Abstract of thesis entitled

"Loanword Truncation and Optimal Word Length: Evidence from Cantonese"

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There is a universal trend to reduce the size of commonly used lexical items and proper names. For instance, English names are sometimes shortened to monosyllables to show intimacy, as in *Pat* < *Patricia*, *Pete* < *Peter*; commonly used words are clipped, e.g. *lab* < *laboratory*, *prep* < *prepare*. The process by which the number of syllables in a word is reduced is termed truncation.

The truncation of words is a productive and impromptu process which generates a variety of shortened words, the loose restriction on the process allows possible truncated forms for the same word. Despite the great flexibility in the truncatory process, there is always a minimal size beyond which a word cannot be further truncated.

Past literature and studies suggested that the minimal size is determined by the prosodic structure, and it has been proposed that the size of the minimal word matches exactly the size of a foot (F) (McCarthy and Prince 1986). Later formulations suggest that the size of a word, as well as other morphological categories (such as stem, root and affix) has a minimal size

which can be described in terms of the phonological hierarchy (Prosodic Word – Foot – Syllable – Mora) (McCarthy and Prince 1995). Such correlations are, however, not well-established in some languages (Downing 2006). Cantonese is an example where the phonological categories do not correspond to minimal words and minimal stems.

The thesis aims to present and describe the Cantonese truncation data, collected from a corpus of English loanwords in Hong Kong and a spoken Hong Kong Cantonese Corpus (HKCanCor); and use the data to testify the general truncation theories. The data show (1) a discrepancy in size between verbs and nouns, and between nouns and stems, (2) sub-minimal (i.e. monosyllabic) verb and common noun truncations, and (3) words with high frequency are shorter. These peculiarities suggest that word size in Cantonese is sensitive to syntactic position and frequency information of the word. Local morphological information does not in itself determines the truncated size of a word.

It is proposed that size restrictions in Cantonese truncations can be explained by Duanmu (2007)'s information-stress principle which states that well-predicted elements should receive less stress, and Zipf's law (1965), which suggests that the form of frequently used words will become more economical. An examination of Cantonese loanword truncation suggests that information correlates with word length. A word is best to have a length which correlates with its information load in an utterance. A stressed position is more likely to be disyllabic and lengthened while an unstressed position is more likely to be monosyllabic and shortened. An optimal word length can then be defined as the size of a word, with respect to its word class (or each syntactic position) which best matches with its information load.
(462 words)

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by

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Declaration

I declare that the thesis and the research work thereof represents my own work, except where due acknowledgement is made, and that it has not been previously included in a thesis, dissertation or report submitted to this University or to any other institution for a degree, diploma or other qualifications.

Signed: _____

Lau Chaak Ming

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This thesis is, anyhow, dedicated to myself. My interest in learning languages inspired my interest in language systems and the rules behind which evolve the language we are using now. I have longed for conducting my own research, and giving answers to the questions I

have in mind ever since I was in secondary school. Before departing to Japan to further my research and postgraduate studies, I am glad to work on topics regarding Cantonese, the language I use everyday which I love very much.

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Lau Chaak Ming

Contents

Chapter 1 Introduction

1.1. Truncation and Minimal Word Length

Truncation is a word formation process which reduces word length. The reduction generally takes the form of removing certain parts of a word. Many facets of the process have been explored. Dictionaries dedicated to truncated words have been published in several languages, e.g. English (Rybicki 1971; De Sola 1978; *The American heritage abbreviations dictionary* 2005), Japanese (Kodansya Jitenkyoku 1996; Obunsya 2000), Chinese (Zhong 1986; Naxu and Wang 1996), etc. There are also studies which focus on one particular type of truncation in a particular language, such as the formation of hypocoristics (English, Lappe 2008; Japanese, Poser 1984), the truncation of place names (e.g. Australian English, Simpson 2001), etc. Truncation has also been studied under formal linguistic frameworks. There have been attempts to explain the precise detail of the transformation or evolvement of the final truncated forms, within modern phonological or morphological framework, notably McCarthy and Prince (1986, et. seq.), Itô (1990), Benua (1995), Yip (1992).

The form produced by the truncatory process must be, by definition, shorter than the original form. Then what is the shortest possible truncation is a language? Cross-linguistic evidence shows that words are usually not truncated to the shortest possible word in a language (e.g. Downing 2006), i.e. there is a limit beyond which a word cannot be further shortened. This can be illustrated with examples from Japanese. Japanese is a quantity-sensitive language (Akamatsu 1997), and the minimal word size in the native vocabulary is one mora. There is a very large amount of English loanwords in the Japanese vocabulary, some of which are prone to truncation. Regardless of the length of the original word, English loanwords can be truncated to 2 morae at most. Although monomoraic words are permitted in the native

vocabulary, monomoraic loanwords have never been reported (Itô 1990). Consider the examples in (1).

(1) Japanese two mora, disyllabic truncations

a. *sure-do* 'thread' > *sure*, **su*; c.f. *su* 'vinegar'

b. *terorizumu* 'terrorism' > *tero*, **te*; c.f. *te* 'hand'

c. *konekushoN* 'connection' > *kone*, *ko; c.f. *ko* 'child'

Although monomoraic words are found in the Japanese lexicon, truncated words cannot be further shortened when they reach two morae. Two morae is therefore said to be the minimal word size for Japanese truncations. Similar absolute limits are imposed on truncated words in other languages as well, and these limits which set the bottom lines for truncation may be different from the minimal size in the native vocabulary.

Cantonese is another language that has a large number of loanwords (e.g. Kiu 1977). The majority of these loanwords are disyllabic, with few exceptions. Monosyllabic English words are converted to two or more syllables in the loanword form (2).

(2) Cantonese loanwords

a. *cheese* > zi^1si^2, *zi^1

b. *block* > bok^6lok^1, *bok, *lok

c. *beer* > be^1zau^2, *be^1

Examples in (2) pose a word length problem. Although monosyllabic words are very common in the native lexicon, the disyllabic forms are usually preferred for the loanwords (Yip 1993). Cantonese loanwords are said to follow a disyllabic minimum, which means that monosyllabic forms are highly disfavoured in Cantonese.

The aim of this thesis is to investigate the minimality requirements exemplified in (2), and to find out whether, and if so, in what form, such size limit exists in Cantonese truncations. I will provide an explanation of the minimal word requirement, in truncation and non-truncation, native and loan vocabulary, towards the end of the thesis.

In the rest of this chapter, I will provide some working definitions several key concepts and discuss the word length problem posed by the truncatory process. I will first give a more precise definition to the terminology used throughout the thesis: truncation (section 1.1), word length (section 1.2) and loanword (section 1.3). I will then present several views on the word-length problem in the literature. The templatic view proposed by Prosodic Morphology (McCarthy and Prince 1986 et. seq.) (section 1.4) and some modifications to the traditional templatic view, motivated by the Optimality-theoretical movement (Prince and Smolensky 1993) and the Correspondence Theory (McCarthy and Prince 1994; Benua 1995) (section 1.5) will be discussed. The above views assume a heavy role of phonology, especially prosody, in the truncation process. I will, however, propose two additional factors, namely frequency and part of speech (section 1.6). To conclude the chapter, I will explain the framework that I will employ in the current study and the questions that I aim at answering towards the end of the thesis (section 1.7).

1.2. Truncation

Truncation broadly means the reduction of the number of syllables (or morae) in a word which is not induced by other phonological markedness requirements. The loss of syllables can be achieved in very different ways, and has been traditionally classified under different processes. Weeda (1992) provides a list with 20 different terms for truncation. As the precise mechanism of the formation of truncated form is not the focus of the thesis, I will use the

word truncation to refer to all processes that achieve the goal of reducing the number of syllables or morae.

No matter what view one takes, truncation is a relation that links at least two forms. One is the longer form, which is subject to reduction, and the other is the reduced form. I will adopt the definition used in Benua (1995), in which truncation refers to a mapping between a base form (i.e. the pre-truncation form) and a truncated form. The truncated form is part of but not equal to the base form. If the process view is employed, truncation is the process of shortening, and if the constraint-based view is employed, truncation is the subset of constraints which enforces Base-Trunc Identity (or BT-Identity, Benua 1995).

Having defined truncation above, there are two properties of truncation which should be mentioned. Firstly, there are always several possible legitimate choices for truncation. Such flexibility makes truncation a many-to-many mapping relation. That is, a base form can have more than one truncated forms, and the same truncated form could be the result of truncations from different base forms. Consider an example from English. English nicknames are formed by truncating names to one or two syllables, e.g. *Pete* < *Peter*. Sometimes more than one name yields the same truncated form, e.g. *Pat* < *Patrick*, *Patricia*; *Sandy* < *Alexander*, *Alexandra*. Some names have more than one truncated form, e.g. *Pat*, *Tricia* < *Patricia*; *Oli*, *Livy* < *Olivia* (Examples from Lappe 2008).

Secondly, following the first property, it is possible to have truncated forms of different lengths. Consider the following example in Cantonese. *Zim*^{1}*saa*^{1}*zeoi*^{2} (尖沙咀 *Tsim Sha Tsui*, a place name in Hong Kong), a tri-syllabic name, is truncated to 2 syllables, *zim*^{1}*zeoi*^{2} (尖咀), with the second syllable deleted. It is also truncated as a monosyllabic morpheme, *zim*^{1}, in

compounds, e.g. *zim[1]dung[1]* (*Tsim Sha Tsui East*). In such cases, it is not possible to discern which the base form is, *zim[1]saa[1]zeoi[2]* or *zim[1]zeoi[2]*. The monosyllabic morpheme may well be truncated from the disyllabic word or the trisyllabic word. Due to these properties, it is not always possible to ascertain the real base form from which the truncation process begins at the first place.

Certain classification of truncated forms requires knowledge about historical information (e.g. the earliest occurrence of a word) and truncation strategies (whether it is an extraction of prominent parts or removal of insignificant parts). It is noted that such information is not available to most language users. I will only make distinctions which may be necessary for later discussions.

1.2.1. Simplex versus complex truncation

Simplex truncation refers to the reduction of syllables or morae where the base form is a word, and the truncated form is used as a word on its own. e.g. *lab* < *laboratory*. The resulting form is on a morphological level identical to the base form. It can be used as an isolated word, and its distribution is relatively free. The process through which compounds are reduced to a shorter length is called a complex truncation, e.g. *comp sci* < *computer science*. A common description to a complex truncation is that one of the stems from each word in the compound is extracted and put back together. It has been suggested that complex words are truncated by a different mechanism in which morphology has a role, e.g. in Japanese, only complex truncations can end with a heavy syllable (LaBrune 2002). Simplex truncation is absent in some languages. Standard Chinese, for instance, has very limited simplex truncations. This may be due to its short average word length (words are generally one or two syllable(s) long), and does not allow room for further truncation.

1.2.2. Orthographic versus phonological truncation

If the resulting string of the truncated form is part of the phonological form, (e.g. *bus* < *omnibus*), it is considered to be phonological. In contrast, acronym formation or abbreviation, which puts together the first letters of several words, e.g. *NASA*, *CIA*, *FBI*, etc, are orthographic truncations, as the resulting string is not a part of the phonological form. Orthographic truncations are created to save space or typing effort, and the actual number of syllables may be longer than the original words. A notable example is the compound *world wide web*, an originally tri-syllabic compound, truncated to *WWW*, a three-letter long acronym with nine syllables.

1.2.3. Pure truncation versus affixation

In some truncated forms, the truncated string does not correspond exactly to the base form. For example, English name hypocoristic truncation requires the addition of –y at the end of the truncated form. Pure truncation refers to processes which do not result in such morpheme additions.

1.2.4. Subtractive versus simple truncation: (Weeda 1992)

A word can be truncated by radically cutting down the size of the base form to a desired target size or less commonly by taking away a small part from the base form. The former process is called simple truncation and the latter subtractive truncation. Typologically, most truncations are simple truncation, and subtractive truncation only accounts for a very small portion in any data. And in reality, when a word is four syllables or shorter, it poses a problem as to what is considered subtractive. To give an example, when the name *Patricia* is truncated to *Tricia*, is the first syllable taken away to save time (hence subtractive truncation) or the word is reduced

to the disyllabic target size (hence simple truncation)? There is no simple way tell the two apart, and it seems that in the above case, both answers are right. The distinction will therefore not be made in the present study.

Orthographic truncation is considered a phenomenon in the written language, and therefore will be excluded in the present study. All processes, including complex truncation, affixed truncation (e.g. hypocoristics), and subtractive truncation, which result in the reduction of number of syllables (or morae) will be referred to as *truncation* in the rest of this thesis.

1.3. Word Length

There are several ways of measuring the length of a word, and this section discusses the merits of three useful measurement units, namely segments, prosodic units and time duration.

The first way is to measure the number of segments in a word. Number of segments, or units that draw on the number of segments, are the units widely used in the early phonological literature (e.g. X theory, CV theory). The word size of Arabic verb declensions, for example, is measured by a combination of consonants (C) and vowels (V) in the CV theory (McCarthy 1979). An Arabic verb is said to fit in an invariant shape of CV(C)CVC. The problem of the segmental counting mechanism is raised by McCarthy and Prince (1986). Non-reduplicative morphological processes are known to utilise the size information, where only part of the base is copied in the reduplicative morphemes. The copied part is usually constrained by the number of syllables or morae, instead of the number of segments in a word. If segment is the unit for counting, a chunk of three segments should be treated identically in at least some phonological environments. For instance, the three chunks, *kla-*, *ale-*, *kal-*, all containing three segments, should be treated identically in at least some languages. Yet such language has

never been reported. The lack of such a language is rather odd (McCarthy and Prince 1986).

The second way of measuring word size is to count the number of prosodic components. As there is no known phonological process which relies on counting the number of segments, McCarthy and Prince (1986), in their prosodic morphology proposal, suggest that word size should be measured in prosodic units. Prosodic word, foot, syllable and mora are the legitimate members of the prosodic hierarchy. The definition of prosodic word, foot or mora may be disputed, but the number of syllables is usually accepted universally.

There is yet another way commonly used in the psychological literature (e.g. Baddeley et. al. 1975, et. seq.), which is to measure the average time it takes to utter a word. This is a measure unit which can be tested acoustically. Yet there is large inter-speaker variation and contextual variation. The same word can be uttered at different speed under different context, and a person who speaks fast needs less time to utter a word.

The three methods above have their own merits, but the study of truncation requires an invariant measurement that will not be affected by individual speaker difference and segmental analysis. In the present study, the term word length refers to the number of syllables or morae (where applicable), which are the two lowest units on the prosodic hierarchy. This choice is made as the number of syllables and morae is usually agreed in most languages. The term word duration refers to the time it takes to utter a particular word. The terms length requirement and size requirement will be used analogously in the remaining text, to refer to a restriction to word size / word length in terms of number of syllables / morae. The number of segments will not be used as a measurement of word size. Having defined the unit of measurement, I will elaborate my definition on the adaptation and truncation of loanwords.

1.4. Loanword, Loanword Adaptation and Loanword Truncation

Loanwords are lexical items in a language (the borrowing language, or Lb hereafter) which are borrowed from another language (the source language, or Ls hereafter). The realisations of the borrowed form are usually different from the original form due to the differences between the phonologies (both the phonological inventories and the phonotactics) of the borrowing language and the source language. The process in which loanwords is distorted to adapt the phonological environment of the borrowing language, called loanword adaptation, are commonly known to preserve the resemblance to the source language by making minimal distortion to the pronunciation.

In some languages, notably Japanese (Itô 1990) and Cantonese (Kiu 1977), loanwords are systematically truncated. Such truncations are considered not a central part of loanword adaptation (e.g. Silverman 1992), as it goes beyond the need to accommodate native phonology. It is best to consider these to be two separate processes, namely loanword adaptation, which modifies phonetic forms to fit with the native sound inventory, and loanword truncation, which removes unwanted syllables / morae.

