

# Do Mandarin-French bilinguals hear Chinese when reading French?



<sup>1,3</sup>Yaru Wu, <sup>2</sup>Jeremy Yeaton, <sup>1</sup>Frédéric Isel

<sup>1</sup>Modèles, Dynamiques, Corpus (MoDyCo), UMR 7114, CNRS, France

<sup>2</sup>Laboratoire de Psychologie Cognitive UMR 7290, Aix-Marseille Université, France

<sup>3</sup>Laboratoire de Phonétique et Phonologie (UMR7018, CNRS-Sorbonne Nouvelle), France

yaru.wu@sorbonne-nouvelle.fr, jeremy.yeaton@univ-amu.fr, fisel@parisnanterre.fr

## Introduction

### Motivations

#### Monolingual

Visual word processing => the phonological code is activated [1].

#### Bi-Multilingual (fewer studies):

Lexical decision: Error rate high & RT long for words with the same pronunciation in L1 and L2 [2,3] => activation of linguistic information in parallel languages [4]

### Objective

- To study inter-lingual lexical interferences in adult Mandarin Chinese bilinguals with different levels of proficiency in French (L2).

### Why Mandarin-French bilinguals

Most European languages: alphabetical overlap [3,5]

e.g. same spelling => similar pronunciation ("roof" in English and Dutch /u:/, o:/)

e.g. same pronunciation => similar spelling (leaf vs. lief)

=> difficult to study the contribution of spelling or pronunciation in a study of interlinguistic interactions

Chinese: logographic writing => spelling - separate pronunciation

### Wu et Thierry (2010)

- Reading the words in the L2 would activate the phonological representations of the L1 but not the orthographic representations

### Contributions

- New language pair
  - Interaction of the 4 factors
- Linguistics factors : Language proficiency & everyday use of L2  
- Cognitive factors: Selective attention & inhibiting ability

### Hypothesis & Predictions

**Hypothesis tested:** When reading or listening to L2 words, phonological representations of the L1 are automatically activated (see bilingual co-activation model) [6]. This is not the case for spelling representations [7].

**Predictions:** The strength of phonological interference in the L1 over the L2 should correlate negatively with proficiency level of learners in the L2. The more proficient they are in the L2, the lower the interference (L1 inhibition and/or L1 activation level).

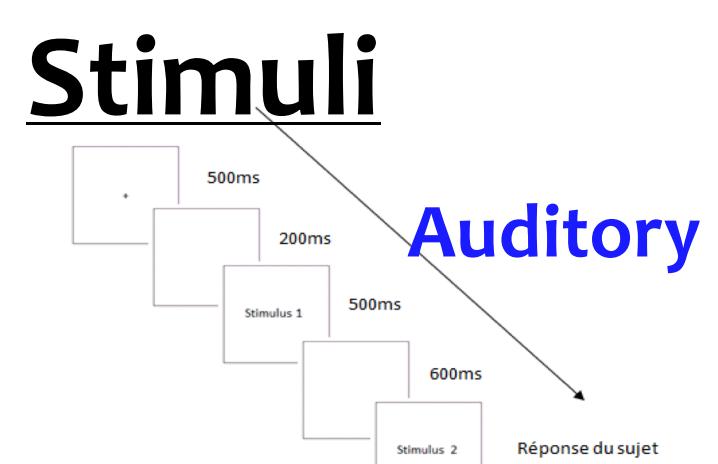
## Method

### Conditions

Condition Spo	Condition sPo	Condition spo	Condition spo
Sem +	Sem -	Sem -	Sem -
Pho -	Pho +	Pho -	Pho -
Ortho -	Ortho -	Ortho +	Ortho -
cerise – myrtille (cherry – blueberry) Yingtao – lánméi 櫻桃 – 蓝莓	bougie - piment (candle - chili pepper) lǎzhú - jiājiao 蜡烛 - 辣椒	comptable – réunion (accountant - meeting) Kuàiji - huìyi 会计 - 会议	parc – lèvre (park – lip) Gongyuán - Zúichún 公园 - 嘴唇
SR: 4,48	SR: 0,63	SR: 0,89	SR: 0,38

\* SR: semantic relatedness of the words in French (evaluated by 30 French natives)

### Modalities



Conditions	Number of pairs
Sem + Pho - Ortho - (Spo)	60
Sem - Pho + Ortho - (sPo)	30
Sem - Pho - Ortho + (spo)	30
Sem - Pho - Ortho - (spo)	60
Total	180 pairs (360 words)

