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THE IMPACT OF PHONETIC TRAINING IN THE PERCEPTION AND PODUCTION OF EUROPEAN PORTUGUESE STOPS BY MANDARIN SPEAKERS

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ABSTRACT: This study aims to improve knowledge regarding the process of L2 consonants acquisition and investigate the effectiveness of training strategies that can favor its learning. It compares the effect of a phonetic training using two High Variability Phonetic Training (HVPT) methods on training the perception of European Portuguese (EP) stop consonants by Mandarin native speakers, learners of EP as a L2. More specifically, it will investigate if the expected improvement is greater under the HVPT approach using an identification task (ID) or through an AX discrimination task (DIS). In a pretest-training-posttest design, thirty L2 learners of EP will be divided into 2 experimental groups and a control group. Experimental groups will differ in the training method: ID task and DIS task. Participants will be tested on their ability to perceive the target sounds presented in non-words and real words before training, after training and two months later. Thus, this study will address the following questions: a) whether training can improve the perception and production of trained as well as untrained segments, b) whether improvement generalizes to novel stimuli and talkers, c) if improvement is retained over time, and d) which training method is more effective (ID or DIS).

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Keywords: High Variability Phonetic Training, second language acquisition, speech perception and production, European Portuguese, Mandarin Speakers

RESUMO: Este estudo tem como objetivo aumentar o nosso conhecimento relativamente ao processo de aquisição de consoantes de uma língua-segunda (LS) e investigar a eficácia de estratégias de treino que possam favorecer a sua aprendizagem. Compara a eficácia de um treino fonético utilizando dois métodos da abordagem "High Variability Phonetic Training" (HVPT) no treino da perceção das consoantes oclusivas do Português Europeu (PE) por falantes nativos do mandarim, aprendentes do PE como LS. Mais especificamente, vai aferir se a melhoria expectável é superior utilizando uma tarefa de identificação (ID) ou uma tarefa de discriminação auditiva AX (DIS). Com um design pré-teste/treino/pós-teste, trinta aprendentes LS do PE serão divididos em dois grupos experimentais e um grupo de controlo. Os grupos experimentais serão treinados através de dois métodos diferentes de treino: treino ID e treino DIS. Os participantes serão testados nas suas competências em percecionar os sons-alvo apresentados em pseudopalavras e palavras reais antes do treino, depois do treino e dois meses após o final do mesmo. Assim, o presente estudo tentará dar respostas às seguintes questões: a) se o treino pode melhorar a perceção e a produção de segmentos treinados e de outros que não foram alvo de treino, b) se a melhoria generaliza para novos estímulos e novos falantes, c) se há retenção da aprendizagem ao longo do tempo, e d) que tipo de tarefa de treino é mais eficaz (ID ou DIS).

Palavras-chave: Treino Fonético, Aquisição de segunda Língua, Produção e Perceção orais, Português Europeu, Falantes de Mandarim

1. Introduction

Previous work in SLA area has shown that the perception and production of non-native contrasts are a challenge even for advanced L2 learners (Bohn, 1995; Polka, 1992; Strange, 1995). Adults are language-specific perceivers of speech as the result of their perceptual attunement to the phonetic characteristics of the vowels and consonants of their native language (L1) (Flege,

1995a). Non-native Portuguese speakers around the world usually have their own way of pronouncing Portuguese sounds, which can probably be accounted for by the interference of their native language. According to Lott (1983: p. 256), interference refers to "the errors made by learners in using the target language and it can be traced back to the learner's native language". The interference of native language is also evident among Chinese learners of Portuguese. A study from Mai (2006) suggests that it is difficult for Mandarin EP learners to produce some Portuguese sounds as those sounds are not available in the phoneme inventory system of their native language or are very similar to some of their phonological categories (Shu, 2014; Oliveira, 2016). Several studies (Cao, 2018; Nunes, 2015; Shu, 2014; Zhou, 2017) also state that many EP phonemes have their counterparts in Mandarin, but some of them do not share with Mandarin language counterparts. Which is the case of the stop consonants contrasts that will be the target of our research.

The influence of existing L1 phonetic categories on the development of L2 categories has been the object of study of a number of L2 speech models. The most closely connected to the present study are subsequently described. The Speech Learning Model (SLM: Flege, 1995a, 2003), one of the most influential L2 speech models, states that a non-native sound that is dissimilar to a pre-existing L1 sound will eventually be acquired with more ease than an L2 sound that has a similar counterpart in the L1 language inventory. According to the SLM, given enough input and experience, learners might succeed in establishing separate long-term memory representations from the pre-existing L1 categories and, as a consequence, both L1 and L2 categories will coexist in the same phonological space. A second relevant speech perception model, the Native Language Magnet model (NLM: Kuhl & Iverson, 1995), also postulates that non-native sound perception occurs within the native language's boundaries. In fact, the authors explain that good exemplars of L1 speech sounds act as perceptual magnets and thus attract perceptually similar target language sounds, which impedes the formation of new categories. Similarly, the Perceptual Assimilation Model (PAM-L2: Best & Tyler, 2007), explores the possible outcomes of the interference from L1 categories on L2 sound discrimination accuracy by establishing and describing possible cross-language category assimilation patterns.

