Chao Han

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Research Overview

My research goal is to understand how we perceive and process speech sounds, how the brain extracts abstract categories from varying acoustic cues, and how the categories are represented, in both typical and clinical populations. I conducted both behavioral and EEG experiments to answer those questions. My current project asks whether and how a phoneme representation encodes acoustic details, using the auditory oddball paradigm.

Education

2022 Ph.D. in Linguistics (Expected in July), University of Delaware, Newark, DE

2015 M.A. in Linguistics and Cognitive Science, University of Delaware, Newark, DE

2014 M.A. in Linguistics and Applied Linguistics, Beijing Foreign Studies University, Beijing, China.

2009 B.A. in International Economics and Trade, Beijing Foreign Studies University, Beijing, China.

Projects

Current

The Nature of Phoneme Representation (Role: Co-PI)

- The project asks whether the phoneme representation contains acoustic details. Using the varying-standards oddball paradigm, we present subjects with frequent voiceless stops varying in VOT interspersed with infrequent voiceless stops with a different VOT. An MMN elicited by the within-category deviance would suggest that the brain extracts a phoneme representation containing the acoustic details.
- Funded by NSF DDRIG (PI: Arild Hestvik. Co-PI: Chao Han)

Underspecificaiton and Auditory Processing Disorder (Role: Researcher)

- The project asks whether the auditory processing disorder (APD) affects speech processing at the acoustic level or the phonological level. The acoustic-level processing is indexed by symmetric MMNs elicited in a classical oddball paradigm which presents voicing contrasts in both directions; the phonological-level processing is indexed by asymmetric MMNs elicited in the varying-standards paradigm where one of the two types of standards shows featural

underspecificaiton in the phonological level. We tested children with APD using both paradigms and compared their results to those of typically developed children.
- Funded by NIH COBRE Grant (PI: Kyoko Nagao. Co-PI: Arild Hestvik, and Thierry Morlet) and NIH NIGMS IDeA (PI: Stuart Binder-Macleod)

Previous

Discriminability and Prototypicality of Vowel Perception (Role: Researcher)
- This project asks how discriminability and prototypicality modulate the MMN amplitude. In the MMN paradigm, we presented Japanese speakers with English [æ, ɑ] as standards and [ʌ] as deviants. Although the [æ - ʌ] contrast is more discriminable according to the Perceptual Assimilation Model, we found a larger MMN for the [ɑ - ʌ] contrast as [ɑ] is perceived as a more prototypical member of Japanese /a/.
- Funded by Japan Society for Promotion of Science KAKENHI Grant (PI: Yasuaki Shinohara. Co-PI: Arild Hestvik).

L2 Processing of Filled Gaps (Role: Researcher)
- The project investigates how L2 learners resolve English filler-gap dependencies using an ERP experiment. We found that although L2 learners' behavioral performance is comparable to native speakers and is positively correlated with proficiency and working memory, their brain response is qualitatively different from that of native speakers regardless of their proficiency level.

Perceptual Confusion of Mandarin Tones (Role: Researcher)
- The project investigates the perceptual confusion of Mandarin Tone 3 and Tone 4 in connected speech. In the four-alternative forced-choice task, participants identified syllables extracted from tri-syllabic words recorded in short dialogues. The results showed the same level of perceptibility of T3 and T4. Furthermore, the two tones were better perceived when in a focused context or at the edge of a word, confirming the effect of prosodic structure on tonal perception.

Publications

2022 Dong, Z. R., **Han, C.**, Hestvik, A., & Hermon, G. L2 processing of filled gaps. Linguistic Approaches to Bilingualism. https://doi.org/10.1075/lab.20058.don

2022 Shinohara, Y., **Han, C.**, Hestvik, A. Discriminability and prototypicality of non-native vowels. *Studies in Second Language Acquisition, 4*(4), 1–19. https://doi.org/10.1017/S0272263121000978

2022 Rhodes, R., Avcu, E., **Han, C.**, & Hestvik, A. Auditory predictions are phonological when phonetic information is variable. *Language, Cognition and Neuroscience*, 1–16. https://doi.org/10.1080/23273798.2022.2043395

2020 **Han, C.**, Vogel, I., Yuan, Y., Athanasopoulou, A. Perceptual confusion of Mandarin tone 3 and tone 4. *University of Pennsylvania Working Papers in Linguistics*, 26(1), 12.

2019 Rhodes, R., **Han, C.**, Hestvik, A. Phonological memory traces do not contain phonetic information. *Attention, Perception, & Psychophysics, 81*(4), pp. 897–911. https://doi.org/10.3758/s13414-019-01728-1

2019 Rhodes, R., **Han, C.**, Hestvik, A. Ad hoc phonetic categorization and prediction. In S. Calhoun, P. Escudero, M. Tabain, & P. Warren (Eds.), *Proceedings of the 19th International Congress of Phonetic Sciences, Melbourne, Australia 2019* (pp. 1223-1227).

2019 Shinohara, Y., **Han, C.**, Hestvik, A. Effects of perceptual assimilation: The perception of English /æ/, /ʌ/, and /ɑ/ by Japanese speakers. In S. Calhoun, P. Escudero, M. Tabain, & P. Warren (Eds.), *Proceedings of the 19th International Congress of Phonetic Sciences, Melbourne, Australia 2019* (pp. 2344-2348).

2019 Vogel, I., Athanasopoulou, A., **Han, C.**, Yue, Y. How perceptible is the difference between tone 3 and tone 4 in Mandarin Chinese? In S. Calhoun, P. Escudero, M. Tabain, & P. Warren (Eds.), *Proceedings of the 19th International Congress of Phonetic Sciences, Melbourne, Australia 2019* (pp. 2027-2031).

