# The TYPALOC Corpus: A Collection of Various Dysarthric Speech Recordings in Read and Spontaneous Styles

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**Abstract**

This paper presents the TYPALOC corpus of French Dysarthric and Healthy speech and the rationale underlying its constitution. The objective is to compare phonetic variation in the speech of dysarthric vs. healthy speakers in different speech conditions (read and unprepared speech). More precisely, we aim to compare the extent, types and location of phonetic variation within these different populations and speech conditions. The TYPALOC corpus is constituted of a selection of 28 dysarthric patients (three different pathologies) and of 12 healthy control speakers recorded while reading the same text and in a more natural continuous speech condition. Each audio signal has been segmented into Inter-Pausal Units. Then, the corpus has been manually transcribed and automatically aligned. The alignment has been corrected by an expert phonetician. Moreover, the corpus benefits from an automatic syllabification and an Automatic Detection of Acoustic Phone-Based Anomalies. Finally, in order to interpret phonetic variations due to pathologies, a perceptual evaluation of each patient has been conducted. Quantitative data are provided at the end of the paper.

**Keywords:** Corpus, speech disorders, read and spontaneous speech, automatic speech processing, anomaly detection

## 1. Introduction

This paper presents the TYPALOC corpus of French Dysarthric and Healthy speech and the rationale underlying its constitution. This corpus is built in the context of the TYPALOC project (ANR-12-BSHS2-0003) whose objective is to compare phonetic variation in the speech of dysarthric vs. healthy speakers in different speech conditions. Assuming that pathological alterations in the speech signal are somewhat comparable in shape (under-articulated forms) to the one we can find in casual speech produced by healthy speakers, our objective is to compare the extent, types and location of phonetic variation within these different populations and speech conditions.

Dysarthria refers to a group of motor speech disorders caused by damage to either the central or peripheral nervous system. These lesions disrupt the transfer of information from the nervous system to the muscles involved in speech production. According to the location of the lesion in the brain and the severity of the damage, any of the different speech subsystems can be affected (respiration, phonation, subglottal activities) and speech distortions can cover a large spectrum of degree. Moreover, according to the etiology of the lesion and the disease associated with it (toxic, metabolic, traumatic or degenerative diseases), types of dysarthria vary with respect to pathophysiologies determining the kind of deficits in the motor execution and/or control of speech movements (deficits in speed, range, strength, rigidity/steadiness, tonus, precision/accuracy, and/or coordination) (Murdoch, 1998, Duffy 2013). Finally, speaker specific strategies and therapeutic treatment add further intra-group variability in speech profiles into the picture.

Research on disordered speech is confronted to the difficulty of getting appropriate and sufficiently large quantities of speech data. Thanks to our work on dysarthria since several years, we have been able to combine and organize various collections of French dysarthric speech recordings and associated clinical information (see Fougeron et al., 2010). The TYPALOC corpus is constituted of a selection of 28 dysarthric patients and of 12 healthy control speakers recorded while reading the same text and in a more natural continuous speech condition. In the remaining part of the paper we will provide a quantitative description of the content of the TYPALOC corpus in terms of the population included, speech content, and metadata available.

## 2. Corpus

The TYPALOC corpus is made of a collection of speech recordings selected from different databases. Inclusion criteria and populationòs characteristics are described below. The corpus is composed by two main populations: dysarthric speakers and healthy speakers. Each population contains several sub-groups.

### 2.1. Healthy Speakers

Since the speech profiles encountered in dysarthria are diverse (as seen above), we decided to also introduce diversity in the healthy speakers population used. Two groups of healthy speakers were selected according to a large scale of characteristic. The Healthy Senior (HS) group includes 6 speakers (3 males and 3 females) aged from 63 to 82. Most of them come from the North of France. The Healthy Junior (HJ) group includes 6 speakers (3 males and 3 females) aged from 29 to 47. HJ speakersôrecordings are extracted from a large corpus of conversational speech, the CID (Bertrand et al., 2008). Most of them come from the South East of France.

### 2.2. Dysarthric Speakers

Three types of dysarthria sub-groups are included in the corpus. They are all associated with neurological degenerative diseases and they were chosen to illustrate troubles on the three major neurological systems: the extrapyramidal system with Parkinsonõs disease (PD), the pyramidal system with Amyotrophic Lateral Sclerosis (ALS), and the cerebelar system with Cerebelar ataxia (CA).
Eight PD patients (48 to 81 years old), eight CA patients (32 to 77 years old), twelve ALS patients (50 to 81 years old) are included in the corpus.

