An Introduction to the Phonological Basis of Chinese Characters in Modern Mandarin

by

Stephen M. Kraemer
American English Institute
University of Oregon
skraemer@uoregon.edu
现代汉字语音简介

雷思遠
American English Institute
University of Oregon
skraemer@uoregon.edu
Phonetic Compound
（形声字xingshengzi）

• A “signific” part, which indicates meaning
• plus
• A “phonetic” part which indicates sound
• 妈 [ma1] = 女 (female) + 马 [ma3]
The Mandarin Syllable

- A syllable in Modern Standard Mandarin
- Consists of:
  - An initial
  - A final
  - A tone
The Final

• The final can also be broken down into a medial (vowel), a nucleus (vowel) and an ending (vowel or consonant)

• Final = (M)N(E)
# Mandarin Consonants

<table>
<thead>
<tr>
<th>Source: Kratochvil (1968:25)</th>
<th>Labial</th>
<th>Labiodental</th>
<th>Dental</th>
<th>Alveolar</th>
<th>Alveopalatal</th>
<th>Palatal</th>
<th>Velar</th>
</tr>
</thead>
<tbody>
<tr>
<td>stop</td>
<td>p, p’</td>
<td>t, t’</td>
<td></td>
<td>k, k’</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>nasal</td>
<td>m</td>
<td>n</td>
<td></td>
<td>(ŋ)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fricative</td>
<td>f</td>
<td>s</td>
<td></td>
<td>ŋ, ʐ(r)</td>
<td>ɕ</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>lateral</td>
<td></td>
<td>l</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>affricate</td>
<td>ts, ts’</td>
<td>tʂ, tʂ’</td>
<td>tɕ, tɕ’</td>
<td>te, te’</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Mandarin Vowels

1 ɻi  y(ü)  u
  e  ə  ɛ  ɤ
  ə
  a  o

Source: Cheng(1973:12)
Background Literature

• Xu Shen—說 文 解 字 Shuo Wen Jie Zi (2nd cent. A.D.)
• Soothill-1911
• Karlgren-1916, 1923a, 1923b, 1926, 1940, 1949, 1958
• Wieger-1927/1965
• Astor-1970
• Kraemer-1980, 1991a, 1991b
• DeFrancis-1984
• Alber-1986, 1989
周有光 Zhou Youguang (1980)
汉字声旁读音便查 Hanzi shengpang duyin biancha (A handy look up for the pronunciation of phonetics in Chinese characters)

• Zhou analyzes characters in the Xin Hua Zidian (1971) based on Phonetic elements and sets up three categories of phonetic compound characters based on the similarity of the phonetic compound to the pronunciation of the phonetic itself.

• The 3 categories are:
• (1) Same pronunciation (同音 Tong yin), including same or different tones
• (2) Similar pronunciation (半同音 Ban tong yin) (similar phonemes)
• (3) Different pronunciation (异音 Yi yin) (not as similar to the original phonetic pronunciation)
John DeFrancis (1984)

- DeFrancis also sets up three categories of phonetic compound characters based on the similarity of the phonetic compound to the pronunciation of the phonetic itself.

DeFrancis’s 3 categories are:
- (1) “Complete identity” (same pronunciation including tone)
- (2) “Identity except for tones in some cases”
- (3) “Partial similarity in the segmental phonemes” (DeFrancis (1984))
Types of Phonological Patterning in Mandarin Characters

- Phonemic Congruence
  Characters share one or more phonemes
- Featural Congruence
  \( V' \)'s share features
  \( C' \)'s share features
- Initials and Finals: The Segment
- Segment Structure
  Patterning in arrangement of \( C' \)'s or \( V' \)'s
- Overall Patterns in the Written Language
Phonemic Congruence
Types of Phonetic Series Based on Phonemic Congruence (Kraemer 1980)

Seven Categories:

- Totally Perfect
- Segment Perfect
- Initial Perfect
- Final Perfect
- Tone Perfect
- Initial – Tone Perfect
- Final – Tone Perfect
Seven Categories of Phonetic Series Found in Wieger (Kraemer 1980)
579 Series Found + 63 (in Astor(1970))

