Development of speech fluency in an additional language: Analysis of breakdown rates in the speech of an Argentine learner of Brazilian Portuguese

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Abstract

This study investigates the longitudinal development of breakdown fluency in the speech of an advanced Argentine learner of Brazilian Portuguese (L3). The analysis is grounded in Complex Dynamic Systems Theory (CDST), which views language as a non-linear and adaptive system. We analyzed 24 audio recordings of spontaneous speech collected over one year. The study adopted an A-B-A

methodological design, with a period of explicit pronunciation instruction between recording sessions 10 and 15. Breakdown fluency was operationalized through measures of silent and filled pauses in both mid-clause and end-of-clause contexts. The results of the Peak Analysis with Monte Carlo Simulations revealed no abrupt changes, which may be attributed to the learner's high proficiency. However, a Change Point Analysis showed a significant decrease in the duration and quantity of silent end-of-clause pauses. This suggests that even advanced learners continue to develop fluency, and that these changes can occur gradually. The findings also align with previous research indicating that pronunciation instruction may have a positive impact on fluency development.

Keywords: L2 speech fluency; breakdown fluency; Portuguese as an additional language; Spanish as a first language

1. Introduction

Although "fluency" is a commonly used term in additional language classrooms, defining the construct of *spoken fluency* is far from straightforward. Fillmore (2000) characterized fluency as the ability to speak with few pauses, to be creative in expressing ideas in new ways, and to construct metaphors. Fluency, therefore, is closely related to the degree of control that learners exert over their additional language systems. It is manifested in the speed and efficiency with which learners process and produce language, resulting in comprehensible communication (Housen et al., 2012).

Several authors (Bosker et al., 2013; Skehan, 2014; Saito et al., 2018a) have argued that fluency comprises both perception and multiple subconstructs, such as breakdown fluency, speed fluency, and repair fluency. This study focuses on one of these dimensions: breakdown fluency, which refers to the rate of interruptions in speech and considers both the quantity and duration of (filled and silent) pauses produced by additional language learners during communication. These pauses are measured according to the context in which they appear (mid-clause pauses and end-of-clause pauses). The context of the pauses indicates greater or lesser proficiency in the target language (Leonard & Shea, 2017).

The present study investigates the breakdown fluency in the speech of an Argentine learner (born in the state of Buenos Aires) who

acquired Portuguese as a third language after Spanish (L1) and English (L2). At the beginning of data collection, the learner had been living in Porto Alegre, Brazil, for three years, and demonstrated a high level of proficiency in Portuguese, using it regularly in professional contexts. The dataset consists of 24 audio recordings, each comprising 10 minutes of spontaneous speech (the first and last minutes were cut, leaving 8 minutes for analysis), collected every 15 days between October 2018 and September 2019. Between data collections 10 and 15, the learner participated in explicit instruction sessions focused on the pronunciation of vowel and consonant sounds in Brazilian Portuguese.

As this is a longitudinal study, and given that L2 fluency is understood to develop non-linearly, this chapter is grounded in Complex Dynamic Systems Theory (CDST). This theory is first introduced in the Literature Review, followed by a discussion of fluency and key studies in the field. The Method section then outlines the study design. Fluency development was examined through a complex-dynamic analysis (Lowie, 2017), including the analytical procedures of Peak Analysis with Monte Carlo Simulations (van Dijk et al., 2011) and Change Point Analysis (Taylor, 2000). These methodologies enable the observation of variability over time, which may indicate phase shifts in the learner's system (Verspoor et al., 2021).

With this study, we aim to contribute to the discussions on the construct of fluency as well as map the developmental strategies employed by an advanced L2 learner.

