Empirical Study on Pause Lengths in Catalan Easy Language Audios

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Abstract
This study investigates the effect of pause lengthening in Easy Language audios — a feature typically recommended to improve comprehension — on participants' understanding, acceptability, and preferences. The participants of this study included 35 neurotypical Catalan native speakers (control group), 34 Catalan native speakers with intellectual disabilities (ID), and 31 second-language learners of Catalan (L2). Participants completed a comprehension test with audio featuring four inter-sentence pauses (590 ms, 740 ms, 890 ms, 1040 ms) and four intra-sentence pauses (250 ms, 400 ms, 550 ms, 700 ms). They also rated pause acceptability and indicated preferences.
Results showed no significant improvement in comprehension with longer pauses in the ID or control groups, whereas L2 learners showed a non-significant trend toward improvement. Longer inter-sentence pauses were generally acceptable across groups, whereas longer intra-sentence pauses were less favored by the control group. Preferences for pause durations were unclear for the ID and L2 groups.
Key words: pauses, Easy Language, Listening comprehension, L2 learners, Intellectual disability

1. Introduction

Easy language is a simplified language variety designed to improve access to information by offering specific recommendations on wording, structure, and design for individuals with comprehension difficulties (ISO, 2023). These difficulties may arise from various causes: intellectual disabilities, neurocognitive disorders, learning disabilities, second language learners, or functional illiteracy, among others (Lindholm & Vanhatalo, 2021).
In recent years, Easy Language has started to extend into oral and audiovisual formats, such as easy audio descriptions, easy news programs, and Easy Language interpreting (Maaß, 2020; Nahón Guillén, 2020; Pujadas-Farreras & Matamala, 2025; Rubanovsky-Paz et al., 2024; Schulz et al., 2020; Yalon-Chamovitz et al., 2019). Among the various recommendations given for these formats, a recurring one in several Easy Language guidelines is the use of pauses (ILSMH-EA, 1998; Inclusion Europe, 2009; ISO, 2023), which professionals also advocate for, emphasizing that longer pauses can aid in information processing (Pujadas-Farreras & Matamala, 2025; SELSI project, 2023).
However, these guidelines lack specificity, offering no clear instructions on the length or placement of pauses. Research on pauses in Easy Language remains limited, with only a few studies identified to date, specifically for Japanese (Prafiyanto, 2020; Prafiyanto et al., 2018). This lack of research leaves it unclear whether the recommendation to use pauses is effective in improving comprehension. Moreover, because existing guidelines are so vague, practitioners are left without concrete implementation parameters, leading to inconsistent, subjective applications in practice. This ambiguity creates challenges for professionals who must decide when, where, and how long to pause without evidence-based guidance. In addition, because each language has its own prosodic characteristics, research on pauses should be conducted within specific linguistic contexts. This is essential for developing locally relevant guidelines, especially since pause length within a sentence can significantly

impact a speaker's communicative effectiveness (Price, 2021). Furthermore, it is relevant to empirically test these recommendations across different user groups, as different user profiles may require different pause lengths. In the identified studies, only language learners were considered.

This study aims to investigate whether longer inter-sentence and intra-sentence pauses in Catalan Easy Language audios impact comprehension. It also examines the acceptability of these pauses and users' preferences, involving three participant groups: a control group of neurotypical Catalan native speakers, a group of Catalan native speakers with intellectual disabilities, and a group of second language learners of Catalan. In this study, both objective (comprehension) and subjective (acceptability and preferences) measures are assessed, as previous Easy Language research has shown that acceptability can influence the cognitive effort required to process read content (Gutermuth, 2020).

2. Silent pauses in speech

The term' hesitations' refers to various occurrences, including pauses, that interrupt the natural flow of spoken language and are typically regarded as not contributing to the semantic content of the message (Baqué & Machuca, 2023). Pauses are interruptions or stops during speech or reading (Mestres et al., 2019) that speakers can use to highlight the information structure by indicating groups of words or prosodic phrases and manipulating the distribution and length of these pauses (Gustafson-Capkova & Megyesi, 2001; Swerts & Geluykens, 1994).

Pauses can be categorized into filled pauses, which involve vocalizations such as [ə:] or [əm], and unfilled pauses, also known as empty or silent pauses, which occur without any filler particles (Maclay & Osgood, 1959). However, some studies have observed that the concept of pauses should be expanded, because the term' silent pauses' fails to consider the acoustic characteristics of inhalation and exhalation during speech pauses (Belz & Trouvain, 2019; Trouvain et al., 2016). Silent pauses are often categorized into longer pauses, often accompanied by inhalation, to indicate higher syntactic-prosodic breaks and shorter pauses, predominantly non-breath pauses, for breaks within sentences (Fuchs et al., 2013; Gee & Grosjean, 1983; Grosjean et al., 1979; Grosjean & Collins, 1979; Trouvain et al., 2016; Werner et al., 2022).

As Fauth and Trouvain (2018) and Trouvain and Werner (2022) mention, there is no consensus regarding how long a pause must be to be considered a pause. For example, Trouvain (2004) establishes the minimum length at 100 ms, Cucchiarini et al. (2002) and Lennon (1990) establish it at 200 ms, and Tavakoli (2011) at 400 ms.

Pauses can also show a high variability in duration (Campione & Véronis, 2002). For example, Campione and Véronis (2002) suggest a categorization of brief (<200 ms), medium (200-1000 ms) and long (>1000 ms) pauses, the latter only occurring in spontaneous speech, based on their study with five languages (English, French, German, Italian, Spanish). In French, Grosman et al. (2018) found that 50% of pauses lasted 250-600 ms. Gustafson-Capkova and Megyesi (2001) find an average of 271 ms for professional readings of Swedish radio news and 561 ms for non-professionals. In spontaneous Spanish, Rebollo Couto (1998) finds that silent pauses have a duration from 42 to 1344 ms. Finally, Cantin and Ríos (1991) report average durations of 590 ms for inter-sentence pauses and 250 ms for intra-sentence pauses in Catalan.

Llisterri et al. (2024) have also conducted an in-depth analysis of the methodological issues regarding how to establish the duration of silent pauses.

All these previous studies were conducted on standard language varieties, as Easy Language or other simplified language varieties are yet to be studied.

2.1. Comprehension facilitated by pauses

Research on the role of pauses in comprehension has highlighted their potential to enhance understanding, particularly in individuals with brain damage, by improving the identification of prosodic boundaries and overall content processing.

Studies with subjects with brain damage have generally found that longer pauses increased accuracy in prosodic boundaries identification and comprehension (Aasland & Baum, 2003; de Beer et al., 2022; Lasky et al., 1976; Liles & Brookshire, 1975; Park et al., 2002; Sheppard et al., 2019), but these findings are not uniform. For example, Aasland and Baum (2003) and Park et al. (2002) observed improved comprehension with intra-sentence pauses up to 500 ms. With longer inter-sentence pauses, Lasky et al. (1976) and Liles and Brookshire (1974) also reported an improvement, using 1-second pauses and 5-second pauses, respectively. However, in a later study, Brookshire and Nicholas (1984) found inconsistent results while using 4-second pauses. Similarly, Blanchard and Prescott (1980) found no significant improvement when pause durations were expanded by factors of 1.25, 1.5, and 1.75. Furthermore, Blumstein et al.'s (1985) study tested pauses from 250 ms to 3000 ms, and while it found that adding pauses at syntactically salient points were particularly effective for Wernicke's aphasics, intra-sentence pauses actually significantly impaired comprehension performance.

Similar variability appears in studies with L2 learners, as positive effects have been reported using inter-sentence pauses of 3 seconds (Blau, 1990; Leeser, 2004) and 1–2 seconds (Kano & Saito, 1997), and intra-sentence pauses ranging from 200–800 ms (Sugai et al., 2007) and 200–450 ms (Sugai et al., 2016). However, Leeser (2004) reports on the findings of Sagarra (1998) and Chaudron and Richards (1986), noting that neither study found significant results, despite Sagarra also employing 1-2 second inter-sentence pauses.

