table 2 shows the parameters for 10 Tibeto-Burman languages. Liangshan Yi has the fewest syllables with 723; Xiahe Tibetan has the most syllables with 986; and the average number of syllables is 866. Zaiwa has the fewest initials with 19; Burman has the most initials with 69; and the average number of initials is 53. Liangshan Yi has the fewest finals with only 37; Zaiwa has the most finals with 145; and the average number of finals is 68. Zaiwa has the fewest tones with 3; Achang, Dege Tibetan, Lhasa Tibetan, Xikaze Tibetan, and Yushu Tibetan have the most tones with 6 each; the other two Tibetan dialects have no tones; and the average number of tones is 4. According to the parameters of Tibeto-Burman languages, the number of syllables is smaller than those of Chinese dialects, Miao, Yao, Zhuang, or Dai.

Table 3 shows the parameters of 10 language points in Miao, Yao, Zhuang, and Dai. Mian has the fewest syllables, 820; Diandongbei Miao has the most syllables, 1,326; and the average number of syllables is 1,005. The Dai language has the fewest initials, 20; Chuanqiandian Miao has the most initials, 128; and the average number of initials is 60. Xiangxi Miao has the fewest finals with 19; the Thai language has the most finals with 145; and the average number of finals is 70. Thai has the fewest tones, with 5; Jinmen Yao has the most tones with 11; and the average number of tones is 9. According to the database of Miao, Yao, Zhuang, and Dai, there is an average of more than 1,000 syllables, which is close to the number of syllables in Chinese dialects.

Table 3. Parameter of syllable, initial, final, and tone in Miao Yao Zhuang and Dai

Language	Syllable	Initial	Final	Tone
Mian	820	81	62	10
Dai	841	20	92	10
Tai	942	34	145	5
Qiandong Miao	978	48	28	8
Xiangxi Miao	982	102	19	7
Zhuang	995	22	115	9
Chuanqiandian Miao	1,016	128	33	8
Li	1,042	25	139	9
Yao	1,107	78	36	11
Diandongbei Miao	1,326	57	29	8

Based on the above parameter analysis, it can be seen that the number of distinct syllables in the spoken language ranges from 700 to 1,400 after a full investigation of the spoken language, and the average number of the syllables is around 1,000. The data of 40 Sino-Tibetan languages shows a range of syllables, which reflects the basic cognitive ability of people to process sounds at the syllable level. This is also the most basic evidence that we put forward for the *Active Syllable Average Limit 1,000*.

4. Theoretical syllabic space and *Active Syllable Average Limit 1,000*

In the Sino-Tibetan languages, the actual number of syllables in a phonemic system, which is usually defined as the actual syllabic space, is typically smaller than the theoretical syllabic space; this theoretical syllabic space is usually defined as the three-dimensional space obtained by the formula *initial* × *final* × *tone*, which represents the maximum possible value of a language syllable theoretically. According to our data, the theoretical syllabic space of different languages varies greatly, and the difference in phonemic system reflects the different properties of languages, such as the phonemic structure or language contact during the process of evolution. Based on specific data, let us look at the characteristics and differences between the actual syllabic space and the theoretical syllabic space.

Table 4 shows the parameters of the theoretical syllabic space and the redundancy rate of Chinese dialect syllables. Among them, the minimum theoretical syllabic space is 2,736 in Wuhan, the maximum theoretical syllabic space is 11,232 in Chaozhou, and the average value of theoretical syllabic space of Chinese dialect is 5,713. It can be seen that in Chinese dialects, the theoretical syllabic space is very different, far beyond the differences of the actual syllabic space. The difference can be expressed by the ratio of maximum value to minimum value. The ratio of the theoretical syllabic space in Chinese dialects is 4.11 (11,232 divided by 2,736). The ratio of the actual syllabic space in Chinese dialects is 1.92 (1,483 divided by 772); see Table 1. It can be seen that the difference of the ratio between actual syllabic space and theoretical syllabic space is quite large.

