PARTS OF SPEECH AND FILLED PAUSES IN SCHIZOPHRENIA

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▪ ABSTRACT: The aim of this work is to compare filled pause length and its distribution across parts of speech between two groups: patients with schizophrenia and people without this condition. The two hypotheses of this work are: I) there is a significant difference regarding filled pauses length between patients and no patients II) there is a relevant difference of length among filled pauses occurring right before a part of speech between the two groups. Methodologically, we compare 112 filled pauses taken from 13 audios of C-ORAL-ESQ (Rocha, 2019), a representative spoken corpus of patients with schizophrenia and 11 audios from C-ORAL-BRASIL I (Raso; Mello, 2012), which is a representative spoken corpus of informal Brazilian Portuguese. After data cleaning and treatment in the Python environment, we tagged utterances from both corpora with a tagger that we have built and trained in Mac-Morpho (Aluísio *et al*., 2003). The results show that there is a significant difference (p= 0,003) between filled pauses length between patients and no patients. Regarding parts of speech, we found that people with schizophrenia perform filled pauses larger than no patients, except for adverbs, with significant differences in filled pauses found right before personal pronouns.

▪ KEYWORDS: prosody; computational linguistics; Python.

Introduction

Pause is a common phenomenon in speech and it can be grouped into two major classes: filled pauses and silent pauses. The first class corresponds to a segment lengthening during speech, usually without any meaning, while the second class concerns the silent intervals in which a speaker does not produce any vocalization at all (Esposito *et al*,. 2007; Rose; Watanabe, 2019; Kosmala; Crible, 2022; Williams, 2022; Wiklund, 2023).

Some investigations concerning this issue in schizophrenic patients have been reported (cf. Silverman, 1973; Clemmer, 1980; Mahrer; Manschreck; Molino, 1983; Alpert; Clark; Pouget, 1994; Spitzer *et al*., 1994; Barch; Berenbaum, 1997; Rapcan *et al*., 2010; Martínez-Sánchez *et al*., 2015; Figueroa; Martínez, 2018; Gosztola *et al*.,

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2018; Çokal *et al*., 2019; León Bustos, 2020, Parola *et al*., 2020, among others). These works remark how different pause frequency and its duration appear in schizophrenia compared to normal subjects. In a nutshell, it is assumed that people with this mental illness make more pauses, which also have a larger length than normal subjects.

This paper aims to shed some light on this issue by comparing filled pauses length between two groups, schizophrenic and normal subjects, while considering their grammar context of occurrence, that is, the part of speech context where the filled pause occurs. Initially, we present our theoretical background. In sequence, we present our methodology for testing our two hypotheses. In the last part of the paper, we present our results and our discussion regarding this issue.

Theoretical background

Although filled and silent pauses are clearly divided into two major classes, they are often indistinctively referred to when used to make assumptions concerning disfluencies in schizophrenia. Alpert, Kotsaftis and Pouget (1997), for instance, claim that patients with a high score in negative symptoms perform more pauses – the filled or the silent ones – with larger length, either when comparing to patients with less scores in negative symptoms or to normal subjects.

Feldstein and Jaffe (1963) compare filled pauses frequency between two groups made of 30 patients with schizophrenia and 30 controls. In this experiment, participants had to pay attention to four figures: two of them described as "affective" and two as "non affective". Thereafter, subjects had to tell what they remember about the stories referred to by the figures. The results suggest that schizophrenics made more filled pauses than the controls. The authors claim that any person has a "distribution" of behavioral and linguistic answers that are activated in some environments (cf. Feldstein; Jaffe, 1963). More filled pauses frequency in the subjects with this mental illness could suggest that their linguistic distribution is "wider and have different probability structures than the language distributions of non schizophrenics" (Feldstein; Jaffe, 1963, p. 778). Nonetheless, Feldstein and Jaffe do not share more details about what would be the so-called linguistic distribution, nor measure pause length between the two groups.

Actually, some researchers claim quite the opposite regarding filled pauses frequency in schizophrenic patients. Matsumoto *et al*. (2013), for example, conducted a procedure where 6 patients with schizophrenia and 6 controls had to describe Rorschach inkblots, which were viewed through a mirror. During 21 minutes, considering 3 minutes for each inkblot, participants had to speak about what they were seeing. The results showed that patients with schizophrenia made much less filled pauses than the controls. According to the authors, filled pauses were associated with discourse monitoring. Hence, as patients made more pauses, it could suggest that they control less the quality of what they are speaking.

Pauses and part of speech

There is a substantial lack of studies comparing part of speech distribution right before[1] pauses, either for its frequency or its length.

Maclay and Osgood (1959), for instance, used a sample with 163 utterances taken from a university conference, with an average of 309 words. Among other variables, the authors were targeting the distribution of filled and silent pauses regarding parts of speech, that is, before which parts of speech pause usually occurs. In 778 occurrences of filled pauses, 418 were before a lexical word, while 360 were before a functional word (p-value=0.02 in Chi-Square test).

Additionally, Maclay and Osgood point out that filled pauses happened more often in the border of longer phrases, while silent pauses in the word borders. To the authors, a filled pause could indicate where the speaker seemed to decide what to say, and lexical words could be harder to process. However, the linguists remark that this fact is not always due to a filled pause, as data showed that subjects could also make linguistic choices and decisions before silent pauses.

These findings were criticized by Cook (1971). This author disagrees with the data balancing made by Maclay and Osgood. Cook also highlighted that he found different results in his experiment. To Cook (1971), Maclay and Osgood did not use a representative sample, besides, they ignored relative frequency of parts of speech, that is, these last two linguists have assumed that parts of speech were equally frequent in their samples.

In his study, Cook used a transcription drawn from an audio made during an interview with 11 speakers. After studying them, the researcher claims that both lexical and functional parts of speech have equal probability to happen right before a filled pause. Moreover, the linguist underscores that pronouns, which he considers as a lexical part of speech,[2] occur more than nouns and verbs right before pauses. Further, the author emphasizes the high frequency of pauses before conjunctions and claims that a filled pause might occur at the beginning of a sentence until its third word.