Finally, studies involving native speakers (Fortunato-Tavares et al., 2023; Henderson & He, 2022; Tanaka et al., 2011) also show improvements in comprehension when longer pauses are used at prosodic boundaries. Fortunato-Tavares et al. (2023) reported improvements using 100–300 ms intra-sentence pauses, while Tanaka et al. (2011) observed benefits from 0–400 ms inter-sentence pauses.

Nonetheless, none of these studies were conducted using Easy Language. Prafiyanto (2020) and Prafiyanto et al. (2018), the only studies focusing on Easy Language identified, reported non-significant results in their research on Japanese Easy Language when using 200-800 ms inter-sentence pauses.

Research also indicates that varying pause lengths can influence listeners' perceptions and comprehension, with longer pauses often aiding in the identification of prosodic boundaries (Wright, 2021). Furthermore, studies have shown that pause duration is influenced by the length of the upcoming utterance, suggesting that speakers plan the upcoming speech during pauses (Krivokapić et al., 2022).

Easy Language standards and guidelines recognize pauses as an important feature of audio creation in Easy Language. However, as noted by Pujadas-Farreras and Matamala (2025), the available standards that address prosody remain limited, and their recommendations are often vague and nonspecific. The ISO standard (2023), for example, advises the use of 'adequate' pauses between words and sentences to convey sentence and text structure, but it does not define what constitutes adequacy. Similarly, the ILSMH-EA guidelines (1998) mention the need to pause briefly between sentences but offer no further detail on the duration. Finally, the Inclusion Europe guidelines (2009) stress the importance of pausing at logical points to allow listeners time to process information before introducing new content. As observed, these recommendations do not explain how long such pauses should be to aid comprehension or how they should be applied specifically, remaining quite general.

Professional creators of Easy Language audios and videos adopt practices that closely align with these recommendations. Interviews with professionals (Pujadas-Farreras and Matamala, 2025) showed that they believe pauses are useful for helping users process information. They also used the pauses to signal transitions between topics and to indicate progression. Additionally, a recommendation from these interviews was to make longer pauses between prosodic units rather than between individual words. Similarly, a report from the SELSI project (2023), which focuses on oral Easy Language, highlighted that both professionals and users consider long pauses between words, sentences, clauses, and different subjects to be effective strategies.

Nonetheless, some professionals have also mentioned that the use of pauses in Easy Language may not always align with practices in standard language. For example, in standard language interpreting, pauses are typically discouraged, whereas in Easy Language interpreting, pauses are more commonly used to support comprehension (Pujadas-Farreras & Matamala, 2025).

However, as previously noted, there is a lack of empirical evidence supporting these recommendations and practices. To date, only the studies conducted by Prafiyanto (2020) and Prafiyanto et al. (2018) have specifically examined this issue, and they reported non-significant results.

3. Methods

This study aimed to research whether longer inter-sentence and intra-sentence silent pauses in Catalan Easy Language audios significantly impact comprehension. The second objective was to assess the acceptability of different pause durations and participants' preferences. Based on the study objectives, the following research questions have been formulated:

a) Does the duration of inter-sentence and intra-sentence silent pauses in Catalan Easy Language audios significantly impact comprehension?
b) Which inter-sentence and intra-sentence pause durations do participants find most acceptable and preferable?

The Ethics Committee of the Autonomous University of Barcelona approved the protocol for this study.

3.1. Participants

Participation in this study was entirely voluntary, and the participants were not compensated economically. Prior to their involvement, all participants provided written consent using a consent form designed in Easy Language to ensure accessibility. Participants were free to withdraw at any point during the study if they chose not to continue for any reason.

The participant sample for this study overlapped with a previous study (Pujadas-Farreras & Machuca, 2025), which involved three groups: (1) a neurotypical control group of native Catalan speakers, (2) a group of neurotypical second-language learners of Catalan (L2 group), and (3) a group of native Catalan speakers with intellectual disabilities (ID group). The only difference was that one participant in the ID group declined to participate, resulting in a total of 100 participants.

Participants in the ID group had mild to moderate intellectual disabilities, as indicated by the associations through which they were recruited, and were familiar with Easy Language materials, as some had participated in validation sessions for these materials or used them themselves. No formal assessments of their language skills were conducted within the study; instead, the study identified individuals who, in their judgment, possessed sufficient language abilities to participate.

The L2 group consisted of participants with A1 or A2 proficiency levels in Catalan. Their first languages included Spanish (n = 19), English (n = 3), Portuguese (n = 3),

Italian (n = 2), Russian (n = 1), Urdu (n = 1), French (n = 1), and Romanian (n = 1). All had lived in Catalonia for five years or less, with most having arrived either in the same year as the study or the year before. Their primary exposure to Catalan came through language classes, although three participants reported additional exposure via work or intentional engagement with Catalan-language media. However, due to the widespread tendency of locals to switch to Spanish when addressing non-native speakers, overall exposure to Catalan in daily life was minimal unless actively sought out. None of the L2 participants had prior experience with Easy Language materials.
Finally, all participants in the control group had at least completed a bachelor's degree or an equivalent level of education.
All participants in the three groups also completed the Raven's Coloured Progressive Matrices test (see Section 3.3) to ensure homogeneity within the groups.

Table 1 displays the participants' demographic information, including their age and Raven test scores (out of 36), with slight adjustments to reflect the updated participant totals.

	Control	L2	ID
Count	35	31	34
Age (Years)	46.31 (±16.51)	38.65 (±13.52)	45.97 (±14.68)
Raven test	34.14 (±1.85)	33.39 (±1.84)	21.35 (±7.01)
Catalan level	Native	A1 (n=18)/A2 (n=13)	Native

Table 1. Participants demographics

The control group was recruited through snowball sampling, with outreach conducted through social media and public posters. The L2 group mainly consisted of students from three adult education centers (CFA Madrid, CFA Torre Romeu, and CFA Gavà), where participation was part of a class activity. Additionally, information about the study was shared with students through the UAB Idiomes school and the Consorci per la Normalització Lingüística ('Consortium for Language Normalisation'). Finally, the ID group was recruited through two associations: Som Fundació and Fundació Asproseat Proa Esplugues.

3.2. Materials

The audio materials for this study were recorded by a professional voice actor with an F0 of 218 Hz, consistent with recommendations and studies that found that listeners favor lower-pitched voices (Accessible Information Working Group, 2011; Machuca & Matamala, 2022; Pujadas-Farreras & Matamala, 2025). As previously noted, acceptability can influence the cognitive effort required to process a text (Gutermuth, 2020). Similarly, using a voice with high acceptability may enhance listenability (Machuca & Matamala, 2025), which is why this specific voice was chosen for the stimuli.
The articulation rate, which does not count pauses (Dowding et al., 2024), was set to 150 words per minute for each audio, aligning with the speed identified as most acceptable across the participant groups in a previous study (Pujadas-Farreras & Machuca, 2025).
The recordings were also modified to include varying pause durations. Inter-sentence pauses began at 590 ms and intra-sentence pauses at 250 ms, which correspond to the average durations for each pause type in Catalan, as reported by Cantin and Ríos (1991). Each pause was then incrementally extended in 150 ms intervals, following the methodology proposed by Prafiyanto et al. (2018). Table 2 shows the durations used in each audio.

