

PHONETIC AND PRAGMATIC FEATURES OF THE FRENCH DISCOURSE MARKER *ET PUIS*: A LONGITUDINAL STUDY IN 10 FEMALE SPEAKERS

Annette Gerstenberg, Susanne Fuchs, Laura L. Koenig

Universität Potsdam, Potsdam (Germany), Leibniz-Zentrum Allgemeine Sprachwissenschaft, Berlin (Germany), Adelphi University, New York (USA)
gerstenberg@uni-potsdam.de

ABSTRACT

We contribute to the growing field of phonetic studies on aging. Our data is not limited to laboratory settings, but comes from an extensive corpus of spontaneous speech data recorded over 10 years. We take the example of the frequent French discourse marker *et puis* ‘and then’. Its occurrences are compared in 10 French female participants recorded at two timepoints 10 years apart. Following earlier work showing interaction between acoustic features and prosody, we assume a similar interaction with regard to discourse functions. We labelled all occurrences of *et puis*, accounting for differences in duration, f₀, formants (F1, F2) and central discourse functions between the two timepoints. Our results show a significant and consistent effect of age for F2 and in some positions for F1. Duration marked selected discourse functions, no interaction was found for f₀. We propose to consider this as a stabilizing effect of the frequent discourse marker.

Keywords: aging, discourse markers, vowels, duration, formants

1. INTRODUCTION

The inclusion of older speakers in age-related phonetic research has become more and more frequent both in cross-generational and longitudinal designs. Such studies explore a wide range of questions: age-related effects on speech acoustics; sociolinguistically meaningful variables and their age-specific use; cross-generational [1] or longitudinal data focusing on individual trajectories from a sociolinguistic perspective [2]. However, it remains a challenge to trace changes with age and at the same time account for the particular properties of spontaneous language.

Since many aspects of speech acoustics, including vowel formants, vary systematically with gender [3, 4] and increase statistical complexity, we base

our study on a sample of 10 female speakers from a longitudinal corpus of biographical interviews recorded in France [5]. A previous longitudinal study on the French filler particle *euh* [6] established the interaction of aging mainly with prosodic positions, and suggested that aging may not be visible throughout the speech signal. An effect of age for f₀ was only found in the final position of a segment, and also for F2, with both measures showing lower values at older ages. Using a similar approach, we will investigate another frequent element of spoken French, further exploring pragmatic functions, the discourse marker *et puis*. Discourse markers are known to be linked to generation-specific patterns [7]; e.g., French *enfin* meaning ‘that is’ is used to introduce a substitution marker in the context of potential age-related disfluencies [8]. The two parts of *et puis* /e pui/ are considered to operate pragmatically as a unitary discourse marker [9]. It is frequently used, and its pragmatic functions are well understood [10]. This allows for the composition of a highly comparable sample, in which the discourse marker is affected by age-related prosodic changes. Following earlier work, we expected to see an effect of aging between the two time points (t1 and t2) for F2 and interaction with pragmatic factors. While [11] found a significant age-related effect only for f₀ and F1 (but not F2), other studies have found that F2 is also subject to age-related changes [1, 12]. The cited studies differ greatly in methods, in the composition of the underlying samples, and in syllable position and phonetic context; a comprehensive review found no evidence for an invariant pattern of age-related changes in vowel formants [13]. In cross-generational settings, age differences can be due to individual and social conditions. The advantage of the repeated recordings of the same speakers as used for the present study is the resulting high degree of speaker stability on many levels, such as education, lifestyle factors such as singing and smoking, communication styles and