### 2.3. Speech Material and Recording Information

All the speech files included in the dysarthric population have been selected from a database of pathological speech which contains recordings collected over the past 30 years by Dr Claude Chevrie-Muller (CCM) with her team at the õLaboratoire dõétude de la voix et de la paroleô(INSERM U3) and nowadays by Dr Lise Crevier-Buchman at the Voice and Speech Lab in the Hospital Georges Pompidou (HEGP Paris). All patients were recorded according to the CCM protocol (described in Fougeron et al, 2010)..
Dysarthric and healthy speakers were recorded in either a silent room or a sound booth with high quality microphones. For all speakers, sample of speech produced in two speech styles, read vs. un-prepared production, are provided in the corpus. For the read style, the text ñLe Cordonnierò included in the CCM protocol is used. It is a childrenõs story of 172 words relating the story of a shoemaker and its providential goblins helpers. .For the dysarthric and healthy senior speakers, the spontaneous speech situation was an interview conducted by the researcher with few speech chunks produced by the researcher (i.e. a virtual monologue). They had to talk about their everyday life, their personal history, their work or some personal events. In contrast, healthy junior speakers talked about particular events or situations (narrative sequences) in a relaxed and interactive conversation with a single interlocutor. Thus, despite a similar discourse context (narration) for all populations, the HJ communicative situation slightly differed from that of all the other populations. Furthermore, as can be seen in Tables 1 and 2, the duration of speech recordings in the spontaneous condition is substantially longer for the healthy speakers than for the patients.

### 2.4. Inclusion Criteria & Corpus Constitution

Patients were included in each dysarthria sub-group according to the following inclusion criteria:

- The speech quality of the audio files
- The amount of speech data available in the spontaneous condition. Patientsô production was usually quite short (less than 2 minutes). Speakers having the longest recordings were selected (from 19 to 234 seconds, see Table 2)
- Severity of the dysarthria: in order to be able to run phonetic analysis on the sound files we excluded severe cases of dysarthria with strongly distorted and fully unintelligible productions.

## 3. Annotations

### 3.1. Transcriptions

Each audio signal was segmented into Inter-Pausal Units (IPUs), i.e. chuncks of speech bounded by silent pauses over 250ms. All noises (laughing, breathes, interviewer interventions etc.) were annotated and isolated from the speech of the participant. For each speaker, an orthographic transcription was provided at the IPUs-level. Two different convention guides for transcription have been proposed in order to be adapted to both speech styles. Both guides had the same convention for phoneme distortion or elision and for the coding of novel words.

- Phoneme or word deletions are transcribed between brackets: Ex: "pauv(r)e" (*poor*) ;"dans un (petit) village" (*in a small village*)
- Phoneme or word distorsions are transcribed between brackets with the orthographic original word and the current pronunciation (in SAMPA code [1] ): Ex: "[aéroport, aReopOR]ò (*airport*)
- Repetitions or false starts are transcribed with a dash following the repetition (e.g. ñle- le- le-ò)

Moreover, conventions for read text took into account word elision, insertion or substitution which may appear from the original text. These conventions are obviously not adapted to spontaneous speech for which the speech content is not pre-scripted. Conventions for the spontaneous speech additionally integrated codes for more unexpected productions: filled pauses (euh, mmh, ben, hein, hum), proper names (in SAMPA code), or onomatopoeia (ah, oh, eh, ouh, aïe, paf, boum, etc.).

### 3.2. Automatic Alignment

The segmentation of the speech utterances into the sequence of phones was carried out thanks to an automatic text-constrained phone alignment tool. This tool takes as input the sequence of words pronounced in each utterance and a phonetized phonologically-varied lexicon of words based on a set of 37 French phones. The sequence of words comes from the manual orthographic transcription described in section 3.1. The automatic alignment process is based on a Viterbi decoding and graph-search algorithms, the core of which is the acoustic modeling of each phone, based on a Hidden Markov Model (HMM). Indeed, each phone is modeled using a 3-state context-independent HMM topology which are

[1]French SAMPA code :
https://www.phon.ucl.ac.uk/home/sampa/french.htm

built using the Maximum Likelihood Estimate paradigm on the basis of about 200 hours of French radiophonic speech recordings (Galliano et al. 2005). In order to get speaker-dependent models, a three-iteration Maximum A Posteriori (MAP) adaptation is performed to adapt all the HMM parameters. This automatic alignment process results in a couple of start and end boundaries per phone produced in the speech records.

For each speaker, automatic alignments were manually corrected by an expert phonetician in order to 1/ provide correct phoneme boundaries necessary for phonetic analyses and 2/ evaluate aligners and automatic detection of acoustic phone-based anomalies (see 3.4). The task of the expert phonetician was 1/ to locate and correct large discrepancies and 2/ at the level of the phoneme, to adjust boundaries according to traditional acoustic landmarks as illustrated in Figure 1.

The evaluation of the automatic alignment is based on two measurements issued from the comparison between the automatic outputs and the manual ones provided by the expert as follows:

- the Start Shift (SS), which is given by the difference between the phone start boundaries from the automatic and manual segmentations;
- the Midpoint Shift (MS), which is given by the difference between the phone midpoints from the automatic and the manual segmentations.

Figures 2 and 3 display the distributions of relative phone frequencies according to the SS and MS measurements respectively for the different populations. To understand these figures, the bar associated with a SS equal to 0 refers, for instance, to the set of phones for which the shifts of their start boundaries, comparing both manual and automatic segmentations, are shorter than 1 frame i.e. 10ms. The distributions related to the SS measurements show that 85%, 65%, 71% and 80% of phones are located in the +/-2 frame interval for control, ALS, CA and PD groups respectively, which is the acceptable range usually used in phone segmentation evaluation ([-20ms,20ms] i.e. +/-2 frame interval). Very similar behaviour can be observed for the MS measurements. These rates are quite satisfactory considering the quality of speech and the variability in terms of dysarthria severity degrees present in the dysarthric population. It is interesting to notice that the PD group behaves similarly to the control one while the ALS and CA groups, showing more severe dysarthria degrees (see section 4) exhibit lower percentages, i.e. more boundary shifts outside this ńnormalôrange.