Audio 1	Audio 2	Audio 3	Audio 4
Inter: 590 ms Intra: 250 ms	Inter: 740 ms Intra: 400 ms	Inter: 890 ms Intra: 550 ms	Inter: 1040 ms Intra: 700 ms

Table 2. Overview of stimuli

The scripts for each audio were 130 words long and adapted from the book *Com tenir cura del planeta* ('How to Take Care of the Planet') (Peralta, 2023). Both the scripts and the corresponding comprehension questions underwent validation by professionals affiliated with the Easy-to-Read Association to ensure the texts were properly written in Catalan Easy Language. This process followed one of the expert judgment methodologies outlined by Cabero Almenara and Llorente Cejudo (2013). Additionally, the scripts were analyzed using the Flesch-Szigriszt readability index, achieving scores between 80 and 91, which classify them as 'very easy' (Barrio Cantalejo, 2007). This analysis further helped ensure that all texts were of equivalent difficulty.

Table 3 provides an example of the comprehension questions used in Catalan, along with its English translation.

Original in Catalan	Translation
Quin altre regal recomana l'àudio? a) Els objectes de plàstic. b) Els objectes de vidre. c) Els objectes de fang.	What other gift does the audio recommend? a) Plastic items. b) Glass items. c) Clay items.

Table 3. Example of a comprehension question from Audio 3

3.3. Procedure

The experiment lasted about 40 minutes and was conducted individually in a quiet room. Participants had previously completed the Raven's Coloured Progressive Matrices test (Raven, 1998) as part of an earlier study, and the data from that assessment were reused for this experiment. The Raven's test is a widely used non-verbal intelligence assessment that evaluates general intelligence and abstract reasoning skills, serving as a measure of fluid intelligence (Bilker et al., 2012).

After completing a brief volume test, participants listened to all the audios presented in different orders. Each audio was played twice, with participants answering three orally presented multiple-choice comprehension questions after each playback. However, for this study, only responses from the first listening were analyzed. The second-listening data will be examined in a follow-up study that will explore the effects of repeated exposure, potential priming, and self-correcting strategies among participants.

Following the comprehension task, participants evaluated the acceptability of each pause using a six-point Likert scale: 0 (not noticeable), 1 (too short), 2 (short), 3 (suitable), 4 (long), and 5 (too long). To assist with this evaluation, participants listened to short excerpts featuring different pause durations, one at a time. After each excerpt, they rated the acceptability of the pause using a Likert scale. Participants provided their ratings based entirely on their own judgment, without any prior training or anchoring examples to calibrate their responses on the Likert scale. Once all four pause durations for one type of pause (either intra-sentence or inter-sentence) were rated, participants were asked to select their preferred duration, if any, to assess user preference. This process was then repeated for the other type of pause. The order in which participants heard the pause durations during the evaluation matched the order presented in the comprehension task; however, to control for order effects, each participant experienced a different sequence, as previously described.

3.4. Data analysis

The choice of bivariate tests depended on the types and distributions of the variables. For comparisons involving two qualitative variables, tests for distribution homogeneity (chi-square or likelihood ratio) were applied. When examining one quantitative and one qualitative variable, normality (Shapiro-Wilk) and variance homogeneity (Levene's test) were first assessed. Depending on these results, either parametric methods (t-test or ANOVA) or non-parametric alternatives (Mann-Whitney U or Kruskal-Wallis) were employed. For comparisons between one ordinal and one qualitative variable, a generalized linear model with a binomial distribution was used. When significant results were found, post hoc pairwise comparisons were conducted, with p-values adjusted for Type I error using either the Tukey or Bonferroni correction. Data analysis was performed using SAS v9.4 software, with a confidence level of 95%. The analyses were carried out by the Statistics Division of the Autonomous University of Barcelona.

4. Results

This section will present the comprehension results for each pause duration, as well as the acceptability ratings and participants' preferences.

4.1. Comprehension results

To assess whether the order of stimulus presentation influenced participants' responses, a non-parametric two-way analysis of variance (ANOVA) was conducted using the Scheirer-Ray-Hare test, examining the interaction between participant group and presentation order. The results (the R1 variables refer to the pauses analyzed) indicated that the interaction effect was not statistically significant ($H = 3.41$, $p = 0.75$ for R1_590_250; $H = 4.82$, $p = 0.56$ for R1_740_400; $H = 3.92$, $p = 0.68$ for R1_890_550; $H = 3.76$, $p = 0.70$ for R1_1040_700), suggesting that the effect of order did not vary significantly across groups.

Furthermore, an analysis within groups suggests that, in general, comprehension results are not significantly influenced by the order of presentation, participants' age, Raven test scores, or, for the L2 group, their level of Catalan. However, there are two exceptions. In the ID group, participants with higher Raven scores show better comprehension for the audio with 890 ms and 500 ms pauses. In the L2 group, Catalan proficiency becomes significant for the results of the longest pauses, 1040 ms and 700 ms. These findings are detailed in Table 4.

Pause	Group	Order	Age	Raven	Catalan
R1_590_250	ID	p=0.936	p=0.259	p=0.097	
	Control	p=0.952	p=0.916	p=0.856	
	L2	p=0.228	p=0.219	p=0.810	p=0.418
R1_740_400	ID	p=0.614	p=0.832	p=0.166	
	Control	p=1.000	p=0.247	p=0.980	
	L2	p=0.228	p=0.345	p=0.092	p=0.844
R1_890_550	ID	p=0.060	p=0.705	p=0.032 *	
	Control	p=0.707	p=0.924	p=0.859	
	L2	p=0.818	p=0.785	p=0.387	p=0.696
R1_1040_700	ID	p=0.387	p=0.475	p=0.610	
	Control	p=1.000	p=0.628	p=0.230	
	L2	p=0.109	p=0.416	p=0.350	p=0.005 *

Table 4. Comprehension results according to different factors: order, age, Raven test, and Catalan proficiency (* p < 0.05)

Starting with the audio featuring the shortest pauses, with 590 ms for inter-sentence pauses and 250 ms for intra-sentence pauses (Figure 1), both the L2 and ID (t=4.77, p < .001) groups show a significant difference in comprehension compared to the control group. Additionally, there is no significant difference between the L2 group and the ID group (t=2.24, p = .070). The control group achieved a mean result of 2.91 (±0.05), while the L2 group scored 2.35 (±0.13) and the ID group, 1.91 (±0.14). Interestingly, the standard errors for both groups are quite similar, indicating comparable precision in their mean estimates.

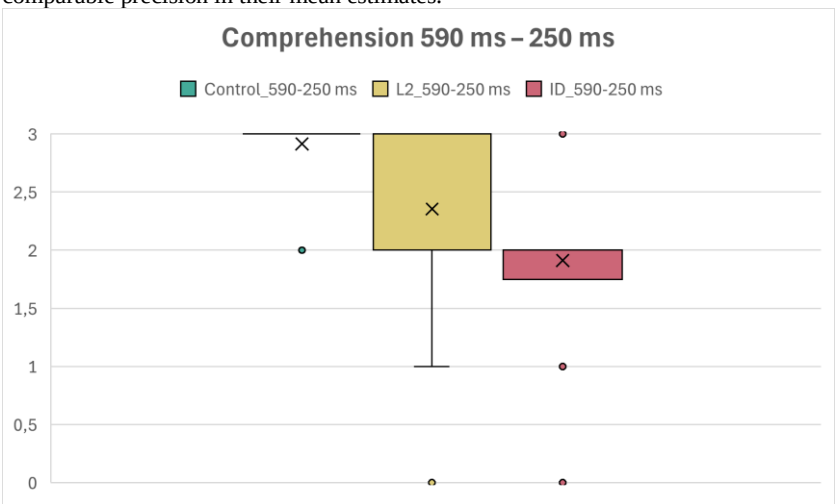


Figure 1. Comprehension results with 590 ms-250 ms pauses

Turning to the audio with 740 ms inter-sentence pauses and 400 ms intra-sentence pauses (Figure 2), the comprehension results show a mean score of 1.94 (±0.14) for the ID group, 2.35 (±0.13) for the L2 group, and 2.94 (±0.04) for the control group.

