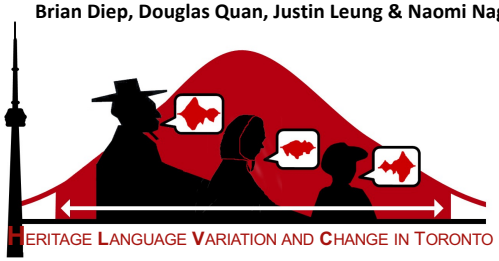
Variation in Transcribing Heritage Cantonese

Brian Diep, Douglas Quan, Justin Leung & Naomi Nagy



HTTPS://NGN.ARTSCI.UTORONTO.CA/HLVC

justinr.leung@mail.utoronto.ca

Workshop on Cantonese, Hong Kong Baptist University, 24 June 2023

Social Sciences and Humanities Research Council of Canada | Conseil de recherches en sciences humaines du Canada

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What is the HLVC Project?

- Large-scale project investigating variation and change in Toronto's heritage languages
  - To **document and describe heritage languages** spoken by immigrants and 2 generations of their descendants
    - To compare to a Homeland "baseline" & local English (also variable)
    - to understand changes in progress
  - To **create a corpus** available for research on a variety of topics
  - To **push variationist research beyond its monolingually-oriented core (and its majority language focus)**
  - To **promote HL vitality** through research, training, and "knowledge mobilization" in and out of the classroom

(Nagy & Meyerhoff 2008, Nagy 2017)

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Cantonese in 2 multilingual cities

http://www.servcorp.com.hk/media/9459/-twoifc-building-3

https://evolvetours.com/wp-content/uploads/2015/04/CN-Tower.jpg

In Hong Kong:

- **86%** of population uses CAN
- 83% are able to speak English
- **5%** have "very good" English

Census and Statistics Dept. (2014:4)

In Toronto (since the 1970s):

- **4.5%** report CAN as mother tongue (267,000 MT speakers)
- 96% are able to speak English
- **77%** (mostly) use English "at home"

Statistics Canada (2016)

Variables previously examined

Dependent variables	Homeland change?	Heritage change?
(I): /i/-/ɪ/ split (Tse 2019)	Yes	Yes
(Y): /y/-/u/ merger (Tse 2019)	No	Yes
(E): /ɛ/ split by coda (Tse 2019)	No	No
(O): /ɔ/ split by coda (Tse 2019)	Yes	No
(VOT) (Tan & Nagy 2017)	No	No
(N): /n/ → /l/ (Nagy in press)	Yes	No
(CL): specializing to singular nouns (Nagy & Lo 2019)	No	Yes
(PRODROP): less pro-drop (Nagy et al. 2011, Nagy in press)	No	No
(MOTION): satellite-/verb-framing (Leung 2022)	No	Yes

Cantonese interviews in the HLVC Corpus

- Audio recordings of sociolinguistic interviews conducted in Cantonese
- Two types of transcripts
  - Jyutping: phonetics/phonology (cf. Nagy et al. in press; Tan & Nagy 2017; Tse 2016, 2019, 2022)
  - Chinese characters: lexicon, morphosyntax (cf. Nagy & Lo 2019; Leung 2022)

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Traditional methods of interview transcription

- Manual transcription in **jyutping**
  - Easier for heritage-speaking student volunteers and RAs with limited knowledge of characters
- Manual transcription in **Chinese characters**
  - Helps with disambiguating homophones

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Transcription status

		Jyutping + Characters	Jyutping only	Total
Heritage (Toronto)	Gen 1	11	7	18
	Gen 2	10	15	25
	Gen 3	2	4	6
Homeland (Hong Kong)		11	3	14
Total		34	29	63

The Problem

- Many interview transcripts are jyutping only
- Inconsistencies in transcripts
  - Orthographic variants
  - Mergers in RA/volunteers
- What method(s) can we use to systematically generate additional character transcriptions, leveraging the fact that we have a partially annotated dataset?