### 3.3. Automatic Syllabification

Syllabification of the recordings was done with the automatic syllabification system described in (Bigi et al. 2010) and included in SPPAS (Bigi, 2015), a tool distributed under the terms of the GNU Public License. Time-aligned phoneme sequences were syllabified based on several rules. Phoneme sequences are parsed based on the two following principles:

(1) only one vowel per syllable,
(2) pause is a syllable boundary.

These two principles focus the problem on the task of finding a syllabic boundary between two vowels in each IPU. Syllable boundary detection is based on rules adapted to the six phonemic classes: Vowels, Stops, Fricatives, Liquids, Nasals and Glides. The rules follow usual phonological statements for most of the spoken corpus and provide an acceptable syllabification for the most part of spoken corpora.

### 3.4. Automatic Detection of Acoustic Phone-Based Anomalies

In a general context, anomaly detection refers to the problem of finding patterns in data that do not conform to an expected behavior. In dysarthric speech, anomalies can refer to unexpected acoustic patterns, compared with a typical or normal speech production, observed on different units of speech like phones for instance. The goal of an automatic anomaly detection and localization can be twofold: (1) to steer human experts towards specific parts of the speech, considered as atypical, which is especially relevant when considering large speech corpora, (2) to help the evaluation of dysarthria severity in clinical practice by providing a visual display of abnormal phenomena localized in the speech production of patients.

The automatic anomaly detection tool relies on two steps: (1) the text-constrained phone alignment described in section 3.2, which provides the phone boundaries, and (2) a two class - normal and abnormal phones (anomalies) - supervised classification. In each class, phones are characterized by a set of features considered as relevant for the discrimination task (see Laaridh et al. 2015 for more information about the set of features used). The classification task is based on Support Vector Machines (SVM) coupled with a polynomial kernel, which has been largely applied to pattern recognition problems (Vapnik, 1995, Scholkopf et al. 2001). Several SVM models were trained by distinguishing the speech productions by gender and phonetic categories (unvoiced consonants, voiced consonants, oral vowels, nasal vowels). These different configurations permit to take into account specificities of each phonetic category while refining both abnormal and normal classes. In this paper, the different SVM models are trained using the SVMlight tool (see Joachims, 1999 for more information). In addition, the SVM based models were trained on a speech corpus different from the TYPALOC one, for which a manual annotation of normal and abnormal phones was performed by an expert phonetician. This corpus comprised both dysarthric and healthy read speech recordings as described in (Laaridh et al., 2015).

The evaluation of the automatic anomaly detection system is not trivial since we do not have some manual annotations of the abnormal phones for the TYPALOC corpus. However, figure 4 provides for each speaker (both patients and control subjects) the automatic anomaly detection rate according to the Dysarthria Severity Degree issued from the perceptual evaluation described in section 4. These results are obtained from the read speech only. The reader may refer to (Laaridh et al., 2016) for results involving spontaneous speech.

This figure shows an important relationship between the two measures, with an overall correlation coefficient of 0.81. The high correlation observed here, even if it does not prove the accuracy of the automatic anomaly detection approach at the phone level, seems to confirm the potential of the system to deal with acoustic speech alterations.

## 4. Perceptual Evaluation

In order to relate the acoustic characteristics on the speech file to perceived speech abnormalities, a perceptual evaluation of the speech of the dysarthric group was carried out by 11 expert judges (10 speech pathologists and 1 neurologist). About one minute of speech extracted at the beginning of the read and spontaneous recordings was evaluated according to the 8 items of the French perceptive evaluation scale of dysarthria (GEPD). Six speech dimensions are rated on a 4 degrees scale (0=normal to 3=severely impaired): dysarthria severity, speech intelligibility, presence of nasal resonance, palilalia, articulatory accuracy and regularity of the speech rate. The two remaining dimensions: melodic fluctuation and speech rate, were rated also on a 0 to 3 scale with + or ï sign to indicate the direction of the abnormal pattern (too fast/slow, hyper/hypo modulated). Individual perceptual scores per speaker and style are given in Table 2. Figure 5 presents averaged perceptual profiles by population and speech style.

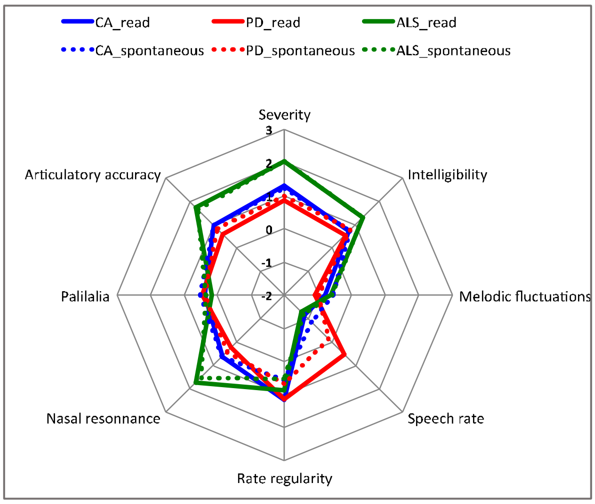


Figure 5: Mean perceptual scores on the 8 speech dimensions by dysarthria group and speech style.