For a Total of 642 Series

Out of 858 Series in Wieger(1927/1965)
Seven Categories of Phonetic Series Found in Wieger (Kraemer 1980)
Out of 858 Series in Wieger (1927/1965)
• Totally Perfect-124 (+63 in Astor (1970))
• Segment Perfect-192
• Initial Perfect-35
• Final Perfect-153
• Tone Perfect-40
• Initial – Tone Perfect-13
• Final – Tone Perfect-22
Totally Perfect

• 成 [tʂʰəŋ2] (chéng-become)
• is a phonetic in 城 [tʂʰəŋ2] (chéng-city)
Totally Perfect

• 丈 [tʂɑŋ4] (zhàng-measure (land))
• is a phonetic in
  仗 [tʂɑŋ4] (zhàng-weapons)
  杖 [tʂɑŋ4] (zhàng-cane; stick)
长 [tʂɑŋ3] (zhāng-grow) is a phonetic in 张 [tʂɑŋ1] (zhāng-surname, measure word)
Segment Perfect

马 [ma3] (mǎ-horse) is a phonetic in

吗 [ma0] (ma-question word)
骂 [ma4] (mà-scold)
妈 [ma1] (mā-mother)
门 [mən²] (mén-door) is a phonetic in
们 [mən⁰] (men-plural)
方 [fɑŋ1] (fāng-place) is a phonetic in

房 [fɑŋ2] (fáng-house)
防 [fɑŋ2] (fáng-guard against)
访 [fɑŋ3] (fǎng-visit)
放 [fɑŋ4] (fàng-let go)
Initial  Perfect

• 先  [ɕiɛn1] (xīan-first) is a phonetic in
• 洗  [ɕi3]  (xǐ-wash)

• 你  [ni3]  (nǐ-you) is a phonetic in
• 您  [nin2]  (nín-you-polite)
Initial Consonant + Vowel (CV) Perfect

• 先 [ɕiɛn1] (xīan-first) is a phonetic in
• 洗 [ɕi3] (xǐ-wash)
• both share [ɕi-] xi-

• 你 [ni3] (nǐ-you) is a phonetic in
• 您 [nin2] (nín-you-polite)
• both share [ni-] ni-
Final Perfect


方 [fɑŋ1] (fāng) Series-Quantitative Analysis
方 [fɑŋ1] (fāng-place; square; just a moment ago) is a phonetic in

房 [fɑŋ2] (fáng-house)
防 [fɑŋ2] (fáng-guard against)
访 [fɑŋ3] (fǎng-visit)
纺 [fɑŋ3] (fǎng-spin)
仿 [fɑŋ3] (fǎng-imitate, copy)
放 [fɑŋ4] (fàng-let go)
旁 [p’ɑŋ2] (páng-side)
方 [fʊŋ1] (fāng-place) is a phonetic in

2 [fʊŋ2]
3 [fʊŋ3]
1 [fʊŋ4]
1 [p’ʊŋ2]

In DeFrancis’s Texts, from DeFrancis Index Volume-approx. 1700 chars.
(DeFrancis (1970))
8 characters total with individual pronunciations

1 Phonetic element with 7 phonetic compounds
6/7 = 86% Segment Perfect
1/7 = 14% Final Perfect

But 7/7 = 100% Final Perfect or Better
方 [fəŋ1] (fāng-place) is a phonetic in
房 [fəŋ2] (fáng-house)-3/4 phonemes are the same as 方 [fəŋ1]=75%phonetic
防 [fəŋ2] (fáng-guard against)-3/4= 75%phonetic
访 [fəŋ3] (fǎng-visit)-3/4= 75%phonetic
紡 [fəŋ3] (fǎng-spin)-3/4= 75%phonetic
仿 [fəŋ3] (fǎng-imitate, copy)-3/4= 75%phonetic
放 [fəŋ4] (fàng-let go)-3/4= 75%phonetic
旁 [p’əŋ2] (páng-side)-2/4= 50% phonetic