One may wonder what makes loanword truncation different from the truncation of native words. The answer lies in the internal structure of words. There is a cross-linguistic tendency which prefers monosyllabic morphemes to longer morphemes (Russell 1997). It means that a morpheme is usually one syllable long. Polysyllabic words, which are legitimate candidates for truncation, tend to have an internal morphological structure (i.e. formed by combining several morphemes). Polysyllabic words are therefore hardly truncated because shorter words can be formed by other morphological means. In contrast, the morphological structure of

loanwords is usually not available to the speakers, and the adaptation process may have obscured the morphological relation. As loanword truncation is not 'guided by pre-existing internal morphological structure' (Itô 1990), results from loanword truncation better reflect the preference of the phonological system, more so than native truncations, which are constrained by morphological factors.

1.5. Explaining Word Length by Templates

As discussed above, truncation is a productive process that generates a variety of truncated forms, which vary in terms of word length, defined as number of syllables or morae (section 1.2). Despite the great flexibility, these truncations are restricted by a minimum length, beyond which words cannot be truncated (section 1.1). This length requirement calls for a theoretical explanation. My aim in this section is to present the view which uses the notion 'template' to explain the size or shape requirements in truncation (and other morphological processes). Here, I will present an explanation from the templatic theories in the prosodic morphology literature. I will first discuss the basic assumptions of prosodic morphology and templates (McCarthy and Prince 1986, et. seq.) (section 1.5.1). Then, I will present an outline of Generalised Template Theory (McCarthy and Prince 1995) (section 1.5.3) and Morphological-Based Template Theory (Downing 2006) (section 1.5.4).

1.5.1. Templates and Prosodic Morphology

Template refers to the invariant or canonical shape, which shapes the surface form of a morpheme (McCarthy and Prince 1995). In truncations, reduplications, circumscriptions and root-and-pattern morphology, the segmental detail (i.e. what segments the morpheme contains) is not specified, and is to be filled by contents from the base form. Consider the example in (3) from Ilocano. The left column is the singular form of nouns. Plural nouns are

formed by prefixing a plural morpheme in front of the underlying form of the word. Despite the difference in the segmental contents of the added parts, they are considered different realisations of the same reduplicative morpheme (RED).

(3) Ilocano Heavy Reduplication (McCarthy and Prince 1986)

a.	kaldíŋ	“goat”	kal-kaldíŋ	“goats”
b.	kláse	“class”	klas-kláse	“classes”
c.	trák	“truck”	tra:-trák	“trucks”

The RED morpheme prefixed to Ilocano nouns, although segmentally different, takes the same shape. All realisations of RED morpheme in Ilocano plurals are exactly one syllable long, and they are always heavy. It is therefore said that Ilocano plural construction is formed by adding a reduplicative morpheme in front of the base noun, and this reduplicative morpheme follows a template which is a maximally filled syllable (McCarthy and Prince 1995).

Prosodic morphology is one of the most influential theories which restrict the definition of a template. It is considered to be ‘a theory of how prosodic structure impinges on templatic and circumscriptional morphology’ (McCarthy and Prince 1995:318). It claims that when a template is needed in any morphological operations (such as truncation), or when an operation requires the delimitation of forms, the boundary must be defined by the prosody. The formal definition of the principle is stated below:-

(4) Principles of Prosodic Morphology (McCarthy and Prince 1995)

a. Prosodic Morphology Hypothesis

Templates are defined in terms of the authentic units of prosody: mora (μ), syllable (σ), foot (F), prosodic word (PrWd).

b. Template Satisfaction Condition

Satisfaction of templatic constraints is obligatory and is determined by the principles of prosody, both universal and language-specific.

c. Prosodic Circumscription (omitted).

Following McCarthy and Prince (1986), the hierarchy is ordered in a dominance relation, depicted in (5).

(5) Prosodic Hierarchy (McCarthy and Prince 1986)

Prosodic Word (PrWd)

|

Foot (F)

|

Syllable (σ)

|

Mora (μ)

In the above hierarchy, mora is the unit of syllable weight (Hyman 1985). In quantity-sensitive languages, a heavy syllable contains two morae and a light syllable contains one, and in quantity-insensitive language, all syllables contain one mora. Every prosodic word must contain at least one foot, every foot must contain at least one syllable and every syllable must contain at least one mora. Prince (1980) poses the binary requirement on foot size, which requires feet to be binary at syllabic or moraic analysis. In order to fulfil the binary requirement, a foot must contain either two syllables or one syllable with two morae.

It has been suggested that the smallest morphological word should be a minimal prosodic

word (McCarthy and Prince 1986). Given the above definitions, the smallest word can be defined as the smallest possible prosodic word. By the dominant relation, a prosodic word must contain a foot, and by the foot binary requirement, a foot must contain either two syllables or two morae. Thus, every word (in the morphological sense) must contain two syllables or two morae (McCarthy and Prince 1986).

Several morphological processes, such as the formation of Cantonese hypocoristics (6), provide a clear demonstration of the correlation.

(6) Cantonese Hypocoristics (partly adopted from Yip 1993)

a. Monosyllabic names

i. *Chan* > *Ah Chan*

ii. *Keung* > *Ah Keung*

iii. *Paul* > *Ah Paul*

b. Disyllabic names

i. *Au Yeung* > * *Ah Au Yeung*

ii. *Kwok Keung* > * *Ah Kwok Keung*

Cantonese, which is traditionally classified as a quantity insensitive language, should follow a disyllabic minimality requirement (the quantity insensitive status is disputed, see Lai 1999 and Chapter 3). Quantity insensitive language has, in theory, disyllabic foot. Monosyllabic names are therefore prefixed to form a foot (Yip 1993).

The Cantonese case illustrates how the prosodic category, foot, correlates with the word-size requirement. The early proposal of prosodic morphology suggests that a word is minimally a foot. The correlation does hold for some cases, e.g. Arabic broken plurals, Japanese bimoraic

truncation, Ilocano heavy reduplication, etc., yet the 'foot equals minimal word' hypothesis does not hold in most cases. I will illustrate the point with Japanese loanword truncation (7). (Brackets indicate foot boundary).

(7) Japanese loanword truncation (Itô 1990)

a. Valid 2-morae truncations

i. *helicopter* > *he.ri.ko.pu.ta.a* > (*he.ri*)

ii. *demonstration* > *de.mon.su.to.re.shon* > (*de.mo*)

b. Invalid 2-morae truncations

i. *word* > (*waa*) *do*, *(*waa*)

ii. *permanent* > *paa.ma.nen.to* > (*paa*) *ma*, *(*paa*)

As shown in the examples of (7), fulfilling the size requirements at the word level is not sufficient for a truncation to be considered well-formed. It is possible that there exists a size limit at other sub-lexical morphological levels, like stems or affixes. The additional requirement in Japanese loanword truncation, for instance, is a disyllabic stem requirement (Itô 1990), which goes hand-in-hand with the bimoraic word minimality requirement. The Japanese example suggests that size requirement has been over-simplified in McCarthy and Prince's (1986) formulation. It requires a more sophisticated formulation which explains size requirement at other morphological levels.

Due to the frequent mismatch between the foot-sized template and the minimal word, a more general framework, called Generalised Template Theory (McCarthy and Prince 1995, et. seq.) was developed. Under this theory, there are separate templates for different morphological categories, such as affix, stem, root, etc.

1.5.2. Generalised Template Theory (GTT)

We are now ready to consider GTT. One major proposal in GTT is that Prosodic Word (PrWd) is not necessarily identical to the size of a lexical word. Instead, it can be identical to any unit in the morphological hierarchy. It is stated formally as a constraint in (8).

(8) MCat = PrWd (McCarthy and Prince 1995),

where MCat ≡ Root, Stem, Lexical Word, etc.

This allows great flexibility in explaining cross-linguistic variability in word size. In addition, the size of different morphological categories can be specified at different levels of prosodic hierarchy. Japanese loanword truncation, as illustrated in (7), poses a problem to the word-foot correlation suggested by the traditional prosodic morphology analysis. GTT provides a better explanation by utilising both stem requirement and word requirement. Itô (1990) suggests that Japanese derived words comprise stems and affixes. A word consists of either two stems or a stem plus an affix. It is subject to the minimal word requirement of a foot, and there is an additional requirement at the stem level, which requires a minimal stem to be two syllables. The heavy syllable form is actually attested in compounds, such as *waa-puro* < word processor and *kuru-paa* < *curvy* + *permanent (a hair style)*. This form is allowed because the two stems which form the compound both fulfil the stem requirement, and the word must contain two or more syllables.

(9) Example of Japanese loanword truncation (Itô 1990)

a. *helicopter* > *he.ri.ko.pu.ta.a* > (*he.ri*)

b. *demonstration* > *de.mon.su.to.re.shon* > (*de.mo*)

c. *word* > (*waa*) *do*, *(*waa*)

d. *permanent* > *paa.ma.nen.to* > (*paa*) *ma*, *(*paa*)

When the form is used in isolation, although *(*waa*) fulfils the minimal stem requirement, it fails to satisfy the two syllables requirement at the word level, and therefore fails to surface. The additional flexibility provided by GTT is that the size of a word, a stem and an affix can be individually defined with any of the prosodic hierarchy. The above example explains how the size requirements of word and stem explain most cases of Japanese loanword truncation. Below lists out some commonly used constraints / rankings (adopted from Downing 2006)

(10) GTT constraints

a. Affix <= σ: An affix is smaller than or equal to a syllable

b. Root(Faith) >> Affix(Faith): Roots contain more marked structure than Affixes.

c. Headedness: Every Prosodic Word must contain a Foot.

(11) Other constraints

a. Binarity(σ): Feet are disyllabic or bimoraic (Prince 1980)

b. Max-BR: Every segment in the base form has a copy in the reduplicated morpheme. (Correspondence Theory, McCarthy and Prince 1995)

With these additional constraints, the distinction between size requirement of affix and root can be formalised in the OT framework. Ilocano has a different kind of reduplication, in which only a light syllable is copied by the reduplicative morpheme. The two reduplications can be explained with GTT constraints, which allows the specification of different prosodic requirements at different morphological levels (example adopted from McCarthy and Prince 1986, OT table adopted and modified from Downing 2006:14).

RED_{Affix}-trabaho	AFFIX ≤ σ	NOCODA-$_{AFFIX}$	*VV-$_{AFFIX}$	BINARITY(σ)	MAX-BR
a. trab-trabaho		*!			***
b. tra:-trabaho			*!		****
c. trabaho-trabaho	*!			***	

→d. tra-trabaho				*	****

Ilocano Light Reduplication, with GTT constraints

RED_{Stem}-trabaho	AFFIX ≤ σ	NOCODA-$_{AFFIX}$	*VV-$_{AFFIX}$	BINARITY(σ)	MAX-BR
→a. trab-trabaho					***
b. tra:-trabaho					****!
c. trabaho-trabaho				*!**	
d. tra-trabaho				*!	****

Ilocano Heavy Reduplication, with GTT constraints

The GTT constraints, as shown above, allows the formulation of template restriction, on different morphological categories. In the above example, light and heavy reduplications are explained by the same ranking of constraints. Light reduplication can be explained by imposing a set of affix-targeting constraints, which restricts the size or form of an affix. This prohibits heavy affixes surfacing in light reduplication but not in heavy reduplication.

This formulation has the merit that templates are generalised as a set of OT constraints, instead of separate phonological rules, and that the two reduplications can be explained by adopting morphological categories. Light reduplication is an affix-reduplication and is therefore subject to affix-related constraints. Heavy reduplication, as it deals with stems, is freed from those constraints. By providing different size requirements to different morphological categories, the two types of reduplication can now be explained by the same set of constraints rankings in OT.

Allowing templates to be specified at different levels, however, has not addressed some

theoretical issues. For example, it cannot explain the word minimality phenomenon in languages without stress or with large amount of sub-minimal truncated words. There are two alternative proposals which attempt to explain these unaccounted for cases. One proposal is to explain word size requirements by the morphological composition of a word (section 1.5.3). Another way to explain word size is to dispense with templates entirely, and use alignment constraints to regulate word truncation (section 1.6).

1.5.3. Morpheme-Based Template Theory (MBT)

Most GTT formulations suggest a correlation between foot and word minimality. A minimal word is commonly agreed to be one foot in size, which is equal to two syllables or two morae, depending whether a language is quantity sensitive or not. According to the requirement, if word minimality depends on the size of a foot, a quantity sensitive language should have a minimal word size of two morae, one heavy syllable or two light syllables. The correlation between the two was shown to be inadequate by Downing (2006). The disyllabic minimality phenomenon is strikingly more prevalent than the number of quantity insensitive languages (Downing 2006), which suggests that disyllabic minimality may be irrelevant to quantity sensitivity. German, for example, is a quantity sensitive language, yet it exhibits disyllabic word minimality, as illustrated by the infinitives (12):

(12) German accusative formation (Ussishkin 2000:38-9, adopted from Downing 2006:137)

a. Monosyllabic infinitive

   i. *sehen* zeː.n̩, *zeːn;

   ii. *bauen* bau.n̩, *baun

b. Monosyllabic nouns:

   i. *zehn* tseːn,

ii. *Köln* kœln.

On the other hand, sub-minimal words are universal. Tokyo Japanese has a large number of native words which is one-mora long, which is definitely under the one-foot minimal requirement (Itô 1990). As will be shown in Chapter 2, Cantonese is another language that violates the correlation

Downing (2006) argues that there is a clear mismatch between foot structure and minimality requirement in some languages, and the hypothesis that the minimal word is a prosodic word is not true cross-linguistically. She suggests an alternative which exploits the correlation between morpheme counts and word size.

The basic assumption of the morpheme-based template theory is that the phonological hierarchy in (5) should be separated into two. Downing follows Inkelas (1989)'s analysis to separate Feet – Syllable – Mora to form a hierarchy (the rhythmic hierarchy), and Prosodic Word dominates Prosodic Stem and Prosodic Root in the new prosodic hierarchy.

The size of a morpheme is constrained by the morpheme to syllable correlation, which suggests that a morpheme is best realised as one syllable. This is formalised as the MORPH-SYLL constraint (13):

(13) MORPH-SYLL (Russell 1997:121)

Each morpheme contains exactly one syllable.

According to the morpheme-syllable correlation principle, word size is correlated to the number of morphemes instead of an absolute size constraint on words. A word is minimally a stem, and a minimal stem is formed by a root plus an affix (or two roots). If the morph-syll principle is observed, the prevalence of disyllabic minimality is well-accounted for. This

restriction on Stem size is formulated as a constraint in (14)

(14) Prosodic Stem Minimality (Itô 1990, Itô and Mester 1992)

A minimal Stem is disyllabic.

With the Morpheme-Syllable Correlation and Stem Minimality, morpheme-based template formulation explains the cross-linguistically applicable disyllabic requirement without using the foot correlation. It also solves the puzzle in Tokyo Japanese, as suggested by Itô, where derived words and underived words are subject to different size requirements, by considering truncation an attached morpheme to the root. I will return to this theory in my analysis (Chapter 3).

1.6. Explaining Word Length without Templates

As shown in the Ilocano example, heavy reduplication can be explained without using any template. The MAX-BT constraints and Binarity constraint allow the surfacing of heavy reduplicative forms. Here comes a question of redundancy. Is it possible to explain truncated word lengths without using the template concepts? There have been attempts to use only alignments and MAX-BT / DEP-BT constraints to explain the formulation of truncated forms. For instance, LaBrune (2002) explains Japanese simplex truncation by Align constraints and correctly predicts the range of possible Japanese truncations.