The improvement in comprehension compared to the shorter pauses is minimal, with mean scores remaining nearly unchanged across all groups. The control group shows a slightly smaller standard error in this condition, indicating a marginally more precise estimate of the mean score. However, both the L2 and ID groups have the same standard error as before, indicating that the precision of their average scores did not improve with longer pauses. This may imply that lengthening the pauses to these durations does not meaningfully aid processing for L2 and ID listeners.

The difference in comprehension between the target groups and the control group remains statistically significant (Control vs. L2 group: $t = 3.5$, $p = .002$; Control vs. ID group: $t = 4.49$, $p < .001$), while the difference between the two target groups ($t=2.11$, $p < 0.1$) is only marginally significant.

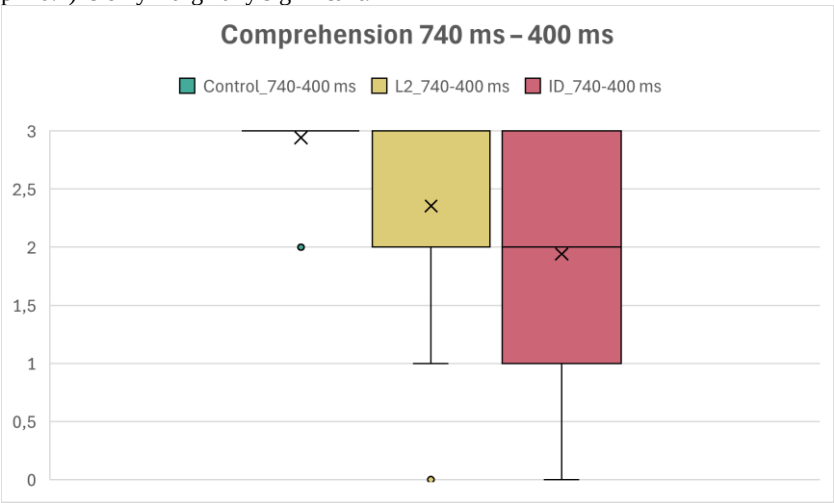


Figure 2. Comprehension results with 740 ms-400 ms pauses

In the audio with 890 ms inter-sentence and 550 ms intra-sentence pauses (Figure 3), the L2 group shows an increase in comprehension, scoring 2.48 with a slightly lower standard error (±0.12), indicating a marginally more precise estimate of their mean than in earlier conditions. These pauses correspond to the highest mean performance and the lowest standard error observed for the L2 group across all conditions. In contrast, both the control group and the ID group show their worst results with these pauses, with scores of 2.86 (±0.06) for the control group and 1.85 (±0.14) for the ID group.

Unlike the previous pause durations, significant differences emerge between all groups: between the L2 and control groups ($t=2.67$, $p = .024$), the L2 and ID groups ($t=3.19$, $p = .005$), and the ID and control groups ($t=5.02$, $p < .001$).

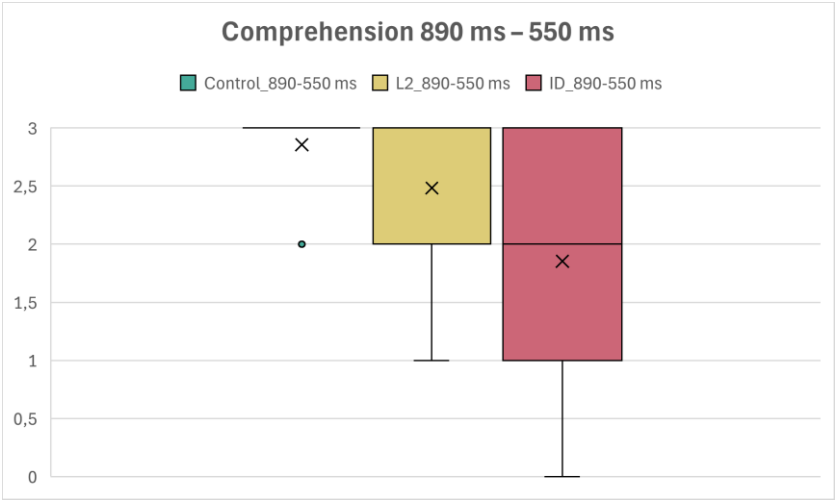


Figure 3. Comprehension results with 890 ms-550 ms pauses

Finally, the audio with the longest pauses, 1040 ms for inter-sentence and 700 ms for intra-sentence (Figure 4), shows the lowest mean score for the L2 group, 2.23 (±0.14), while the control group scores 2.89 (±0.06) and the ID group scores 1.88 (±0.14). Notably, despite the improvement seen with the earlier pause, this longer pause does not show the same results for the L2 group. However, when separated by proficiency, the A2-level participants maintain the improvement ($F=9.41$, $p=0.005$), with a mean score of 2.77 (±0.13), while A1-level participants show lower results, with a score of 1.83 (±0.20).

These pauses also show no significant difference in comprehension between the target groups ($t=1.71$, $p = .091$). Moreover, the comprehension differences between the target groups and the control group remain statistically significant ($t = 3.86$ and 4.93, $p < .001$).

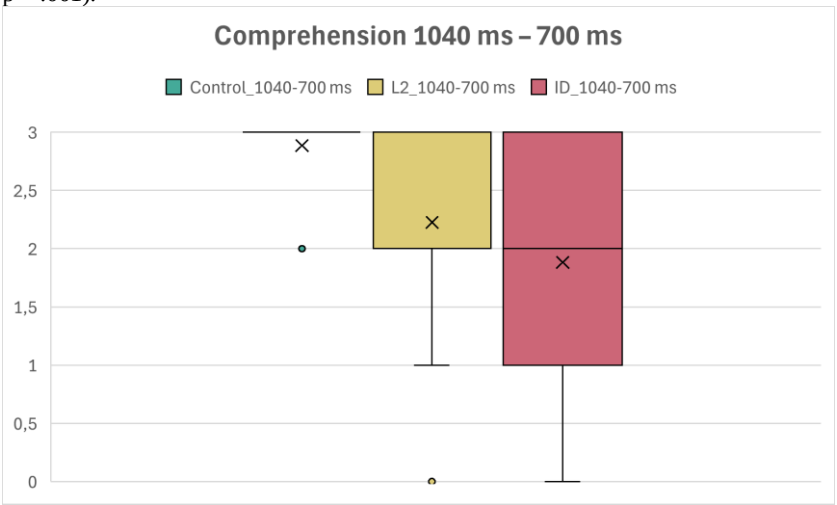


Figure 4. Comprehension results with 1040 ms-700 ms pauses

It is also worth noting that, within each group, differences in comprehension across the various pause conditions are not statistically significant. Specifically, no effect of

pause was found for the L2 group ($F(3, 388) = 0.67$, $p = .568$), the control group ($F(3, 388) = 0.47$, $p = .702$), or the ID group ($F(3, 388) = 0.07$, $p = .976$). This indicates that, despite some variation in performance, no specific pause length significantly improves or hinders comprehension within any group.

4.2. Acceptability results

As mentioned in Section 3, acceptability was evaluated through a six-point Likert scale, with the following ratings: 0 = not noticeable, 1 = too short, 2 = short, 3 = suitable, 4 = long, and 5 = too long.

4.2.1. Inter-sentence pauses

Starting with the control group, the Raven test results did not influence the acceptability ratings. However, the order in which the 740 ms pause was presented affected its rating, with it being rated 'long' when presented in the second or last audio. The participants' age only affected the rating of the 1040 ms pause, which older participants considered 'too long'. These findings are detailed in Table 5.

