# The Theory of Internal Compensation in Language Systems

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**Abstract**: This essay elaborates as thoroughly as possible the theory of internal compensation of the natural language system, and proves that the general distinctive function, which vanishes because of the loss or decrease of one or more sub-systems or units with their distinctive function, will be compensated with the increase of others or something new to guarantee the general balance of the whole system and fulfill the need of communication. By just discussing some phenomena of internal compensation at the phonological level here, this essay reveals some interesting rules and gives new explanations to some phenomena that have not been explained or not explained properly, then prove the theory's function of explanation.

**Key words**: language system, internal compensation, phonological level

### 0. Introduction

Saussure has built the value theory based on the mutual relationship of language units. This essay provides support for his theory, and expands on its notion of internal compensation in language systems. The so-called internal compensation in language system refers to the mutually dependent relationship of each unit of a language. When distinctions disappear because of the decrease of one or more sub-systems or units with their distinctive function, they will be compensated by the increase or creation of other distinctions, to guarantee the general balance of the whole system and fulfill the need of communication. By discussing some phenomena of internal compensation at the phonological level, this essay reveals some interesting rules and gives new explanations to some phenomena that have not been explained or not explained properly, and also provides evidence for the explanatory power of Saussure's theory.

### 1. The basic theory

#### 1.1. Definition

"Internal compensation" was originally a physiological term. It refers to the phenomenon

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that if an animal receives damage to an organ or its function, another related organ often will grow or its function increase to compensate for the loss. As a self-sufficient sign system, internal compensation in natural languages means that in one language system, the function of distinctiveness remains stable, due to the importance of distinctiveness in communication; if distinctions disappear in one subsystem, other distinctions appear in other subsystems, guaranteeing the general balance of the system.

## 1.2. Theoretical foundation for internal compensation in a language system

As one kind of sign system, language's vocation is to fulfill the needs of language users to describe the objective world and express their subjective world.[①] It requires that the sub-systems and units in sound, vocabulary and grammar of one language be able to produce enough distinctions to make any communications come true.

The general distinctive function is constituted jointly and held respectively by the functions of each sub-system. Therefore, in theory, the number of distinctions in two languages, dialects or even the same language in different historical phases should be approximately equal to each other, and the number of their respective sub-systems and units remains stable.[②] But as a matter of fact, even the nations of approximately the same productivity use very different languages, especially in phonetics, next in vocabularies and last in their grammars. To assert as a hypothesis, under the premise that the number of distinctions in a language is invariable, the number of the sub-systems with their elements is always in the relation of mutual compensation. For example, supposing the general distinctive function (F) is originally constituted respectively by the three groups A, B, C; if the units in group A decrease in number or weaken in function, the number of distinctions will be diminished, but one or both groups B and C must increase in quantity or enhance in function to compensate for the loss to guarantee the language's general function. In other words, language's general function is invariable, while each element is mutually compensative in quantity and function. This kind of internal compensation exists between many languages and levels, such as different languages in one language family, languages in different families, the dialects in one language and one language in different historic phases. Moreover, it possibly occurs in and between various levels of one language. The compensation can be found in both macroscopic observations and microscopic analysis. Overall, the internal compensation phenomenon happens on every level and aspect of

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[①] Regarding this, R.H. Robins said that, "it is already proved that each kind of language structure can coexist with the culture of any level or with the developing culture." (P415) В.А.Звегинцев(P203) also said that, "The alive language at any time is a product of temporary balance."
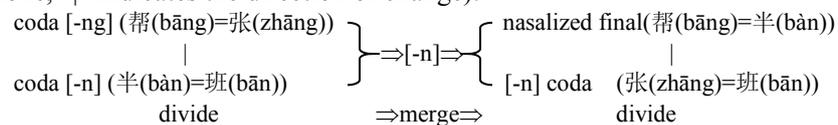
[②] Here I only consider the method, removing external factors like culture and degree of economic development, which can influence the language.

language, and it happens all the time.[③]

### 1.3. Issues concerning research methodology

The first step in discovering and analyzing internal compensation in language is to contrast the amount of distinctions, and the second is to analyze the relations between the different amounts. The contrastive method may be used on all levels and all aspects of language to discover any kind of difference.

On the basis of all the differences, we can analyze the causal relation of different amounts specifically, namely, compensation relations or compensation connections. By contrasting the final system of Changsha dialect and the Middle Chinese, we can obtain two rules: (a) the coda [-ng] in Middle Chinese vanished in Changsha dialect, and was replaced by [-n]; (b) the codas of Middle Chinese were divided into two parts in Changsha dialect , one part is read as –n (班（bān）、担(dān)、关(guān)、弯(wān)), the other was nasalized (半(bàn)、酸(suān)、展(zhǎn)、片(piàn)). As a result, (a) 8 finals have been reduced in Changsha dialect, that is, the words with [-ng] and [-n] turned into the homophones; (b) modern Chinese coda [-n] was divided into two again, namely, the homophones produced by (a) were set into two groups. It is obvious here that the compensation relation existed between the two diachronic changes, that is the coda [–n]'s divergence compensated for the loss of general distinctive function which was caused by the vanished coda [–ng]. The graphical representation is as follows ("=" indicates homophone, "|" indicates the direction of change):

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coda [-ng] (帮(bāng)=张(zhāng))  ⎤                ⎡ nasalized final(帮(bāng)=半(bàn))
               |                  ⎬⇒[-n]⇒⎨              |
coda [-n] (半(bàn)=班(bān))       ⎦                ⎣ [-n] coda   (张(zhāng)=班(bān))
          divide                  ⇒merge⇒              divide
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In researching the process of internal compensation, we should pay special attention to the general distinctive functions of the languages and their sub-systems, and focus on the change patterns of these two important aspects: (1) Merges, specifically merges caused as a result of the reduction of certain sub-system units or the essential elements or the degeneration of their distribution (this signifies the general distinctive function has been reduced); and (2) Divergence, specifically divergences caused by the creation or increase in units or elements of some subsystem (this means the general distinctive function has been compensated).

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③ Certainly, internal compensation in language means that if a sub-system's distinctive function is reduced, another sub-system's distinctive function will be enhanced; if one kind of essential factor decreases, another kind of essential factor will increase. The simplification of one kind of essential factor would cause the abundance of another kind of essential factor, but not only a new combination of them. The internal compensation in language is also different from evolution or change of the language essential, but emphasizing the compensation and the balance of the general distinctive function.