I have reviewed the treatment of truncation in formal approaches, by Prosodic Morphology, and later formulations of Generalised Template Theory under OT. Prosodic Morphology is the view that prosody determines the size of templates in morphological operations. GTT augments the original proposal by allowing bases, stems, roots to be the target of prosodic size constraints. MBT suggests that morphological composition is the source of templatic

restrictions, and that the size constraints are from the Morph-Syll principle. These later theories have incorporated the truncation process into the general OT framework, which simplifies the morphological explanation by reducing the process to The Emergence of The Unmarked (TETU). Although the concept of template is completely replaced by Align, MAX-BT and DEP-BT constraints in recent formulation (e.g. LaBrune 2002), I will argue that template, or a similar size requirement, is indispensable when actual language processing is taken into consideration. Yet the template is not to be defined under formal linguistic formulation. Instead, it requires consideration of two other factors, word class and word frequency.

1.7. Other factors affecting Word Length

Prosody has been thought to be a major, if not exclusive, factor that determines word length, and yet in the vast literature of synergetic / quantitative linguistics (Zipf 1968; Mandelbrot 1953; Miller, Newman and Friedman 1958; Baayen 1991; etc.), which studies the statistically properties of language, word class and word frequency have been shown to affect word length.

1.7.1. Word class

Average word length varies between word classes. Functional words are in general shorter than lexical words. A typical preposition, in general, will not be longer than a typical verb. Within lexical items, verbs tend to be shorter than nouns. For instance, in several languages, nouns are minimally disyllables and verbs are minimally monosyllables (Bantu, Orie 1997; Standard Chinese, Duanmu 2000; etc.). It seems reasonable to assume that different word classes may have different average word size. The correlation between word length and word class in Cantonese is discussed in Luke and Lau (2008) and will be further elaborated in

1.7.2. Word Frequency

Word frequency is also shown to have an effect on word length. More frequent words tend to be shorter. The same effect is shown in English, Latin, French, Pekingese and several Native American languages (Zipf 1968). From an information processing perspective, less frequent words cause confusion if shortened while frequently used words produce too much redundancy if they are kept untruncated. This viewpoint will be further discussed in Chapter 4.

1.8. The Present Study

In this chapter, I have defined truncation as a many-to-many relation which reduces the word length of a word. Word length is defined in terms of number of syllables, and word duration is defined as the time it takes to utter a word. I have suggested a working definition for the term truncation, and described the adaptation process and subsequent truncation. Examples of loanword truncation show that there is a limit to the shortening process, in which words are not allowed to truncate beyond a minimal length. The word minimality phenomenon was accounted for under various formal linguistic frameworks. I have described the prosodic morphology view, which proposes that a minimal word is a template which has the size of a prosodic foot.

Further elaborations on the theory, such as the Generalised Template Theory and Morpheme Based Template Theory, that suggests different definitions to template, have also been discussed. Then I outlined two alternative views, namely the atemplatic theory which explains word minimality by alignment and correspondence constraints, and the synergetic linguistic

view which suggests a significant role for word frequency.

In subsequent chapters, I will present the data from Cantonese loanword truncation. Cantonese has a large amount of truncated loanwords. It has a productive process which trims loanwords down to one to two syllables, and allows loanwords to form compounds. I will first describe the loanword data collected from different word lists, and outline the idiosyncrasies in the data (chapter 2). Then, I will move on to discuss the prosodic structure and lexical statistics of Hong Kong Cantonese (chapter 3). Next, I will test the data against existing theories, and will compare the predictions from existing theories. I will propose an information load account which explains the relation between word length and factors that affect word length (chapter 4).

Chapter 2 Cantonese loanword truncation

The previous chapter reviewed some universal phenomena about loanwords, truncation and some theoretical accounts of these phenomena. In this chapter, Cantonese data on truncation of loanwords is presented. The aim of this chapter is to examine the truncation patterns that take place after the adaptation of loanwords, and to highlight some peculiarities in loanword truncation which challenge traditional views on word length requirements. I will first discuss the definition of loanwords in Cantonese (section 2.1). Next, I will give a description of the database I have created for this investigation (section 2.2). Then, I will describe the loanword adaptation pattern of English words that have entered Cantonese (section 2.3). Next, I will describe the truncation process that commonly takes place in the Cantonese native vocabulary (section 2.4.1) and in loanwords (section 2.4.2). On the basis of detailed description of Cantonese truncations, I will discuss some observations on the data, which shows an asymmetry between word classes and morphological classes (section 2.4.3).

2.1. Loanwords in Cantonese and its definition

Cantonese is the predominant language in Hong Kong, and the most common first language of the majority of the population. English, in contrast, is a compulsory subject in the education system, and is the medium of instruction in one-third of secondary schools in Hong Kong. Educated Hong Kong Chinese have some command of English, and English words are commonly found to be inserted into everyday Cantonese conversation. (Luke and Richard 1982; D. Li 2003; Luke 2005)

Due to the diaglossic situation in Cantonese, the simple definition of loanword requires some modification. Modern Standard Chinese is the literary language in Hong Kong, and a lot of

words enter Cantonese through the written language. Yet the lexicon of Modern Standard Chinese is highly incorporated into the native lexicon. Due to the high overlap between the two sets of vocabulary and the large amounts of cognates, it is inappropriate to consider words from Standard Chinese loanwords. In the subsequent discussion, the term 'native words' refers to words with Cantonese or Standard Chinese origins, unless otherwise specified.

The question then becomes whether all English words in Cantonese speech should be considered loanwords. Due to the highly identifiable nature of English words, the use of English words in Cantonese has been considered as a case of code-mixing in the literature (e.g. Pennington 1994). I will argue that most code-mixings are indeed lexical borrowing, as these items are used in compliance to Cantonese grammar, are pronounced in a Cantonese-influenced fashion and are susceptible to the truncation process.

The argument stems from several radically different definitions employed by scholars on what constitute a loanword. Paradis and LaCharité (1996, 2003), following Myer-Scotton (1992), only consider integrated loanwords (loanwords that have a L1 representation in both bilinguals and monolinguals) as adapted loanwords, and consider all other non-native items as code-switching. In contrast, Haugen (1950) defines loanword as words that are learnt in a different linguistic context where the word is used. Despite the popularity of loanwords in daily Hong Kong Cantonese (D. Li, 2003), speakers can often distinguish loanwords with clear English origin from the native vocabulary. Only a very small amount of loanwords are integrated into the native Cantonese lexicon, and are usually those which are undistinguishable from native lexical items. Speakers' intuition should be a fairly acceptable criterion to tell whether a word is still considered a loanword or not.

Beside Haugen's (1950) linguistic context criterion, it has also been proposed that phonological integration can be used as a criterion to distinguish loanwords from non-loanwords. Paradis and LaCharité exclude all words that contain foreign phoneme from the loan word list, as it shows incomplete adaptation. Poplack et. al (1984, 1988) suggests that loanwords, although sometimes not completely integrated phonologically, are more integrated compared to full sentence code-switches. A word which is phonologically integrated is definitely a loanword, yet the reverse is not true. A loanword is not necessarily pronounced in a phonologically integrated manner. That highly proficient bilinguals tend to pronounce borrowed items in an L2-like fashion is a good example. Level of phonological integration will not be a good criterion as it reflects the speakers' competence rather than the degree of integration of a particular loanword.

Yet another way to distinguish whether a word is loan or native is whether or not the word can be written using Chinese characters (Chan and Kwok 1982). It is not advisable to use the availability of Chinese characters as a means to separate loanwords from non-loanwords, as there is a significant portion of native Cantonese words which cannot be written or are written as sound approximation, a method applied to both native Cantonese words and loanwords. Chinese characters are sometimes created to represent English loanwords, e.g. *lift* is written with the 'car' radical 車 on the left and the character for 'stand' 立 on the right. The right part of the character reads /la:p/, which approximates the pronunciation of the loanword /li:p/

As a working definition, I will consider all words that are perceived as 'English words' by native Cantonese speakers (i.e. learnt at different linguistic context), which are frequently

attested in Cantonese speech (followed from Myers-Scotton 1992) as loanwords, regardless of the level of phonological integration.

2.2. Cantonese loanword data

A loanword database is constructed for the purpose of this study. It is based on data from Cheung (1972), Chan and Kwok (1982) and Bauer and Benedict (1997). In addition to the three lists, newer loanwords and recent pronunciations of older loanwords, as of the year of 2008, were included in the database. The database has a total of 1921 loanword entries. Some listed entries from older sources are out of use, but are kept on the lists for the sake of completeness. Each entry records a loanword, with the written form, pronunciation, variants (both written and spoken), English gloss, word class in Cantonese contexts, source and remarks.

The newly added entries are words with English origin, which I have heard or used, and found perfectly grammatical when used in a suitable Cantonese context. I am certain that not all words are used by every speaker. I am justifying my judgement, as the purpose of the database is not to provide a complete list of 'accepted loanwords'. The data serves only to give a general picture of the use of loanwords by educated Hong Kong Cantonese speakers.

2.3. Adaptation of loanwords

This section summarises the adaptation of English sounds in Cantonese loanwords. The adaptations of consonants and stress are regular. There are some variations in vowel adaptations, especially in older loanwords, mainly due to the orthographic system of Cantonese (c.f. Yip 2006). The rules described below are true for most newly imported loanwords, but less applicable to older loans. This is a universal trend reported by Haugen

(1950), which suggests that loanwords at the early stage show a high degree of variation.

I have extracted data from the database freely to illustrate my discussion. Phonetic transcriptions of Cantonese words are IPA, and are placed in square brackets ([ ]). Phonemic transcriptions are written in LSHK Romanisation, in *italic* fonts. Tones are omitted if not relevant to the discussion.

2.3.1. Onset

Cantonese and English are largely different from each other in the structure of the onset. In Cantonese, labialisation is allowed only after velar consonants. Consonant clusters are not allowed in Cantonese onsets, except for a few variants of onomatopoeia which allows /l/ in its contracted forms. English onsets are relatively freer. Consonant clusters are common in the onset, with a maximum of three consonants. Stops and voiceless fricatives /s/ and /f/ can be followed by virtually all approximants. Cantonese distinguishes two sets of stops and affricates, aspirated and unaspirated. English distinguishes two sets of stops, fricatives and affricates which differ by voicing.

The adaptation of stops is straight-forward. English voiced stops are adapted as Cantonese unaspirated stops, while English voiceless stops are adapted as Cantonese aspirated stops. There are few exceptions in earlier loanwords, where voiceless English stops are adapted as unaspirated stops. The number is relatively small and can be considered as an exception (Cheung 1972). The voicing rule applies to the affricates as well.

(15) Adaptation of English Stops

a.	*bus*	[bʌs]	>	[paː.siː]
b.	*order*	[ɔː.də]	>	[ɔː.taː]

c. *dockyard* [dɒk.jɑːd] > [tɔːk.jaːt]

d. *guitar* [gɪ.tɑː] > [kiː.tʰaː]

e. *band* [bænd] > [pɛn]

f. *chalk* [ʧɔːk] > [tsʰɔːk] OR [ʧʰɔːk]

As aspiration is not distinctive in fricatives, all fricatives are mapped to their voiceless counterparts. The sound v is a notable exception, where it is adapted as /w/ in word-initial positions and word-medial position after closed syllables and as /f/ in word-final position and word-medial position after open syllables. Anteriority is not a distinctive feature in Cantonese fricatives and affricates. Therefore, all English fricatives and affricates are mapped to their anterior counterparts. The sets of post-alveolar sounds, ʃ, ʒ, ʧ and ʤ are adapted as s, s, tsʰ and ts respectively. Interdentals are not found in Cantonese. In older loans, the sound θ and ð are adapted as tʰ and t respectively. In new loanwords, θ is adapted as f.

(16) Adaptation of English Fricatives and Affricate

a. *sorry* [sɒ.ɹɪ] > [sɔː.wiː]

b. *file* [fɑɪl] > [faːj.low]

c. *hello* [hel.əʊ] > [haː.low]

d. *zinc* [ziŋk] > [sɪŋ]

e. *saving* [seɪ.vɪŋ] > [sej.fɪŋ]

f. *van* [væn] > [wɛːn]

g. *shaft* [ʃɑːft] > [sɐp]

h. *check* [ʧek] > [tsʰɛːk] OR [ʧʰɛːk]

i. *jelly* [ʤel.i] > [tsɛː.lej]

j. *thank you* [θæŋk.ju] > [tɛːŋ.kiːw] OR [fɛːŋ.kiːw]

Indeed, the post-alveolar sounds are found in Cantonese as allophones or accepted variants before certain rounded vowels, ɵ, œ, ʏ. For affricates, ɔ and ʊ also induce the -anterior variant. The two sets of fricatives / affricates are therefore pronounceable by most Hong Kong Cantonese speakers. Newer loans are found to distinguish between +anterior and –anterior sounds.

(17) Adaptation of English Fricatives and Affricate in newer loans

a.	*sharp*	[ʃɑːp]	>	[sɑːp] OR [ʃɑːp]
b.	*cheap*	[ʧiːp]	>	[tsʰiːp] OR [ʧʰiːp]
c.	*jeep*	[ʤiːp]	>	[tsiːp] OR [ʧiːp]

Other sounds are adapted by the corresponding phoneme in Cantonese. Due to the lack of /r/, it is adapted as /w/ in isolation, and sometimes dropped in consonant clusters. Some very old loans adapt /r/ as /l/, which is not attested in any new loan words. There is a trend to retain the /r/ sound in newer loanwords. Due to the n-l merger in Cantonese, n is often substitute by the l sounds in loanwords.

(18) Adaptation of English Nasals and Approximants.

a.	*major*	[meɪʤ.ə]	>	[mɛːtsɑː] OR [mej.ʧœː]
b.	*number*	[nʌmb.ə]	>	[nɐm.pɑː] OR [lɐm.pɑː]
c.	*rum*	[ɹʌm]	>	[lɐm] OR [ɹɐm]
d.	*round*	[ɹaʊnd]	>	[lɑːŋ] OR [ɹɑːŋ]
e.	*lift*	[lɪft]	>	[liːp]
f.	*winner*	[wɪn.ə]	>	[wiːn.nɑː]

Consonant clusters are generally not allowed in Cantonese, while English allows a variety of consonant clusters. Cantonese loanwords adapt consonant clusters by epenthesising a vowel

between the first and second consonants. The sound /r/ in consonant clusters is treated very differently. In newer loans, /r/ either add a [+round] to the previous stop, or simply removed. The sound /l/ is dropped or retained as clusters in newer loans.

(19) Epenthesis in English Loanwords

a.	*cream*	[kɹɪm]	>	[kej.liːm]
b.	*brandy*	[bɹænd.ɪ]	>	[bɐt.laːn.tej]
c.	*brake*	[bɹeɪk]	>	[pɪk.lɪk]
d.	*smart*	[smɑːt]	>	[siː.maːt]
e.	*stick*	[stɪk]	>	[siː.tɪk]

(20) Dropping or adaptation of /r/ and /l/ in English Loanwords

a.	*cream*	[kɹɪm]	>	[kʷiːm]
b.	*track*	[tɹæk]	>	[ʧʷʰɛːk]
c.	*brake*	[bɹeɪk]	>	[pɪk]
d.	*freezer*	[fɹiːs.ə]	>	[fliː.saː] OR [fiː.saː]
e.	*place*	[pleɪs]	>	[pʰlej.siː] OR [pʰej.siː]
f.	*plan*	[plæn]	>	[pʰlɛːn] OR [pʰɛːn]

Yip (1993) suggests that the choice between epenthesis and dropping is conditioned by the length of the word. She proposes that monosyllabic words are more prone to epenthesis, such that the disyllabic word size requirement can be maintained.

(21) Consonant Cluster Epenthesis and Word Length Requirement

a. Monosyllabic words

i.	*print*	[pɹɪnt]	>	[pʰiː.liːn]
ii.	*plum*	[plʌm]	>	[pow.lem]
iii.	*brake*	[bɹeɪk]	>	[pɪk.lɪk]

b. Disyllabic words

i. *printer* [pɹiːnt.ə] > [pʰiːn.tʰaː]

ii. *freezer* [fɹiːs.ə] > [fliː.saː] OR [fiː.saː]

This length pattern may be true at some point of time, but there seems to be a trend to avoid epenthesis entirely in the new data (Yip 2006).