While expected intra-group speaker variability exists, the CA, PD and ALS groups included in the corpus present the main characteristics described for their respective dysarthria type (see reviews in Murdoch 1998, Duffy 2013 among others). Overall the ALS group presents the most severely rated speech with higher score in dysarthria severity, intelligibility and articulatory accuracy. It also shows the typical presence of abnormal nasal resonance, due to poor or absent velo-pharyngeal closure. Abnormally slow speech rate, typical of ataxic and of flaccid/spastic dysarthria is observed in our CA and ALS groups. Conversely, a normal to fast speech rate is found for the PD group, following previous descriptions. Speech production in all groups is also characterized by reduced pitch fluctuations. Comparison of the results according to speech style (limited to the first minute in each recording) shows very little differences: overall, the speech dimensions altered in each population are equally rated in the read vs. spontaneous speech style.

## 5. Conclusion

The TYPALOC corpus offers a substantial database in which speech data produced by diverse French-speaking populations (dysarthric and healthy ones) is provided. The originality of the corpus is to allow a comparison between controlled and less controlled speech in the two populations.

However the constitution of such a database involves some limits that we encountered. Firstly as we mentioned, a large part of the dysarthric corpus was recorded 30 years ago. As a consequence, the quality of some recordings is not optimal or at least not always comparable with that of earlier recordings, which can be a biais for automated treatment. Furthermore, the medical information accompanying the recordings is not always up to date (e.g. no UPDRS evaluation for the PD group). Second, the duration of spontaneous speech recordings for dysarthric speakers is often quite short, leading to obvious limitations on the analyses possible on this speech style.

Nonetheless, to our knowledge no corpus of this kind exists for French and such a corpus is also rare in other languages. Finally, the corpus benefits from a rich panel of annotations (phonemes, syllables, words, IPU, phone-based anomalies) which allows a large set of analyses.

## 6. Acknowledgements

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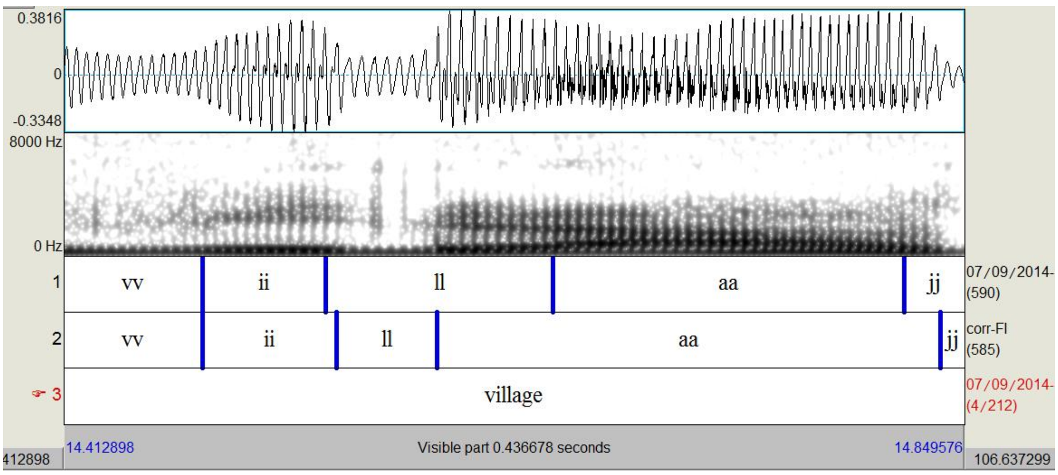


Figure 1: An example of speech transcription (Tier 3: orthographic transcription), automatic alignment (Tier 1) and the correction of automatic alignment by a expert phonetician (Tier 2). In this example (speaker CCM-002710-01, Cerebelar Ataxia), the expert has shifted some phoneme boundaries in the word ñvillageò (the liquid /l/, the vowel /a/, etc.) in order to restore correct segment spaces.