Befi-Lopes, Nuñes and Cáceres (2013) investigated silent pauses length before parts of speech with 30 children with Specific Language Impairment (SLI) between 4;0-6;11 years old. The authors pulled the data from tasks where the subjects had to look at 4 pictures that could make a story, which they were supposed to tell. After having the transcriptions and part of speech tagging done, the researchers measured the time duration of pauses before nouns, adjectives, verbs, conjunctions, prepositions and pronouns.

The linguists found shorter pause duration before nouns in both groups. In turn, the larger pauses were detected before conjunctions. According to Befi-Lopes, Nuñes

[1] The part of speech that immediately precedes a pause.

[2] Cook (1971) considers pronouns as belonging to the lexical class, probably because he was replicating Maclay and Osgood's (1959) study, who considered them as lexical words, except possessive pronouns, which were classified as function words. Maclay and Osgood's choice, in turn, is based on Fries' (1952) proposal, to which we did not have access.

and Cáceres (2013) nouns are the first part of speech children learn and they are deeply rooted in the lexicon. Consequently, nouns would be easier to produce. On the other hand, conjunctions are function words that demand greater linguistic complexity in order to elaborate a sentence, as this part of speech signs interdependence relations and morphosyntactic dependencies that were more difficult for children subjects to make it through. For this reason, larger pauses before conjunctions than nouns would be acceptable.

Albeit the results discussed above are different, the role of part of speech in affecting the duration of filled pauses is remarked by the authors. Though Cook (1971) treated pronouns as lexical words[3] – and had found more of this part of speech before a filled pause – the linguist also points that there was significant frequency of this phenomenon before conjunctions. This result was similar to the one found by Befi-Lopes, Nuñes and Cáceres (2013), which showed that there is a longer duration of silent pauses before conjunctions. It is convenient to say as well that Maclay and Osgood (1959) found more filled pauses before lexical words. However, authors' methodology was later criticized by Cook (1971), what would jeopardize such result.

To sum up, there are investigations concerning the role of parts of speech before pauses, both silent or filled ones, though the conclusions drawn from this issue are different. In our paper, it is important to pay attention to how filled pauses behave before parts of speech, mainly the functional ones, in order to explore what has already been reported.

Lexical and functional parts of speech

Terminology regarding parts of speech in Portuguese were based on the work of the Greek grammarian Dionysius Thrax, in the 1st century BC. Even two millennia after, there are several authors who adopted his approach, which has been paramount and almost unchanged in Brazilian grammar tradition (cf. Vieira, 2018).

Far from this agreement is the debate in Linguistics concerning not only lexicon and its parts of speech, but also what a word might be. Hence, it is extremely controversial the definition of word and its categorization by one or more criteria (cf. Haspelmath, 2011). Likewise, this divergence is present in grouping lexicon into parts of speech. Even in a particular language, that is, without any translinguistic and typological issue taken into account, the status of some lexical items has been questioned, that is, whether they belong to a part of speech or another, or even the existence of some of them.[4]

[3] In this study, we consider pronouns as part of functional classes, as will be shown posteriorly.

[4] Basílio (2021, p. 62-63, our translation for [existem muitos problemas relativos à definição de advérbio como classe]), for instance, mentions that "there are many problems related to the definition of adverb as a class". Perini's (2021) work discusses in detail the problem of the taxonomy of linguistic units, focusing specifically on the delimitation of these units into word classes. The author also questions whether adverbs are really a class.

According to Haspelmath (2012), since 1990, parts of speech have been divided into two categories: the lexical and the functional ones. Following Vitral (2017), lexical parts of speech are defined with having an external meaning, specifically, they refer to beings, events, actions, quantities, etc. that occur or are part of the world. On the other hand, functional parts of speech have an internal meaning, that is, they associate themselves to the lexical ones so they can compose, detail or make the meaning of the last ones clearer. The author categorizes part of speech as follows.

Chart 1 – Lexical and functional classes

Lexical words	*Function words*
Noun	Inflection
Verb	Determiner
Adjective	Pronoun
Adverb	Preposition
Numeral	Conjunction

Source: Adapted from Vitral (2017, p. 111).

The study conducted in our paper has considered Vitral's classification, as his claims are drawn from a recent Brazilian Portuguese grammar, as well as his division into lexical and functional parts of speech are overspread and well known in Linguistics. Besides, theoretically assuming these two major classes are widely used in investigations relating to speech of normal subjects or individuals with some kind of atypical condition or mental illness (cf. Mohr; Pulvermüller; Zaidel, 1994; Howell; Au-Yeung; Sackin, 1999; Turner; Tjaden, 2000; Bird; Franklin; Howard, 2002; Bell *et al.,* 2009; Mackenzie; Curtin; Graham, 2012; Juste; Sassi; Andrade, 2012; Baese-Berk *et al.*, 2019, among others).

In our analysis, Mac-Morpho[5] classes were considered as belonging to one of these two macroclasses,[6] taking into account the typology presented by Vitral (2017). It is worth mentioning that the inflection class was not used because the analysis considered the items in their entirety, that is, not decomposed into smaller parts. Thus, verb inflection did not count as a separate category in our analysis. Lastly, determiners' class is broad and encompasses, for instance, articles, which were therefore considered as a function class.

[5] Although the functioning of words is often fuzzy with regard to their organization in certain classes, we believe that it is necessary to start from some point in the computational task. Therefore, we assume the words' classification of Mac-Morpho and the Vitral's (2017) typology for their categorization into macroclasses.

[6] We have chosen to count auxiliary verbs in the category of function words because they encode intrinsically grammatical/functional features, such as number, tense, and aspect. Such verbs commonly originate from a linguistic change process called grammaticalization (cf. Heine, 1993; Ribeiro, 1993; Kuteva, 2001; Coelho, 2006, 2021; Narrog; Heine, 2011; Vitral; Coelho, 2019).

Methodology

Hypotheses

This research has two null hypotheses and, therefore, two alternative hypotheses as follows:

Null hypothesis 1: Schizophrenic patients and normal subjects make pauses with no significant difference in duration.

Alternative hypothesis 1: There is a significant difference between pause duration between these two groups. In this case, $p < 0.05$.

Null hypothesis 2: Both groups make filled pauses with similar duration before different parts of speech.

Alternative hypothesis 2: The duration of a filled pause before different parts of speech present significant differences between the patients and the controls. In this case, $p < 0.05$.