Thus the average phonetic rating of the phonetic element 方 [fəŋ1] in the above 7 characters would be 71.4 percent phonetic.
方 [faŋ1] (fāng) Series-Quantitative Analysis

方 [faŋ1] (fāng-place; square; just a moment ago) is a phonetic in

枋 [faŋ1] (fāng)
邡 [faŋ1] (fāng)
釴 [faŋ1] (fāng)
芳 [faŋ1] (fāng)
坊 [faŋ1] (fāng)
妨 [faŋ1] (fāng)
坊 [faŋ2] (fáng)
妨 [faŋ2] (fáng)
防 [faŋ2] (fáng)
舫 [faŋ2] (fáng)
鯈 [faŋ2] (fáng)
舫 [faŋ2] (fáng)
房 [faŋ2] (fáng)
紡 [faŋ3] (fāng)
仿 [faŋ3] (fāng)
访 [faŋ3] (fāng)
昉 [faŋ3] (fāng)
舫 [faŋ3] (fāng)
放 [faŋ4] (fāng)
旁 [p'ɑŋ2] (páng)
徬 [p'ɑŋ2] (páng)
[示]方 [pəŋ1] (bēng)
方 [fɑŋ1] (fāng) Series-Quantitative Analysis
方 [fɑŋ1] (fāng-place; square; just a moment ago) is a phonetic in

枋 [fɑŋ1] (fāng)
邠 [fɑŋ1] (fāng)
芳 [fɑŋ1] (fāng)
坊 [fɑŋ1] (fāng)
妨 [fɑŋ1] (fāng)
坊 [fɑŋ2] (fāng)
妨 [fɑŋ2] (fāng)
防 [fɑŋ2] (fāng)
舫 [fɑŋ2] (fāng)
舫 [fɑŋ2] (fāng)
房 [fɑŋ2] (fāng)
紡 [fɑŋ3] (fāng)
仿 [fɑŋ3] (fāng)
访 [fɑŋ3] (fāng)
昉 [fɑŋ3] (fāng)
舫 [fɑŋ3] (fāng)
放 [fɑŋ4] (fāng)
旁 [p'ɑŋ2] (páng)
徧 [p'ɑŋ2] (páng)
[示]方 [pəŋ1] (běng)
方 [făn1] (făng-place) is a phonetic in

6 [făn1]
6 [făn2]
5 [făn3]
1 [făn4]
2 [p’ăn2]
1 [pên1]

22 characters total with indiv. Pronunciations (Zhou Youguang (1980))

1 Phonetic element with 21 phonetic compounds

6/21 = 29% Totally Perfect
12/21 = 57% Segment Perfect
2/21 = 10% Final Perfect
1/21 = 5% Ending η Perfect

But 18/21 = 86% Segment Perfect or Better
21/21 = 100% Final Perfect or Better
方 [fɑŋ1] (fāng-place) is a phonetic in

6 [fɑŋ1] 4/4 phonemes are the same as 方 [fɑŋ1]=6 X 100% phonetic
6 [fɑŋ2] 3/4 phonemes are the same as 方 [fɑŋ1]=6 X 75% phonetic
5 [fɑŋ3] 3/4 phonemes are the same as 方 [fɑŋ1]=5 X 75% phonetic
1 [fɑŋ4] 3/4 phonemes are the same as 方 [fɑŋ1]=1 X 75% phonetic
2 [p'ɑŋ2] 2/4 phonemes are the same as 方 [fɑŋ1]=2 X 50% phonetic
1 [peŋ1] 2/4 phonemes are the same as 方 [fɑŋ1]=1 X 50% phonetic

22 characters total with indiv. Pronunciations (Zhou Youguang (1980))

1 Phonetic element with 21 phonetic compounds

Thus the average phonetic rating of the phonetic element 方 [fɑŋ1] in the above 21 characters would be 81% percent phonetic.
Rime Perfect (NE Perfect)

- In a rime perfect phonetic series, the characters share this same main vowel or nucleus (N) followed by the same final vowel or consonant ending (E).
Rime Perfect

- 门 [mən2] (mén-door) is a phonetic in

- They share the rime [ən] (-en ).
Rime Perfect: Underlying Forms

- 山 [ʂan1] (shān-mountain) is a phonetic
- 仙 [ɕiɛn1] (xiān-immortal).