Inter-sentence pauses	Group	Order	Age	Raven	Catalan
590 ms	ID	p=0.258	p=0.836	p=0.336	
	Control	p=0.380	p=0.826	p=0.151	
	L2	p=0.267	p=0.438	p=0.328	p=0.119
740 ms	ID	p=0.078	p=0.124	p=0.426	
	Control	p=0.006 *	p=0.695	p=0.515	
	L2	p=0.476	p=0.702	p=0.448	p=0.264
890 ms	ID	p=0.046 *	p=0.260	p=0.549	
	Control	p=0.650	p=0.239	p=0.282	
	L2	p=0.037 *	p=0.619	p=0.379	p=0.054
1040 ms	ID	p=0.025 *	p=0.391	p=0.613	
	Control	p=0.325	p=0.041 *	p=0.256	
	L2	p=0.998	p=0.379	p=0.558	p=0.059

Table 5. Acceptability results in inter-sentence pauses according to different factors: order, age, Raven test, and Catalan proficiency (* $p < 0.05$)

Figure 5 illustrates the error bars, which represent the consistency of participants' ratings for each pause duration. Smaller error bars reflect a higher level of agreement among participants, while larger error bars indicate greater variability in their responses. In the control group, the pauses with the highest ratings, closest to 3 ('suitable'), are 740 ms, with a score of 3.14, and 890 ms, with a score of 3.20. These are followed by the 590 ms pause, which is regarded as somewhat short, receiving a rating of 2.77, and the 1040 ms pause. Nonetheless, this last pause is still considered 'suitable', with a score of 3.49, indicating that participants generally find it acceptable as well. In this group, the differences are significant ($\chi^2 = 14.3$, $p = 0.003$) between the 590 ms pauses (with the lowest mean) and the 1040 ms pauses (with the highest mean). However, these differences do not depend on order, age, or Raven scores ($p > 0.05$).

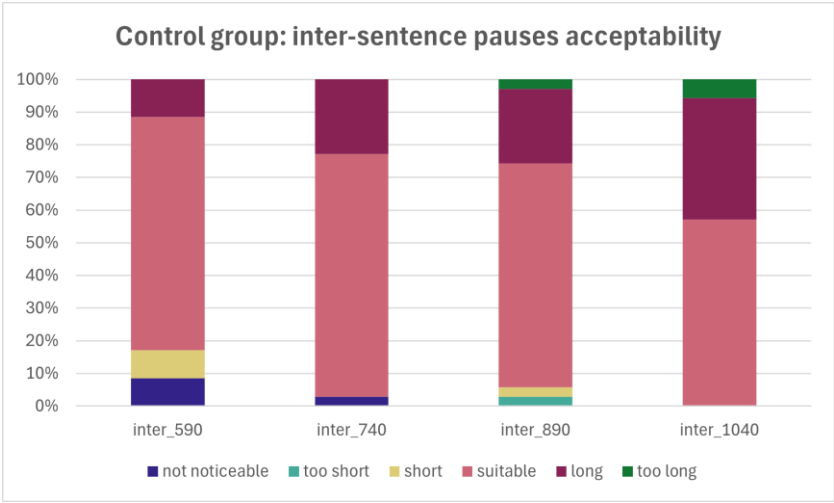


Figure 5. Acceptability of inter-sentence pauses, control group

In the L2 group (Figure 6), the results are quite different, with 590 ms being the better-rated pause at 2.94, followed surprisingly by the 890 ms pause at 3.13, and the 1040 ms pause at 3.19. Interestingly, the 740 ms pause is rated lower than the 590 ms pause, at 2.71, indicating that, on average, it is perceived as shorter. Language level does not significantly affect these ratings, nor does the age or the Raven scores of the participants, but when the 890 ms pause is heard in the third audio, fewer participants consider it 'suitable'.

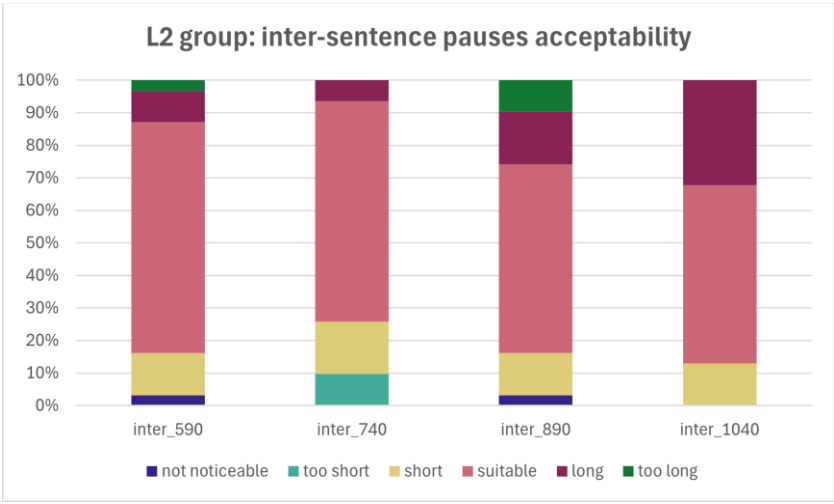


Figure 6. Acceptability of inter-sentence pauses, L2 group

Finally, the age and Raven test scores of the ID group did not influence the acceptability results. When the audio with the 890 ms pause was heard in the third audio, participants rated it as 'too short'. Similarly, the 1040 ms pause was rated 'too short' when heard in the first audio, but 'short' when heard in the third. However, no significant differences are observed ($p > 0.05$).

Notably, the ID group (Figure 7) does not find any of the pauses close to 'suitable' on average. Among the options, the 1040 ms pause is rated best, with a score of 2.38,

though it is still considered generally short by the group. This is followed by the 740 ms pause, rated at 2.24, and the 590 ms pause at 2.12. The 890 ms pause receives the lowest rating (2.09), suggesting the group perceives it as shorter than both the 590 ms and 740 ms pauses. However, no statistically significant differences were observed (χ^2 =1.05, p=0.790).

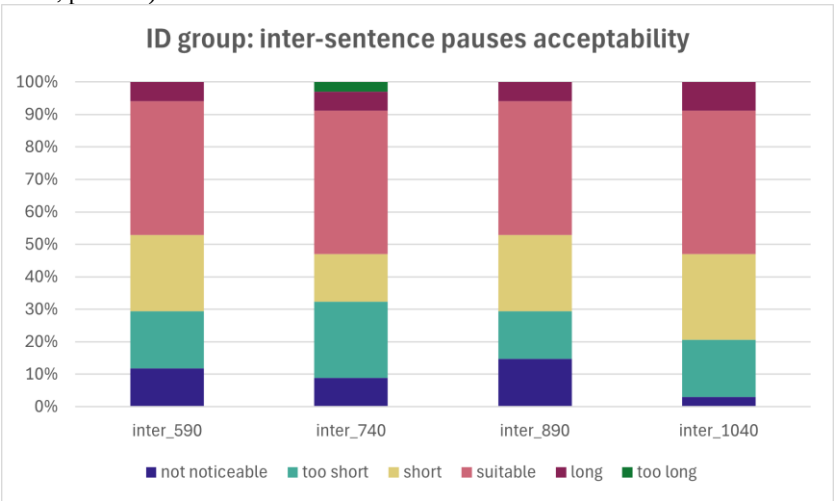


Figure 7. Acceptability of inter-sentence pauses, ID group

While the groups differ in their ratings of the pauses, the 1040 ms pause, rated best by the ID group, is also rated 'suitable' by both the L2 and control groups, with the control group leaning slightly towards 'long' (3.49). However, there is a significant difference in the perception of this pause between the ID group and the other two groups ($p < .001$). Similarly, significant differences are observed in ratings of the other pauses: the ID group generally finds them shorter than the L2 and control groups, who rate them as more acceptable overall.

4.2.2. Intra-sentence pauses

When examining the acceptability of intra-sentence pauses in the control group, the 550 ms pause was rated as 'long' or 'too long' when heard in the first audio. Neither age nor Raven test scores affected the ratings, as shown in Table 6.

