Does Having a Good Ear Promote Successful L2 Speech Learning?

A Behavioural and Neural Investigation

Abstract

Why are certain individuals talented at learning a second language (L2)? Here we propose the first quasi-experimental study to test our hypothesis that having a good ear, i.e. precisely representing auditory information, predicts the success of L2 speech learning. As a methodological innovation, participants will be first assessed for their conscious and subconscious sensitivity to various non-verbal sounds via behavioural and neurophysiological instruments. Subsequently, a series of quasi-experimental studies will then elucidate how participants with varied auditory profiles improve their L2 speech when engaged in different types of speech training methods from the field of L2 education.

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CONTEXT

Developing adequate second language (L2) speech has become an increasingly important goal in today's globalised world. Whereas education researchers have proposed a range of instructional options (e.g., explicit and language-focused vs. implicit and meaning-oriented), existing literature has indicated that not all students respond equally to these techniques, with some achieving highly-advanced performance and others showing tremendous difficulty. Turning to neuroscience literature, possessing a good ear (precise auditory processing) has been discussed as a root of first language (L1) acquisition. Auditory processing enables learners to detect patterns in pitch, higher-frequency spectral features, and duration at multiple time scales in order to distinguish speech sounds and track syntactic structure. Impaired auditory processing, therefore, may be one source of language learning difficulty and impairment.

OBJECTIVES

By interfacing somewhat independently developed fields (education, neuroscience), the proposed study will test our novel hypothesis that ***individual differences in neurocognitive functions related to auditory processing can explain why certain L2 learners attain different degrees of success under different instructional programs (form- vs. meaning-oriented)***. As a methodological innovation, we will assess L2 learners' auditory profiles not only at conscious levels (via behavioural tests), but also at pre-conscious levels (by measuring participants' brainwaves as they listen to sound). Subsequently, a series of quasi-experimental studies with a pre-test and immediate/delayed-posttest design will elucidate how participants with varied auditory skills improve their L2 speech, when engaged in different types of training methods. For the sake of comparability with the existing literature, the study will investigate the aptitude-treatment interaction in two different, difficult and well-researched instances of adult L2 speech learning—Japanese native speakers learning the English /r/-/l/ contrast (e.g., "rock" vs. "lock") and English native speakers learning the Mandarin tonal contrasts (e.g., *eight* /pa^{1}/, *to pull* /pa^{2}/, *handle* /pa^{3}/, vs. *father* /pa^{4}/).

Following the aptitude-treatment interaction paradigm in L2 education research, our hypotheses are as follows:

1. Individuals who are better able to explicitly detect auditory features in behavioural tests will benefit more from explicit language instruction.
2. Whereas the extent to which brainwaves matches sound waves may positively facilitate explicit learning to some degree, it will exert more substantial impact on implicit learning.

Significance and Originality

The proposed project will promote interdisciplinary conversations between experts in education and neuroscience, and generate a range of new insights for both fields. The outcomes will allow education scholars to conceptualise L2 learners' phonetic aptitude at both conscious and sub-conscious levels based on behavioural and neural evidence of auditory processing. Such profiles can be used to highlight students' advantages and shortcomings under different training conditions, and suggest optimal, profile-matched instructional methods. With respect to neuroscience, scholars have extensively debated whether the cognitive foundations of language acquisition are language-specific or domain-general, and whether these mechanisms differ between L1 and L2. Examining the generalizability of the audition-acquisition link to adult L2 speech learning, the proposed study will make unique theoretical contributions. We hypothesise that domain-general, auditory processing underlies language acquisition throughout the lifetime; and that the same mechanism governs both L1 and L2.

Methodology

Participants: A total of beginner-to-intermediate 150 Japanese students learning English and 150 British college students learning Mandarin will be recruited at language schools and universities in London.

Independent variables: To measure the participants' *explicit* perceptual acuity, they will take tests assessing their ability to discriminate sounds on the basis of a number of auditory dimensions, including pitch, duration, and how quickly the amplitude of the sound rises. To measure the participants' *implicit* perceptual encoding, the participants' neural representation of sound will be assessed by measuring a brainwave called the frequency following response. This response reproduces the characteristics of the sound which is played to participants, and it is relatively unaffected by whether or not participants are alert and awake. As a result, this method can be used to measure individual differences in implicit auditory processing.

Treatment: Next, the participants will learn the target language features via four different types of training methods. These methods will differ in whether learning takes place explicitly (through language-focused practice) or implicitly (through meaningful tasks) on perceptive or productive modes. Whereas previous literature has found all these methods equally effective, the focus of the current study lies in associations between individual differences in participants' auditory processing and instructional gains. Each experiment will comprise four training sessions lasting 50 minutes each. In addition, control groups will be included to check for test-retest effects.

1. EXPLICIT/RECEPTIVE: Participants will be explicitly asked to identify target sounds produced by multiple talkers. To reinforce learning, feedback will be provided after each trial.
2. IMPLICIT/RECEPTIVE: Participants will rapidly detect the appearance of a visual target in 1 of 4 screen locations by clicking a corresponding button. Each target appears with a synthesized target sound (English ”r” and “l”; Mandarin tones). Participants will associate sound categories with visual (location of visuals) and motor (responses to visuals) information—simulating more naturalistic, multimodal L2 speech learning.
3. EXPLICIT/PRODUCTIVE: The participants will first receive explicit instruction on the target features. Then, they will read aloud target features embedded at word, sentence and paragraph levels. During all the practice activities, an instructor will provide explicit correction in response to participants' mispronunciation of target features.
4. IMPLICIT/PRODUCTIVE: The participants will participate in meaning-oriented tasks, where learners are induced to use a set of words which include the speech sounds being taught (e.g., debating on the topic “***running*** inside is better than ***running*** outside”). In response to learners' mispronunciation of these sounds, the instructors will provide incidental and unobtrusive feedback.

Pre-posttests: With participants' initial performance controlled for, their improvement will be scrutinized via multiple perception (identification, discrimination) and production (controlled, spontaneous) tasks. By comparing the participants' perception/production and auditory scores, the study will reveal how different dimensions of auditory processing (explicit/implicit) are uniquely tied to different types of L2 speech learning (explicit/implicit). To confirm the robustness of the findings, the study will reveal whether such results are “generalizable” across two different contexts (Japanese learners of English vs. British learners of Chinese) and modes (perception vs. production) of L2 speech learning.