Corpora

The corpora used in this paper were C-ORAL-ESQ (Rocha, 2019)[7], which is representative of patients with schizophrenia, and C-ORAL-BRASIL I (Raso; Mello, 2012)[8], which represents informal spoken Brazilian Portuguese. We selected 13 transcriptions from C-ORAL-ESQ and 11 from C-ORAL-BRASIL. Usually, the audios from C-ORAL-BRASIL are wider and have more words, so this difference between samples is acceptable.

We have used monologues from C-ORAL-BRASIL I, which are mainly monologic audios, where a narrator tells a story to a listener who barely speaks during the interaction. Interactions in C-ORAL-ESQ, in turn, were recorded in a psychiatric appointment between patients with schizophrenia, with occasional familiar members accompanying them, and their psychiatrist. Though the first corpus is not a control of the second, they are both representative of their populations. We understand corpus representativeness as a stratified distribution of its population and linguistic phenomena

[7] This corpus is still being compiled, although the recording sessions were interrupted for a certain period due to the COVID-19 pandemic. It is being planned 40 recordings with an average of 1,500 words each, which will result in a total of approximately 60,000 words. The recordings refer to the interaction between doctor and patient during psychiatric medical appointments in a hospital located in the city of Belo Horizonte/MG. The architecture of this corpus, in terms of transcription, segmentation and annotation parameters, will follow the same criteria used in the C-ORAL-BRASIL I corpus (Raso; Mello, 2012).

[8] C-ORAL-BRASIL I can be accessed for free at http://www.c-oral-brasil.org/db-com, as well as at https://www.linguateca.pt/acesso/corpus.php?corpus=CORALBRASIL.

for which this corpus aims to be representative. This means that corpus samples must represent both social and linguistic varieties of their population (BIBER, 1993, p. 242-246).

In our sample, each group, patients and normal subjects, is made up of 7 men and 4 women, which range from 18 to over 60 years old.

Data extraction and balancing

Data were collected from transcriptions in xml format, which were available for both corpora. Then, a program was coded in Python language that clean and treat data, make parts of speech tagging with 92.24% accuracy and extract data we were interested in automatically. The tagger was trained in Mac-Morpho (Aluísio *et al*., 2003) and readapted for oral data by text mining and spelling normalization by one of the authors.[9]

Figure 1 – Grammatical classes tagger

utterances POS	word before	class before	pause length
PAUSA			0
[('esse', 'PROADJ'), ('rapaz', 'N…	esse	PROADJ	0.331
PAUSA			0
[('abriu', 'V'), ('um', 'ART'), (…	abriu	V	0.486

Source: Authors' elaboration.

To sum it up, the program identifies the location of a filled pause, which was previously aligned in WinPitch (Martin, 2004) and, after treating and tagging the data, finds what word or part of speech is before a filled pause, which has also its length measured. In Figure 1, we can see that "esse" ('this') and "abriu" ('opened') occur right before a filled pause (PAUSA). For this reason, the corresponding value for the column "word_before" is filled with these words. As in this case we have an adjective and a verb, these words are tagged as PROADJ and V and have the duration of the filled pause before them measured (0.331 for the first and 0.486 for the second one).

In total, the transcriptions have 38,733 words, while the subcorpus built for comparison, which was made by utterances where a filled pause, has 1,072, with 61 filled pauses per corpus.

From this subcorpus, we extract and compare:

a) The length of 61 filled pauses of each corpus.
b) The frequency of parts of speech before a filled pause.
c) The frequency of lexicon before a filled pause.

[9] https://github.com/carlosjuniorcosta1

d) The length of a filled pause before parts of speech.
e) Statistical relevance tests, according to the distribution and sample size – Mann Whitney U for non-normal distributions or T-test for normal distributions.

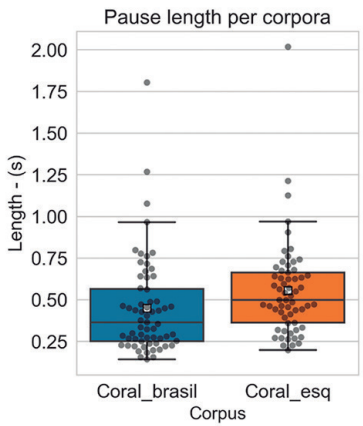
Finally, we have made a statistical significance test according to sample size and its distribution. In this case, we used Mann Whitney's U Test for non-normal samples and T-Test for normal distributions.

Data analyses

Total pause length in both groups

The comparison of pause length, which does not consider parts of speech in this moment, is shown in Figure 2. The black dots demonstrate the duration of each of 112 filled pauses. The boxes, in turn, have their height determined by the concentration of these black dots.

Figure 2 – Pause length per corpora



Source: Authors' elaboration.

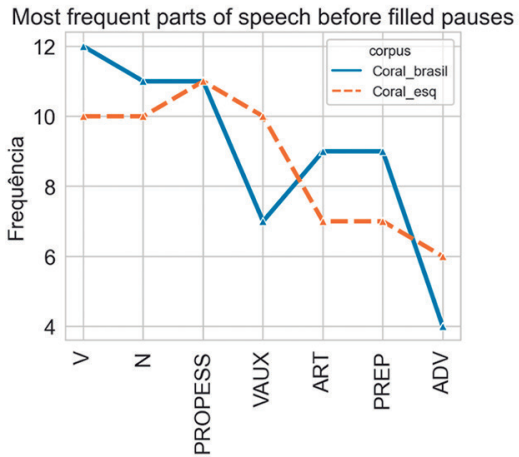
We can notice that most of the filled pauses from C-ORAL-ESQ are placed in a higher position in y axis. Due to this reason, the mean duration of filled pauses (represented by the white square) in C-ORAL-ESQ are higher (0.554 s, std = 0.287) than C-ORAL-BRASIL I (0.449 S, std= 0.298). This difference is statistically relevant (p=0.003 in Mann Whitney U Test), which indicates that schizophrenic patients perform filled pauses with larger duration than normal subjects.

As $p<0.05$, we refuse the null hypothesis 1 and we also accept the alternative hypothesis 1. For this reason, we suggest that people suffering from this mental illness perform larger filled pauses in spontaneous speech than people without this condition.

