Tonal bilingualsim: the case of two related Chinese dialects

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8 General Discussion

This thesis investigated the role of tone in lexical processing by tonal bilinguals of two related Chinese dialects, Standard Chinese (SC) and Jinan Mandarin (JM). Theories and findings on different aspects of lexical processing were revisited in the context of this special type of bilingualism. In the following sections, the findings of individual chapters are first summarized, and then their general implications are discussed.

8.1 Summary for individual chapters

Chapter 2 investigates to what extent the interlingual category-goodness between different tonal systems keeps its impact on lexical access and speech comprehension. The acoustic distributions, interlingual perception, and the corresponding interlingual lexical and semantic activations of SC and JM rising tones were investigated in a group of experiments. An asymmetry was found in production and perception: the JM rising tone is more similar to the SC high-rising tone in acoustic distribution and interlingual perception. Such asymmetry also influences the tonal bilinguals' interlingual lexical access: SC high-rising final pseudo-words were more likely to be accepted as a JM real word than their low-rising final counterparts. However, the asymmetrical mapping did not affect the semantic activation after lexical access, which suggests some discreteness in the different levels of speech comprehension, namely between lexical activation and semantic activation. Interlingual two-to-one mapping is known to affect speech perception (Best & Strange, 1992; Bohn & Flege, 1990; Flege, Bohn, & Jang, 1997; Miyawaki et al., 1975) and lexical access (Cutler & Otake, 2004; Dufour, Nguyen, & Frauenfelder, 2007; Pallier, Colomé, & Sebastián-Gallés, 2001). Chapter 2 generalized the previous findings to the tonal system of native tonal bilinguals and expanded the research questions to include lexical access and the corresponding word comprehension.

Chapter 3 addresses the question of how the strength of systematic correspondence is influenced by the sociolinguistic and cognitive backgrounds of the individuals. Between-word pitch distances of JM words can be predicted from SC tonal categories using statistical modeling, with interlingual tonal identity and individual backgrounds taken into consideration. The global influence of the bilinguals' sociolinguistic and cognitive backgrounds on the strength of systematic correspondence was found for the first time. The expected success of this statistical prediction mainly verified what historical linguists have known for decades, namely the systematic correspondence mechanism (Dyen, 1963; Meillet & Ford, 1967). Moreover, this study revealed the way sociolinguistic and cognitive backgrounds affect the general strength of systematic correspondence for the first time. The age-dependent and -independent effects were statistically teased apart.

What is the role of tonal similarity in the auditory lexical access of etymologically related translation equivalents? Chapter 4 tapped into this question and found that, although the bilinguals showed no difference in the general reaction times to tonal-identical and tonal-non-identical translation equivalents, tonal

similarity showed different effects (facilitatory vs. interfering) on the lexical access of tonal-identical and tonal-non-identical translation equivalents. The interaction of tonal similarity with language mode (i.e. SC versus JM) and test blocks was also complex. Regardless of the status of the translation equivalents (i.e. identical or not), the SC word was processed faster than its JM equivalent with SC as the dominant dialect. This indicates that the lexical representations of translation equivalents in the bilingual lexicon are not only distinguished by lexical tones but also by language mode. Moreover, the SC-JM bilinguals showed an unusual lexical advantage compared to the tonal-monolingual controls, suggesting that bilinguals of closely related dialects, with their mental lexicon full of etymologically related translation equivalents, may benefit from this structure of their bilingual mental lexicon in auditory lexical access. The present finding is different from earlier findings using visual tasks (Dijkstra, Miwa, Brummelhuis, Sappelli, & Baayen, 2010), where the discontinuous effects of tonal similarity in visual word recognition suggested that the orthographically identical cognates share one common lexical representation. Complex interactions were found between tonal similarity and language mode. This suggests that language mode influences how exactly tonal similarity affects the lexical co-activation and lexical competition between etymologically related translation equivalents.

Chapter 5 studied how tonal pattern variation between tonal lexical variants affects auditory lexical access. True repetition, within-category variation, tonal pattern variation, and lexically contrastive variation were compared in an auditory form-priming experiment. The results support the view that tonal patterns have representative status in lexical access but also converge in a lexically specific way. Different types of variability have been investigated for decades in models of auditory lexical recognition and speech production (Connine, Ranbom, & Patterson, 2008; Goldinger, 1998; Lahiri & Reetz, 2002). The present study contributes to this topic by providing new evidence from the suprasegmental aspect. By including a previously untested condition these findings are in line with earlier studies of pronunciation variants, and support that both tonal-pattern variants are stored under the same lemma (Bürki, Ernestus, & Frauenfelder, 2010; Ernestus, 2014) and are sensitive to variant frequency (Connine et al., 2008). However, the present findings generally cannot be explained by the underspecification hypothesis of lexical representation, or listeners' tolerance of mismatches in the process (Lahiri & Marslen-Wilson, 1991; Marslen-Wilson & Zwitserlood, 1989). This is because a general flexibility regarding tone would predict a lack of difference across different types of tonal conditions, which counters the findings in Chapter 5.

