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Prof. Dr. James Kirby
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Dear Prof. Dr. Kirby:

I am writing to apply for the full-time postdoctoral research scientist position in the Spoken Language Processing group at the Institute of Phonetics and Speech Processing, LMU Munich. I am currently in the third year of PhD in Linguistics at the University of York under the supervision of Dr. Eleanor Chodroff and Prof. Paul Foulkes (expected completion late 2022 – early 2023). I would be interested in working on tone production and perception in the EVOTONE project. I believe my background and research interests would nicely complement ongoing research in your group.

My PhD project ("Production and perception of Mandarin dialect tone systems") looks into the phonetically distinct lexical tone systems across Mandarin branch dialects including the Beijing, Chengdu, Jinan, Taiyuan, Wuhan, and Xi'an dialects, through corpus-phonetic approaches. The project also investigates the perceptual mechanisms involved in processing dialectal variation in lexical tone to achieve mutual intelligibility despite the unfamiliar tone systems between Mandarin dialects (Tang & van Heuven 2008, Gooskens, 2018). The fundamental assumption of this research is that the perceptual system is highly constructive and adaptive (Munro & Derwing, 1995; Norris, McQueen & Cutler, 2003): phonetic tone variations are processed with integrated mechanisms that are activated and conditioned by available cues, and can be adapted to given appropriate exposure. By hybrid mechanisms, two high-level strategies have been identified: bottom-up and top-down processing (Kinchla & Wolfe, 1979; Theeeuwes, 2010; Rauss & Pourtois, 2013).

From the perception experiments, I have found that the perception of Mandarin dialect tone systems is guided by both top-down expectedness based on the sentential context and bottom-up tone acoustics directly from the immediate speech (Zhao, Sloggett & Chodroff, 2022, *Speech Prosody*). For the familiar tone system, both top-down and bottom-up information are used, as the sentential context and tone representations are both reliable cues for listeners. For the unfamiliar tone system, top-down information seems to override tone acoustics and the listener chooses the most probable phonological tone category for the word given the context. But surprisingly, unfamiliar phonetic tones are also processed, evidenced by a credible slowdown in response to the intended, but contextually less probable phonological tone category. These findings demonstrate an integration of bottom-up and top-down processing of lexical tones, which may be conditioned by relative reliability of the information—the perceptual system seems adept enough at processing available information in the bottom-up

process regardless of tone reliability, but may not use such information in determining word identity and refer to top-down information for sentence meaning.

Listeners' sensitivity to bottom-up tone information also has strong implications for perceptual adaptation to unfamiliar tone systems. Credible differences in response times appear as early as the experiment onset, indicating rapid adaptation to the novel tone system even with minimal exposure to the experiment stimuli. Moreover, introducing uninterrupted exposure prior to the experiment resulted in improved perceptual adaptation, and this improvement was greater for dialects that have more dissimilar phonetic tone inventories from the listener's native speech (Zhao & Chodroff, 2022, BAAP). This supports the previous finding concerning the Perceptual Assimilation Model that greater dissimilarity leads to better discrimination (So & Best, 2011, 2014; Reid et al., 2015).

Sufficient understanding of tone systems is essential for interpreting perception results when cross-dialect perception differences are observed. To update Mandarin dialect tone systems with acoustic-phonetic detail, I have collected the *ManDi: Mandarin Regional Dialect Corpus* remotely using participant-controlled smartphone recording device (Zhao & Chodroff, 2022, LREC). The current version contains 357 recordings from 36 speakers, available on OSF at https://osf.io/fgv4w/. The corpus data were processed using the Montreal Forced Aligner for phonetic segmentation, and with Praat and R scripting for acoustic-phonetic analysis. This skillset generalizes well to other speech corpora. I also hope to continue to build the *ManDi* corpus to cover a wider range of Mandarin dialects.

My research on lexical tone takes both production and perception perspective. For production, the acoustic-phonetic realizations of lexical tones were established for the six Mandarin dialects, but the measured pitch contours from current data clearly indicate certain changes from previously documented tones. I would be very interested in investigating whether these changes are systematically represented and what the factors or rules might be that govern tone variation over time—how and why have the closely related dialects evolved to have such distinct tone systems? More generally, such findings on tone evolution, together with typological analysis, may inform what makes a possible tone system when synthesizing a tone language. My current perception study experimented with natural speech stimuli. I would be interested in replicating the experiment with synthesized tone systems mapped onto the familiar segment sequences, so that the cross-dialect similarity of the tone system could be better controlled.

I would be very grateful for the opportunity to be a contributing member to the Spoken Language Processing group as a postdoctoral researcher. My CV and the two papers are included in the application files with this letter. The conference presentation materials mentioned in this letter can be found at https://liangzhaolz.github.io/research/. Please feel free to contact my references: Dr. Eleanor Chodroff (eleanor.chodroff@york.ac.uk), Lecturer in Phonetics and Phonology at University of York and Dr. Shayne Sloggett (shayne.sloggett@york.ac.uk), Experimental Officer in Psycholinguistics at University of York.

Thank you for considering my application, and I look forward to hearing from you!

Sincerely,
Liang Zhao