## 1.4. The reference frame of contrast

Contrasts can be made along two dimensions: the time coordinate and the space coordinate. In the time coordinate, we contrast diachronically the different developmental phases of a language or of different languages of the same type or the different diachronic aspects of languages in the same family. In the space coordinate, we contrast synchronically the languages of one type or family or the different dialects of one language.

## 1.5. Types of internal compensation

There are many complex situations in internal compensation, and what is comparatively easier to observe is the classification in terms of stratifications and quantity.

Classification by level may consist of same-level compensation (e.g., at the level of pronunciation, vocabulary, grammar, and so on), or it may consist of compensation between different levels (e.g, changes in pronunciation may cause compensation in vocabulary, and so on).

Classification by quantity refers to the number of units or levels involved in the compensation. Depending on whether only two, or more than two, changes are linked, a shift may be classified as dual-compensation (only two language units, or two kinds of language units, or two levels of language units, are involved), or as multivariate compensation (many units or many kinds or levels of language units are involved).

## 2. Types of internal compensation at the phonological level

The phonological level can be further divided into the phoneme level and the syllable level. Phonological internal compensation may be classified as follows:

| | | |
|---|---|---|
| The internal compensation at the phoneme level | Internal compensation in segmental phoneme | Internal compensation between vowel phonemes |
| | | Internal compensation between consonant phonemes |
| | | Internal compensation between vowel phoneme and consonant phoneme |
| | Internal compensation in non-segmental phoneme | Internal compensation in tonemes |
| | | Internal compensation between chroneme and toneme |
| | | Internal compensation between chroneme and stroneme |
| | | Internal compensation between toneme and stroneme |
| | | …… |
| | Internal compensation between segmental phoneme and non-segmental phoneme | |
| Internal compensation at syllable level | Internal compensation between combination and the word length | |
| | Internal compensation between the rhyme and the word length | |

Since the phoneme level is the nucleus of phonology, we choose here the phonological level to test the theory of internal compensation in language systems. The changes we look at here are primarily instances of same-level dual-compensation, though the results should

generalize.

## 2.1. The internal compensation in segment phonemes

### 2.1.1. The internal compensation between vowel phonemes

First, let us examine the internal compensation between monophthongs and diphthongs. The change of French vowels is a splendid illustration. Latin retained the diphthong /au/, however, French, which belongs to a Latin branch, was influenced by the Gaulish language, so its diphthongs /ae/ and /au/ respectively degenerated or contracted as the monophthongs /e/ and /o/ during the time of Charlemagne in 8ᵗʰ century A.D.. Words that originally had different sounds turned into homophones or homographs. In order to make effective compensation, besides inheriting original Latin monophthongs /a/, /e/, /i/, /o/, /u/, the vowel system of French added two vowels /y/, /ø/, which can be either open or closed. Moreover, it added a centered /ø/ in the distribution scope of /ø/, namely each weakened form of the unaccented vowels. Obviously, "this rich system of vowels greatly compensated for the loss of the vanished French vowel /au/ which is the only diphthong still remaining in Latin".(Albe,1987:6)

"The great vowel shift" in English that occurred between the 14th and 16th century also is a good example. This change involved all long vowels. Jean Aitchison (1997) depicted this great change vividly as follows:

$$[əi]\leftarrow[i:] \qquad\qquad [u:]\rightarrow[əu]$$
$$[e:] \qquad\qquad\qquad [o:]$$
$$[ɛ:] \qquad\qquad [ɔ:]$$
$$[a]$$
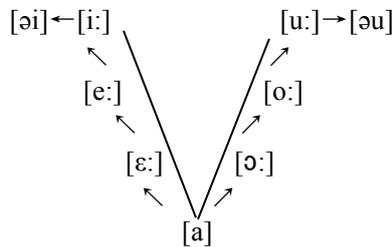
This vast shift changed the appearance of English greatly in one or two centuries. Just look at the material Jean Aitchison listed in the book:

| The Great Vowel Shift | | | | | | |
|---|---|---|---|---|---|---|
| Middle English | | Became | Early modern English | | Became | Modern English | |

| Middle English | | Became | Early modern English | | Became | Modern English | |
|---|---|---|---|---|---|---|---|
| [a:] | [na:mə]name | → | [ɛ:] | [nɛ:m] | → | [ei:] | [nei:m] |
| [ɛ:] | [mɛ:t]meat | → | [e:] | [me:t] | → | [i:] | [mi:t] |
| [e:] | [me:t]meet | → | [i:] | [mi:t] | → | [i:] | [mi:t] |
| [i:] | [ri:d]ride | → | [əi] | [rəid] | → | [ai] | [raid] |
| [ɔ:] | [bɔ:t]boat | → | [o:] | [bo:t] | → | [ov/əv] | [bovt/bəvt] |
| [o:] | [bo:t]boot | → | [u:] | [bu:t] | → | [u:] | [bu:t] |

What changed in the great vowel shift of English is not only the quality of the vowel phonemes, but also the relation between the phonetic forms and meanings. Because this change had lasted for a certain period before it was complete, in the earliest stage of this push-chain change, namely when [a] turned into [e:], [ɔ:] into [o:], these four vowels must

have co-existed temporarily, and then the divergence completed step by step. At last, [e] in English gave up its place of articulation to [a], and continued rising to capture [i]'s place, [i] which is higher than its own. Thus, the homophony due to the merger of [a] and [e] was temporarily diverged. Hereby, the war of balance that started by loss ended with compensation. Then, the same process of "loss-compensation" also happened between [i] and [e], so after finally rising to its apex of the place of articulation [i] had to fall down to the bottom, occupied by [a], to form a compound vowel [ai] with it. Therefore, it could be distinguished from [i] and [a]. Seen in this way, "the great vowel shift" contained three processes of "loss-compensation".

A similar shift also happened in Middle Chinese. Its basic development is shown in the next table.

| Middle Chinese | | Turned | Modern Chinese (mandarin) | |
|---|---|---|---|---|
| [ɑ] | [ɣɑu] | → | [a] | [xau] |
| [a] | [ɣau] | → | [ia] | [ɕ iau] |
| [ia] | [kia] | → | [ie] | [tɕ ie] |
| [ie] | [kiei] | → | [i] | [tɕ i] |
| [i] | [tsi] | → | [ï] | [tsï] |

Regarding the reason of this shift, some people thought it unknowable. But we also have sufficient reasons to believe that at the beginning of the turning from the first vowel to the second, there must have been many homophones that thereupon had to be diverged with positive methods. There were possibly many methods and the most feasible ways were either [a] returned to the original place of articulation or [e] risen to a higher place. Whatever the methods, we can get the result that the homophones created by the mergence of the two could be diverged clearly.