basic health factors (although the latter may also differ between t1 and t2 in longitudinal designs). Finding interactions between phonetic measures of age and pragmatic functions could provide further evidence that acoustic features of aging do not appear across the board, but can be overridden by discourse functions. Prosody is known to be a resource in interaction, used to convey speaking styles, power relations or managing conflicts [14]. Analysis of entrainment, looking for tendencies of participants in a conversation to develop a similar behaviour as their counterparts, revealed that it can be found on the level of discourse markers, but only partly; some features did not participate in entrainment [15]. While some features are speaker-specific, other prosodic cues are characteristics of specific discourse markers and play a central role in fulfilling their pragmatic functions as the marking of discourse relations. Discourse markers such as French *et* ‘and’ as well as *alors* ‘then’ create discourse relations such as temporality, addition, consequence, concession, specification and topic shift. It has been shown that the actualisation of these discourse relations is supported by prosodic means: less frequently used discourse relations are marked by a stronger “prosodic segmentation” with long silent pauses, prosodic boundaries, lengthening of the discourse marker and pitch reset, while cues of “prosodic integration” (no pause, less frequent prosodic boundary, no lengthening) are used in the case of unmarked, predictable discourse relations [16]. The setting used for the present study allows for the combination of the two approaches which, on the one hand, investigate potential interactions of age and the acoustic measures of a frequent discourse marker, and on the other hand observe interactions in the use of prosodic and phonetic cues for different discourse relations, again, with a potential interaction with age.

2. METHODOLOGY

The sample is comprised of two series of recordings with 10 female speakers showing no signs of cognitive impairment. Mean age was 75.7 for t1 (median=78) and 86 for t2 (median=88), covering three levels of education: four speakers had finished high school (Baccalauréat), 5 attended school until age 15/16 (Brevet d’études primaires) and 1 until age 12/13 (Certificat d’études). The interviews of the first (t1, 2005) and the second (t2, 2015/2016) series comprise 120 635 words. The selection of *et puis* was motivated by its corpus-specific frequency:

after the conjunction *parce que* ‘because’ [17] with a frequency of 638 occurrences, *et puis* is the second most frequent connector, with 598 occurrences. We included instances of *et puis* in the analysis (n=431) where /e/ was voiced and labeled the onset of the first vowel, the burst and the offset of the second vowel in PRAAT [18].

2.1. Acoustic analyses

In PRAAT, formant and f0 measures were obtained automatically for the vowel /e/. Preliminary analyses showed that the vowel glide in *puis* was frequently quite short and its pronunciation placed on a continuum between the proper vowel glide and /i/. This, combined with carry-over effects of the plosive burst, meant that automatic formant and f0 measures frequently yielded unrealistic values or else were undefined. PRAAT analysis settings used the burg method, a window size of 25 ms, a maximum frequency range of 5500 Hz, and pre-emphasis. The default setting was to estimate 5 formants; that value was changed to 4 or 6 for individual tokens when the automatic output yielded unreasonable values based on visual and auditory assessment. The f0 analysis used the PRAAT default values of 75 Hz and 600 Hz as the minimum and maximum allowable values. Although data loss for *et* was less extreme than for *puis*, a number of tokens still yielded undefined or unrealistic values. The final number of measured tokens was 393 for f0 and 315 for formants in /e:/. We did not analyze *puis*, because of the extreme data loss.

2.2. Annotating discourse functions

For the pragmatic functions of discourse markers, different hierarchical models combining the levels of semantics, cognition and discourse segmentation have been proposed. In a recent model that yielded a high level of replicability [10], the authors propose a two-level annotation. On the first level, four different “domains” of discourse markers are identified. Upon application to our data two of them turned out to be relevant, the “ideational domain”, “linked to states of affairs in the world, semantic relations between external events” and the “sequential domain”, “linked to the structuring of local and global discourse segments such as topics and turns” (p. 11-12). On the second level, the model presents 15 different functions which can be flexibly combined with the domains on the first level.

Accordingly, *et puis*, corresponding to *and then* in the English translation from French, is labeled as “ideational” on the level of domain

and “temporal” on the level of functions in the following context: “I continued my studies and then uh at the second internship I didn’t uh I didn’t carry it out” [10] (p.33). In order to avoid small numbers of occurrences and missing values for certain levels, we ultimately grouped them into four functional categories: the original categories of Addition (ADD) for discourse-new information; Monitoring (MNT) used to control the discourse flow, in our approach joined with hesitations; semantical categories (SEM) grouping the less frequent categories of, e.g., temporal and causal relations; Topic (TOP) for start / change of or return to a topic. As for the embedding of *et puis*, we also reduced the number of categories and annotated whether a pause preceded the discourse marker or not (Category Prae: Pause vs. Other) and did the same for the part following *et puis* (Category Post: Pause vs. Other).

