Explorations of Chinese Theoretical and Applied Linguistics

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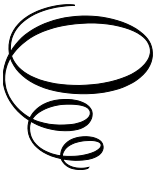
Edited by

Dongyan Chen and Daniel Bell

Cambridge Scholars Publishing



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[1] The conference has now developed into a biennial event. The 2nd ISOCTAL Conference was successfully held on 14th-16th December 2017 at the University of Milano-Bicocca, Italy, and the third event on 12th-14th December 2019 at the University College Cork, Ireland.

We thank our authors for their patience during the development of this book and for their rigour in taking on board feedback and addressing issues accordingly.

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for instance, Buckeye East Asian Linguistics (Volume 4), and such conference proceedings as the Proceedings of the 19th International Congress of Phonetic Sciences and Proceedings of the 32nd Pacific Asia Conference on Language, Information and Computation.

CHAPTER ONE

INTRODUCTION

DONGYAN CHEN AND DANIEL BELL

Scholarly work on Chinese is currently benefiting from a number of accelerating trends in contemporary linguistics, and Chinese in turn is becoming increasingly prominent across the spectrum of theoretical and applied research. Since the 1980s, formal approaches to Chinese have shed light upon important aspects of the study of language, and recent years have also seen an increase in theoretical work on Chinese within China, as well as East-West collaboration in the emergence of new conference series and journals. In terms of language documentation, the diversity existent among Chinese dialects – as well as within Mandarin (which with approximately 900 million native speakers, is the most widely spoken Sinitic language) – is also increasingly becoming apparent in the typological literature. This has been associated with steadily greater appreciation of the value of authentic corpus data in order to provide a reliable basis for empirical work, and efforts are also appearing to incorporate a theoretical approach to the study of regional varieties of Chinese. Meanwhile, Chinese has also been gaining greater prominence internationally within applied linguistics, notably in the field of Second Language Acquisition (SLA) and use. In this area, the growth of Chinese as a global language has led to a redressing of the balance between studies with L1 English and L2 Chinese to studies with Chinese as the L2, and with regard to the latter, the research is broadening out the range of language pairs considered as well as incorporating different Chinese dialects as L1 and L2.

The studies in the present collection, in different ways, reflect these trends. This volume emerged from the first *International Symposium on Chinese Theoretical and Applied Linguistics (ISOCTAL)*, a conference series which combines the two major camps in linguistics and seeks to encourage international collaboration across disciplines. Chinese linguistics is understood in this context to incorporate all Sinitic languages – for instance,

including Mandarin, Cantonese and their regional variants. This volume draws together contributions to Chinese linguistics which address the following major themes.

Part One is comprised of theoretically-informed descriptions of linguistic phenomena – studies which have empirical value and/or seek to make a contribution to linguistic theory through the analysis of their data. Part Two engages with Chinese applied linguistics and specifically with second language acquisition (SLA) and use, where the role of Chinese as L1 or L2 is elucidated for the relevant domains. In Part One of this volume, the focus is predominantly on Standard Mandarin, but Shanghainese (a Wu dialect, which is largely not mutually intelligible with other Sinitic languages, including Mandarin) is considered in the final chapter. Theoretically, the studies are primarily concerned with Optimality theory (Chapter 2), Information structure (Chapter 3), Semantics/scalar inferences (Chapter 4), and Serial verb constructions (Chapter 5), whilst Chapter 6 offers a formal approach to Shanghai Chinese morphosyntax.

Part Two of the volume addresses Second Language Acquisition and use by first considering the relatively new field of the acquisition of Chinese by Danish learners – with a focus on phonology (Chapter 7). Next, the expression of attitudes/appraisal in L1 Chinese and L2 English are considered (Chapter 8), followed by a discussion of the well-known Critical Period Hypothesis in relation to the acquisition of Chinese syntax by Cantonese learners of Mandarin (Chapter 9).