### 2.1.2. Internal compensation in consonant phonemes

At the beginning of the 19th century, Jacob Grimm put forth "the Grimm law" in his book *German Grammar* (*Deutsche Grammatik*). This law has reflected the great consonant shift in the Germanic branch of the Indo-European language family. According to this law, the primitive Indo-European language had experienced three great changes: First [bh], [dh], [gh] turned into [b], [d], [g], then [b], [d], [g] discarded their own pronunciation characteristics to become [ p ], [ t ], [ k ], and finally [p], [t], [k] had no space to draw back but turned into [f ], [θ], [h].

In every language of the Sino-Tibetan language family, internal compensation between the consonants divided them into two kinds: the internal compensation between the initial consonants and consonant endings and the internal compensation between initial consonants.

First, we discuss the internal compensation between the initial consonants and consonant endings. This kind of internal compensation exists widely in every Sino-Tibetan language.

To begin with, let us look at the contrast between the initial consonants and consonant endings in every typical dialect of Chinese.

| Dialects | Wu Dialect | Northern | Xiang Dialect | Gan Dialect | Yue Dialect | Hakka Dialect | Min Dialect |
|---|---|---|---|---|---|---|---|
| Initial Consonants | 27 | 22 | 23 | 19 | 20 | 17 | 14 |
| Consonant Endings | 2 | 2 | 2 | 4 | 6 | 6 | 7 |

There were at least 9 consonant endings in ancient Chinese. Till the middle age, it still retained six consonant endings in two groups ([-m, -n, -ŋ, -p, -t, -k]). In modern Chinese, the consonant endings turned towards the two poles: the Northern dialect, Wu dialect and Xiang dialect reduced many consonant endings, and they now only have two ([-n, -ŋ]) in general; other dialects mostly retained the consonant endings of Middle Chinese (4-7). At face value, this change must have resulted in a decrease in the number of phonemes in the first three dialects. However, if we change the perspective and look at initial rather than final consonants, we can find that the first three dialects have 23-27 initial consonants, while the latter four dialects only 19-14. Therefore it is reasonable to say that among all Chinese dialects, the internal compensation between the initial consonants and consonant endings do exist systematically.

Another interesting example is found in the Burman branch of Tibeto-Burman language family. Please compare:

| Languages | Zaiwa Language | Achang Language | Burman |
|---|---|---|---|
| Initial Consonants | 28 | 37 | 64 |
| Consonant Endings | 7 | 7 | 1 |

Ancient Burmese language had diverse codas that afterwards vanished with other consonants, leaving only one consonant ending. Thereupon, the consonant systems in the Burmese language and Zaiwa language stepped onto different roads: One road was to increase initial consonants as the Rangoon dialect in Burmese language, which has 64 initial consonants, among which there are 32 consonant clusters. The other road was to keep the ancient consonant endings, with only half of the Burmese initial consonants. Obviously, the internal compensation between initial consonants and consonant endings in the three languages of the Burmese branch is more typical.

Second, we discuss the internal compensation between initial consonants only. The most typical example in this aspect comes from Jing group (精组, including [ts-]、[ts -]、[dz -]、[s-] and [z-])、 Zhao group two (照二, including [tʃ-]、[tʃ -]、[dʒ -] and [ʃ-]) and Zhao group three (照三, including [tɕ-]、[tɕ -]、[dʑ -]、[ɕ-]、[ʑ-] and [◆ʑ-]), the three groups of the Qixian dialect of Chinese in Jin dynasty. It presented as a typical pull-chain mutation in an evolution of nearly a thousand years, as follows:

Jing group          [-i_ ]/[-y_ ]<sup>④</sup>
↑                        ↓
Zhao group two     Zhao group three

Xu Tongqiang (1990) gave a beautiful summary of this mutation: "The structural relation between the phonetic level and the semantic level are distinctive: In Chinese, the replacement in each position of syllable structure inevitably corresponds with distinctive meaning. Vice versa, the distinctive meaning inevitably corresponds with the replacement of phonemes. Therefore, the push-chain or pull-chain change of phonemes inevitably disturbs the balance of the pronunciation system and the meaning system: the originally different words become homonyms, which is disadvantageous to daily communication. In order to get a new balance, the union of pronunciation and meaning needs to make suitable adjustments. The chain cycling of phonemes possibly is an economic and effective means to realize the compensation, because it adjusts the union of pronunciation and meaning to facilitate communication under the premise of keeping the phonological structure stable and invariable, and makes the union distinctive in general. In fact, the pull-chain change in the Germanic consonants revealed by Grimm's Law is realized through the power of loss-compensation."

### 2.1.3. Internal compensation between vowels and consonants

Example one: The Caucasus language family has been divided into the northeast branch and the northwest branch and the two are very different in grammar and pronunciation. The northwest branch has a very simple pronoun system while the northeast an extremely complex one. At the same time, they also have marked differences in pronunciation.

The Northwest branch has few vowels but many consonants, while the northeast is the opposite. Besides unvoiced, voiced stop, unvoiced, and voiced affricated larynx which are common in other languages, the northeast branch has more than 70 consonants including labial consonants, hard consonants, semi-aspirate and velarized consonants. The combination of 6 to 8 consonants is usual.

The Northeast language branch is exactly the opposite with an extremely complex vowel system. Besides the 5 common vowels, many languages have nasalized long vowels, laryngealized and labialized sounds, which are really unique. Chechen language is the most prominent, for its distinctive vowels and their combinations are as many as 30. The conclusion is that the variety of consonants compensates for a gap in pronunciation. And the Northwest branch makes up its deficient pronunciation system by lots of consonants. Therefore, these two branches realize their compensation of phonological systems in entirely different ways.

Example two: Internal compensation operates between the vowels and the consonants in

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④ [-i_] represents [-i] or vowels beginning with [-i]; [-y_] represents [-y] or vowels beginning with [-y].

the Sino-Tibetan language family, and with great complexity and diversity, especially in Tibet language branch and the Jingpo branch. Please see the following table.

| Language Branches | Languages | Initial | Vowel |
|---|---|---|---|
| Tibetan Branch | Tibetan | 28 | 17 |
| | Moto Monba | 37 | 9 |
| | Zuona Monba | 47 | 13 |
| | Jiarong language | 233 | 7 |
| Jingpo Branch | Jingpo language | 31 | 10 |
| | Duong language | 51 | 7 |
| | Dengyudarang dialect | 49 | 6 |
| | Dengyugeman dialect | 53 | 6 |

From the table above, we can see that the initial consonants of the two branches reduce in turn from top to bottom, while the vowels increase in turn. They are mutually compensatory. The only exception is Zuona Monba (the details follow).

