

The system of Coptic vowel reduction: Evidence from L2 Greek usage

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In this paper I study Coptic vowel reduction through L2 Greek misspellings in Egypt from the Roman period onwards. Greek was the language of the government with mostly Egyptian scribes. In many cases, it is obvious that the nonstandard vowel replacements in Greek result from the Coptic tendency to reduce the quality of unstressed vowels to schwa. L2 Greek misspellings offer a glimpse into the system of vowel reduction in Coptic, evidence of which is not easily obtained language-internally. The misspellings are congruent with phoneme distribution in Coptic and can be verified by similar misspellings of Greek loanwords in native Coptic texts. Observed phenomena are the reduction of unstressed word-final vowels to schwa, stress-conditioned allophonic variation in round vowels, and consonant-to-vowel coarticulation word-medially.

KEYWORDS: Coptic phonetics, Egyptian Greek, language contact, vowel reduction.

1. Introduction

This paper studies the system of vowel reduction in Coptic through evidence given by L2 Greek misspellings. In this article, I claim that Greek nonstandard vowel orthography resulted from Egyptian¹ phonological transfer onto Greek. The material used for this study comes from the Roman period (1st century CE onward). Although Egyptian influence on Greek could be detected on the morphosyntactic level even before the Roman period (Vierros 2012), phonological variation becomes more frequent in the Roman period due to two co-existing factors: the phonological development of Greek and the emergence of Coptic. Besides the L1 phonological influence, the use of the same alphabet for both languages also enabled L1 Egyptian scribes to transfer Coptic orthographic conventions onto the L2 Greek they produced.

The majority of examples of nonstandard variation comes from a small corpus, the Narmouthis Greek ostraca (O.Narm.),² from the 2nd-3rd century CE. It is among the earliest Greek text corpora that reveal Egyptian phonological impact on a larger scale. The results of the phonological analysis in Dahlgren (2016, 2017) show that the position of stress and the tendency in Coptic for consonant-to-vowel coarticulation in reduced environments, were the main factors behind the nonstandard

(L2) Greek vowel orthography. The analysis of Egyptian Greek in this paper draws on the searches of Dahlgren (2017)³ for test words and individual orthographic replacements within a digital repository of Greek texts, providing evidence for the main types of Egyptian-influenced variation present in O.Narm.

1.1. Greek-Egyptian language contact

Greek and Egyptian were in intense contact in Egypt from the conquest of Egypt by Alexander the Great in 332 BCE, after which Greek became the official language of the government. At the beginning of the Macedonian regime in Egypt, the government had only Greek scribes, but later also Egyptian scribes were trained in Greek. By the Roman period, most scribes were L1 Egyptian speakers writing in L2 Greek (Clarysse 1993: 186-188; see also e.g. Papaconstantinou 2010 regarding multilingualism in Egypt more generally).

With many L2 writers of Greek, texts from this period contain considerable nonstandard orthographic variation, partly based on the influence of Coptic phonology, as is typical of language contact scenarios (Thomason 2001, Matras 2009). For instance, there is frequent variation between the letters used for Greek voiced and voiceless stops, as in the misspelling of *adelphos* ‘to brother’ in (1), because Egyptian did not have a voicing opposition in stops (Loprieno 1995: 40-43).

- (1) ατελφω *atelp^hō* < ἀδελφῶ *adelph^hō* ‘brother (dative)’ (O.Narm. 103)

In addition to this, there is substantial variation in vowel quality resulting from Egyptian influence (Gignac 1976, 1991; Horrocks 2010: 112; Dahlgren 2017). What has previously not been considered is how this variability could benefit research into Coptic phonology, in this case the system of vowel reduction in Coptic.

1.2. Methodology and material

The present paper focuses on the system of Coptic vowel reduction. The material used for this analysis was taken from Greek and Coptic documentary texts. The Coptic material also includes some very early literary texts with rich nonstandard variation, alongside the documentary material. The Greek texts come from the Roman to Byzantine era, ca. 1st to 8th century CE. The Coptic material consists of ca. 500 nonstandard variants of Greek loanwords from different dialectal areas in Egypt from the 3rd to 13th century CE. The data for Coptic were collected from the Database and Dictionary of Greek Loanwords in Coptic (DDGLC, Freie Universität Berlin).