### Participants

#### Experimental Group (Bl: 11/30 participants):

- Late Sinophone Learners of French, 18-30 years old, right-handed, from Beijing/Tianjing

#### Control Group:

FR : Native French, 18-30 years old, right-handed (26/30 participants)

CH: Native French, 18-30 years old, right-handed

## Analyses

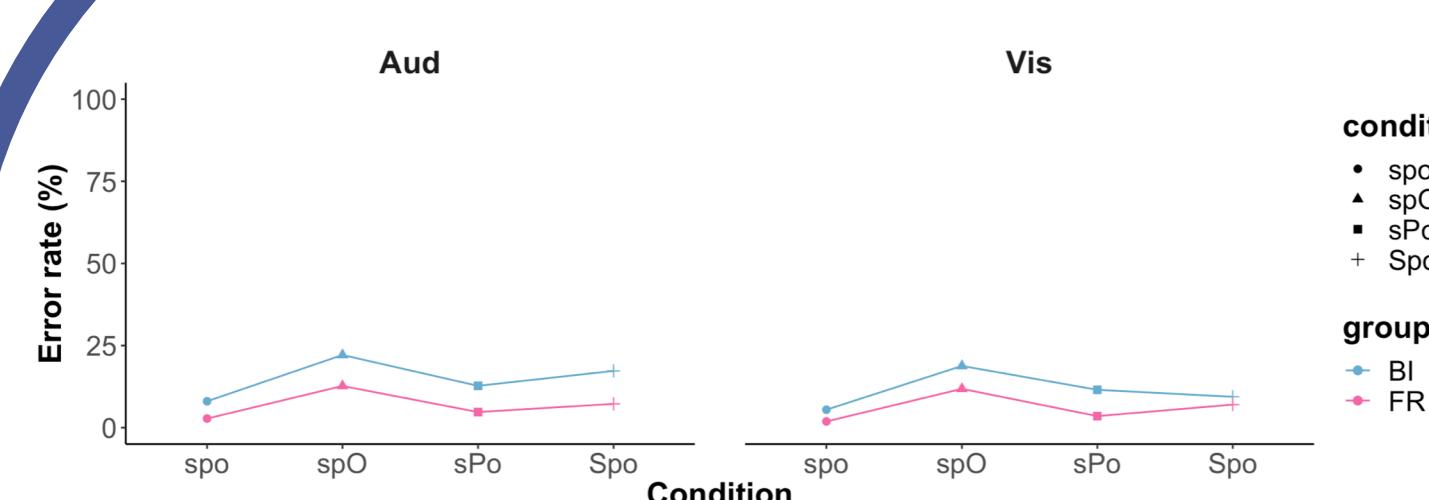
### Behavioral data

- Reaction time (RT) & correctness (semantically related or not)
- Correctness: Generalized linear mixed effects regression with condition, group, modality as fixed effects; participant ID as random effects ; by-participant slopes for the effect of condition and modality
- RT: Linear mixed effects regression with condition, group, modality as fixed effects; participant ID as random effects ; by-participant slopes for the effect of condition and modality