Example three: Various Chinese dialects have compensation between the vowels in nucleus and consonant endings.

Regarding this, Yuan Jiahua (1960, P.313) pointed out, "(with various Chinese dialects) the number of vowels and that of consonant endings are related: if there are fewer consonant endings, there will be more vowels. This rule may be described as 'mutual compensation'." "The Wu dialect has many vowels, mostly caused by the disappearance and loss of the consonant endings. Some dialects still keep the traces of nasalized vowels in nasal codas, but most locations do not show any trace of the nasalized vowels at all." The contrast of 10 dialects is as follows:

| Locations | Vowels In Nucleus | Vowel Endings | Consonant Endings | Sum |
|---|---|---|---|---|
| Meixian | 6 | 2 | 6 | 8 |
| Nanchang | 7 | 2 | 4 | 6 |
| Fuzhou | 7 | 3 | 2 | 5 |
| Changsha | 7 | 2 | 2 | 4 |
| Wuhan | 7 | 2 | 2 | 4 |
| Beijing | 7 | 2 | 2 | 4 |
| Guangzhou | 8 | 3 | 6 | 9 |
| Xiamen | 11 | 2 | 7 | 9 |
| Suzhou | 11 | 0 | 3 | 3 |
| Xi'an | 11 | 2 | 1 | 3 |

(The table above does not include apical vowels. )

The statistical figure shows that Yuan's conclusion is correct. Yuan Jiahua (1960) also pointed out, "Southern Min dialect is very special, both the vowel and the coda increased because of the huge differences of variant pronunciation in written Chinese and spoken Chinese." Deng Shaojun (1981) also said, "There are a lot of words with 'entering tone', but this is only a superficial phenomenon of Guangzhou dialect. In fact, the entering tone is fluctuating, changing.... The coda weakened gradually, [-k] is like [-ʔ ], and the overall entering tone has gradually weakened." Although the situation is complex, we still may see

the mutual compensation in the contrast of the consonant endings and vowels in nucleus.

Firstly, the number of nuclear vowels in various dialects is between 6 and 11. The table is arranged to show the vowels in an increasing tendency from left to right; the consonant endings, on the other hand, basically decrease, so the two are clearly in a relation of mutual compensation.

Next, Middle Chinese pronunciation system only has three consonant endings ([-m], [-n], [-ng]), which have been reduced in various dialects in modern Chinese. The Xi'an dialect has the least, as it has retained only the consonant ending [-ng]. All else being equal, we have enough reason to say that the losses caused by the reduction of consonant endings are compensated for by the dramatic increase in the number of nuclear vowels. Among them, the Meixian dialect and the Xi'an dialect occupied two ends of a pole: they respectively have 6 and 11 nuclear vowels but 6 and 1 consonant endings, nearly 6 times as many to compensate. Therefore, when seen only synchronically, the only conclusion that can be obtained is that the two dialects have huge differences in pronunciation; but when seen in connection with the diachronic tendencies, we can discover the self-compensation in the two dialects in the process.

### 2.1.4. Internal compensation between the initial and the final

We also can find internal compensation rules between consonants and the rhyme, which is most typical in various Chinese dialects. See the following table:

| Dialects | Min Dialect | Hakka Dialect | Gan Dialect | Yue Dialect | Wu Dialect | Xiang Dialect | Northern Dialect |
|---|---|---|---|---|---|---|---|
| Finals | 79 | 74 | 65 | 53 | 49 | 40 | 39 |
| Initials | 14 | 17 | 19 | 20 | 27 | 23 | 22 |

It is clear from the above table that the number of the finals in various Chinese dialects is between 79 and 39, and that of initials conversely ranges between 14 and 27, which exactly presents the mutually compensative relation.[5]

These are four more examples in Miao-Yao language stock.

| Language Branch | Miao Language Branch | | Yao Language Branch | |
|---|---|---|---|---|
| Languages | Miao Language | Bunu Language | Mian Language | She Language |
| Initials | 53 | 59 | Few | 19 |
| Finals | 14 | 36 | Many | 28 |

(The status of She language has not been determined. )

The table above tells us that the Miao language branch has more initials than finals, and has neither stop coda nor nasalized coda [-m], but [-n] and [-ng] appearing separately in front of the front-high vowel and back-low vowel, and they do not often appear in opposition. The Yao language branch, in contrast, shows the opposite pattern, for there are
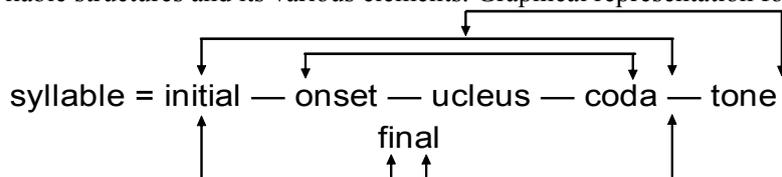
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[5] As for some dialects, (like the Wu dialect) the number of the initial consonants surpasses the sequence convention above. So we have to seek for the causes from other aspects.

fewer initials than finals. Furthermore, both of them have 8 tones, so that their respective phonological systems are not disturbed. It can be said that, the diverse initials of the Miao language compensated for the loss caused by insufficient finals, which is the opposite of the pattern in the Yao language branch.