Parts of speech and lexicon frequencies before filled pauses

The first ascertainment we can make about parts of speech (Figure 3) before filled pauses in both groups is that there is no predominance of lexical over functional items. It is important to notice that verbs, personal pronouns and nouns were the most frequent parts of speech in both groups, with a quite even distribution. From auxiliary verbs on, the frequency lines of each sample follow a different trajectory and we cannot find any further pattern.

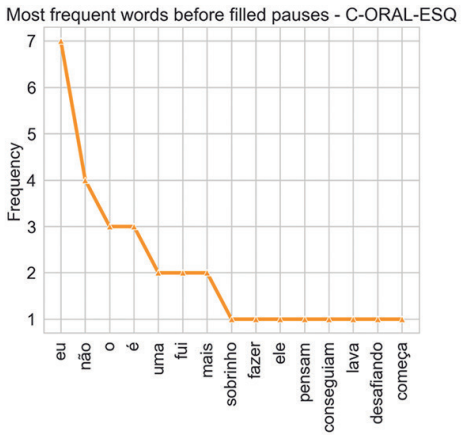
Figure 3 – Most frequent parts of speech before filled pauses



Source: Authors' elaboration.

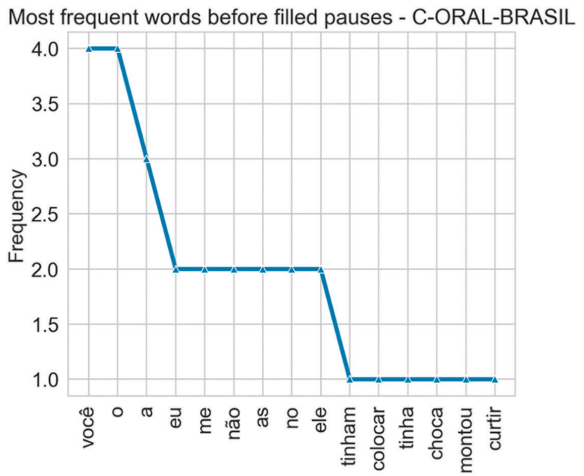
Regarding lexicon distribution, we found that both groups had almost the same number of different words, namely 47 in C-ORAL-BRASIL I and 45 in C-ORAL-ESQ. Despite the unevenness in the line, as in auxiliary verbs (VAUX) and prepositions (PREP) between groups, this difference is not statistically relevant, as will be exhibited later ($p = 0.568$ for VAUX and $p = 0.430$ for PREP).

Figure 4 – Most frequent words before filled pauses: C-ORAL-ESQ



Source: Authors' elaboration.

Figure 5 – Most frequent words before filled pauses: C-ORAL-BRASIL



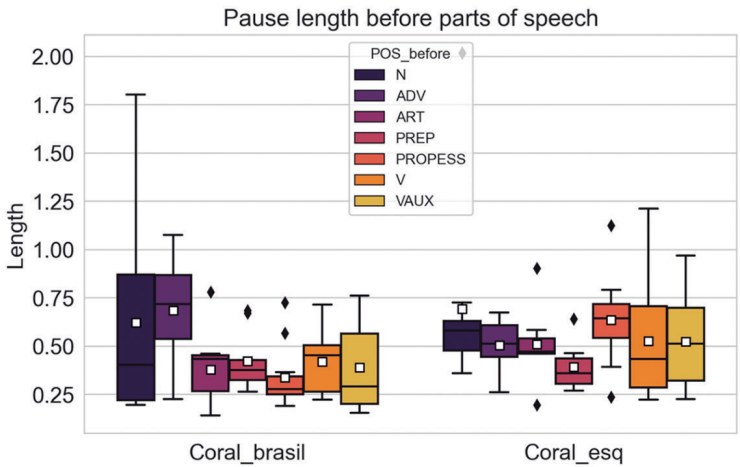
Source: Authors' elaboration.

Except for the word "*não*" ('no', in Portuguese), only functional words are placed in the first ten positions, and there is a long line with mostly lexical words that occurred just once. Although function words are naturally more frequent than lexical words in texts, it is actually interesting that this is also true right before a filled pause in both corpora.

Length of filled pauses before parts of speech

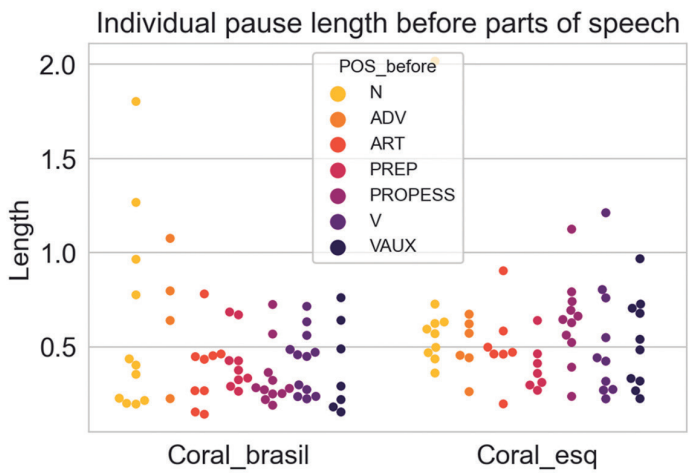
The boxplot in figure 6 shows the duration distribution of parts of speech, while in figure 7 we can see each of these filled pauses with their corresponding length.

Figure 6 – Pause length before parts of speech



Source: Authors' elaboration.

Figure 7 – Individual pause length before parts of speech



Source: Authors' elaboration.

In figure 6, we can see that the mean duration of pauses before parts of speech are larger in C-ORAL-ESQ than in C-ORAL-BRASIL I, excepting by adverbs. These measures also can be seen in table 1. The median, which is less sensitive to outliers that could push the mean up or down, is higher in C-ORAL-ESQ than C-ORAL-BRASIL I, except by verbs and adverbs. These results suggest that schizophrenic patients perform larger filled pauses before most parts of speech than the normal subjects.