The following is a summary of the chapters in more detail. **Chapter 2** advocates a Perceptually-based Optimality Theory (PB-OT) approach to the problem of phonological opacity by considering the case of Mandarin Chinese nasal rhymes. Opacity occurs where a phonological process is non-transparent in surface phonetic patterns, and this is problematic for Optimality Theory since it only makes reference to surface forms. The authors argue that the solution provided by the traditional OT approach, along with the more recent Output-Output Correspondence (OO-Correspondence) and OT with Candidate Chains (OT-CC) approaches are "unnatural" within an OT framework due to simply imitating input-output derivation processes associated with rule-based phonology. The conceptual inadequacy of these approaches is discussed, and PB-OT, with its focus on the evaluation of output forms (and whole inventories of vowels and vowel-nasal environments), is argued to account for opacity in Chinese nasal rhymes whilst also more fully conforming to the tenets of Optimality Theory.

Chapter 3 explores an important construction in Chinese, presentational sentences, which introduce new referential entities into the discourse ([(NP_G+) VP+NP_F], such as …*lái rén la* 'someone has come!'). Using natural speech data, it takes as its focus the role of path (of motion) verbs in these sentences (e.g. *lái* 'come' in the example just given). The chapter proposes an information structure analysis in which the construction is used to mark the post-verbal NP as a non-topic, as well as to fulfil more specific pragmatic functions (entity-foregrounding, encoding of an event, and enumerative focus). The corpus data analysed in the chapter is useful with regard to what it tells us about the verb *lái* in presentational sentences, as this was the most common path verb in this construction – whether as a monomorphemic verb or as a deictic in complex path verbs (e.g. *jìn-lai* 'enter-come'). Overall, the chapter helps elucidate the usage of *lai* (and certain other path verbs) in relation to the pragmatic functions of the presentational sentence as well as with regard to the quantification of the post-verbal NP.

Chapter 4 discusses syntactic and semantic functions of *yidianr*, a polarity item in Chinese. The authors conduct a literature review on polarity items from the perspectives of syntax, semantics and pragmatics and introduce the diachronic development of *yidianr*. Following the approach of Israel (2011), in which polarity sensitivity is a lexical semantic property of the relevant items, they argue that the quantity expression *yidianr* in Chinese functions as a minimiser when occurring in a construction that denotes a scalar inference, namely syntactic negation, rhetorical questions, the focus constructions *lian…ye*/*dou* and the *jiu* 'then' conditional construction.

Chapter 5 discusses, from a cross-linguistic perspective, problems arising from criteria used in defining serial verb constructions (SVCs). According to the author, the existing literature defines SVCs in both a broad and narrow sense which correspond to the single clause and single event criteria commonly used to identify SVCs. The author suggests that the single clause criterion is too broad, while the single event criterion is weakened through affinity to the problematic concept of the macro event property (MEP). The chapter points to incompatibility between the single clause and the single event criteria by referring to cases of multiple events within one clause. The chapter argues that the single clause criterion should be narrowed down to the syntactic unit that corresponds to a single event, whilst the aktionsart of the single event should be defined as an accomplishment.

Chapter 6 describes the distribution of phonological variants *(laq/laqlaq/laqhae/laqkae*) of the L marker in Shanghai Chinese, a

morpheme which roughly corresponds to the imperfective markers *zai* and *zhe* in Standard Mandarin. The study provides an explanation to the puzzle of why the short form *laq* behaves differently from the other variants, for instance being prohibited from occurring alone as a predicate and from following a sentence-final verb/VP. The author notes the role of syntactic movement in constructions where *laq* is disallowed, and argues for a syntax-phonology interface analysis in which a blocking rule applies at the PF level (the mapping between syntax and phonology) due to the inability of *laq* to license the trace of the moved element. The study concludes that the general rule, subsuming cases involving movement, is that phonological realisation as *laq* is prevented when the marker is the sister of an empty category.

Moving on to Part 2, **Chapter 7** engages with the emerging field of the acquisition of Chinese by L1 Danish learners, and it provides empirical data on the challenges encountered with regard to Chinese dental obstruents. The investigation considers whether – as predicted in previous literature – a 'quirk' of Danish phonology, the high degree of affrication found for alveolar stops, causes problems in learners' production of the Standard Chinese phonemic dental stops and affricates /t t^h t^s t^{sh}/. The study focuses mainly on the Danish alveolar stop /t^s/, and also considers transfer for this phoneme during production of English. The findings indicate that the majority of Danes encounter problems with the Chinese dental obstruents, pronouncing /ts/ as a fricative, and also transferring affrication to the Chinese phonemes /t^h ts^h/ as well as during production of English. The chapter argues that the effect of this transfer is to reduce the distinction between /t^h ts^h/ in their Chinese output. Overall, in terms of linguistic theory, the findings are consistent both with Best's Perceptual Assimilation Model (PAM; e.g. Best et al. 2001) and Flege's Speech Learning Model (SLM, e.g. Flege 1995).