Chinese syllable structure mainly fits the "1×1=1" pattern constituted on the basis of "1" as revealed by Xu Tongqiang (1991), namely the entire syllable is constituted with initial, final and the tone, with only one element allowed to appear in each position. On the final level, we can get onset, nucleus and coda according to the phoneme position and one position, one element. There could be zero element in the positions of onset and coda. Thus, Chinese syllable structure level and its pattern may be indicated as in the following table:

| Level Order | Level Organization | Structure |
|---|---|---|
| Level 1 | 1 onset×1 nucleus×1 coda=1 final | 1×1=1 |
| Level 2 | 1 initial ×1 final=1 segmental | 1×1=1 |
| Level 3 | 1 segmental×1 tone=1 syllable | 1×1=1 |
| Level 4 | 1 syllable×1 concept=1 word | 1×1=1 |

This simple structure organization implies a self-operative and self-regulatory mechanism in Chinese. With the basis of "1" from the bottom to the top, it forms a strict structure as its levels are connected one by one. "1" after the equal mark is the product of "1" before the equation mark. It is not only one kind of structure, but also "1" as an element of structure to participate in the higher structure. "1" around the equation mark is a structure based on a mathematical function: "1" as a variable = "1" as a constant. If the variable before the equation mark becomes "2" or "3", it will become an unbalanced structural equation: 1×2 (3) =1. At that time, the mutually dependent and mutually balancing structures between the subsystems will make self-adjustments to adjust the mutual relations by new transformations. If the constant "1" restricts the variable "2" or "3" to make them turn to "1" by transformation, the structure of "1×1=1" can be re-balanced. Therefore, there may be multiple mutual compensations on each level of Chinese syllable structures and its various elements. Graphical representation follows:

$$\text{syllable} = \text{initial} \text{ --- } \text{onset} \text{ --- } \text{ucleus} \text{ --- } \text{coda} \text{ --- } \text{tone}$$
$$\text{final}$$

Xu Tongqiang believed that consonant clusters in ancient Chinese vanished because of the structural mechanism of this "1×1=1", and it was the same with the productivity of binding words.

In addition, Xu (1990) also pointed out that many newly created diplophonic words in modern Chinese do not fit into the structural mechanism of "1×1=1", so the relevant

balancing mechanism monosyllablizes them through the change of initials, finals and tones to recompose them into new monosyllables again. Lin Maocan and Yan Jingzhu (1990) also showed that the vowels in the onset and nucleus of the Mandarin unstressed syllable all show the shift of position away from their original positions of four tones to the central vowel, while the vowel in coda position, the coda [-n] and some cases of coda [-ng] tends to be dropped. In two-word groups with distinctive features, the character length with unstressed codas has been reduced by 45% compared with the stressed characters, and the duration of their finals has reduced by 53%. Some data of their papers are quoted as follows:

| Stressed Two Word Groups | | Unstressed Two Word Groups | |
|---|---|---|---|
| Former Word | Latter Word | Former Word | Latter Word |
| 276 milliseconds | 303 milliseconds | 250 milliseconds | 167 milliseconds |

This group of data provides powerful demonstration that the total duration of two-word group that contains neutral-tone words has reduced by 1/4. Moreover, after the latter syllable lost its tone, it depends on the former syllable and "all syllable tones of the entire word fuse together to constitute a tone like a monosyllable" (Wu Tai 1986). Xu Tongqiang (1990) pointed out that this not only happens to the unstressed syllable, but also to the tones of the changed initials and finials. "The common goal is to unify two independent syllables of the two morphemes to stand in a one-syllable framing to get a monosyllable" and "make the self-adjustment in Chinese structure, and maintain the one-to-one correspondence and balanced connection between syllables and words".

## 2.2. Internal compensation in non-segmental phonemes

### 2.2.1. Internal compensation in homogeneous non-segmental phonemes

Homogeneous internal compensation of non-segmental phonemes always occurs between chronemes. The Sino-Tibetan language family offers rich data.

Example one: Internal compensation of Chinese tonal system. Three noticeable changes in the tonal system occurred in Chinese history, and they started respectively at the following times:

| Tonal Change | Starting Time |
|---|---|
| the level tone was divided into the first and second tones | the mid-tang dynasty(in the mid-9th century) |
| the voiced rising tone turned the fourth tone | the late tang dynasty(at the end of 9th century) |
| the entering tone vanished | the yuan dynasty(in the first half of the 13th century) |

The four-tone system of Chinese was well-established no later than the Eastern Han Dynasty, and remained the same during the Three Kingdoms, the South and North Dynasty, Sui Dynasty and even the Tang dynasty. But in mid-Tang, it started to fluctuate. At the time of Five Dynasties and Southern Song Dynasty, the voiced rising tone started to turn into the present-day fourth tone. The evolution of entering tone dividing into the three

tones began no later than Yuan dynasty.[6] The fact that it took less than 300 years for the Chinese tonal system to change from the division of the level tone to the disappearance of the entering tone raises the question of whether there is any intrinsic relation among the three significant evolutions. Now, let us use the internal compensation theory to explain this phenomenon. See below:

| | | The Law of Tonal Changes | | | | |
|---|---|---|---|---|---|---|
| *Qie Yun* | | Level Tone | | Rising Tone | Falling Tone | Entering Tone |
| AFter *Qie Yun* | the level tone divided into the first and second tones | the first tone | the second tone | the third tone | the fourth tone | the entering tone |
| | the voiced rising tone turned into the fourth tone | | | part of | | |
| | the entering tone divided into the three tones | the first tone | the second tone | the third tone | | the fourth tone |

From the above table, we can see the tonal system represented by *Qie Yun* had four tones, but in the 9th century when the level tone was divided into the first and second tones, there were five tones. Maybe it is because there were too many words of level tone. According to the statistics of just one book, *Guang Yun*, we can find that

| tones | *Guang Yun* pages | percentage |
|---|---|---|
| level tone | 212 | 41% |
| rising tone | 102 | 20% |
| falling tone | 107 | 20% |
| entering tone | 9 | 19% |

Although it's an idle method, it is clear that the number of pages of level tone characters in *Guang Yun* are almost the sum of any two of the others.[7] Semiotically, the level tone loads much more information than the other three. The four tones can be arranged in terms of their information load as: Level tone > Rising tone/falling tone > Entering tone. Due to the huge difference in the information load, the first significant evolution of chroneme system occurred, "The level tone was divided into the first and second tones". Its result created the following pattern:

| tones | *Guang Yun* pages | percentage |
|---|---|---|
| first tone | 106 | 20.5% |
| second tone | 106 | 20.5% |
| third tone | 105 | 20% |
| fourth tone | 107 | 20% |

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[6] The earliest rhyme book which was recorded in detail officially can be found in *The Phonetics of the Central Plains* by Zhou Deqing in the Yuan Dynasty.
[7] Perhaps because of this, the editor of *Guang Yun* divided the characters of the level tone into two volumes, "Level tone one" and "Level tone two".

| | | |
|---|---|---|
| entering tone | 99 | 19% |

After the evolution, the mountain became the plain. The biggest difference in information load in chronemes was just 20.5%-19%=1.5%. How symmetrical and balanced the Chinese tonal system was! If there are some doubts, I should say what should be doubted is not the result of the evolution but the causes leading to so many level tones before.