2.3. Statistical treatment

Statistic analyses were computed in R [19] with Posit [20], using the packages *lme4* [21], *lmerTest* [22] and *ggplot2* [23]. Specifics of the models are given in the results section below. All values with $\alpha \leq 0.05$ were considered significant. For each dependent acoustic measure, linear mixed models were run, with speaker-specific random slopes. In every subsection, we focus on results with significant outcomes.

3. RESULTS

3.1. Does fundamental frequency in *et puis* change with aging and discourse function or prosody?

We obtained an overall f0 from /e:/ in *et puis* and investigated whether it changes significantly with the speakers’ age as well as with the use of this word in discourse. We first ran a model with speaker-specific random slopes for the interaction between the two predictors. Since this showed a singular fit, we reduced the model to speaker-specific random slopes of age only, resulting in $\text{lmer}(\text{overall_f0}) \sim \text{pragfunct} * \text{timepoint} + (1 + \text{timepoint} | \text{speaker})$. Our findings revealed no main effect of age, no effect of pragmatic function, and no interaction between the two factors, as graphically displayed in Fig. 1. In a next step, we ran a model with age and the occurrence of pauses before or after *et puis*. All of them were similarly constructed as described above, only including Prae (Pause vs. Other) or Post (Pause or Other) as predictors. None of the obtained results reached significance.

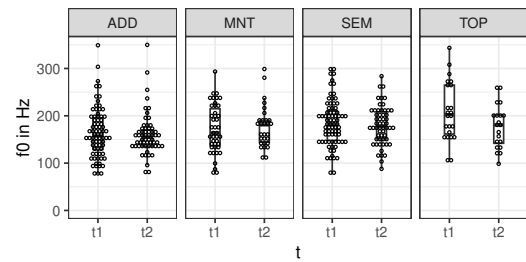


Figure 1: Boxplots with dot values showing overall f0 in Hz. Different subplots correspond to the four pragmatic functions. Addition (ADD), Monitoring (MNT), Semantic relation (SEM), Topic change (TOP).

3.2. Do formants change with aging and discourse function or prosody?

Models similar to the ones for f0 (pragmatic function * age; Prae * age; Post * age) were run for F1 and F2. While F1 did not change with age or pragmatic function, F2 showed a main effect of age only (Fig. 2). At the later time point (t2), speakers had on average a lower F2 ($t = -2.39, p = 0.0276^*$) which means they produced the /e:/ from a more retracted place of articulation.

For pauses, we found that there was no effect when a pause did or did not follow *et puis*, but we found a main effect ($t = 2.817, p = 0.00517^{**}$) for F1 for the Prae condition (Pause or no pause was preceding). Moreover, an interaction with age was found as well ($t = -2.163, p = 0.0314^*$). The interaction reveals that with younger age (t1) F1 is lower than with older age (t2), but only in cases where no pause was present before *et puis*. If a pause was present before the target utterance, speakers started with a similar F1 value independent of their age.

When we ran the model with either pauses preceding (Prae) or following (Post) the target utterance and age, we found that F2 was always affected by age (Prae: $t = -3.342, p = 0.003201^{**}$, Post: $t = -3.696, p = 0.00465^{**}$). Thus, the second formant is a very robust marker of age and can be found in all conditions, independently of whether they have certain pragmatic functions or occur in prosodically marked positions. Some additional effects were found: when a pause preceded the utterance, F2 was also higher than without a pause ($t = 3.687, p = 0.000268^{***}$). Finally, a marginal interaction was found (Post*age), when a pause followed the utterance, speakers produced no F2 difference at different time points, while they did when no pause was present $t = 2.017, p = 0.04458^*$.