1.3. *The phonological systems of Roman period Greek and Coptic*

Classical Greek of ca. 350 BCE had six vowels /a(:) e(:) i(:) y(:) o(:) u(:)/ and the diphthongs /a(:)i au e(:)u o(:)i/ (Horrocks 2010: 164-165). While there was a transparent correspondence between graphemes and vowel phonemes in the classical period, subsequent sound changes made the relationship between orthography and phonology in the Greek used in Egypt during the Roman period considerably more complex. By the Roman period the former diphthongs $\epsilon\iota$ *ei* (formerly /ei/) and $\alpha\iota$ *ai* (formerly /ai/) had merged with /i/ [i] and /e/ [e] respectively, while during this period $\omicron\iota$ *oi* (formerly /oi/) started to merge with $\upsilon\gamma$ /y/, both pronounced as [ø] or [y]. The quantity distinction had vanished, which progressively led to further mergers during the Roman period. η $\bar{\epsilon}$ (formerly /e:/) became /e/ [e], distinct from /e/ [e], but was in the process of further raising to /i/ [i], with much fluctuation in quality until the 8th century CE (Horrocks 2010: 166-168).⁴ The development of ω \bar{o} (formerly /o:/) is more straightforward, as it had merged with \omicron *o* /o/ as /o/ [o] already by the Roman period.

In the Roman period, the vowel inventory of Egyptian Greek was thus /a e e̅ i y o u/. The vowel /e/ could be spelled with either ϵ *e* or $\alpha\iota$ *ai*, /y/ could be spelled with either υ *u* or $\omicron\iota$ *oi*, /i/ could be spelled with either ι *i* or $\epsilon\iota$ *ei*, and /o/ could be spelled with either \omicron *o* or ω \bar{o} . The other phonemic vowels could be represented by only a single grapheme, i.e. /a/ by α *a*, /e/ by η $\bar{\epsilon}$, and /u/ by $\omicron\upsilon$ *ou*.

Coptic borrowed the Greek alphabet (Grossman & Richter 2015: 69-101), but in addition to the Greek letters also took six or seven (depending on the dialect) signs from Demotic Egyptian, the stage of Egyptian prior to Coptic, for consonantal phonemes that were not part of the Greek system. Borrowing the Greek alphabet for Coptic gave access to vowel graphemes for the first time in the history of Egyptian. Prior to this, all Egyptian writing systems lacked dedicated vowel signs, although the signs for glides /j/ and /w/ sometimes also represented vowel qualities depending on the position of the phoneme (Allen 2013: 53-54). This paper assumes the (Coptic) Egyptian vowel qualities adopted by Peust (1999). These are, in stressed position, /a/ λ *a*, /ε/ ϵ *e*, /e/ η $\hat{\epsilon}$, /i/ ι *i*, /ɔ/ \omicron *o*, /o/ ω \hat{o} , /u/ $\omicron\upsilon$ *ou*.⁵ Unlike Greek, which allowed all vowel qualities in every position, not all vowel qualities could occur in unstressed position in Coptic.

In unstressed position, Peust treats <e> as schwa /ə/⁶ (Peust 1999: 250-254), and it is the most frequently used grapheme for marking a word-final unstressed vowel. While it is not easy to draw details of the Coptic vowel system from its orthographic attestations, dialect forms can help to clarify some aspects. For instance, in some shorter words with only two vowel qualities, the position of stress in a word can be determined by the variation in vowel orthography in dialectal forms. For

example, in the Sahidic dialect,⁷ the word ‘age’ is written ⲁⲗⲉ *ahe*, while in Bohairic it is written ⲁⲗⲓ *ahi*. According to e.g. Girgis (1966), variation mainly concerned unstressed vowels, so the variation in the orthography of the second vowel suggests it is unstressed and the first one stressed. Furthermore, Sahidic contains a minimal pair that proves the stress to be on the first syllable in ‘age’: ⲁⲗⲉ *ahe* [‘ahə] and on the second syllable in another word, ‘yes’, that displays orthographic variation on the first syllable: ⲉⲗⲉ~ⲁⲗⲉ *ehe~ahe* [ə‘hɛ~a‘hɛ] (Peust 1999: 273-274). This simultaneously confirms the possibility of /ɛ/ in a stressed position.

Coptic had no unstressed [o] or [ɔ], and [u] occurs as an allophone of /o/ and /ɔ/ in unstressed position. However, /u/ is also an independent phoneme (Peust: 1999: 211-213, 250-254). Furthermore, the Coptic dialects vary widely in terms of orthographic conventions, among others the forms *sôtom* – *sôtem* – *sôtṃ* – *sôtme* – *sôtṃ(e)*⁸ for the word ‘hear, listen’ in different Coptic dialects.⁹ According to Loprieno (1995: 40; also Depuydt 1993: 365), this variation does not necessarily represent linguistic features of the local variety, but rather mainly dialect-specific conventions for the use of the Greek alphabet to represent Coptic phonemes. Some information can, nevertheless, be gathered from this dialectal variation. It makes clear that the last syllable contained the unstressed vowel, although it is still remarkable how differently it was depicted in writing among the dialects. For instance, one of the Fayyumic dialects (an archaic, northern form of Fayyumic called F7) seems to have used <o> to denote word-final schwa in syllables that follow a tonic <ô> and end in a bilabial (as in *sôtom*, the vowel quality probably rounded by the context), while <e> and sometimes <i> are used even in other Fayyumic varieties in these positions (see Kasser 1991a-b).

