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Four low central vowels in Eastern Andalusian Spanish: /a/ before underlying /-s/, /-r/, and /-θ/ in El Ejido

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Keywords

Eastern Andalusian Spanish, vowel doubling, Spanish consonant deletion, Andalusian Spanish phonetics, Andalusian Spanish phonology.

1 Introduction

Schuchardt (1881), Wulff (1889) and Navarro Tomás (1938; 1939) were the first authors to explain how Eastern Andalusian Spanish (henceforth *EAS*) deletes most syllable-final consonants; however, the effects of coda deletion on surrounding segments is still unknown.

The deletion of /-s/ in EAS is believed to open a preceding vowel (e.g. Navarro Tomás 1938; 1939, and Alvar 1973: map 1696); this vowel opening has been supported with acoustic analyses by some authors (e.g. Martínez Melgar 1994; Sanders 1998). There are, however, different points of view regarding

which vowels open before underlying /-s/: Navarro Tomás (1938, 1939) and Sanders (1998) believe that only /a/, /e/, and /o/ open; for Salvador (1977), all vowels open in this position except /u/; finally, Peñalver Castillo (2006) and Martínez Melgar (1986; 1994) claim that all vowels open before underlying /-s/. This phenomenon of vowel opening is essential to understand the differences between Eastern Andalusian Spanish, with vowel opening before underlying /-s/, and Western Andalusian Spanish (henceforth *WAS*), which lacks vowel opening before underlying /-s/ (e.g. Villena Ponsoda 2000).

Even the phonetic realisation of EAS /-s/ is widely debated. Some scholars have argued that EAS coda-final /s/ can be aspirated or deleted (e.g. Navarro Tomás 1938; 1939; García Marcos 1987), while others claim that /s/ is not completely deleted (Gerfen 2002). Moreover, different realisations of /s/ have also been linked to sociolinguistic features (Peñalver Castillo 2006; Tejada Giráldez 2012).

Even though most consonants are deleted in EAS syllable-finally, deleted /-s/ has been the focus of most studies (Herrero de Haro 2016). Many authors (e.g. Navarro Tomás 1938; 1939; Salvador 1957; Carlson 2012) posit that the deletion of /-s/ opens the preceding vowel and that the quality of the vowel carries the semantic function of the underlying /-s/. The process of marking underlying /-s/ through vowel opening in EAS is referred to as *vowel doubling*. Thus, *vowel opening* refers to the phonetic process of opening vowels before underlying /-s/ and *vowel doubling* is understood as the phonemic process by which open vowels carry the semantic load of underlying /-s/. Alarcos Llorach (1958) and López Morales (1984), however, reject the phonemicisation of vowel opening.

This paper presents an extended analysis of EAS vowel doubling. The present article analyses the acoustic characteristics of word-final /a/ and of /a/ preceding underlying word-final /s/, /r/, and /Θ/ (henceforth [a^{s}], [a^{r}], and [a^{θ}], respectively). This analysis aims to establish whether the deletion of each of these consonants creates consistent changes to the F1 and F2 of the Spanish low central vowel, as it was the case with /e/ in Herrero de Haro (2016) and with /o/ in Herrero de Haro (2017). Once this has been established, a perception test will investigate whether EAS speakers from Western Almería can distinguish between [a], [a^{s}], [a^{r}], and [a^{θ}]. It is worth noting that consonants written in superscript (e.g. [$^{\theta}$]) represent underlying consonants; these consonants have been totally deleted from the phonetic output of the speakers and there is no aspiration present to mark the underlying consonant.

EAS deletes coda-final /s/, /r/ and /Θ/ but speakers of this variety of Spanish can still differentiate word-final /e/, /e/ preceding deleted word-final /s/, and /e/ preceding deleted word-final /r/ when presented in isolation (Herrero de Haro 2016). However, the distinctive feature in operation in those contrasts is not clear (Herrero de Haro 2016). It is noteworthy, however, that the term *dialect* will not be used to refer to EAS in this paper; Mondéjar Cumpián (2011: 34) in Valeš

(2014) explains how the main differences between EAS and Castilian Spanish (henceforth *CS*) relate to pronunciation.

Herrero de Haro (2016; 2017) describes how some scholars had already noted differences on the effects of different consonant deletion on vowels; Wulff (1889) transcribed the different effects of consonant deletion on previous vowels in the following way: *toros* (toroh) 'bulls'; *abrasador* (abrasao:) 'hot'; *soledad* (soleá) 'loneliness'; *cruz* (kruh) 'cross'; *espada* (empa:) 'sword'; *toril* (tori:) 'bullpen'; *pasar* (pasa·) 'to pass'. Furthermore, Herrero de Haro (2017) describes how Alvar (1973: maps 1626 and 1629) focuses on the Spanish words *tos* 'cough' and *voz* 'voice'. According to Alvar (1973: maps 1626 and 1629), speakers from the towns of Algarinejo (Gr303), Escúzar (Gr503), and Alboloduy (Al501) can differentiate /os/ from /oϴ/ even when /s/ and /ϴ/ are deleted. Navarro Tomás (1938) had already identified different effects on vowels depending on the deleted consonant they preceded and posited that, when deleted, /l/ and /r/ do not always trigger opening of the previous vowel but, when they do, these vowels open less than when followed by underlying /-s/. Those are, to my knowledge, the only studies which have analysed the role of vowel quality in carrying the semantic load of underlying consonants other than /s/. Gerfen and Hall (2001: 4) have also commented on this: "Although much attention has been paid to word-final s-aspiration because of its role in preserving semantic contrasts, there has been little focus on whether other contrasts are also maintained when coda aspiration is implemented".

Phonetic-phonological changes in languages usually affect more than one sound (Alarcos Llorach 1976: 12) and new developments can arise to solve ambiguity when contrasts are lost in a phonemic system (Alarcos Llorach 1976: 122). Consequently, underlying word-final /s/, /r/, and /ϴ/ could be maintained after /a/ by changing the quality of /a/, which could create a new phonetic (and possibly phonemic) contrast.

Salvador (1957; 1977), Sanders (1998), Peñalver Castillo (2006), and Carlson (2012) posit that the semantic function of underlying /-s/ is carried out in EAS by vowel opening, considering the open counterparts of the Spanish vowels as phonemes. López Morales (1984) and Martínez Melgar (1986) support that EAS vowels open before underlying /-s/ but they considered this opening phonetic. For Contreras Jurado (1975) and for Cerdà Massó (1992), however, the fact that open vowels only appear word-finally means that this feature cannot be phonemic; Gerfen and Hall (2001) found that there is a difference between vowels preceding underlying /s/, /k/, and /p/ word-internally. Alarcos Llorach (1958, 1983), Contreras Jurado (1975) and Cerdà Massó (1992) present an interesting position and they reject *vowel doubling* but propose *vowel system doubling*. All this shows how the phonetic-phonological debate regarding EAS vowel doubling is complex, but it highlights the fact that the focus has been on /Vowel/ vs /Vowel +

deleted /s// (/V/ vs /V^{s}/); the present paper analyses this issue further to establish whether EAS speakers, at least in Western Almería, can differentiate between [a], [a^{s}], [a^{r}], and [a^{θ}].