2019 Athanasopoulou, A., Vogel, I., **Han, C.**, Yue, Y. Confusability of Mandarin tone 3 and tone 4: effects of focus and syllable position. In S. Calhoun, P. Escudero, M. Tabain, & P. Warren (Eds.), *Proceedings of the 19th International Congress of Phonetic Sciences, Melbourne, Australia 2019* (pp. 442-446).

Presentations

2019 **Han, C.**, Yuan, Y., Vogel, I. Perception of Mandarin tone 3 and tone 4: Effects of syllable position and focus. Talk at *The 43rd Penn Linguistics Conference*, Philadelphia, PA.

2019 Avcu, E., Rhodes, R., **Han, C.**, & Hestvik, A. P300 as an index of phonotactic violation. Poster at *The 93rd Annual Meeting of the Linguistic Society of America*, New York, NY.

2018 **Han, C.**, Pereira, O., Walter, C., Morlet, T., Hestvik, A., & Nagao, K. Phoneme identification of children with various auditory processing deficits. Talk at *The 12th Mini-Conference on Acoustic*, Washington, DC.

2018 **Han, C.**, Yuan, Y., Vogel, I. Perceptual confusion of Mandarin tone 3 and tone 4. Poster at *The International Forum on Frontiers in Linguistics*, Beijing, China.

2018 Avcu, E., Rhodes, R., **Han, C.**, & Hestvik, A. Neurophysiological signature of phonotactic rule-learning. Poster at *The 59th Annual Meeting of Psychonomic Society*, New Orleans, LA.

2018 Avcu, E., Rhodes, R., **Han, C.**, & Hestvik, A. Neural underpinnings of phonotactic rule Learning. Poster at *The 49th Annual Meeting of the North East Linguistic Society*, New York, NY.

2018 Rhodes, R., **Han, C.** Phonetic content of auditory representations. Poster at *The 10th Annual Meeting of the Society for the Neurobiology of Language*, Québec City, Canada.

2018 Pereira, O., **Han, C.**, Hestvik, A., Morlet, T., & Nagao, K. Phonetic vs. phonological MMN: A novel approach to detect auditory processing deficit in children. Poster at *The 8th Mismatch Negativity Conference*, Helsinki, Finland.

2018 Rhodes, R., **Han, C.**, Hestvik, A. No ad hoc perceptual grouping of speech sounds in the varying standards oddball paradigm. Poster at *The 8th Mismatch Negativity Conference*, Helsinki, Finland.

2017 Rhodes, R., **Han, C.**, Hestvik, A. The ad hoc perceptual grouping of speech sounds in the varying standards oddball paradigm. Poster at *The 24th Annual Meeting of the Cognitive Neuroscience Society*, San Francisco, CA.

2017 Pereira, O., Hestvik, A., Morlet, T., **Han, C.**, Scharf, S., Sklar, R., Nemith, J., DeVore, B., & Nagao, K. Using the mismatch negativity paradigm to explore the deficits in children with auditory processing disorder. Poster at *The DE-CTR ACCEL 4th Annual Meeting*, Newark, DE.

2013 **Han, C.**, Chen, Y. Are Chinese people facing Past? Experimental evidence for Chinese spatiotemporal representations. Talk at *The 2nd International Conference on Psycholinguistics*, Fujian, China.

2013 **Han, C.**, Chen, Y. Psychological reality of space-time metaphors in the horizontal and the vertical dimensions in Mandarin. Talk at *The 3rd National Forum on Neurolinguistics and Second Language Acquisition*, Beijing, China.

Teaching

As Instructor

CGSC496/696 Psycholinguistics | Spring 2022
CGSC433/633 Introduction to Acoustic Phonetics | Spring 2020
CGSC470/670 Elements of Cognitive Science | Fall 2019

As Teaching Assistant

CGSC420/620 Research Methods in Cognitive Science | Fall 2021
PSYC209 Measurement and Statistics | Fall 2018, Spring 2019
CGSC433/633 Introduction to Acoustic Phonetics | Spring 2018
PYSC390 Social Psychology | Fall 2017
CGSC170 Introduction to Cognitive Science | Spring 2017
LING403/603 Introduction to Phonology | Fall 2016
PYSC100 General Psychology | Spring 2016

Honors and Awards

2015-2021 Summer Research Grant, Department of Linguistics and Cognitive Science, University of Delaware

2017-2018 Professional Development Award, University of Delaware

2018 The 2nd place of the Best Student Papers Competition at *The 12th Mini Conference on Acoustics*, the Washington DC Chapter of the Acoustical Society of America.

2012 Xu Gehui Alumni Scholarship, Beijing Foreign Studies University

Service

2019-2022 **Lab Manager** for Experimental Psycholinguistics Lab, University of Delaware

2019 **Reviewer** for *Language, Cognition and Neuroscience*

2017-2018 **Committee Member** for Linguistics Colloquium Series, University of Delaware

2018 **Student Organizer/Reviewer** for *2018 Linguistics and Cognitive Science Student Conference*, University of Delaware

2017 **Student Organizer** for *The 47th Linguistic Symposium on Romance Languages*

2012-2013 **Organizer** for Linguistics Reading Salon, Beijing Foreign Studies University

2012-2013 **Secretary** for Graduate Student Association, Beijing Foreign Studies University

Skills

Experiment Design: E-prime, Praat

EEG Acquisition: Magstim EGI, Brain Vision

Neural Signal Processing: ERP analysis, spectral analysis (FFT, Welch's method), time-frequency analysis (Morlet wavelet convolution, filter-Hilbert transform, short-time Fourier transform, multi-taper), source separation (PCA, ICA, GED)

Programming: R, MATLAB, Python

Language: Mandarin Chinese, Rui'an dialect of Wu Chinese, English, Japanese