It seems clear enough from these examples that all dialects had a stressed /ɔ/, even if F7 also marked the unstressed vowel with the same grapheme. It must be stressed, however, that we are dealing with variation in the written language and it is difficult to decipher different dialectal vowel qualities precisely. Consequently, there are many different interpretations particularly of the inventory of unstressed vowels. Depuydt (1993) considers only schwa to occur in unstressed position, while Haspelmath (2015: 124, largely following Loprieno 1995: 50) includes also /a/. Girgis (1966: 81-82) and Peust (1999: 250-254), however, argue that the high vowels /i u/ can also occur in unstressed position, yielding the inventory /a ə i u/ for unstressed vowels in the language.

These disagreements render Egyptian-influenced L2 Greek variation valuable for determining the Coptic phonological system. Greek non-standard spellings are often the product of a near-phonetic representation when the writer does not remember, know or care about the stand-

ard form, and involve less influence of the dialectal variation in Coptic orthographic conventions due to the words being foreign in origin. This means that the phonetic level can be more accurately determined.

One obvious problem regarding vowel reduction is that it is directly related to stress position, and stress patterns in Coptic remain unclear. Peust (1999: 268-274) offers some evidence from a typological and etymological perspective that largely points towards a stress-timed system, stating that stress always falls on one of the last two syllables. This does not appear to always be the case, however. Rather, it seems to fall on a heavy syllable in disyllabic words, and on the middle syllable in trisyllabic ones. Sometimes, there seems to be a realignment of stress which is evident from a certain type of orthographic variation, e.g. using geminate consonants instead of single ones (of the standard orthographic form) before the stressed vowel as an orthographic marker for the stress position. One such example is ΓΕΝΝΗΜΑ *gennēma* [gen'nema] < *génēma*. It is possible that this system was also used to mark a heavy syllable to aid the reader by means of orthography, in order to mark the (Greek original) stress, as in ΣΤΟΥΛΛΟΥΣ *stoullous* / *stullus*/ < ΣΤΥΛΟΣ *stýlos* /'stylos/. Without the geminate /l/ in the misspelling, the first syllable would have been light, thus not corresponding to Coptic stress rules. Transfer of stress in L2 Greek usage can be further deduced from the instances where the Greek original stressed vowel has been replaced in line with the phonological system of Coptic, for example using <o> /ɔ/ in stressed syllables and <ou> /u/ in unstressed ones for round vowels (for more on Coptic stress see Dahlgren 2017: 133-138). Examples of this phenomenon are given in sections 3.1 and 3.2.

Coptologists disagree on whether the (formerly) short and long vowel graphemes ε, η e, ê and ο, ω o, ô taken from the Greek alphabet represented in Coptic distinctions of quantity (e.g. Loprieno 1995) or of quality (e.g. Peust 1999, Greenberg 1962). There are several examples of marking phonetically long vowels with two sequential vowel graphemes, as in αα aa, εε ee, ηη êê, οο oo and ωω ôô, which points toward these individual graphemes representing phoneme quality distinctions. Greenberg (1990: 429-432) and Peust (1999: 205-210) take these as evidence for vowel length in stressed syllables. According to Greenberg, the double vowels form a single syllable peak and cannot be treated as anything other than quantity markers. However, many Coptologists maintain that two sequential short vowels are divided by a glottal stop: oo = [oʔo] (Loprieno 1995: 44). Later renderings of Arabic loanwords in Coptic, as in (2) *alkaroore*, tend to depict Arabic long vowels with double short vowel graphemes, instead of the graphemes for the formerly long Greek vowels (here close-mid vowel ω ô), offering further evidence to support the quality hypothesis.