Chapter 6 compared JM lexical variants which are either identical or non-identical to their SC translation equivalents and examined their lexical access for speech production. The variant probability effect suggests that the SC-JM bilinguals do store the JM tonal lexical variant they did not produce in the corpus, and that the difference in individual one-time choice still mainly reflects the variant probability instead of the individual difference in lexical representation. The variant probability effect was found in tonal variants for the first time and the effect is in line with the segmental findings (Connine et al., 2008).

Do SC-JM tonal bilinguals differ from SC tonal monolinguals when automatically retrieving tonal information from Chinese characters? What tonal

information does the common written form of the etymologically related translation equivalents activate? In order to answer these questions, Chapter 7 adopted a Stroop paradigm. Although showing a general lexical disadvantage in visual word production, the bilinguals benefited more from the congruent conditions and suffered less from the incongruent conditions in this Stroop experiment. The SC-JM bilinguals also differ from the SC tonal monolinguals in their lack of tonal sensitivity. Although phonological interference existed in both the tonal monolinguals and the tonal bilinguals, only the tonal monolinguals showed tonal effects. The present findings are different from the results of previous Chinese Stroop experiments (Li, Lin, Wang, & Jiang, 2013; Spinks, Liu, Perfetti, & Tan, 2000), which did not specify whether their Chinese participants had tonal backgrounds other than Standard Chinese and found incongruent tonal effects. Our findings suggest that tonal bilinguals are different from tonal monolinguals in their tone-related attention-control. Future studies on Chinese visual word recognition should take the participants' experiences with tonal dialects into consideration.

8.2 General implications

8.2.1 The role of tone in lexical process

Lexical tones distinguish words in tonal languages. Just like lexical stress (Levelt, Roelofs, & Meyer, 1999; Schiller & Costa, 2006), lexical tones function like abstract lexical frames in lexical access. However, not all the tone-related aspects of lexical process are clear. Additionally, findings from tonal languages may potentially inspire the studies on lexical stress in return.

For instance, how are tonal lexical variants [i.e. /tɕiɛn tan (High-level+Rising)/ and /tɕiɛn tan (Low+High)/ both mean 'simple' in JM] stored and processed in lexical access? Chapter 5 adopted a form priming paradigm and investigated the role of different levels of tonal variability in a single-dialect auditory lexical decision experiment. In light of the findings from Chapter 5, Chapter 6 investigated the issue of tonal representation in the context of bilingualism. These chapters show that unproduced lexical variants are nevertheless stored and the naming latency is affected by the variant probability. Tonal patterns may have representative status, but the lexically specific convergence of tonal patterns also happens in lexical access. It would be interesting to see whether these findings also apply to other types of tonal languages with register tones (e.g. Yoruba) and pitch accent languages (e.g. Swedish). These findings may also be of interest for studies on languages with lexical variants which are different in stress [e.g. válisi and valísi both mean 'tooth' in the Budai Rukai dialect of Formosan (C.-M. Chen, 2006)].

8.2.2 Interlingual matching of phonological inventories

Tonal bilinguals face a series of dilemmas regarding the phonological processing before lexical retrieval, some of which can also exist between remote languages. For instance, one tonal category in Dialect A is similar to two different tonal categories

in Dialect B. Can both of these tonal categories from Dialect B activate the same tonal category in Dialect A during lexical access? What is the effect of interlingual category-goodness? Does the effect of interlingual category-goodness last until semantic activation? Chapter 2 looked specifically into a tonal case of phonological similarity in the sound inventories. It is shown that, in auditory lexical access, the tonal acoustic space can be divided differently according to the language mode, which is sensitive to interlingual category-goodness, and the effect of interlingual category-goodness only lasts until lexical access occurs. These findings may be generalized to tonal bilingualism involving remote languages and to similar two-to-one matching cases involving consonants and vowels.

8.2.3 Mental representation of etymologically related translation equivalents

Some findings in this thesis are specific to etymologically related translation equivalents, including both cognates and loan-words. Previous studies mostly use 'cognate' to refer to all such words and the most well-known findings are about the 'cognate facilitation' effect (Costa, Caramazza, & Sebastian-Galles, 2000; Dijkstra, Grainger, & Van Heuven, 1999). Closely related dialects are special in that the bilingual mental lexicon is teaming with etymologically related translation equivalents. Bilingualism involving closely related dialects offers an ideal test case for the mental representation of etymologically related translation equivalents.

