CHAPTER 2

Orthographic Variation beyond Spelling Mistakes: Tremas and Adscripts in 194 Greek Papyrus Letters

Winnie Smith

1 Introduction

Greek has a very long tradition of historical spelling. It is, in that sense, anchored in the past: in the words of the introduction to this volume, users of Post-classical Koine Greek were "continuously looking over [their] shoulder at the frozen grammar of Classical Attic", even as the grammar could only *be* frozen by later generations, who were able to construct an idealized past because it was no longer messily alive. 'Later generations' is deliberately vague: while some parts of the history of selecting (and constructing) Classical Attic as a model for later Greek, such as the Atticist movement, were conscious processes driven by elite individuals (Kim 2023, pp. 124ff.), others were more organic. This includes Greek's orthographic conservatism, one aspect of which, the use of iota adscripts, I will be looking at in this chapter.

With a few minor exceptions,[1] spelling norms for writing Koine Greek were the same as those for Classical Greek. In historical orthographies, spelling conventions are slow to change to keep pace with phonological changes (Coulmas 2003, pp. 96–102). This means that the gap between conservative written norms and the sounds of Greek increases with time, and the increasing size of that gap is clearest in writers who do not spell normatively. As a result, spelling variants have frequently been used as an indirect clue to variation and change in speech.

However, the importance of orthography for reconstructing phonology arguably also means that historical linguistics has not always considered orthography much in its own right (Evans 2012). In this chapter, I discuss

1 The most famous is probably the spelling of Classical GIGNOMAI 'become', which is spelled ⟨ginomai⟩ in Koine Greek. Following practice in Early Modern English spelling research (cf. e.g. Culpeper & Kytö 2010, p. 199, n. 2), I will be using small caps for the citation forms of words, which, like a lemma, are superordinate: e.g. YOU includes *you, u, yew*. Angled brackets highlight specific forms under discussion, which may be variants. For example, I might well spell YOU ⟨u⟩ when messaging friends online.

two orthographic variables in a sample of around 200 Ancient Greek letters to illustrate some of the misconceptions this can encourage. The letters are all papyri (texts written on a reed surface) dated to between 50–250 CE, and sent, received and/or found at ancient Oxyrhynchus, Egypt. At this period, Egypt was under Roman control, and ancient Greek was the default written language.

Some but not all of the texts in this set contain adscripts, tremas, or both. **Adscripts** denote a specific kind of spelling variation, where the graphemes ⟨ω, η, α⟩ (ō, ē, a) may be followed by an iota (⟨ι⟩, ⟨i⟩) in certain circumstances (see p.). In Roman-era papyri, adscripts are optional (Clarysse 1976): thus e.g. ἀδελφῶι (with adscript) and ἀδελφῶ (without adscript) are equivalent forms of *adelphō*$_i$ (BROTHER.DAT.SG.). **Tremas**, also called diaereses (pl.; sg. diaeresis), are diacritics. They typically take the form of two dots, ¨, and mainly occur over ⟨ι, υ⟩ (i, u). Though tremas are far from random (see page onwards), they are also not written systematically.

Both variables expose problems with a chain of assumptions sometimes made about spelling in ancient Greek papyri. Crudely speaking, the reasoning runs as follows:

1. Ancient Greek spelling is standardized.
2. In a standardized orthography, well-educated people adhere to the standard.
3. Consequently, spelling variation is a sign of poor literacy.
4. Being less literate, variable spellers' choices reflect speech sounds: they are phonemically motivated.
5. However, being less literate, variable spellers' phonemically motivated choices may reflect language contact between spoken Greek and Egyptian.
6. This complicates analyses which aim to distinguish between spellings which reflect this language contact and spellings which reflect diachronic sound changes shared by all varieties of Greek.[2]

This sequence is a construction anchored in how linguistic normativity operates in the highly codified European national languages used for classical scholarship, and not in the different ways language standards operated in Greco-Roman antiquity, where drivers of standardization such as mass education and the nation-state did not exist (Introduction, this volume). Though

2 For an overview of 1–3, see (Colvin 2009, pp. 34ff.); 4–6: (Horrocks 2010, pp. 111–113).

there are things to unpack at every stage of the sequence, I will focus on steps 3 and 4. Through a case study of a single papyrus, P.Oxy. 12 1482, I will illustrate how the connection between spelling variation and illiteracy in papyri (step 3) is at least in part a back-formation: a concept from scholars' own literate cultures transferred, sometimes uncritically, onto ancient texts. Indeed, the assumed link between variation and illiteracy is so strong that it can lead to an overly narrow interpretation of orthographic variation in Greek papyri, ignoring patterns that do not fit that narrative.

Because tremas and adscripts are not written systematically, they have received relatively little attention as text features in their own right, with the notable exception of Clarysse (1976) on adscripts and Ast (2017) on tremas among other diacritics. Perhaps unsurprisingly, this lack of regularity has been interpreted as more evidence of lack of literate sophistication in ancient writers. In an important monograph on the ancient book, Schubart (1921, p. 85) argues that "sie [d.h. die Schreiber] setzen die Punkte auf diese Vokale ohne Wahl, wie es ihnen gerade einfällt".[3] Such authoritative but unsupported claims remain influential, so that editors can feel that adscripts and tremas are used "in what can seem like a capricious manner" (Ast 2017, p. 147).