- They have the two rimes [an] and [ɛn]
- But they share the same underlying form of the rime (-an) (See Cheng 1973).
Rime Perfect: Underlying Forms

- 占 [tʂan1,4] (zhān-to divine; zhàn-to occupy) is a phonetic in
- 点 [tiɛn3] (diǎn- a point) and

- They have the two rimes [an] and [ɛn.]
- But they share the same *underlying form* of the rime (-an) (See Cheng 1973).
Featural Congruence
Similar Vowel Features

- 是 [ʂɨ4] (shì-to be) is a phonetic in 题 [t’i2] (tí-topic) and 提 [t’i2] (tí-lift from above).
- They share the similar final vowels: [ɻ] (i) (in shi) and [i] (i) (in ti).
- The vowels [ɻ], [i] and [i] are high, unround vowels and can be considered allophones of the single phoneme -i (see Kratochvil 1968:28).
- Due to co-occurrence restrictions, [ʂ] takes only the back unround vowel [ɻ], while [t] takes only the front unround vowel [i].
Similar Vowel Features

- 是 [ʂʅ4] (shì-to be) is a phonetic in
- 题 [t′i2] (tí-topic) and
- 提 [t′i2] (tí-lift from above).
- C1 V / C2 V  (V = i) (phonemic) same final V phonemically)
- [ʂʅ4] / [t′i2]
- (shi) / (ti)
Similar Vowel Features

• 是 [ʂʅ4] (shì-to be) is a phonetic in
• 題 [t’i2] (tí-topic) and
• 提 [t’i2] (tí-lift from above).

• Cheng(1973:14) considers [ɨ] and [ i ] to be variants of a high unround central vowel ɪ and [ i ] to be a separate underlying high unround vowel. Using his phonemic analysis, we might express the pattern [ʂʅ4] [t’i2] as

• [ʂʅ4] C1 V1 [+high,-round]
• [t’i2] C2 V2 [+high,-round]
Similar Vowel Features

• 是 [ʂʅ4] (shì-to be) is a phonetic in
• 寬提 匙湜题堤騠醍 (Zhou (1980))
• 湜[ʂʅ2]
• 寬[ʂʅ2]
• 匙[ʂʅ0] [tf’ʅ2]
• 题 [t’i2]
• 提 [t’i2] [ti1]
• 驠[t’i2]
• 醒[t’i2]
• 堤[ti1]
Similar Vowel Features

• 是 [ʂʅ4] (shì-to be) is a phonetic in
• 寰提 匙湜题堤騠醍
We see the pattern
• [ʂʅ4] [ʂʅ2] [ʂʅ0] [tʂʰ2] [tʰ2] [ti1] as

• [ʂʅ4,2,0] C1 V1 [+high,-round]
• [tʂʰ2] C2 V1 [+high,-round]
• [tʰ2] C3 V2 [+high,-round]
• [ti1] C4 V2 [+high,-round]
Similar Vowel Features

带 [tai4] (dài-to wear) is phonetic in

滞 (tʂʅ4) (Zhou1980)

• We see the pattern
• [tai4] [tʂʅ4] as

• [tai4] C1 V1 [+low,-round] V2 [+high,-round]
  [tʂʅ4] C2 V2 [+high,-round]
Similar Vowel Features

• (滴) [ti] (di) is a phonetic in
  搏[ts'ai1] 謡[tʂɤ2] (Zhou (1980))

• 滴[ti1]
• 嫡[ti2]
• 嘀[ti2]
• 銳 [ti1,2]
• 蹦[ti2][tʂʅ2]
• 搏[ts'ai1]
• 謿[tʂɤ2]
Similar Vowel Features