2. Review of literature

2.1. Theoretical framework

This study is grounded in Complex Dynamic Systems Theory (CDST) (Verspoor et al., 2011, 2021; Larsen-Freeman, 2014, 2017; De Bot, 2017; Lowie, 2017; Hiver & Al-Hoorie, 2020). In contrast to linear and static views of language development, CDST sees language as a dynamic, adaptive, and constantly adjusting system, which justifies the use of longitudinal methodologies in L2 research. From this perspective, language is not just a collection of rules, but rather a complex system, whose functionality emerges from the interconnection and interdependence of its multiple subsystems (such

as phonology, lexis, syntax, and pragmatics). Thus, language development is understood as a continuous, non-linear process that is profoundly interdependent on several variables, such as cognitive, social, and contextual factors over time (Verspoor et al., 2011; Lowie, 2017; Hiver & Al-Hoorie, 2020).

In CDST, the notions of change and emergence are central, as language is viewed as inherently dynamic rather than fixed or static. L2 development is thus seen as a continuous process of adaptation, with no predefined end point or final state of mastery (Larsen-Freeman, 2014, 2017). Unlike traditional approaches that aim to generalize findings across large groups, CDST emphasizes longitudinal analyses of individual learners. While learners may exhibit similarities, their developmental trajectories are understood to be fundamentally unique (Lowie & Verspoor, 2019).

Changes in the systems occur in what the theory refers to as "phase spaces". Drawing on Larsen-Freeman's (2014) golf course metaphor, the learner can be imagined as a golf ball that occasionally enters a "hole" (a temporarily stable state) before continuing along a dynamic, non-linear trajectory. This hole represents an "attractor state", a pattern of linguistic use that has become stable, where learning seems to stagnate. For development to proceed, a "push" is necessary, such as the provision of explicit instruction or a new form of input, to move the ball out of this state of stability. When the learner is "in motion", processing new input, there is notable variability in their production (the ball rolling across the field). This period of high variability indicates instability and reorganization of the system, being an essential precursor to the emergence of a new, more complex pattern and the subsequent decrease in variability (Larsen-Freeman, 2014, 2017).

Complex-dynamic systems are, by nature, open, adaptive, and context-dependent, continuously interacting with the environment and being influenced by external feedback. They are also non-linear, exhibiting periods of fluctuation and even chaos. In this framework, variability is no longer seen as an "error" but as a crucial and informative aspect in CDST; it occurs at moments of phase-state transition and is a strong indicator of L2 learning. Consistently low levels of variability can signal stagnation (an attractor state), while high variability suggests that the learner's system is actively

reorganizing and, quite possibly, learning and becoming more complex (Verspoor et al., 2021).

For this reason, analytical methodologies capable of detecting abrupt and gradual shifts (such as peaks or change points in time series) are particularly valuable, as they reveal moments when learners begin to reorganize their systems in response to new communicative demands (Taylor, 2000; Verspoor et al., 2011). In summary, CDST offers a robust and ecologically-valid theoretical basis for investigating the development of L2 fluency. This is especially true in contexts of significant changes, such as the immersion in a new country, where fluency evolves and reconfigures dynamically over time, as the learner's language system adapts to a new and rich environment of input and interaction.

2.2. L2 fluency development

In recent years, studies interested in the teaching and learning of additional languages have focused on the triad of Complexity, Accuracy, and Fluency (CAF), aiming to investigate ways to help learners improve their language proficiency.

De Jong and Perfetti (2011:534) explain that language learners want to be fluent in the sense of "being able to express their thoughts easily, with more attention to meaning than form, in any given situation". The authors emphasize that there is no single definition for fluency in the literature, but that it is often understood to refer to the flow and smoothness of delivery.

Segalowitz (2010:165) argues that fluency can be distinguished in three facets: (i) cognitive fluency – 'the efficiency of operation of the underlying processes responsible for the production of utterances'; (ii) utterance fluency – 'the features of utterances that reflect the speaker's cognitive fluency' which can be acoustically measured; (iii) and perceived fluency - 'the inferences listeners make about speakers' cognitive fluency based on their perceptions of their utterance fluency'.