2.3.2. Coda

Codas are usually more restrictive than the onsets. English codas can have up to four consonants (e.g. *sixths*), but these are usually the result of complex morphological constructions. Stops and nasals are permitted in Cantonese codas, so most English words can be substituted by their Cantonese counterparts. As there is no voicing or aspiration distinction in the Cantonese coda position, all English stops are adapted as a voiceless stop. The voicing distinction is preserved as a vowel length distinction in some syllables (e.g. site and side), as voiced codas lengthen preceding vowels in English. Final /l/ becomes /w/, and syllabic /l/ undergoes vocalisation and becomes /low/. Fricatives are adapted by epenthesising a vowel. Alveolar sounds (/s/, /ʦ/) are epenthesised by an /iː/, labial sounds (/f/) is epenthesised by an /uː/, post-alveolar sounds (/ʃ/, /ʧ/) are epenthesised by /yː/. To some speakers, mainly those with higher English proficiency, fricatives are allowed in coda positions, and epenthesis is optional. In older loans, final fricatives can be adapted as homorganic stops. This adaptation is no longer productive.

(22) Adaptation of English Codas

a. *cheque* [ʧek] > [ʦʰɛːk]

b. *bus* [bʌs] > [paː.siː]

c. *save* [seɪv] > [sej.fuː]

d. *plan* [plæn] > [pʰɛn]

e. *cash* [kæʃ] > [kʰɛː.ʃyː]

In case of consonant clusters, if the word-final consonant is less sonorant, e.g. stops after fricatives or nasals, they are almost always dropped. Otherwise, epenthesis (/iː/ or /uː/) takes place to rescue the final consonant.

(23) Adaptation of English Complex Codas

a.	*friend*	[fɹend]	>	[fɛːn]
b.	*band*	[bænd]	>	[pɛːn]
c.	*toast*	[təʊst]	>	[tɔː.siː]
d.	*last*	[lɑst]	>	[laː.siː] OR [laːs]
e.	*disk*	[dɪsk]	>	[tiːt.siː] OR [tiːs]
f.	*tips*	[tɪps]	>	[tʰiːp.siː] OR [tʰiːp]
g.	*fax*	[fæks]	>	[fɛːk.siː] OR [fɛːk]

2.3.3. Nucleus

Both languages have a relatively large vowel inventory, and it is nearly always possible to find a good match in Cantonese which fits with an English vowel. There are some mergers in Cantonese adaptations of English vowels (e.g. /æ/ and /ɛ/, /ɒ/ and /ɔ/). The sound /ɛ/ and /œ/ are very restrictive phonemes in the native Cantonese vocabulary, which do not occur before /m/ and /w/, and only occur before /n/ and /t/ in very special cases (Cheung 1986). Indeed these combinations are found in loanwords as they give the best approximation to English sounds.

In earlier loans, however, the adaptation has a lot of variation, possibly due to the tendency to match Chinese characters with the pronunciation. The users of earlier loanwords tend to associate a borrowed item with Chinese characters. When there are accidental gaps where no

Chinese character is available for a certain sound, a less proximate syllable will be used. Examples are given in (24).

(24) Chinese character matching in Loanword adaptation

a. *kid* *gat*^{1} 吉 (instead of *kit*^{1} or *kat*^{1})

b. *jack* *zik*^{1}(*ce*^{1}) 積(車) (instead of *zek*^{1})

Yip (2006) discusses an OT analysis which explains the variation in early Cantonese loanwords, and suggests that the choice of vowel is due to constraints in Cantonese phonology. As the character matching hypothesis explains all irregular cases, I will not further discuss the OT approach to this problem.

Excluding the loanwords which are character-matched, vowels are adapted quite regularly in Cantonese. The following shows the mapping of some English vowels to Cantonese adapted forms in regular cases. The tendency is to map an English vowel to its perceptually most similar counterpart in Cantonese.

(25) Adaptation of English vowels

a. *cheese* [ʧis] > [tsiː.siː]

b. *tick* [tɪk] > [tʰɪk]

c. *food* [fʊd] > [fuːt]

d. *book* [bʊk] > [pʊk]

e. *friend* [fɹend] > [fɛːn]

f. *court* [kɔːt] > [kɔːt]

g. *cushion* [kʊʃ.ən] > [kuːsən]

h. *jam* [ʤæm] > [ʧɛːm]

i. *partner* [pɑtn.ə] > [paːtnaː]

j. *hurt* [hɜt] > [hœːt]

2.3.4. Syllables

Before truncation, each English syllable is represented by one Cantonese syllable. This applies to syllabic consonants and contracted syllables. Every syllable is assigned a tone, and the tone assignment matches with the stress location of the original word.

The tonal arrangement of stress is first discussed by Kiu (1977). She suggests that the stressed syllable is assigned a tone 1 (high-level or high-falling), and she observes that final unstressed syllables are assigned a tone 2 (high-rising), and unstressed syllables in other positions tone 6 (low-level).

Cheung Yat Sing (1986) discusses cases with longer syllables and epenthesis, and refines the rules for stress-to-tone assignment. He points out that post-stress syllables receive a low-falling tone (tone 4) instead of a rising tone (tone 2). The rising is the result of the Cantonese lexical tone-sandhi rule which rises familiar items. Pre-stressed syllables are reported to be low-level (tone 6) in ordinary syllables and mid-level (tone 3) in epenthesised syllables. In my data, there is no distinction between epenthesised and ordinary syllables, and all pre-stress syllables are always low-level (tone 6). The difference between Cheung's descriptions and mine may be due to inter-speaker variation.

Luke (2008) summarises the rule of tone assignment in a phonological perspective. He suggests an M-H-L template. The stressed syllable is assigned with an H tone, syllables preceding it an M tone and an L tone after the stress. If there is a secondary stress, H tone is assigned to all syllables between the two stresses. (It is possible that the stressed syllable has a

tone-bearing unit HL, which marks post-stress syllables low, and pre-stressed syllables are under-specified, and therefore receives an M tone). This description matches with the data, where H tone is a high-level 55, M tone is a low-level 22 and L tone is a low-falling 21.

I have summarised the tendencies for loanword adaptation above. I listed the adaptation pattern in onsets, codas and nuclei, and described the tone assignment rules which models after English stress. Due to the character matching tendency in earlier loanword adaptation, there is a high number of exceptions to the rules. Such exceptions are rare in the newer loans. Also, as the level of bilingualism increases in Hong Kong, many phonotactic restrictions on the distribution of phonemes, such as the fricative coda restriction, have been lifted. The increased regularity and the emergence of new phonological structure signal that the adaptation of English loanword may have become a productive process. As loanwords are inevitably longer than native words, they are prone to further truncations. Next, I will discuss the truncation phenomenon in Cantonese.

2.4. Cantonese truncation

Cantonese is known for its short word length. It has a word length of about 1.5 syllables per word (HKCanCor, the figure is measured by the average length of lemmas; the actual value should be slightly higher). Supposedly, a language with such short word length should not have much space for further truncation. There is no need and no room for truncation at all in the native Cantonese vocabulary. Indeed, not all words are short. No matter how short it is in the native vocabulary, there is a need to use longer words to refer to proper nouns and new concepts. Compounding, the most natural way to form new word, inevitably create long words. These words are prone to truncation.

The aim of this section is to outline the truncation patterns in the native Cantonese vocabulary (section 2.4.1) and in loanwords (section 2.4.2). Native truncations and loanword truncations are markedly different in terms of the choice of retained syllables, but the length requirements are the same. Having said that, both native and loanword are subject to the same length requirement. Both native and loanword truncations may generate two truncated forms in Cantonese, a monosyllabic truncation form and a disyllabic truncation form. I will give a detailed description to these dual-forms and their actual distribution (section 2.4.3).

2.4.1. Truncation in native vocabulary

As most simplex words (i.e., non-compounds) are monosyllabic or disyllabic in Cantonese, simplex truncation is almost unattested in the native vocabulary. Most compounds, however, are formed by concatenating simplex words. Compounding results in new words that are significantly longer than most words in the native vocabulary. When these words enter the daily lexicon, there is a need to have these words shortened.

Luke and Nancarrow (1999) provide a list of Cantonese truncation and discuss a detailed explanation of the mechanism of Cantonese truncation. All listed Cantonese truncations are shorter versions of compound, and are categorised into 16 types of truncation constructions. If similar truncatory patterns are grouped together, there are two major forms of truncation in Cantonese, namely clipping and extraction. To illustrate these truncations, I will use the following schematic diagram to refer to the base form and the corresponding truncated forms.

Compound: $[\sigma_1\sigma_2\sigma_3]_{W1}\ [\sigma_1\sigma_2]_{W2}\ [\sigma_1\sigma_2]_{W3}$

The above diagram shows a compound, which is formed by putting three words together. The first word is tri-syllabic, and the second and third words are disyllabic. Square brackets [ ] mark the word boundary.

Clipping is to choose the most significant word or words in the compound, and use that word to denote the meaning assumed by the compound.

(26) Cantonese Clipping (Luke and Nancarrow, 1999)

a. *[maa^{5}lai^{6}][ji^{1}jyun^{2}]* 瑪麗醫院 > *[maa^{5}lai^{6}]* 瑪麗

b. *[dik^{6}si^{6}nei^{4}][lok^{6}jyun^{4}]* 迪士尼樂園 > *[dik^{6}si^{6}nei^{4}]* 迪士尼

In above examples, the second word that forms the compound is removed. However, this should not be understood as a word-formation process. These truncated forms should have existed in the lexicon before the formation of these compounds. It is better to say that clipping gives new meanings to the clipped word.

Extraction is the process where one syllable (or less likely two syllables) is extracted from each of the constituting words. For example, if a compound has the form $[\sigma_1\sigma_2\sigma_3]_{W1}$ $[\sigma_1\sigma_2]_{W2}$ $[\sigma_1\sigma_2]_{W3}$, after extraction, a possible resulting word would be $[[\sigma_1]_{W1}$ $[\sigma_2]_{W2}$ $[\sigma_1]_{W3}]_{C1}$.

(27) Cantonese Extractions

a. *[se^{5}wui^{2}][man^{4}zyu^{2}][lin^{4}sin^{3}]* 社會民主連線> *[se^{5}man^{4}lin^{4}]* 社民連

Social, Democratic, Link

b. *[hoeng^{1}gong^{2}][daai^{6}hok^{6}]* 香港大學 > *[gong^{2}dai^{6}]* 港大

Hong Kong, University

c. *[zung^{1}man^{4}][daai^{6}hok^{6}]* 中文大學 > *[zung^{1}daai^{6}]* 中大

Chinese, University

There are truncations that lie between extraction and clipping. A compound can be formed by first clipping to remove unnecessary words, and then extracting key morphemes to further shorten the compound.

(28) Cantonese Truncation, clipping + extraction

a. *[hoeng^{1}gong^{2}][dak^{6}bit^{6}][hang^{4}zing^{3}keoi^{1}]* [香港][特別][行政區]

Hong Kong, Special, Administrative Region

> *[dak^{6}bit^{6}][hang^{4}zing^{3}keoi^{1}]* (clipping, W1 removed)

> *[[dak^{6}][keoi^{1}]]* (extraction, S1 of W2 and S3 of W3 retained)

b. *[[zim^{1}saa^{1}zeoi^{3}][dei^{6}tit^{3}zaam^{6}]][[hang^{4}sang^{1}][ngan^{4}hong^{4}]]*

[[尖沙咀][地鐵站]][[恆生][銀行]]

Tsim Sha Tsui, MTR Station, Hang Seng, Bank

> *[[zim^{1}saa^{1}zeoi^{3}][dei^{6}tit^{3}zaam^{6}]][[hang^{4}sang^{1}]]* (clipping, removed *[ngan^{4}hong^{4}]*)

> *[[zim^{1}][dei^{6}]][[hang^{4}]]* (extraction)

> *[zim^{1}][dei^{6}hang^{4}]* (*dei^{6}hang^{4}* formed a fixed compound)

The above strategies are parallel to examples found in other Chinese languages, such as Modern Standard Chinese. The same word may result in other truncated forms in other Chinese varieties. Yet these variations lie in the choice of clipped morpheme / retained syllables, and not much in any fundamental differences in the truncation processes themselves.

Most truncations in Cantonese, as illustrated above, are results of reducing compounds into shorter forms. The two major ways of shortening, clipping and extraction, requires the base form to be a compound. Simplex truncation has not been reported at all in the literature, and therefore is not accounted for by the two processes above. Here are few examples that are arguably simplex truncations.

(29) Cantonese Simplex Truncation

a. Place names

i. *zim^{1}saa^{1}zeoi^{2}* 尖沙咀 'Tsim Sha Tsui' > *zim^{1}zeoi^{2}* 尖咀

ii. *gau^{2}lung^{4}sing^{4}* 九龍城 'Kowloon City' > *lung^{4}sing^{4}* 龍城

b. Noun to verb truncations

i. *din*^{6}*waa*^{2} 電話 'telephone' > *din*^{6} 電 'to phone' (slang)

ii. *seoi*^{6}*min*^{4} 睡眠 'sleep' > *min*^{4} 眠 'to sleep' (slang)

c. Hypocoristic formation

i. *cat*^{1}*sap*^{6}*jat*^{1} 七十一 '7Eleven' > *cat*^{1}*zai*^{2} 七仔

ii. *sap*^{6}*man*^{1}*faan*^{6} 十仔 'Ten-dollar-rice' > *sap*^{6}*zai*^{2} 十仔

iii. *faan*^{1}*baan*^{2}*dip*^{2} 翻版碟 'pirate copy disc' > *lou*^{5}*faan*^{1} 老翻

Above listed simplex truncations are however, limited in usage. Hypocoristics, usually not regarded as a truncation strategy, indeed shorten words in some cases. These examples, although small in number, show the acceptance of simplex truncation in the native grammar.

2.4.2. Loanword Truncations in Cantonese

Cantonese is known for its large number of loanwords from English. (Luke 2005) Due to the structural difference between the two languages, loanwords are more prone to truncation in Cantonese. This section outlines the properties of English loanwords and describes the loanword truncation process in Cantonese.

English words have rich morphological structures, with flexible word formations by affixation and other processes. There is also a large number of Latin-originated words which are three syllables or longer. English words that enter Cantonese are, therefore, significantly longer than the native vocabulary. In addition, Cantonese adaptation optionally performs epenthesis to English consonant clusters and fricative codas, which increases the length of borrowed English words. Moreover, the morphemic structure in English is more opaque than that of Cantonese, due to the phonological writing system and the complicated etymology of English

words. The combination of these factors makes English words more prone to truncation in Cantonese.

Note that although English is the official language of Hong Kong, and most people in Hong Kong are bilingual in English and Cantonese to some extent, the language is not widely used by the ethnic Chinese population. Despite the increase in level of bilingualism in Hong Kong, borrowed items from English are still limited to cultural loans, which are always related to the school or work environment (Chan and Kwok 1982). Depending on speakers' attitude to loanwords, a truncated form is not always accepted by the entire language community. Nonetheless, a more-or-less consistent pattern emerged as more and more loanwords enter the core Cantonese lexicon. Here I will describe the mechanism supplemented by universally used truncations as well as truncations used in a particular industry or by a particular social class.

In contrast to native truncation, there is a significant amount of simplex truncation in loanwords. (30) shows a list of examples ordered by the number of syllables in the truncated form. Some of them have been used in Cantonese since the 1980s, while some are newer loans and field-specific loanwords. The list serves as a description of the data. Generalisation of the data will be provided in subsequent chapters. Words with an '@' mark are newer forms that are field-specific and probably not shared by the entire Cantonese-speaking community.