Table 1 – Statistic summary of the data

classe_diante	corpus	count	mean	median	std	max	min	p_value
ADV	Coral_brasil	4	0.685	0.718	0.355	1.076	0.225	0.591
ADV	Coral_esq	4	0.58	0.597	0.093	0.673	0.455	0.591
ART	Coral_brasil	7	0.357	0.267	0.223	0.781	0.142	0.208
ART	Coral_esq	7	0.511	0.471	0.21	0.904	0.197	0.208
N	Coral_brasil	10	0.641	0.378	0.553	1.803	0.196	0.344
N	Coral_esq	10	0.693	0.582	0.478	2.017	0.361	0.344
PREP	Coral_brasil	7	0.349	0.334	0.064	0.427	0.264	0.430
PREP	Coral_esq	7	0.393	0.359	0.128	0.64	0.269	0.430
PROPESS	Coral_brasil	11	0.339	0.279	0.163	0.725	0.19	*0.007*
PROPESS	Coral_esq	11	0.637	0.645	0.227	1.125	0.237	*0.007*
V	Coral_brasil	10	0.432	0.454	0.171	0.715	0.224	0.407
V	Coral_esq	10	0.528	0.433	0.313	1.212	0.224	0.407
VAUX	Coral_brasil	7	0.391	0.291	0.241	0.761	0.154	0.568
VAUX	Coral_esq	7	0.46	0.484	0.195	0.705	0.225	0.568

Source: Authors' elaboration.

In spite of these findings, the only statistically significant difference between the two groups occurs in personal pronouns (p=0.007). This suggests that patients suffering from schizophrenia made larger filled pauses before personal pronouns. The large number of verbs before filled pauses, which could sign new sentences, as well as nouns and personal pronouns, which could mark a subject function, allows us to hypothesize that these filled pauses may occur before the border of new sentences. However, there is a lot of reformulation before and after a filled pause in our data, so that would demand a specific qualitative analysis, as in spoken Brazilian Portuguese an utterance does not always correspond to a sentence, and there are even utterances with no verbs.

Due to the fact that $p < 0.05$, we can refuse the null hypothesis 2 and we can also accept the alternative hypothesis 2. Hence, the length of a filled pause before parts of speech, specifically the personal pronouns, presented a statistically significant difference between the two groups, with larger pauses for schizophrenic patients before personal pronouns.

Discussion

Our results suggest that considering parts of speech before a filled pause, as well as their duration, and not only their frequency is relevant and can shed some light on the study of this linguistic phenomenon. When a filled pause is analyzed considering just its duration, it has been observed to have a significant difference (p=0.003), as it was already suggested in Alpert, Kotsaftis and Pouget (1997). In this case, it is important to remark that these authors were also referring to silent pauses, which is different from our results.

Additionally, our study can suggest that the larger duration of filled pauses of patients converges with the fact that schizophrenic patients have more disfluencies in speech, besides the duration of a filled pause, than normal subjects. When there is more contextualization of a filled pause, as before of a specific part of speech, the substantial difference of duration between the two groups is reduced. In our view, this occurs mainly because pause contextualization depends on a lot of variables, as there are a variety of parts of speech, and this would demand us a larger research corpus for precision and generalization.

At this moment, we can remark that patients suffering from schizophrenia made filled pauses with almost twice the length than normal subjects before personal pronouns. It is important to say that some investigations have reported that schizophrenic tend to have cognitive impairments that could reflect in work memory, attention and language processing, which could sign also a condition to process context, as "[...] each of these domains requires the active representation of such context information for effective function" (Barch; Caesar, 2012, p. 28). Thus, this impact in linguistic production is actually expected. Our study found that this impact occurs before personal pronouns.

The major part of data suggests that filled pauses occur before singular first-person pronouns. We claim that this can indicate some difficulty to update the person's ego deixis in discourse – which is defined as "[...] conceive of oneself as a coherent and consistent living subject with a stable but flexible personal identity, delimited from others (non-self) [...]" (Scharfetter, 2008, p. 52), since filled pauses can be a disfluency sign (Barr, 2003) and singular first-person pronoun is a grammatical manifestation of ego in the deictic person system (Rauh, 1983). Such specific linguistic impact is supported by the fact that schizophrenia promotes a deep fragmentation of ego, which can lead to its dissociation or even to its destruction (cf. Scharfetter, 2008; Leube; Whitney; Kircher, 2008; Boeker *et al*., 2006).

Final remarks

Schizophrenic patients and normal subjects made filled pauses before similar parts of speech, with similar distribution of frequency in the most frequent ones (verbs, personal pronouns and nouns). The most recurrent lexicon before filled pauses was

mainly of function words, as personal pronouns and articles. Content words were also present, as verbs and nouns, but, as already expected, with different types. The number of distinct words between the two groups is minimum (47 for C-ORAL-BRASIL I and 45 for C-ORAL-ESQ), something that could be related to the fact that functional parts of speech, as articles, prepositions and personal pronouns, naturally count with less types, which rises the frequencies of their groups.

The most significant difference relates to the length of these pauses. Without considering their part of speech context, we found that schizophrenic patients performed filled pauses significantly larger than normal subjects. Considering part of speech context before filled pauses, we found that patients performed pauses with higher means and even medians than normal subjects, though the only statistically relevant result is in the context before personal pronouns.

This result was associated with a possible difficulty in updating the person deixis in terms of the ego, considering that a filled pause is a type of disfluency and that the first person singular pronoun is a grammatical feature of the ego in the person deictic system. This would probably occur due to the fact that schizophrenia promotes a fragmentation of the ego in the patients, which includes the very loss of the contact with the reality around them.

These considerations pave the way for future investigations, which may explore a comparison between verbs inflected in the first person singular, without its corresponding personal pronoun, and verbs inflected in other grammatical persons, equally without marking of the corresponding personal pronouns in front of filled pauses, in order to verify if they occur more frequently and with longer duration in front of verbs inflected in the first person singular. Such work could corroborate the hypothesis on the relationship between the deictic system (grammatical correlate) and ego fragmentation (neurological correlate of the mental disorder).