Table 4. The theoretical syllabic space and the redundancy rate among Chinese dialects

Language	Theoretical space	Redundancy rate
Wuhan	2,736	70.5
Chengdu	2,880	69.62
Jian'ou	2,970	64.01
Beijing	3,344	69.02
Jinan	3,648	72.59
Taiyuan	3,780	79.58
Yangzhou	3,825	76.6
Hefei	4,305	78.82
Suang'an	4,320	79.84
Xi'an	4,320	76.44
Chanshang	4,800	83.13
Fuzhou	6,048	81.07
Xiamen	6,307	81.62
Wenzhou	6,720	86.09
Meizhou	7,344	83.73
Nanchang	7,714	87.04
Suzhou	9,016	89.76
Yangjiang	9,234	86.47
Guangzhou	9,720	86.94
Chaozhou	11,232	86.8

Table 5 shows the parameters of the theoretical syllabic space and the redundancy rate for Tibeto-Burman. Among them, the minimum theoretical space of the syllable is 2,124 in Xunhua Tibetan, the maximum theoretical space of the syllable is 23,220 in Achang, and the average value of the theoretical space for Tibeto-Burman languages is 13,110. The ratio of Tibeto-Burman theoretical syllabic space is 10.93 (23,220 divided by 2,124) and the ratio of the actual syllables in Tibeto-Burman is 1.36 (986 divided by 723). See Table 2. The values for Chinese dialects, on the other hand, are very different.

Table 5. The theoretical syllabic space and the redundancy rate for Tibeto-Burman

Language	Theoretical space	Redundancy rate
Xunhua	2,124	58.33
Xiahe	5,460	81.94
Zaiwa	8,265	88.7
Rikaze	12,420	92.58
Yushu	13,932	93.37
Yi	14,245	94.92
Mian	14,628	93.76
Lasa	16,380	94.62
Dege	20,424	96.26
Achang	23,220	96.87

Table 6 lists the parameters of the theoretical syllabic space and the redundancy rate of Miao, Yao, Zhuang, and Dai. The minimum theoretical space of syllables is 10,752 in Qiandong Miao, the maximum theoretical space of syllables is 50,220 in Mian, and the average value of syllables of Miao, Yao, Zhuang, and Dai is 24,954. The ratio of the theoretical syllabic space of Miao, Yao, Zhuang, and Dai is 4.67 (50,220 divided by 10,752). The ratio of actual syllables in Miao, Yao, Zhuang, and Dai is 1.62 (1326 divided by 820); see Table 3. It can be seen that the results are similar to those found in Chinese dialects. From this analysis, we find that there is not much difference in the ratios for Chinese dialects, for Tibeto-Burman, or for Miao, Yao, Zhuang, and Dai.

Table 6. The theoretical space and the redundancy rate of Miao, Yao, Zhuang, and Dai

Language	Theoretical space	Redundancy rate
Qiandong Miao	10,752	90.9
Diandongbei Miao	13,224	89.97
Xiangxi Miao	13,566	92.76
Dai	18,400	95.43
Zhuang	22,770	95.63
Tai	24,650	96.18
Yao	30,888	96.42
Li	31,275	96.67
Chuanqiandian Miao	33,792	96.99
Mian	50,220	98.37

It can be seen from the above analysis that the theoretical space of syllables is much larger than the actual space of syllables. Now, if we draw the parameters of actual syllables vs. the theoretical space of syllables on a graph, as shown in

Figure 1. It can be seen from the figure that the actual space of syllables is basically a horizontal line. Although the actual space of syllables ranges from 700 to 1,400, the difference between the actual space of syllables and the theoretical space of syllables is very large. It can be seen from the fitting formula that the actual space of syllables is basically a horizontal linear function, while the theoretical space of syllables is presented as an exponential function, as shown in Figure 1. Note the two curves in Figure 1. The number of actual syllables itself has very strong stability, regardless of change in the systems or composition of phonemic systems. Therefore, we say that the number of actual syllables has strong stability showing the phonemic cognitive ability of humans. There is also a mutual restriction between the actual syllables and the basic morpheme, which reflects the basic cognitive ability of the combination of sound and meaning. The theoretical space of syllables reflects the dynamic process of language contact and evolution, which may have some connection with the structure of a phonemic system.