Our study focuses on utterance fluency, particularly one of its acoustic measures, which is called "breakdown fluency". Bosker et al. (2013) define breakdown fluency as the number of filled (e.g., ah, oh, eh) and unfilled pauses in the middle and end of clauses. More specifically, Kormos and Dénes (2004) draw attention to the fact that

the number of end-of-clause pauses is argued to signal L2 learners' engagement with conceptualization and content planning. In other words, more proficient learners use the end-of-clause pauses more often because they are used to planning what will be said. On the other hand, the number of mid-clause pauses is related to the present state of L2 learners' timely phonological, lexical and syntactic encoding, i.e., questions usually related to lower proficiency in the target language, when learners forget certain lexical items, are unsure about pronunciation, or even about the syntactic structure of a sentence.

Studies such as Saito et al. (2018a) have highlighted the relevance of measuring acoustic breakdown, as it serves to distinguish between low and mid-level fluency. Similarly, mid-clause pauses are used to differentiate mid- and high-level fluency. Breakdown fluency, in particular, is a strong predictor of L2 fluency at beginner levels, as less experienced learners typically take longer to conceptualize their utterances due to limited representation and processing of the target language system. This often results in a greater number of filled or silent pauses during encoding and formulation. This study seeks to examine how this parameter evolves over time in the speech of an Argentine learner of Brazilian Portuguese.

2.3. Studies on the development of fluency in additional languages

Based on the assumption that speech fluency improves more significantly when exposure to the target language occurs over the long term, Hanzawa (2021) analyzed 50 Japanese university students learning English as an additional language during one academic year with the aim of monitoring its impact on L2 fluency measures (i.e., speed, breakdown, and repair fluency). The author also used a questionnaire based on a language contact profile to assess how fluency measures related to learners' experiences, both in the classroom and in less structured learning contexts.

A total of 150 speech samples were collected during the analysis period (50 students across three testing points). On three separate occasions, students were recorded in spontaneous conversations as they presented their personal narratives. The speech samples were annotated using Praat – version 6.1.41 (Boersma & Weenink, 2021). Filled and unfilled pauses were counted manually and also with the help of a script. All speech was transcribed manually to check the

location and duration of pauses, self-repairs and repetitions of all speech samples. The results showed that, while the duration of mid-clause pauses significantly declined during both semesters, it took an entire academic year to observe significant improvements in end-of-clause pauses duration. Conversely, no developmental changes were observed over time in articulation rate, the frequency of mid-clause or end-of-clause pauses, or the number of repairs. The study offers valuable insights for research on L2 fluency, notably that a reduction in the number of pauses is considered an indicator of increased fluency, and that pause duration may decrease before pause frequency does. In examining the relationship between fluency and learning experience, Hanzawa (2021) found that learning experience was specifically associated with changes in the frequency of end-of-clause pauses and the number of repairs. These findings led the author to conclude that, although long-term gains in L2 fluency are evident, their effectiveness depends on how learners engage with and make use of their learning experiences.

Saito et al. (2018b) analyzed the development of English as an additional language in a group of 40 Japanese students during their first year at university. Spontaneous speech samples were collected at three different times (beginning, middle, and end of the project) and various aspects of speech were analyzed, including breakdown, speed and repair fluency parameters. These measures were associated with the participants' aptitude for developing L2 English pronunciation, mainly through explicit learning aptitude (associative memory, phonemic coding), i.e., based on the benefits from their teachers' explicit instruction and corrective feedback.

Based on their findings, the authors confirmed the hypothesis that improvements in the pronunciation of new consonantal and vocalic sounds—both in simple (e.g., CV) and complex (e.g., CVC, CCVCC) syllable structures, with correct stress placement achieved through explicit instruction, lead to enhanced fluency. In other words, accurate pronunciation allows for L2 speech with fewer pauses and repetitions and at an optimal tempo.

The study also examined students' aptitude for incidental learning, measured through sound sequence recognition. Overall, participants showed notable improvement in L2 pronunciation proficiency, even over a short period. Learners with stronger associative memory may

be able to retain more information in their phonological store, thereby freeing up cognitive resources for fluent L2 speech.

