

**On Some Quantitative Aspects  
of the Componential Structure  
of Chinese Characters**



**Norbert Kordek**

# **On Some Quantitative Aspects of the Componential Structure of Chinese Characters**



**Poznań 2013**

Recenzent: prof. dr hab. Grażyna Demenko

Projekt okładki: Helena Oszmiańska

Copyright by:  
Norbert Kordek and Wydawnictwo Rys

Wydanie I, Poznań 2013

**ISBN 978-83-63664-13-8**

Wydanie:



Wydawnictwo Rys  
ul. Różana 9/10  
61-577 Poznań  
tel./fax 048 61 833 16 03  
kom. 0600 44 55 80  
e-mail: [rysstudio@o2.pl](mailto:rysstudio@o2.pl)  
[www.wydawnictworys.com](http://www.wydawnictworys.com)

## Contents

Acknowledgements.....	11
Preface .....	13
1. Preliminary considerations .....	17
1.1. On the nature of Chinese script.....	17
1.1.1. Terminology and scope.....	17
1.1.2. Typology and relation to speech.....	19
1.1.3. Traditional characterology .....	20
1.2. Six categories (六書 <i>liùshū</i> ).....	22
1.3. Modern characterology (漢字學 <i>hànzixué</i> ).....	26
1.4. Number of Chinese characters.....	27
2. Chinese character sets.....	31
2.1. Noncoded Character Sets (NCSes) .....	32
2.1.1. Chinese noncoded character sets .....	32
2.1.1.1. China.....	32
2.1.1.2. Taiwan .....	33
2.1.2. Non-Chinese noncoded character sets.....	34
2.2. Coded Characters Sets (CCSes) .....	35
2.2.1. Chinese coded character sets.....	35
2.2.1.1. China.....	35
2.2.1.2. Taiwan .....	37
2.2.2. Non-Chinese and international CCSes .....	39
2.2.2.1. Unicode – Unihan.....	39
3. Theoretical preliminaries .....	42
3.1. Segmentotactics and segmentotactics .....	43
3.1.1. Introduction .....	43
3.1.2. Prerequisites for segmentotactic investigations.....	45
3.2. Phonotactics .....	45
3.2.1. Terminology.....	46
3.2.1.1. Tactophoneme .....	47

3.3. Beyond phonotactics.....	48
3.3.1. Orthotactics .....	49
3.3.2. Phonemotactics, syllabotactics and morphotactics .....	51
3.3.3. Graphotactics .....	52
3.3.3.1. Exemplary analysis.....	54
3.3.2.2. Levels of analysis.....	57
4. Structure of Chinese characters .....	59
4.1. Terminology .....	59
4.2. Hierarchy of constituents.....	61
4.3. Composition .....	61
4.4. Decomposition and component types.....	62
4.4.1. The decomposition .....	62
4.4.1.1. Decomposition rules.....	63
4.4.1.2. Decomposition structure .....	66
4.4.1.3. Functional categories of components.....	72
4.4.2. Component lists.....	74
4.4.3. 說文解字 <i>Shuōwén Jiězì</i> (SWJZ) and the modern components .....	78
4.4.4. Functional types of components .....	78
4.4.4.1. Modern ‘six categories’ .....	79
4.5. Strokes .....	80
4.6. Simplification of characters.....	86
4.6.1. Extent of simplification .....	87
4.6.2. Simplification methods .....	88
4.6.3. Simplification of components .....	89
5. Models of Chinese character descriptions.....	91
5.1. Character description language (CDL) projects.....	91
5.1.1. Ideographic description sequence (IDS).....	91
5.1.1.1. Character Information Service Environment (CHISE) .....	93
5.1.1.2. Kawabata’s Kanji Database Project (KDP) .....	95
5.1.2. Chinese Documents Processing Lab (CDP) .....	99
5.1.3. Wenlin CDL .....	111

