

Self-organisation in phonological development: *Templates in Brazilian and European Portuguese*

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Abstract. This study investigates the emergence of early phonological *templates*, i.e. systematic shapes that facilitate the expansion of the lexicon, in the linguistic development of six children, three acquiring Brazilian Portuguese (BP) and three acquiring the European variety (EP). We follow the dynamic perspective of phonological development, which understands language development as a process of evolution characterised by variability. According to this view, although there is instability in development there are adjustments in the system due to the self-organization principle, which can be understood as a spontaneous pattern formation. The whole-word phonology/templates model is adopted in the analysis of early phonological patterns. The model claims that the organising principle in early phonological development is the whole word, not features or segments. These early word patterns are understood as templates. A preliminary longitudinal study was conducted to investigate early templates in BP and EP. We observed variability between the subjects regarding *template* types. In addition, we observed that instances of use and disuse of templates vary from child to child. The preliminary results suggest that there are templates operating during variability in phonological development. Also, the manifestation of a template characterises instability in the development. In instances of instability, templates are formed due to the principle of self-organisation, namely the spontaneous formation of patterns. The system organises itself due to its inherent ability to find patterns from some type of interaction.

Keywords: Brazilian and European Portuguese, dynamic systems, self-organization, templates

Introduction

This study investigates the emergence of early phonological *templates* in the phonological development of three children acquiring Brazilian Portuguese (BP) and three children acquiring the European variety (EP).

Within the dynamic systems theory in the study of child language, variety, flexibility and asynchrony tend to occur in the developmental process (Thelen & Smith, 1994). In this perspective, there is instability in development as there are adjustments in the system due to a self-organisation principle. Dynamic systems theory stresses the continuity between the development of phonological structure and the development of all other structures in nature (Szreder, 2012:14). Self-organisation thus appears as ‘order emerging without hierarchical pre-planning, based on the structural and functional capacities of the system’ (Davis & Bedore, 2013:134) and as a result of spontaneous pattern formation (Kelso, 1995). In an emergentist view, self-organisation does not require a blueprint or cookbook (Davis & Bedore, 2013:156).

Within the perspective of whole word/templatic phonology, the whole word is understood as the organising principle in early phonological development, not features or segments (Vihman & Croft, 2007; Vihman & Velleman, 2002). Many unusual phonological substitutions tend to occur due to ‘pattern force’ (Macken, 1979). In this perspective, some early word patterns are understood as templates, i.e. systematic shapes that facilitate the expansion of the lexicon.

The whole word approach consists of an attempt to understand children’s phonological development in itself and on its own terms (Ferguson & Farwell, 1975). Word templates are seen as child-specific word patterns and their effect is to make a lot of the child’s words sound similar to each other (Keren-Portnoy, Vihman, DePaolis, Bidgood, & McGillion, 2011). They are the child’s responses to challenging target forms. Difficulties for the child emerge due to limitations/idiosyncrasies on

articulation, articulatory planning, memory or biases/preferences. Therefore, idiosyncrasies give rise to individual differences in production. Moreover, individual templates may be similar to the target word (*selected forms*) or be distorted forms of the target word (*adapted forms*). Some examples of ‘bizarre’ forms in the acquisition of English as L1 have been reported previously (Waterson, 1971:179):

Child Production	Target
['nẽ.nẽ]/['ni.ni]	<i>finger</i>
['nẽ.nẽ]	<i>window</i>
['nã.nã]	<i>another</i>
['nã.nø]	<i>Randall</i>

In Brazilian Portuguese, some examples of these ‘bizarre’ forms, emerging often as reduplicated syllables, have also been found. Baia (2008) names these ‘bizarre’, adapted forms produced by a child ‘lexical creations’, following Secco (1994). The same is observed in the acquisition of European Portuguese (Correia, 2010). Therefore, adapted and selected forms can, in fact, be identified in the early speech of children speaking two varieties of Portuguese, BP and EP:

Table 1. Child words in BP and EP acquisition

Brazilian Portuguese (Baia 2010, 2013)				European Portuguese (Baia & Correia, 2016; Correia 2010)			
Age	Child production	Target	Gloss	Age	Child production	Target	Gloss
1;1	[ba.'ba] [a.'bo]	<i>bola</i> ['bɔla]	‘ball’	1;1	['pɔ.'bɔ] ['ba.'bɛ]	<i>bebé</i> [be.'be]	‘baby’
1;3	[ba.'ba]			1;2	[aβɛ.'βɛ] [ɐ.'βɛβɛ]		
1;5	[ba.'ba] [bɔ.'bɔ]			1;4	[ɐbɛ.'be] [ɛbe.'be]		
1;7	[bɔ.'bɔ] ['bɔ.ja]			1;7	[be.'be]		
1;1	[ka.'ka] [ka]	<i>Karine</i> [ka.'rini]	‘name of the child’s sister’	1;1	['ẽ:w]	<i>não</i> [nẽw]	‘no’
1;3	[ka.'ka]			1;2	[nɐ.'nẽw]		
1;5	[ka.'ka]			1;4	[na] [nẽw]		
1;7	[ka.'ka] [ka.'i]			1;7	[nẽw]		

The productions illustrated show that the speech of children speaking BP and EP is mainly characterized by an initial iambic pattern, although Portuguese words have stress mainly in the penultimate syllable. The authors observe similar deletion and filler sound insertion strategies in the speech of Brazilian and Portuguese children. However, different word shapes are found, both within the same child and between children, across varieties.

