A constraint-based modelling for developmental paths in the acquisition of European Portuguese /l/-final plural forms

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Background: The interwoven relationship between morphology and phonology has been long addressed in formal linguistic analysis, while still little is known on how this interaction is acquired in childhood (Fikkert & Freitas 2006; Kerkhoff 2007). In an attempt to tackle this issue, Freitas and Afonso (2017) observed that the acquisition of irregular plural morphology by Portuguese children is constrained by the quality of the stem-final vowel. In particular, the plurals of words ending with /il/ is produced less accurately than the plurals of words with other final vowels (/al/, /ɛl/, /ɔl/ and /ul/). Freitas and Afonso speculated that the attested acquisition order is an instantiation of phonological complexity: the formation of plurals of /il/-final words activates two phonological rules, namely /l/-glidization and merger between [j] and [i] driven by OCP (e.g. e.g. /funi**l** + s/ → /funi**j** + s/ → [funiʃ]), while the pluralization of other /l/-final words only requires /l/-glidization (e.g. /anima**l** + s/ → [ɐ.ni.ˈma**j**ʃ]). However, there is still an on-going debate on the concept of phonological complexity and it is even less clear whether it can be measured by the number of rules involved in computation.

Current study: We present a constraint-based modelling of how Portuguese children acquire the irregular plurals of /l/-final words and thereby argue that the stem-final vowel effect emerges in the course of phonological development, without resorting to phonological complexity. The simulation was performed with ranked constraints of Stochastic OT (Boersma 1998) using their associated error-driven Gradual Learning Algorithm (GLA; Boersma & Hayes 2001). We first built the initial grammar (tableau 1 and 2) which yields the most prevalent repair form employed by Portuguese children before target-like production, i.e. retaining the singular form as a whole and inserting a schwa between t the final lateral and the plural suffix /s/ (e.g. /anima**l** + **s**/ → [ɐ.ni.ˈma**liʃ**]). The initial grammar was then translated into a format that is suitable for simulation in Praat (Boersma & Weenink 2022), namely, by assigning values and plasticity to the constraints, shown in (3). The virtual learner was fed with target surface forms produced by adults (e.g. [ɐ.ni.ˈmaiʃ]), and also with the same amount of underlying forms /animal+s/ for her own grammar to generate some learner's forms. In total the learner received 2800 pairs of underlying and adult surface forms (560 pairs for each vowel × 5 stem-final vowel). Each time when the adult surface form and the learner's own production differ, the GLA will be triggered, raising the values of constraints that disfavour the learner's own output (incorrect form) and, at the same time, lowering the values of constraints that penalise the adult form (correct form).

Results & Discussion: The stimulated course of learning is depicted in Figure 1. As pointed by the upward arrow, the faithfulness constraint DEP outranks IDENT, after the learner have received approximately 400 data. At this moment, a crucial change occurs, as the learner begins to produce /l/ ~ [j] alternation, which suffices for target realisation of all plurals of /l/-final words, except those ending with /il/ (tableau 4 and 5). The pluralisation of /il/-final words only

becomes target-like after approximately 2000 data, when OCP outranks MAX (tableau 6 and 7). The results of our simulation show that the attested acquisition order as a function of stem-final vowel in Portuguese morpho-phonological acquisition (Freitas & Afonso 2017) may stem from the development of phonological grammar.

(1)

/animal + s/	*Coda cluster	MAX	IDENT	DEP	OCP
anima[ɬʃ]	*!				
anima[Øʃ]		*!			
anima[jʃ]			*!		
☞ anima[liʃ]				*	

(2)

/funil + s/	*Coda cluster	MAX	IDENT	DEP	OCP
funi[ɬʃ]	*!				
funi[Øʃ]		*!			
funi[jʃ]			*!		*
☞ funi[liʃ]				*	

(3)

Constraint	*ranking value*	*plasticity*
SYLL	100	0.1
MAX	100	0.1
IDENT	100	0.1
DEP	50	0.1
***[ij]**	50	0.1

(4)

/animal + s/	100 *Coda cluster	91.42 MAX	80.82 DEP	77.76 IDENT	52.51 OCP
anima[ɬ]s	*!				
anima[Ø]s		*!			
anima[li]s			*!		
☞ anima[j]s				*	

(5)

/funil + s/	100 *Coda cluster	91.42 MAX	80.82 DEP	77.76 IDENT	52.51 OCP
funi[ɬ]s	*!				
funi[Ø]s		*!			
funi[li]s			*!		
☞ funi[j]s				*	*

(6)

/animal + s/	100 *Coda cluster	87.73 DEP	86.17 OCP	83.42 MAX	78.85 IDENT
anima[ɬ]s	*!				
anima[li]s		*!			
anima[Ø]s				*!	
☞ anima[j]s					*

(7)

/funil + s/	100 *Coda cluster	87.73 DEP	86.17 OCP	83.42 MAX	78.85 IDENT
funi[ɬ]s	*!				
funi[li]s		*!			
funi[j]s			*!		*
☞ funi[Ø]s				*	

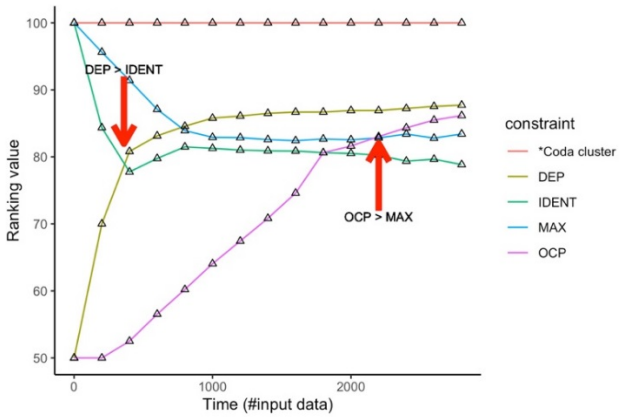

Figure 1 - The stimulated course of learning

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