THE ACQUISITION OF ENGLISH "–ED" COMPLEX CODAS BY BRAZILIAN PORTUGUESE SPEAKERS: A REANALYSIS UNDER A CONNECTIONIST OPTIMALITY THEORY

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Submitted in January 2005

ABSTRACT: *This study aims to apply the proposal of a connectionist version of Optimality Theory (Bonilha, 2004) in order to analyze the data which were previously considered in Alves (2004), regarding the acquisition, by Brazilian Portuguese speakers, of English complex codas which characterize the English morpheme "-ed". The analysis which was carried out in Alves (2004), developed through the standard model of Optimality Theory, reached the conclusion that the acquisition of a second language may imply not only the constraints reranking, but also the acquisition of a new underlying representation which is able to lead to output forms which are similar to those produced by native speakers. By considering the fact that, for a Connectionist OT, the phoneme does not exist as a mental representation, hence not constituting an underlying form, we intend to verify the adequacy of Connectionist Optimality Theory to revisit the analysis developed in Alves (2004).*
KEYWORDS: Connectionist Optimality Theory, second language acquisition, input

1. Introduction

In his study of the acquisition, by Brazilian Portuguese speakers, of the English complex codas finished by the coronal plosive segment which characterizes the " –ed" morpheme, Alves (2004)[1] proposed to categorize the verbs in two groups, as we can see in (01)[2].

[1] The main results obtained from Alves (2004) can be seen in ROA (701): *The acquisition of English –ed complex codas by Brazilian Portuguese speakers - more than just a matter of constraint demotion*.
[2] This study aims to investigate solely the acquisition of the final consonant sequences which characterize the English complex codas. The acquisition of the [+voiced] feature in the coda obstruents is not going to be analyzed in this article.

(01)

Group A – Verbs containing a complex coda whose penultimate consonant is not allowed in coda position by Brazilian Portuguese. Ex: *lived* [lɪ**v**d], *watched* [wɑ**tʃ**t], *stopped* [stɔ:**p**t], *laughed* [læ:**f**t].

Group B – Verbs containing a complex coda whose penultimate consonant is allowed in a single coda position by the L1 (Brazilian Portuguese allows [N], [S], [r] and [l] and semivowels in single codas). Ex: *missed* [mɪ**s**t], *passed* [pæ**s**t], *traveled* [trævə**l**d], *remembered* [rɪmembə**r**d], *discovered* [dɪskʌvə**r**d].

Seven undergraduate English language students took part in the study. There were three data collection moments, the first one being prior to the provision, to this group of students, of explicit instruction concerning the production of the "–ed" complex codas. Table 01[3] shows the output patterns, referring to both Groups A and B, produced by the learners in the three data collection moments.

Table 01 – Output patterns produced by the learners (data obtained from Alves 2004)[4]

Data Collection Phases	*Outputs* (Group A)	*Outputs* (Group B)
Pre-Instruction (Nov/2002)	[lɪvɪd]	[mɪsɪd] [mɪst]
Post-Instruction 1 and 2 (Jan/2003 e Mar/2003)	[lɪvɪd] [lɪvd] [lɪv]	[mɪsɪd] [mɪst] [mɪs]

It is worth mentioning that the same subject could produce all the three syllabic patterns which were verified after the provision of explicit instruction. This characterizes, thus, the variability in the students´ productions.

In order to account for such variability, Alves (2004) claimed that, although the students already showed, in the first phase of data collection, a constraint ranking which was able to lead to the production of complex codas, these students did not possess an input

[3] In the tables and tableaux that follow, we will use the verb *lived* [lɪvd] to symbolize all Group A verbs produced by the learners, and *missed* [mɪst] to represent all Group B verbs.

[4] All the constraints which were used in the tableaux which follow are constituents of the ranking which characterizes the Brazilian Portuguese syllabic system (Lee 1999), seen as the students´ initial state (H_0). In

representation which, from such a constraint ranking, could make it possible for the target forms to be produced. So as to justify his claim, the author mentions that non-suffixed forms, whose consonant sequences were also explicitly clear in orthography, such as *act*, *apt*, *card*, *field,* and *past*, were already produced appropriately by the learners, which confirms their capability of producing complex codas finished by coronal plosives even in the first data collection phase.