Intra-sentence pauses	Group	Order	Age	Raven	Catalan
250 ms	ID	p=0.258	p=0.356	p=0.713	
	Control	p=0.162	p=0.775	p=0.885	
	L2	p=0.356	p=0.985	p=0.742	p=0.109
400 ms	ID	p=0.592	p=0.412	p=0.174	
	Control	p=0.819	p=0.817	p=0.630	
	L2	p=0.184	p=0.671	p=0.399	p=0.194
550 ms	ID	p=0.696	p=0.727	p=0.292	
	Control	P<0.001 *	p=0.598	p=0.898	
	L2	p=0.511	p=0.553	p=0.010 *	p=0.163
700 ms	ID	p=0.278	p=0.920	p=0.137	
	Control	p=0.281	p=0.323	p=0.874	
	L2	p=0.219	p=0.447	p=0.164	p=0.457

Table 6. Acceptability results in intra-sentence pauses according to different factors: order, age, Raven test, and Catalan proficiency (* p < 0.05)

The control group (Figure 8) rates the 250 ms pause most favorably, with a score of 2.94. This is followed by the 400 ms pause, which starts to lean towards 'long' with a score of 3.51, the 550 ms pause at 3.63, and finally the 700 ms pause, which is considered extremely close to being rated as 'long', with a score of 3.94 and a median of 4. Notably, despite these pauses being shorter than the inter-sentence pauses, none of the participants rated them as 'not noticeable. Furthermore, lengthening intra-sentence pauses appears to be less tolerated than lengthening inter-sentence pauses. Significant differences are observed according to the duration of the intra-sentence pause ($\chi^2 = 26.86$, $p < 0.001$). The score is lower for the 250 ms pause compared to the other pauses.

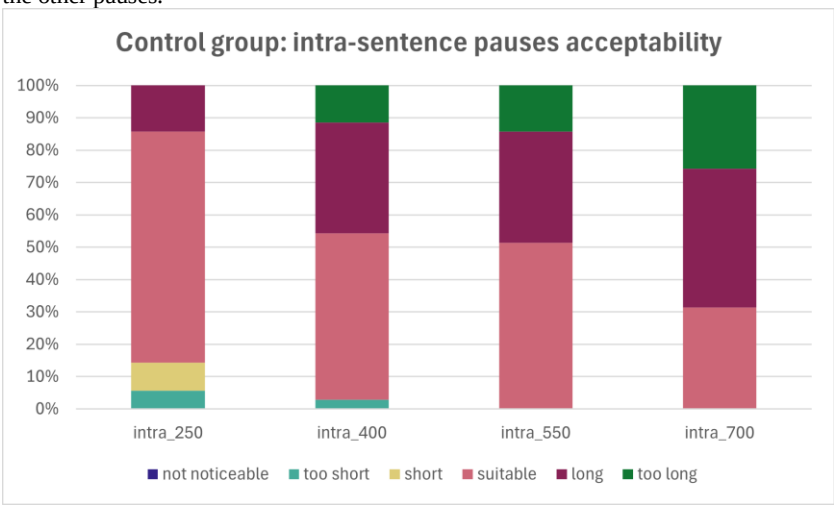


Figure 8. Acceptability of intra-sentence pauses, control group

The ratings in the L2 group were not significantly affected by the participants' age, Catalan level, or the order of the pauses. However, participants with lower Raven scores perceived the 550 ms pause as shorter than those in the same group, although these differences were not statistically significant.

This group (Figure 9) rates the 400 ms pause with an average score of 3, followed by the 550 ms pause, which has an average of 2.97, and the 250 ms pause with a mean rating of 2.77. In contrast to the control group, the L2 group is more accepting of longer pauses in the intra-sentence position, with only the longest pause (700 ms) receiving a relatively higher rating of 3.58.

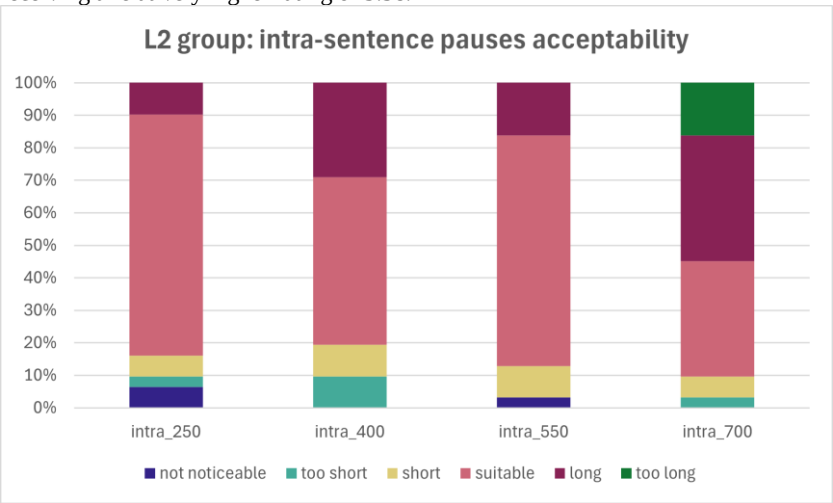


Figure 9. Acceptability of intra-sentence pauses, L2 group

Finally, the acceptability results for the intra-sentence pauses in the ID group were not affected by the participants' age, Raven test scores, or the order in which the pauses were presented. Although the ID group (Figure 10) rates the intra-sentence pauses more favorably than the inter-sentence pauses, their ratings still fall below 'suitable', as none of the pauses reach an average score close to 3. The best-rated pause is the longest, 700 ms, with a score of 2.71, followed by the 550 ms pause with an average of 2.59. The 400 ms pause is rated at 2.53, and the 250 ms pause receives a mean score of 2.24. Interestingly, while some participants considered the 400 ms and 550 ms pauses as 'too long', this was not the case with the 700 ms pause. However, no significant differences are observed according to the duration of the intra-sentence pause ($\chi^2 = 3.74$, $p = 0.291$).

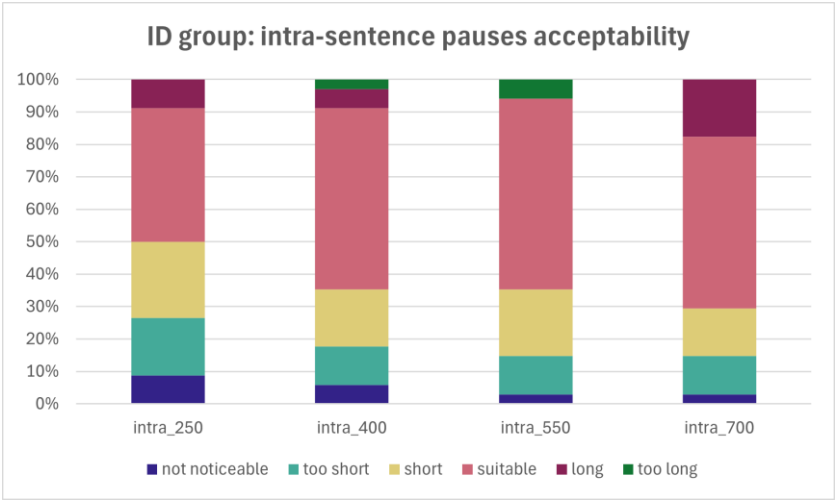


Figure 10. Acceptability of intra-sentence pauses, ID group

In general, there is a significant difference in the acceptability of the pauses across the three groups. The ID group tends to find the pauses short on average, while the control group generally perceives them as longer, and the L2 group considers most of them as acceptable. Focusing on the ratings from the L2 and ID groups, although their best-rated pause does not coincide, the 550 ms pause stands out as the second most favorably rated by both groups.

4.3. Preference results

As previously mentioned, after rating each pause, participants were asked to indicate their preferred pause duration, if any, for both inter-sentence and intra-sentence pauses.

Preference ratings in the ID group were not influenced by age, Raven scores, or the order of the pauses. Similarly, the control group showed no effect of age, Raven scores, or order on their preferences. In the L2 group, age did not affect participants' responses, but they favored the 740 ms inter-sentence pause when it was presented in the last audio. Those in this group with lower Raven scores also tended to prefer the 700 ms intra-sentence pause.