Different types of L2 phonetic training paradigms have been designed either to investigate the relationship between speech perception and production and thus benefit the theoretical field, or to benefit both teachers and learners in their practice and study (e.g., perception-only training:

Bradlow et al., 1997; production only-training: Hattori & Iverson, 2008; perception and production training: Tsuhima & Hamada, 2005).

Amid all different kinds of phonetic training paradigms, High Variability Phonetic Training (HVPT) (Logan et al., 1991) has received particular attention in recent decades due to its effectiveness in improving the perception and production of different consonant and vowel contrasts by L2 learners (Hardison, 2003; Hazan et al., 2005; Iverson & Evans, 2009; Strange & Dittmann, 1984). HVPT involves the use of natural training stimuli with various phonetic contexts produced by multiple speakers. Traditionally, most HVPT studies trained L2 learners' perception by means of discrimination (DIS) (Miranda et al., 1989; Strange & Dittmann, 1984) and/or identification (ID) training procedures (Jamieson & Morosan, 1986; Logan & Pruitt, 1995). Despite the widely reported superiority of ID training (Bradlow, 2008; Aliaga-García & Mora, 2009; Logan & Pruitt, 1995), some studies that compared ID and DIS point to the fact that both training methods are effective when modifying learners' perception of L2 sounds (Flege, 1995; Nozawa, 2015; Shinohara & Iverson, 2018). For instance, Flege (1995b) directly compared these two procedures (discrimination and forced-choice identification) in a study training Mandarin speaker in L2 English final stops. Results revealed that both types of training promoted gain, generalization, and retention of learning to the same extent.

The use of HVPT training stimuli has been found to promote the perceptual learning of the subjects (Bradlow et al., 1997, 1999; Lively et al., 1993, 1994; Logan et al., 1991), and generalization effects to new words and new speakers have also been obtained, especially when the subjects were trained with a wider variety of stimulus variability (Bradlow et al., 1997; Wang, 2002; Wong, 2013). Other studies have also shown that the training effects are retained in the long term (Bradlow et al., 1997, 1999; Lively et al., 1994). Perceptual learning through HVPT has also shown to be able to transfer to the production domain, although a wide array of individual differences amidst learners have been observed across the different studies (Bradlow et al., 1999; Hazan et al., 2005; Lambacher et al., 2005).

In respect to Chinese learners of EP, there is a scarcity in the number of experimental studies regarding the perception and production of sounds (Cao, 2018; Nunes, 2015; Nunes & Martins, 2011; Oliveira, 2016; Shu, 2014; Zhou, 2017). Some of the typical difficulties felt by these learners are documented, but they are based in observational or small samples studies. Some of the difficulties are related with the perception and production of stop consonants.

The goal of this research will be the study and analysis of the acquisition of the six stops of EP, namely the three contrasts /p-b/, /t-d/ and /k-g/ in initial and medial word position. The main difference between these segments in the two languages lies in the fact that the contrasting pair in EP is voiced and in Mandarin is aspirated (/p/ - /p^h/; /t/ - /t^h/; /k/ - /k^h/), representing a difference between the L1 (Mandarin) and L2 (European Portuguese) phonological systems.

The current paper presents an undergoing research whose goal will be to contrast the effect of two phonetic training regimes (ID and DIS) on the perception of L2 European Portuguese stops by Mandarin native speakers. Moreover, the study also aims to assess if learning acquired through training will generalize and will be retained over a period of two months.

2. Methodology

2.1 Participants

Thirty native Mandarin speakers majoring in Portuguese Studies bachelor's degree in the University of Macau (age range: 19-23 years) will participate in this study and will be divided into two experimental groups and a control group (CG). The experimental groups will be an identification group (ID) and a discrimination group (DIS). All subjects will have studied EP for a period between 1 to 3 years and none of them should have stayed more than six months in a country with Portuguese as the official language. They should also report normal hearing and vision.

2.2 Design and Material

All groups will be assessed before training, after training and two months later (T1, T2 and T3). The experimental groups will receive training on consonants stops by means of non-word stimuli. Assessment will involve an identification task of CVCV non-words and real words, so that real words will assess a type of generalization and a production task (assessed before the ID task) with real words through a naming task. Moreover, all talkers from testing and training will differ,

so that generalization to novel talkers will be assessed along with the main effect of training. The CG will perform some phonological exercises during the same period.

Recordings of eight EP native speakers (4F and 4M) will provide the training, testing and generalization stimuli. The recordings will take place in a soundproof chamber in the Portuguese School of Macau and each word will be recorded three times, with additional repetitions whenever necessary. Stimuli will be embedded in a carrier sentence in order to sound more spontaneous.

2.2.1 Testing Stimuli

Testing stimuli will consist of unmodified CVCV non-words and real words produced by two speakers unheard during the training phase. 24 CVCV non-words and 12 real words will be used to test the perception of the six stop consonants placed either on onset/initial or coda/medial position. In addition, 12 non-words and 4 real words will be included as testing fillers.