As we marvel at the balance of Chinese tonal system in the 9th century, a new situation arose. Probably after more than 100 years, namely at the turn of the 10th century, the voiced rising tone turned into the fourth tone, breaking the newly-formed balanced system all of a sudden. After this evolution, Chinese tonal system still maintained the original five tones, but had some subtle quantitative change. About 30% of characters of voiced rising tone changed into the falling tone. Obviously, this was only a local trimming, with strict conditions: the initials had to be voiced. I think the cause for this change is that the tonal system after the level tone division was too well balanced for the language users, who were not always "satisfied with one's place", and liked to create something new to break the balance or pursue something different. The result of this evolution is as follows:

| tones | *Guang Yun* pages | percentage |
|---|---|---|
| first tone | 106 | 20.5% |
| second tone | 106 | 20.5% |
| third tone | 70 | 13.7% |
| forth tone | 142 | 26.3% |
| entering tone | 99 | 19% |

Evidently, the change in the voiced characters broke the balance of Chinese tonal system in the 9th century, which led to the situation where there were less characters of rising tone than those of falling tone, so the information load of falling tone had nearly doubled that of the rising tone. The biggest difference in information load then was 26.3%-13.7%=12.6%. The information loads of the five tones are ordered as such: Falling tone > First tone > Second tone > Entering tone > Rising tone. It can be predicted that this unbalanced situation was waiting for a new break to get a new balance.

As expected, probably at the same time or a little later, a new evolution began, namely the entering tone dividing into three tones. And the evolution was completed in the northern Mandarin dialect in the prime of the Yuan Dynasty. *Zhong Yuan Yin Yun——Zheng Yu Zuo Ci Qi Li* (《中原音韵·正语作词起例》, *The Phonetics of the Central Plains: Examples of Word Making in Standard Chinese*) written by Zhou Deqing pointed out, "*Yin Yun* (The Phonetics of the Central Plains) contains no entering tone, for it has been divided into three tones, the level tone, the rising tone and the falling tone. Our predecessors have recorded this evolution clearly in their works but with no systematic

discussion. Now, I'd like to collect the characters with the same sound. If there is something wrong, my comrade, please correct it for me." "The entering tone was divided into three tones to enrich the rhyme for poetry. However, the entering tone was still distinguished from the others." There are two points we must figure out. One is "Our predecessors have recorded this evolution". So the entering tone must have vanished earlier than the book *The Phonetics of the Central Plains*, because Zhou Deqing based his work on the Yuan verse rhyming scheme stipulated by such predecessors as Guan, Zheng, Bai,, Ma, etc. Another is "the entering tone is still distinguished from the others." Zhou Deqing here referred to the dialect in some part of the central China rather than the capital of Yuan. Thus, we can get that the evolution of entering tone was completed in the 13th century, the golden time of Yuan verse. The Chinese tonal system had experienced two shock waves in this evolution simultaneously: (1) The original five tones were reduced to four; (2) The characters (approximately 19% of *Guang Yun* (广韵)) originally with the entering tone were redistributed to other tones, adding to the imbalance in information load of the four tones on the basis of evolution of the voiced rising tone.

According to Tang Zuofan (1987:175), modern Chinese has about 500 characters that originally had entering tone. In modern Beijing dialect, the four intonations to replace them are distributed as follows:

| Distributed tone | number of characters | percentage |
|---|---|---|
| First tone | 75 | 15% |
| Second tone | 150 | 30% |
| Third tone | 30 | 6% |
| Fourth tone | 250 | 50% |

The chart above shows the approximate proportion of the characters with entering tone in *Guang Yun* dividing into each tone respectively.    Putting together this and the preceding data, the result of this evolution of the entering tone can be graphed as follows:

| tones | initial percentage | percentage of the entering tone dividing | | present percentage |
|---|---|---|---|---|
| first tone | 205% | 15% | converted into 2.5% | 23% |
| second tone | 205% | 30% | converted into 6% | 26.5% |
| third tone | 137% | 6% | converted into 1.2% | 24.5% |
| fourth tone | 263% | 50% | converted into 9.5% | 35.8% |

The table tells us that, after the evolution of the entering tone, the order of the information load of each tone was adjusted as follows: Falling tone > Second tone > Rising tone > First tone. The information load of the falling tone not only still occupied the first place, but also increased by nearly 10 percentage points compared with the original. The information load of the first tone and the second both had increased respectively but the gap between the first and the others grew much wider. Furthermore, the biggest difference

in information load in the tonal system is: 35.8%-23%=12.8%. The information load of Chinese tonal system has roughly maintained this pattern up to the present.

## 2.2.2. Internal compensation between chroneme and toneme

Example one: The Bantu stock and Polynesia stock in African continent both are agglutinating languages, and they have almost the same number of segmental phonemes. The difference is that the Bantu has the toneme to distinguish meaning while the Polynesia uses the chroneme. These two stocks from the same primitive mother tongue stepped onto the different paths in the historical process and chose the different non-segmental phonemes to distinguish meanings.

Example two: Four languages in the southwest language group of the Zhuang language branch of the Dong Dai family have almost the some number of segmental phonemes (They all have simple initials and complex finals), but have obvious differences in toneme and chroneme ( as seen in the next table).

|  | Dai language | Lao Language | Zhuang Language | Xishuangbanna language | Dehong Language |
|---|---|---|---|---|---|
| The quantity of tonemes | 5 | 6 | 8 | 9 | 9 |
| The scope of chroneme distribution | All vowels | All vowels | Vowels with coda | One vowel | One vowel |

From the above table we know that, in this language family, the number of tonemes is in inverse proportion to the scope of the vowels with or without the opposition of long and short phones.