In the present study, samples of spontaneous speech from El Ejido (Western Almería) are analysed on Praat (Boersma and Weenink 2001) to ascertain whether F1 and F2 values vary between [a], [a^{s}], [a^{r}], and [a^{θ}]. Once this has been established, a perception test with native speakers from Western Almería will help examine if local speakers from the area can distinguish between these low central vowels. Perception has also been underresearched in EAS (Bishop 2007). As explained in Herrero de Haro (2016; 2017), phonemic analyses of EAS have been based on theoretical work or on acoustic analyses but perception experiments have been ignored. Herrero de Haro (forthcoming) explains that "speakers of a language, or of a geolect in our case, bestow on sounds the category of phonemes inasmuch these sounds contrast meaning in the speakers' minds"; thus, it seems necessary to include a perception experiment in the phonological analysis of EAS.

Navarro Tomás (1938; 1939), Rodríguez-Castellano and Palacio (1948a, 1948b), Alonso et al. (1950), Alvar (1955), Salvador (1957, 1977), Alarcos Llorach (1983) and, more recently, Martínez Melgar (1994), Gerfen (2002), Peñalver Castillo (2006), Jiménez and Lloret (2007), and Tejada Giráldez (2012) have proposed theories on the phonemic system of EAS; however, perceptual analyses with EAS speakers have not been carried out to support these theories. García Marcos (1987), O'Neill (2010), and Torreira (2007b) are, however, three of the very few studies which have analysed EAS perceptually (Herrero de Haro 2016; 2017). The lack of perception studies of EAS vowels have motivated the perception test in the present paper.

Perceptual studies for underlying /-s/ have been carried out for other varieties of Spanish which also present /-s/ deletion: this has been studied in Western Andalusian Spanish by Torreira (2007a; 2007b; 2012); Hammond (1978) analysed this for Caribbean Spanish; and Figueroa (2000) studied this feature in Puerto Rican Spanish. However, those three varieties of Spanish present a much higher rate of /-s/ aspiration rather than deletion and they do not present vowel opening preceding /-s/ deletion, so those findings cannot be applied to EAS. Furthermore, many articles have been published in the last 15 years on Andalusian varieties (e.g. Villena Ponsoda 2000; 2005; Hernández Campoy and Villena Ponsoda 2009; Moya Corral 2010; Melguizo Moreno 2007; Valeš 2014; Morris 2000) but these works present a sociolinguistic account of Andalusian Spanish or focus on Western Andalusian Spanish. There is no work to date which analyses the effect of /-s/, /-r/ and /-Θ/ deletion on a preceding /a/, although there are two studies which analyse the effect of /-s/, /-r/ and /-Θ/ deletion on a preceding /e/ (Herrero de Haro 2016) and on /o/ (Herrero de Haro 2017).

The correct terminology to use when describing features of EAS is also debated. Some authors use the terms *deletion* or *aspiration* (e.g. Navarro Tomás 1938; 1939; López Morales 1984); others use the term *debuccalisation* (Morris 2000). The term which will be used in the present article will be *deletion*, as there was no aspiration present in any of the 468 tokens analysed in this paper. The perception experiment shows that not all contrasts in [a], [a^{s}], [a^{r}], and [a$^{\Theta}$] are neutralised, thus the term *neutralisation* will also be avoided in this paper. It is worth mentioning that Torreira (2007a; 2007b; 2012) found pre- and post-aspiration in the sequences /st/, /sp/, and /sk/, but it is necessary to remember that those studies focus on Western Andalusian Spanish. For further differences between EAS and WAS, see Alvar (1973) and Villena Ponsoda (2008).

The present article is comprised of 7 sections. The introduction is included in Section 1 and Section 2 explains the methodology followed. In Section 3, there is a brief review of literature analysing /a/ preceding consonant deletion in EAS. Section 4 presents a study of word-final /a/ and of /a/ preceding deleted word-final /s/, /r/, and /Θ/. In Section 5, there is a discussion of the results for the perception test of [a], [a^{s}], [a^{r}], and [a$^{\Theta}$]. The conclusions are presented in Section 6 and the bibliography in Section 7.

2 Research methodology

2.1 Compilation of data

The data for the present article was gathered in the same way as in Herrero de Haro (2016; 2017). The author, originally from El Ejido (Western Almería), visited this region and recorded native speakers from the area.

The interviews had three parts when time allowed: 1) an interview covering a range of informal topics (hobbies, daily routine, etc.), to help create an informal atmosphere; 2) a section where participants had to read a list of words and phrases containing the five Spanish vowels in a variety of contexts; 3) a section where the speakers had to name objects from photos. The participants were friends and relatives of the author in some occasions, although students from different schools were also interviewed. The researcher completed the samples approaching people in the streets. Some interviews lasted just over 5 minutes while others lasted almost an hour; the interviews took place in the house of the participants, at local schools, in cafés and in parks. Some researchers (e.g. Martínez Melgar 1986) have raised concerns in language studies when participants try to speak in an unnatural way to converge with a variety of higher status used by the interviewer. This was not the case in this study; the interviewer is a native speaker from Western Almería and his local accent and the informal nature of the conversations made the participants feel at ease when speaking in their vernacular

EAS accent. The samples were recorded using a Zoom H2n digital recorder and Praat (Boersma & Weenink 2001) was used to perform the acoustic analysis.

The present study was carried out in El Ejido, a town in the Easternmost Andalusian province of Almería, 36 km west of the border with Granada province. The province of Almería, together with the provinces of Granada, Jaén, and Córdoba, make up Eastern Andalusia (e.g. Jiménez Fernández 1999; Villena Ponsoda 2000; Moya Corral 2010). The age of the participants is as detailed below.

Table 1. Age of the participants.

Gender	Number of speakers	Age range	Average age	Standard Deviation
Male	15	12–78	32 years 6 months	17.03
Female	9	17–78	42 years 4 months	21.05

All participants were from the town of El Ejido and displayed a typical accent from Western Almería (e.g. deletion of most consonants in coda; opening of vowels preceding underlying consonants; velarisation of word-final /n/; gemination of consonants following underlying consonants, etc.). A more thorough account of this geolect can be found in Villena Ponsoda (2000, 2008), Valeš (2014), Moya Corral (2010), and in Jiménez Fernández (1999).