• (滴) [ti] (di) is a phonetic in
  摘 [tʂai1] 警 [tʂɤ₂] (Zhou (1980))

We see the pattern

• [ti1] [ti2] [ʈʂɨ˨] [tʂai1] [tʂɤ₂] as

• [ti1,2] ] C1 V1 [+high,-round]
• [ʈʂɨ˨] C2 V2 [+high,-round]
• [tʂai1] C2 V3 V1 [+low,-round] [+high,-round]
• [tʂɤ₂] C2 V4 [+mid,-round]
Initial Consonant Features
Final Perfect with Related Initial Consonants

长 [tʂʰɑŋ2] (cháng-long) 张 [tʂɑŋ1] (zhāng-surname, measure word).
They share the final [ɑŋ] -ang .

The initial Consonants are [tʂ] zh and [tʂ‘] ch .

Both initial Consonants are alveopalatal (retroflex) affricates. They differ only in the feature of aspiration. The consonant [tʂ‘] ch is aspirated, while the consonant [tʂ] zh is unaspirated.
Final Perfect with Related Initial Consonants


The initial consonants are [ f ]  and [p’] .

The initial consonant [f] is labiodental and the initial consonant [p’] is bilabial.
Final Perfect with Related Initial Consonants

艮 [kən3,4] (gěn, gèn -brusque; surname)
根 [kən1] (gēn-root)
很 [xən3] (hěn-very).
They share the final [ən] -en .

The initial Consonants are [k] g and [x] h .
• The consonants are both velars. They have the same place of articulation.
Initial Consonant Features
t

(Duanmu(2007))

• [ +stop
  -fric
  -voice
  -asp
  +ant]
  +Cor
t'

(Duanmu(2007))

- [ +stop
  - fric
  - voice
  + asp
  + ant]
  + Cor
The two Consonants share voiceless anterior coronal stop features. They have 5 features in common, and differ in 1 feature. They differ only in the feature of [aspiration].
t, t'

党 (tan³) Phonetic series (Zhou 1980):

党 (tan³) 谠 (tan³) 傥 (t’an³) (金)党 (t’an³)

• 党 = [+stop → t / 党 谠
  -fric t’ / 傥 (金)党
  -voice
  +ant
  +Cor
t

(Duanmu(2007))

• [ +stop
  -fric
  -voice
  -asp
  +ant]
  +Cor
tʂ

(Duanmu(2007))

• [ +stop
  +fric
  -voice
  -asp
  -ant]
  +Cor
The two Consonants share voiceless unaspirated coronal stop features. They have 4 features in common, and differ in 2 features, [friction] and [anterior]. (Note: the dental affricate [ts] also shares these features.)
\( t, \ tʂ \)

帶 (Tai4) Phonetic series (Zhou 1980):

帶 (tai4) 滯 (tʂʅ4)

- 帶 = [+stop \rightarrow t / 帶
  -voice \quad tʂ / 滯
  -asp \quad (ts \ does \ not \ occur)
  +Cor
(滴)(Ti) Phonetic series (Zhou1980):

滴(ti1) 嫡(ti2) 嘀(ti2) 镝(ti1,2) 踏(ti2, tʂʅ2)
摘(tʂai) 谪(tʂɤ2)

• (滴) = [+stop → t / 滴 嫡 嘀 镝
-voice] tʂ / 摘 谪
-asp t, tʂ /踏
+Cor (ts does not occur)
\textbf{t}’

(SanDuanmu(2007))

\begin{itemize}
\item [+stop
  \begin{itemize}
  \item [-fric]
  \item [-voice]
  \item [+asp]
  \item [+ant] +Cor
  \end{itemize}
\end{itemize}
tʂʻ

(SanDuanmu(2007))

• [+stop
  +fric
  -voice
  +asp
  -ant]
  +Cor
The two Consonants share voiceless aspirated coronal stop features. They have 4 features in common, and differ in 2 features, [friction] and [anterior]. (Note: the dental affricate [ts’] also shares these features.)
堂(t‘anŋ2) Phonetic series (Zhou1980):