In this paper, we hypothesize that inter- and intravariability found in the comparison of templates in different Brazilian children (Baia, 2013) will be similar to the variability found in the comparison between Brazilian and Portuguese children. That is, we expect to find in two varieties of the same language a variable developmental path.

Method

This study investigates the emergence of early phonological templates in the linguistic development of children acquiring Brazilian and European Portuguese. To conduct this study, we considered a

sample of longitudinal spontaneous speech from 6 children (3 acquiring BP + 3 acquiring EP), between 0;9 and 2;0. For BP, we used the *corpus A aquisição do ritmo em Português Brasileiro – Processos de Ancoragem* (Santos, 2005). For EP, we used the ‘CCF’ *corpus*, from the *Acquisition of European Portuguese* databank (available in <http://phonbank.talkbank.org/access/Romance/Portuguese/CCF.html>). Children’s speech was collected monthly in observational sessions of 30-45 minutes from both *corpora*. For the analysis, orthographic and IPA phonetic transcription were considered (with 90% inter-judge reliability; dubious 10% were excluded). To distinguish reduplicated words from babbling, we adopted the criteria proposed by Vihman and McCune (1994), i.e. the context (mother identification) and the type of vocalization (correspondence with the target word) disambiguated the child’s utterance as *word* or *babbling*. Dubious and unintelligible transcriptions and productions were disregarded from the analysis. For the template analysis, a phonological structure had to occur at least in 40% of the total number of tokens in each session to be considered a template. Table 2 summarizes the data analysed.

Table 2. Data from Brazilian and Portuguese children analysed

Child	Age	Total # of productions
BP1 (male/Sao Paulo) Brazilian	0;9 – 2;0 16 sessions/months	Words: 1975 tokens
BP2 (male/ Sao Paulo) Brazilian	0;9 – 2;0 16 sessions/months	Words: 697 tokens
BP3 (male/ Sao Paulo) Brazilian	0;10 – 2;0 15 sessions/months	Words: 939 tokens
EP1 (female/ Lisbon) Portuguese	0;10 – 1;8 10 sessions/months	Words: 394 tokens
EP2 (female/ Lisbon) Portuguese	0;11 – 1;3 4 sessions/months	Words: 557 tokens
EP3 (male/ Lisbon) Portuguese	1;3 – 1;7 4 sessions/months	Words: 492 tokens

Results

Brazilian Portuguese

We observed variability between the subjects, regarding the type of template. In addition, we observed that instances of use and disuse of templates vary from child to child.

The following tables show how each template (T) was distributed along the sessions for the three Brazilian children observed. The first transcription corresponds to the child’s utterance, whereas the target appears in the second transcription.

We observe that the first child, BP1, uses templates for a reduced period of time when compared to his peers. BP1 uses templates until 1;4, whereas BP2 and BP3 use phonological patterns until 1;8 and 1;10, respectively. Full ($C_1V_1.C_1V_1$) and partial ($C_1V_1.C_1V_2$) reduplications are present all along the observational period, often simultaneously. Although the three children use reduplication as a production strategy, BP2 also uses $V.CV$ and $V.CV$ words, BP1 and BP3 also use CV words as templates. Templates are in use and disuse as development proceeds. As the tables show, all Brazilian children whose data were analysed used selected and adapted templates, and that is independent of target word size or shape.

Table 3. BP1's templates (BP)

	0;10	0;11	1;0	1;1	1;2	1;3	1;4
T	C ₁ V ₁ .'C ₁ V ₁ C ₁ V ₁ .'C ₁ V ₂	C ₁ V ₁ .'C ₁ V ₁ C ₁ V ₁ .'C ₁ V ₂			CV	CV	C ₁ V ₁ .'C ₁ V ₁ C ₁ V ₁ .'C ₁ V ₂

BP1: i. reduplication (C₁V₁.'C₁V₁ and C₁V₁.'C₁V₂) ii. CV*Child form / Target form*

[ne'ne] *nenê* / [ne'ne] 'baby' (selected)
 [po'po] *vovô* / [vo'vo] 'grandfather' (selected)
 [ka'ka] *galinha* / [ga'liŋe] 'hen' (adapted)
 [ta'ta] *tchau* / [tʃaʊ] 'bye' (adapted)