Bao (2023) examined how measures of speed and breakdown fluency (duration and quantity of pauses) relate to proficiency in English as an additional language. The author analyzed 162 Chinese speakers from four Chinese universities in their second year of university who participated in a retelling task. They all spoke Chinese as L1 and had learned English as a foreign language in a formal setting for a minimum of 8 years. Participants took a national English proficiency test for English majors to assess whether they met the required language proficiency levels. The test consisted of six parts, that is, dictation (10 points), listening comprehension (20 points), language usage (20 points), cloze (10 points), reading comprehension (20 points), and writing (20 points). The retelling task was based on a short story about a little boy who was eager to succeed in sports and believed that success was determined by results. The story was 335 words long and, on the retelling task, the participants were asked to listen to the story twice, and allowed to take notes while listening without being told the research purpose. Immediately after that, the participants had to retell the story with earphones in 3min or so. Rates of speed and breakdown fluency (silent and filled pauses/mid- and end-of-clause pauses) were analyzed in the retelling of the story.

In Bao's study, the mid-clause pause durations were significantly shorter than the end-of clause pause durations, but there was a strong correlation between the two pause duration measures. That is, as the learners paused longer between clause boundaries for recalling information, they tended to pause longer within a clause to plan and articulate speech. Also, the strong relationship between two pause duration measures suggests the difficulties that the learners encountered in information recall, lexical retrieval and syntactic encoding, and thus the double pressure of language and content processing.

In turn, the quantity of pauses was weakly or even not significantly correlated with the pause duration measures. Bao's study demonstrates that proficiency in English as an additional language contributed significantly to speed fluency rather than breakdown fluency, a finding that might be dependent upon how proficiency was measured. Perhaps, according to Bao, given the limited attentional

resources and time pressure, the learners most probably prioritized content accuracy over fluency. It is also important to emphasize that Bao's study also confirmed the fact that learners make pauses not only in the middle of clauses for word retrieval and syntactic encoding, but also at clause boundaries for concept formulation or content recall.

3. Method

3.1. Data collection

This study involved a native speaker of Spanish from Argentina, whose parents were also monolingual speakers of Spanish. At the time of the first data collection, the participant was 37 years old, had resided in Porto Alegre (state of Rio Grande do Sul, Brazil) for six years, and worked as a professor at the Federal University of Rio Grande do Sul (UFRGS). In the beginning of data collection, the participant had a pre-intermediate level of English, as assessed by the language course in which he was enrolled. Brazilian Portuguese was his L3.

Despite his daily immersion in a Brazilian Portuguese context due to his professional role as a university professor, the learner had not received specific formal instruction in Brazilian Portuguese phonetics. The study adopted a longitudinal approach to examine the participant's developmental trajectory in acquiring Brazilian Portuguese pronunciation. It followed the A-B-A methodological design, as proposed by Hiver and Al-Hoorie (2020), which allows for the observation of changes across three different phases: before a teaching intervention, during the intervention, and after the didactic intervention (which, in this paper, consisted of explicit instruction on the Brazilian Portuguese sound system and fluency strategies in this additional language).

The intervention consisted of explicit pronunciation instruction focused on Brazilian Portuguese, focusing on both segmental (vowels and consonants) and suprasegmental (rhythm, intonation, stress, and fluency) aspects. Instruction was delivered in one-to-one sessions between the learner and the first author. In all sessions, the Brazilian Portuguese pronunciation manual by Alves et al. (2017) was used. This book adopts a task-based approach to pronunciation teaching, inviting learners to engage with cultural aspects of Brazil as part of the learning process. All units also incorporated Celce-Murcia et al.'s

(2010) five-step framework for communicative pronunciation teaching, which includes theoretical explanation, guided practice, and corrective feedback.

Following Alves et al.'s (2017) manual, the participant received instruction on both segmental and suprasegmental aspects of Brazilian Portuguese (BP). As the lessons adopted a communicative, task-based approach, suprasegmental features were practiced and addressed (including through the provision of feedback) even in units primarily focused on segmental aspects.