- (2) ἀλκαροορε *alkaroore* < *al-qārūra* (Richter 2006: 496-497)

The orthographic variant of this Arabic loanword presents some features of Coptic in it. For instance, the Arabic original /u:/ in the second (stressed) syllable is replaced with /ɔ/, because in Coptic the stressed round vowel was orthographically marked with *o* /ɔ/. Furthermore, to mark the longer duration of the syllable due to stress, the Arabic original /u:/ is written with two sequential graphemes, despite the fact that they were originally used to mark short /o/ in Greek. At this time, *o* represented /ɔ/ in Coptic, and there are good grounds for assuming that *omega* (ω), formerly the grapheme for /o:/ in Greek, did not mark a long vowel in Coptic, or else it could easily have been used to mark a long vowel in this Arabic loanword (Richter 2006: 496-497). This paper thus assumes that the vowels represented by *eta* and *omega* differed in quality, not quantity, from those represented by *epsilon* and *omicron*: they are written here as /e/ and /o/ against /ɛ/ and /ɔ/ respectively.

I understand L2 Greek misspellings as supporting the accounts of the vowel system proposed in Girgis (1966) and Peust (1999). For instance, there are very clear spellings that involve the reduction of the original Greek unstressed /o/ to /u/, which is not possible in Depuydt's, Loprieno's and Haspelmath's interpretations, as they do not permit unstressed /u/. For instance, *akoáριοι* is written as *akouarioi* /akuarioi/ 'water carrier (nominative plural)' in (3), with /u/ in unstressed position for original Greek /o/ (cf. Peust 1999: 211-213).

- (3) ἀκουαριοι *akouarioi* /akuarioi/ < ἀκοάριοι *akoáριοι* (O.Claud. 4 715.11)

An important fact to take into consideration regarding Coptic is that consonant qualities carry high functional load,¹⁰ as is typical in Afroasiatic languages. Word formation is based on a so-called 'consonantal skeleton' consisting of 1-4 consonants and occurring in some form in all verbal forms: infinitive, imperative, stative and construct participle. Vowels are used to form grammatical categories (the so-called root-and-pattern formation) (Layton 2000: 152). For instance, c-τ-π *s-t-p* occurs in all forms as cωτπ *sōtp*, cετπ- *setp*, cοτπ= *sotp* =, cοτπ *sotp* 'choose'. The basic lexical root was an abstract phonological entity which was formed into a word with inflectional affixes, in earlier stages of Egyptian mostly suffixes, which conveyed deictic markers and grammatical functions such as gender, number, tense etc. (Loprieno & Müller 2012: 119-120). Because of its morphological structure, Coptic can be said to be 'consonantal' more than 'vocalic', although the consonant inventory had diminished considerably by the time of Coptic from original Egyptian.

The consonant inventory of Coptic, based on Loprieno (1995: 40) but with transliteration practices according to Grossman & Haspelmath (2015), is presented in Table 1. For comparison, the consonantal inventory of Greek is presented in Table 2.

		Labial	Dental/Alveolar	Palatal	Velar	Glottal
Plosive	Palatalised				/k ⁱ / ɛ k ⁱ	
	Voiceless	/p/ π p	/t/ τ t	/c/ ɣ č	/k/ κ k	/ʔ/
	Ejective ¹¹		/t'/ τ t	/c'/ ɣ č	/k'/ κ k	
	Voiced	/b/ β b	(/d/ Δ d)		/g/ γ g	
	Aspirated ¹²	/p ^h / φ p ^h	/t ^h / θ t ^h		/k ^h / χ k ^h	
Fricative	Voiceless	/f/ q f	/s/ c s	/ʃ/ ɥ š		/h/ ɣ h
	Voiced		(/z/ z z)			((/ʃ/))
Nasal		/m/ μ m	/n/ ν n			
Trill			/r/ ρ r			
Lateral			/l/ λ l			
Glide		/w/ ου ou		/j/ (ε) j		

Table 1. The Coptic consonantal inventory according to Loprieno (1999: 40-46). The phonemes in parentheses only appear in Greek loanwords. The phoneme /ʃ/ (in double parentheses) historically merged with /ʔ/, so its presence is doubtful at the Coptic stage of Egyptian (Loprieno 1995: 248). As some traces of it remain in some vocalic oppositions, it has been tentatively included in this chart.

		Labial	Dental/Alveolar	Velar	Glottal
Plosive	Voiceless	/p/ π p	/t/ τ t	/k/ κ k	
	Voiced	/b/ β b	/d/ δ d	/g/ γ g	
	Aspirated	/p ^h / φ p ^h	/t ^h / θ t ^h	/k ^h / χ k ^h	
Fricative	Voiceless		/s/ σ s		/h/ ‘ h
	Voiced		/z/ ζ z		
Nasal		/m/ μ m	/n/ ν n		
Trill			/r/ ρ r		
Lateral			/l/ λ l		

Table 2. The Roman period Greek consonantal inventory according to Horrocks (2010: 170-172).