(30) Monosyllabic truncations in Cantonese English loanwords

a. First-syllable stressed word, with first syllable retained

i. *jin*^{1} in < *interview*

ii. *soet*^{1} cert < *certificate*

iii. *mon*^{1} mon < *monitor*

iv. *kem*[1] chem < *chemistry*

v. *@dap*[1] dup < *duplicate*

b. First-syllable unstressed word, with first syllable retained

i. *@wi*[6] re < *reply*

ii. *baai*[6] bi < *bisexual*

iii. *baai*[6] bi < *biology*

iv. *@ken*[2] can < *canteen*

v. *@fi*[6] phi < *philosophy*

c. Stressed syllable retained

i. *@pit*[1] peat < *repeat*

ii. *@zhek*[1] ject < *reject*

iii. *pot*[1] port < *report*

iv. *taat*[1] tart < *start*

v. *foem*[1] firm < *confirm*

As shown in the above examples, almost all monosyllabic truncations are formed by extracting the first syllable in the word. That is, the second syllable and onwards are truncated. Exceptions apply to words that start with re-, or other common English prefixes. In these cases, the second syllable is retained, probably to avoid the repeated use of the same prefix. The truncation does not alter the tone assignment to the word. When a stressed syllable is used, it will receive a tone 1 (high-level tone), and when an unstressed syllable is chosen, it receives a tone 6 (low-level tone).

There is a clear trend to truncate syllables that contain ill-formed codas. So when the second syllable contains a fricative coda, it is quite likely to be truncated, especially in older loans. If there is no segmental ill-formedness, words can also be truncated to two syllables. Examples

are listed below. Disyllabic form is especially preferred in names of school subjects, as shown in (31). It is always preferred to keep the first two syllables of the loanword. Exceptions are loanwords with a very long history.

(31) Disyllabic loanword truncation in Cantonese

a. First two syllables

i.	*baai*^{6}*o*^{1}	bio	< *biology*
ii.	*che*^{1}*aa*^{2}	chair	< *chairman*
iii.	*fuk*^{1}*si*^{2}	福士< *Volkswagen*	
iv.	*sat*^{6}*kiu*^{1}	secu	< *security*
v.	*sou*^{6}*lit*^{1}	solit	< *solicitor*
vi.	*ko*^{1}*li*^{2}	quali	< *qualification*
vii.	*kam*^{6}*pou*^{6}	compo	< *composition*

b. Last two syllables

i.	*waa*^{4}*tin*^{4}	華田< *Ovaltine*
ii.	*mai*^{1}*sin*^{1}	咪仙< *streptomycin* (a kind of drug)

The tone assignment is similar to the rule described in Luke (2008). If there is no stress in the first two syllables, the two syllables receive tone 6, otherwise, stressed syllable receives tone 1, pre-stressed syllable receives tone 6, post-stressed syllable receives tone 4. Most nouns undergo tone sandhi, which is consistent with Kiu (1977)'s description.

As explained above, truncation is not a one-to-one mapping process. The very same word can be truncated into several forms. In Cantonese loanword truncation, a monosyllabic version of a word sometimes co-exists with the disyllabic forms, as shown in (32).

(32) Disyllabic truncation further reduced to monosyllable

a.	*saai*^{6}psy	<	*saai*^{6}*ko*^{1}	psycho	< *psychology*	
b.	*fi*^{6}	phi	<	*fi*^{6}*lo*^{1}	philo	< *philosophy*
c.	*laai*^{1}	lib	<	*laai*^{1}*baa*^{2}	拉把< *library*	
d.	*en*^{1}	eng	<	*en*^{1}*zhin*^{2}	engine	< *engineering*
e.	*ji*^{1}	e	<	*ji*^{6}*kon*^{1}	econ	< *economics*
f.	*tin*^{4}	田	<	*waa*^{4}*tin*^{4}	華田< *Ovaltine*	

Complex truncation is also commonly attested in loanwords. The mechanism is similar to that of native truncations. Extraction is the most common form of loanword complex truncation. For example, when a compound of the form $[\sigma_1\sigma_2\sigma_3]_{W1}\ [\sigma_1\sigma_2\sigma_3\sigma_4]_{W2}$ is truncated, the first syllable(s) of each word is extracted, into a form like $[[\sigma_1\sigma_2]_{W1}\ [\sigma_1]_{W2}]_{C1}$. Example (33) is a sample of compound truncations.

(33) Loanword complex truncations

a.	*jin*^{6}*cou*^{6} *saai*^{6}	*Intro. Psy.*	<	*Introduction to Psychology*	
	$[[\sigma_1\sigma_2]_{W1}\ [\sigma_1]_{W3}]_{C}$			$[[\sigma_1\sigma_2\sigma_3\sigma_4]_{W1}\ [\sigma_1]_{W2}\ [\sigma_1\sigma_2\sigma_3\sigma_4]_{W3}]_{C}$	
b.	*mek*^{6}*ken*^{1} *en*^{1}	*mechan eng*	<	*Mechanical Engineering*	
	$[[\sigma_1\sigma_2]_{W1}\ [\sigma_1]_{W2}]_{C}$			$[[\sigma_1\sigma_2\sigma_3\sigma_4]_{W1}\ [\sigma_1\sigma_2\sigma_3\sigma_4\sigma_5]_{W2}]_{C}$	
c.	*ing*^{1} *lit*^{1}	*Eng. Lit.*	<	*English Literature*	
	$[[\sigma_1]_{W1}\ [\sigma_1]_{W2}]_{C}$			$[[\sigma_1\sigma_2]_{W1}\ [\sigma_1\sigma_2\sigma_3]_{W2}]_{C}$	
d.	*tim*^{1} *kep*^{1}	*team cap*	<	*Team Captain*	
	$[[\sigma_1]_{W1}\ [\sigma_1]_{W2}]_{C}$			$[[\sigma_1]_{W1}\ [\sigma_1\sigma_2]_{W2}]_{C}$	
e.	*fi*^{1}*kem*^{1}*piu*^{1}	*phy, chem, pure*	<	*Physics, Chemistry, Pure*	
	$[[\sigma_1]_{W1}\ [\sigma_1]_{W2}\ [\sigma_1]_{W3}]_{C}$			$[[\sigma_1\sigma_2]_{W1}\ [\sigma_1\sigma_2\sigma_3]_{W2}\ [[\sigma_1\sigma_2]_{W1}]_{C3}]_{C}$	

In above examples, it is shown that each element in the compound is reduced to one syllable. Except when it acts as a modifier (as in a and b), where the element is reduced into two syllables instead.

Note that some simplex words also undergo complex truncations. These words are broken down into compounds before being truncated (34).

(34) Special Loanword complex truncations

a. *dem^{1}taa^{2}* < *[demonstra][tor]* < *demonstrator*

b. *sdet^{6}seon^{2}* < *[statisti][cian]* < *statistician*

I have described the loanword truncation mechanism in this section, and outlined the variations that may occur when truncated forms are used. In simplex truncations, forms can be truncated into one or two syllables. Complex truncation truncates each element (or morpheme) into one syllable, and modifiers can also be truncated into two syllables.

It remains to be explained what conditions the length of a truncation. There should be a reason behind the lack of monosyllabic forms in some disyllabic words, and the existence of two truncated forms for the same word. The next section will discuss the asymmetry based on the distribution of forms.

2.4.3. Doublets and triplets

Doublets refer to two (or more) coexisting forms for the same loanword. When a loanword is truncated to a monosyllable, there is a tendency to add a morpheme to the truncated form to make it disyllabic (35). The monosyllabic form and the morpheme-added form then form a doublet.

(35) Dual forms formed by adding a morpheme to a monosyllabic loanword / loan truncation

a. *beer* > *be*^{1} > *be*^{1}*zau*^{2} (-alcohol)

b. *pair* > *pe*^{1} > *pe*^{1}*paai*^{2} (-cards) 'playing cards'

c. *jack* > *zik*^{1} > *zik*^{1}*ce*^{1} (-car) 'lifting cars'

d. *library* > *laai*^{1} > *laai*^{1}*gei*^{3} (-hypocoristics)

e. *iodine* > *din*^{1} > *din*^{1}*zau*^{2} (-alcohol) ''

To make things more complicated, when a word is truncated twice, there will be two truncated forms along with a base form. If all three forms are used in the daily speech, they will form a triplet (36).

(36) Triplets formed by two truncations

a. *computer* > *kam*^{6}*piu*^{1}*taa*^{4} > *kam*^{6}*piu*^{1} > *kam*^{6}

b. *Ovaltine* > *o*^{1}*waa*^{4}*tin*^{4} > *waa*^{4}*tin*^{4} > *tin*^{4}

c. *Pure math* > *piu*^{1}*aa*^{1}*met*^{1} > *piu*^{1}*aa*^{2} > *piu*^{1}

It is quite intuitive that these doublets and triplets should cease to exist after a more economical form is coined, as it is not economical to keep more than one form for the same meaning. Nonetheless, the two or three semantically identical forms indeed coexist in the lexicon, with a highly different distribution. In the following, I will discuss the distribution of monosyllabic truncations and polysyllabic truncations / base forms, in terms of word class, morphological category and semantic category.

2.4.3.1. Verb-noun asymmetries

Although nouns can be truncated into one syllable, monosyllabic truncation is always subject to some restrictions. Many of the monosyllabic forms can only be used as verbs or adjectives. Example (37) shows monosyllabic truncations that are not allowed to be used as nouns. (Gloss: PER – perfect aspect; TRUNC – truncated; CL – classifier, PRT – particles)

(37) Monosyllables not allowed as nouns

a. *interview > in*

i.* *ngo^{5} heoi^{3}zo^{2} saam^{1}go^{3} jin^{1}*

I go-PER three CL interview-TRUNC

I have been to three interviews.

ii.*ngo^{5} jin^{1}zo^{2} saam^{1}fan^{6} gung^{1}*

I interview-TRUNC-PER three CL jobs

I have interviewed three jobs.

b. *copy > cop*

i. * *ngo^{5} jau^{5} saam^{1}fan^{6} kop^{1}*

I have three CL copy-TRUNC

I have got three copies.

ii. *ngo^{5} kop^{1}zo^{2} saam^{1}fan^{6}*

I copy-TRUNC-PER three CL

I have made three copies.

c. *email > e*

i. * *ngo^{5} zoeng^{1} di^{1}e^{1} di^{6}lit^{1} saai^{3}*

I DIP CL email-TRUNC delete all

I have deleted all emails.

ii. *ngo^{5} e^{1}zo^{2} fan^{6} si^{1}wi^{1} gwo^{3}heoi^{3} laa^{3}*

I email-TRUNC-PER CL resume over PRT

I have already sent my resume by email.

Although the use of polysyllabic verb is always accepted, derived forms, either truncated or epenthesised, are not allowed / preferred in verb position if the size exceeds one syllable.

(38) Polysyllabic forms as verb

a. *demonstrate > demo*

i. *keoi^{5} dem^{1}zo^{2} gei^{2}ci^{3}*

ii. * *keoi^{5} dem^{1}mo^{2}zo^{2} gei^{2}ci^{3}*

3.SG demonstrate-TRUNC-PER

He demonstrated (=showed) several times.

b. *fax > faxi*

i. *fan^{6}je^{5} ngo^{5} fek^{1}zo^{2} gwo^{3}heoi^{3}*

ii. ? *fan^{6}je^{5} ngo^{5} fek^{1}si^{4}zo^{2} gwo^{3}heoi^{3}*

CL thing 1.SG fax-(TRUNC)-PER over

I have faxed (the document).

c. *tips > tipsi*

i. *keoi^{5} tip^{1} zung^{6} dai^{6}saam^{1} coeng^{4}*

ii. ? *keoi^{5} tip^{1}si^{2} zung^{6} dai^{6}saam^{1} coeng^{4}*

3.SG tip-(TRUNC) accurate third race

He made the right guess in the third race.

When there is a choice of word length, the monosyllabic form is usually banned from being used as a noun, while the polysyllabic version is odd when used as a verb. This point is well illustrated by the examples above.

2.4.3.2. Stem-word asymmetries

Among the truncation doublets, truncated forms being used as morphemes tend to be monosyllabic and those as words tend to be disyllabic. The trend can be shown in the truncation of school-related loanwords. Subject name is one of the categories that usually have both forms. In most of the case, the disyllabic forms can be used freely, while some monosyllabic forms only appear as bound morphemes.

(39) Stem-Word asymmetries

a. Stem

i. *Sing^{1}zo^{2}* *le^{1}* 升咗lv

up-PER level-Stem

ii. *fi^{1}kem^{1}bi^{6}*

physic-Stem chemistry-stem biology-stem

b. Word

i. *le^{1}fou^{2}* (**le^{1}*) *hou^{2}* *gou^{1}* level好高

level so high

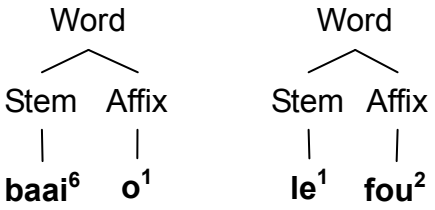
ii. *baai^{6}o^{1}*(**baai^{6}*) *hou^{2}* *naan^{4}* bio好難

biology-TRUNC so tough

The monosyllabic forms are found to be more restricted when compared to the disyllabic forms. The distribution of these monosyllabic forms is highly limited. They appear only as part of a compound or, marginally, in a fossilised VO construction. When the morphological composition of these forms is considered, the monosyllabic truncations do not seem to be fully-functioned words. I will describe the disyllabic truncation as a word, which is the resulting product of word truncation. The disyllabic form consists of a stem and an affix. The stem is the more prominent part of the word which is retained in further truncation. The affix

is the optional part which is attached when the word is used independently. The monosyllabic form is created by the removal of the affix. I will represent the morphological structure of these words as (40). Or schematically, *level* > *le*^{1}*fou*^{2} > [[le^{1}]$_{\text{Stem}}$ [fou^{2}]$_{\text{Affix}}$]$_{\text{Word}}$.

(40) Morphological structure of truncated forms



Having presented the two properties of Cantonese loanword truncation, I will briefly summarise the six types of Cantonese simplex truncation or adaptation patterns with examples in (41). Complex truncation pattern can be formed by compounding stems or words.

(41) Truncation patterns in Cantonese

	Source Word		Truncated form	Orthography
a.	Disyllabic truncation			
i.	*biology*	>	*baai*^{6}*o*^{1}	bio
ii.	*chairman*	>	*che*^{1}*aa*^{2}	chair
iii.	*library*	>	*laai*^{1}*baa*^{2}	lib / 拉把
b.	Augmented monosyllabic truncation / adaptation			
i.	*beer*	>	*be*^{1}*zau*^{2}	啤酒
ii.	*pair*	>	*pe*^{1}*paai*^{2}	啤牌
iii.	*jack*	>	*zik*^{1}*ce*^{1}	積車
iv.	*library*	>	*laai*^{1}*gei*^{3}	拉記

v. *iodine* > *din^{1}zau^{2}* 碘酒

c. Epenthesised monosyllabic truncation / adaptation

i. *fax* > *fek^{1}si^{2}* fax

ii. *plum* > *bou^{3}lam^{1}* 布冧

iii. *brake* > *bik^{6}lik^{1}* 迫力

iv. *cream* > *gei^{6}lim^{1}* 忌廉

d. Noun monosyllabic truncation

i. *chemistry* > *kem^{1}* chem

ii. *linguistics* > *ling^{6}* ling

iii. *monitor* > *mon^{1}* mon /

iv. *microphone* > *mai^{1}* mic /

e. Verb monosyllabic truncation

i. *interview* > *in^{1}* in

ii. *report* > *pot^{1}* pot

iii. *compromise* > *kam^{1}* com

iv. *copy* > *kop^{1}* / *kap^{1}* cop

v. *capture* > *kep^{1}* cap

f. Stem monosyllabic truncation

i. *biology* > *baai^{6}* bio / bi

ii. *library* > *laai^{1}* lib

iii. *level* > *le^{1}* lv

A good theory should predict the word size requirement of all of the above truncation patterns. I will now turn to the prosodic structure of Cantonese in the next chapter, and try to describe these patterns under templatic phonology.

