Formalizing the mismatch between L2 perception and production of European Portuguese liquids by L1-Mandarin learners

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In the L2 production of European Portuguese (EP), L1-Mandarin learners often replace the tap with [l], but never the reverse (*/l/ → [ɾ]) (Zhou 2017). By contrast, perceptual studies showed that the segmental substitution takes place bidirectionally, /l/ ↔ /ɾ/ (Cao, 2018, Vale, 2020). The most straightforward solution to this mismatch is to postulate that L2 learners have developed distinct phonological grammars for perception and production (Ramus et al. 2010).

In the current study, we will argue against this distinct-grammar view by showing that the mismatch can emerge from an L2 phonological grammar which is identical in the two speech modalities. Our formalisation adopts the Bidirectional Phonology and Phonetics model (BiPhon; Boersma 2011), where all elements of grammar, i.e. OT constraints, are used in perception and production with the same constraint ranking. We first build an L2 perception grammar, tableaux (1) and (2), where both auditory forms [l] and [ɾ] (simplified as F2 values) can be categorized as either /l/ or /ɾ/, in line with the perceptual results. This bidirectional perceptual confusion is due to the fact that the cue constraints, which evaluate the mapping between auditory and surface phonological forms, are unranked with respect to the same auditory value, and the faithfulness constraint IDENT does not play a role in the sublexical categorization since it evaluates the mapping between surface and underlying phonological forms. The production results, reminiscent of asymmetrical lexical access reported previously (e.g. Darcy et al 2013), suggest that the /l/-/ɾ/ distinction is somehow preserved, yet not target-like in the L2 lexicon (otherwise, the confusion would be bidirectional). We thus postulate that the L2 lateral, which bears no detectable difference from the L1 lateral, is accurately represented in the lexicon, whereas the L2 rhotic seems to be underspecified, compatible both with /l/ and /ɾ/. In the production tableaux (3) and (4), where the underlying phonological forms retrieved from the learners' lexicon serve as input, the same set of constraints and constraint ranking are employed. In particular, as shown in tableau (3), when an underlying form containing the lateral is activated, due to highest-ranked constraint IDENT, candidates with surface tap are ruled out. Then the cue constraints militate against the auditory from [1285Hz], which represents a prototypical tap. Consequently, the underlying lateral will be realized with [l]. On the other hand, when a word is intended comprising the underlying rhotic, which is stored as the underspecified |@|, the decision for choosing an output hinges on cue constraints, because the high ranked IDENT cannot regulate an underspecified representation. Thus the underlying rhotic is produced as [l], see tableau (4). Even after more target-like cue knowledge, which results in the cue constraints occasionally being re-ranked as in tableaux (5) and (6), the production of the lateral will not change but the production of the rhotic will vary between the lateral and the tap.

As shown in our formalisation, we conclude that the mismatch between L2 perceptual and production evidence is not due to two separate phonological grammars

(constraint rankings), but to the fact that the two paralinguistic processes targeted by perception and production studies involve different mappings: in the perception experiment only the mapping from auditory to phonological surface form is triggered, while production task also involves mapping of the lexical form onto the phonological surface form (and thus includes IDENT constraints).

References

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(1)

[835Hz] ([l]$_{Aud}$)	IDENT	*[1285Hz] /l/	*[1285Hz] /ɾ/	*[835Hz] /ɾ/	*[835Hz] /l/
☞ /l/					*
☞ /ɾ/				*	

(2)

[1285Hz] ([ɾ]$_{Aud}$)	IDENT	*[1285Hz] /l/	*[1285Hz] / ɾ /	*[835Hz] /ɾ/	*[835Hz] /l/
☞ /l/		*			
☞ /ɾ/			*		

(3)

|mala|	IDENT	* /l/ [1285Hz]	* /ɾ/ [1285Hz]	* /ɾ/ [835Hz]	* /l/ [835Hz]
☞ /.ma.la./ [835Hz] ([l]$_{Aud}$)					*
/.ma.la./ [1285Hz] ([l]$_{Aud}$)		*!			
/.ma.ra./ [835Hz] ([ɾ]$_{Aud}$)	*!			*	
/.ma.ra./ [1285Hz] ([ɾ]$_{Aud}$)	*!		*		

(4)

|ka@a|	IDENT	* /l/ [1285Hz]	* /ɾ/ [1285Hz]	* /ɾ/ [835Hz]	* /l/ [835Hz]
☞ /.ka.la./ [835Hz] ([l]$_{Aud}$)					*
☞ /.ka.ra./ [835Hz] ([l]$_{Aud}$)				*	
/.ka.ra./ [1285Hz]([ɾ]$_{Aud}$)			*!		
/.ka.la./ [1285Hz] ([ɾ]$_{Aud}$)		*!			

(5)

|mala|	IDENT	* /l/ [1285Hz]	* /ɾ/ [835Hz]	* /ɾ/ [1285Hz]	* /l/ [835Hz]
☞ /.ma.la./ [835Hz] ([l]$_{Aud}$)					*
/.ma.la./ [1285Hz] ([l]$_{Aud}$)		*!			
/.ma.ra./ [835Hz] ([ɾ]$_{Aud}$)	*!		*		
/.ma.ra./ [1285Hz] ([ɾ]$_{Aud}$)	*!			*	

(6)

|ka@a|	IDENT	* /l/ [1285Hz]	* /ɾ/ [835Hz]	* /ɾ/ [1285Hz]	* /l/ [835Hz]
☞ /.ka.la./ [835Hz] ([l]$_{Aud}$)					*
/.ka.ra./ [835Hz] ([l]$_{Aud}$)			*!		
☞ /.ka.ra./ [1285Hz] ([ɾ]$_{Aud}$)				*	
/.ka.la./ [1285Hz] ([ɾ]$_{Aud}$)		*!			