It has been posited by some authors (e.g. Navarro Tomás 1938, 1939; Rodríguez-Castellano and Palacio 1948a; Alvar 1973; Peñalver Castillo 2006) that the consonants /Θ/ and /s/ are neutralised in EAS due to the phenomenon of *seseo* (pronouncing /Θ/ as [s]) or *ceceo* (pronouncing /s/ as [Θ]); however, the 24 speakers recorded for the present study distinguished between these two consonants and none of them presented *seseo* or *ceceo*. The current norm in El Ejido is to distinguish /s/ from /Θ/; it seems like Navarro Tomás et al. (1933) identified a change in progress as they noticed that younger speakers in Western Almería tended to distinguish /s/ and /Θ/.

2.2 Recordings

Sanders (1998) and Torreira (2012) call for the analysis of more natural forms of speech in dialectical studies; thus, only the recordings gathered during the free conversation and the description of the photos were analysed for the present article.

The sequence /aΘ/ has a much lower occurrence rate in Spanish than /a/, /as/, or /ar/. To prevent an imbalance of tokens, the reading extracts were going to be analysed to increase the amount of /aΘ/ tokens. However, it was decided to keep an imbalance from tokens analysed from natural conversations rather than analysing tokens taken from a reading list, which would not represent natural EAS speech.

The samples of [a], [a^{s}], [a^{r}], and [a$^{\theta}$] were analysed acoustically using Praat (Boersma & Weenink 2001). The number of tokens analysed in the present paper are:

Table 2. Number of tokens of [a], [a^{s}], [a^{r}], and [a$^{\theta}$] analysed.

[a]	[a^{s}]	[a^{r}]	[a$^{\theta}$]	Total
163	131	122	52	**468**

The F1 and F2 of [a], [a^{s}], [a^{r}], and [a$^{\theta}$] were only measured word-finally. Additionally, /as/, /ar/, and /aϴ/ were only analysed when the coda consonant had been totally deleted, measuring the formants of [a], [a^{s}], [a^{r}], and [a$^{\theta}$]. Furthermore, tokens which appeared immediately before or after other vowels were discarded to avoid measuring vowels affected by coarticulation (e.g. sequences like *copiar* [ko$^{\text{l}}$pja$^{\text{r}}$] 'to copy' or *cantar o* [kan$^{\text{l}}$ta$^{\text{r}}$ o] 'to sing or' were not analysed). The author listened to each conversation on Praat (Boersma & Weenink 2001) and when he identified word-final [a], [a^{s}], [a^{r}], and [a$^{\theta}$], the recording was paused and the spectrogram of the relevant vowel analysed. Formants in transition were ignored and F1 and F2 measurements were only taken during their stable sections. Once the stable section of a vowel had been identified, the mean F1 and F2 measurement of the selected section was taken executing the commands *Formant*/*Get first formant* and *Formant Get second formant*.

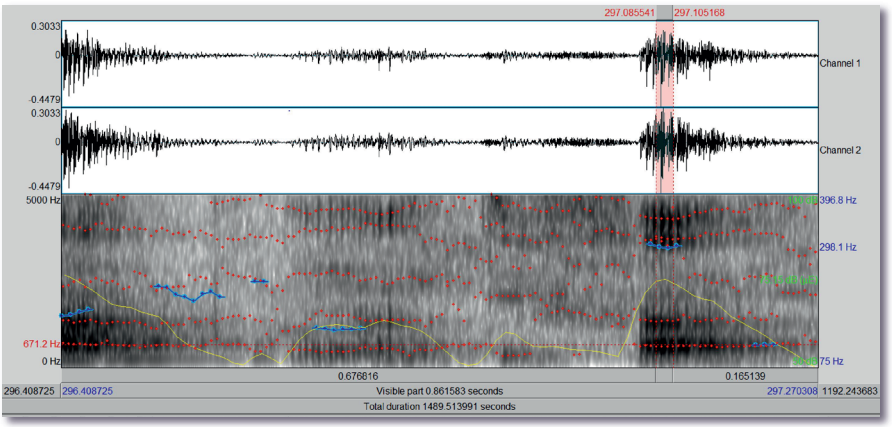

Fig. 1. Sample of analysed portion of [a$^{\Theta}$] in *antifaz* [anti$^{\text{l}}$fa$^{\Theta}$] 'mask'.

Formant values were rounded up or down and no decimals were taken; thus, *697.8* became *698* and *1412.2* became *1412*. Each analysed token was grouped under the category [a], [a^{s}], [a^{r}], or [a$^{\Theta}$] on an Excel spreadsheet and once all the tokens had been analysed, the mean and standard deviations were calculated for F1 and for F2. These results are discussed in Section 4.

2.3 Perception experiment

A perception test was also conducted. The researcher recorded himself reading *a*, *as*, *ar*, and *az* in his normal EAS accent, thus pronouncing them [a], [a^{s}], [a^{r}], and [a$^{\theta}$], respectively. The author chose two examples per vowel which represented clear and natural EAS sounds, that is, not unnaturally short or long. These tokens were copied onto an audio track using Audacity (Audacity Team 2013) and then the researcher read numbers in a normative CS accent and added a number before each token for participants to know which question they were answering at all times (e.g. *uno* [a$^{\Theta}$] 'one [aΘ]', *dos* [a] 'two [a]'). The items were presented in a randomised order and the participants heard two items for each vowel (i.e. two [a], two [a^{s}], two [a^{r}], and two [a$^{\theta}$].). This was also done for the other four Spanish vowels; the results for /e/ are discussed in Herrero de Haro (2016) and the results for /o/ in Herrero de Haro (2017); /i/ and /u/ will be discussed in future articles.

The perception test used was a forced-choice task in which participants had to decide which category each vowel belonged to (Appendix 1). In order to focus on native speakers from Western Almería, answers were discarded for speakers who had not lived in Western Almería at least since the age of four. Permission was obtained from the researcher's institution and from the Office of Education in Almería and the experiments were carried out in five secondary schools: two from Adra, two from El Ejido, and one from Balerma. The students were given an MP3 player and earphones each and they completed the experiment during a portion of one of their lessons. There was no time limit to complete the task. The participants were asked to choose an answer when they were confident or to leave it blank if they were not sure of the right answer. The total number of answers collected was 856, 214 for each of the four vowels tested ([a], [a^{s}], [a^{r}], [a$^{\Theta}$]). Regarding blank answers, out of the 214 answers per vowel type, three blank answers were received for [a], none for [a^{s}], two for [a^{r}], and one for [a$^{\Theta}$]. As mentioned in Herrero de Haro (2016), even phonemes such as /e/ and /i/ are not distinguished by Spanish speakers with a 100% accuracy in Spanish; leaving blank answers instead of guessing indicates the reliability of the participants.