This is a shame, as where they occur, both features are used in ways which challenge associations between variation, error, and illiteracy. By looking at the distribution of tremas and adscripts, I hope to show narratives that equate orthographic variation with error require more nuance than they are sometimes given. For instance, the variation as error model is partly a result of a tendency in previous linguistic work on papyri to concentrate on *spelling* variation, i.e. variation in the character choices for representing a particular sound in writing. But if orthographies are treated as sets of conventions for how language is written (Rutkowska & Rössler 2012, p. 213), variation in these conventions extends to differences below character level (e.g. letterforms) and in non-character text features, e.g. punctuation, diacritics, and word spacing. As the example of P.Oxy. 12 1482 will show, tremas can exist happily in texts with atypically high spelling variation; this is significant because tremas are more frequently associated with literary and school texts aimed at pupils, especially Homer (Fournet 1995; Cribiore 1996, pp. 83–84), and in exercises written by them (Cribiore 2005, pp. 190–191). The presence of tremas in a text, however spelled, thus suggests more than elementary formal literacy.

3 'They [i.e. writers] place the points over these vowels indiscriminately, as the fancy takes them.' Own translation.

If tremas challenge the link between variation and illiteracy, adscripts show that viewing spelling variation as error also depends on how spelling variation is defined. As with tremas, adscripts are a variable feature whose variability is not consistently reflected in editions. They are sometimes included in the transcription, sometimes in a critical apparatus, sometimes not noted, and at other times silently regularized to modern print conventions. The last three options can make print transcriptions appear more regular than the underlying papyri, helping to reinforce modern expectations of regular written norms which are partly a product of the editing process.

2 An Illiterate Writer?

The impetus for considering tremas and adscripts alongside what is traditionally treated as spelling error came from a caustic assessment of an ancient writer's literacy. In the second century CE, a man called Moros sent a letter that was discarded, preserved, excavated some 1,700 years later, and published in 1916 as P.Oxy. 12 1482. It may or may not have been written by someone else, since using scribes was common in Roman Egypt, whether the sender wrote Greek confidently, hesitantly, or not at all. For isolated documents like this, it is hard to know whether the sender was also the writer, so I will call the latter X, to avoid paraphrases later on. Whoever X was, their writing ability came in for the full weight of scholarly disapproval. According to Grenfell and Hunt, its original editors, the papyrus displays "the rude uncial of an illiterate writer, who makes numerous mistakes of spelling in spite of several corrections" (Grenfell and Hunt 1916, p. 241).

The rude uncial of an illiterate writer is a memorable phrase, all the more so because it makes little sense. The letter, all in one hand, is well preserved. It contains 160 words over 26 lines, enough to say that X's handwriting does not display the characteristics of Greek papyrus texts produced by inexperienced adult writers. These include:

- letters formed separately;
- unconfident letter shapes, sometimes formed by many strokes ('multistroke');
- large spaces between letters;
- lack of uniformity (e.g. uneven lines and margins, letter shapes, and direction of writing).

CRIBIORE 1996, pp. 103; 116–117

P.Koeln 10 419 (third-fourth century CE), a letter which does contain many of these features, is a useful comparison here. Features that display lack of writing confidence in P.Koeln 10 419 include unequal letter size and spacing, multistroke letter shapes, different amounts of ink used per letter, and writing that does not keep to a consistent line. I have annotated some of these features on the image of lines 15–17 below.

By contrast, P.Oxy. 12 1482 displays none of these features. Instead, it shows even lines, consistent letter shape and spacing, and some letter sequences joined together through ligatures (e.g. the sequence ὁτι, ὅτι (*hoti*, THAT.CONJ), in l. 3).

An image of the first three lines is reproduced in Figure 2.3, but as it is of far lower quality than the one for P.Koeln 10 419, the differences between the two papyri are perhaps clearest when comparing the texts of both papyri traced from the images, rather than the images themselves. Partially legible letters are shown, with dotted lines for the missing portions. Lost letters are not marked. In P.Oxy. 12 1482, l. 1, the image shows what appears to be a small vertical line after επιμαχω, which may or may not be the top fragment of a damaged iota adscript. Both of the papyrus' editions (P.Oxy. 12 1482 or Sel.Pap. I 124) read επιμαχωØ. There is nothing on this line in the current volumes of the *Berichtingungsliste* (Vols. 1–13). Given the poor image quality, I have tentatively noted the stroke in the tracing here and at Figure 2.5 but will follow the editions in transcription.