堂(t‘anŋ2)螳(t‘anŋ2)膛(t‘anŋ2)镗(t‘anŋ1,2)蹚(t‘anŋ1)镗(t‘anŋ2)瞠(t‘t̥ sɐŋ1)

樘=t [+stop → tʰ /堂螳膛镗蹚樘

-voice] t̥ s’ /瞠

+asp (ts’ does not occur)
+Cor
Initals and Finals: The Segment

To look at the full segment pronunciation of characters in phonetic series in Modern Mandarin, one needs to recombine initials and finals (the segment), looking at their combinations and paying attention to their co-occurrence restrictions.
Initials and Finals: The Segment

带(Tai4) Phonetic series (Zhou1980):

带 (tai4) 滞(tʂɀ4)
带(Tai4) Phonetic series (Zhou1980):

带 (tai4) 滞(tʂʅ4)

带  = [+stop V[-mid,-rnd](V1)[+high,-rnd] 4 → tai4 / 带
       -voice
       -asp]
       +Cor  (ts does not occur)
           (ta, tai, ti, tʂa, tʂai do not occur)
t, ʂ

(滴)(ti) Phonetic series (Zhou1980):

滴(ti1) 嫡(ti2) 嘀(ti2) 镆(ti1,2) 踏(ti2, ʂʅ2) 
摘(tʂai) 譽(tʃe2)

(滴)= [+stop  V[-rnd] (V1)[+high,-rnd] → ti1/滴 镆 
-voice → ti2/嫡 嘀 镆
-Asp → ti2, ʂʅ2 /踏
+Cor] → tʂai /摘
→ tʃe2 /谪

(ts does not occur)
(ta, te, tei, tai, tʂa, tʃei do not occur)
Segment Structure
Same Consonant-Vowel Pattern

• 是 [ʂɿ4] (shì-to be)
  題 [t’i2] (tí-topic) and 提 [t’i2] (tí-lift from above).

• C1 V / C2 V  (V = i) (phonemic) (same final V phonemically)

• [ʂɿ] / [t’i]

• (shi) / (ti)
Other Consonant-Vowel Patterns: Rime Perfect

- 山 [ʂan1] (shān-mountain) is a phonetic in
- 仙 [ɕiɛn1] (xiān-immortal)
- C1 V n / C2 i V n (V = a) (same underlying vowel)
- [ʂan] / [ɕiɛn]
- (shan) / (xian)

- 占 [tʂan1] (zhān-to divine) is a phonetic in
- 点 [tɕiɛn3] (diǎn- a point) and 店 [tɕiɛn4] (diàn-shop).
- C1 V n / C2 i V n (V = a) (same underlying vowel)
- [tʂan] / [tɕiɛn]
- (zhan) / (dian)
Overall Patterns in the Written Language
d, zh  Phonetic Series

- (Di) (滴) di, zhi, zhe, zhai
- Dai 带 dai, zhi
- Ding 定 ding, dian, zhan
- Du  du, dao, zhuo
- Dui 队 du, zhuo, zhu, zhong
t  ts (d, zh)

Phonetic + Compound Characters

• Ti (滴)  ti  tsɿ  tsɿg  tsɿai

• Tai 带  tai  tsɿ

• Tin 定  tin  tiɛn  tsɿn

• Tu tu  tau  tsuo

• Tuei队  tuei,  tsuei

• (Tsuo)（啄） tu  tsuo  tsu  tsuŋ
t  tʂ  tʂ́̚ (d, zh, ch)

• Di 氐 Di, de, zhi, chi
ti  tr  tʂɿ  tʂɿ́

• (Chuo)啜 duo, zhui, chuo, chuai
tuo  tʂuei  tʂʻuo  tʂʻuai
t tsʻ (d, ch)

- Dang 当 dang, cheng
təŋ tʂʻəŋ

- Dong 东 dong, chen
tun tʂʻəŋ
tʻ tʂ tʂʻ (t, zh, ch)