3 Analyses of /a/ in previous studies of EAS

3.1 The vowel /a/ in EAS and in CS

It is important to review reported F1 and F2 values of /a/ in EAS and in CS before analysing how /s/, /r/, and /Θ/ deletion might have affected the quality of /a/ in EAS. The following table contains some reported values for /a/ in CS; values have been rounded up or down.

Table 3. Formant values for Castilian [a] in previous studies.

Study	Type of /a/	F1	F2
Alarcos Llorach (1976)	Castilian /a/	700	1500
Quilis (1981)	Castilian /a/	690	1400
Quilis and Esgueva (1983)	Castilian /a/ in open syllable. Male	666	1220
Quilis and Esgueva (1983)	Castilian /a/	657 (male)	1215 (male)
		664 (female)	1168 (female)
Martínez Celdrán (1984)	Castilian /a/	680	1265
Martínez Celdrán (1995)	Castilian /a/ in 20–30-year-old speakers	699 (male)	1471 (male)
		886 (female)	1712 (female)
Mean value		*705*	*1369*

The values above can be compared with reported values for EAS /a/; the values below in Table 4 have been rounded up or down. According to the measurements above, EAS /a/ is slightly more closed and more fronted than its CS counterpart. Herrero de Haro (2016) showed that EAS /e/ is more open and more back than its CS counterpart and Herrero de Haro (2017) showed that EAS /o/ was more open and more fronted in EAS than in CS. These results seem to support Corbin's (2006) position that EAS vowels tend towards centralisation when compared to their CS counterparts.

Table 4. Formant values for EAS [a].

Study	Type of /a/	F1	F2
Martínez Melgar (1986)	EAS /a/	566	1349
Martínez Melgar (1994)	EAS /a/	648	1488
Sanders (1994)	EAS /a/	649	1448
Sanders (1998)	Pretonic EAS /a/	640	1467
Sanders (1998)	Tonic EAS /a/	658	1484
Sanders (1998)	Word-final EAS /a/	621	1393
Corbin (2006)	EAS /a/	758	1660
Mean value		*649*	*1470*

This difference in the quality of EAS and CS has been discussed in previous studies (e.g. Contreras Jurado 1975; Martínez Melgar 1986). These authors avoided using the term *closed* when describing EAS vowels not following an underlying /-s/, instead, the former author distinguished between *word not affected by prosodeme of openness* vs *affected word* and the latter described an opposition based on *open* vs *non-open* vowels.

3.2 Previous studies of EAS /a/ before underlying /-s/

The low central vowel has already been analysed preceding underlying /-s/ in EAS; the values below have been rounded up or down.

Table 5. Formant values for EAS [as].

Study	Type of /a/	F1	F2
Martínez Melgar (1986)	EAS /a/ preceding underlying /-s/	569	1335
Martínez Melgar (1994)	EAS /a/ preceding underlying /-s/	654	1441
Sanders (1994)	EAS /a/ preceding underlying /-s/	674	1491
Sanders (1998)	Pre-tonic EAS /a/ preceding underlying /-s/	684	1448
Sanders (1998)	Tonic EAS /a/ preceding underlying /-s/	689	1492
Sanders (1998)	Word-final EAS /a/ preceding underlying /-s/	649	1533
Corbin (2006)	EAS /a/ preceding underlying /-s/	755	1660
Mean value		*668*	*1486*

Martínez Melgar (1986, 1994) shows a very slight opening and backing of /a/ in EAS when it precedes underlying /-s/. Sanders (1994) shows a slightly bigger opening and fronting in EAS preceding underlying /-s/. Sanders (1998) presents the same for tonic [a^{s}] but opening and backing for pre-tonic [a^{s}]. Corbin (2006) suggests some different results to the other authors, describing minimal closing of /a/ when it precedes underlying /s/ and no changes in the F2. The overall results from the studies above show opening and fronting of [a^{s}] with respect to [a]. These overall results seem to oppose the velar character of /a/ preceding deleted /-s/ posited by Navarro Tomás (1938) but they present a similar tendency to the one presented in Herrero de Haro (2016) for /e/ and in Herrero de Haro (2017) for /o/: opening of a vowel preceding underlying /-s/.

Interestingly, Corbin (2006) also reported values for other realisations of /as/ in EAS: [as] (F1 826, F2 1610); [ah] (F1 791, F2 1660); and [a^{s}] (F1 758, F2 1640). Corbin (2006) maintained that in /es/ and in /os/, the vowels are more

open in EAS when /-s/ is deleted than when it is preserved; when /-s/ is realised as a post-aspiration ([h]), the values for the vowels are in the middle. For /a/, however, the situation is different. In /as/, the vowel shows the highest degree of opening when it precedes [s] and the vowel is more closed when it precedes deleted /-s/; /a/ preceding [h] has a degree of opening between the ones reported for the other two realisations (Corbin 2006). This contradicts the views presented by most researchers, as EAS scholars have agreed on the opening of /a/ preceding underlying /-s/ (e.g. Navarro Tomás 1938, 1939; Sanders 1998). More than opening, Corbin's (2006) results show a tendency for EAS vowels to centralisation when followed by an underlying /-s/.

4 Acoustic analysis of EAS /a/

4.1 Word-final /a/ in EAS

An acoustic analysis of the samples gathered for the present study has yielded the following results for word-final /a/.

Table 6. F1 and F2 values for word-final [a] in EAS.

Word-final /a/ in EAS						
F1	*F2*	*F1 range*	*Stan Dev F1*	*F2 range*	*Stan Dev F2*	*Tokens*
679	1451	489–851	78.91	1186–2039	156.14	163

The F1 value obtained for EAS [a] is slightly higher than the ones obtained by Martínez Melgar (1986, 1994) and by Sanders (1994; 1998) but lower than the one presented in Corbin (2006). Likewise, the F2 value obtained for EAS [a] is in line with those presented by Martínez Melgar (1986; 1994) and Sanders (1994; 1998) but lower than the ones reported in Corbin (2006). The F1 measurements obtained for EAS [a] are close to those reported in Table 3 and 4 for CS and for EAS, respectively; the F2 values from the present study are much closer to the ones reported in Table 4 for EAS. When we compare the results from the present study with the average from Table 3, we can see that EAS [a] seems to be more closed and fronted than in CS, what agrees with what Corbin (2006) posited.

4.2 /a/ preceding underlying /-s/ in EAS

The following data have been obtained from the analysis of [a^{s}]. The F2 values from Table 7 are in line with those reported in Table 5 by Martínez Melgar (1986; 1994) and by Sanders (1994; 1998); the F2 results presented in Corbin (2006) are much higher than the ones reported in the present study.

Table 7. F1 and F2 values for word-final [a^{s}] in EAS.