In languages where consonants have a high functional load, clear perception of consonantal qualities is of vital importance, either because of the amount of consonant qualities in the phoneme inventory or the role of consonants in word formation. According to Traunmüller (1999), consonant-to-vowel coarticulation is an aid for speech perception in highly consonantal languages such as the NW Caucasian languages and Northern Chinese, because it gives additional information about the phonetic properties of the consonants through the adapted qualities of the vowels. Although NW Caucasian languages and Northern Chinese differ from Coptic by having much larger consonant inventories, Coptic could be counted as ‘consonantal’ for other reasons. Coptic borrowed from Greek extensively, but around two-thirds of the lexicon derive from earlier stages of Egyptian (Layton 2000: 12). The Egyptian language structure changed from suffixing in Egyptian to prefixing in Coptic, but the etymological structure of words still rested on consonant roots. Therefore, because of the root-and-pattern structure and the apparent consonant-to-vowel coarticulation on unstressed vowels, Coptic might have used the same strategy as NW Caucasian and Northern Chinese. Kahle (1954: 54) already noted the Coptic tendency for consonantal coarticulation on extensive dialectal material; for instance the nonstandard writings of $\eta \hat{e}$ instead of ϵe before /n m r/ (nasal, bilabial, coronal). The lack of unstressed /o/ and /ɔ/ in Coptic is probably also connected to the non-clear perception of these mid vowels in an unstressed position; like /e/ and /ɛ/, they would be vulnerable to coarticulatory effect.

2. Features of Coptic vowel reduction

The results of the analysis of L2 Greek nonstandard variants undertaken here largely confirm the findings of Girgis (1966). Different reduction strategies are presented in the sections below. In 2.1 I discuss the reduction of unstressed word-final vowels to schwa, in 2.2 I discuss the reduction of /o/ and /ɔ/ to /u/ in unstressed position, and in 2.3 I discuss the reduction of word-medial vowel quality and how it relates to consonant-to-vowel coarticulation.

2.1. Reduction of unstressed word-final vowels to schwa

According to Flemming (2009: 79-86, 89-91), the longer duration of a schwa word-finally gives it time to reach its ‘target’, i.e. it has time to become fully centralised. This contrasts with word-medial position, where shorter duration leaves schwa susceptible to variation conditioned by the quality of adjacent phonemes.

The transfer of the Coptic stress system to Greek caused the reduction in quality of unstressed Greek word-final vowels. In Greek, morphological information was mostly coded in the vowel quality of the final syllable. The distinction of e.g. imperative and infinitive endings, therefore, disappeared when these vowel qualities were neutralised, as in the nonstandard production of *pempsen* from the standard *pémpson* (active aorist imperative of *pémpō*, ‘send’) (4). Both spellings are phonetically realised as [pemp̥sə(n)] according to Coptic phonological rules (see the papyrus corpus O.Claud. 2. and Leiwo 2010, 2017). Original word-final *o* was graphemically replaced with *e* and word-final /n/ was frequently dropped in Egyptian Greek (Gignac 1976: 111), so the word effectively ended in schwa. Coptic allowed /a i u ə/ as word-final unstressed vowels, but frequently <e> /ə/ appeared near sonorants (Peust 1999: 251-253). This is probably why it is so frequent in L2 Greek word-finally; e.g. examples (4) to (6) all include sonorants before or after the reduced vowel.

(4) πειμψεν *pempse(n)* < πέμψον *pémpso(n)* (O.Claud. 2, 2nd century CE)

In this particular instance, the variation is more likely related to language contact than the internal phonological developments of Greek. These types of spelling mistakes were atypical for L1 writers because of the functional load of word-final vowel qualities in Greek. Furthermore, /o/ and /e/ are still distinctive qualities in Modern Greek, and there is no vowel variation of this type in Modern Greek dialects. According to Trudgill (2003: 53-54, 59), the Northern dialects have certain established vowel reduction patterns, but these delete unstressed word-final /i/ and /u/, and raise /o/ and /e/ to /u/ and /i/, respectively. These are clearly independent phenomena from those observed in Egyptian Greek, resulting from the impact of Coptic.

2.2. Reduction of /o/ and /ɔ/ to /u/ in unstressed position

Variation between /ɔ/ and /u/ could be linked to consonantal coarticulation, as in (5) *Makrinou* (personal name, genitive), where the Greek original word-final *ω* *ō* indicating the dative case was replaced with *ou* /u/, marking the genitive case. The quality of the vowel could simply have been raised due to the effect of the front consonant (/n/); according to Flemming (2003), coronal consonants from dental to post-alveolar regions tend to front the vowel quality (see Jakobson 1968 for the terminology).¹³ This was a frequent phenomenon concerning the variation between genitive and dative forms before they merged, and not nec-

essarily indicative of an L2 user (Stolk 2015: 71, 74). However, /u/ was also one of the vowels allowed in unstressed position in Coptic (Peust 1999: 253), and indeed often found in the presence of a nasal, especially in the Sahidic dialect (Peust 1999: 238-239).