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- *RESUMO: O objetivo deste trabalho é comparar a duração e distribuição de pausas preenchidas, que possuem um segmento vocalizado, em relação a classes de palavras de pacientes com esquizofrenia e pessoas sem essa condição. As hipóteses deste trabalho são: I) existe diferença significativa na duração de pausas preenchidas entre pacientes e não pacientes II) existe diferença significativa entre a duração de pausas diante de certas classes de palavras entre os dois grupos. Metodologicamente, são comparadas 112 pausas preenchidas, extraídas de 13 áudios do C-ORAL-ESQ (Rocha, 2019), corpus representativo da fala de pacientes com esquizofrenia e 11 áudios do C-ORAL-BRASIL I (Raso; Mello, 2012), corpus representativo do português brasileiro falado informal. Para classificar as classes de palavras, foi utilizado um etiquetador do tipo brill tagger treinado no Mac-Morpho (Aluísio et al. 2003) com 92,24% de acurácia e adaptado para dados orais por meio de normalização ortográfica em linguagem*

Python. Os resultados mostram que há diferença estatística significativa (p = 0,003) entre a duração de pausas preenchidas entre pacientes e não pacientes. Em relação às classes de palavras, foi observado que os pacientes realizam pausas preenchidas maiores na maioria das classes de palavras, exceto em advérbios, mas há diferença relevante apenas entre pausas diante de pronomes pessoais (p = 0,007).

- *PALAVRAS-CHAVE: prosódia; linguística computacional; Python.*

REFERENCES

ALPERT, M.; CLARK, A.; POUGET, E. The syntactic role of pauses in the speech of schizophrenic patients with alogia. **Journal of Abnormal Psychology**, [Ann Arbor], v. 103, n. 4, p. 750-757, 1994. DOI: 10.1037//0021-843x.103.4.750.

ALPERT, M.; KOTSAFTIS, A.; POUGET, E. At Issue: speech fluency and schizophrenic negative signs. **Schizophrenia Bulletin**, [College Park], v. 23, n. 2, p. 171-177, 1997. DOI: 10.1093/schbul/23.2.171.

ALUÍSIO, S.; PELIZZONI, J.; MARCHI, A.; OLIVEIRA, L.; MANENTI, R.; MARQUIAFÁVEL, V. An account of the challenge of tagging a reference corpus for Brazilian Portuguese. *In*: MAMEDE, N. J.; TRANCOSO, I.; BAPTISTA, J.; NUNES, M. G. V. (ed.). **Proceedings of the 6th International Conference on Computational Processing of the Portuguese Language**. Berlin; Heidelberg: Springer, 2003. p. 110-117. DOI: https://doi.org/10.1007/3-540-45011-4_17.

BAESE-BERK, M.; DILLEY, L.; HENRY, M.; VINKE, L.; BANZINA, E. Not just a function of function words: Distal speech rate influences perception of prosodically weak syllables. **Attention, Perception & Psychophysics**, [Berlim], v. 81, p. 571-589, 2019. DOI: https://doi.org/10.3758/s13414-018-1626-4.

BARCH, D.; BERENBAUM, H. Language generation in schizophrenia and mania: the relationships among verbosity, syntactic complexity, and pausing. **Journal of Psycholinguistic Research**, [Nova Iorque], v. 26, p. 401-412, 1997. DOI: 10.1023/a:1025026019107.

BARCH, D.; CAESAR, A. Cognition in schizophrenia: core psychological and neural mechanisms. **Trends in Cognitive Sciences**, [Kidlington], v. 16, n. 2, p. 27-34, 2012. DOI: 10.1016/j.tics.2011.11.015.

BARR, D. Paralinguistic correlates of conceptual structure. **Psychonomic Bulletin & Review**, [Berlim], v. 10, n. 2, p. 462-467, 2003. DOI: https://doi.org/10.3758/BF03196507.

BASÍLIO, M. **Formação e classes de palavras no português do Brasil**. 3.ed. São Paulo: Contexto, 2021.

BEFI-LOPES, D.; NUÑES, C.; CÁCERES, A. Correlação entre vocabulário expressivo e extensão média do enunciado em crianças com alteração específica de linguagem. **Revista CEFAC**, [São Paulo], v. 15, n. 1, p. 51-57, 2013. Available in: http://www.redalyc.org/articulo.oa?id=169325724006. Access on: 09 ago. 2023.

BELL, A.; BRENIER, J.; GREGORY, M.; GIRAND, C.; JURAFSKY, D. Predictability effects on duration of content and function words in conversational English. **Journal of Memory and Language**, [Amesterdã], v. 60, n. 1, p. 92-111, 2009. DOI: https://doi.org/10.1016/j.jml.2008.06.003.

BIBER, D. Representativeness in corpus design. **Literary and Linguistic Computing**, [Oxford], v. 8, n. 4, p. 243-257, 1993. Available in: http://otipl.philol.msu.ru/media/biber930.pdf. Access on: 09 ago. 2023.

BIRD, H.; FRANKLIN, S.; HOWARD, D. 'Little words' – not really: function and content words in normal and aphasic speech. **Journal of Neurolinguistics**, [Amesterdã] v. 15, n. 3, p. 209-237, 2002. DOI: https://doi.org/10.1016/S0911-6044(01)00031-8. Available in: https://www.sciencedirect.com/science/article/pii/S0911604401000318. Access on: 09 ago. 2023.

BIRD, H.; FRANKLIN, S.; HOWARD, D. 'Little words' – not really: function and content words in normal and aphasic speech. **Journal of Neurolinguistics**, [Amesterdã], v. 15, n. 3, p. 209-237, 2002. DOI: https://doi.org/10.1016/S0911-6044(01)00031-8.

BOEKER, H.; KLEISER, M.; LEHMAN, D.; JAENKE, L.; BOGERTS, B.; NORTHOFF, G. Executive dysfunction, self, and ego pathology in schizophrenia: an exploratory study of neuropsychology and personality. **Comprehensive Psychiatry**, [Nova Iorque], v. 47, n. 1, p. 7-19, 2006. DOI: 10.1016/j.comppsych.2005.04.003.

CLEMMER, E. J. Psycholinguistic aspects of pause and temporal patterns in schizophrenic speech. **Journal of Psycholinguistic Research**, [Nova Iorque], v. 9, n. 2, p. 161-185, 1980. DOI: 10.1007/BF01067469.