### EEG Processing

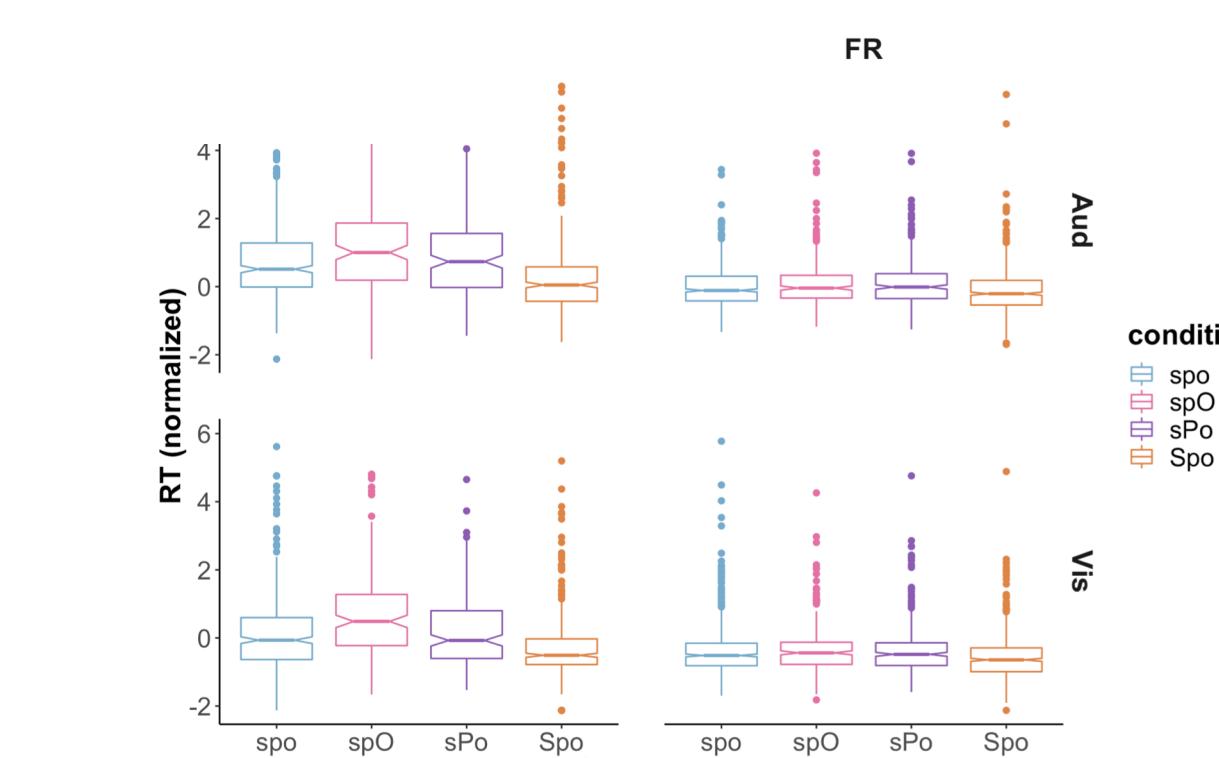
- 64-channel BioSemi EEG - mastoid re-referenced and filtered 0.5-40 Hz
- Removed trials with incorrect response/ first translation
- 900-ms epochs (-100 to 800 ms post stimulus onset)
- Removed ICA components containing ocular artifacts
- Cluster-based permutation test (0-600ms, 2500 permutations)