Methods

1) Corpus-based imputation

2) Machine-transliteration (Diep 2022)

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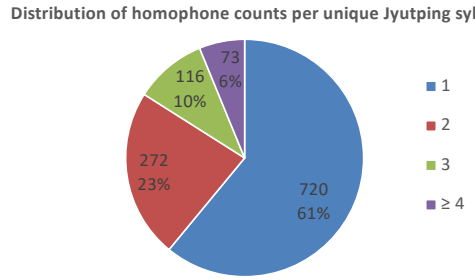
Corpus-based imputation

- Some fully annotated interviews → Use existing annotations to predict the most likely character for any given Jyutping syllable
- Similar themes in interviews based on the same interview script → many recurring words across interviews



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Corpus-based imputation

- For any jyutping string that is missing character transcriptions, we look at the fully annotated corpus and find all the annotated characters that share the same jyutping
- We directly impute the most likely character that shares the jyutping
- We can also store all other possible characters for easier manual correction by a research assistant
- In the future, this could be further improved by looking at bigrams, etc.
  - but this is moving toward our second method

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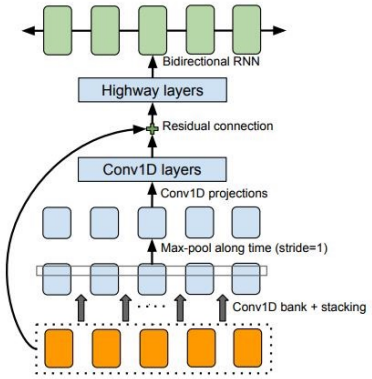
Machine-Transliteration

- With advances in natural language processing, applications of machine learning (ML) have become more accessible and widespread in research
  - Still rare for Cantonese
- We adapt an ML model developed for transliteration of Mandarin pinyin to characters for the equivalent task with jyutping



Architecture of a transliterator model (Wang et al. 2017)

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Machine-Transliteration Data

We train on publicly-available corpora of Cantonese with both character and jyutping transcriptions, such as:

- Hong Kong Cantonese Corpus (Luke & Wong 2015)
- Child Heritage Chinese Corpus (Mai & Yip 2017)
- Guthrie Bilingual Corpus (Guthrie 1983)
- HKU-70 Corpus (Weizman & Fletcher 2000)
- Lee-Wong-Leung Corpus (Lee et al. 1991–94)
- Leo Corpus (Mai & Yip 2022)
- Paidologos Corpus: Cantonese (Edwards & Beckerman 2008)
- Yip-Matthews Bilingual Corpus (Yip & Matthews 2007)

Over 4 million Chinese words from over 1,232 interviews

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Machine-Transliteration

After training on the aforementioned corpora, we apply the model to the HLVC corpus data to convert jyutping annotations to characters.

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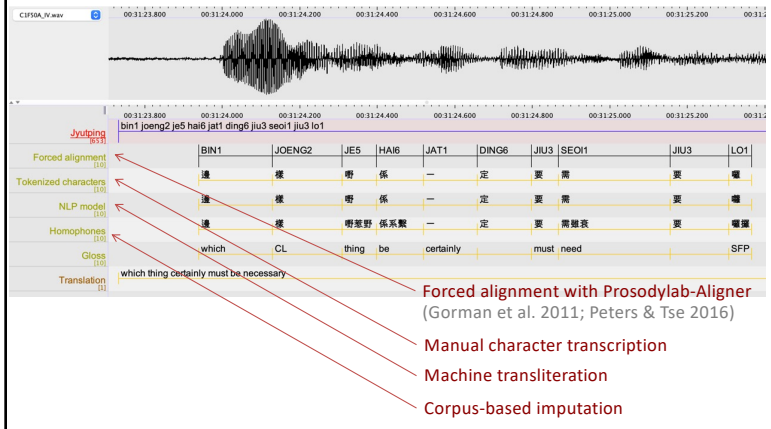
Example of the two methods



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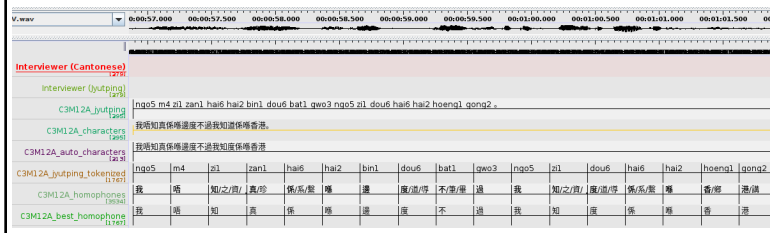
Methods Comparison