Alves (2004) concluded, thus, that a new underlying representation had to be acquired by the learners. His analysis showed that output forms characterized by an interconsonantal epenthetic vowel, such as [lɪvɪd] and [mɪsɪd], came from inputs such as /lɪv+ɪd/ and /mɪs+ɪd/, respectively. These input forms, according to Alves (2004), originated from the letter "e" which characterizes the "–ed" morpheme in orthography. The target consonant clusters, on the other hand, are originated from the same hierarchy, but from another input form, characterized by the absence of the vowel - /lɪv+d/ and /mɪs+d/. The tableaux from (02) to (05) present the same constraint ranking, in which Faithfulness outranks Markedness, and indicate that the variable outputs are a consequence of a variation in the input forms.

(02)

/lɪv+ɪd/	Max	Dep	CodaCond	NoCoda	NoComp
a) lɪ.vɪ.dɪ		*!			
b) lɪv.dɪ	*!	*	*	*	
c) ☞lɪ.vɪd			*	*	
d) lɪv	*!*		*	*	
e) lɪvd	*!		**	*	*

(03)

/lɪv+d/	Max	Dep	CodaCond	NoCoda	NoComp
a) lɪ.vɪ.dɪ		*!*			
b) lɪv.dɪ		*!	*	*	
c) lɪ.vɪd		*!	*	*	
d) lɪv	*!		*	*	
e) ☞lɪvd			**	*	*

the tableaux that follow, only those constraints which proved relevant to the analysis of the acquisition of the

(04)

/mɪs+ɪd/	Max	Dep	CodaCond	NoCoda	NoComp
a) mɪs.dɪ	*!	*		*	
b) mɪ.sɪ.dɪ		*!			
c) mɪ.sɪ	*!				
d) ☞mɪ.sɪd			*	*	
e) mɪs	*!*			*	
f) mɪst	*!		*	*	*

(05)

/mɪs+d/	Max	Dep	CodaCond	NoCoda	NoComp
a) mɪs.dɪ		*!		*	
b) mɪ.sɪ.dɪ		*!*			
c) mɪ.sɪd		*!	*	*	
d) mɪs	*!			*	
e) mɪ.sɪ	*!	*			
f) ☞mɪst			*	*	*

It is important to mention, as was done by Alves (2004), that the constraint ranking presented in the tableaux above is not the Brazilian Portuguese (L1) hierarchy, which, in our students´case, functioned as the initial hierarchic state (H_0) in their acquisition process. The Brazilian Portuguese syllabic structure is represented by Max>>CodaCond>>Dep (following Collischonn 2000), and such a hierarchic relation would lead to the production of epenthetic vowels following the final coronal plosive.

In his attempt to account for output forms such as [lɪv] and [mɪs], which were originated from the input form which did no contain the vowel /ɪ/, Alves (2004) made use of the proposal of a floating ranking by Bonilha & Matzenauer (2003). According to this proposal, when, inside the stratum, the ranking between Max and CodaCond is {Max >> CodaCond}, the target forms surface as outputs, and when {CodaCond >> Max}, the optimal output is the one showing a one-consonant coda, in view of the deletion of the final [t]/[d].

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coda structure, according to Alves (2004), are going to be shown.

(06)

/lɪv+d/	Dep	Max	CodaCond	NoCoda	NoComp
lɪ.vɪ.dɪ	*!*				
lɪ.vɪ	*!	*			
lɪvɪd	*!		*	*	
☞lɪv		*	*	*	
☞lɪvd			**	*	*

The verbs which belong to group B showed the same behavior presented in (06), which referred to Group A verbs. Besides, as we could see in Table 01, the output forms showing an interconsonantal vowel were also produced variably, along with the target outputs and those forms characterized by the deletion of the final plosive: [lɪvɪd]~[lɪvd]~[lɪv], regarding Group A verbs, and [mɪsɪd]~[mɪst]~[mɪs], regarding Group B. However, for those outputs which were originated from the input form containing the vowel /ɪ/, it was necessary to impose that the internal ranking of the constraints that composed the ranked stratum was always the same, the one in which Faithfulness outranks Markedness, in a way that there was not any variation in the ranking status of the constraints which compose the stratum in question.

In summary, based on the analysis whose results were discussed above, Table 02 shows the hierarchies which represent the three moments of data collection, as well as the input and output forms which were verified in each one of these three testing phases.