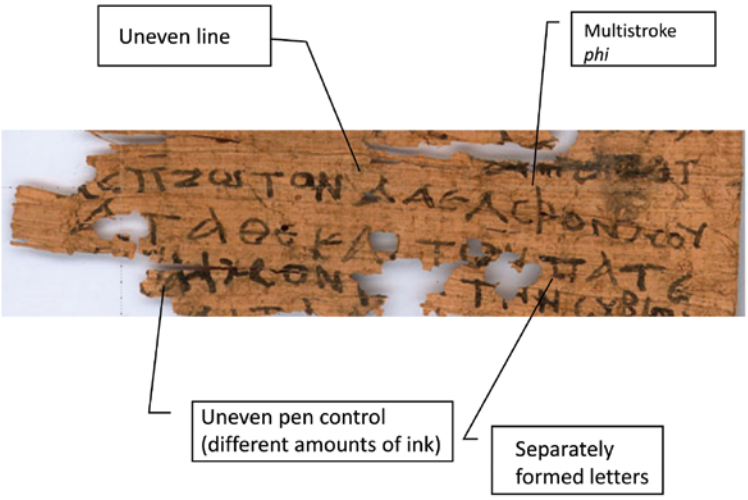


FIGURE 2.1 Low literacy features in P.Koeln 10 419, ll. 15–17

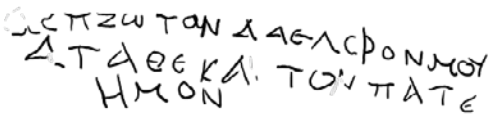
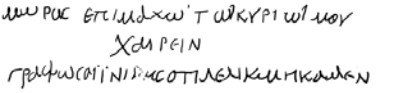
P.Koeln 10 419		P.Oxy. 12 1482
		
close diplomatic transcript	ασπζωτοναδελφονμου αγαθεκαι τονπατε ραημων	μωρος επιμαχωι τωικυριωιμου χαιρειν γραφωσοιϊνιδηοτιλελικμηκαμεν
edited text	ἀσπ<ά>ζω τὸν ἀδελφόν μου Ἄγαθε καὶ τὸν πατε- ρα\ṇ/ ημον	Μῶρος Ἐπιμάχῳ τῶι κυρίωι μου χαίρειν. γράφω σοι ἵν’ ἰδῇς ὅτι λελικμήκαμεν
transliteration	*aspazō ton adelphon mou* *Agathe kai ton pate-* *ran hēmon*	*Mōros Epimakhōi tōi kuriōi mou* *khairein.* *graphō soi hin’ idēi̯s hoti lelikmēkamen*
translation	say hello to my brother, Agathos, and to our father	Moros to Epimachus his master, greetings. I’m writing to you so that you know that we’ve winnowed…

FIGURE 2.2 Comparison of hands in P.Koeln 10 419 and P.Oxy. 12 1482

The difference in letter sizing, spacing, shape, and direction is immediately visible when comparing P.Koeln 10 419 on the left against P.Oxy. 12 1482 on the right. The contrast with the hand of a truly unconfident writer, as in P.Koeln 10 419, shows that X's 'rude uncial' was, in fact, perfectly fluent. The image of P.Oxy. 12 1482, ll. 1–3 also shows X using some of the genre conventions of Greek papyrus letters from Egypt, namely word spacing and decorative word arrangement in the opening address (Sarri 2017, pp. 114–120), with *khairein* (l. 2) centered and occupying a line to itself:

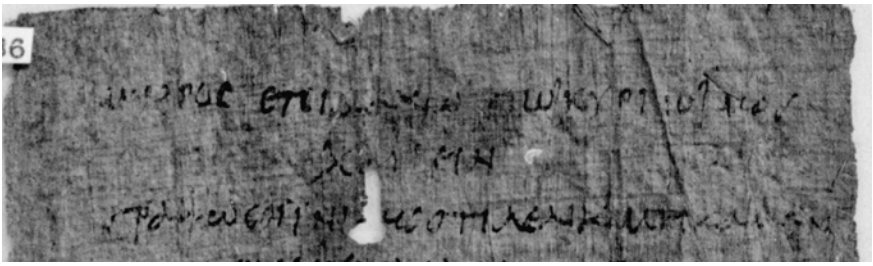


FIGURE 2.3 P.Oxy. 12 1482, ll. 1–3

Someone who can pen a whole letter fluently, and is familiar with genre layout conventions, can hardly be called illiterate in the sense of struggling to write. The level of literacy represented by fluency should not be underestimated in Roman Egypt. Also, in the second century CE, Petaus, a village scribe charged with investigating concerns about his colleague Ischyrion's literacy, reported back to the *strategos* that Ischyrion was not illiterate (*agrammatos*) because he was able to sign his own name (Kraus 2000, pp. 329–336). Petaus, in fact, struggled to sign his name consistently himself, but that does not detract from the fact that he thought the ability to sign one's name an acceptable definition of literacy in a document intended for administrative superiors.

Spending some time looking at P.Oxy. 12 1482's supposedly *rude hand*, the first component in Grenfell and Hunt's negative assessment of X's literacy shows that the epithet is unjustified. It also calls for a reassessment of their second reason for calling X an *illiterate writer*: irregular spelling.

X's spelling is indeed variable. 26 of the papyrus' 160 lacuna-free words (or 16%) are marked as spelling variants by the editors, in addition to X's own corrections. It is also true that, seen as a whole, Greek papyrus spelling is rather consistent: the mean correction rate for the *c.*60,000 documents available through the Papyrological Navigator (meta)database (PN; https://papyri.info/) is 2%, and the median 2.3% (Depauw & Stolk 2015, pp. 203–204).