The explicit instruction phase was conducted in 13 sessions, distributed between the 10th and 15th data collections. Our goal was to consciously, reflectively, and systematically promote the participant's perception and production of Brazilian Portuguese sounds. This is in line with Saito et al. (2018b), which confirms that explicit pronunciation training improves speech fluency.

Data collection sessions were held fortnightly, between October 2018 and September 2019, totaling 12 sessions and 24 audio files. The primary goal of these sessions was to collect samples of the participant's spontaneous speech, recorded using a voice recorder. The participant was invited to freely narrate a situation he had been through during the week or discuss whatever issue from work. Each session lasted approximately 10 minutes.

3.2. Data analysis

Before data analysis, each audio file was trimmed by removing the first and last minute of the recording to eliminate segments more prone to background noise, initial hesitations, or artificially constructed endings. With these procedures, 8 continuous minutes of speech from each speech sample were considered for analysis, ensuring greater uniformity and consistency in the comparison between audio recordings throughout the study.

The analysis of breakdown fluency began with the manual transcription of speech and labeling of silent pauses - moments of silence of at least 400 ms, in agreement with Derwing et al. (2004) -, and filled pauses (e.g., "né," "hum," "eh...") from the 24 speech samples.

After the labeling, which was performed using Praat (version 6.1.41), calculations were carried out to determine the pause rates.

These rates were calculated using distinct formulas based on Hanzawa (2021), dividing the pauses by the total number of syllables. Considering that the location of pauses indicates different stages of speech processing (Skehan et al., 2016), this study classified pauses as mid-clause pauses and end-of-clause pauses. The distinction between the beginning/end and middle of a clause was made based on intonational phrase boundaries, following the analysis of Brazilian Portuguese proposed by Tenani (2002).

Following the studies reviewed in the previous section (Hanzawa, 2021; Bao, 2023), breakdown measures were analyzed in terms of the quantities (frequency) and durations of filled pauses and silent pauses (both in mid-clause and end-of-clause contexts), totaling 8 distinct calculations.

To calculate the frequency of the pauses, the number of filled pauses and silent pauses was divided by the total number of syllables. To measure pause duration rates, the duration of silent and filled pauses (in milliseconds) was divided by the number of syllables. For these calculations, we considered phonetic instead of phonological syllables, ensuring a more precise measure of oral production.

3.3. Statistical procedures

This study employed two analytical methods grounded in the dynamic–complex paradigm: Peak Analysis with Monte Carlo Simulations and Change Point Analysis. Both types of analysis were conducted to examine potential changes in: (i) the duration of filled mid-clause pauses; (ii) the duration of filled end-of-clause pauses; (iii) the quantity of filled mid-clause pauses; (iv) the quantity of filled end-of-clause pauses; (v) the duration of silent mid-clause pauses; (vi) the duration of silent end-of-clause pauses; (vii) the quantity of silent mid-clause pauses; and (viii) the quantity of silent end-of-clause pauses.

The first method, Peak Analysis with Monte Carlo Simulations, aims to identify abrupt changes in the learner's developmental trajectory. As discussed in the literature review, within the framework of Dynamic Systems Theory, such events of local variability can be interpreted as moments of "chaos" in the system, potentially signaling learning, and may be followed by the emergence of a new production pattern over time. This methodological approach, as proposed by van

Dijk et al. (2011), consists of a resampling-based technique designed to distinguish these sudden changes from coincidental fluctuation in a variable behavior over time.

We started by identifying peaks in the data series of each breakdown index (e.g., duration of filled mid-clause pauses, quantity of filled mid-clause pauses, etc.). Following van Dijk et al. (2011), 'peaks' were operationalized as the maximum difference between two-point moving averages in the data series. These differences were calculated across different time windows, ranging from consecutive values (e.g. the difference between the averages of data points 1;2 and 2;3) up to six-step windows (e.g. the difference between the averages of data points 3;4 and 8;9). Both positive and negative differences were calculated, corresponding, respectively, to the increase or decrease in the variable's value over time.