- (5) Μακρινου *Makrinou* < Μακρίνω *Makrínō* (O.Narm. 92)

In other cases involving more transparent evidence of the Coptic phonological impact on Greek, there appears to be transfer of the Coptic stress system onto that of Greek, as in the L2 Greek misspelling (6) *lou-gou* /lugu/ from *λόγου* ‘word (genitive)’, although this again takes place near a front consonant (/l/).

- (6) λουγου *lougou* < λόγου *lógu* (PSI 8 884.2 Oxyrhynchites 390 CE)

In this example, the non-standard spelling seems to indicate that the round vowel of the first syllable is unstressed by replacing the Greek original /o/ with /u/, the round vowel permitted in unstressed position in Coptic. While speculative, it is possible that the ending has been kept intact because genitive endings were frequent and easy to remember by heart due to Greek patronymics being marked with the genitive case.

Most of the /o/ and /u/ variation in Egyptian Greek seems to be related to the impact of the Coptic stress system and the phoneme distribution related to it. As Coptic had no unstressed /ɔ/, which was written with the same grapheme *omicron* *o* <o> as that which in Greek was phonemically /o/, it was regularly replaced with /u/ in L2 Greek writing. This was simply following the positionally conditioned allophony in Coptic regarding /ɔ u/, as in (3) *akoáριοι* written as *akouarioi* /akuarioi/, or in the previous example. In some cases, stressed Greek /u/, on the contrary, was replaced with *o*, as in (7) *komiontai* from *komioûntai* /komiuntai/, ‘to take care of’.

- (7) κομιονται *komiontai* < κομιοῦνται *komioûntai* (BGU 4 1123.6, Alexandria 30 BCE - 14 CE)

2.3. Reduction of word-medial vowel quality: consonant-to-vowel coarticulation

Word-medially, the unstressed vowel inventory in Coptic seems to have consisted of /a i u ə/ (Girgis 1966: 73; Peust 1999: 252), with allophonic distinctions in some vowels conditioned by the consonantal environment. This matches Flemming’s theory (see 2.1) of word-medial schwa adapting to the quality of adjacent consonants. Consonantal coarticulation mostly concerned the front vowel axis. In native Coptic texts,

eta <ē> could be realised as either /i/ or /a/, depending on consonantal environment, as in the New Egyptian rendering *mīš* in cuneiform writings for earlier Egyptian *μησ* *mēs* ‘crowd, thong’. It has a raised vowel between bilabial and coronal consonants (Lambdin 1958: 179; Peust 1999: 228-230). An example of a low vowel is the changed quality of the front vowel in *argatēs* from *ergátēs* ‘workman’, related to the adjacency of /r/, which in Coptic either fronted/raised or retracted/lowered the adjacent vowel quality depending on the immediate surroundings of the liquid. In *argatēs*, /g/, which follows /r/, and also likely /a/ in the second syllable, triggered the lowering (Dahlgren 2017: 95-97). An example in another direction, /a/ raising into /ε/ near a front consonant (/n/): *eneke* from *enágein* ‘to sue’ (examples from Girgis 1966: 73-76). Variation was thus possible along the continuum /i~e~ε~a/, depending on the consonantal environment.

In (8) *metropoli* from *mētropólei* /*mɛtropolɪ*/ ‘the city (dative)’, the unstressed vowel in the first syllable, reduced in quality, is lowered from the Greek original [ɛ] to [e] because of the bilabial before it. According to Flemming (2009: 82-84, 92), bilabials cause a ‘trough’ effect on adjacent vowels, and especially high vowels are lowered in quality.¹⁴ Also Carignan *et al.* (2013) noticed that labials can lower the quality of high vowels and raise that of the low ones. Labials tend to do this in Coptic more than cause the vowel quality to become rounded.¹⁵ In Egyptian Greek (9) *kʰylōpōlis* /*kʰylopolis*/ from *kʰylopōlēs* /*kʰylopóles*/ (personal name), the final syllable’s /ɛ/ is raised due to the adjacency of the coronal consonants /l/ and /s/.