X's letter is thus substantially more variable than average, and also exhibits a range of variation patterns, including:

TABLE 2.1 Variant types in P.Oxy. 12 1482

Variation type	Graphic units	Examples	Phonemic background
interchange	⟨ει⟩ | ⟨ι⟩, ⟨η⟩	see Figure 2.4 below	iotacism (/i/ maps to ⟨ει⟩ | ⟨ι⟩, ⟨η⟩) (Horrocks 2010, pp. 160–170)
	⟨υ⟩ | ⟨ου⟩, ⟨οι⟩	τυτων reg. Τούτων l. 10 χυνικε, χυνικα reg. Χοίνικε(ς), χοίνικα(ς) ll. 9–10	underdifferentiation of Greek /y/ (see below)
	⟨θ⟩ | ⟨τ⟩	θειμης reg. τιμῆς l. 11	possibly, underdifferentiation of Greek /t/, /th/ | /θ/ (Gignac 1976, pp. 92–96); (Loprieno 1995, pp. 43–44)
	⟨ε⟩ | ⟨η⟩	παρες, reg. Πα⟨νά⟩ρης ll. 7, 13	loss of phonemic vowel length (/e/) maps to ⟨ε⟩, ⟨η⟩ (Horrocks 2010, pp. 160–170)
omission			possibly, syllable deletion following transfer of Coptic stress (Dahlgren 2016, pp. 98–103)

As shown in the table, there are phonemic factors involved in all these patterns, and ⟨υ⟩ | ⟨ου⟩ interchanges in particular are characteristic of Greek-Egyptian contact (Dahlgren 2017, pp. 68–80). My point here is not to deny phonemic influence on variable spelling, but to argue that phonemic spelling does not account sufficiently for written variation even in a document, such as this one, with spelling variation substantially above average.

Phonemically, for example, the variants in P.Oxy. 12 1482 show that for X /i/ corresponded to at least three graphic units: {⟨ει⟩, ⟨ι⟩, and ⟨η⟩}. Interchanges in both directions between ⟨ι⟩ ↔ ⟨ει⟩ and ⟨ει⟩ ↔ ⟨η⟩ also imply an equivalence between ⟨ι⟩ and ⟨η⟩, as shown in Figure 2.4.

line	editorial wordform		transcription & gloss		grapheme variation	
	as read	regularized	as read	regularized	as read	regularized
3	ἰδῇς	εἰδῇς	*idē̩s*	*eidē̩s*	<ι>	<ει>
			know.2.sg.perf.subj.act.			
8	εἰσχύσωμεν	ἰσχύσωμεν	*eiskhusōmen*	*iskhusōmen*	<ει>	<ι>
			be_able.1.pl.aor.subj.act			
11	θειμῆς	τιμῆς	*theimēs*	*times*	<ει>	<ι>
			price.gen.sg.			
16	δοκιμάσις	δοκιμάσεις	*dokimasis*	*dokimaseis*	<ι>	<ει>
			decide.2.sg.fut.ind.act			
16-17	Βασταζι	βαστάζεις	*bastazi*	*bastazeis*	<ι>	<ει>
			transport.2.sg.pres.ind.act			
17	Γράψις	γράψεις	*grapsis*	*grapseis*	<ι>	<ει>
			write.2.sg.fut.ind.act.			
19	ἢ	εἰ	*ē*	*ei*	<η>	<ει>
			if.conj.			
19	Θέλις	θέλεις	*thelis*	*theleis*	<ι>	<ει>
21	ἀποτέθεικα	ἀποτέθηκα	*apotetheika*	*apotethēka*	<ει>	<η>
			store.1.sg.perf.ind.act			

FIGURE 2.4 Graphic interchanges in P.Oxy. 12 1482

In this situation, where a sound, x, corresponds to the written units {a,b,c}, a variable speller could potentially select any of {a,b,c} any time x occurs. Every occurrence of a, b, or c is therefore linguistically interesting, whether the choice, editorially speaking, is a spelling variant or not. Returning to lines 1–3, I have marked every occurrence of ⟨η⟩ (red), ⟨ι⟩ (blue), and ⟨ει⟩ (yellow) on the traced letterforms below:

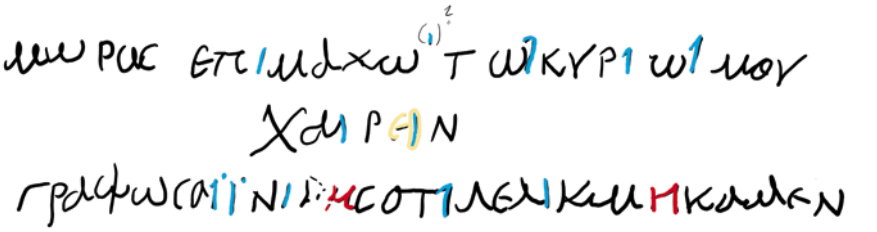


FIGURE 2.5 Traced text of P.Oxy. 12 1482 ll. 1–3

Seen from this point of view, an iota is an iota. With no apparatus or typographic conventions to set any instance apart from the others, it is easier to see that spelling variation (editorially, whether an iota should be written) sits alongside variation in whether it is written (τωι and κυριωι in l. 1 have adscripts, but ιδης in l. 3 does not) and how (e.g. iotas with and without tremas adjacent in σοιϊνα, l. 3). Many papyri contain no tremas at all, whereas at the other extreme, some texts place tremas over every initial iota and upsilon (e.g. P.Oxy. 77 5111). Seeing whether any usage patterns can be established across documents of comparable date and type would thus help broaden understanding of the (socio)linguistic implications of Greek spelling.