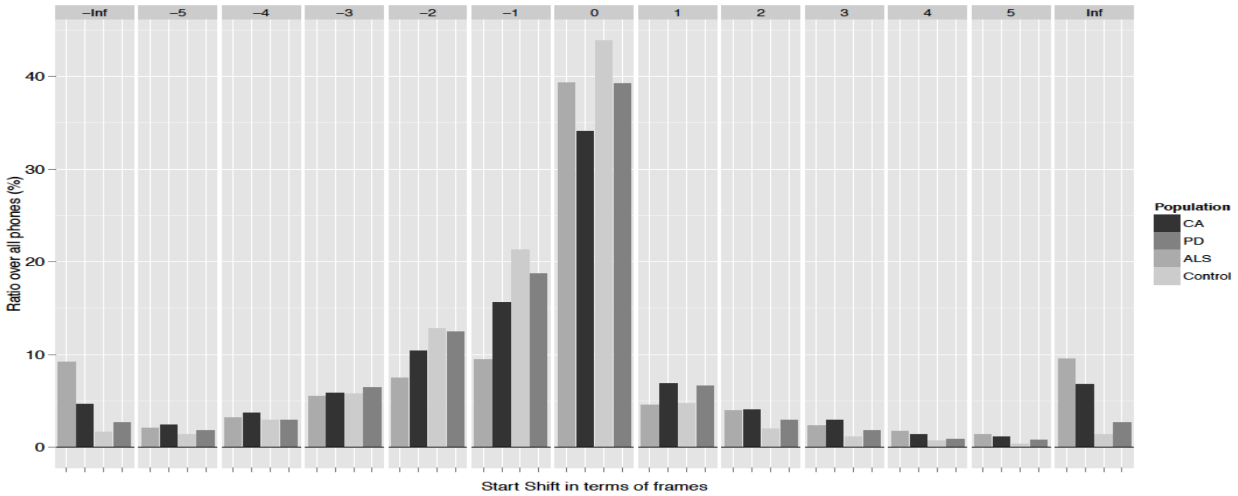


Figure 2 : Distributions of the relative phone frequencies according to the Start Shift measures expressed in terms of frames (10 ms) for the four populations of the TYPALOC corpus.

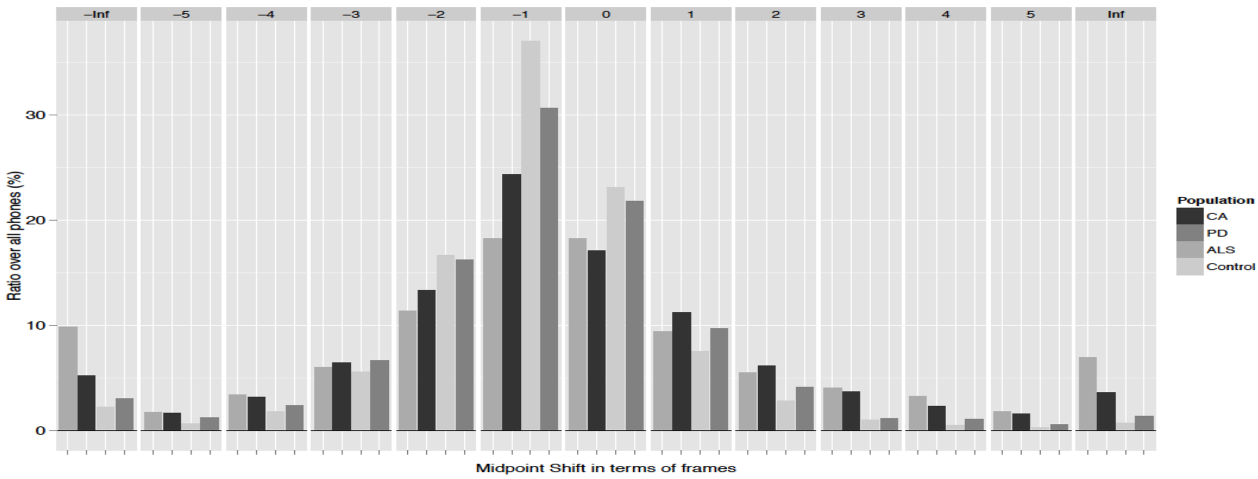


Figure 3 : Distributions of the relative phone frequencies according to the Midpoint Shift measures expressed in terms of frames (10 ms) for the four populations of the TYPALOC corpus.

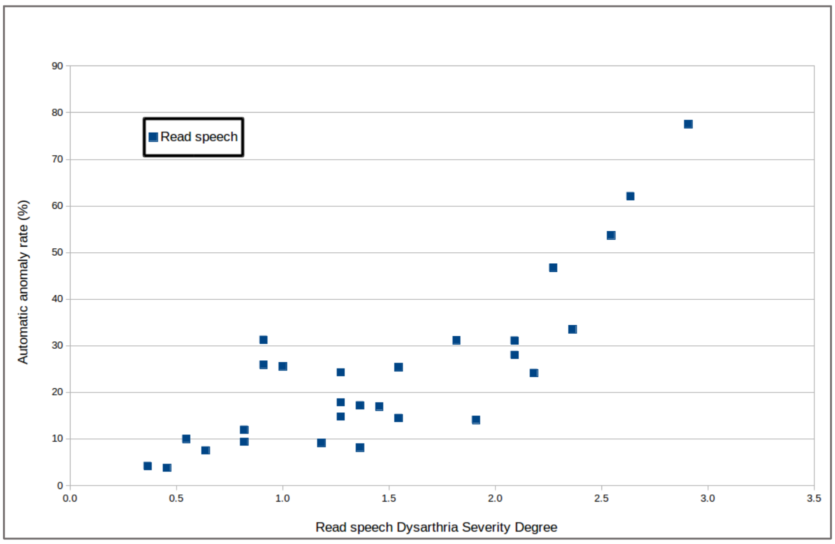


Figure 4 : Relationship between the automatic anomaly rate and perceived dysarthria severity degree (0=normal, 3=severe) for the 28 dysarthric speakers..