Table 02 – The learners´ acquisition sequence (Alves 2004)

Hierarchy	**Input (A)**	**Output (A)**	**Input (B)**	**Output (B)**
Pre-Instruction (Nov/2002) Max >> Dep >> CodaCond	/lɪv+ɪd/	[lɪvɪd]	/mɪs+ɪd/ /mɪs+d/	[mɪsɪd] [mɪst]
Post-Instruction 1 and 2 (Jan/Mar 2003) Dep >> Max,CodaCond	/lɪv+ɪd/ /lɪv+d/	[lɪvɪd] [lɪvd]	/mɪs+ɪd/ /mɪs+d/	[mɪsɪd] [mɪst]
Dep >> CodaCond,Max	/lɪv+d/	[lɪv]	/mɪs+d/	[mɪs]

2. Another possible analysis

In the present paper, we aim to reanalyze the data shown in Alves (2004) under a Connectionist Optimality Theory. Firstly, it is important to reconsider the constraints which are going to be used in the present analysis, given the inadequacy of the conceptualization of CodaCond as a constraint. According to Lee (1999), CodaCond presents, as we consider the possible codas in Portuguese, the definition shown in (07).

(07)

CodaCond: the Brazilian Portuguese coda may only contain [-voc, +son] or [-son, +cont, +cor].

As Bonilha (2004) questions, "how can we assume a positive statement referring to segments located in coda position, once, by definition, codas are prohibited? As we consider CodaCond as a sub-family of NoCoda, how can we formulate the former constraint as a positive constraint?"

This issue involves more than the conceptualization level itself, once it also implies direct consequences to the analysis which was developed by Alves (2004). As we consider that the author followed the proposal by Lee (1999) regarding the L1 constraint ranking, and, besides that, considered CodaCond as the only constraint which was responsible for simplification strategies such as epenthesis and deletion, it can be easily seen that an output such as [lɪvd] implies two violation marks on CodaCond, since there are two segments in coda which are forbidden to appear in this position by Brazilian Portuguese. Similarly, one output such as [lɪv] implies only one violation mark, with the emergence of [v] in final position. The use of CodaCond as the sole markedness constraint to account for the output forms found in Alves (2004), however, tends to diminish the specificity of a complex coda when compared to a single coda, once the same analytical treatment is provided to either one or two-consonant codas. Indeed, the difference between simple and complex codas cannot be explained in OT only through a greater or lesser number of violation marks regarding CodaCond, not even if a distinction between NoCoda and NoComplexCoda is being considered. According to Vinhas, Mesquita and Bonilha (2003, 2004), the English codas, as well as the onsets, are acquired by Brazilian Portuguese speakers according to the

consonant sequence which composes the cluster. Therefore, it is necessary to consider the role of constraints which explain the different consonant sequences which correspond to the target.

Another problem, which was brought up by the hierarchy considered by Alves (2004), concerns the ranking relation Max>>Dep>>CodaCond, which explains the production of outputs such as [lɪvd], [lɪvɪd] – as we assume different inputs – but does not account for the production of output patterns such as the one in [lɪv]. So that this output can be explained, it is necessary to consider an inversion in the ranking, by proposing the hierarchic relation Dep>>CodaCond, Max. As we consider the application of the Learning Algorithm proposed by Tesar & Smolensky (2000), we see that, taking Max>>CodaCond>>Dep as the initial state H_0, the demotion of CodaCond to a position below Dep is justifiable due to the inputs in the English language which are going to motivate the acquisition of such codas. However, as we depart from H_0, what input forms would motivate the change in ranking status between the faithfulness constraints? Why do we have Dep>>Max in this acquisition stage? Indeed, Alves (2004) does not explain why there was such an inversion in the constraint ranking, which accounts for output forms such as [lɪv] and [mɪs].

In the present paper, therefore, we are going to alter some of the constraints and the hierarchy presented by Alves (2004). Following Vinhas, Farias, Soares & Bonilha (2004), we assume that the L1 hierarchy, regarding the coda constraints, is the one presented in (08).

(08)
Max I/O, Dep I/O >> NoCoda, *[-vocalic, +sonorant]$_{(coda)}$, *[-sonorant, +continuant, coronal] $_{(coda)}$

The ranking in (08) does not present the Positional Markedness constraints which militate against the segments which may occur in the English coda in any position of the Portuguese syllabic hierarchy. According to Vinhas, Mesquita & Bonilha (2003, 2004), as we follow the proposal of an OT which is characterized as totally connectionist, as proposed by Bonilha (2004), constraints which characterize the second language, but do not

militate in the L1 ranking, are acquired only after the learner is put into contact with the L2 inputs.