3 Dataset

Given the wide range of variation in adscript and trema usage from writer to writer, patterns which hold above an individual level are more likely to emerge from studying a coherent set of documents than by focusing on separate documents with little known context to connect them. Since I am interested in patterns that are shared among writers rather than individual use, I have chosen to restrict other variables (time, date range, and place) and leave authorship open. The sample of texts I used consists of documents which matched particular criteria on a search of the Papyrological Navigator (PN) in March 2018.

This is, rhetorically, its own form of construction: as Sluiter (2017, pp. 31–32) points out, appeals to technology are often used to frame a research method as an advance, even though 'new' is not necessarily better, or even new at all. Empiricist approaches to language have a long tradition, and even computer-assisted corpus or corpus-based work is now over 60 years old (Jenset & McGillivray 2017, pp. 67–73). Quantifying spelling variation by using digitized transcriptions is not valuable because it is newfangled; it is valuable because it makes it possible to see patterns in data in a new way, and thus challenge—or confirm—earlier hypotheses. Having anchored using digital tools as an appropriately classical way of innovating to refresh tradition (new is the new old), let me describe my method. The search targeted texts:

– in Ancient Greek;
– whose provenance was given as Oxyrhynchus (i.e. found and/or sent there);
– dated strictly between 50–250 CE;
– whose metadata matched one or more search terms in English, German, Italian or French used by editors to describe letters.[4]

The search retrieved 202 matches. 8 were duplicates or not (electronically) transcribed, leaving a sample of 194 texts.

Letters are an inherently fuzzy category, and several of the documents have been called letters by one group of editors and something else by another. P.Oxy. 77 5111, for instance, is entitled *Petition of Temple Personnel* in the edition, and *Schreiben* (*amtlich*) ((official) correspondence) in the Heidelberger Gesamtverzeichnis data archive. All the same, I have included all the results, regardless of their status as letters, since the main focus was on looking at tremas and adscripts overall rather than grouping them by document type.

To count the number of tremas and adscripts, I relied mainly on checking XML-encoded transcriptions accessed through PN against digital or print images of the document. Access to images matters, since changes introduced by remediation (transferring information from one format to another (Kichuk 2007)) can mean print editions can differ from what can be read from the papyrus or an image of it. Editorial practice on noting tremas and adscripts varies: P.Oxy., for instance, has from Volume 1 in theory always written iotas adscript if present on the papyrus, and regularized them to subscript if not (P.Oxy. 1, p. xvi). Documents edited in condensed form, however, may in fact regularize both <ω> and <ωι> to ῳ, as with e.g. P.Oxy. 42 3085, ll. 1–2, where the edition's

4 The specific terms were: letter OR correspondence OR Brief OR Schreiben OR Korrespondenz OR lettre OR lettera.

Ἑρμείας Σαραπίωνι τῷ φιλτάτῳ χαίρειν	*Hermeias philtatō$_i$ khairein*	*Sarapiōni*	*tō$_i$*

corresponds to

Ερμειας Σαραπιωνι τω φιλτατωϊ χαιρειν	*Hermeias philtatō**ï** khairein*	*Sarapiōni*	*tō**i***

A further reason for checking images is that PN's XML files do not always encode these features, particularly tremas, in the same way as print editions. For example, change logs on the XML files sometimes record that editorial diaereses were missed in a previous version of the PN record. So, a change made to P.Oxy. 63 4353 (not in the sample) on 29 March 2011 specifies that 8 editorial tremas have been added to the file:

```
–<change when="2011-03-29T16:00:25.414-04:00" who="https://papyri.info/editor/users/joshuad.sosin">
    Vote - Accept-Straight-to-FInalization - Accept, but note (καὶ λαμ(προτάτης)) --> καὶ (λαμ(προτάτης)). Overhaul
    reg throughout; also numerous old entry omissions: ancient diaeresis ibn lin1 ὑπάτων, lin4 Ζωΐλᾶτος, lin6
    ταπητῴῦφος, lin13 ταπητοῦφικῷ, lin14 ὑπὲρ, lin19 ὑπερθέσεως, lin21 ὑπαρ, lin24 ὑπὲρ,
 </change>
```

FIGURE 2.6 Remediation changes to P.Oxy. 63 4353

In simple terms, therefore, I relied on images to check for the presence of tremas and adscripts where available, checking for tremas on all documents and adscripts when not editorially marked. Where images were not available, I accepted tremas and adscripts noted by editors as printed. If editors of texts without an image did not mark tremas or adscripts, I excluded these texts from my calculations, since there was no way of checking whether the papyrus lacked these features, or whether they had simply not been transcribed.