Chapter 8 considers how the roles and attitudes speakers adopt during narration are influenced by the language used. Using a corpus of narrations by L1 Chinese and L2 English speakers, the authors examine the domain of Judgement, a sub-system of the Appraisal System (Martin and White 2005) concerned with assessments of the actions and character of others. As might be expected, the authors found that the variety of Judgement expressions was reduced in the L2 narrations, though sometimes the differences were striking. In speakers' L1 narrations, Social Esteem judgements were more common than Social Sanctions, with judgements concerning Tenacity (e.g. *danxiao* 'cowardly') and Normality (e.g. *qipa* 'weird') having the highest frequency, followed by Capacity (e.g. *bucuo* 'not bad'). In English, Capacity judgements (e.g. 'capable' and 'proud') were most common, followed by

Tenacity and Normality. Meanwhile, with regard to Social Sanctions (moral judgements concerning one's truthfulness and ethicality), these were used in Chinese but were entirely absent in English – a fact which the authors explain in terms of the different roles narrators adopt in the L1 compared to the L2.

Finally, **Chapter 9** contributes to a longstanding puzzle in second language acquisition research, i.e. the effect of AoA (age of acquisition) on L2 learners' ultimate attainment. The authors of the chapter conducted an experimental study on 30 Cantonese speakers' production of displacement and disposal pre-transitive *ba*-constructions in Mandarin (with 20 native Mandarin speakers as a control group) using pictures as stimuli. Data from regression modelling showed a tendency that with increased AoA, ultimate attainment became more divergent from the L2 target. However, their results did not show poorer L2 attainment where participants' AoA exceeded particular pre-puberty age breakpoints, leading the authors to reject the Critical Period Hypothesis proposed in the existing literature. Also, they report that Cantonese learners did not differ qualitatively in their acquisition of subtypes of the *ba*-construction, whilst L1 Cantonese learners performed better than learners with other L1 backgrounds – a finding which they attribute to the typological affinity of Cantonese and Mandarin.

PART ONE

CHAPTER TWO

A PERCEPTUALLY-BASED OT APPROACH TO OPACITY IN MANDARIN CHINESE NASAL RHYMES[1]

MINGQIONG LUO, JEROEN VAN DE WEIJER & MARJOLEINE SLOOS

Abstract

In this paper we discuss a case of opacity in Mandarin Chinese. Opacity refers to non-transparency in surface phonetic patterns, which, in rule-based approaches, is captured by rule ordering. In Optimality Theory (henceforth OT), opacity poses a problem because constraints are surface-oriented. We show how opacity arises from rules like rhyme harmony, vowel nasalisation, and nasal deletion in Mandarin Chinese nasal rhymes, *i.e.* syllables closed by a nasal. Whereas it is difficult or impossible to capture this effect in standard OT, it is possible to do so in more recent variants of OT (involving output-output (OO)-correspondence and Candidate Chains), but these approaches have a number of conceptual problems. We then introduce the framework of Perceptually-based OT, which provides a number of constraints on (oral vs. nasal) vowel perception in relevant environments. In addition, it evaluates whole inventories of vowels and vowel-nasal environments (unlike standard OT, in which EVAL only evaluates candidate sets from single input forms). We show that, under such an approach, the problem of opacity in Mandarin Chinese nasal rhymes can be solved.

[1] This paper is supported by a general research project fund from Shanghai International Studies University (SISU), China. The project is entitled "The acquisition of English sounds by native Chinese learners of a specific dialect: An L3 perspective" and the project number is 20161140011.

Key words: Mandarin Chinese, opacity, Optimality Theory (OT), Perceptually-based; nasal rhymes

1. Introduction: opacity

Phonological opacity occurs when the application of a phonological process is not visible on the phonetic surface. The effect was first described in rule-based phonology, as represented by *The Sound Pattern of English* (SPE) (Chomsky and Halle 1968).