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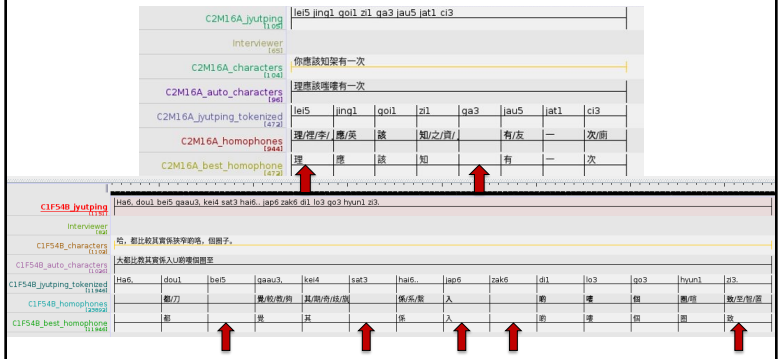
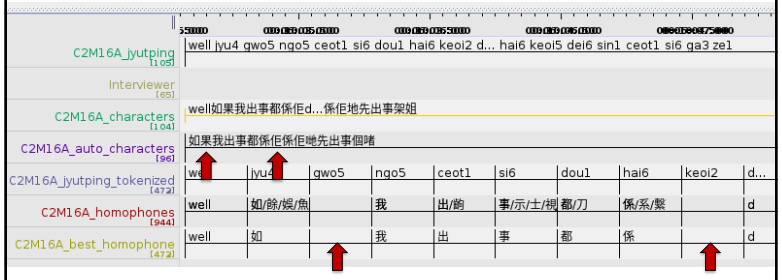
Methods Comparison



Both methods show poor results when the original jyutping transcription is “incorrect”:

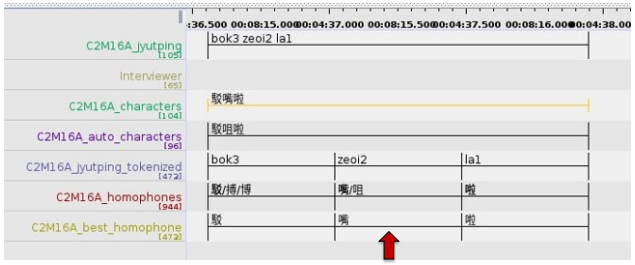
- Genuine transcriber errors: haap3 zaak3 → jap6 zak6, zi2 → zi3, gaa3 → ga3
- Mergers in speaker: nei5 → lei5
- Possible mergers in transcriber: bei2 → bei5, sat6 → sat3

Methods Comparison



- Machine transliteration sometimes has a slight advantage when dealing with problems mentioned in the previous slide
  - gwo2 → gwo5
  - keoi5 → keoi2

Methods Comparison



Corpus-based imputation shows better results when predicting simpler/common words

CER for Transliteration Methods

We report similar average CER (character error rate) for each transliteration method across homeland and heritage speakers

	Corpus-based Imputation	Machine Transliteration
Homeland	0.30	0.21
Heritage	0.31	0.26

Discussion

- **Corpus construction** can be expedited using **(semi-)automated processes**
  - Naïve approach is ~70% accurate
  - ML approach boosts accuracy by 5–10%
  - Comparison of approaches can help with proofreading
- **Promoting HL vitality** through **"knowledge mobilization"**
  - Speakers who are less- or non-literate in the variety can contribute to the documentation of their own language variety

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Thanks to the HLVC Cantonese RAs

Abigail Chan・Ariel Chan・Karen Chan・Karina Cheung・Kate Cheung・Mira Chow・Mira Chung・Naomi Cui・Joyce Fok・Kei-Fung Ho・Teresa Kwok・Cookie Lau・Vina Law・Ewen Lee・Wilma Lee・Samuel Lo・Tiffany Luk・Yannie Mork・Jonathan Ng・Rita Pang・Valerie Pang・Andrew Peters・Samantha Pong・Ian Quan・Bonita Sham・Janice Shum・Mario So Gao・Haili Su・Katherine Sung・Angel Tam・Ziwen Tan・Josephine Tong・Sarah Truong・Holman Tse・Elaine Wang・Victoria Wang・Ka-man Wong・Joyce Woo・Junrui Wu・Olivia Yu・Christopher Zhu・Minyi Zhu

多謝

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