Child form / Target form

[pe] *pé* / [pe] 'foot' (selected)
 [la] *lá* / [la] 'there' (selected)
 [da] *dado* / [dadʊ] 'dice' (adapted)
 [fo] *flor* / [flor] 'flower' (adapted)

Table 4. BP2's templates (BP)

	0;9	0;10	0;11	1;3	1;4	1;5	1;6	1;8
T	C ₁ V ₁ .'C ₁ V ₁ C ₁ V ₁ .'C ₁ V ₂	C ₁ V ₁ .'C ₁ V ₁ C ₁ V ₁ .'C ₁ V ₂	V ₁ .'CV ₁ V ₁ .'CV ₂	C ₁ V ₁ .'C ₁ V ₁ C ₁ V ₁ .'C ₁ V ₂	'V ₁ .CV ₁ 'V ₁ .CV ₂	C ₁ V ₁ .'C ₁ V ₁ C ₁ V ₁ .'C ₁ V ₂	C ₁ V ₁ .'C ₁ V ₁ C ₁ V ₁ .'C ₁ V ₂	C ₁ V ₁ .'C ₁ V ₂

BP2: i. reduplication (C₁V₁.'C₁V₁ and C₁V₁.'C₁V₂) ii. 'V.CV*Child form / Target form*

[k^ho'k^ho] *cocô* / [ko'ko] 'poo' (selected)
 [pa'pa] *sapato* / [sa'patʊ] 'shoe' (adapted)

Child form / Target form

[esɪ] *esse* / [esɪ] 'this' (selected) [opa]
roupa / [hope] 'clothes' (adapted)

iii. V.'CV*Child form / Target form*

[a'ki] *aqui* / [a'ki] 'here' (selected)
 [o'k^ho] *cocô* / [ko'ko] 'poo' (adapted)

Table 5. BP3's templates (BP)

	0;11	1;0	1;1	1;2	1;3	1;4	1;5	1;6
T	CV		C ₁ V ₁ .'C ₁ V ₁ C ₁ V ₁ .'C ₁ V ₂	'V ₁ .CV ₁ 'V ₁ .CV ₂	C ₁ V ₁ .'C ₁ V ₁ C ₁ V ₁ .'C ₁ V ₂	C ₁ V ₁ .'C ₁ V ₁ C ₁ V ₁ .'C ₁ V ₂	C ₁ V ₁ .'C ₁ V ₁ C ₁ V ₁ .'C ₁ V ₂	C ₁ V ₁ .'C ₁ V ₁ C ₁ V ₁ .'C ₁ V ₂
	1;7	1;8	1;9	1;10	1;11	2;0		
T	C _{v1} V ₁ .'C _{v1} V ₁ C _{v1} V ₁ .'C _{v1} V ₂	C ₁ V ₁ .'C ₁ V ₁ C ₁ V ₁ .'C ₁ V ₂	C ₁ V ₁ .'C ₁ V ₁ C ₁ V ₁ .'C ₁ V ₂	C ₁ V ₁ .'C ₁ V ₁ C ₁ V ₁ .'C ₁ V ₂				

BP3: i. reduplication (C₁V₁.'C₁V₁ and C₁V₁.'C₁V₂) ii. 'V.CV*Child form / Target form*

[ma'mã] *mamãe* / [ma'mãĩ] 'mother' (selected)
 [po'po] *alô* / [a'lo] 'hello' (adapted)

Child form / Target form

[uma] *uma* / [ũme] 'one' (selected)
 [ok^hi] *óculos* / [okulʊs] 'glasses' (adapted)

iii. CV*Child form / Target form*

[da] *dá* / [da] 'give me' (selected)
 [k^ha] *caca* / [kake] 'poo/dirty thing' (adapted)

European Portuguese

As in BP data, we observed variability between the subjects regarding the type of template, as well as the instances of use and disuse of *templates*.

The following tables show how each template (T) was distributed along the sessions for the three Portuguese children observed:

Table 6. EP1's templates (EP)

	1;0	1;1	1;2	1;3	1;4	1;5	1;6	1;7	1;8
T	V ₁ .'CV ₁ V ₁ .'CV ₂		C ₁ V ₁ .'C ₁ V ₁ C ₁ V ₁ .'C ₁ V ₂			V ₁ .'CV ₁ V ₁ .'CV ₂			

EP1: i. V.CV

Child form / Target form

[v.'la] *olá* / [o.'la] 'hello' (selected)

[a.'βe] *bebé* / [bɛ.'bɛ] 'baby' (adapted)

[v.'pe] *pinguim* / [pi.'gwi] 'penguin' (adapt)