The compensation of pitch and length is somewhat alike in Mandarin tonal system and may serve as a relevant witness; the system has three aspects, the pitch, length and intensity, with pitch as its essential ingredient (Lin Maocan and Yan Jingzhu, 1980). But this is only the general case. If we expand our horizon, we discover some unusual changes. As a tonic language, the difference in pitch in a syllable is capable of meaning differentiation. But when it comes to bi-syllable or unstressed or stressed syllable, there arises a qualitative difference because the essential ingredient there becomes the length rather than the pitch. With regard to this issue, Lin Tao's (1983) research is the most persuasive. He composes the length of the first syllable of bi-syllable as 210 milliseconds, that of the latter syllable as 240 milliseconds, and that of the unstressed as 140 milliseconds. The length of the two kinds of bi-syllable groups is presented as follows:

| Type Of Bi-Syllables | The Former Syllable | The Latter Syllable | Total Length |
|---|---|---|---|
| Stressed+ Stressed | 210milliseconds | 240milliseconds | 450milliseconds |
| Stressed+ Unstressed | 210 milliseconds | 140millisecond s | 350milliseconds |

He chose 7 "stressed + stressed" syllable words (鸭头(yātóu)、一亿(yíyì)、马头(mǎtóu)、大爷(dàyé)、大衣(dàyī)、大姨(dàyí)、大义(dàyì)). To begin with, he cut the length of the

second syllable four times: first he cut off 100 milliseconds, next 130 milliseconds, and the third time ,150 milliseconds, then there are four stressed-stressed length patterns:

H(1)210+240=450 milliseconds

H(2)210+140=350 milliseconds

H(3)210+110=320 milliseconds

H(4)210+90=300 milliseconds

He chose 5 "stressed + unstressed" syllable words ("丫·头(yātou)、姨·妈(yíma)、码·头 (mǎtou)、大·爷 (dàye)、大·意 (dàyi)") to cut in the same way and gets three kinds of stressed-unstressed length pattern:

L(1)210+140 =350 milliseconds

L(2)210+110 =320 milliseconds

L(3)210+90 =300 milliseconds

Among them, H (2) and L (1) have the same length and H (3) and L (2) are the same. When composing, due to the different preceding syllable, we use the following data for the pitch of unstressed syllable:

After the first tone          120-60Hz

After the second tone         130-80Hz

After the third tone          100-130Hz

After the fourth tone         100-60Hz

Then we change frequencies to 130-130Hz or 80-120Hz (or 140-80Hz) respectively, and so each unstressed syllable has three values, matched simultaneously with three different lengths: 140Hz, 110Hz, and 90Hz, making it possible for each unstressed syllable to be capable of 9 different kinds of pitch and length. Finally we examine the function of pitch and length in unstressed syllables by a perception experiment. After the experiment, we can get the following results for the 7 stressed+stressed syllables:

| Total Length | Recognizable | | Unrecognizable |
|---|---|---|---|
| | Stressed+Stressed | Stressed+Unstressed | |
| 450 milliseconds | 90% | 3% | 7% |
| | 83% | 7% | 10% |
| 350 milliseconds | 70% | 13% | 17% |
| | 67% | 18% | 15% |
| 320 milliseconds | 50% | 30% | 20% |
| | 47% | 33% | 20% |
| 300 milliseconds | 30% | 43% | 27% |
| | 32% | 45% | 23% |

The statistical figure tells us that, with the length reducing gradually, the stressed+stressed is getting more difficult to be heard as stressed+stressed, but easier to be heard as stressed+unstressed. The percentage of unrecognizability also rises gradually. The test results fully demonstrate that length plays an important role in distinguishing stressed

and unstressed. Also, the pattern for words of stressed-unstressed structure is roughly the same, though the tendency is not so obvious as stressed+stressed. On the contrary, in these two kinds of disyllabic words, the pitch is not that important. Moreover, the shorter the second syllable is, the less function the pitch can play in perception.

Even though this research has only involved synchronic and static analysis, it has provided some crucial evidence for us. Firstly, it is affirmed that the Chinese tonal system takes the pitch as its essential factor, moreover, the neutral tone has formed slowly from the non-unstressed syllables through neutralization. So it can thus be assumed that, essential factor of the neutral syllables is also realized through pitch like non-unstressed syllables, but later it gradually turned to length. Why? Mr. Lin has offered an incisive explanation: "Chinese is a tonic language, so the pitch in the stress has played a major role in distinguishing meanings. The change of length is mainly used to distinguish the stressed from the unstressed. Pitch and length in language have an explicit division of function." In other words, before the unstressed syllable appeared, pitch in Chinese was very important. And after the unstressed syllable appeared, its status started to weaken, and then gave up its place to length gradually. In other words, the loss of the pitch function for meaning differentiation in unstressed syllables is suitably and fully compensated by length. Besides, length has always been secondary to pitch in function in Chinese syllables.

### 2.2.3. Internal compensation between chroneme and stroneme

Internal compensation between chroneme and stroneme has been discovered in the west and the south language branches of the Slav language family. The west branch includes Polish, Czech, while the south branch contains Macedonian, Serbian-Croatian language and Slovenian language. Among them, Polish and Macedonian are too unusual to discuss here. The other three languages are more or less the same in the number of segmental phonemes. Suppose other conditions are the same, and we have the data of next table.

| Languages | Segmental Phonemes | Chronemes | Stronemes |
|---|---|---|---|
| Slovenian | 30 | 0 | 3 |
| Serbia-Croatian | 25 | 0 | 4 |
| Czech | 30 | 2 | 0 |

The languages listed in the table are divided into two groups: The first two languages have stronemes while the latter language chronemes. The two types have compensated for each other.

### 2.2.4. Internal compensation between toneme and stroneme

Various Chinese dialects have tonemes and most of them have stronemes. But the Guangdong dialect is an exceptional case, for it has some chronemes which the others are short of. For example, it has the final oppositions as follows: [-aːi]("拜, 皆")—[-ai]("米,

辉"), [-a:u]("包,抓")—[-au]("斗,亩"), [-a:m]("胆,监")—[-am]("甘,今"), [-a:n]("班,间")—[-an]("奔,斤"), [-a:ng]("冷,硬")—[-ang]("杏,肯"), [-a:p]("杂,集")—[-ap]("立,入"), [-a:t]("八,刮")—[-at]("笔,不"), [-a:k]("百,格")—[-ak]("北,克"). Obviously, 8 pairs of 16 finals formed by the Guangdong dialect phoneme /a/ are opposite to the finals by its length opposition. Therefore, polysyllablic words in Guangdong dialect lack the opposition between the stressed and unstressed phonemes that exists commonly in other dialects.

## 2.3. Internal compensation between segmental phoneme and non-segmental phoneme

Among the languages that belong to the same morphophonemic type or in the close families, if one has fewer segmental phonemes, compensation may be realized by non-segmental phonemes.