Once all peaks were calculated, to test them against chance, we resampled the data with Monte Carlo simulations. Scores for each data series were resampled (with replacement) 10,000 times, and positive and negative peaks were calculated in each resampling iteration. We then calculated the number of times that the resampled differences were at least as high (for positive peaks) or at least as low (for negative peaks) as the differences registered in the original data series. If this value was met in only 5% of the resampling iterations, the respective peak was taken to be more than a coincidental fluctuation and was thus considered significant.

The second analytical method, Change Point Analysis, identifies changes in the pattern of variable behavior over time. In CDST research, this technique has traditionally been used to detect phase transitions in learning trajectories, which can also include gradual, small-sustained changes that are not properly captured by Peak Analysis with Monte Carlo Simulations (Alves, 2023).

Taylor (2000)'s *Change-Point Analyzer* was used in order to perform the analyses. The software first computes the cumulative sum of the data series, which is done by adding the difference between the score of data point *x* and the average score of all data points to the previous sum. The program then determines the difference between the lowest and highest value of the resulting cumulative sum and resamples (without replacing) the data series 1000 times. In each resampling interaction, the software calculates a new cumulative sum

trajectory and the associated difference in its highest and lowest value. By dividing the number of times the original difference between cumulative sum points was exceeded by the total number of resampling iterations, the program provides, as a percentage, the confidence level that a change occurred.

4. Results

4.1. Results of the Peak Analysis with Monte Carlo Simulations

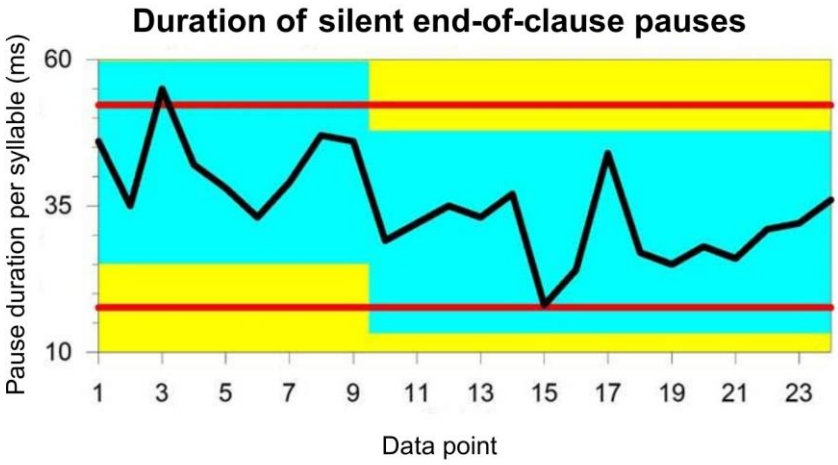
Monte Carlo Simulations were conducted for each of the eight parameters listed above. No significant peaks were identified. At first glance, this result may seem unexpected, as it suggests that the learner does not exhibit abrupt changes in their developing linguistic system. However, given that the learner has an advanced level of proficiency and regularly uses Portuguese in professional settings, the absence of abrupt jumps is easier to interpret: the learner's additional language system is likely more stable, and changes in production patterns may therefore emerge more gradually.

In sum, the results suggest that no abrupt changes occurred in the quantity or duration of filled and silent pauses across the 24 recording sessions. However, the absence of significant peaks does not rule out the possibility of phase shifts. In this regard, Change Point Analysis may reveal important aspects of the learner's developmental trajectory.

4.2. Results of the Change Point Analysis

The Change Point Analysis did not reveal any phase shifts in the developmental trajectory of filled pauses. This absence may also be attributed to the participant's high level of proficiency in Brazilian Portuguese, suggesting that the use of filled pauses has already reached a stable low pattern with no further fluctuations.