[v.'kɐ] *cão* [kɛw̃] / 'dog' (adapted)

ii. reduplication (C₁V₁.'C₁V₁ and C₁V₁.'C₁V₂)

Child form / Target form

[βi.'βe] *bebé* / [bɛ.'bɛ] 'baby' (selected)

[tɐ.'ta] *está* / [ʃ'ta] 'it is' (adapted)

[pa.'pa] *papa* / [pɐ.'pa] 'daddy' (selected)

Table 7. EP2's templates (EP)

	0;11	0;12	1;1	1;2	1;3
T		CV	'C ₁ V ₁ .'C ₁ V ₁		CV

EP2: i. CV

Child form / Target form

[mɛ̃] *mama* / [mɐ.'mɛ̃] 'mommy' (adapted)

[n.'e] *Inês* / [i.'neʃ] 'name' (adapted)

[tɔ] *toma* / ['tɔmɐ] 'take it' (adapted)

[da] *dá* / [da] 'give me' (selected)

[Rɐ] *carro* / ['karu] 'car' (adapted)

ii. reduplication ('C₁V₁.'C₁V₁)

Child form / Target form

['mɛ.'mɛ̃] *mamá* / [mɐ.'mɛ̃] *mother* (selected)

['nɐ.'nɐ̃] *não* / ['nɛw̃] *no* (adapted)

Table 8. EP3's templates (EP)

	1;3	1;4	1;5	1;6	1;7	1;8	1;9
T	CV			C ₁ V ₁ .'C ₁ V ₁ CV		C ₁ V ₁ .'C ₁ V ₂ CV	

EP3: i. CV

Child form / Target form

[pa] *papá* / [pɐ.'pa] *daddy* (adapted)

[da] *dá* / [da] *give me* (selected)

[βo] *bola* / ['bɔlɐ] *ball* (adapted)

ii. reduplication (C₁V₁.'C₁V₁ and C₁V₁.'C₁V₂)

Child form / Target form

[mɐ.'mɛ̃] *mama* / [mɐ.'mɛ̃] *mommy* (selected)

[dɐ.'dɛ̃] *dá* / [da] *give me* (adapted)

Like Brazilian children, Portuguese children use reduplication as a production strategy. However, differences are observed between the children speaking the two varieties, as Portuguese children seem to use *templates* to a much lesser extent and for a smaller period of time. EP1 and EP3 use *templates* until 1;5 and 1;8, respectively, but EP2 abandons phonological patterns very early on (1;3). In Portuguese children, full and partial reduplication may co-occur (as in C), or they can alternate (as in

EP3). In addition to reduplication, which is a production strategy common to the Portuguese children observed, V.'CV (in EP1's case) and CV (in EP2 and EP3's case) are also available strategies.

As for Brazilian children, Portuguese children whose data were analysed used selected and adapted templates and that is independent of word size or word shape.

These preliminary results suggest that there are templates operating in the variability during phonological development. Not all children go through the same developmental path since variability and instability are inherent to development.

Discussion

Although children will eventually reach common ground in the phonology of their language, inter- and intra-variability are found in the way phonological development proceeds, as well as in transition instances. Portuguese and Brazilian children use the same strategy, namely reduplication, both within and between variety(ies), but word forms vary among children. Notice, however, that Brazilian children have templates during more age spans than Portuguese children due to the data collection in the corpora. Reduplication in child speech has specific forms and functions. It has been considered to be a trace of late babbling (Fee & Ingram, 1982) or 'bits of babble' (Lewis, 1936). Repeated syllables are interpreted as a means to facilitate the initial pronunciation (Fee & Ingram, 1982; Ferguson, 1983; Klein, 2005; Schwartz, Leonard, Wilcox, & Folgen, 1980). The production of two identical or partially identical syllables with phonological identity (Klein, 2005) has been reported previously for languages like English (e.g., [dɛdɛ] 'bye' / [mima] 'grandmother' (Schwartz *et al.*, 1980). Repetitions of a core syllable have furthermore been associated with the production of a binary foot (Baia, 2008; Demuth, 1996; Santos 2007). In BP and EP, the production of reduplicated words with final prominence by young children is associated with the processing of iambic feet (Baia, 2008; Correia, 2010; Santos 2007). In this study, child-specific reduplication can be understood as the manifestation of a template/early articulatory routine. In sum, data from BP and EP phonological development show that children vary in the strategies they use to expand the lexicon as well as in the order of use (and disuse) of such strategies. Templates are instances of instability that characterize development and they are the result of self-organisation, that is spontaneous pattern formation.

Conclusion

Although we observed the use of reduplicated structures by Brazilian and Portuguese children, instability and variability were observed among children regarding the use and order of templates. Self-organisation instances of the phonological system differ, both within one child and between children. The system is self-organised due to its inherent capacity to form patterns from interaction. Therefore, variability appears as evidence of an open, dynamic and unstable phonological system.

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