## Results

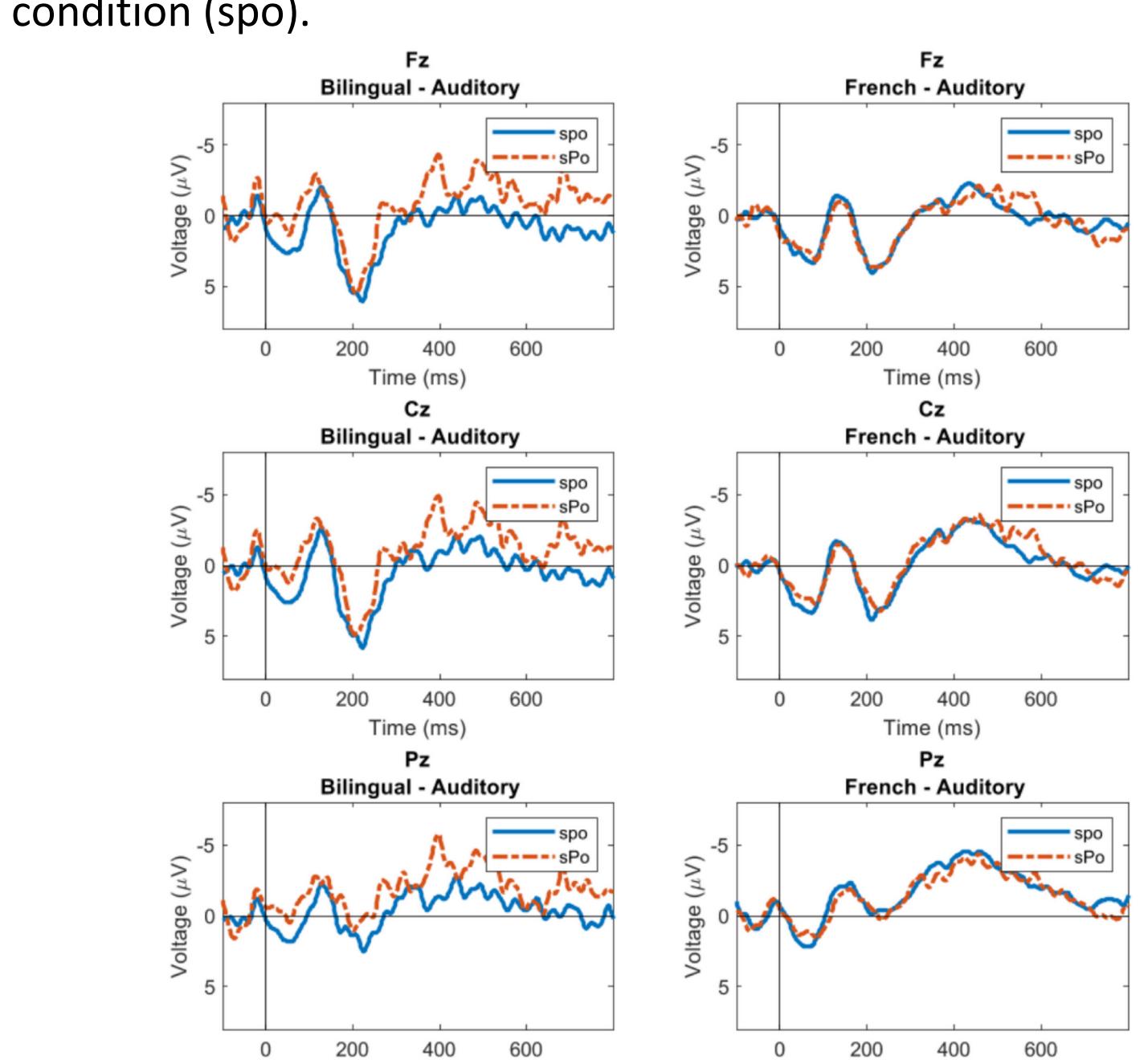


Error rate is lower for native French than for bilinguals in all 3 conditions. It does not significantly differ between modalities.

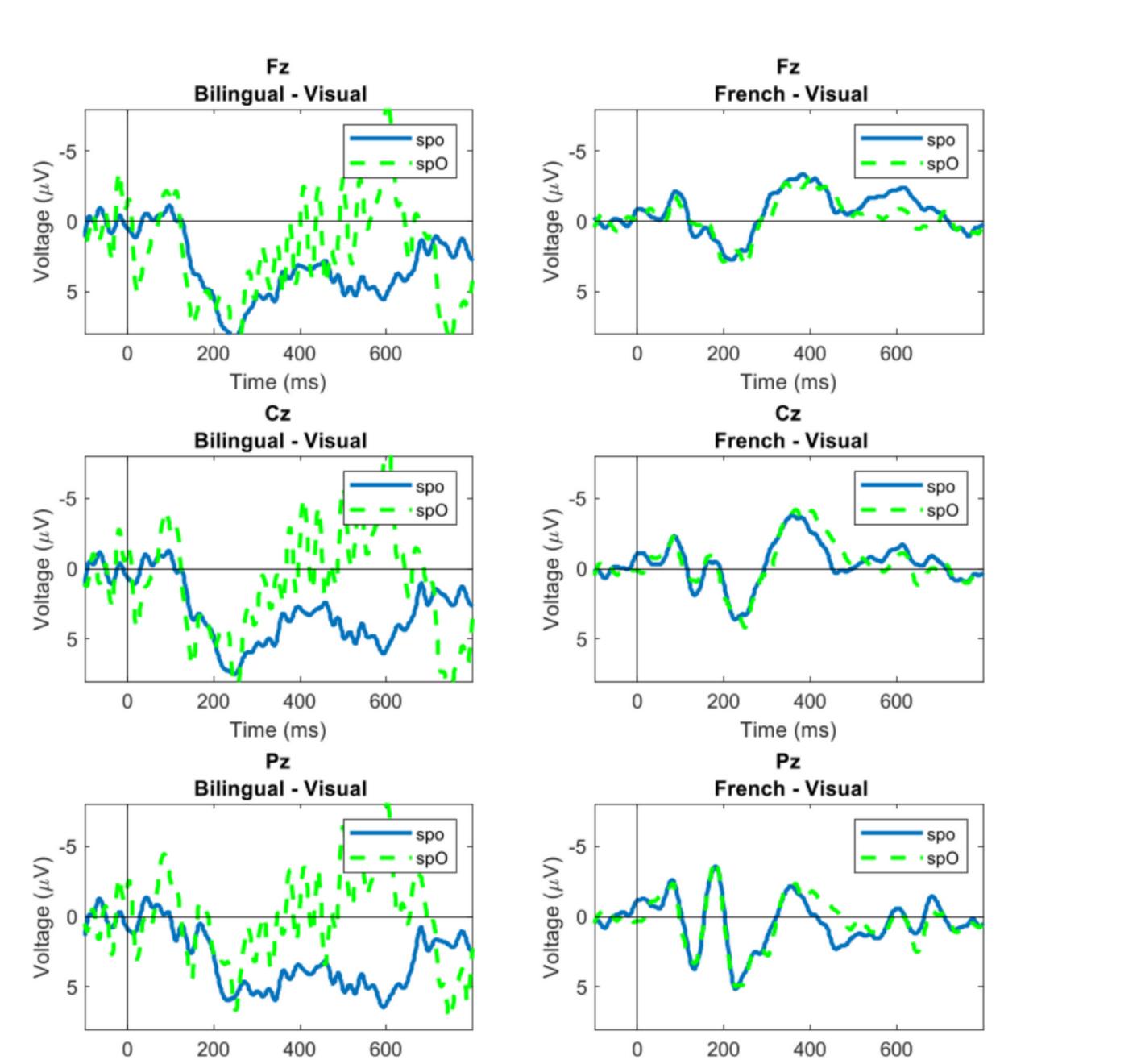
In the visual modality, error rate is higher for orthographically (spO) and phonologically (sPo) related pairs in Mandarin translation than for the baseline condition (spo).