In contrast, a change point was identified in the duration of silent end-of-clause pauses, as shown in Figure 1.



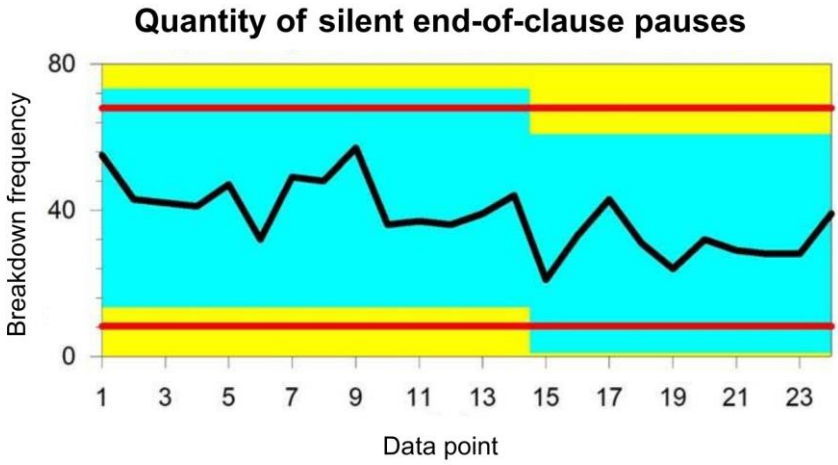
Confidence Level for Candidate Changes = 50%, Confidence Level for Inclusion in Table = 90%, Confidence Interval = 95%, Bootstraps = 1000, Without Replacement, MSE Estimates

Data point	Confidence interval	Conf. level	From	To	Level
10	(7, 13)	99%	42.333	30.467	1

Figure 1: Change Point Analysis of duration of silent end-of-clause pauses.

Figure 1 suggests that the phase shift occurred around the tenth recording session, with a confidence interval between sessions 7 and 13. This is classified as a level 1 change, the most robust level indicated by the software. The analysis indicates a decrease in the duration of silent end-of-clause pauses in the first and second developmental phases.

Change Point Analysis also revealed a phase shift in the quantity of silent end-of-clause pauses. This shift is illustrated in Figure 2.



Data point	Confidence interval	Conf. level	From	To	Level
15	(10, 18)	99%	43.286	30.8	1

Figure 2: Change Point Analysis of the quantity of silent end-of-clause pauses.

Figure 2 indicates that the shift in the quantity of silent pauses occurred after the decrease in their duration. This change likely took place around the fifteenth recording session, with a wide confidence interval suggesting it may have occurred between sessions 10 and 18. Once again, this is classified as a level 1 change, the highest level of robustness identified by the software. This phase shift is characterized by a reduction in the rate of silent pauses. This result also suggests that the learner is developing more fluent speech, with fewer silent end-of-clause pauses.

In sum, although no changes were observed in the measures related to filled or to silent mid-clause pauses, the Change Point Analysis revealed a decrease in the duration of silent end-of-clause pauses, followed by a reduction in their quantity. The next section discusses the sequencing of these two phase shifts.

5. Discussion

This study employed two distinct statistical methods to examine longitudinal changes in fluency: Peak Analysis with Monte Carlo

Simulations and Change Point Analysis. The first method aims to detect abrupt shifts over time, understood as moments of "chaos" that may signal the onset of system reorganization. The second method identifies developmental phase shifts regardless of whether they stem from periods of instability or emerge more gradually. The combined use of both approaches is particularly valuable, as argued by Alves (2023), since they offer complementary insights into the learner's developmental trajectory.

Unexpectedly, no significant peaks were found in the learner's developmental trajectory. This result may be explained by the learner's high level of proficiency, which suggests greater stability in his L2 system. Nevertheless, it was anticipated that the pronunciation instruction provided between sessions 10 and 15 might have triggered developmental changes and system reorganization, including fluency measures. In this sense, the task-based approach adopted, which addressed both segmental and suprasegmental aspects, may have contributed to the development of suprasegmental features associated with utterance fluency, leading the learner to exhibit gradual, non-abrupt changes over time. In other words, although progressive (and slower) changes were observed, the instructional period did not result in abrupt, sudden shifts in the learner's breakdown fluency, reinforcing the relative stability of the learner's advanced L2 system.