Chapter 3 Prosody and Word Length of Cantonese Loanword Truncation

The previous chapter has described the truncation pattern in Cantonese loanwords, and suggested that most loanwords are truncated to one or two syllables. There are four factors that could explain the size of truncations, namely prosodic structure, morphological composition, word class and word frequency. This chapter attempts to explain the word length requirements by the first two factors, which are commonly used in the templatic theories.

The aim of this chapter is to argue that prosodic structure and morphological composition fail to explain the truncation pattern in Cantonese. I will first discuss two major issues in Cantonese stress, namely foot structure and phrasal stress (section 3.1). Then, I will try to explain the size requirements of Cantonese loanword truncations by prosodic categories, which is the common practice of GTT (section 3.2). Next, I will examine the morpheme-syllable correlation, a major constraint in MBT, and describe some exceptions to this tendency (section 3.3). I will summarise the problems of the two templatic views at the end of this chapter.

3.1. Cantonese Stress

The discussion on stress is closely related to the discussion of minimal word, as the hypotheses about word size are usually made with respect to a language's prosodic structure in the literature. In this section, I will discuss the quantity sensitivity of Cantonese, i.e. whether Cantonese distinguishes light versus heavy syllables. Next, I will review two hypotheses about Cantonese foot structure.

3.1.1. Quantity Sensitivity

A language is said to be quantity sensitive if it makes a distinction between light and heavy syllables. If the distinction is not made, it is called a quantity insensitive language. For instance, English is a quantity sensetive language, as there is a distinction between light syllables (those end with the schwa or other short vowels, and do not receive stress) and heavy syllables (those end with a consonant or a long vowel, and may receive word stress).

The issue as to whether Cantonese is quantity sensitive is controversial. Cantonese is traditionally considered as a syllable-timed language, and every syllable has been assumed to have approximately the same duration (Bauer and Benedict 1997). However, by measuring the length of Cantonese syllables in actual speech, it has been found that their length does vary according to vowel length, the coda and the tone (Kao 1971, Cheung 1986, Duanmu 1990, Bauer and Benedict 1997).

If one regards duration differences as a distinction between light and heavy syllable, then Cantonese would be a quantity sensitive language. Kao (1971) measured syllable duration (the time taken to utter a syllable) phonetically, and suggests that the length of the nucleus varies according to the coda followed by it. The length of the vowel is the longest when it is a long vowel (308ms, based on Bauer and Benedict 1997), less so if it is followed by a nasal (203ms) or a stop (169ms). Short vowels have shorter duration (100ms before nasals and 89 ms before stops respectively). At the first glance, it seems that rimes with short vowels are significantly shorter than that of long vowels. Yet there is no clear-cut line as to where to draw the line between heavy and light. Moreover, Cheung (1986) describes a compensation effect within a syllable, where by the coda is lengthened when following a short vowel. Duanmu (1993) also points out that there is an audible pause after a checked syllable. With the compensation effects and the compulsory pause after stop codas, Cantonese syllables can be

considered approximately equal in terms of duration. The durations of individual syllables are about the same, the slight variation between them is not sufficient to claim that Cantonese is quantity sensitive.

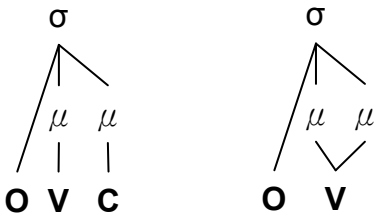
It is later pointed out that when isolated words are shown to a speaker, all words are pronounced in 'the citation form', which does not reflect the word length in connected speech (Lai 1999). Kao's study, which focuses on isolated words, does not capture the variations in syllable length in casual speech. In the spoken language, some syllables are known to be shorter than others. Bauer and Benedict (1997) point out that Cantonese hypocoristic aa3 is markedly shorter than other syllables. Lai (1999) further points out that hypocoristic aa3, negative morpheme m4, and classifiers are significantly shorter. If these syllables are underlyingly short, they will be a good example of the light-heavy distinction which qualifies a quantity sensitive language.

The light-heavy distinction is, however, controversial. Although some syllables are predictably shorter than others in connected speech, shortened syllables are not necessary light syllables. In previous descriptions of Cantonese phonology, all syllables are assumed to be heavy. Cheung's (1986) description suggests that Cantonese syllables are bimoraic, where the onset and coda both receive half mora, and the vowel receives one mora, as shown in (42). In this structure, the removal of the second mora will mean the loss of the final consonant and vowel shortening. Duanmu (1993) suggests that the two weight-bearing unit (either X or mora) dominate the vowel and coda, as shown in (43). All M-languages (Chinese languages in which every syllable 'contribute to the phrasal tone') are assumed to have heavy rimes in all stressed syllables, including open syllables. With Prince's (1992) Weight-to-Stress principle, which states that heavy syllable attracts stress while light syllables do not; light-syllables tend

to be stressless, and do not have the whole range of tonal inventory. If Duanmu's (1993) syllable structure is employed, shortened classifiers are not legitimate light syllables, as these destressed classifiers are often tone-bearing (some of them even have contour tones). Some 'light syllables' end with stops, which violate the structure of a light syllable in Duanmu's structure. Even the difference is accepted, it cannot be a one between quantity sensitivity.

(42) Cheung's (1986) syllable structure

(43) Duanmu's (1993) syllable structure (Heavy syllables)



One may argue that the destressed syllables have a similar status to neutral tones in other M-languages, and therefore should be a kind of light syllable. I will argue that this position is not convincing with three reasons. First, those destressed syllables in Cantonese are fundamentally different from light syllables in other M-languages. Consider the examples from Mandarin (Chao 1968) and Southern Min (Higuchi 2003) (44). Both instances of neutral tones form minimal pairs with other lexical words. It can be said that syllables with neutral tones are underlyingly toneless. While in Cantonese, the destressed syllables can alternate with its heavy form. This grammatical alternation means that there are no minimal pairs formed by light-heavy syllables.

(44) Mandarin and Southern Min neutral tones

a. *difang* (Mandarin)

i. $di^{4}fang^{1}$ the province

ii. $di^{4}fang^{0}$ a place

b. *au-jit* (Southern Min)

i. $au^{7\text{-}3}$-jit^{8} tomorrow

ii. au^{7}--jit^{0} the day after tomorrow

The second reason is the tone-bearing ability of light syllables. Assuming that light syllable can bear tones, as all light syllables have to be monomoraic, contour tone will be entirely absent from all light syllables. On the contrary, there are classifiers, verbs and particles that have contour tones. It follows that these items cannot be monomoraic underlyingly.

The third reason to support the QI hypothesis is that the destressed form is attributable to a higher-level process, namely the non-head stress rule (Duanmu 1999). The non-head stress rule states that phrasal stress is assigned to non-heads. For example, in a verb phrase [V NP], V is the head and NP is non-head. The NP receives the phrasal stress. Classifiers, Negative marker, aspect particles and verbs in VO constructions are often shortened due to the lack of phrasal stress. This phenomenon is parallel to English phrasal stress assignment (45). In (47a), the main verb *buy* is a heavy syllable. That it is shorter than the DP *car* is due to the lack of phrasal stress. The non-head stress rule can apply regardless of syllable weight.

(45) English non-head stress rules (Examples modified from Duanmu 2007)

a. [V DP] *buy CAR*

b. [P NP] *to JOHN*

c. [D NP] *the GUY*

To summarise my view to the quantity sensitivity of Cantonese, there is no genuine light syllables in Cantonese, as there are no minimal pairs, no loss of tonal information and that every case of light syllables can be attributed to the non-head stress rule. However, due to the existence of contour tones, all syllables, whether long or short, could be underlyingly bimoraic. However, due to its quantity insensitivity, Cantonese syllables are actually monomoraic.

3.1.2. Footing

Previous studies have considered Cantonese a quantity sensitive language. As a quantity language, there are two possible foot structure, the moraic trochee and iamb. Lai (2001) proposes an iamb for Cantonese, where (S) and (WS) are the two possible foot types. The structure is supported by the (light-heavy) formation in (classifier-noun) combination and the (negative-verb) combination (46).

(46) Iambic stress proposal (Lai 1999, transliteration modified)

a. Negative + Verb

x

(m^4 sik^6)

NEG eat ‘(will) not eat’

b. Classifier + Noun

x

(zek^3 gau^2)

CL dog ‘the dog’

It is also mentioned that when poems and four-word idioms are read out, words are grouped two-by-two, and stress falls on the second syllables, which provides further supports for the iambic proposal.

In disyllabic words, however, the light-heavy foot structure does not hold. Examples in (47) result in ungrammatical footing if the iamb is employed.

(47) Non-iambic word stress on disyllabic words

a. x

(hoeng^{1} gong^{2}) 'Hong Kong'

b. x

(bun^{2} syu^{1}) 'This book'

c. x

(aa^{3} gwan^{1}) 'first runner up'

If iambic footing is enforced, the second syllables of these words will form a degenerate feet or form another iamb with the following verb, like (48).

(48) Problems of iambic footing in Cantonese

a. x x x x x

*(hoeng^{1} gong^{2}) (hai^{6}) (gwok^{3} zai3) (daai6) (dou1 wui6)

Iambic footing itself is an unnatural foot structure (Hayes 1995), and it should be very careful when applying the iamb to the prosody of a language. It is true that the last syllable of a noun is usually lengthened at the end of a phrase, but this may come from the lengthening effect at the end of a phrase. The iambic footing in Cantonese, which seems to have stemmed from the final-lengthening phenomenon, fails to predict the stress pattern in disyllabic words. For

above reasons, the universally unusual iambic footing should not apply to Cantonese.

Duanmu (2000) proposes a dual trochee stress for Mandarin. Dual trochee (Duanmu 1999) is the proposal that heavy syllable receives moraic stress (Weight to Stress Principle) and syllabic stress falls on the first syllable of a foot. When there are (heavy-light) combinations, the first syllable receives moraic stress, and in (heavy-heavy) combinations, the first syllable receives syllabic stress. Duanmu (2007) further assumes a minimal size of two syllables for each foot. This is less of an assumption but a requirement in Cantonese as a quantity insensitive language, as the minimum foot size is always disyllables. However, I adopt Duanmu (2000)'s view that trochee can be formed with an empty beat if it is at the edge of a phrase, with the understanding that empty beat is realized as a pause or lengthening phonetically. The proposed foot structure for Cantonese is therefore a simple syllabic trochee as shown in (49).

(49) Syllabic Trochee in Cantonese

a.
x
(S S)

b. At phrase boundaries
x
(S ø)

3.2. Prosodic Category and Word Size

The aim of this section is to test if template theories and other phonological based variants explain the word size tendency in Cantonese. I will first use the traditional form of prosodic morphology (Prince and McCarthy 1986) to explain the Cantonese data, and try to improve it

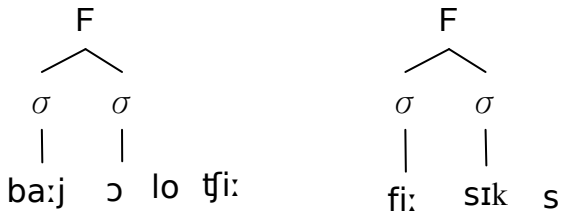
with the Generalised version (GTT) subsequently.

3.2.1. Prosodic Morphology (McCarthy and Prince 1986)

According to the earliest prosodic morphology formulation, a word is minimally a prosodic word, and a prosodic word is minimally a foot. Cantonese, which is suggested to be a quantity insensitive language, employs syllabic trochee footing. The minimal size is therefore a disyllabic word. A disyllabic template correctly predicts three types of loanword truncations. When the template is applied to polysyllabic loanwords, the first parts of the loanword are copied to the template. The process produces a disyllabic and maximally filled truncated form (50). If a monosyllabic loanword is borrowed, the second syllable will be left unfilled. There are two possible solutions. The first solution is to add a native morpheme to that position, as in (51). The second solution is to epenthesis missing slots with the nearest available sounds, as in (52).

(50) Disyllabic truncation

a. (i) *biology*, (ii) *physics*



(51) Augmented monosyllabic truncation

a. *beer* pɛː + [σ σ]$_F$ > [pɛː σ]$_F$ > [pɛː tsɐw]$_F$ (beer + alchohol)

b. *certificate* saː + [σ σ]$_F$> [saː σ]$_F$ > [saː tsiː]$_F$ (certificate + paper)

c. *cheque* tsɪk + [σ σ]$_F$ > [tsɪk σ]$_F$ > [tsɪk tsiː]$_F$ (cheque + paper)

(52) Epenthesised monosyllabic truncation

a. *plum* plʌm + [σ σ]$_F$ > [p. lem]$_F$> [pow. lem]$_F$

(/l/ cannot fill the segment after p, and therefore moved to the second syllable in the template. /p/ is not a well-formed syllable, and therefore epenthesised.)

b. *brake* bɹeɪk + [σ σ]$_F$ > [p. lɪk]$_F$> [pɪk. lɪk]$_F$

(/r/ cannot fill the segment after /p/, and therefore moved to the second syllable in the template. /p/ is not a well-formed syllable, and therefore epenthesised. In this case, the contents of the second syllable is copied to the first syllable)

At the first glance, the foot-word correlation correctly predicts the disyllabic forms used in older loans. However, there is also a whole set of monosyllabic loanword truncations that cannot be explained. Verb truncation has been known since 1970s (Cheung 1972 gives an example, *tip*, which is truncated from *tip.si)*. If the relationship between prosodic word and minimal word is to be upheld, then all monosyllabic truncations are indeed subminimal.

One solution is to assume that all monosyllabic truncations are morphemes, not words. Yet both nouns (e.g. *chemistry* > *chem*, *microphone* > *mic*) and verbs (e.g. *capture* > *cap*, *interview* > *in*) are known to truncate to monosyllables, and there is no morphological motivation to mark all disyllabic truncations as words and all monosyllabic truncations as morphological units.

Next, I will use the generalised form of template theory, which allows different templatic constraints at various morphological levels.

3.2.2. Generalised Template Theory (McCarthy and Prince 1995)

The greatest improvement of the generalised form is that word size is no longer bounded to the prosodic word. Instead, GTT proposes that the size of a foot is equal to any of the

morphological categories: Word, Stem or Affix. It also allows specification of size constraint at each morphological level, as long as these size constraints are expressed in prosodic units.

I propose that the prosodic word (PrWd) is equal to the size of a minimal word, and the size of a stem is minimally one syllable. The prosodic word- minimal word correlation is followed from the old assumption, as the disyllabic minimal word size does explain two types of data. Disyllabic truncations and epenthesised monosyllabic adaptations are formed so as to follow the minimal word requirement. Stem has the size of one syllable. This explains the size of monosyllabic truncations by morphological terms. Augmented monosyllabic loanwords, previous explained by the disyllabic requirement, can now be accounted for by the stem size requirement. The stem is adapted as monosyllable, so that it can form a word with another stem.

This formulation has two problems. The first problem is that monosyllabic nouns are still sub-minimal under this formulation. If a noun can be used independently, that noun cannot be considered sub-lexical. A solution would be to allow the monosyllable to form a foot with an empty beat. This makes monosyllabic noun truncations possible.

However, this implies that both monosyllabic forms and disyllabic forms are acceptable for truncated nouns, which is not true. Consider some stem-word asymmetry examples. There is a great number of words that prohibit monosyllabic forms to be used alone. This requires an anti-allomorphy rule to control the use of monosyllabic forms (53).