/a/ preceding deleted word-final /s/ in EAS						
F1	*F2*	*F1 range*	*Stan Dev F1*	*F2 range*	*Stan Dev F2*	*Tokens*
724	1471	538–964	79.98	1069–2045	167.79	131

Likewise, the F1 obtained in the present paper for [a^{s}] is in line with the one reported in Martínez Melgar (1994) and in Sanders (1994; 1998) but much higher than the one presented in Martínez Melgar (1986) and much lower than the one reported in Corbin (2006). The results from the present study agree with the overall tendency presented in Table 7; [a^{s}] is more open and fronted than [a] in EAS. Thus, the measurements obtained so far suggest that there is a difference in quality between EAS [a] and [a^{s}].

As it was the case in Herrero de Haro (2016; 2017) for /e/ and for /o/, respectively, the opening of /a/ preceding an underlying word-final /s/ supports the results presented in Navarro Tomás (1938; 1939), Alonso et al. (1950), Alvar (1955), Salvador (1957; 1977), Alvar (1973), Gómez Asensio (1977), Zubizarreta (1979), López Morales (1984), Martínez Melgar (1986; 1994), Sanders (1998), and Peñalver Castillo (2006).

For some authors (e.g. López Morales 1984; Martínez Melgar 1986), EAS vowel opening is a phonetic feature, not a phonological one; however, this has not been tested to date and the perception test from Section 5 will confirm if this is the case.

4.3 /a/ preceding underlying /-r/ in EAS

The vowel [a^{r}] was analysed in recordings from 24 participants. The table below presents the data obtained.

Table 8. F1 and F2 values for word-final [a^{r}] in EAS.

/a/ preceding deleted word-final /r/ in EAS						
F1	*F2*	*F1 range*	*Stan Dev F1*	*F2 range*	*Stan Dev F2*	*Tokens*
753	1525	559–1062	81.10	988–2114	191.28	122

There are no previous acoustic measurements for word-final [a^{r}] in EAS (Herrero de Haro 2016, 2017), meaning that the results from Table 8 cannot be compared with findings from previous studies. Nevertheless, it should be noted that Navarro Tomás' (1938; 1939) impressionistic studies found that vowels preceding deleted /-r/ showed a lower degree of opening than those vowels preceding deleted /-s/.

Standard deviation values from Table 8 show that the measurements obtained for [a^{r}] are consistent across the samples. F1 and F2 values are higher for [a^{r}] than for [a^{s}], which shows that /a/ is more open and more fronted when it precedes deleted /-r/ than when it precedes deleted /-s/; this refutes the impressionistic analyses presented in Navarro Tomás (1938; 1939). These results suggest that EAS /a/ has a different quality depending on whether it is followed by underlying /-s/ or by underlying /-r/. This has never been demonstrated before with acoustic analyses. Results from the perception test analysed in Section 5 will clarify whether or not EAS speakers can distinguish [a^{r}] from [a^{s}].

4.4 /a/ preceding underlying /-θ/ in EAS

The vowel [a^{θ}] was analysed in the recordings. The amount of tokens of [a^{θ}] analysed were 52, which are fewer than the 163 tokens analysed of [a], the 131 of [a^{s}], and the 122 of [a^{r}]. The possibility of analysing instances of [a^{θ}] from reading extracts was observed at first; however, it was considered more beneficial for the current study to sacrifice extra tokens in order to support a more natural body of samples.

Table 9. F1 and F2 values for word-final [a^{θ}] in EAS.

/a/ preceding deleted word-final /θ/ in EAS						
F1	*F2*	*F1 range*	*Stan Dev F1*	*F2 range*	*Stan Dev F2*	*Tokens*
721	1383	521–937	82.66	1147–1665	113.55	52

F1 values for [a^{θ}] are higher than for [a] but lower than for [a^{s}] and [a^{r}]. This shows that the deletion of [θ] opens /a/ less than the deletion of /-s/ or /-r/. F2, however, presents a much lower value in [a^{θ}] than in [a], [a^{s}], or [a^{r}], which suggests that [θ] deletion causes backing of /a/. Herrero de Haro (2016) identifies a similar tendency for /e/ and Herrero de Haro (2017) a similar tendency for /o/.

The values obtained in the acoustic analysis of /a/ preceding underlying /Θ/ suggest that [a^{θ}] has different F1 and F2 values to [a], [a^{s}], and [a^{r}]; that is, that the deletion of word-final /s/, /r/, and /Θ/ causes a different modification to the quality of a preceding /a/.

Alvar (1973: maps 1613, 1620, and 1625) analysed the Spanish words *zagal* 'kid', *mar* 'sea' and *más* 'more' and posited that deleting /l/, /r/, and /s/ word-finally caused different changes in the quality of a preceding /a/ in some Andalusian towns (e.g. Berja [Al507]). Navarro Tomás (1938) and Jiménez & Lloret (2007) also suggested that the deletion of word-final /l/ and /r/ causes a lower degree of opening on a preceding vowel than /-s/ deletion. According to Herrero de Haro (2016), "these are the only instances in EAS literature which analyse the role of vowel

quality in marking the functional load of neutralised coda-final consonants other than /s/". Herrero de Haro (2016; 2017) proposes the opposite, and claims that /e/ and /o/ are more open before an underlying /r/ than before an underlying /-s/. To my knowledge, Herrero de Haro (2016; 2017) and the present paper are the only studies to examine whether native speakers of EAS can identify in each case whether /e/, /o/, and /a/ are followed by an underlying /s/, /r/ or /Θ/.

4.5 The vowels [a], [a^{s}], [a^{r}], and [a^{Θ}] in EAS

It is worth reviewing the conclusions reached for /e/ in Herrero de Haro (2016) and /o/ in Herrero de Haro (2017) before looking at the data obtained for /a/.

Table 10. F1 and F2 values for word-final [e], [e^{s}], [e^{r}], and [e^{Θ}] in EAS. Herrero de Haro (2016).

Participant	**[e]**		**[e^{s}]**		**[e^{r}]**		**[e^{Θ}]**	
	F1	*F2*	*F1*	*F2*	*F1*	*F2*	*F1*	*F2*
F29E	456	2091	611	1959	652	1847	616	2054
F31E	473	2117	580	1867	630	1937	582	1658
M31E	484	2064	597	1736	603	1800	632	1675
M34E	481	1919	601	1649	677	1734	579	1535
Mean	473.5	2047.75	597.25	1802.75	640.5	1829.5	602.25	1730.5
Standard Dev.	12.55	88.51	12.91	137.04	31.52	85.34	25.97	224.50

Table 11. F1 and F2 values for word-final [o], [o^{s}], [o^{r}], and [o^{Θ}] in EAS. Herrero de Haro (2017).