(8) *μετροπολι metropoli* < *μητροπόλει mētropólei* (O.Narm. 110)

(9) *ξυλωπωλις kʰylōpōlis* < *ξυλοπώλης kʰylopōlēs* (O.Narm. 21)

The range of variation of /i/ and /a/ in terms of height can be seen especially well in (10), where both vowels are realised as [ɛ] in a misspelling of the Greek loanword for ‘frankincense’ in an early Coptic bible translation.

(10) *λεβηνογ[ç] lebenous* < *λίβανος líbanos* (P.Hamb.Bil. 1, 3rd-4th century CE)

In this misspelling, the first (stressed) syllable’s /i/ was reduced to [ɛ], probably affected by the following bilabial. While this is not the most typical example of a Greek word being misspelled in a Coptic text, the manuscript being a private copy with somewhat shaky orthography, the near-phonetic example shows how strong consonant-to-vowel coarticulation is as a pattern of vowel reduction in Coptic. If there were competing phenomena involved, coarticulation would quite often ‘win’ in Coptic, even in a case with a stressed /i/ that should retain the vowel quality (see

section 3). The front vowels in unstressed position are strongly affected by the surrounding consonantal qualities, in this example even in the syllable that was stressed in Greek. Similarly, also the second (unstressed) syllable's /a/ was reduced to [ɛ], affected also either by the bilabial or the following coronal consonant. It is worth noting that , at this time in Coptic pronounced [β], was one of the sonorants that often had <e> /ə/ appearing next to them at least in the Akhmimic dialect (see 2.1) (Peust 1999: 251, 133-137; Depuydt 1993: 365-366).

3. Coptic vowel reduction in a cross-linguistic perspective

The phonological analysis of L2 Greek vowel variants revealed three patterns for Coptic vowel reduction: reduction of a word-final vowel to schwa (2.1), stress-related allophony of [o], [ɔ] and [u] (2.2), and word-medial consonant-to-vowel coarticulation (2.3). Generally speaking, vowel reduction took place in unstressed syllables, but this is not always clear from the L2 Greek usage. Transfer of stress patterns from Egyptian to Greek might have taken place, so sometimes a vowel could be replaced in what was a stressed syllable in Greek but might have counted as unstressed in the Coptic phonological system (see section 1.3).

According to Crosswhite (2001: 20-27) and Harris (2005: 119-122), languages have two main strategies of vowel reduction. One of these is CENTRIPETAL, in which there is centralisation of peripheral vowels to a schwa-like quality. Languages that have this type of vowel reduction are e.g. Bulgarian and Eastern Ojibwa. The other is CENTRIFUGAL, in which vowels are reduced to corner vowels /i a u/, as in Standard Arabic and Russian. Coptic does not seem to follow either one of these strategies directly. However, because the evidence lies on misspellings in texts, it is somewhat difficult to determine. For instance, the use of /i a u/ in so many misspellings in L2 Greek may have represented phonemic vowel reduction utilising the corner vowel strategy, or these may have merely been near-phonetic depictions by the writers of what the audible perception of the exact quality of the neutral vowel was. According to Girgis (1966: 73, 79), unstressed /a/ and /i/ mostly retained their quality in unstressed positions. However, /e/ and /ɛ/ had a number of replacements that mostly followed the quality of the adjacent consonants. In addition to this, /o/ and /ɔ/ could not occur in an unstressed position and were replaced most often by /u/ (see examples in section 2). Coptic also seems to reduce word-final vowels to schwa (Peust 1999: 250-254; Dahlgren 2017: 62-66; see section 2.1) but on the other hand, front vowels were also found to fluctuate heavily according to the quality of adjacent con-

sonants (see 2.3), i.e. were susceptible to variation conditioned by consonantal environment. Therefore, this reduction of vowel quality, if phonemic, may represent a true phonetic schwa, at least word-finally. Word-medially, however, the reduced quality of the vowel is more susceptible to be adapted to the quality of adjacent consonants and is likely phonetic, not phonemic. In Harris's and Crosswhite's typology, the centralisation of vowel quality means prominence reducing. This does not seem to concern the quality of the reduced vowels in Coptic, at least word-medially, as they keep the phonetic residues of the adjacent consonants. Therefore, phonetically they are not schwas i.e. central unstressed vowels, but deploy rather a prominence enhancing tactic by mainly utilising the corner vowels in representing the reduced vowels' qualities, in order to reveal the adjacent consonants' qualities through consonant-to-vowel coarticulation.