4 Adscripts

4.1 *Background*

Iota adscripts occur after ⟨ω⟩, ⟨η⟩, ⟨α⟩ (ō, ē, a) where these represent etymological long vowel diphthongs. Third century BCE papyri commonly write adscripts, suggesting that these sequences still represented spoken diphthongs. However, by the mid-first century CE, the date of the earliest document in my sample, these diphthongs had long monophthongized. The number of adscripts written in non-literary texts declines steeply in the second century BCE (Clarysse 1976, pp. 150–151), and, from the same period on, monophthongization is supported by spelling variants where e.g. etymological ⟨ω⟩ is hypercorrected to ⟨ωι⟩, e.g. ὁμολογῶι (*homologōi*) for ὁμολογῶ

(*homologō*) (AGREE.1.SG.IND.PRES.ACT) (Gignac 1976, pp. 183–186), and, with many more examples, Depauw and Stolk 2015).[5]

This means that where adscripts are written in etymologically correct positions in my texts, the choice of ⟨ωι⟩ over ⟨ω⟩ does not have a phonological basis. Though adscripts can in theory appear elsewhere (e.g. in contract verb forms, or in lexical roots in items such as *ōion* 'egg'), in practice, historical adscript spellings in papyri are largely confined to affixes: dative singular forms (e.g. *adelphōi* BROTHER.DAT.SG.) for nouns, adjectives and pronouns, and subjunctives for verbs (e.g. *eidēis*, 'so that you know'[6]). Their usage is also often pragmatically restricted. Both Clarysse (1976, p. 151) and Youtie (1947, p. 111) observe that adscripts correlate with document section, surviving longest in

– the opening portions of document types where a sender addresses a recipient (e.g. letters and petitions);
– delivery addresses, indicating where the document was to be sent.

A secondary complication is that modern print conventions for representing etymological *ōι*, *ēι*, *aι* in Ancient Greek differ from papyrus ones. Figure 2.7 shows three options for representing *ōι*:

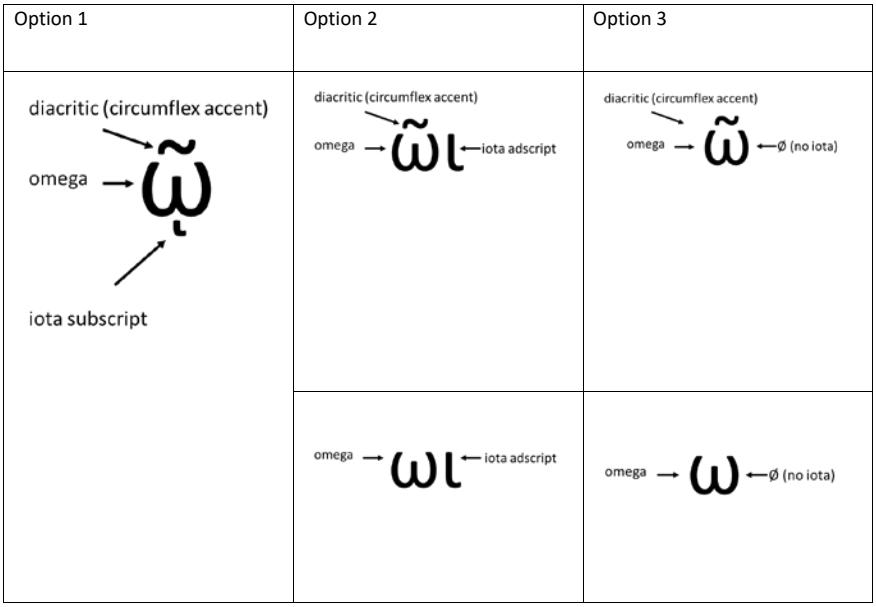


FIGURE 2.7 Allographs of *ōi*

5 Depauw and Stolk (2015) [accessed 28 June 2019] give 9 examples of second-century BCE texts with *homologōi* ὁμολογῶι == ὁμολογῶ *homologō* ('I agree') spread across 5 different provenances. The 9 include P.Princ. 2 17, l. 3; O.Bodl. 1 257, l. 2; P.Münch. 3 53, l.4; P.Tebt. 1 11 ctr, l. 4, and PSI 9 1023, l. 3.

6 *Eidēis*, though semantically present, is morphologically perfect: KNOW.2.SG.PERF.SUBJ.ACT.

Modern print editions use options 1 or 2 (with diacritics). Iota subscripts are a modern print and medieval manuscript convention, generally dated to the twelfth century CE onwards; they are vanishingly rare in papyri and pre-medieval inscriptions (for two exceptions, see Clarysse 1976, p. 151, nn. 6–7). Papyrus letters themselves use options 2 or 3, generally without diacritics.