Chapter 3 shows that the systematic correspondence between SC-JM etymologically related words varies across bilingual individuals, affected by their sociolinguistic and cognitive backgrounds. Using an auditory lexical decision task, Chapter 6 shows that, in the bilingual mental lexicon, lexical nodes are distinguished not only by the pronunciation but also by the language mode, whether the translation equivalents are identical or not. This finding is not totally consistent with earlier findings (Dijkstra et al., 2010).

The inconsistency may come from several different sources, because the SC-JM case is even more special than just two closely related tonal dialects. First, there is segmental identity between the etymologically related translation equivalents. Second, the same written form (Chinese character) is used for the translation equivalents, which means that the previously used visual word recognition paradigms cannot be tested in the current case. In light of these unique features, what is the cause behind the inconsistent findings? It could be that the auditory and the visual route yield access to different underlying lexical representations. It could also be that a bilingual lexicon dominated by etymologically related translation equivalents functions differently from a bilingual lexicon where etymologically related translation equivalents only exist sporadically. Alternatively, it could be that tonal information is processed differently from segmental information in bilingual lexical access as well.

To answer the theoretical questions on the bilingual lexical representation of etymologically related words, many empirical questions still need to be addressed. If bilinguals can be found between two dialects using different written forms for the etymologically related translation equivalents (e.g. Urdu and Hindi), would the

pattern of effect be more similar to previous findings or to the current findings? Would a bilingual lexicon with a mediocre number of etymologically related translation equivalents show a different pattern (e.g. SC with a more remote Chinese dialect)? If another pair of dialects is tested, whose etymologically related translation equivalents are tonally identical but vary in segmental similarity, would similar effects as found in the current study still show up? To further understand the lexical representation of etymologically related words, more bilingual cases with closely related dialects need to be tested.

8.2.4 Bilingual visual word recognition of logographic written forms

How phonological information is activated and retrieved via logographic written forms (especially Chinese characters) has intrigued researchers for many years (Perfetti & Zhang, 1991, 1995; Tzeng, Hung, & Wang, 1977; Wu, Zhou, & Shu, 1999; Zhou & Marslen-Wilson, 1999). Bilingual visual word recognition involving various types of writing systems has also received a lot of attention (H.-C. Chen & Ho, 1986; Dyer, 1971; Fang, Tzeng, & Alva, 1981; Kiyak, 1982; Preston & Lambert, 1969). It is surprising that few studies have taken into consideration that the same logographic written forms can be associated with different pronunciations in related dialects. It was assumed that findings from experiments, without knowing the participants' dialect backgrounds, could be generalized to both monolinguals and bilinguals who use this logographic writing system.

When reading Chinese characters aloud, SC-JM bilinguals' performance is influenced by variant-probability (Chapter 6) and individual backgrounds (Chapter 3). When simply coming across Chinese characters, these bilinguals also activate the relevant mental representations. Chapter 7 shows that the participants' dialectal backgrounds affect their automatic visual word recognition of the common logographic written forms. The pattern of Stroop effects differs between SC-JM tonal bilinguals and SC tonal monolinguals. Though neither group showed exactly the same pattern as found in earlier Chinese Stroop experiments, it was the Stroop facilitation and interference found in the tonal bilingual group, surprisingly, that aligned better with earlier findings (Li et al., 2013; Spinks et al., 2000).

Note that in the current case of bilingualism, the same written form is associated with the same segmental structure but potentially different tonal contours. If the same written form is instead associated with similar but different segmental structures (e.g. for a bilingual who speak both SC and Shanghai Wu dialect), how would the automatic phonological activation happen in automatic visual word recognition? For instance, would both pronunciations be automatically activated? If so, would the activation happen simultaneously or sequentially? Further studies are necessary in order to answer these questions.

8.2.5 Tonal bilinguals' advantages and disadvantages

The bilingual advantages and disadvantages related to lexical tasks were also revisited in this thesis. Bilinguals are known to have lexical disadvantages and executive-control advantages. On the one hand, most previous studies showed that bilinguals are slower in lexical access compared with monolinguals (Bialystok, 2009; Martin et al., 2012; Ransdell & Fischler, 1987). This lexical disadvantage was explained by the fact that bilinguals have a denser lexical neighborhood and hence suffer from more lateral inhibitions (Ransdell & Fischler, 1987). On the other hand, bilinguals are better at resolving conflicts in tasks (Bialystok, 2009; Carlson & Meltzoff, 2008; Hilchey & Klein, 2011; Prior & Gollan, 2011), including the conflict in the Stroop task (Bialystok, Craik, & Luk, 2008). This executive advantage can be explained by the fact that bilinguals receive more training in language switching, which is a conflict-resolution process. Earlier evidence for bilingual advantages and disadvantages has mostly been found in bilinguals of non-tonal languages. Are these earlier findings applicable to tonal bilinguals of closely related dialects?