Type of EAS /o/	**Gender**	**F1**	**F2**	**Stan Dev F1**	**Stan Dev F2**	**Tokens**
Word-final [o]	Male	496	1224	39.64	214.01	54
	Female	485	1205	44.66	245.24	86
	Both	489	1212	42.98	233.08	140
Word-final [o^{s}]	Male	591	1234	44.7	215.19	47
	Female	583	1246	73.67	258.42	39
	Both	587	1239	59.35	234.24	86

Word-final [o^{r}]	Male	627	1209	58.89	206.5	31
	Female	647	1309	71.75	227.91	39
	Both	638	1265	66.7	222.86	70
Word-final [o$^{\Theta}$]	Male	607	1106	60.71	119.4	30
	Female	604	1129	74.28	191.88	7
	Both	607	1110	62.37	133.08	37

Gerfen & Hall (2001) identified a tendency for EAS studies to focus on the effects of /s/ deletion on preceding vowels, disregarding other processes at play when other consonants are deleted.

The table below summarises the results obtained in the present study for word-final [a], [a^{s}], [a^{r}], and [a$^{\Theta}$] in EAS.

Table 12. F1 and F2 values for word-final [a], [a^{s}], [a^{r}], and [a$^{\Theta}$] in EAS.

Vowel	F1	F2	F1 range	Stan Dev F1	F2 range	Stan Dev F2	Tokens
[a]	679	1451	489–851	78.91	1186–2039	156.14	163
[a^{s}]	724	1471	538–964	79.98	1069–2045	167.79	131
[a^{r}]	753	1525	559–1062	81.10	988–2114	191.28	122
[a$^{\Theta}$]	721	1383	521–937	82.66	1147–1665	113.55	52

These measurements are easier to interpret in the following graph.

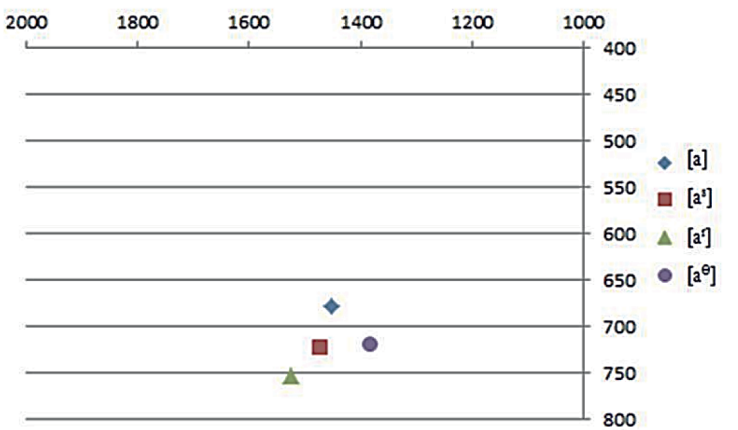

Fig. 2. Average F1 and F2 values of word-final [a], [a^{s}], [a^{r}], and [a$^{\Theta}$] in EAS.

Table 12 shows how F1 and F2 values differ between [a], [a^{s}], [a^{r}], and [a^{Θ}] word-finally in EAS. As it was posited in Herrero de Haro (2016; 2017) for /e/ and for /o/, respectively, the differences between these four types of /a/ could correspond to two types of distinctions: 1) a primary distinction based on F1 differences between word-final /a/ and /a/ preceding underlying word-final /s/, /r/, and /Θ/. A much lower F1 value for [a] than for [a^{s}], [a^{r}], and [a^{Θ}] justifies this position; 2) a secondary distinction between the F1 values of [a^{s}], [a^{r}], and [a^{Θ}]; these values are close to each other but they are clearly higher than for [a].

F2 values for [a], [a^{s}], [a^{r}], and [a^{Θ}], however, follow a different pattern to F1. F2 values show how /a/ is slightly fronted when it precedes underlying /s/ and how [a^{r}] is pronounced further front than [a^{s}]. However, /a/ is backed considerably when it precedes underlying [-Θ].

The measurements obtained for the 468 tokens of /a/ were analysed on SPSS in order to establish whether F1 and F2 values for [a], [a^{s}], [a^{r}], and [a^{Θ}] were statistically significant. The baseline *p-value* for determining statistical significance was 0.5.

The first analysis carried out was a one-way ANOVA. This test confirmed that the differences between F1 values for [a], [a^{s}], [a^{r}], and [a^{Θ}] are statistically significant (F (3,464) =20.795, *p-value* = 0.00). Likewise, a one-way ANOVA also confirmed that this was the case as well for differences between F2 values for [a], [a^{s}], [a^{r}], and [a^{Θ}] (F (3,464) =10.494, *p-value* = 0.00). A one-way ANOVA can identify if there is a significant difference for F1 and F2 values in [a], [a^{s}], [a^{r}], and [a^{Θ}]; however, it cannot identify which one of those differences is statistically significant. Thus, it was decided to compare F1 and F2 values between each of the four realisations of /a/ using Tukey post hoc tests for multiple comparisons. In the interest of brevity, the *p-value* from the cross comparisons between F1 values of [a], [a^{s}], [a^{r}], and [a^{Θ}] have been included in the table below.

Table 13. *p-value* for differences between the F1 of word-final [a], [a^{s}], [a^{r}], and [a^{Θ}] in EAS.

F1	**[a]**	**[a^{s}]**	**[a^{r}]**	**[a^{Θ}]**
[a]		.000 *	.000 *	.005 *
[a^{s}]	.000 *		.022 *	.997
[a^{r}]	.000 *	.022 *		.083
[a^{Θ}]	.005 *	.997	.083	

* indicates differences which are statistically significant.

Table 13 shows how F1 is statistically different between all the realisations of /a/ analysed except for the pairs [a^{s}] – [a$^{\Theta}$] and [a^{r}] – [a$^{\Theta}$]. The Tukey post hoc test for the F1 of [a^{r}] and [a$^{\Theta}$] yielded a *p-value* of 0.83; this difference is not statistically significant but this result suggests that there is still a strong difference between the F1 of [a^{r}] and [a$^{\Theta}$].

A Tukey post hoc test yielded the following results for the F2 of [a], [a^{s}], [a^{r}], and [a$^{\Theta}$]. The results presented in Table 14 indicate that F2 is statistically different between the four allophones of /a/ except for the pair [a] – [a^{s}]. Regarding F1 in the four realisations of /a/ analysed, the only contrasts which were not statistically significant were for the pairs [a^{s}] – [a$^{\Theta}$] and [a^{r}] – [a$^{\Theta}$]; however, the *p-value* obtained for the difference of these two pairs using the Tukey post hoc test showed that the differences in F2 between these two pairs of vowels are statistically significant. Likewise, the F2 of [a] and [a^{s}] are not statistically significant but their F1 is. Therefore, it can be established that the deletion of /s/, /r/, and /Θ/ word-finally creates a new system of four low central vowels in EAS: [a], [a^{s}], [a^{r}], and [a$^{\Theta}$].