4. Conclusion

Information of the reduction of Coptic vowels is not easily obtained from native language sources because vowel orthography in Coptic words differs from one dialect to another and may represent primarily orthographic conventions rather than phonemic differences. Furthermore, there is some disagreement among Coptologists whether the originally short and long Greek vowel graphemes for mid vowels represent quantity or quality differences in Coptic, which complicates the assessment of unstressed vowel qualities. However, misspellings in L2 Greek used in Egypt reveal patterns of Coptic vowel reduction, which can easily be compared to Coptic native language texts. There are three main strategies: reduction of word-final unstressed vowel to schwa, stress-related allophony of round vowels, and consonant-to-vowel coarticulation word-medially. When assessed with reference to strategies of vowel reduction attested cross-linguistically, Coptic seems to mix the two systems mentioned, i.e. utilising centralisation and corner vowel qualities, at least on the phonetic level linked to coarticulation.

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Notes

¹ Egyptian is usually divided to five different stages: Old Egyptian (2690-2000 BCE), Middle Egyptian (2000-1650 BCE), Late Egyptian (1350-650 BCE), Demotic Egyptian (650 BCE - 5th/4th century CE), and Coptic (from ca. 3rd century CE). In the first three stages, hieroglyphs were used for writing, with the so-called hieratic (cursive) script also being used in Late Egyptian. An even more cursive and abbreviated script developed from the hieratic is used for Demotic Egyptian (Allen 2013: 2-4). In this paper, the term 'Egyptian' is used for the language structures that might have existed before Coptic, i.e. the last stage of the Egyptian language, whereas the term 'Coptic' is used when evidence comes directly from Coptic (such as exact vowel qualities only known through Coptic, or material written in Coptic).

² Documentary material such as tax receipts and land sale documents provide more orthographic variation than literary texts. Literary texts were always produced with much more care and were often written by more educated scribes. All Greek manuscript editions used in this paper are accessible online in the Papyrological Navigator under DDBDP (Duke Databank of Documentary Papyri, <papyri.fi>).

³ This study searched for test words from corpora showing a high degree of variation in the Papyrological Navigator (<papyri.info>), currently containing ca. 70,000 texts. Phoneme-based searches were conducted in two searchable databases that use orthographic irregularities (i.e. misspellings) as the search unit (Trismegistos Text Irregularities, <trismegistos.org/textirregularities> and Paratypa (<papygreek.hum.helsinki.fi/variations>). The results were verified by extending the analysis to the variation in later Arabic loanwords in Coptic. The latter also displayed variation resulting from the impact from Coptic. Evidence for Coptic vowel reduction, therefore, can be deduced from two language contact situations several centuries apart.

⁴ According to Horrocks, the full merger would not have taken place "before the early Byzantine period" but the documentary papyri do have this variation throughout the centuries until 800 CE.

⁵ Transliteration of Coptic in this paper follows the Leipzig-Jerusalem transliteration convention (Grossman & Haspelmath 2015).

⁶ Although Peust used the sign for a phonetic schwa, i.e. a mid central vowel, in some examples, in reality he must have been talking about a more general unstressed vowel quality. This could be evident from the fact that the quality of the unstressed vowel is changeable within the phoneme environment in coarticulation.

⁷ Coptic had several different dialects: Bohairic, Fayyumic, Oxyrhynchite in Lower Egypt and Sahidic, Akhmimic and Lycopolitan in Upper Egypt. In addition, there was Middle Egyptian (Mesokemic) (Kasser 1991a).

⁸ In this order: F7 (archaic Fayyumic); Fayyumic/Bohairic; Sahidic/South Fayyumic/Protodialect; Akhmimic; Lycopolitan.

⁹ These are disyllabic words with stress on the first syllable.

¹⁰ Since the Prague school, the understanding of 'high functional load' has been that it involves phonemes that appear in a large number of words in a language, yielding phonological contrasts in minimal pairs and resisting merger. Wedel, Kaplan & Jackson (2013) have confirmed this hypothesis with the first large-scale qualitative study on the functional load hypothesis.

¹¹ Loprieno has included ejectives in his consonant inventory, but this view is not shared by all Coptologists (see Peust 1999: 81-83 for overview).

¹² In the Bohairic dialect only.

¹³ Jakobson was the first to divide consonants into front and back, following the similar division of vowels. Front consonants include labials and dentals (this includes /n/) and back consonants consist of palato-velars (this also including pharyngeal)

(Jakobson 1968: 79-81). The division has remained in use in acoustic phonetics.

¹⁴ The tongue body lowers when a labial stop is produced when surrounded by close vowels, causing vowels to assimilate to the lowered tongue body position thus making it difficult to pronounce close vowels (Flemming 2009: 82-84, 92).

¹⁵ According to a preliminary sample, vowel lowering from *eta* to *epsilon* is statistically significant near bilabials.

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