Example one: Contrast between several agglutinating languages. Firstly, see the material in the following table.

| Language | Consonants | Vowels | Non-Segmental Phonemes |
|---|---|---|---|
| Japanese | 23 | 5 | chronemes |
| Bantu | 1/9 | 5 | tonemes |
| Polynesian Group | 13 | 5 | chronemes |
| Hausa Language | 30 | 5 | chronemes+tonemes |
| Indonesian | 25 | 9 | 0 |

The five languages or groups above have almost the same number of segmental phonemes and their syllables are all of CV pattern, and moreover, they have only several dozens of syllables. But generally their words are very long, with at least one non-segmental phoneme, which more or less compensate for the pronunciation system. Swahili that belongs to the Bantu language family is the only one without a tonal system, but it has a superabundance of segmental phonemes, of the order of 31 (26 consonants), which is twice as many as other languages in the same language family. Comparing with other languages in Bantu family, we have enough reasons to say that Swahili lost or had not produced the tones, but a great number of consonant phonemes had compensated for the loss of this pronunciation system. Hausa, belonging to Chadic group in the Afro-Asiatic family is also an exceptional case. Only languages in Chad stock have tones, but Semitic group, Egyptian-Coptic group, Berber group, and Cushitic group in this language family do not have any distinctive tonemes. Comparing them with the early pronunciation system, we can find that Chadic group not only kept chronemes, but also added four new tonemes.

Example two: Most of the languages in the Austronesian family (the Malayo-Polynesian family) have distinctive chronemes, while Indonesian group has no non-segmental phonemes. Why? Originally the former only had 8 segmental phonemes, while the latter

had 34. Malay in the Indonesian group has 24 consonants, 6 monophthongs and 3 diphthongs; the Madagascar language has 22 consonants, 6 monophthongs and 2 diphthongs. They have many more segmental phonemes than the Polynesian.

Example three: Tibetan language and Jiarong language both belong to the Tibetan language branch, but the former has 4 tones while the latter has none. Why might this be between so close languages? The following contrast is helpful in solving the riddle.

| Languages | Initials | Finals | Codas | Tones |
|---|---|---|---|---|
| Tibetan | 28 | 47 | 5 | 4 |
| Jiarong Languange | 233 | 71 | 9 | 0 |

The above table shows that number of codas in Jiarong is nearly twice more than that of Tibetan, the number of finals is one half more and the initials are 7.3 times more. The loss of tones in Jiarong is compensated with more than enough segmental phonemes.

Example four: Deng language, Jingpo language, and Dulong language in Jingpo language branch of the Tibeto-Burman language family are quite close to each other, but the former two have 4 tones while the last has only three. The next chart shows related figures of the three languages.

| Languages | Initials | Finals | Consonant Ending | Tones |
|---|---|---|---|---|
| Dengyu, Darang Dialect | 49 | 44 | 3 | 4 |
| Jingpo Language | 31 | 88 | 7 | 4 |
| Dulong Language | 51 | 132 | 16 | 3 |

The figures tell us that the Dulong language has many more finals than the first two languages, exactly as many as the sum of the first two, and has one half more codas than their sum, which compensates for the tone lost.

Example five: Internal compensation between stroneme and segmental phonemes in 11 languages of Slav branch in Indo-European family. See the following table.

| Language Branchs | Languages | Types | Initials | Vowels | Total of Segmentla Phonemes | Chronemes | Stronemes |
|---|---|---|---|---|---|---|---|
| East Branch | Russian | Inflecting | 37 | 5 | 42 | 0 | Free |
| West Branch | Polish | Inflecting | 35 | 8 | 43 | 0 | 0 |
| | Czech | Inflecting | 25 | 5 | 30 | Long or short | 0 |
| South Branch | Serbian-Croatian | Inflecting | 25 | 5 | 30 | 0 | Fixed 3 |
| | Slovenian | Inflecting | 20 | 5 | 25 | 0 | Fixed 4 |
| | Macedonian | analytic | 26 | 5 | 31 | 0 | 0 |

(Because of insufficient data, I just list six languages in the table.)

Firstly, Russian and Polish have the most segmental phonemes, respectively 42 and 43.

The stroneme compensates for the one phoneme that does not exist in Russian. Other languages have almost the same number of segmental phonemes, between 25 and 31. Czech has chronemes, while Serbian-Croatian and Slovenian have the fixed stresses. The latter with least segmental phonemes has more fixed stresses. In a word, they all have different compensations. Macedonian, most noticeably, has no chronemes or stronemes at all. Maybe because of this, it is turning from an inflectional language into an analytic language. So in the historical course of the Slav branch, when the number of segmental phonemes was reduced to 30, there might be two types of change, one in which non-segmental phonemes compensates for the loss, and the other in which the language changes types.

Non-segmental phonemes will trigger segmental compensation when their distinctive features are weakened. According to Li Rulong (1990), in Chinese, the tones influenced the initials and the finals a great deal, especially the finals. There are two kinds of influences, strengthening and weakening. In particular, the strengthening of low tones occurs in the following way: (1)high vowels are changed into low vowels to increase sonority; (2)low vowels are changed into complex or compound vowels to increase sonority; (3) one syllable splits into two syllables.

The reason why the low tones strengthened the initials and finals is that its intensity is weaker, so the strengthened vowel is a kind of compensation to maintain the balance of the entire syllable intensity. This kind of strengthening phenomenon mainly occurred in southern Chinese dialects. The changed finals in Fuzhou dialect are a typical example: it only occurred in three low tones, the unvoiced falling tone, the voiced falling tone and unvoiced entering tone; and it influenced all the finals (the only exception is the finals with the nucleus /a/). It has three concrete rules: (1) a high vowel final is changed into a complex vowel with an added vowel, which is one degree opener, as its nucleus; (2) a final compound with two high vowels also adds a vowel one degree opener as its nucleus; (3) All the other vowels become opener by one degree. For example

基[-i]—记[-ei]　　　　姑[-u]—故[-ou]

歌[-o]—告[-ou]　　　　辉[-ui]—会[-uoi]

## 3. Conclusion

This essay has elaborated the theory of internal compensation in language systems. Through the comprehensive induction and contrast analysis of the internal compensation on the phonological level, we not only further verify the universality of the internal compensation in languages, but also reveal operation mechanisms and the language internal actions which have not been perceived before without this theory. Moreover, it has offered new explanations for phenomena that have not been explained or explained insufficiently,

to supporting the explanatory power. Of course, besides the pronunciation, the theory manifests itself in other aspects of a language (Wang Jue 2001 for details). For reasons of space, these are not covered here.

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