Still regarding the constraint ranking in (08), it must be noted that the Portuguese codas are allowed to surface as outputs in view of the demotion of the positional Markedness constraints *[-vocalic, +sonorant]$_{(coda)}$, and *[-sonorant, +continuant, coronal]$_{(coda)}$ to a position below the Faithfulness constraints. Unlike Lee (1999), Vinhas, Farias, Soares & Bonilha (2004) assume that there is not a hierarchic relation between Max I/O and Dep I/O, as both constraints share the same stratum in a sense of a probabilistic grammar. In this regard, the fact that the Faithfulness constraints do not present a fixed dominance between each other does not deny the fact that, probabilistically, in the Brazilian Portuguese grammar, Max/IO outranks Dep I/O in most of the speakers´ productions.

As we once again concentrate on the analysis carried out by Alves (2004) and consider the constraint ranking presented in (08), we see that, so that complex codas such as [lɪvd] and [mɪst] (in *lived* and *missed*, respectively) can be properly analyzed, it will also be necessary to consider the role of NoSequence ([+continuant, +voiced, labial], [-sonorant, coronal, +voiced]) and NoSequence ([+continuant, -sonorant, coronal], [-sonorant, coronal, -voiced])[5], as we can see in the ranking presented in (09).

(09)
H1= NoSequence ([+continuant, +voiced, labial], [-sonorant, coronal, +voiced]), NoSequence ([+continuant, -sonorant, coronal], [-sonorant, coronal, -voiced])>>Max I/O, Dep I/O >> NoCoda, *[-vocalic, +sonorant] $_{(coda)}$, *[-sonorant, +continuant, coronal] $_{(coda)}$, *[+continuant, +voiced, labial] $_{(coda)}$, *[-sonorant, coronal, -continuant] $_{(coda)}$

The hierarchy in (09) represents the acquisition stage which is characterized by the emergence of English single codas – [v], [d], [t] – due to the demotion of *[+continuant, +voiced, labial]$_{(coda)}$, *[-sonorant, coronal, -continuant]$_{(coda)}$. Unlike what has been done by Alves (2004), which used solely CodaCond without analytically distinguishing simple from

[5] In order to simplify their use in the following tableaux, the constraints NoSequence ([+continuous, +voiced, labial], [-sonorant, coronal, +voiced]) and NoSequence ([+continuant, -sonorant, coronal], [-sonorant, coronal, -voiced]) are going to be represented as NoSequence (vd) e NoSequence (st).

complex codas, the present analysis claims that the NoSequence[6] constraints are highly ranked in the students´ grammars.

As we depart from the ranking in (09)[7], the tableaux which follow will consider, firstly, only the input forms /lɪ+vd/ and /mɪs+d/, as it is shown in (10) and (11).

(10)

/lɪv+d/	NoSequence (vd), NoSequence (st)	Max	Dep	NotComplex(coda)	NoCoda
a) lɪ.vɪ.dɪ			**!		
b) ☞lɪv.dɪ			*		*
c) ☞lɪ.vɪd			*		*
d) ☞lɪv		*			*
e) lɪvd	*!			*	

(11)

/mɪs+d/	NoSequence (vd), NoSequence (st)	Max	Dep	NotComplex(coda)	NoCoda
a) ☞mɪs.dɪ			*		*
b) mɪ.sɪ.dɪ			**!		
c) mɪ.sɪ		*	*!		
d) ☞mɪ.sɪd			*		*
e) ☞mɪs		*			*
f) mɪst	*!			*	

The tableau in (10) illustrates the possible variable production of three distinct output forms [lɪvɪd], [lɪvdɪ] e [lɪv] at the same acquisition stage. According to the data in Table 01, in the first data collection phase, the only output form which is effectively produced by the learners is [lɪvɪd], and it must be added that outputs such as [lɪvdɪ] are never produced, not even in latter stages. One possible means of explaining this fact is to consider that

[6] The NoSequence constraint family is used to account for the acquisition of complex onsets and codas in Bernhardt & Stemberger (1998).

[7] The constraints *[-vocalic, +sonorant]$_{(coda)}$, *[-sonorant, +continuant, coronal]$_{(coda)}$, *[+continuant, +voiced, labial]$_{(coda)}$, *[-sonorant, coronal, -continuant]$_{(coda)}$ are not going to be shown in the following tableaux, once they have already been demoted.