Tong 童 tong, tuan, zhuang, chuang, chong  
tʻun tʻuan tsʻuan tsʻun tsʻun

• (Zhen)(珍) tian, zhen, chen  
tʻien tʻsen tsʻen

• Zhuan 专 tuan, zhuang, chuan  
tʻuan tsuan tsʻuan
t  tʻ  tʂ (d, t, zh)

• Dong  dong, tong, teng, tu, zhong
t tʼ tʂʼ (d, t, ch)

• Di 帝 di, ti, chi
ti tʼi tʂʼɿ

• Deng 登 deng, teng, cheng, chen
təŋ tʼəŋ tʂʻəŋ tʂʻən
t t’ tʂ tʂ’ (d, t, zh, ch)

• Dan旦 dan, da, tan, zha, zhou, cha
tan tə t’an tʂə tʂou tʂ’ə

• Tun屯 dun, du, den, tun, zhun, chun
tuen tu tən tʂunən tʂ’unən

Zhou周 diao, tiao, ti, zhou, zhao, chou
tiau t’iau t’i tʂou tʂau tʂ’ou
A General Pattern of Initials

\[
\begin{align*}
  t & \ tʂ' \ (d, \ ch) \\
  t & \ tʂ \ tʂ' \ (d, \ zh, \ ch) \\
  t' & \ tʂ \ tʂ' \ (t, \ zh, ch) \\
  t & \ t' \ tʂ \ (d, \ t, \ zh) \\
  t & \ t' \ tʂ' \ (d, \ t, \ ch) \\
  t & \ t' \ tʂ \ tʂ' \ (d, \ t, \ zh, \ ch)
\end{align*}
\]

Each Series of Initials is a more restricted subset of the larger set of initials $t \ t' \ tʂ \ tʂ' \ (d, \ t, \ zh, \ ch)$. 
A General Pattern of Initials

- $t\ tʂ'$ (d, ch)
- $t\ tʂ\ tʂ'$ (d, zh, ch)
- $t'\ tʂ\ tʂ'$ (t, zh, ch)
- $t\ t'\ tʂ$ (d, t, zh)
- $t\ t'\ tʂ'$ (d, t, ch)
- $t\ t'\ tʂ\ tʂ'$ (d, t, zh, ch)

• [+stop]
  -voice
  +Cor

The Initials Consonants share voiceless coronal stop features. They have 3 features in common, and differ in 3 features, [friction] [aspiration] and [anterior].
However, the initial consonants above are a restricted set of voiceless coronal stops. The non-retroflex voiceless coronal stops (ts  ts‘ ) (zh  c) do not occur.
Summary of Initial Features

• t  t’  5 features in common, and differ in 1 feature,
• t,  tʂ  4 features in common, and differ in 2 features
  t’ tʂ  4 features in common, and differ in 2 features
    t  tʂ’ (d, ch)
    t  tʂ  tʂ’ (d, zh, ch)
    t’ tʂ  tʂ’ (t, zh,ch)
    t  t’ tʂ (d, t, zh)
    t  t’ tʂ’ (d, t, ch)
    t  t’ tʂ  tʂ’ (d, t, zh, ch)
•  3 features in common, and differ in 3 features
A General Pattern of Initials

Each phonetic series above represents an individual pattern of initial consonants, each of which is a subset of a more general pattern.
Final Patterns

• In addition to the initials, the finals in the above series are also showing definite phonological patterns.
t  ts (d, zh)

• Di （滴） di, zhi, zhe, zhai
ti, tʂɻ, tʂɤ, tʂai

• All Finals are V or VV, unround.
t  tʂ (d, zh)

- Dai 带 dai, zhi
tai, tʂɿ

- All Finals are V or VV, unround.
t  tʂ (d, zh)

- Ding 定 ding, dian, zhan
  tiŋ  tiɛn  tʂan
All Endings are C (nasal)
All Vowels V are unround
t ʈʂ (d, zh)

- Du  du, dao, zhuo
  tu  tau  tʂuo
All finals are V or VV with one round vowel.
t  tʂ (d, zh)