Table 14. Statistical differences between the F2 of word-final [a], [a^{s}], [a^{r}], and [a$^{\Theta}$] in EAS.

F2	[a]	[a^{s}]	[a^{r}]	[a$^{\Theta}$]
[a]		.693	.001 *	.043 *
[a^{s}]	.693		.044 *	.005 *
[a^{r}]	.001 *	.044 *		.000 *
[a$^{\Theta}$]	.043 *	.005 *	.000 *	

* indicates differences which are statistically significant.

The F1 and the F2 of these four vowels show statistical differences between these four allophones of /a/. The present article presents the first attempt to identify and describe these four realisations of /a/ in EAS.

The perception tests discussed in Section 5 will analyse whether EAS speakers from Western Almería can distinguish between [a], [a^{s}], [a^{r}], and [a$^{\Theta}$]. This follows Gerfen and Hall's (2001) and Bishop's (2007) demand for more perception studies on EAS vowels, as researchers have focused on the production of EAS vowels, ignoring perceptual studies.

Understanding if each of these four realisations of /a/ ([a], [a^{s}], [a^{r}], and [a$^{\Theta}$]) can be identified by EAS speakers will help establish whether these four vowels have allophonic or phonemic value; however, a rigorous phonological study should be carried out before [a], [a^{s}], [a^{r}], and [a$^{\Theta}$] can be considered full phonemes.

5 Perception experiment

This section analyses data from perception experiments with native speakers of EAS from Western Almería to help establish whether these speakers can identify [a], [a^{s}], [a^{r}], and [a$^{\Theta}$].

5.1 Perception experiment: [a] vs [a^{s}] vs [a^{r}] vs [a$^{\theta}$]

This experiment analyses the contrasts between [a], [a^{s}], [a^{r}], and [a$^{\Theta}$]. The respondents were given an individual MP3 player each and a handout to record their answers (Appendix 1).

The participants were asked to listen to an audio track and select the option they heard in each case: [a], [a^{s}], [a^{r}], or [a$^{\Theta}$]. The results obtained are included in the table below. Results for /e/ and /o/ are reported in Herrero de Haro (2016; 2017), respectively, and the results for /i/ and /u/ will be reported in future articles.

5.2 Results from the perception experiment

The participants had to match each sound they heard with one of four categories in a forced-choice perception experiment. The respondents were students from two secondary schools in El Ejido, from two secondary schools in Adra, and from one secondary school in Balerma. These three towns are in Western Almería.

The data obtained from the perception test are summarised below. Each item ([a], [a^{s}], [a^{r}], and [a$^{\Theta}$]) appeared twice in the audio track; this explains why the number of answers for each item is double the amount of participants. The description *not counting blank answers as errors* is the total number of possible correct answers out of the submitted responses (e.g. if 20 student completed the test and five left blank answers, the number of *not counting blank answers as errors* would be 15). Due to restrictions of space, the results for the five secondary schools have been merged into one table.

A series of one sample t-tests were run on SPSS in order to evaluate whether the percentages of correct identification were statistically significant. It is worth mentioning that, as each sound could be grouped into one of four categories, chance level is 25%.

Table 15. Results from the perception test for the five groups of participants.

	[a]	[a^{s}]	[a^{r}]	[a$^{\Theta}$]	Total
Answers	214	214	214	214	856
Blank answer	3	0	2	1	6/856 (0.7%)
Correct answers (counting blank answers as errors)	93/214 (43.46%)	37/214 (17.29%)	52/214 (24.30%)	57/214 (26.64%)	239/856 (27.92%)
Correct answers (not counting blank answers as errors)	93/211 (44.08%)	37/214 (17.29%)	52/212 (24.53%)	58/213 (27.23%)	239/850 (28.12%)
Number of respondents	107	107	107	107	107

The vowel [a] was identified correctly in 44.08% of cases (43.46% if we count blank answers as errors). A one sample t-test yielded a *p-value* = 0.000, which means that the correct identification of [a] is not due to chance, that is, that EAS speakers from Western Almería can distinguish [a] from [a^{s}], [a^{r}], and [a$^{\Theta}$]. However, despite the multiple studies identifying /a/ opening before underlying /s/ (e.g. Navarro Tomás 1938; 1939; Martínez Melgar 1994; Peñalver Castillo 2006), it cannot be concluded yet what the distinctive feature of this contrast is. It has not been analysed to date whether the distinctive feature in this contrast is similar to the one proposed for other varieties of Spanish (e.g. vowel lengthening for Miami-Cuban Spanish [Hammond 1978]) and for Puerto Rican Spanish (Figueroa 2000); or post-aspirated /t/ in /st/ in Western Andalusian Spanish (Torreira 2007b; Ruch and Harrington 2014). As pointed out by Contreras Jurado (1975), this contrast might be based on suprasegmental features in EAS.

Regarding [a^{s}], the correct identification of 17.29% is below chance level, thus not statistically significant. Therefore, it can be posited that EAS speakers from Western Almería cannot distinguish [a^{s}] from [a], [a^{r}], or [a$^{\Theta}$]. Likewise, the percentage of correct identification for [a^{r}], (24.53% if we ignore blank answers and 24.30% if we count blank answers as errors), is below chance level (25%), thus below the threshold needed for that identification to be statistically significant. This confirms that EAS speakers from Western Almería cannot differentiate [a^{r}] from [a], [a^{s}], or [a$^{\Theta}$].

The vowel [a$^{\Theta}$] was identified correctly in 27.23% of cases (26.64% if we count blank answers as errors). This degree of identification is slightly over chance level; however, a one sample t-test shows that the correct identification of this vowel is not strong enough to be considered statistically significant (*p-*

value = 0.314). As a result, it can be confirmed that EAS speakers from Western Almería cannot distinguish [a$^{\Theta}$] from [a], [a^{s}], or [a$^{\Theta}$].

5.3 Discussion of the results from the perception experiment

The data from the perception test show that EAS speakers can distinguish word-final /a/ from /a/ preceding underlying word-final /s/, /r/, or /Θ/. However, the statistical analyses carried out in Section 5.2 show that EAS speakers from Western Almería cannot identify deleted word-final /s/, /r/, or /Θ/ after /a/. This contrasts with the results obtained for /e/ in Herrero de Haro (2016); the results obtained show that EAS speakers can distinguish word-final /e/ from /e/ preceding underlying word-final /s/, /r/, and /Θ/ and that EAS speakers can identify [e], [e^{s}], and [e^{r}]. Likewise, the results obtained for /o/ in Herrero de Haro (2017) show that EAS speakers can differentiate word-final /o/ from /o/ preceding underlying word-final /s/, /r/, and /Θ/ and that EAS speakers can identify [o] and [o$^{\Theta}$] correctly.