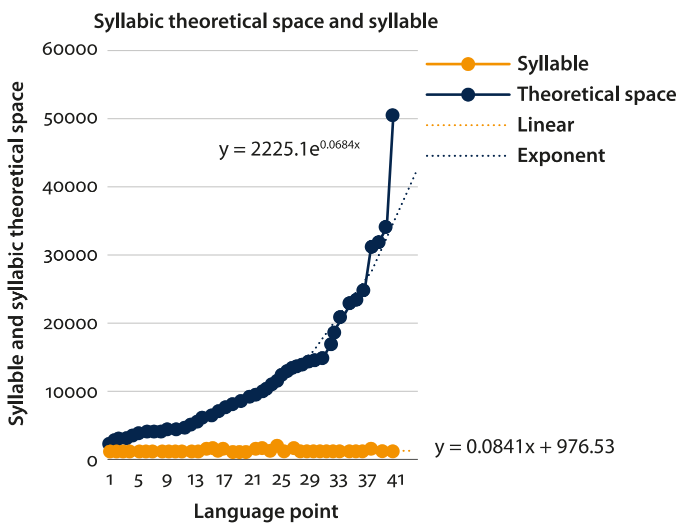

Figure 1. Theoretical syllabic space vs. actual syllabic space

5. The redundancy rate of *Active Syllable Average Limit 1,000*

In information theory, the concept of redundancy is mainly used to characterize the degree of redundancy of information sources (Shannon & Weaver 1949). In oral communication, redundancy is indispensable, and its main function is to increase the anti-noise ability of a signal in normal communication. In this paper, the redundancy entropy of a phonemic system is defined by the ratio of actual space over the theoretical space of syllables in a phonemic system. The redundancy rate is defined as 1 minus the redundancy entropy multiplied by 100%. Tables 4–6 list the theoretical syllabic space and the redundancy rates for forty languages. Now let us analyze the redundancy rates of the Sino-Tibetan languages to show the nature of the *Active Syllable Average Limit 1,000*.

Among the Chinese dialects, the minimum redundancy rate is 64.01% for Jianou, and the maximum redundancy rate is 89.76% for Suzhou as shown in Table 4. From these data, it can be seen that there is a great difference in redundancy rates for Chinese dialects as a whole. The average redundancy rate is 79.48%. In Tibeto-Burman languages, on the other hand, the minimum redundancy rate is 58.33% in Xunhua Tibetan and the maximum redundancy rate is 96.87% in Achang as shown in Table 5. The average redundancy is 89.14%. The minimum redundancy rate is 90.9% in Diandong Miao and the maximum redundancy rate is 98.37% in Mian. See Table 6. The average redundancy rate is 94.93%.

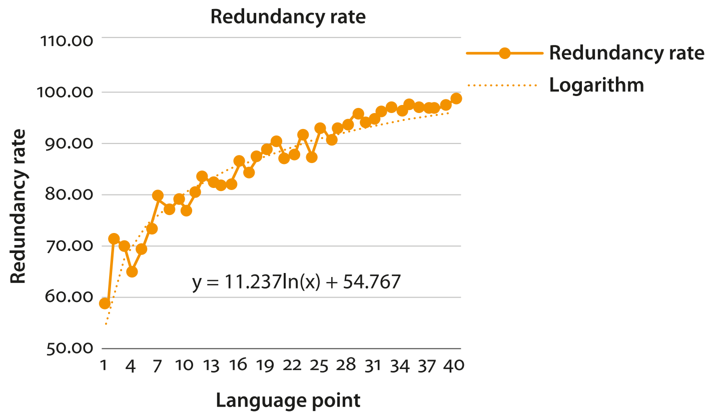

Figure 2. The redundancy rates of forty Sino-Tibetan languages

Figure 2 shows a curved redundancy rate. From the figure, it can be seen that the curve of the redundancy rate presents a logarithmic distribution. Since the redundancy rate is defined as a percentage, the values range between 0% and 100%. Among the forty languages, the minimum redundancy rate is 58.33%, the maximum redundancy is 98.37%. Thus, the redundancy rate of 60% can be considered the minimum redundancy rate for normal communication in the Sino-Tibetan languages. It indicates the lowest limit of phonemic cognition of people in oral communication, which is another important index to measure the cognitive ability of human language.