COELHO, S. M. **Estudo diacrônico do processo de expansão gramatical e lexical dos itens ter, haver, ser, estar e ir na língua portuguesa**. 2006. 323f. Thesis (Doctor in Estudos Linguistics) – Faculdade de Letras, Universidade Federal de Minas Gerais, Belo Horizonte, 2006.

COELHO, S. M. Um estudo de preposições em contexto de construções de verbo auxiliar. **ALFA: Revista de Linguística**, São Paulo, v. 65, e12953, 2021. DOI: 10.1590/1981-5794-e12953. Available in: https://periodicos.fclar.unesp.br/alfa/article/view/12953. Access on: 9 ago. 2023.

COOK, M. The incidence of filled pauses in relation to part of speech. **Language and Speech**, [Teddington], v. 14, p. 135-139, 1971. Doi: 10.1177/002383097101400203.

ÇOKAL, D.; ZIMMERER, V.; TURKINGTON, D.; FERRIER, N.; VARLEY, R.; WATSON, S.; HINZEN, W. Disturbing the rhythm of thought: Speech pausing patterns in schizophrenia, with and without formal disorder. **PLOS ONE**, [São Francisco], v. 14, n. 5, p. e0217404, 2019. DOI: 10.1371/journal.pone.0217404. eCollection 2019.

ESPOSITO, A.; STEJSKAL, V.; SMÉKAL, Z.; BOURBAKIS, N. The significance of empty speech pauses: cognitive and algorithmic issues. *In*: MELE, F.; RAMELLA, G.; SANTILLO, S.; VENTRIGLIA, F. (org.). **Advances in Brain, Vision, and Artificial Intelligence (BVAI '07).** Berlin; Heidelberg: Springer, 2007. p. 542-554. (Lecture Notes in Computer Science, v. 4729).

FELDSTEIN, S.; JAFFE, J. Schizophrenic speech fluency: a partial replication and a hypothesis. **Psychological Reports**, [Londres], v. 13, p. 775-780, 1963. DOI: https://doi.org/10.2466/pr0.1963.13.3.775.

FIGUEROA, A.; MARTÍNEZ, C. Las pausas en personas con diagnóstico de esquizofrenia de primer episodio. **Pragmalingüística**, [Cádiz], v. 26, p. 88-108, 2018. Available in: https://revistas.uca.es/index.php/pragma/article/view/4063. Access on: 9 ago. 2023.

FRIES, C. **The structure of English**. New York: Harcourt, Brace, 1952.

GOSZTOLYA, G.; BAGI, A.; SZALÓKI, S.; SZENDI, I.; HOFFMANN, I. Identifying schizophrenia based on temporal parameters in spontaneous speech. *In*: INTERSPEECH, 2018, Hyderabad. **Proceedings** […], Hyderabad: Indian Institute of Technology: International Speech Communication Association, 2018. p. 3408-3412. Available in: https://www.isca-speech.org/archive/pdfs/interspeech_2018/gosztolya18b_interspeech.pdf. Access on: 09 ago. 2023.

HASPELMATH, M. The indeterminacy of word segmentation and the nature of morphology and syntax. **Folia Linguistica**, [Berlim], v. 45, p. 31-80, 2011. DOI: https://doi.org/10.1515/flin.2011.002. Available in: https://www.degruyter.com/document/doi/10.1515/flin.2011.002/html. Access on: 09 ago. 2023.

HASPELMATH, M. How to compare major word-classes across the world's languages. *In*: GRAF, T.; PAPERNO, D.; SZABOLCSI, A.; TELLINGS, J. (org.). **Theories of everything**: in honor of Edward Keenan. Los Angeles: University of California at Los Angeles, 2012. p. 109-130.

HEINE, B. **Auxiliaries**: cognitive forces and grammaticalization. New York; Oxford: Oxford University Press, 1993.

HOWELL, P.; AU-YEUNG, J.; SACKIN, S. Exchange of stuttering from function words to content words with age. **Journal of Speech, Language, and Hearing Research**, [Rockville], v. 42, n. 2, p. 345-354, 1999. DOI:10.1044/jslhr.4202.345.

JUSTE, F.; SASSI, F.; ANDRADE, C. Exchange of disfluency with age from function to content words in Brazilian Portuguese speakers who do and do not stutter. **Clinical Linguistics & Phonetics**, [Londres], v. 26, n. 11-12, p. 946-961, 2012. DOI: 10.3109/02699206.2012.728278.

KOSMALA, L.; CRIBLE, L. The dual status of filled pauses: evidence from genre, proficiency and co-occurence. **Language and Speech**, [Teddington], v. 65, n. 1, p. 216-239, 2022. DOI: https://doi.org/10.1177/00238309211010862.

KUTEVA, T. **Auxiliation**: an enquiry into the nature of grammaticalization. Oxford: Oxford University Press, 2001.

LEÓN BUSTOS, M. E. **Relación entre neurocognición, síntomas clínicos y pausas en el discurso en Esquizofrenia**. 2020. 69 f. Thesis (Doctor in Neuroscience) – Facultad de Medicina, Universidad de Chile. Santiago, 2020. Available in: https://repositorio.uchile.cl/handle/2250/180824. Access on: 10 ago. 2023.

LEUBE, D.; WHITNEY, C.; KIRCHER, T. The neural correlates of ego-disturbances (passivity phenomena) and formal thought disorder in schizophrenia. **European Archives of Psychiatry and Clinical Neuroscience**, [Berlim], v. 258, p. 22-27, 2008. DOI: 10.1007/s00406-008-5017-z.

MACKENZIE, H.; CURTIN, S.; GRAHAM, S. Class matters: 12-month-olds' word-object associations privilege content over function words. **Developmental Science**, Oxford, v. 15, n. 6, p. 753-761, 2012.

MACLAY, H.; OSGOOD, C. Hesitation phenomena in spontaneous English speech. **Word**, [Filadelfia], v. 15, p. 19-44, 1959. DOI: https://doi.org/10.1080/00437956.1959.11659682.

MAHRER, B.; MANSCHRECK, T.; MOLINO, T. Redundancy, pause distributions and thought disorder in schizophrenia. **Language and Speech**, [Teddington], v. 26, n. 2, p. 191-199, 1983. DOI: 10.1177/002383098302600207.