| Healthy Senior | | | | | | Healthy Junior | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Speaker** | **style** | **(i)** | **(j)** | **(k)** | **(l)** | **Speaker** | **style** | **(i)** | **(j)** | **(k)** | **(l)** |
| BEX-CDB000-01 | R | 53 | 169 | 606 | 4,66 | AEX-CAB000-01 | R | 50 | 169 | 602 | 5 |
| | S | 547 | 2278 | 6172 | 5,07 | | S | 212 | 995 | 3236 | 5,6 |
| BEX-CEB000-01 | R | 53 | 171 | 592 | 4,58 | AEX-CAC000-01 | R | 46 | 171 | 606 | 5,56 |
| | S | 287 | 1166 | 3254 | 4,97 | | S | 237 | 1236 | 3847 | 6,2 |
| BEX-CHE000-01 | R | 48 | 169 | 577 | 5,09 | AEX-CAG000-01 | R | 47 | 170 | 613 | - |
| | S | 745 | 2738 | 8099 | 4,66 | | S | 231 | 1225 | 3204 | 6,3 |
| BEX-CKN000-01 | R | 54 | 169 | 596 | 4,62 | AEX-CLJ000-01 | R | 49 | 169 | 583 | 4,98 |
| | S | 367 | 1238 | 3683 | 4,41 | | S | 248 | 1310 | 3804 | 5,93 |
| BEX-CMB000-01 | R | 59 | 172 | 599 | 4,22 | AEX-CML000-01 | R | 43 | 171 | 597 | 5,75 |
| | S | 396 | 1370 | 4116 | 4,61 | | S | 227 | 1192 | 3101 | 6,09 |
| BEX-CNKN00-01 | R | 51 | 169 | 584 | 4,72 | AEX-CSR000-01 | R | 53 | 169 | 604 | 4,84 |
| | S | 745 | 2546 | 7375 | 4,25 | | S | 219 | 1038 | 2571 | 5,45 |
| ***HS Group Mean*** | ***R*** | ***53*** | ***170*** | ***592*** | ***4,65*** | ***HJ Group Mean*** | ***R*** | ***48*** | ***170*** | ***601*** | ***5,23*** |
| | ***S*** | ***514*** | ***1889*** | ***5450*** | ***4,66*** | | ***S*** | ***229*** | ***1166*** | ***3294*** | ***5,93*** |

Table 1 : Quantitative description of the corpus for the **Healthy populations** and for each speech style (R: Read; S: Spontaneous). In the columns (i) to (l) data on the speech content available in terms of: i/ duration of speech produced (in sec.); j/ number of words and k/ phonemes; l/ speech rate (nb of syll./sec.).