The results for inter-sentence pauses (Figure 11) show that neither the L2 group nor the ID group had a clear preference, as the differences in votes between options were typically 1 or 2. Additionally, in both groups, the most common response was to abstain, either due to a lack of preference or uncertainty about how to answer. In the L2 group, the second most popular choice was 590 ms (22.6%), followed by 740 ms and 890 ms, each of which received 19.4% of the votes. In the ID group, 740 ms (23.5%) and 890 ms (20.6%) were the next most selected options.

While the control group showed a somewhat clearer tendency, with 34.3% selecting 590 ms as their preferred pause duration and 25.7% opting not to answer, the overall distribution of preferences does not differ significantly between groups ($\chi^2 = 3.11$, $p = 0.927$).

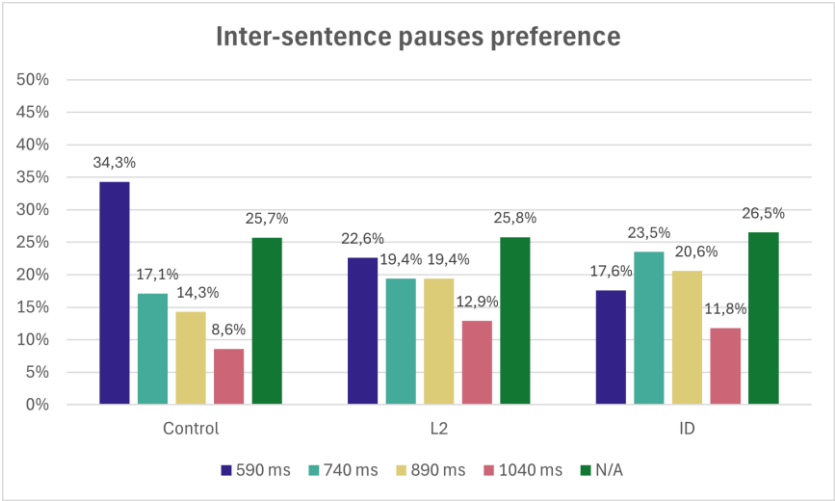


Figure 11. Inter-sentence pauses preference

For intra-sentence pauses (Figure 12), the ID group showed a preference for 400 ms pauses, which received 32.4% of the votes, followed by 250 ms pauses with 20.6%. In the L2 group, the most preferred duration was 250 ms (25.8%), followed closely by 550 ms pauses and abstentions, both at 22.6%. The control group showed the clearest preference, with 48.6% selecting 250 ms pauses, followed by 20% favouring 550 ms pauses. However, although there appears to be a notable visual difference, the result is not statistically significant ($\chi^2 = 12.4$, $p = 0.134$).

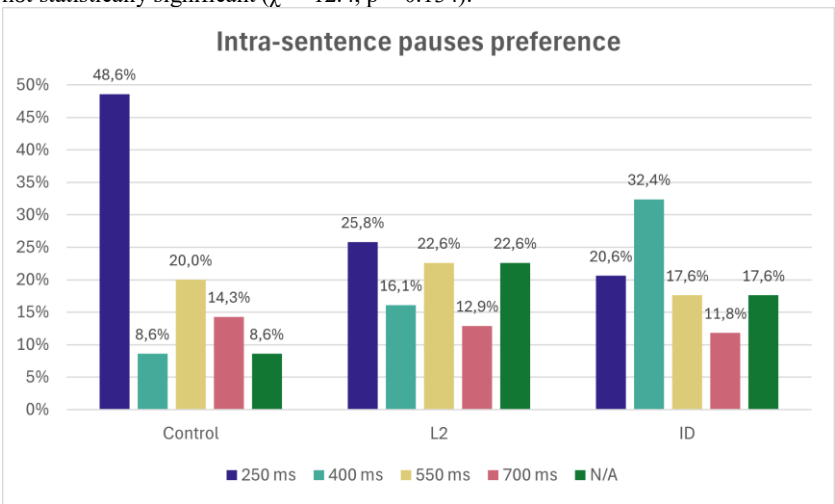


Figure 12. Intra-sentence pauses preference

5. Discussion

This study examined the impact of four inter-sentence (590 ms, 740 ms, 890 ms, 1040 ms) and four intra-sentence (250 ms, 400 ms, 550 ms, 700 ms) pause durations on the comprehension of Catalan Easy Language audios. Additionally, the acceptability of each pause and the participants' preferences were evaluated. The aim was to answer two central research questions:

a) Does the duration of inter-sentence and intra-sentence silent pauses in Catalan Easy Language audios significantly impact comprehension?
b) Which inter-sentence and intra-sentence pause durations do participants find most acceptable and preferable?

In response to the first question, although existing guidelines and practices in Easy Language recommend the use of longer pauses (ILSMH-EA, 1998; Inclusion Europe, 2009; ISO, 2023; Pujadas-Farreras & Matamala, 2025; SELSI project, 2023), the comprehension results in this study do not align with these recommendations, as none of the participant groups demonstrated significantly better comprehension with any of the tested pause durations. Both the control group and the ID group show slightly better performance with shorter pauses. Conversely, the L2 group demonstrates improvement as pauses become longer, although this effect is more consistent among participants at the A2 level. However, the improvement is not statistically significant.

These findings are consistent with prior research (Prafiyanto, 2020; Prafiyanto et al., 2018), which also tested similar pause durations in Easy Language audios and found no significant effects. One possible explanation for the lack of significant improvement observed in these studies is the already simplified language used in the audios, which may render additional pauses unnecessary. Chaudron and Richards (1986) suggest that non-significant results in their L2 study might be attributed to the slower speech rate in their audios, which could make further pauses less impactful. Similarly, the combination of a 150 wpm speech rate and simplified language in the study presented in this article might account for the absence of significant improvement.

This could also explain why studies using standard language generally found positive results despite employing similar pause lengths, as in Blumstein et al. (1985) and Sugai et al. (2007, 2008). Nonetheless, it is worth noting that although the improvement observed in the L2 group was not statistically significant, it is consistent with the findings of Sugai et al. (2007, 2016), who reported enhanced comprehension among lower-intermediate L2 learners when longer pauses were incorporated.

However, studies by Blanchard and Prescott (1980), Sagarra (1998), and Chaudron and Richards (1986), which explored the effect of pauses on comprehension in standard language, also reported non-significant results.

It is also interesting to note that the length of the tested pauses does not appear to consistently correlate with the significance of the results found in other studies. For instance, Sagarra (1998) tested pauses ranging from 1 to 2 seconds and found no significant improvements, whereas Leeser (2004), who also tested 3-second pauses, reported a significant enhancement in comprehension. Similarly, Prafiyanto (2018), who examined pauses between 200 and 800 ms, observed no significant effects, but Aasland and Baum (2003), testing pauses up to 500 ms, did find significant improvements.

Another potential explanation could be that unusually long pauses are more difficult to process than those of typical duration. Lundholm Fors (2015) notes that extended pauses can create challenges in processing, which might help explain why the control and ID groups performed better with shorter pauses. These shorter pauses are closer to the average Catalan pause duration, as measured by Cantin and Ríos (1991). Additionally, pause length can influence listeners' perceptions of speech, with longer pauses often leading to the impression of a slower speech rate, even if the actual rate is unchanged (Liu et al., 2022). This perceived slowness might affect comprehension, as participants may find it harder to maintain concentration when they perceive the speech as too slow.

Furthermore, speakers who take longer pauses are often perceived as less knowledgeable or confident (Matzinger et al., 2023), which can increase listeners'

cognitive load as they try to interpret these cues. This added mental effort may divert attention from processing the content itself, potentially explaining the lack of improvement in comprehension observed in some of the groups.