*[labial, +continuant, +voiced, -sonorant]$_{(coda)}$ militates against *[-sonorant, coronal]$_{(coda)}$, which would cause [d], rather than [v], to be preferable in the coda. It is important to mention that, following Bernhardt & Stemberger – referring to English L1 acquisition – and Vinhas, Farias, Soares & Bonilha (2004) – concerning English L2 acquisition – plosive codas are acquired prior to fricative codas.

The non-production of output forms such as [lɪv] in the first data collection stage may be attributed to a probabilistic ordering, in accordance with a Connectionist OT, between the two Faithfulness constraints in the L1 ranking, in which Max/IO preferably outranks Dep/IO.

The tableau in (11) also attests the emergence of three possible outputs - [mɪsɪd], [mɪsdɪ] e [mɪs] – however, the subjects produced only [mɪsɪd], besides the output [mɪst], which was not confirmed as a possible output form.

The production of outputs such as [mɪst], in the first collection stage, makes us consider an alternation in the ranking which was presented in the tableau in (11), as we can see in (12).

(12)

/mɪs+d/	NoSequence (vd),	NoSequence (st)	Max	Dep	NotComplex(coda)	NoCoda
a) ☞mɪs.dɪ				*		*
b) mɪ.sɪ.dɪ				**!		
c) mɪ.sɪ			*	*!		
d) ☞mɪ.sɪd				*		*
e) ☞mɪs			*			*
f) ☞mɪst		*			*	

Once we consider, through the application of the Gradual Learning Algorithm proposed by Hayes & Boersma (1999) – which is the algorithm which best represents the gradualness and probability which characterize a connectionist model – that NoSequence (st) has already started its demotion process in the learners´ ranking, the production of outputs such as [mɪst] cannot be regarded as unexpected, and the data concerning the first collection phase is therefore justified.

The acquisition of [st] before [vd] sequences is also attested by Bernhardt & Stemberger (1998), regarding English L1 acquisition. According to these authors, voiceless complex codas are acquired before voiced complex codas, and the production of voiced codas as voiceless may be even seen as one of the simplification strategies used by the children.

The syllabic patterns shown by Alves (2004), concerning the second and third stages of data collection, which took place after the provision of explicit instruction to the group of students, can also be explained by the ranking presented in the tableau in (12), as we refer to the input /mɪs+d/. However, productions originated from the input /lɪv+d/, after the explicit instruction, demand that NoSequence (vd) be also reordered in the learners´ ranking. This can be observed in the tableau in (13).

(13)

/lɪv+d/	NoSequence (vd)	NoSequence (st)	Max	Dep	NotComplex(coda)	NoCoda
a) lɪ.vɪ.dɪ				**!		
b) ☞lɪv.dɪ				*		*
c) ☞lɪ.vɪd				*		*
d) ☞lɪv			*			*
e) ☞lɪvd	*				*	

The analysis which was proposed here proves advantageous, once it is able to justify the various output forms produced by the learners without having to fall back on an alternation concerning the input form. This analysis assumes, in accordance with a connectionist OT, that:

(a) the construction of a hierarchy may imply both constraint demotions and promotions – through the application of the Gradual Learning Algorithm;

(b) the constraint ranking is probabilistic – a stochastic grammar;

(c) NoSequence constraints, which are acquired during the L2 acquisition process, play a decisive role in the learners´ productions.

(d) Max I/O and Dep I/O share a stratum in the L1 ranking.

It is also relevant to mention that the present analysis is able to explain the variation in [lɪvɪd] ~ [lɪv] ~ [lɪvd] without having to postulate a ranking in which Dep I/O outranks Max I/O, as it was necessary in Alves (2004).

Although the present analysis, therefore, may seem to be more economical, some questions still remain, and seem to demand answers before we can finally disregard the possibility of the concomitance of the inputs /lɪv+ɪd/ ~/lɪv+d/ and /mɪs+ɪd/ ~ /mɪs+d/, in the students´ L2 acquisition process.

Firstly, the analysis which is proposed here is only possible if we consider that the [vd] sequence had not yet been acquired by the subjects, once the demotion of NoSequence (vd) to the same stratum of the faithfulness constraints would allow the output [lɪvd] to be produced in the first data collection. This, however, was not what Alves (2004) verified in the data he analysed.