- Dui 队 dui, zhui
tuei,  tʂuei
Final Perfect (Same final)
t  tʂ (d, zh)

- (Zhuo) (啄) du, zhuo, zhu, zhong
  tu, tʂuo tʂu tʂunŋ

All finals have one round V [u]
t  tʂ  tʂʰ (d, zh, ch)

• (chuo) (啜) duo, zhui, chuo, chuai

  tuo  tʂuei  tʂʰuo  tʂʰuai

All finals have one round vowel and are diphthongs or triphongs. All vowels have uV(i).
t  tʂ  tʂʻ (d, zh, ch)

- Di 氐  Di, de, zhi, chi
  ti  tr  tʂɿ  tʂɿ

- Finals are V (-round).
t  tʂʻ (d, ch)

• Dang 当 dang, cheng
tʂʻəŋ  tʂʻəŋ

All finals have Vŋ.
All V are [-high, -round]
Nuclear V has [ɑ] / [ə] choice.
t  t‘  tʂ‘ (d, t, ch)

• Di 帝 di, ti, chi
ti  t‘i  tʂ‘ʅ
• Finals are V (+high,-round)

• Deng 登 deng, teng, cheng, chen
təŋ  t‘əŋ  tʂ‘əŋ  tʂ‘ən
• Finals are əC
t‘ tʂ tʂ‘ (t, zh, ch)

Tong 童 tong, tuan, zhuang, chuang, chong
   t‘un t‘uan tʂuŋ tʂ‘uŋ tʂ‘un

• (Zhen) (珍) tian, zhen, chen
   t‘ien tʂən tʂ‘ən

• Zhuan 专 tuan, zhuang, chuan
   t‘uan tʂuan tʂ‘uan
t  t’  tʂ  tʂ’ (d, t, zh, ch)

• Dan旦 dan, da, tan, zha, zhou, cha
tan  tɔ  t’an  tʂə  tʂou  tʂ’ə

• Tun屯 dun, du, den, tun, zhun, chun
tuən  tu  tən  tuən  tʂuən  tʂ’uən

Zhou周 diao, tiao, ti, zhou, zhao, chou
tiau  t’iau  t’i  tʂou  tʂau  tʂ’ou
Similar Initials and Finals

- Di 帝 di, ti, chi
  - ti tʻi tʂʻi
- Finals are V (+high,-round)

- Di 氏 Di, de, zhi, chi
  - ti tʂ tʂʻ tʂʻ
- Finals are V (-round).
Similar Initials and Finals

- Dai 带 dai, zhi
tai, ʈʂʅ

- All Finals are V or VV, unround.

- Di （滴） di, zhi, zhe, zhai
ti, ʈʂɻ, ʈʂɭɻ, ʈʂai

- All Finals are V or VV, unround.
Initials and Finals

- In Chinese characters in Modern Mandarin, initial consonants are forming regular recurring patterns. Finals are also forming their own recurring patterns in the written language.
# Overall Patterns: Initials vs. Finals

<table>
<thead>
<tr>
<th>Initials</th>
<th>Finals</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>V</td>
</tr>
<tr>
<td>B</td>
<td>W</td>
</tr>
<tr>
<td>C</td>
<td>X</td>
</tr>
<tr>
<td>D</td>
<td>Y</td>
</tr>
</tbody>
</table>
Overall Patterns: Segments for Each Individual Phonetic Series

- Initials-Finals (Segments) for Each Phonetic Series
  - A-V
  - B-W
  - C-X
  - D-Y
Implications and Applications

- The phononological patterns of the writing system
- L1 language acquisition
- L2 language acquisition
- Language teaching / Pedagogy
- Psycholinguistics
- Neurolinguistic Processing of Chinese Characters
References


References


References

• Kraemer, Stephen M. (1991b). *Levels of phonological regularity in the Chinese writing system*. Working paper. [https://scholarsbank.uoregon.edu/xmlui/handle/1794/8133](https://scholarsbank.uoregon.edu/xmlui/handle/1794/8133)


References


谢谢 Xiexie.