By convention, any ancient forms using option 3 are regularized to option 1 in print editions: thus e.g. *adelphō* (papyrus αδελφω, without diacritics), would be printed as ἀδελφῷ (*adelphō*$_i$). The treatment of option 2 varies: some editions preserve ancient adscripts (printing αδελφωι as ἀδελφῶι), while others also regularize αδελφωι to ἀδελφῷ.

4.2 *Textual Patterns*

Where editors use options 1 and 2 in the same text, I have assumed that the difference between subscript and adscript iotas is meaningful and consistent: i.e. that if adscript ωι is transcribed, any print ῳ regularizes papyrus ⟨ω⟩. I therefore, did not check the images of papyri where adscripts were editorially marked.

Of the 194 documents, 90 contained at least one adscript marked by the editor. This left 104 documents where adscripts are not editorially marked. I have again excluded documents which only print subscripts and do not have an image available. There were 38 of these, leaving 73 texts for which I checked the images manually. I found only one adscript not marked by the editor: τῶι on P.Oxy. 36 2781, l. 2. As I have not found a correction in the *Berichtigungsliste*, I present the image below:

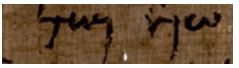


FIGURE 2.8 <tōi üiō>, P.Oxy. 36 2781, l. 2

This makes a total of 91 total documents in which an adscript was identified. These 91 documents contained a total of 290 adscripts. As expected, these are not evenly distributed. In absolute terms, there is one clear outlier: whereas the other documents range between 1–11 adscripts, SB 22.15708 contains 22, as illustrated in Figure 2.9:

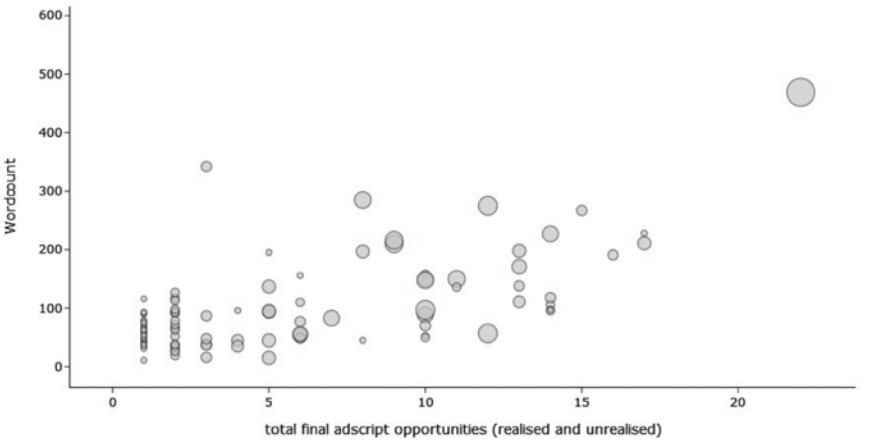


FIGURE 2.9 Distribution of adscripts in 193 papyri (excluding TM 20506)

However, absolute numbers do not say anything about the proportion of words with adscripts in each text, particularly as SB 22 15708 is also the second-longest document in the sample in terms of both total and lacuna-free words. Proportionally, SB 22 15708 is much less remarkable: just under 5% of its words are adscripted, whereas 12 texts have proportions of 10% or above.[7]

All of these 12 texts are short. None is longer than 75 editorial words, which includes partially or fully restored wordforms, below both the mean (109 words) and median (82.5) for the dataset. Seven are short because of extensive damage to the papyrus and can be discounted. Five, however, are both materially and textually fairly complete.[8] Concentrating on these, there is a tendency for adscripts to be written in the first few and final lines of the text, matching Youtie's and Clarysse's observations about where adscripts occur.

7 These are: P.Oxy. 2 297; P.Oxy. 3 523; P.Oxy. 3 589; P.Oxy. 18 2184; P.Oxy. 41 2976; P.Oxy. 44 3176; P.Oxy. 47 3341; P.Oxy. 47 3357; P.Oxy. 75 5054; P.Oxy.Hels. 47c; SB 10 10275; SB 16 13058.

8 Truncated: P.Oxy. 3 589; P.Oxy. 18 2184; P.Oxy. 41 2976, P.Oxy.Hels. 47c; SB 10 1027; damaged text: P.Oxy. 44 3176; P.Oxy. 47 3341; (near-)complete: P.Oxy. 2 297; P.Oxy. 3 523; P.Oxy. 47 3357; P.Oxy. 75 5054; SB 16 13058.