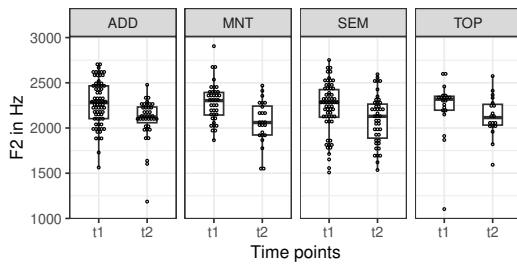


Figure 2: Boxplots with dot values showing F2 in Hz. Different subplots correspond to the four pragmatic functions. Addition (ADD), Monitoring (MNT), Semantic relation (SEM), Topic change (TOP).

3.3. Does duration change with aging and discourse function or prosody?

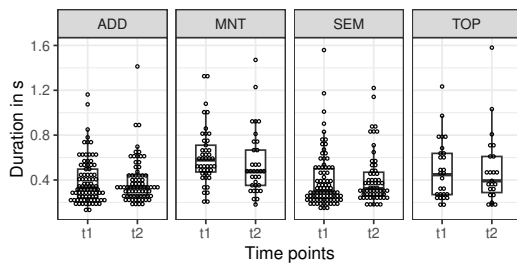


Figure 3: Boxplots with dot values showing the duration of *et puis* in seconds. Different subplots correspond to the four pragmatic functions. Addition (ADD), Monitoring (MNT), Semantic relation (SEM), Topic change (TOP).

While pragmatic functions had no imprint on the production of either f_0 , F_1 or F_2 , i.e. spectral characteristics of the utterance, they did have an influence on the duration of said utterance. *et puis* was produced for a significantly longer duration in Monitoring (MNT: +0.443s) than in Adding a new topic (ADD: $t=4.761$, $p=0.000269^{***}$). No other effects were found. Not surprisingly, the prosodic parameters (Prae and Post) also affected the duration of the utterance, but in all cases without an interaction with the speakers' age. When a pause preceded the utterance, the duration of *et puis* was slightly longer than when no pause was present ($t=2.469$, $p=0.014^*$). The same happened when a pause followed the utterance. Here we found again, a longer duration of *et puis* ($t=3.634$, $p=0.0104^*$). Thus, pauses surrounding the utterance caused general lengthening.

4. DISCUSSION

Changes in f_0 did not turn out to differ significantly between t_1 and t_2 . This could reflect the specific 10 year time-span for our older speakers which might be not be indicative of age-related f_0 changes in female speakers: age-related changes develop on a continuum and are gradual in nature [1, p. 14]. Previous studies have often focused on younger vs. older speakers (see review in [6]). Our findings show that fine-grained analyses of changes within the limited timespan of 10 years refine our understanding of age-related changes in aspects of voice. Further, focusing on specific segments and/or words with different discourse functions may show different patterns from what has been attested in past work. Alternatively, we could assume a general stability of the basic measure of f_0 linked to the frequency of this specific discourse marker. An intriguing finding is represented by the interaction of a lower F_1 at t_1 with specific discourse functions, i.e., exclusively after a speech sequence, not after a pause. This raises the question of the potentially changing mechanisms of coarticulation with age. This is also the case for F_2 as a marker of age which was found to be very consistent. The finding that *et puis* was longer in the less frequent Monitoring (MNT) function than in the more frequent function of Adding (ADD) is in line with [16].

5. CONCLUSION

As in [6], F_2 turned out to be a robust marker of age, found in all prosodic contexts and pragmatic functions. This was less true for F_1 , which turned out to be age-sensitive only in very specific contexts (after a preceding speech segment vs. pause). Related challenges for future research concern the involvement of F_1 and F_2 in coarticulation, and with regard to articulation rate and age. The duration of *et puis* was influenced by its pragmatic function, but not age. We interpret this finding in two directions: First, temporal phonetic properties mark pragmatic functions and second, pragmatic functions may be stable across the age span we investigated. Our results provide further evidence that certain prosodic positions show age effects while others do not. In turn, f_0 of /e/ in the highly frequent discourse marker *et puis* did not show age-related change. In a next step, comparisons could be drawn to other portions of less routinized speech, where age-related changes may be more visibly reflected. Could it be the case, that the discourse marker *et puis* shows stable prosodic patterns as has been shown for pieces of formulaic language [24]?

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