Opacity poses a serious problem for the Optimality Theory (OT; Prince and Smolensky (1993 [2004])), which only evaluates the well-formedness of the surface form, disallows reference to pre-output forms, and replaces derivations with an evaluation module which is produced as output. A variety of approaches have been proposed to deal with opacity within the OT framework, such as Local Conjunction (Smolensky 1995), OO (Output to output) Correspondence (Benua 1995, 1997), Sympathy Theory (McCarthy 1999), OT with "candidate chains" (OT-CC) (McCarthy 2005), and Harmonic Serialism (HS) (McCarthy 2011; McCarthy and Pater 2016). All these approaches tackle opacity by introducing some derivational variant into classical OT, but at the cost of invoking "unnatural" mechanisms or constraints (see *e.g.* van der Hulst and Ritter 2000 for a critique of sympathy-based approaches). An alternative approach is possible, however. Perceptually-based OT approaches (PB-OT) use perceptually- and articulatorily-grounded constraints which can capture opacity (see Steriade 2001, Flemming 2004, among others). Since PB-OT is only based on the distributional patterns of the output forms, ignoring input-output correspondence, it avoids the need to resort to a derivational process or to invoke unnatural constraints to account for opaque surface patterns.

In the following sections of this paper, we will first show how opacity arises in Mandarin Chinese (thereafter MC nasal rhymes), focusing on the rules that would be needed in a derivational approach in Section 2. In Section 3, we will explain how classical OT is unable to account for opacity effects and outline the operation (and defects) of OO-Correspondence and OT-CC approaches. Section 4 explains how PB-OT captures opacity in MC nasal rhymes, highlighting its advantages over more traditional approaches. Section 5 offers a brief discussion and conclusion.

2. Opacity in MC nasal rhymes

MC has two contrastive nasal codas: the coronal /n/ and the velar /ŋ/ (*e.g.* Duanmu (2000)).

(1)	Character	Pinyin	IPA	English
a.	搬	*ban*	/pan/^{55}	“carry”
	帮	*bang*	/paŋ/^{55}	“help”
b.	奔	*ben*	/pen/^{55}	“rush”
	崩	*beng*	/peŋ/^{55}	“collapse”
c.	宾	*bin*	/pin/^{55}	“guest”
	冰	*bing*	/piŋ/^{55}	“ice”

The vowel preceding the tautosyllabic nasal coda undergoes nasalisation and rhyme harmony. Rhyme harmony refers to agreement of the backness feature of the vowel and the tautosyllabic nasal coda: when the vowel is followed by the coronal /n/, its backness feature is [–back]; when it is followed by the velar /ŋ/, its backness feature is [+back]. Both nasalisation and rhyme harmony are natural phonetically: vowel nasalisation is caused by anticipatory lowering of the velum, and rhyme harmony results from anticipatory fronting or backing during the vowel.

The phonetic properties of the vowel actually provide better perceptual cues to the place of articulation of the nasal than the nasal itself (*e.g.* Chen 1973; Ren 1988; Lin and Yan 1991; Chen 2000; Mou 2006, among others). That is, the vocalic properties identify both the presence of a final nasal and its place of articulation (Ren 1988). In MC monosyllables, the beginning and end of the F2 transition of /a, i, ə/ generally have a higher frequency before /n/ than before /ŋ/ (Ren 1988; Lin & Yan 1991). In addition, /a, ə/ have a lower F1 and a higher F3 before /n/ than before /ŋ/ (Lin & Yan 1991). The presence of the place of articulation of the nasal can be detected by measuring the phonetic attributes in the vowel region: the former by the presence of a vowel-nasal consonant boundary, and the latter by determining the vowel formant (F2 and F3) frequencies and the acoustic attributes at the vowel-nasal consonant boundary (Chen 2000).

These phonetically-induced processes in MC nasal rhymes have been phonologised in the grammar (2).