The difference in F1 values between the *unaltered* /a/ ([a]) and the *altered* realisations of /a/ ([a^{s}], [a^{r}], and [a$^{\theta}$]) could explain why EAS speakers can differentiate between word-final /a/ and /a/ preceding underlying word-final /s/, /r/, and /Θ/. The small differences between the F1 values of [a^{s}], [a^{r}], and [a$^{\theta}$] might make it difficult for these EAS speakers to differentiate between these three vowels. F2 values for [a$^{\theta}$] are considerably lower than for [a], [a^{s}], and [a^{r}] and this could explain that EAS speakers identify [a$^{\theta}$] at a higher rate than the other two altered vowels ([a^{s}] and [a^{r}]). This degree of identification, however, is not statistically significant.

Considering the results obtained in the perception experiment, it can be posited that EAS speakers from Western Almería can differentiate word-final /a/ from /a/ preceding underlying word-final /s/, /r/, or /θ/. However, these speakers cannot identify whether word-final /s/, /r/ or /θ/ has been deleted after /a/. Taking all this into consideration, the contrast [a] vs [a^{s}] studied by several scholars (e.g. López Morales 1984; Sanders 1998) might be, as posited in Navarro Tomás (1939), not due to the correct identification of the quality of [a^{s}], but based on identifying that a consonant has been deleted. As such, contrasts like [a] vs [a^{s}], [a] vs [a^{r}] or [a] vs [a$^{\Theta}$] could be resolved in the mind of EAS speakers by perceiving (or not) an underlying consonant in each pair of vowels.

6 Conclusion

The first aim of the present paper was to investigate whether the deletion of word-final /s/, /r/, and /Θ/ causes different changes in a preceding /a/ in EAS. Acoustic analyses of 468 samples from 24 speakers have shown that this is, in fact, the case. Thus, /a/ appears to have, at least, four allophones word-finally in EAS:

word-final /a/ ([a]); /a/ before underlying word-final /s/ ([a^{s}]); /a/ before underlying word-final /r/ ([a^{r}]); and /a/ before underlying word-final /Θ/ ([a^{Θ}]). A series of statistical tests show that the differences between the F1 and F2 of these vowels are statistically significant. It could be argued that more than 468 tokens of /a/ should be analysed before drawing conclusions on the effects of /s/, /r/, and /Θ/ deletion on a preceding /a/; however, it is worth remembering that the 468 tokens analysed in the present study have been obtained from free speech, thus representing naturally occurring speech behaviours in EAS. Furthermore, a corpus of 468 tokens should be accepted as a starting point given that this is the first attempt to quantify the effect that word-final consonant deletion, other than /s/, has on /a/.

The pattern described for /a/ in the present paper is similar to the one reported for /e/ and for /o/ in Herrero de Haro (2016; 2017).

The present paper has also analysed the perception of [a], [a^{s}], [a^{r}], and [a^{Θ}]. The results obtained show that EAS speakers from Western Almería can identify whether /a/ does or does not precede an underlying word-final consonant; Herrero de Haro (2016; 2017) also conclude that this opposition can also be identified in EAS for /e/ and /o/. However, EAS speakers cannot identify whether /a/ is followed by an underlying word-final /s/, /r/, or /Θ/; this contrasts with the results presented in Herrero de Haro (2016; 2017), where EAS speakers distinguished the following vowels: [e^{s}] from [e], [e^{r}], and [e^{θ}]; [e^{r}] from [e], [e^{s}], and [e^{θ}]; and [o^{Θ}] from [o], [o^{r}], and [o^{s}].

Alvar (1973: maps 1613, 1620, and 1625) reported differences in /a/ depending on whether it was followed by underlying word-final /s/, /r/, or /l/; however, the present article represents the first study to quantify the differences that the deletion of word-final consonants causes on a preceding /a/ and the perception of such realisations.

I believe that the effects that /s/, /r/, or /Θ/ deletion have on /a/ word-finally are also in operation word-medially. Likewise, I suspect that /i/ and /u/ are also subject to changes of quality when they precede a deleted word-final /s/, /r/, or /Θ/. These two aspects, however, still remain to be analysed.

Considering what has been exposed in the present paper, it can be concluded that:

– word-final /s/, /r/, and /θ/ deletion changes the quality of a preceding /a/ in EAS; these changes are statistically significant and create a system of four low central vowels ([a], [a^{s}], [a^{r}], and [a^{θ}]).
– EAS speakers can differentiate between word-final /a/ and /a/ preceding underlying word-final /s/, /r/, and /θ/.

– EAS speakers can identify whether or not /a/ precedes a deleted word-final /s/, /r/, or /θ/, but they cannot identify which one of these consonants has been deleted in each case.
– The EAS contrasts [a] vs [a^{s}], [a] vs [a^{r}], and [a] vs [a$^{\theta}$] are not based on identifying the quality of [a^{s}], [a^{r}], or [a$^{\theta}$], but on identifying that a consonant has been deleted.

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Appendix 1

Hoja de respuestas. Experimento 0

Datos personales: Hombre Mujer

Edad: _____

¿En qué pueblo vives? _____

Si no has vivido en ese pueblo **desde que tienes 4 años**, di en qué pueblo vivías antes y cuánto tiempo llevas en el pueblo en el que vives ahora:

_____

_____

Señala con un círculo la respuesta correcta. Si cometes un error, tacha la respuesta incorrecta y señala con un círculo la respuesta correcta.

1	a	as	ar	az
2	a	as	ar	az
3	a	as	ar	az
4	a	as	ar	az
5	a	as	ar	az
6	a	as	ar	az
7	a	as	ar	az
8	a	as	ar	az
9	e	es	er	ez
10	e	es	er	ez
11	e	es	er	ez
12	e	es	er	ez
13	e	es	er	ez
14	e	es	er	ez
15	e	es	er	ez
16	e	es	er	ez

17	i	is	ir	iz
18	i	is	ir	iz
19	i	is	ir	iz
20	i	is	ir	iz
21	i	is	ir	iz
22	i	is	ir	iz
23	i	is	ir	iz
24	i	is	ir	iz
25	o	os	or	oz
26	o	os	or	oz
27	o	os	or	oz
28	o	os	or	oz
29	o	os	or	oz
30	o	os	or	oz
31	o	os	or	oz
32	o	os	or	oz
33	u	us	ur	uz
34	u	us	ur	uz
35	u	us	ur	uz
36	u	us	ur	uz
37	u	us	ur	uz
38	u	us	ur	uz
39	u	us	ur	uz
40	u	us	ur	uz

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