(53) Anti-Allomorphy Rule (Duanmu 2007)

A word does not change its shape if it has phrasal stress

This rule blocks the use of monosyllabic forms when a disyllabic form is available. This is in general true, as words that only have monosyllabic truncations are allowed to be used as isolated nouns, yet those with disyllabic forms are disallowed in such usage. In (54), the first three examples are words that do not have disyllabic forms (54a and 54b are monosyllabic due to the illformedness of the second syllable in the source word, and 54c is monosyllabic in the first place). The monosyllabic form is grammatical when used as an isolated noun. In contrast, 54d and 54e show how words with disyllabic forms (such as biology > bio, phsyics > physic) block the use of the monosyllabic form as individual nouns.

(54) Disyllabic forms that trigger the Anti-Allomorphy Rule

a. *ngo^{5} duk^{6} kem^{1} gaa^{3}*

I study chemistry-TRUNC SFP.

b. *ngo^{5} duk^{6} ling^{6} gaa^{3}* (linguistics-TRUNC)

c. *ngo^{5} duk^{6} lo^{1} gaa^{3}* (law-TRUNC)

d. * *ngo^{5} duk^{6} fi^{1} gaa^{3}* *ngo^{5} duk^{6} fi^{1}sik^{4} gaa^{3}* (physics-TRUNC)

e. * *ngo^{5} duk^{6} baai^{6} gaa^{3}* *ngo^{5} duk^{6} baai^{6}o^{1} gaa^{3}* (biology-TRUNC)

The second problem is the monosyllabic tendency in verb truncations. Verbs are prevalent in recent Cantonese loanword adaptation, and are often truncated to one syllable (Luke and Lau 2008). According to the foot structure, all verbs are indeed subminimal. One solution is to assume that verbs are indeed stems. A brief investigation of truncated verbs reveals that most of them require either an object, resultative adverbial or an aspect particle. It is therefore reasonable to assume that these verbs are morphologically stems. If that assumption holds, Cantonese intransitive verbs that are monosyllabic should be considered unnatural. It is also

quite unintuitive to assume all loan verbs as stems but acknowledge the word status in the native vocabulary. These monosyllabic truncated forms need a better explanation.

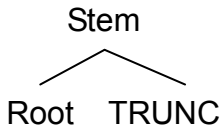
In summary, template theory and its generalised form do describe satisfactorily the general disyllabic pattern of loanwords and the monosyllabic tendency of bound morphemes. Yet monosyllabic lexical items are subminimal under both accounts. Monosyllabic nouns can be explained by the ill-formedness of base form and the anti-allomorphy rule restricts the use of monosyllabic noun truncations. The monosyllabic verb truncation tendency is left unexplained, as there is no segmental or well-formedness motivation to back up the truncation. Although the phonological template does explain a significant portion of the data, it is possible that it is just mere coincidence that truncation size and foot size are about the same. As disyllabic word truncations and disyllabic foot is universally common (Downing 2006), the correlation between foot size and word size should seem to work in many languages. However, as shown in the above examples, it fails to account for the Cantonese data. The correlation itself is also in need of a clear motivation.

Next, I will describe a morphological-based account to the word size problem, which does not make the assumption of foot-word correlation.

3.3. Number of Morphemes and Word Size

Downing (2006) proposes a morpheme based explanation to the word size problem. She suggests that word size is crucially dependent on the Morph-Syll principle. In simplex truncations, the following structure (55) is assumed.

(55) Morphological structure of a truncated form



By assuming the above structure, a truncated word is minimally bimorphemic. Along with the MORPH-SYLL correlation (that the size of a morpheme is at best one syllable), a truncated word, if not affixed, should be disyllabic. Downing (2006) proposes that the disyllabic requirements cross-linguistically attested in truncations are due to the structure above. Hence a quantity sensitive language, despite having monosyllabic foot, should have disyllabic truncation limits.

If that structure is applied, it does correctly predict the disyllabic truncations in Cantonese loanwords. The same structure applies to hypocoristics, and matches the disyllabic tendency of Cantonese native names and loan names.

But it also suggests that all simplex truncations, which have the same structure as the above diagram, should be truncated to two syllables. It implies that all monosyllabic truncations, regardless of word class, are subminimal. Due to the prevalence of Cantonese monosyllables, the theory cannot be applied to the collected data.

Some monosyllabic truncations can be explained by the constraint that disallows identical truncated forms and based forms. As a majority of words in English are disyllabic, the truncated forms will have to be shorter than the base form so that it can be a truncation. However, as shown in the above data, there are monosyllabic truncations which are reduced from trisyllabic words (e.g. *duplicate* > *dup*, *compromise* > *com*), disyllabic truncation is always an option to these loanwords, yet this is not applied to verbs.

In this chapter, I have discussed the representation of Cantonese foot, and applied the notion to test two existing theories on loanword truncation and word size. The prosodic theory, which assumes a correlation between foot and word size, explains a significant portion of the data, yet cannot account for monosyllabic verbs. The theory itself lacks a clear motivation for the correlation. The morphological-based theory (MBT) is effective for complex truncations, but cannot explain most cases of Cantonese monosyllabic truncations. Prosody and morpheme count do not seem to be the decisive factor of word size, as demonstrated in this chapter.

I will propose a solution to this problem from a more functional perspective. It should be noted that prosodic factors do play a role in loanword truncation. I will argue that truncation is a process motivated by non-prosodic factors, and prosodic influence is limited to the local domain.

Chapter 4 Proposal: Information Load and Optimal Word Length

In view of the limited role of prosody and morphology in determining the size of truncation, I will explore the relationship between truncation and syntax and lexical frequency. The relationship between syntax, lexical frequency and word length is captured by the notion of information load. In the remaining of the thesis, I will put forth an argument based on information transmission, which conjectures that word length is optimised, through truncation, to balance information load carried by a sentence, which in turn enhance linguistic economy. It is information load that motivates the process of truncation. I will discuss how the prediction works and suggest where prosody steps in and interact with information load in the last section of this chapter.

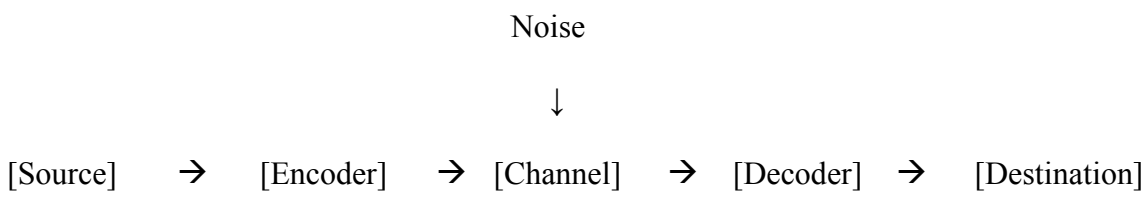
I will first present the view that language is an information-transmitting protocol which observes economic principles (section 4.1). Next, I will outline the data extracted from a spoken Cantonese corpus, which shows the skewed distribution of word length in favour of lexical frequency (section 4.2). Having established the relationship between lexical frequency and word length, I will suggest a way to calculate an optimal word length, with respect to the syntactic position, based on the notion of Information Load (section 4.3). Lastly, I will discuss how prosodic factors contribute to the variation of word length (section 4.4). In particular, I argue that epentheses of verbs serve to maintain prosodic wellformedness.

4.1. Language as an Information Transmitting Protocol

It is necessary to consider properties of information transmitting systems in order to explain why and how words are truncated. I will first explain what it is meant to be an information transmitting protocol. Then I will argue the role of language as an instance of information

transmitting protocol, and how truncation is related to its utmost properties.

The figure below shows a diagram of a simplified communication system, adopted from Gallager (1968).



In the figure, the source (sender) encodes the information into some kind of signal; send it to the receiver through a channel, which is affected by noise. Then the receiver decodes the signal to retrieve the information. The ultimate goal of such a system is to let the two sides, the source and the destination, communicate. To achieve this goal, there has to be a common encoding system so that the information is not distorted. This encoding system which allows the transmission of information has to be mutually agreed with, and I will call it information transmitting protocol (or protocol, in short).

In human communication, the protocol that has been referred to above is the spoken language. One fascinating feature of spoken language, as a protocol, is that it is frequently revised to suit the needs of communication. Every human language has been tested and shaped for thousands of years, throughout which uncountable changes occur. All languages in the world should have tuned to a very efficient form, and become a robust and compact protocol. (By robustness I refer to its error-handling and correction ability and by efficiency I refer to the compactness of signals.)

Robustness is achieved by introducing redundancy, and efficiency is preserved by reducing less-informative signals. Robustness is the intrinsic property of every language, achieved by preserving some level of redundancy in the system. Efficiency can be achieved by amplifying needed information and down-turning unneeded ones. The assignment of stress and lengthening of important syllables and to destress or shorten others is a means to improve efficiency.

Shannon (1948) defines computationally the minimum word length required to transmit a piece of information, which is reversely proportional to the information it carries. Which means, the lesser the information load, the shorter it should be in a communication system. In a formal linguistic framework, a similar basis is employed in the study of word stress in Duanmu (2007)'s information-stress principle (58, 59).

(56) The Information-Stress Principle (Dunamu 2007:144)

A word or phrase that carries more information than its neighbour(s) should be stressed.

(57) Information load (Shannon 1948, in Duanmu's wordings)

The more predictable a form is, the less information it carries.

The principle (58, 59) correctly predicts the reduction of an article, preposition and the stress loss in frequent words. It also implies the Non-head Stress Rule (58), stated in the previous chapter.

(58) Nonhead Stress (Duanmu 1990, 2000)

In the syntactic structure [X XP] (or [XP X]), where X is the syntactic head and XP the syntactic nonhead, XP should be stressed.

For any given phrase, the head is always more restricted comparing to its complement. Hence the head is more predictable, and should not receive stress.

Based on the assumption that human language is an optimised form of information transmission, stress assignment may well be just one of the aspects where information load shapes a language's grammar. I take an extra step to suggest that information load not only determines stress assignments, but also the length of a word. I pose an information-length principle as follows:-

(59) Information-Length Principle

The length of a word changes according to the information load it carries.

Assignment of phrasal stress is a mild form of length regulation. The words with assigned phrasal stress are lengthened in duration, and vice versa. This may not have increased the compactness of information a great deal. In order to utilise the length of a word as a means of enhancing or suppressing information, speakers must be allowed to alter the length of a word. Truncation comes out as a major means to do the task. By truncation, a frequently used and hence easily predictable process, a word can be shortened to save processing time, and in turn highlights adjacent, more important information which is less predictable.

Next, I will report the lexical statistics extracted from a Cantonese Corpus.

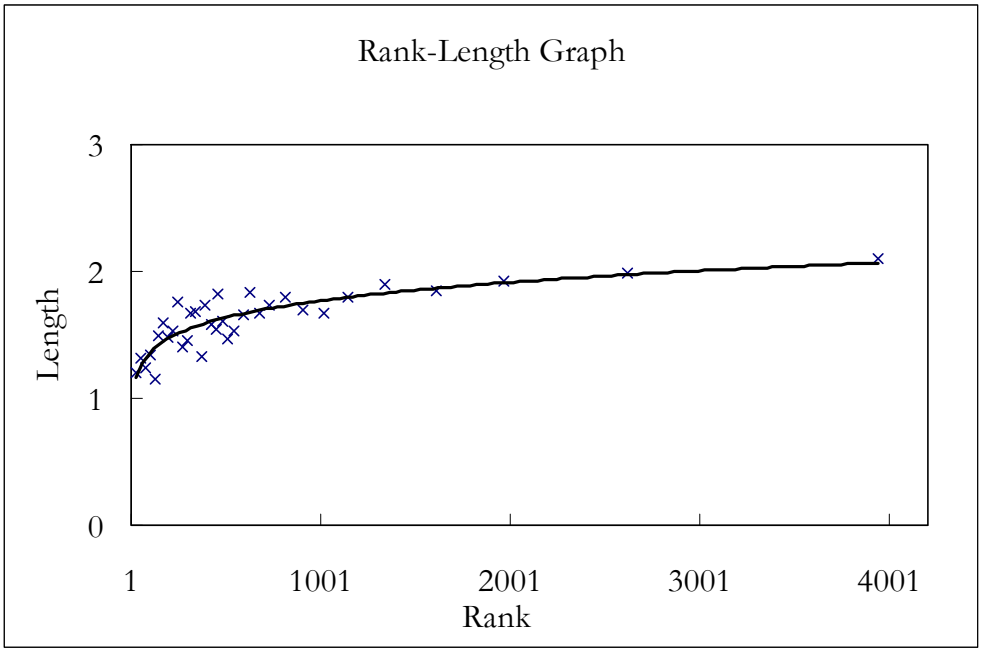
4.2. Lexical Statistics of Cantonese

I have made the assumption that Cantonese, as well as other languages in the world, are efficient and robust information transmission protocol. I defined efficiency as the ability to reduce the length of easily predictable information and increase the length of less predictable ones. This position requires some support from actual language data.

The language data is extracted from HKCanCor, which is a spoken Cantonese corpus that provides a grammatically annotated corpus with 180,000 words and part of speech tagging. A corpus of this size may not be sufficiently large to include all frequent words in a language, but is more than enough for the purpose of lexical statistical analysis. I have extracted all nouns, adjectives and verbs from the corpus and compiled a table of lexical frequency. I will present the data in this section and explain how lexical frequency and word class play a role in determination of word length.

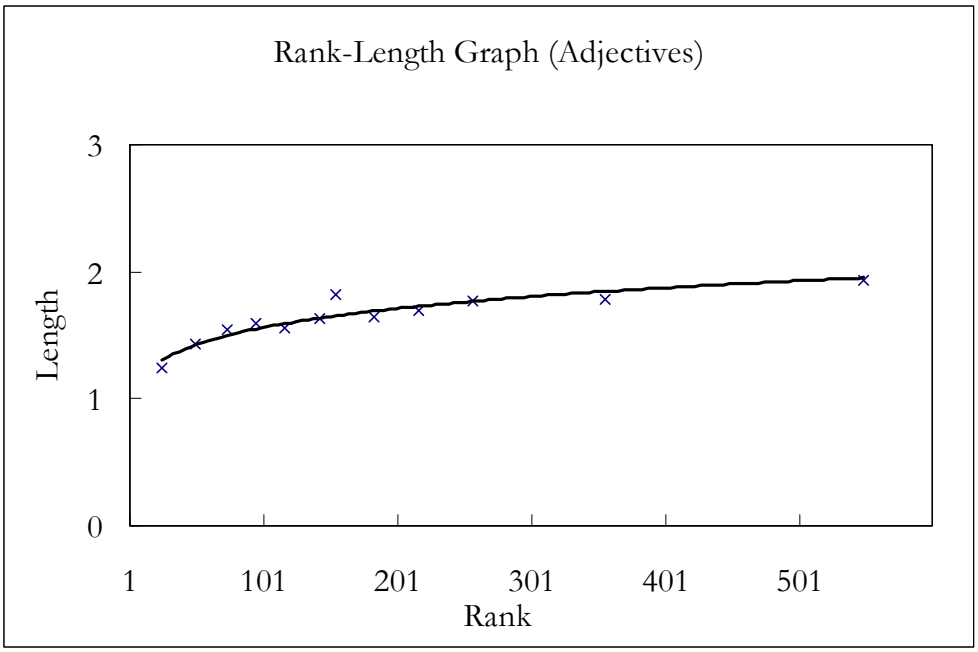
The frequency effect is best described by Zipf (1968). He suggested that how often a word is used (i.e. it's rank) has a correlation with word length. The higher the rank is, the shorter the word will be. It is precisely what the information view to language suggests, as a means to improve efficiency of language processing. The rank-length graph of the Cantonese corpus is shown in (60).