(2) a. $V \rightarrow \tilde{V}$ / _ N# Vowel nasalisation

b. $V_{[-high]} \rightarrow V_{[-back]}$ / _ n# Rhyme harmony with /n/

$V_{[-high]} \rightarrow V_{[+back]}$ / _ ŋ# Rhyme harmony with /ŋ/

Returning to (2a, b), a more accurate phonetic representation of these surface forms would be [pãn], [pɑ̃ŋ], [pẽn], and [pɤ̃ŋ], respectively, in the citation forms. Note that MC also has the high vowels /i, y, u/. These vowels are also specified for backness underlyingly (/i, y/ as [–back] and /u/ as [+back]), but rhyme harmony for high vowels differs from that for /ae/. An intervening vocoid is inserted between the vowel and the nasal coda, with the same backness features as the non-high vowels. Therefore, the surface forms of /in, iŋ/, /yn, yŋ/ and /un, uŋ/ are [in,i$^{\text{ɯ}}$ŋ][2], [yn, yuŋ], and [uən,uŋ].

Despite apparent consensus on the phonological processes concerning the vowels in MC nasal rhymes, many issues remain controversial, especially those concerning the nasal codas in phrase-medial position, where the nasal coda can be followed by three kinds of initials: a consonant, a vowel or a semi-vowel (3).

(3) a.	$V_1N_1.C_2V_2$	*e.g.* /fan.k$^{\text{h}}$ai/	fan-kai	“open (verb)”
b.	$V_1N_1.V_2$	*e.g.* /faŋ.ai/	fang-ai	“interfere”
c.	$V_1N_1.G_1V_2$	*e.g.* /fen.wai/	fen-wai	“especially”

The following spectrograms (Figure 1) show a clear boundary between V_1 and N_1 in the context $V_1N_1.C_2V_2$ (3a) but not in the contexts $V_1N_1.V_2$ (3b) and $V_1N_1.G_1V_2$ (3c).

[2] In Beijing Mandarin, this contrast is more obvious, whereas in other varieties of Mandarin Chinese it is less clear, sometimes resulting in confusion between /in/ vs. /iŋ/.

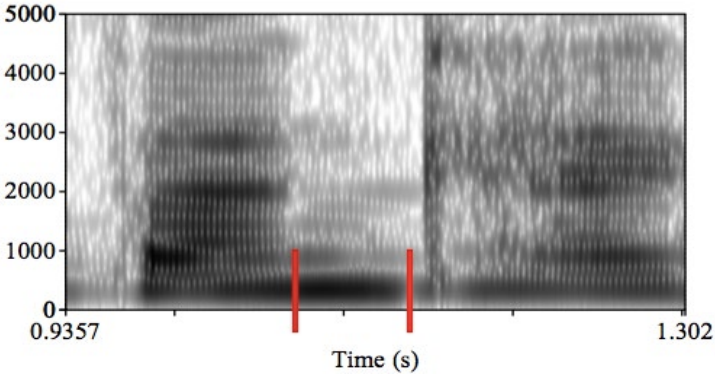


Figure 2-1a: Spectrogram of *fan-k^{h}ai* (the part enclosed between two bars is the nasal)[3]

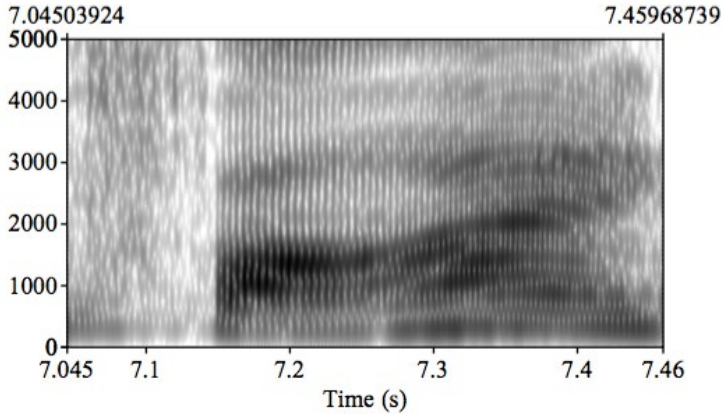


Figure 2-1b: Spectrogram of *fang-ai*

[3] The spectrograms in Figure 2-1 were the Praat analyses of three di-syllabic words pronounced by the first author of this paper, who is a native speaker of MC, and recorded with a microphone connected to a headset, which was connected to the computer.