Finally, overly long pauses are often perceived as less natural and less pleasant (Liu et al., 2022; Price, 2021), and unnatural pausing patterns can negatively affect speech intelligibility (Takayanagi et al., 1999). As a result, listeners may lose focus when they encounter pauses of unusual length, as they are not accustomed to such patterns. This could explain why the two groups with native speakers, the control group and the ID group, performed better with shorter pauses. In contrast, L2 learners, who are less accustomed to the nuances of pausing in their non-native language, might not be as affected by this. This could explain the slight improvement seen in the L2 group, as they may rely less on native-like pause patterns when processing speech.

It is important to note that the current study did not collect direct behavioral or qualitative measures (e.g., attentional drift, processing fatigue, or participants' judgments of naturalness), which limits the ability to empirically validate some of the explanatory hypotheses proposed here. Therefore, some interpretations remain speculative. Future studies incorporating such measures would be valuable to substantiate these mechanisms.

In response to the second question, the findings of this study on the acceptability of different pause durations in Catalan Easy Language audios reveal notable differences across participant groups. Both the L2 and control groups generally consider all inter-sentence pause lengths acceptable, whereas the ID group tends to perceive them as too short. Interestingly, a connection emerges between each group's comprehension results and their pause acceptability ratings. For the control group, the 740 ms inter-sentence pause yields the best comprehension results and is also the most highly rated in terms of acceptability. Similarly, the L2 group shows a preference for the 590 ms and 890 ms pauses, which align with their strongest comprehension outcomes. Conversely, the ID group rates the 1040 ms pause most favorably, though they still perceive it as short overall, which does not coincide with the pause they performed the best with.

A comparable trend emerges with intra-sentence pauses: the L2 group generally finds them acceptable, with only the longest ones perceived as slightly long. In contrast, the ID group consistently views most intra-sentence pauses as short, although the longer pauses are closer to being considered suitable. The control group displays a different pattern, where all pauses except the shortest one (250 ms) are perceived as leaning toward being 'long'. This indicates that while extended pauses are more tolerable in inter-sentence positions, they are less acceptable within sentences for this group, which aligns with findings in other studies (Liu et al., 2022). Furthermore, a similar correlation between acceptability and comprehension results is evident for intra-sentence pauses. The control group rated the 250 ms pause most favorably, which aligns with their second-best comprehension performance. Likewise, the L2 group preferred the 400 ms and 550 ms pauses, which correspond to their best comprehension outcomes. In contrast, the ID group again rated the longest pause (700 ms) most favorably, maintaining their pattern of preferring extended pauses.

The ID group's tendency to rate pauses as 'short' may be linked to the way they process prosodic features such as pauses. Research has shown that pauses are a key distinguishing feature of the speech patterns of individuals with intellectual disabilities compared to neurotypical individuals (Corrales-Astorgano et al., 2016), suggesting that pauses play a particularly significant role in how they interpret and organize speech. This could lead the ID group to perceive all pause durations as shorter than those of other groups, as they may rely on these pauses more heavily to structure and make sense of spoken information. This might explain why they

consistently rated the pauses as shorter, even when the pauses were deemed acceptable by the neurotypical groups.

Regarding the preference results, neither the L2 nor the ID group shows a strong preference for any specific inter-sentence pause, which may be explained by their acceptability ratings: the L2 group generally finds all pauses suitable, while the ID group perceives them all as short. In contrast, the control group demonstrates a clear preference for the shortest pause, 590 ms, over the others. A similar pattern emerges in the preference results for intra-sentence pauses, where the control group consistently favors the shortest pause. However, both the ID and L2 groups show more varied preferences, with the 400 ms and 250 ms pauses receiving the most votes, though the difference between these and the others is minimal.

6. Conclusions

This study explored the impact of different pause durations on comprehension, acceptability, and preference in Catalan Easy Language audios, involving three participant groups: individuals with intellectual disabilities, L2 learners of Catalan, and neurotypical control participants. The findings reveal that the duration of inter-sentence and intra-sentence pauses did not significantly affect comprehension across the groups, despite existing guidelines suggesting the use of longer pauses in Easy Language materials. Interestingly, the L2 group showed slight improvements with longer pauses, particularly among A2-level learners, although the effects were not statistically significant. In contrast, both the control and ID groups performed better with shorter pauses, likely due to a preference for more natural and familiar speech patterns. This suggests that pause length alone may not be a decisive factor in improving comprehension among the Easy Language target groups, and that the combination of different prosodic parameters may be responsible for the improvement.

Regarding acceptability, both the L2 learners and the control group found all inter-sentence pauses acceptable, including the longest ones, while the ID group generally found them all short. For intra-sentence pauses, this is repeated: the ID group finds all durations short, while the L2 group finds them generally acceptable. In contrast, the control group is less accepting of longer pause durations in intra-sentence positions. In addition, neither the L2 nor the ID group showed a clear preference for any specific pause duration, whether for inter-sentence or intra-sentence pauses, when asked to choose their preferred length for each type. The L2 group had a slight inclination towards shorter intra-sentence pauses, however.

Considering these acceptability and preference results, longer inter-sentence pauses, such as 1040 ms, could be recommended, as they were generally well-received by all participant groups. For intra-sentence pauses, however, shorter durations, such as 550 ms, might be more suitable. This duration could accommodate both the L2 group's preference for shorter pauses and the ID group's tendency towards longer pauses, positioning 550 ms as a middle ground acceptable to both groups. However, as these recommendations are based on acceptability and preference only, they are solely intended as practical guidelines aimed at optimizing listener experience, rather than directly enhancing comprehension.

This study has several limitations. First, the short length of the audio samples, each consisting of just 130 words. The brevity of the audios may not have fully captured the effects of pause length on comprehension over longer listening periods. Future research could replicate this experiment using longer audio segments to explore whether comprehension and acceptability patterns remain consistent or evolve as participants engage with more substantial content. In particular, the L2 group, which showed a positive trend, may yield significant results with longer audio samples. It is also possible that longer inter-sentence pauses may become less acceptable with longer audio samples for the L2 and control groups. This could be explored in future

studies to gain further insights into how pause length interacts with extended listening durations. Additionally, the study did not account for individual differences in auditory processing abilities, attention span, or prior familiarity with Easy Language conventions. While participants in the ID group were familiar with these conventions, those in the control and L2 groups were not.

Furthermore, future research could explore empirically the benefits of multimodal reinforcement cues, such as images or videos. In written Easy Language, Rivero-Contreras et al. (2021) reported improvements in word-level processing with supportive images, although overall comprehension gains were inconclusive, and Schatz et al. (2017) found no significant benefit from images in Easy Language texts. In audio formats, it would be valuable to investigate whether on-screen images or video clips enhance listener comprehension and engagement.

Moreover, evaluating whether the simplification strategies used to create Easy Language texts, such as reduced syntactic complexity, high-frequency vocabulary, and active voice, are equally effective in audio delivery would be highly informative. This question is a central focus of the ongoing WEL project, which aims to determine how written Easy Language conventions can be adapted for spoken formats; its forthcoming findings may shed light on best practices for script design and audio production in Easy Language.

In conclusion, this study provides an empirical examination of pause duration as a prosodic feature in Easy Language, an area that has received limited attention in prior research. By analyzing its effects on comprehension, acceptability, and preferences, the study provides valuable insights into the design of Catalan Easy Language audio content. It also deepens current understanding of how prosodic features shape communication in Easy Language and contributes to the broader effort to enhance accessibility and foster effective communication for a wide range of audiences.

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AI Tools Declaration

AI assistance (ChatGPT) was used solely for improving language and readability (specifically for grammar checking, dialectal consistency, and stylistic refinement). After using this tool, the entire text was carefully reviewed and revised by the authors. No part of the article was generated without substantive authorial input, and all ideas, analysis, and interpretation remain entirely the authors' own.

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