| | Speaker | sex | style | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) | (l) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CA** | CCM-002710-01 | F | R | 2,1 | 1,2 | 1,6 | -0,4 | -1,3 | 1,4 | 1,5 | 0 | 69 | 170 | 586 | 3,43 |
| | | | S | 1,8 | 1,2 | 1,6 | 0,5 | -1,2 | 0,9 | 1,2 | 0,8 | 51 | 160 | 446 | 3,6 |
| | CCM-003094-01 | M | R | 1,5 | 0,8 | 1,4 | 0,3 | -2,2 | 1,7 | 0,7 | 0,4 | 83 | 175 | 639 | 3,15 |
| | | | S | 1,9 | 1,1 | 1,6 | -0,1 | -1,4 | 0,9 | 0,9 | 0,7 | 52 | 111 | 363 | 3,99 |
| | CCM-003110-01 | F | R | 1,3 | 0,6 | 0,5 | -0,6 | -0,8 | 1,0 | 0,4 | 0,1 | 67 | 167 | 588 | 3,70 |
| | | | S | 1,2 | 0,6 | 0,9 | -0,6 | -0,6 | 0,5 | 0,5 | 0,3 | 46 | 141 | 408 | 3,92 |
| | CCM-003493-01 | F | R | 0,9 | 0,5 | 0,7 | -1,5 | -1,5 | 0,6 | 0,2 | 0,5 | 74 | 174 | 682 | 3,62 |
| | | | S | 0,8 | 0,5 | 0,5 | -1,1 | -0,7 | 0,5 | 0,3 | 0,1 | 85 | 307 | 875 | 4,37 |
| | CCM-003998-01 | M | R | 1,5 | 1,1 | 0,7 | -1,5 | -1,9 | 1,4 | 0,5 | 0,8 | 71 | 176 | 632 | 3,6 |
| | | | S | 1,2 | 0,5 | 0,5 | -1,0 | -1,5 | 0,0 | 0,5 | 0,3 | 22 | 70 | 201 | 3,71 |
| | CCM-004523-01 | M | R | 0,8 | 0,3 | 0,7 | -0,5 | -0,9 | 1,0 | 0,3 | 0,1 | 61 | 166 | 599 | 3,87 |
| | | | S | 0,8 | 0,8 | 0,8 | -0,7 | -0,5 | 0,5 | 0,5 | 1,1 | 39 | 127 | 408 | 4,34 |
| | CCM-004538-01 | F | R | 1,0 | 0,6 | 1,1 | -0,5 | 0,8 | 1,2 | 0,7 | 0,6 | 55 | 179 | 606 | 4,62 |
| | | | S | 0,6 | 0,4 | 0,8 | -0,1 | 0,0 | 0,7 | 0,5 | 0 | 29 | 107 | 289 | 4,51 |
| | CCM-004773-01 | M | R | 1,2 | 0,7 | 1,1 | -1,5 | -1,3 | 1,1 | 0,5 | 0,5 | 64 | 174 | 629 | 3,96 |
| | | | S | 1,5 | 0,9 | 1,1 | -1,1 | -0,9 | 0,6 | 0,7 | 0,9 | 60 | 219 | 566 | 4,14 |
| | ***CA Group Mean*** | | ***R*** | ***1,3*** | ***0,7*** | ***1,0*** | ***-0,8*** | ***-1,1*** | ***1,2*** | ***0,6*** | ***0,4*** | ***68,0*** | ***172,6*** | ***620,1*** | ***3,7*** |
| | | | ***S*** | ***1,2*** | ***0,8*** | ***1,0*** | ***-0,5*** | ***-0,9*** | ***0,6*** | ***0,6*** | ***0,5*** | ***48,0*** | ***155,3*** | ***444,5*** | ***4,1*** |
| **PD** | CCM-001773-01 | M | R | 0,4 | 0,4 | 0,4 | -0,1 | 1,7 | 0,6 | 0,1 | 0 | 36 | 171 | 577 | 6,53 |
| | | | S | 1,5 | 1,1 | 1,3 | -1,4 | 1,7 | 1,6 | 0,4 | 0,8 | 25 | 112 | 407 | 6,46 |
| | CCM-003130-01 | M | R | 0,8 | 0,6 | 0,8 | -1,5 | 0,0 | 0,6 | 0,0 | 0,5 | 50 | 169 | 590 | 4,89 |
| | | | S | 1,2 | 0,8 | 1,3 | -1,6 | -0,7 | 0,7 | 0,4 | 0,1 | 33 | 129 | 425 | 5,18 |
| | CCM-003148-01 | F | R | 1,3 | 0,9 | 1,2 | -1,4 | 1,5 | 1,8 | 0,5 | 0,8 | 56 | 172 | 591 | 4,36 |
| | | | S | 0,5 | 0,5 | 0,7 | -0,3 | -0,3 | 0,4 | 0,4 | 0,9 | 41 | 147 | 425 | 4,28 |
| | CCM-003346-01 | F | R | 0,5 | 0,4 | 0,2 | -0,7 | 0,6 | 0,7 | 0,1 | 0,5 | 48 | 165 | 572 | 4,87 |
| | | | S | 0,4 | 0,3 | 0,3 | -0,2 | -0,3 | 0,3 | 0,3 | 0,3 | 36 | 132 | 400 | 4,89 |
| | CCM-003557-01 | M | R | 0,6 | 0,4 | 0,1 | -1,6 | -0,5 | 1,3 | 0,2 | 0,6 | 57 | 176 | 651 | 4,56 |
| | | | S | 0,8 | 0,7 | 0,6 | -1,1 | -0,5 | 0,5 | 0,4 | 0,1 | 39 | 144 | 434 | 4,59 |
| | CCM-003733-01 | M | R | 1,4 | 1,2 | 1,1 | -1,6 | -0,5 | 2,2 | 0,4 | 0,5 | 62 | 173 | 635 | 4,1 |
| | | | S | 1,6 | 1,3 | 1,4 | -1,8 | -1,2 | 0,8 | 0,5 | 0,4 | 24 | 109 | 293 | 4,79 |
| | CCM-003734-01 | M | R | 0,5 | 0,1 | 0,4 | -0,7 | -0,1 | 0,7 | 0,2 | 0,2 | 48 | 172 | 595 | 4,49 |
| | | | S | 0,6 | 0,7 | 0,7 | -0,5 | -0,5 | 0,5 | 0,5 | 0,1 | 25 | 124 | 360 | 6,08 |
| | CCM-003848-01 | M | R | 1,3 | 0,6 | 0,6 | -1,2 | 1,5 | 1,2 | 0,5 | 0,3 | 46 | 180 | 626 | 5,63 |
| | | | S | 1,3 | 0,8 | 0,5 | -1,2 | 0,6 | 0,5 | 0,6 | 0,4 | 26 | 134 | 394 | 5,89 |