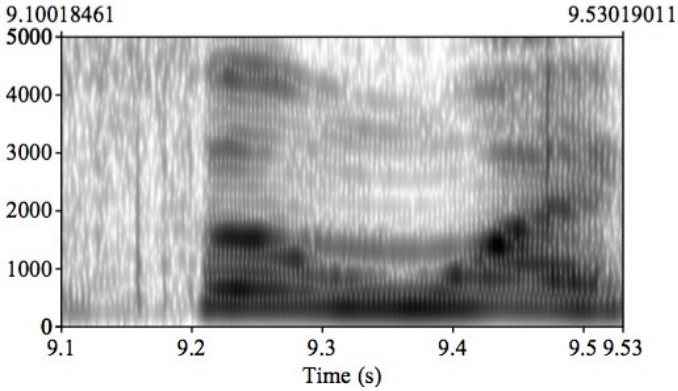
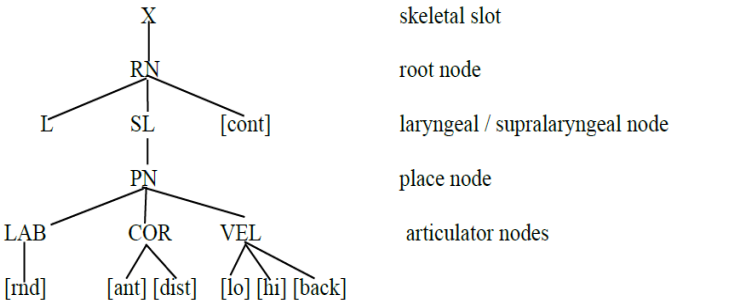


Figure 2-1c: Spectrogram of *fen-wai*

Many researchers (*e.g.* Liang 2001, Fang 2004, among others) interpret this unclear boundary in the contexts $V_1N_1.V_2$ (3b) and $V_1N_1.G_1V_2$ (3c) as a "loss of the nasal coda", but the specifics of the process remain unclear. As Hajek (1997) points out, nasal deletion is not a simple process, because of the inherent complexity of the featural structure of nasals, as illustrated in (4) below:

(4)



(Hajek 1997, 181)

Nasal attenuation (Hajek's term for nasal weakening, including deletion) can happen in any of the following ways:

(5) a. deletion of X, RN, the Supralaryngeal Node, or PN

b. voicing assimilation ([+voi] →[–voi] / __ [–voi])

c. manner assimilation ([–cont] →[+cont] / __ [+cont])

d. place shift (*e.g.* velarisation)

(Hajek 1997, 182)

We propose that in MC, the root node for N is lost in $V_1N.V_2$ and $V_1N.G_1V_2$. One of the major arguments is that the loss of the nasal coda does not lead to the loss of the tone contour that the syllable bears. This suggests that the weight profile of the syllable is retained after nasal deletion. Since the weight profile of the syllable is closely related with the number of skeletal slots in the rhyme (*e.g.* Hajek 1997; Gordon 2004), we assume that the root node of the nasal coda is deleted instead of the skeletal slot.

Some sort of phonetic "weakening" must have taken place before nasal deletion (cf. Chen 1972, Foley 1975, 1977; Pagliuca and Mowrey 1987, Trigo 1988; Hajek 1997 among many others). The nasal consonant is either first debuccalised, losing its place of articulation, or it undergoes other weakening processes such as spirantisation or gliding before absorption (Trigo 1988). MC nasal codas do not have a strong release after oral occlusion (like its onset counterpart does), which results in weaker energy in the murmur region (*e.g.* Xu 1986; Wang 1997; Chen 2000; Mou 2006; Tan, Shi, and Shi 2016 among many others). In the process of nasal attenuation, the nasalised vowel is often lengthened in MC (e.g. Ruhlen 1973; Chen 1974; Foley 1977; Lass 1980; Hayes 1986; Goldsmith 1990). Based on both cross-linguistic and diachronic evidence, Hajek (1997) claims that long nasal vowels are favored over short ones, and that short nasal vowels have a strong cross-linguistic tendency to be either lengthened or eliminated, because increased vowel duration provides better perceptual cues to both the nasality of the vowel and the underlying nasal coda. Moreover, the spectrograms in Figure 2-1 show that the nasal coda in the $V_1N.(G)V$ context is a nasal vowel. A reasonable inference is that the nasalised vowel is lengthened when the nasal coda is deleted.