2.2.2 Training Stimuli

Training stimuli will consist of 62 unmodified CVCV non-words produced by four EP native speakers (2M and 2F) in order to provide a variability of stimuli, which is the main characteristic of the HVPT approach. Every non-word contained one of the six EP stop consonants /p t k b d g/ either initially or finally.

2.2.3 Procedures

The native Mandarin subjects will participate in five 25-minute training sessions delivered by the freeware software *TP 3.1* (Rauber et al., 2012, 2013). Participants will be told that the purpose of the study will be to increase their ability to perceive L2 sounds. The DIS group will be trained by means of an AX discrimination task that will consist of 248 trials (496 stimuli) and will respond by clicking on “same” or “different”. The ID group will be trained by means of a 6-alternative forced-choice identification task. Training will involve the same 496 stimuli, in order to ensure that all groups will be exposed to the same set of stimuli throughout training. Immediate feedback will be provided after each trial indicating if their perceptual answer was correct or

incorrect (when a not correct answer is given, the correct one will be displayed). Moreover, global feedback will be provided at the end of each session indicating the total number of hits and errors.

3. Discussion and Considerations

It is predicted to occur improvement from pre-test to post-test with trained sounds as have been found in previous studies involving HVPT. However, the extent of the improvement may vary across groups and/or type of segments. Besides, improvement on trained sounds is expected to be greater than in untrained but implicitly exposed ones (Pederson & Guion-Anderson, 2010; Nozawa, 2015) due to the role of feedback (Logan & Pruitt, 1995) and explicit instruction (Alves & Luchini, 2016). However, improvement of untrained sounds might occur as a consequence of the balanced exposure received throughout the training regime, supporting previous tendencies of improvement (Nozawa, 2015).

Despite stop consonants perception (in initial-word position) be considered easier to modify than vowels perception (Alves & Luchini, 2016; Collet et al., 2013; Everitt, 2015), it is predicted that the performance in the perception of EP voiced stops will be more challenging since voicing and aspiration (in Mandarin) are both robust cues, and although they might facilitate perception (Burnham, 1986), they can also interfere with each other, due to the difficulty in discriminate them.

Regarding the effectiveness of the training tasks, since both training methods tap into similar levels of processing (Flege, 2003; Højen & Flege, 2006) and also promote L2 categorization (Polka, 1992; Strange, 1992), it is possible that both training methods will be equally effective in improving learners' performance after training, in accordance with Flege (1995b) and Wayland & Li (2008). Different training paradigms (ID and DIS) can enhance different abilities (Iverson et al., 2003; Iverson, Pinet & Evans, 2012; Jamieson & Moroson, 1986; Pisoni & Lively, 1995), but is expected that in the case of stop consonants both groups show similar improvements (Flege, 1995b; Nozawa, 2015).

If the training methods used promote robust learning, perceptual improvement obtained during training will transfer, at least partially, to novel dimensions such as real words (Nishi & Kewley-Port, 2007; Pierce, 2014), new voices/talkers (Flege, 1995b; Iverson & Evans, 2009;

Wang & Munro, 2004) and to novel tokens (Hazan et al., 2005; Lacabex et al., 2008; Rato, 2013; Pereira, 2013). Thus, both methods may be able to promote generalization to new talkers and voices to a similar extent, showing robust learning as a result of the identification training (ID) and the discrimination training (DIS).

Furthermore, if the training methods used are found to be effective in enhancing learners' perception of L2 sounds, it is likely that retention of the perceptual abilities is observed. All groups, independently of the training method they were exposed to, might retain the L2 learning two months after the completion of the training regime, which will shed some light on the long-term effects of HVPT training (Bradlow et al., 1997, 1999; Nishi & Kewley-Port, 2007; Rato, 2013; Wang & Munro, 2004). Retention effects will thus provide further support for the efficacy of the methods, especially for consonants (Flege, 1995b).

Assuming there is improvement from pre-test to post-test, the expectation is that at least some positive changes in learners' production of directly trained L2 sounds will be found, providing further support that perceptual training with no focus on production may lead to production gains, even if to a lesser extent than the perceptual gains (Rochet, 1995; Yamada et al., 1996; Bradlow et al., 1997, 1999; Hardison, 2003, 2004; Hazan et al., 2005; Iverson & Evans, 2009; Thomson, 2011; Pereira, 2013). These findings are predicted to corroborate the SLM's predictions, which postulate that there is a link between perception and production. In fact, according to the SLM, perception precedes production and segments are produced "only as accurately as they are perceived" (Flege, 2003: p. 344). Regarding the effectiveness of each method, to our knowledge the current study is pioneer since there is no previous research which goal has been to train native Mandarin speakers, learners of EP, in the acquisition of consonants and in assessing the training effects on production by contrasting ID tasks with DIS tasks. Therefore, the prediction proposed here is based on previous results involving measures of training robustness other than production skills. Taking into consideration Flege's (1995b) results that both perceptual training methods appeared to be equally effective in improving perception, it is hypothesized that both training tasks (ID and DIS) will promote robust learning to the same extent and thus generalization to production will occur for all trainees, even if to different degrees across segment types.

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