In contrast, the Change Point Analysis revealed phase shifts in the learner's developmental system with respect to silent end-of-clause pauses. No changes were observed in filled pauses, indicating that this strategy had already become a stable feature of the learner's speech. Likewise, no changes were found in mid-clause pauses. It is noteworthy that the changes occurred specifically at utterance boundaries. Silent and filled mid-clause pauses are typically associated with phonological, lexical, and syntactic decoding, whereas pauses at utterance boundaries are more closely tied to conceptualization and content planning (Bosker et al., 2013; Saito et al., 2018a, 2018b; Hanzawa, 2021). The absence of changes in mid-clause pauses may reflect the learner's advanced proficiency, as he no longer relies on such strategies to maintain speech fluency. Conversely, the observed changes in end-of-clause pauses suggest that there was still room for development in this area, reflecting a shift toward more fluent speech.

It is also important to consider the time sequence in which these two phase shifts occurred. The first change (shorter silent pauses) was observed in session 10, followed by a reduction in their quantity in session 15. This ordering has been reported in previous research (Hanzawa, 2021), reflecting a developmental strategy: initially, the duration of longer, content-related pauses is reduced, which eventually leads to fewer silent pauses exceeding 400 ms.

In light of the instructional context of this study, it is relevant to associate the timing of the phase shifts with the period in which explicit pronunciation instruction was provided. The reduction in pause duration occurred at the onset of the instructional period (session 10), while the decrease in pause quantity took place at its conclusion (session 15). It is therefore plausible that pronunciation instruction played some role (albeit indirect) in shaping the learner's speech processing and contributed to fluency development. According to Gordon and Darcy (2022), pronunciation instruction that integrates both segmental and suprasegmental features has a direct impact on learner fluency, which appears to be the case for the participant in this study. These findings also align with those of Saito et al. (2018b), who reported that learners exposed to explicit pronunciation instruction show improvements in fluency.

Finally, the identification of phase shifts through Change Point Analysis, combined with the absence of significant peaks in the Monte Carlo-based Peak Analysis, suggests a gradual and cumulative (rather than abrupt) change in the breakdown fluency measures examined. This pattern may characterize learners with high proficiency in the additional language, whose productions, while relatively stable, remain susceptible to more subtle developmental changes over time.

6. Conclusion

This study examined the development of breakdown fluency in an advanced Argentine learner of Brazilian Portuguese. The analyses revealed that, despite the learner's high level of proficiency, developmental changes still occur in silent end-of-clause pauses. These modifications may have been reinforced by the explicit pronunciation instruction provided between data collection sessions

10 and 15. Rather than abrupt, the changes observed were gradual, reflecting the more stable nature of advanced L2 systems.

As a next step in this research project, we will continue to investigate the learner's developmental strategies related to speed fluency and repair fluency. We believe that analyzing all three constructs will offer a more comprehensive view of the learner's trajectory toward increasingly fluent speech. In this regard, the combined application of Peak Analysis with Monte Carlo Simulations and Change Point Analysis may prove to be a valuable methodological approach.

We believe this study may shed light on several areas of research in Applied Linguistics, including: (i) the definition and operationalization of the construct of "fluency," particularly within the framework of utterance fluency; (ii) the longitudinal tracking of learner development and the application of dynamic–complexity-based methods to longitudinal data; (iii) the developmental study of highly proficient learners, whose language systems tend to be more stable and less susceptible to immediate change; (iv) the mapping of developmental strategies related to fluency; and (v) discussions on the role of formal instruction in the development of fluent speech. We hope this study serves as an invitation to future researchers interested in this underexplored area of investigation in the international research context.

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