Reaction time (RT) is significantly shorter for the semantically related condition (Spo) comparing to the other three semantically unrelated conditions, for both the auditory (top) and visual (bottom) modalities.



ERPs in baseline (spo, solid blue) and phonologically related conditions (sPo, dashed red) in the auditory modality for three midline electrodes in L2 speakers (left) and native French speakers (right). L2 speakers show a peak around 400ms, while French natives do not.



ERPs in baseline (spo, solid blue) and orthographically related conditions (spO, dashed green) in the visual modality for three midline electrodes in L2 speakers (left) and native French speakers (right).

- Bilinguals have significantly longer RT for orthographically (spO) and phonologically (sPo) related pairs in Mandarin translation than for the baseline condition (spo).
- Bilinguals made more errors in the phonologically (sPo) and orthographically (spO) related conditions than in the baseline condition (spo).
- Significant ERP differences from baseline (spo) in semantically related condition (Spo) for both populations (predicted)
- No significant ERP differences from baseline between other conditions (sPo, spO) in native French speakers (predicted)
- No significant ERP differences from baseline between other conditions (sPo, spO) in L2 speakers (not predicted, but unsurprising given predicted effect size and current small sample, cf. COVID-19)

## Conclusion

- ERP data suggests activation of L1 phonological and orthographic representations for L2 speakers
- These preliminary data point to differential activation of phonological and orthographic representations depending on presentation modality
- Current data provide insufficient statistical power to make claims about the relationship between proficiency and any of our experimental measures

## References

- Ferrand, L., & Grainger, J. (1992). Phonology and orthography in visual word recognition: Evidence from masked non-word priming. *The Quarterly Journal of Experimental Psychology Section A*, 45(3), 353-372.
- Doctor, E. A., & Klein, D. (1992). Phonological processing in bilingual word recognition. In *Advances in psychology* (Vol. 83, pp. 237-252). North-Holland.
- Dijkstra, T., Grainger, J., & Van Heuven, W. J. (1999). Recognition of cognates and interlingual homographs: The neglected role of phonology. *Journal of Memory and Language*, 41(4), 496-518.
- Grosjean, F. (1989). Studying bilinguals: Methodological and conceptual issues. *Bilingualism: Language and cognition*, 1(2), 131-149.
- Doctor, E. A., & Klein, D. (1992). Phonological processing in bilingual word recognition. In *Advances in psychology* (Vol. 83, pp. 237-252). North-Holland.
- Van Heuven, W. J., Dijkstra, T., & Grainger, J. (1998). Orthographic neighborhood effects in bilingual word recognition. *Journal of memory and language*, 39(3), 458-483.
- Wu, Y. J., & Thierry, G. (2010). Chinese-English bilinguals reading English hear Chinese. *Journal of Neuroscience*, 30(22), 7646-7651.