How can we firmly state, then, that the complex coda [vd] had not been acquired until then, even if we consider the fact that voiced complex codas are acquired later, if the learners were already able to produce voiced sequences as [rd] and [ld] in words such as card and field? Was the production of these structures being facilitated by the presence of [r] and [l] codas in Portuguese, especially if we consider that the lateral coda is systematically produced as [w] by the subjects of this study?

Secondly, although the non-production of output forms such as [lɪvdɪ] and [mɪsdɪ] can be justified by the assumption that the positional markedness constraints concerning the fricative coda outranks the constraint *[-sonorant, coronal]$_{(coda)}$, how can we explain what is shown in (14)?

(14)
a) past [pas.tʃi] *[pa.sit]

As we consider that the word *past* presents the same consonantal sequence as in *missed*, why do the learners produced [mɪsɪd], although they never produced [pæsɪt]?

As Alves (2004) points out, in those Group B consonant clusters which are also represented, in orthography, by a sequence of consonants, the epenthetic vowel may be

produced in final position only. In fact, it is noticeable that only those verbs containing the "–ed" morpheme are produced with the vowel in an interconsonantal position. As we consider the fact that the verbs which show the " –ed" morpheme are spelled with the letter " –e", we then find satisfactory arguments which confirm the conclusion reached by Alves (2004), stating that outputs such as missed [mɪsɪd] are originated from a distinct input form.

Finally, we must add that the conclusions above are corroborated by the Connectionist Paradigm itself. As we follow the ideas of such a paradigm, we see that, once inputs are not believed to exist as abstract representations, but must be seen as outputs that are processed, how can we disregard the premise that the learner owns, indeed, two inputs which constitute neural mappings, *missed* and *mist*, one originated from spelling and the other originated from the native speakers´ speech, respectively? Shouldn't it really be the input *missed*, originated from the orthography, the one that best reinforces the synapses?

The constraint ranking which was suggested by the present analysis, as well as the connectionist aspects we have already alluded to, are therefore sustained as we consider, according to Alves (2004), that there is a competition between inputs in the constitution of this fragment of the grammar. In fact, this is what can be seen in the tableaux which are shown in (15).

(15a)

/lɪv+ɪd/	NoSequence (vd) NoSequence (st)	Max	Dep	NotComplex(coda)	NoCoda
a) lɪ.vɪ.dɪ			*!		
b) lɪv.dɪ		*!	*		*
☞c) lɪ.vɪd					*
d) lɪv		*!*			
e) lɪvd	*!	*		*	

(15b)

/mɪs+ɪd/	NoSequence (vd) NoSequence (st)	Max	Dep	NotComplex(coda)	NoCoda
a) mɪs.dɪ		*!	*		*
b) mɪ.sɪ.dɪ			*!		
☞c) mɪ.sɪd					*
d) mɪs		*!			*
e) mɪ.sɪ		*!			
f) mɪst	*!	*		*	

The tableaux in (15 a,b) show that, even though we consider the alterations, proposed by our present study, in the analysis developed by Alves (2004), the assumption of a concurrence of inputs also leads to the outputs which were produced by the learners. This thing considered, we once again go over the data in Table 02 so that we can establish a final comparison between the results obtained from the two analyses – the one developed by Alves (2004) and the one we have proposed here, whose results are shown in Table 03.

Table 03 – The learners´ acquisition sequence

Hierarquia	**Input (A)**	***Output* (A)**	**Input (B)**	***Output* (B)**
Pre-Instruction (Nov/2002) NoSequence, Max, Dep >> No Complex, NoCoda	/lɪv+ɪd/	[lɪvɪd]	/mɪs+ɪd/ /mɪs+d/	[mɪsɪd] [mɪst]
Post-Instruction 1 & 2 (Jan/Mar 2003) NoSequence, Max, Dep >> No Complex, NoCoda	/lɪv+ɪd/ /lɪv+d/	[lɪvɪd] [lɪvɪd] [lɪvd] [lɪv]	/mɪs+ɪd/ /mɪs+d/	[mɪsɪd] [mɪst] [mɪs] [mɪsɪd]

The new constraint ranking which was proposed in the present paper enables us to explain the students´ output productions by considering two differentiated inputs and only one constraint ranking. When the subjects produced [lɪvɪd] as the only output form, they maintained the input /lɪv+ɪd/; however, when the subjects produced variable output forms,

such as [lɪvɪd] ~ [lɪvd] ~ [lɪv], they maintained, besides /lɪv+ɪd/, the input /lɪv+d/. These variable forms, indeed, are expected if we consider the fundamentals of a Connectionist OT, from which we can say that the input, the grammar and the output constitute the same unit, which is originated form the probabilistic constraint ranking, according to Bonilha (2004). The same can be said regarding the target form *missed*, which represents Group B verbs.