Regarding bilingual executive-control advantages, the answer to this question is 'yes'. Tonal bilinguals benefited more from the congruent conditions and suffered less from the incongruent conditions (Chapter 7) compared with the monolinguals in the Stroop experiment. This result is consistent with earlier findings (Bialystok et al., 2008). Moreover, the new Stroop findings also draw special attention to bilingual attention control, especially regarding tone. Taking into consideration the findings of Chapters 5 & 6, it is apparent that tone is important for the tonal bilinguals in distinguishing lexical contrasts and lexical variants in auditory and production tasks. Tonal information is aurally available in auditory lexical recognition, and necessary for reading aloud. In contrast, when the bilinguals need to name the ink colors instead of the word itself, the tonal information of the written word becomes distracting. Thus, the lack of tonal sensitivity may actually be of advantage to the tonal bilinguals in this Stroop paradigm. Indeed, the tonal bilinguals are able to redirect their attention away from tone in the automatic visual word activation, better than tonal monolinguals. Recently, the theory of bilingual executive-control advantages was challenged (Paap, 2015; Paap, Johnson, & Sawi, 2015). Paap (2015) said that these advantages are probably 'restricted to very specific and undetermined circumstances'. The current case of tonal bilingualism indeed revealed a very specific executive advantage related to tone. However, the current study also clarifies the circumstance for this advantage.

Then, as for the bilingual lexical disadvantages, the answer to the question above is both 'yes' and 'no'. Not only lexical disadvantage but also lexical advantage was found in this study. In automatic visual word recognition (Chapter 7), as expected, bilinguals named colors generally slower than monolinguals. However, in the auditory lexical decision of etymologically related translation equivalents (Chapter 4), the SC-JM bilinguals showed an unexpected advantage over SC tonal monolinguals in SC mode, after switching from a block in JM mode. One may argue that these bilinguals' lexical advantage may be only restricted to etymologically

related translation equivalents. However, as bilinguals of two related tonal dialects, they have mental lexicons teaming with such words. In other words, this is their normality, not exception. Also, note that the SC-JM bilinguals and SC tonal monolinguals both know some English. Thus, the difference cannot be attributed to the knowledge of non-tonal foreign language. Both the lexical disadvantage and lexical advantage here are specific to the tonal bilingualism of related dialects.

More attention is needed for this type of bilingual lexicon, which is teaming with etymologically related translation equivalents. In earlier studies, even with the same cognates, the bilinguals were still mostly found to be slower than the monolinguals in cognate production (Costa et al., 2000) and visual word recognition (Dijkstra et al., 1999; Lemhöfer, Dijkstra, & Michel, 2004; Lemhöfer et al., 2008; Mulder, Dijkstra, Schreuder, & Baayen, 2014). As the JM-SC translation equivalents are always stored as separate lexical nodes (as found in Chapter 4), there is no reason to believe that the lexical neighborhood is less dense for the JM-SC tonal bilinguals. Then it needs to be considered that these bilinguals may have acquired special advantages in handling the etymologically related translation equivalents in their mental lexicon. For instance, the SC-JM tonal bilinguals may benefit more from lexical coactivation and suffer less from the lateral inhibition for such lexical nodes. This interpretation is also consistent with Chapter 7's findings on speech production, in that the SC-JM bilinguals showed greater Stroop facilitation in consistent conditions and smaller Stroop interference in inconsistent conditions than the SC monolinguals.

To conclude, the behavioral findings in this thesis provided empirical evidence on speech perception, lexical processing, and attention control of tonal bilinguals of related tonal dialects. It started with how tonal bilinguals process the two-to-one interlingual tonal mapping in bilingual lexical access and semantic activation. Then it moved on to how they handle different levels of tonal variability, how they make use of the tonal information to access the target lexical variant, and how they store tonally identical and non-identical translation equivalents. Furthermore, it investigated how these bilinguals benefit from the co-activation and fight with the competition of etymologically related translation equivalents, and use their fine-tuned attention and executive control to cope with task-irrelevant tonal information. Related theoretical issues are revisited and the new findings suggest that current models of bilingual lexical processing need to be adjusted to accommodate the possibilities provided by the tonal bilingualism of related dialects.

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