(60) Rank-Length Graph

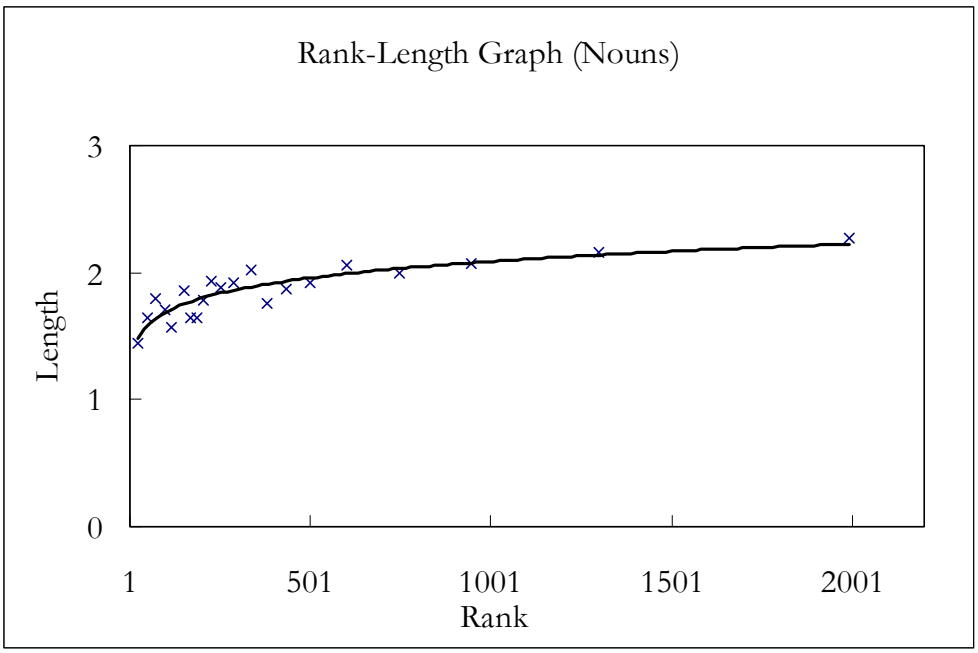


Words were sorted by their ranks and were classified into several groups. Ideally, a group should contain 25 words. When two words are equally frequent in the corpus, they will be assigned to the same group. For instance, the first group contains the most frequent words that ranked top 25 in the corpus; the second group contains words that ranked 26th to 50th; etc. A group average was then computed by averaging all words included in the group. A cross in the graph shows a group average. For instance, the first cross in the graph is the group average of the first group. The left-most cross in the graph shows the average length of the most frequent words, and the right-most cross the least-frequent words. A power line is fitted to show the relationship between rank and word length. As predicted, there is an upward trend in the graph, which shows that the less frequent a word is, the longer it would be. This confirms the insight as encapsulated in Zipf (1968)'s Law, where the number of syllables increases as the rank increases. The upward trend was also found when words are separated into three major word classes – adjectives, verbs and nouns. They are shown in graphs (61, 62, 63) respectively.

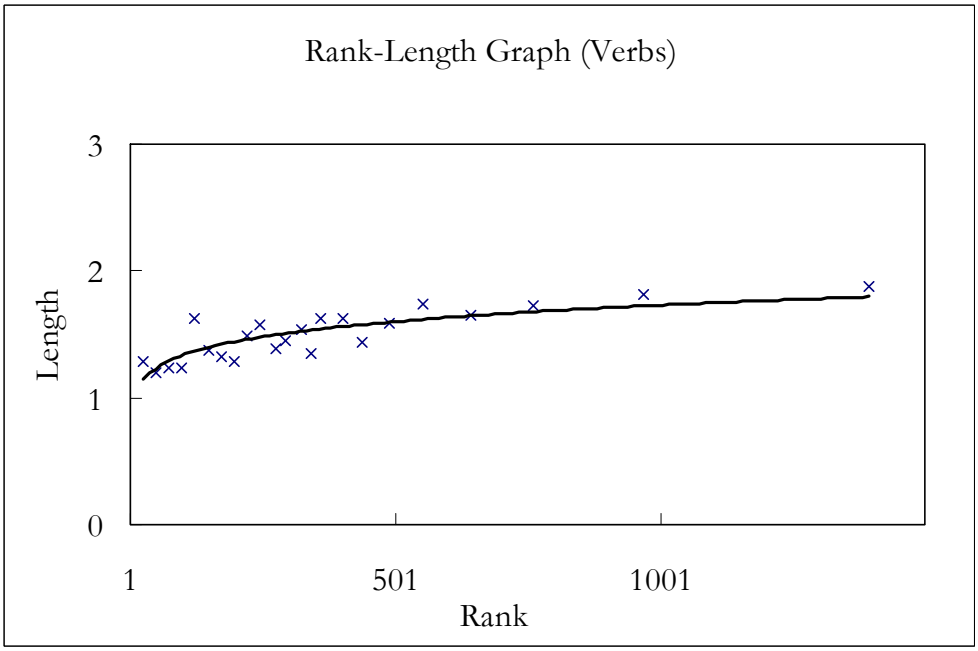
(61) Rank-Length Graph of Cantonese Adjectives



(62) Rank-Length Graph of Cantonese Nouns



(63) Rank-Length Graph of Cantonese Verbs



The graphs show the same upward trend when the data is divided into three word classes. It further confirms the conjecture that Cantonese tend to use more polysyllabic words in less frequent items. The graphs further suggest that there is a marked difference between noun and the other two word classes. Although the top 100 or so most frequently used nouns (shown by the first four crosses) tend to be monosyllabic, the predicted line reaches the disyllabic plateau

very shortly. The lines (predicted average word length) in the verb and adjective graphs, on the other hand, are running below two all the way. This suggests that the chance of having monosyllabic verbs and adjectives are higher than that of nouns.

There are few cases of high-frequency disyllabic verbs and nouns on the list, which may have exaggerate the variation of the data. These unlikely occurrences are due to the word segmentation scheme of the corpus, which marks some obvious compounds / phrases as a word. For instance, the negative form of the copula, m^4hai^6, is marked as a word, which increases significantly the average length of Cantonese verbs. This brings out another problem of similar lexical statistical analysis. The segmentation of words is supplied with the corpus, and the syntactic marking may vary from researcher to researcher. As Cantonese lacks morphological and phonological rules that demarcate word boundaries, word segmentation poses a problem not just for computational models, but also to humans. Nevertheless, the word class asymmetry in the Cantonese lexicon is clearly demonstrated by the corpus data.

4.3. Optimal Word Length

Recall that Optimal Word Length is the target length of a word that best suits the information load of the context. This section provides a means to estimate the optimal word length with the use of a set of lexical statistical data, and explains some consequences if the optimal word length hypothesis is accepted.

To start with, I will first provide a definition of Optimal Word Length, in its full form (64).

(64) Optimal Word Length Hypothesis

There is a mental collection of the average word length with different syntactic categories and at different frequencies. The Optimal Word Length of a word, W, is the

average length of a word which shares the same properties (syntactic category and frequency) with W.

This position assumes that all language users unconsciously keep track of the lexical-statistical data of a language, as it serves as an important piece of information for language processing. Truncation and augmentation are the results of optimal length adjustments, which help ensure that words conform to the norm.

I have to emphasise that the Optimal Word Length is a statistical tendency, and is not enforced in the grammar. This is very important in explaining the word length requirements in loanword truncations. Truncation is never motivated grammatically. There is usually no rule in the grammar that disallows a word that is too long. It simply implies that two words of similar syntactic distribution and frequency tend to have the same length.

Lexical frequency of a language varies across different users, as there should be some words that are frequently used by a group of speakers, while less frequently used by others. Although the actual optimal word length is not calculable, an estimated value can be obtained with a medium size corpus. Since corpus is a sample of daily speech data, the lexical statistics of a corpus should reflect the language preference of a normal user.

An alternative way to calculate the needed numbers of syllable is to find out the information load needed to convey certain type of syntactic constituent. Note that the information load is not a calculable unit, and cannot be measured accurately, as all languages have built in varying levels of redundancy into the system. However, it is possible to compare two expressions, as to what requires more information and what requires less in order to convey

the content of it. This can be demonstrated by a simple comparison between word length of subject noun phrase and object noun phrase. Both of them have the same word class, so it is supposed to be the same in terms of word size requirement. All OT-models, prosodic related or morphologically counting solutions must predict that the two have the same truncation limits or best word length.

In terms of Information Load, the initial phrase is the less restrictive ones (as there is no linguistic ways to guess the first word of an utterance). Possible legitimate sentence-opening phrases / words (such as pronouns, verbs, noun phrases, interjections, etc.) are handy. If they allow such a high degree of flexibility, they require a great deal of information load. When it comes to the object position, as the previous verb may have restricted the possible occurring sequence, shorter forms can well be accepted if it frequently sticks to the verb. That explains why certain monosyllabic nouns are more likely to occur in V-O compounds.

Optimal word length hypothesis relates not just the syntactic and lexical-frequency properties with word length. It also implies what motivates the process of truncation. For example, the optimal length of a word is *w* syllables. Perhaps the word is a name of a newly invented object or a newer form of lifestyle, and it was not that common in the language until recently. A speaker may want to express it in w syllables, yet cannot do so because the language lacks such a form. Innovative speakers may start producing shorter forms of that word by dropping certain syllables. If the truncation is done in a manner and to an extent acceptable by the grammar, the truncated form will more likely to gain currency in the language community.

One should note in no point of time would all words in the language follow exactly the optimal word length. There are other factors (such as prosody, which is discussed in the next

section) which causes variations to word lengths, and the lexical frequency in-use changes rapidly in the language community and the length of words will not be able to catch up the trend. Next, I will discuss the case of vowel epenthesis, an example of prosodic factors that prevents the convergence to an optimal word length.

4.4. The application of Optimal word hypothesis

In this section, I will describe how the hypothesis applies to predict word-lengths, and a possible source of length variation. If the optimal word length hypothesis is strictly followed, all dots on rank-frequency graphs should lie on the best fit line. In reality, word lengths are affected in a small scale, by the prosody and other linguistic factors. These factors contribute the discrepancies between information load and word length. I will start with normal case where word lengths can be predicted by the hypothesis.

The noun-verb asymmetry, which is a characteristic feature of Cantonese loanword truncation, can be accounted for by the optimal word length hypothesis. Recall that nouns are usually truncated to two syllables, or kept untruncated. Even when a monosyllabic form is available for a noun, it will usually be ungrammatical to use that form. I will use two examples, *interview* and *copy* to illustrate this point.

Both words entered Cantonese as a novel lexical item, and the frequency is as high as their counterparts in the native lexicon. As the use of the two words increases, they are supposed to be truncated. Clearly the two words are still not that common to have entered the range where monosyllables are preferred. Truncating these words into monosyllabic nouns lowers the comprehensiveness of one's speech, and is therefore not preferred.

The word interview is not truncated to two syllables. It is best to have a disyllabic for this word, but such item already exists in the native lexicon (*gin*^{3}*gung*^{1}), which makes it less useful to have a disyllabic form. The loanword *inter* in the lexicon may also have blocked the disyllabic truncation.

Verbs have a lower average syllable length when compared to nouns. Verbs with low frequency are on average slightly longer than one syllable. It is therefore common to have monosyllabic verb truncations. The words *copy* and *interview*, for example, despite their not-so-high frequency, are truncated into monosyllables, *kap*^{1} and *in*^{1} respectively.

While monosyllabic forms are mostly not preferred in noun truncations, it is strange why disyllabic forms are allowed in verbs. The acceptance of disyllabic verbs may be due to prosodic factors. For example, the word *kap*^{1}*pi*^{4}*,* which is the disyllabic adaptation of *copy*, is marginally accepted in verb position (*jin*^{1}*taa*^{4}*fiu*^{4} is not accepted). Disyllabic form, either the original word or the epenthesised form is allowed. I argue that this is due to a preference of disyllabic foot. If that is the case, when there are two possible forms for a borrowed verb, it is expected that the disyllabic form will be preferred when not followed by a verbal particle or a classifier.

Having said that the disyllabic form is used for verbs in certain context, noun-verb asymmetry in loanword truncation cannot be explained solely by prosodic factors. The avoidance of monosyllabic noun truncation (although it can form a foot with the following empty beat), and the preference of monosyllabic verb truncation, are better accounted for by the optimal word hypothesis.

To summarise, I suggest how the optimal word length hypothesis is applied, and role of prosody in the process. Monosyllables are generally not preferred in noun truncations as they have sub-optimal word lengths. As truncation is not a process to enforce grammaticality, not all words are truncated to suit the optimal word length. On the other hand, verbs are in general truncated to monosyllables. There are cases where epenthesised verbs are acceptable, and this is to be explained by prosodic factors. The additional syllable serves to form a disyllabic foot.

4.5. Further Research

I have shown that the word length of truncations can be predicted by the average word length of a similar word which comes from the same word class. Although this classification shows that word lengths are strongly correlated to word class, I suggest that word class alone fails to capture the full picture, as it does not incorporate the effect of word frequency and other prosodic factors.

If the information view is correct, the part of speech of words and frequency may not reflect the expected length of words. For instance, there may well be an asymmetry between the subject noun phrase and the object noun phrase, due to their difference in information load. If words are broken down in finer-grained categories, the relationship between word length and syntactic position will become clearer. This will be left for future research.

Chapter 5 Conclusion

Truncation is a productive way to shorten words to improve linguistic economy. Economically, a word should be as short as possible so that it saves the most time. There are forces (e.g. faithfulness) that act against the shortening process, which marks a lower limit for truncated words, so that words cannot be further truncated beyond that limit. The limit, called word minimality requirement or word size requirement, is thoroughly studied under the prosodic morphology framework, which suggests a correlation between prosody and word size.

In Chapter 2, I presented the truncation patterns in Cantonese native and loan lexical items. These data have been extracted from a loanword database and a spoken Cantonese Corpus (HKCanCor). Cantonese data show a discrepancy between word sizes, where verbs are generally monosyllabic and nouns are disyllabic. Monosyllabic nouns are also attested, yet monosyllabic form is blocked when a disyllabic form is available. These data is used to test against the predictions of different theories.

Chapter 3 is a review of two forms of templatic theories, namely Generalised Template Theory and Morpheme-Base Template Theory. In Generalised Template Theory, word size is correlated with prosodic categories. It is suggested that the prosodic word equals one of the morphological categories. I assume that a prosodic word is a morphological word, which successfully predicts the size of noun truncations, yet all verb truncations become subminimal. Morpheme-Base Template Theory suggests that the number of morpheme in a word should be at best equal to the number of syllables. It successfully predicts the word size of complex truncations, yet fails to explain any of the monosyllabic truncations, as any truncation is minimally bimorphemic. I therefore made the conclusion that the two theories cannot explain

the word length of truncated words.

In Chapter 4, I suggested, following Zipf (1968), that frequency plays an important role in the truncation process. No size restriction can be explained without considering the lexical frequency of words. I proposed an information view towards the problem, and suggested that it is best to consider language an information transmitting protocol. The aim of truncation is to reduce or increase word size so that the information load of that word is most balanced, i.e. being both robust and efficient. I conjectured that the information load can be estimated by lexical statistics extracted from a reasonably large corpus, and demonstrated the correlation of word-length and lexical frequency. I defined Optimal Word Length of a word to be the average length of a word with similar status (i.e. similar frequency and similar syntactic position). With this definition, a word is truncated if it is too far away from the Optimal Word Length. This frequency view explains the disyllabic preference for nouns and the monosyllabic preference of truncated verbs, while respecting to the fact that monosyllabic nouns and verbs do exist. The variation of word length, such as the acceptability of epenthesised form of monosyllabic verb, shows that prosody is a separate factor that interacts with the truncation process.

The present study is an attempt to study truncation from a quantitative perspective. I hope I have shown how lexical statistics explains word size limits to truncation.

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