MARTIN, P. WinPitch Corpus: a text to speech alignment tool for multimodal corpora. *In*: LREC, 2004, Lisboa. **Anais** [...]. Lisboa: ELRA, 2004. Available in: http://www.lrec-conf.org/proceedings/lrec2004/pdf/780.pdf. Access on: 31 Aug. 2023.

MARTÍNEZ-SÁNCHEZ, F.; MUELA-MARTÍNEZ, J. A.; CORTÉS-SOTO, P.; JOSÉ, J.; MEILÁN, G.; ANTONIO, J.; FERRÁNDIZ, V.; CAPARRÓS, A. E.; MARÍA, I.; VALVERDE, P. Can the acoustic analysis of expressive prosody discriminate schizophrenia? **The Spanish Journal of Psychology**, [Cambridge], v. 18, n. 86, p. 1-9, 2015. DOI: 10.1017/sjp.2015.85.

MATSUMOTO, K.; KIRCHER, T.; STOKES, P.; BRAMMER, M.; LIDDLE, P.; McGUIRE, P. Frequency and neural correlates of pauses in patients with formal thought disorder. **Frontiers in Psychiatry**, [Suíça], v. 4, p. 1-9, 2013. DOI: 10.3389/

fpsyt.2013.00127. Available in: https://www.frontiersin.org/articles/10.3389/fpsyt.2013.00127/full. Access on: 10 ago. 2023.

MOHR, B.; PULVERMÜLLER, F.; ZAIDEL, E. Lexical decision after left, right and bilateral presentation of function words, content words and non-words: Evidence from interhemispheric interaction. **Neuropsychologia**, [Oxford], v. 32, n. 1, p. 105-124, 1994. DOI: 10.1016/0028-3932(94)90073-6.

NARROG, H.; HEINE, B. (org.). **The Oxford Handbook of Grammaticalization**. Oxford: Oxford University Press, 2011.

PAROLA, A.; SIMONSEN, A.; BLIKSTED, V.; FUSAROLI, R. Voice patterns in schizophrenia: a systematic review and Bayesian meta-analysis. **Schizophrenia Research**, [Amesterdã], v. 216, p. 24-40, 2020. DOI: 10.1016/j.schres.2019.11.031.

PERINI, M. A. **Function and class in Linguistic description**: the taxonomic foundations of Grammar. Cham: Palgrave Macmillan, 2021.

RAPCAN, V.; D'ARCY, S.; YEAP, S.; AFZAL, N.; THAKORE, J.; REILLY, R. B. Acoustic and temporal analysis of speech: a potential biomarker for schizophrenia. **Medical Engineering and Physics**, [Oxford], v. 32, p. 1074-1079, 2010. DOI: 10.1016/j.medengphy.2010.07.013.

RASO, T.; MELLO, H. (org.). **C-ORAL-BRASIL I**: corpus de referência do português brasileiro falado informal. Belo Horizonte: Ed. da UFMG, 2012.

RAUH, G. Aspects of Deixis. *In*: RAUH, G. (org.). **Essays on Deixis**. Tübingen: Narr, 1983. p. 9-60.

RIBEIRO, I. A formação dos tempos compostos: evolução histórica das formas ter, haver e ser. *In*: ROBERTS, I.; KATO, M. (org.). **Português brasileiro**: uma viagem diacrônica – Homenagem a Fernando Tarallo. Campinas: Ed. da Unicamp, 1993. p. 281-344.

ROCHA, B. O corpus C-ORAL-ESQ e a estrutura informacional da fala de pacientes com esquizofrenia. **Working Papers em Linguística**, [Florianópolis], v. 20, n. 1, p. 212-238, 2019. DOI: 10.5007/1984-8420.2019v20n1p212.

ROSE, R.; WATANABE, M. A crosslinguistic corpus study of silent and filled pauses: when do speakers use filled pauses to fill pauses? *In*: CALHOUN, S.; ESCUDERO, P.; TABAIN, M.; WARREN, P. (ed.). **Proceedings of the 19th International Congress of Phonetics (ICPhS 2019).** Melbourne: ICPhS, 2019. p. 2615-2619, 2019. Available in: https://assta.org/proceedings/ICPhS2019/. Access on: 10 aug. 2023.

SCHARFETTER, C. Ego-fragmentation in schizophrenia: A severe dissociation of self-experience. *In*: MOSKOWITZ, A.; SCHÄFER, I.; DORAHY, M. (org.). **Psychosis, trauma and dissociation**: emerging perspectives on severe Psychopathology. Oxford: Wiley-Blackwell, 2008. p. 51-64.

SILVERMAN, G. Redundancy, repetition and pausing in schizophrenic speech. **The British Journal of Psychiatry**, [Cambridge], v. 122, n, 569, p. 407-413, 1973. DOI: 10.1192/bjp.122.4.407.

SPITZER, M.; BEUCKERS, J.; BEYER, S.; MAIER, S.; HERMLE, L. Contextual insensitivity in thought-disordered schizophrenic patients: evidence from pauses in spontaneous speech. **Language and Speech**, [Teddington], v. 37, n. 2, p. 171,185, 1994. DOI: 10.1177/002383099403700205.

TURNER, G.; TJADEN, K. Acoustic differences between content and function words in amyotrophic lateral sclerosis. **Journal of Speech, Language, and Hearing Research**, [Rockville], v. 43, n. 3, p. 769-781, 2000. DOI: 10.1044/jslhr.4303.769.

VIEIRA, F. **A gramática tradicional**: história crítica. São Paulo: Parábola, 2018.

VITRAL, L. **Gramática inteligente do português do Brasil**. São Paulo: Contexto, 2017.

VITRAL, L.; COELHO, S. M. A auxiliarização em português: aspecto, novas formas e implicações teóricas. *In*: GALVES, C.; KATO, M.; ROBERTS, I. (org.). **Português brasileiro**: uma segunda viagem diacrônica. Campinas: Ed. da Unicamp, 2019. p. 253-282.

WIKLUND, M. **Speech and interaction of preadolescents with autism spectrum disorder**: focus on prosody, disfluencies and comprehension problems. Singapore: Springer, 2023.

WILLIAMS, S. **Disfluency and proficiency in second language speech production**. Cham: Palgrave Macmillan, 2022.

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