The nasal attenuation and vowel lengthening processes in MC nasal rhymes can be schematised with the following rule:

(6) $\tilde{V}N \rightarrow \tilde{V}{:}^{N}$/ __ # nasal attenuation and vowel lengthening

After the nasal coda is weakened in $V_1N_1.(G)V_2$ contexts, the nasal coda is completely deleted:

(7) $N \rightarrow \emptyset$ / __. (G)V complete nasal deletion

In the $V_1N_1.C_2V_2$ (3a) environment, changes on the nasal coda are more subtle and complex than those in the $V_1N_1.V_2$ (3b) and $V_1N_1.G_1V_2$ (3c) that we just discussed. They are sensitive to (i) the manner of articulation of C_2; (ii) the place of articulation of N_1; (iii) the vowel height of V_1; (iv) whether there is a morphological boundary between the two syllables; (v) speech rate and speech style (see *e.g.* Xu 1986; Liang 2001; Fang 2004).

Firstly, when C_2 is a stop or an affricate, which has a definite place of constriction in the oral cavity, nasal assimilation is likely to happen. When C_2 is a fricative, which does not have a definite place of constriction in the oral cavity, N_1 is likely to delete, in the same way as nasal deletion in the N.(G)V context mentioned above (Liang 2001).

Secondly, the coronal nasal coda is more likely to undergo place assimilation (to a following consonant) than the velar nasal (*e.g.* Xu 1986; Zheng and Liu 2005; Zheng and Bao 2003; Fang 2004; Liang 2001, among others):

(8) a. $n \rightarrow N_{[\alpha place]} / \_\_.C_{[\alpha place]}$ nasal place assimilation of /n/

b. $n \rightarrow \emptyset / \_\_.C_{[fricative]}$ nasal deletion of /n/

However, even for velars, place assimilation and deletion are still possible, especially in fast-rate speech, because the nasal place feature is much better cued in the vowel region, viz. by the second and third vowel formants F2 and F3 (Chen 2000). Besides, in connected speech, information about single segments at the phonological level can be derived from that at the morphological and syntactic levels (*e.g.* Fang 2004, Tan, Shi, and Shi 2016). In addition, in $V_1N_1.C_2V_2$ (3a) environments, the C_2 closure starts roughly at the midpoint of the realisation of /ŋ/ (Zheng and Liu 2005), *i.e.* /ŋ/ undergoes partial place assimilation and becomes a complex nasal $\widehat{\eta N}_{[-velar]}$. Therefore, possible changes that can happen to the velar nasal coda in MC are as follows:

(9) $\eta \rightarrow \widehat{\eta N}_{[-velar]} / \_\_.C_{[-velar]}V$ partial place assimilation

$\eta \rightarrow N_{[-velar]} / \_\_. C_{[-velar]}V$ complete place assimilation

$\eta \rightarrow \emptyset / \_\_. (G)V$ complete nasal deletion

Thirdly, the vowel preceding the nasal can also affect the realisation of the nasal. For instance, F2 in /a, e/ and F3 in /i/ are significantly higher before /n/ than before /ŋ/ (Chen 2000). Fourthly, coda nasal alternations in MC are more likely to happen within word boundaries than across word boundaries (Xu 1986).

And finally, nasal attenuation is more likely to happen in fast, casual speech than in slow, formal speech (*e.g.* Zheng and Liu 2005; Tan, Shi, and Shi 2016; Fang 2004, among others).

Let us take the derivation of the disyllabic words /fAn^{55}.k^{h}Ai^{55}/, /ʂAn^{55}.Au^{51}/, /p^{h}Aŋ^{35}.tA^{51}/ and /fAŋ^{35}.Ai^{51}/[4] as examples.

(10) i. Underlying form: /fAn.k^{h}Ai/ 翻开 "open"

Vowel nasalisation: fÃn.k^{h}Ai

Rhyme harmony: fãn.k^{h}ai[5]

Nasal place assimilation: fãŋ.k^{h}ai

Surface form: [fãŋ.k^{h}ai]

[4] Here /A/ stands for the low unrounded vowel, with under specification of the backness feature. The superscriptions specify the tones for each syllable: 55 is the high-level Tone 1, 35 the high-rising Tone 2, and 51 the high-dipping Tone 4.