5.1.4. Summary .....	113
5.1.5. Other projects.....	113
5.1.5.1. Hanglyph CDL.....	114
5.1.5.2. Cjklib.....	115
5.1.5.3. Wikimedia Commons Chinese Characters Decomposition Project (CCDP) .....	115
5.2. Grammars .....	118
5.2.1. Distributional model I.....	118
5.2.2. Generative model .....	118
5.2.3. Distributional model II.....	120
5.3. Graphotactics related studies .....	125
5.3.1. Component combination database.....	125
5.3.2. Chinese orthography database.....	126
5.4. Psycholinguistics related studies .....	128
5.5. Mathematical models.....	128
6. Quantitative studies of Chinese script.....	131
6.1. Traditional statistical and quantitative studies .....	131
6.1.1. Frequency of characters .....	131
6.1.2. Frequency of components .....	134
6.1.3. Componential complexity of characters .....	140
6.1.4. Stroke statistics.....	142
6.1.4.1. Stroke number statistics .....	143
6.1.4.2. Stroke count.....	143
6.1.4.3. Stroke count and characters frequency .....	150
6.1.5. Quantitative properties of syllable-to-character mapping .....	152
6.2. Quantitative linguistic laws .....	154
6.2.1. Zipf's Law.....	154
6.2.2. Menzerath-Altmann Law.....	155
6.3. Script complexity .....	158
6.3.1. Compositional method.....	158
6.3.2. Intersectional method.....	159

6.3.3. The complexity of Chinese script .....	161
6.3.3.1. The compositional method and the Chinese script .....	162
6.3.3.2. The intersectional method and the Chinese script .....	165
6.3.3.3. The methods compared.....	168
6.3.3.4. Complexity reduction.....	175
6.3.4. Summary .....	178
7. Graphotactic analysis of Chinese script .....	179
7.1. Graphotactics of Cangjie input method .....	179
7.1.1. Introduction to the Cangjie input method (CIM) .....	179
7.1.2. The graphotactic analysis of Cangjie codes .....	187
7.1.2.1. CIM tactographemicity and t-graphotactemicity .....	189
7.1.2.2. T-efficiency .....	191
7.1.2.3. Tactographemic t-efficiency.....	192
7.1.2.4. CIM categorial graphotactic efficiency.....	193
7.1.2.5. CIM graphemes dispersion .....	194
7.2. Graphotactics of Chinese script.....	200
7.2.1. Levels of analysis.....	201
7.2.2. The database .....	201
7.2.3. Big5 (CNS 11643 Plane 1 and 2).....	204
7.2.3.1. Big5 – immediate components .....	206
7.2.3.2. Big5 basic components .....	211
7.2.4. Comparative analysis.....	216
7.2.4.1 Immediate components .....	217
7.2.4.2. Basic components.....	221
7.2.5. Unihan .....	226
7.2.5.1. Immediate components .....	227
7.2.5.2. Unihan basic components .....	231
7.2.6. Summary .....	235
7.2.6.1. Tactographemicity and t-graphotactemicity.....	235
7.2.6.2. T-efficiency .....	241
7.2.6.3. Tactographemic t-efficiency.....	242

7.2.6.4. Categorial graphotactic efficiency .....	243
7.2.7. Graphemic dispersion .....	244
7.2.7.1. Immediate components .....	244
7.2.7.2. Basic components.....	248
7.2.7.3. Summary.....	253
7.2.8. Complexity of graphotactemes in terms of graphemes.....	254
7.2.8.1. Immediate components .....	255
7.2.8.2. Basic components.....	257
7.2.8.3. Summary .....	259
7.2.9. Summary and concluding remarks .....	260
7.2.10. Perspectives .....	262
References.....	265
Appendix I – Chinese Documents Processing Lab (CDP) basic components list – ordered by frequency .....	281
Appendix II – Big5 character set.....	289
Appendix III – Unihan inventory of basic components .....	301