6. Discussion and conclusion

Through the study of *Active Syllable Average Limit 1,000* in the Sino-Tibetan languages, we can see that there are three kinds of data supporting this basic theory. The first is the actual syllabic space in each spoken language. The second is the theoretical syllabic space composed of initial, final, and tone. The third is the redundancy rate derived from redundancy entropy. In the following, we shall discuss the relationship among the three kinds of data, and then explain the theoretical basis of the phonemic cognition regarding the *Active Syllable Average Limit 1,000*.

The first is the actual syllabic space of languages, which is the most important basis for us to propose the *Active Syllable Average Limit 1,000*. In the 3,000 word samples of the forty languages under consideration, all varieties have an actual syllabic space at least 700 and at most 1,400. If the actual syllabic space is less than 700, we did not use that data, because we consider this data deficient. This ensures the accuracy and adequacy of the data in this study. According to the data, there is no correlation or direct relationship among the actual syllabic space, the theoretical syllabic space and redundancy rate. The result is that the active syllable's average limit is about 1,000. The actual syllabic space would vary between 700 and 1400 according to the different structures of the phonemic system.

The absolute value of the actual syllabic space is very different from the theoretical syllabic space. The relationship between them is that when the theoretical space increases exponentially, the actual syllable basically presents a horizontal distribution. Therefore, it can be considered that the actual syllabic space is very stable. Comparing the actual syllabic space with the number of morphemes, we can also find that there is no correlation or direct functional relationship between them. As we all know, the number of morphemes commonly used in oral communication is more than 1,000, but the actual syllabic space is consistently about 1,000. This means that the number of basic morphemes varies greatly according to language ecology, but the actual syllabic space is stable according to phonemic cognitive ability and varies in a very small range according to the phonemic structures of different languages.

Furthermore, the theoretical syllabic space is very large. We know that the theoretical syllabic space is composed of initial, final, and tone. It can change significantly in a relatively short time, especially when two languages are suddenly in contact with each other. Whenever there is language contact, loanwords can enter a language system and increase the phonemes which causes an increase in theoretical syllabic space. This tells us that the variation in theoretical syllabic space is related to language contact. From this point of view, we can see that the actual syllabic space does not change with the theoretical syllabic space; that is, they have little relationship with each other. From the relationship between the theoretical syllabic space and the redundancy rate, we can find that when the theoretical syllabic space increases exponentially, the redundancy rate will increase logarithmically. That means when two languages come into contact, the redundancy rate will first increase, and then gradually fall back under the control of phonemic cognition. Therefore, the redundancy rate can be used to reflect the complexity and ordered state of language contact and evolution, but the actual syllabic space reflects the phonemic cognitive ability of humanity.

Third, the redundancy rate comes from the concept of information theory and presents the amount of redundant information during communication. From the perspective of speech perception, the higher the redundancy rate, the less likely homophones will appear, while the lower the redundancy rate, the more likely homophones arise. We know that in the process of oral communication, if there are too many homophones, it will directly affect our correct perception in oral communication. According to our data, among the forty Sino-Tibetan languages, the lowest limit in the redundancy rate is about 60%; that is, when the theoretical space of syllables is 100, only 40 actual syllables are used in transmitting information. If the redundancy rate is 90%, only 10 syllables are actually transmitting information. Therefore, the greater the redundancy rate, the less likely people will be confused in the perception of speech communication. However, the smaller the redundancy rates, the more homophones will be encountered in oral communication, so that the perception of speech sounds will be confused during oral communication. Therefore, the redundancy rate of 60% represents the lowest limit in oral communication for the Sino-Tibetan languages, which indicates the lowest limit of phonemic cognition.

From the above analysis, the results show that: (1) the statistical methods can be used in the study of phonemic cognition; (2) the actual syllabic space in spoken Sino-Tibetan languages reflects the mankind's phonemic cognitive ability; (3) the theoretical syllabic space composed of initial, final, and tone in the Sino-Tibetan languages reflects the dynamism of phonemic systems when undergoing language contact and evolution; (4) the redundancy rate of 60% is the lowest limit in oral communication for Sino-Tibetan. Therefore, the conclusion of this study is that *Active Syllable Average Limit 1,000* not only reflects the phonemic cognitive ability of human, but also reflects the interdependence between phonemic cognition and semantic cognition, and reveals an important link in the process of language chain from semantic to phonemic transformation, which has important theoretical significance in the study of language cognition.

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