[5] There are four allophones of the unrounded low vowel in MC: (i) [A] in open syllables, *e.g.* and *gua* [kwA] (瓜, "melon"); (ii) [a] if followed by the glide coda /i/ or the nasal coda /n/, *e.g. hai* [xai] (海, "sea"), *gan* [kan] (干, "dried"); (iii) the low back vowel [ɑ] if it is followed by the back glide coda /u/ or the nasal coda /ŋ/, *e.g. hao* [xɑu] (好, "good"), *bang* [pɑŋ] (帮, "help"); (iv) mid front [ɛ] between the pre-nuclear glide /j/ and the coda /n/, *e.g. tian* [tjɛn] (天, "sky"), *qian* [tɕ^{h}jɛn] (钱, "money"). We use /A/ as the underlying form to highlight the backness harmony with the nasal coda but not to commit to any specific underlying value for backness.

ii. Underlying form: /ʂAn.Au/ 山坳 “col”

Vowel nasalisation: ʂÃn.Au

Rhyme harmony: ʂãn.ɑu

Nasal attenuation and V lengthening: ʂã^{n}.: ɑu

Nasal deletion: ʂã:.ɑu

Nasal place assimilation: N/A

Surface form: [ʂã:.ɑu]

iii. Underlying form: /p^{h}Aŋ.tA/ 庞大 “enormous”

Vowel nasalisation: p^{h}Ãŋ.tA

Rhyme harmony: p^{h}ãŋ.tA

a. Incomplete place assimilation: p^{h}ãŋ͡n.tA (in slow speech)

b. Complete place assimilation: p^{h}ãn.tA (in fast speech)

c. Surface form: a. [p^{h}ãŋ͡n.tA]

b. [p^{h}ãn.tA]

iv. Underlying form: /fAŋ.Ai/ 妨碍 “interfere”

Vowel nasalisation: fÃŋ.Ai

Rhyme harmony: fãŋ.ai

Nasal attenuation and V lengthening: fã^{ŋ}:.ai

Complete nasal deletion: fã:.ai

Nasal place assimilation: N/A

Surface form: [fã:.ai]

From the rule ordering in (10), we can see that in the case of nasal coda deletion, both nasality and the backness feature of the vowel are opaque. In the next section, we will briefly show how classical OT fails to capture this opacity-inducing rule interaction.

3. Opacity as a problem for classical OT and variants on classical OT

3.1 Classical OT

Optimality Theory (OT) can be regarded as the latest development of classical Generative Phonology (GP). Both rely to a certain extent on Universal Grammar (UG) (see *e.g.* Kager 1999, van de Weijer 2014). OT differs from classical GP in that it dispenses with phonological rules completely, and therefore also with serial derivation. It captures all phonology-related phenomena through the ranking of two sets of interactive constraints that evaluate surface forms only: faithfulness constraints and markedness constraints, which are both violable. Faithfulness constraints require that the surface form be faithful to the underlying form, which prevents phonological alternations. Markedness constraints (or well-formedness constraints) trigger phonological alternation by requiring that the surface form be well-formed. The core hypothesis of OT is that all constraints are the same for all languages, and that languages merely differ in the hierarchy of the constraint set.

For MC nasal rhymes, the processes of vowel nasalisation and rhyme harmony are the result of the interaction between the following faithfulness constraints and markedness constraints:

(11) a. Faithfulness constraints

IDENT-IO (nasal): Correspondent segments in input and output have identical values for [nasal].

IDENT-IO (back): Correspondent vowels in input and output have identical values for [back].

b. Markedness constraints

*$V_{ORAL}N$: before a tautosyllabic nasal, vowels must not be oral.

*V_{NASAL}: vowels must not be nasal.

RHYME HARMONY (R-H): The nuclear vowel in the rhyme agrees in its value of the [±back] feature with that of the nasal coda.

The markedness constraints *$V_{ORAL}N$ and R-H are undominated in the constraint hierarchy since they are never violated in surface forms. However, IDENT-IO (nasal) and IDENT-IO (back) can be violated to