| | ***PD Group Mean*** | | ***R*** | ***0,9*** | ***0,6*** | ***0,6*** | ***-1,1*** | ***0,5*** | ***1,1*** | ***0,3*** | ***0,4*** | ***50,4*** | ***172,3*** | ***604,6*** | ***4,9*** |
| | | | ***S*** | ***1,0*** | ***0,8*** | ***0,9*** | ***-1,0*** | ***-0,2*** | ***0,7*** | ***0,4*** | ***0,4*** | ***31,1*** | ***128,9*** | ***392,3*** | ***5,3*** |
| **ALS** | PHO-000024-01 | F | R | 1,5 | 1,0 | 1,0 | 1,2 | -0,2 | 0,5 | 2,6 | 0 | 53 | 170 | 595 | 4,1 |
| | | | S | 1,2 | 0,5 | 1,0 | 0,0 | 0,5 | 0,5 | 2,0 | 0,5 | 45 | 172 | 481 | 4,08 |
| | PHO-000566-01 | F | R | 2,9 | 1,7 | 2,3 | -2,0 | -2,7 | 0,8 | 2,3 | 0 | 164 | 161 | 627 | 1,65 |
| | | | S | 2,7 | 1,7 | 2,1 | -1,5 | -2,6 | 0,2 | 1,6 | 0,2 | 234 | 297 | 904 | 1,71 |
| | PHO-000814-01 | F | R | 2,3 | 1,3 | 1,8 | -1,0 | -2,0 | 0,8 | 2,2 | 0 | 100 | 169 | 637 | 2,6 |
| | | | S | 2,5 | 1,6 | 2,0 | -0,3 | -1,8 | 0,6 | 2,1 | 0,2 | 43 | 101 | 297 | 2,9 |
| | PHO-001070-01 | F | R | 2,4 | 1,6 | 2,2 | 0,1 | -1,1 | 1,0 | 2,1 | 1 | 67 | 132 | 490 | 3,16 |
| | | | S | 2,0 | 1,3 | 1,9 | -0,2 | -1,6 | 0,5 | 1,5 | 0,5 | 42 | 89 | 298 | 3,17 |
| | PHO-001329-01 | F | R | 0,9 | 0,5 | 1,1 | 0,0 | -0,5 | 0,5 | 0,5 | 0 | 63 | 170 | 606 | 3,97 |
| | | | S | 1,3 | 0,9 | 1,3 | -0,2 | 0,0 | 0,6 | 1,3 | 0,3 | 102 | 349 | 1125 | 4,65 |
| | PHO-001473-01 | M | R | 2,1 | 1,0 | 1,5 | 0,1 | -2,2 | 0,8 | 1,1 | 0 | 69 | 117 | 421 | 2,42 |
| | | | S | 2,1 | 1,2 | 1,6 | -0,4 | -2,2 | 0,4 | 0,9 | 0,2 | 51 | 108 | 296 | 2,36 |
| | PHO-001499-01 | F | R | 1,8 | 1,0 | 1,5 | 0,9 | -1,4 | 1,1 | 1,6 | 0,1 | 87 | 168 | 607 | 2,89 |
| | | | S | 1,8 | 0,6 | 1,2 | 0,3 | -1,5 | 0,4 | 1,7 | 0 | 84 | 196 | 619 | 3,18 |
| | PHO-001522-01 | F | R | 2,6 | 1,4 | 1,8 | -2,3 | -2,5 | 0,6 | 1,2 | 0 | 122 | 173 | 641 | 2,05 |
| | | | S | 2,5 | 1,4 | 1,9 | -2,1 | -2,3 | 0,2 | 0,8 | 0,5 | 25 | 54 | 160 | 2,52 |
| | PHO-001594-01 | M | R | 2,2 | 1,6 | 2,3 | -1,5 | -1,6 | 1,0 | 1,4 | 0,4 | 66 | 156 | 527 | 3,45 |
| | | | S | 1,7 | 1,5 | 1,7 | -1,4 | -1,3 | 0,2 | 0,9 | 0,3 | 36 | 109 | 312 | 3,76 |
| | PHO-001670-01 | M | R | 1,9 | 1,5 | 1,9 | -1,1 | -1,2 | 0,7 | 1,2 | 0 | 64 | 169 | 582 | 3,77 |
| | | | S | 2,1 | 1,5 | 1,9 | -0,8 | -0,5 | 0,7 | 1,5 | 0 | 68 | 230 | 658 | 4,27 |
| | PHO-001836-01 | M | R | 2,5 | 2,1 | 2,5 | -1,0 | -1,5 | 0,9 | 2,7 | 0,4 | 99 | 178 | 614 | 2,54 |
| | | | S | 2,7 | 2,2 | 2,3 | 0,3 | -1,8 | 0,4 | 2,3 | 0,1 | 48 | 125 | 355 | 3,18 |
| | PHO-307175-01 | M | R | 1,4 | 1,0 | 1,2 | -0,6 | 1,5 | 1,7 | 2,0 | 0,5 | 44 | 156 | 541 | 5,2 |
| | | | S | 1,6 | 1,0 | 1,0 | -0,5 | 1,1 | 1,6 | 1,7 | 1,7 | 19 | 117 | 298 | 6,32 |
| | ***ALS Group Mean*** | | ***R*** | ***2,0*** | ***1,3*** | ***1,8*** | ***-0,6*** | ***-1,3*** | ***0,9*** | ***1,7*** | ***0,2*** | ***83,2*** | ***159,9*** | ***574,0*** | ***3,2*** |
| | | | ***S*** | ***2,0*** | ***1,3*** | ***1,6*** | ***-0,6*** | ***-1,1*** | ***0,5*** | ***1,5*** | ***0,4*** | ***68,6*** | ***168,9*** | ***500,5*** | ***3,5*** |

Table 2 : Quantitative description of the corpus for the **Dysarthric populations** and for each speech style (R: Read; S: Spontaneous). In the columns (a) to (h), results of the perceptual evaluation (score 0 = non impaired) of: a/ dysarthria severity (0 to 3); b/ global intelligibility (0 to 3); c/ articulatory accuracy (0 to 3); d/ melodic fluctuation (+/- 0 to 3); e/ speech rate (+/- 0 to 3); f/ regularity of speech rate (0 to 3); g/ nasal resonance (0 to 3); h/ palilalia. In the last 4 columns, data on the speech content of: i/ duration of speech produced (in sec.); j/ number of words and k/ phonemes; l/ speech rate (nb of syll./sec.).