In order to explain the variation concerning the three forms [mɪs], [mɪst], and [mɪsɪd] or [lɪv] [lɪvd] and [lɪvɪd], Alves (2004) had to extrinsically claim that, whenever the learner made use of the input /x+ɪd/, the internal ranking of the stratum had to be, necessarily, Max >> CodaCond, otherwise outputs such as [lɪvɪ] and [mɪsɪ] could be obtained. In his analysis, therefore, Alves (2004) recognized the possibility of a variation in the ranking status of the constraints which composed a stratum under one of the input forms, but denied this possibility of variation when considering the concurrent input form. This assumption can be seen as extrinsic, maintained by the analyst himself, once it found no theoretical apparatus provided by the fundamentals of the theory. In our present analysis, however, no extrinsically motivated claim is being made, once the position of the NoSequence constraints in the ranking is only pertinent when we have the input which does not contain the vowel.

For all the aforementioned reasons, we can say that our proposal, which not only applied the Gradual Learning Algorithm, but also suggested different constraints to explain the data which were previously analyzed by Alves (2004), is pertinent.

3. Contributions from a Connectionist OT (Bonilha, 2004) to the co-occurrence of different inputs

According to Bonilha (2004), it is possible to conceive Optimality Theory only by considering its tie with the Connectionist Paradigm, by eliminating the generative aspects which, along with the connectionist aspects, constitute the standard model.

Among the alterations which were proposed by the author, we can mention, as pertinent to the present analysis: (i) the elimination of UG, as we conceive, therefore, that all constraints are acquired on a potential basis; (ii) the understanding that every constraint

ranking is probabilistic, and it constitutes a stochastic grammar; (iii) the substitution of Gen and Eval by another function – the Optimizer – and (iv) the elimination of the underlying representation, while conceived as a distinct grammar representation.

According to Bonilha (op.cit.), the input should no longer be conceived as an isolated representation, once the generation of candidates does no exist. This fact, thus, allows the learners to consider distinct input forms. We can observe, in (16), the formalization which was proposed by the author, herein adapted to the English data.

(16)

Resulting forms from the Optimizer	NoSequence (vd) NoSequence (st)	Max	Dep	NotComplex(coda)	NoCoda
a) [/lɪv+ɪd/]					*
b) [/lɪv+d/]	*			*	
c) [/lɪv+d/]			*		*
d) [/lɪv+d/]		*			*

We consider that the input form, mapped by either audio or visual perception, is "represented", in a connectionist OT, through the violation marks on the constraints which characterize the hierarchy, in such a way that lexicon and grammar constitute a single unit. The tableau in (16) makes it clear that the learners hold, indeed, two distinct inputs.

According to Bonilha (2004), the existence of two distinct input forms may be explained as we recognize the existence of two distinct mappings in only one constraint ranking, such as the mapping [/lɪv+ɪd/] and [/lɪv+d/] under the hierarchy NoSequence, Max, Dep>>NotComplex(coda), NoCoda, as it is shown in (16). Mappings b, c, and d, through the constraint ranking shown in (16), characterize three possible activations based on the same input form. According to Bonilha´s proposal, the Optimizer can, thus, activate four forms – lexicon, grammar and output – having the ranking in (16) as a basis.

Unlike Standard OT, in which the exchange of input forms was not justified by any formal theoretical apparatus, Connectionist OT can be seen, therefore, as a better tool to deal with the concurrence of inputs.

4. Conclusion

The present reanalysis seems to be more satisfactory than the previous analysis developed by Alves (2004). Our analysis applied the Gradual Learning Algorithm, and made use of some constraints which had no been considered by Alves (2004). This allowed the proposal of different constraint rankings, concerning both the L1 and the students´ interlanguage systems, which were made possible by a totally connectionist version of Optimality Theory (2004). Besides being able to explain the output forms produced by the students without having to resort to unjustifiable constraint demotions, Connectionist Optimality Theory also considered the existence of different input forms held by the same learner, as defended in Alves (2004). These reasons allow us to say that the acquisition of the "–ed" complex codas can be more satisfactorily explained through a Connectionist OT analysis.

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