TABLE 2.2 Preserved adscripts by line

Papyrus	Preserved adscripts	Lines	Total lines
P.Oxy. 2 297	4	1, 2, 17, 17	17
P.Oxy. 3 523	2	2, 4	4
P.Oxy. 47 3357	3	1, 2, 2	20
P.Oxy. 75 5054	2	2, 17	17
SB 16 13058	1	1	14

This pattern holds out across the dataset: 39% (113 / 290) of all adscripts occur in the first 2 lines, and 52% (152 / 290) in the first 4. The high proportion of adscripts in these 5 texts is, therefore, partly a function of their length: the shorter a text is, the more of it is made up by the opening greeting and delivery address. This makes SB 22 15708 stand out again, since its proportionally high score is attributable to adscripts occurring regularly in the body of the letter, i.e. in a portion of the text where it is typically less frequent. ¾ of the texts in the sample have fewer than 130.5 words; of the 52 texts which are longer, only 5 have an adscript proportion of 4% or above.[9]

These texts are also unusual in other ways. Two are associated with cultured contexts: P.Oxy. 18 2192 is a letter about books, and the sender of P.Oxy. 73 4959, Ammonios, was an ex-gymnasiarch, a position of considerable social prestige. The set also account for 3 of the 5 instances of adscripted *-āi*,[10] which is underrepresented. This provides a tentative suggestion to explore in future work, namely that adscript *-āi* may potentially be more of a clue to a writer's formal educational level than *-ōi* or *-ēi*. Character by character, -ωι adscripts are considerably more frequent than adscripts involving either -ηι or -αι. This is not entirely surprising. I have already explained that most adscripts occur in specific document sections: opening greetings and delivery remarks. Canonically, opening greetings follow a rigid construction framework as in Table 2.3.

This frame provides three dative slots, all of which provide the opportunity for writing adscript forms. (In the example, all three opportunities are realized, but that is not always the case.) Most recipients in the sample are men. -ω(ι) is always the ending for the masc.dat.sg. definite article. Although -η(ι) and -α(ι)

9 P.Oxy. 1 113 (4.6%); P.Oxy. 47 3356 (5.9%); P.Oxy. 70 4773 (5.1%); SB 22 15708 (4.7%); P.Oxy. 73 4959 (4.6%).

10 P.Oxy. 73 4959, ll. 1, 5; SB 22 15708, l. 10.

TABLE 2.3 Typical opening greetings as exemplified by P.Oxy. 47 3357, ll. 1–2

Sender's name (nominative)	**Recipient's name (dative)**	**Definite article (dative)**	**Modifier (dative)**	**Verb (non-finite)**
Δίδυμος	Διονυσίωι	τῶι	φιλτάτωι	χαίρειν
Didumos	Dionusiōi	tōi	philtatōi	khairein
DIDYMOS.MASC. NOM.SG.	DIONYSIOS.MASC. DAT.SG.	ART.MASC. DAT.SG.	DEAR.MASC.DAT. SG.SUPERL.	GREET.PRES. IND.ACT.INF.
Didymos	to_Dionysios	the	dearest	greetings
Didymos to his dearest Dionysios, greetings.				

are possible terminations for first-declension masculine nouns and adjectives (e.g. the proper names Ἡρακλείδηι, *Hērakleidēi*, HERAKLEIDES.MASC.DAT.SG. (P.Oxy. 45 3240, ll. 10–11), or Θρακίδαι, *Thrakidai*, THRAKIDAS.MASC.DAT.SG. (P.Oxy. 47 3332, l. 1, outside the sample)), the largest group of masculine nouns are second declension stem, where the dative singular ending is -ω(ι).

The gender skew towards male recipients in papyrus letters thus helps account for the greater frequency of -ω(ι) adscripts. However, there is also a difference between the three graphic units when comparing the proportion of wordforms that could end in an adscript to those that do. With a single exception (κωμωιδουμένων *kōmōidoumenōn*, COMEDIANS.PART PL.PRES.MP.MASC.GEN, P.Oxy. 18 2192, ll. 28–29), all adscripts in the sample occur at the ends of words. As most editions in the sample print ωι for papyrus ωι and regularize papyrus ωØ (zero adscript) to subscript ῳ, comparing word-final adscripts to word-final subscripts can provide a rough idea of what proportion of dative singular wordforms are written with an adscript. 4 illustrates the proportions for each of the three graphic units:

TABLE 2.4 Comparison of word-final adscripts and subscripts

	Medial adscripts	**Final adscripts**	**Total adscripts**	**Final subscripts**	**Final adscripts + subscripts**	**Adscript as % of total dat.sg. -V(ι)**
Ωι	1	232	233	483	715	32%
Ηι	0	46	46	186	232	20%
Αι	0	5	5	55	60	8%

These numbers are very crude and would need further refinement for analysis. For example, the table doesn't separate nominal from verbal forms, both of which can end in adscript slots. It also includes hypercorrect spellings in forms where there was no etymological long diphthong.[11] Despite their noisiness, however, the data suggest some hypotheses to explore in future work.

One is that the proportionally higher occurrence of ωι adscripts is a frequency effect: in other words, that the fact that -ω(ι) datives occur more frequently than datives in -ηι or -αι gives writers greater confidence in deciding ωι is an appropriate graphical choice. Alongside greater frequency, both -ω and -ω(ι) also benefit from greater graphical predictability as a dative ending for substantives. In second-declension masculines, ω(ι) is graphically unambiguous: the name Dionysus, whether spelled ⟨Διονυσίω⟩ or ⟨Διονυσίωι⟩, can only be dative. This is not the case for 1st-declension feminines, where forms like ⟨adelphē⟩ are homographs, potentially indicating both nominative / vocative ⟨adelphē⟩ (ἀδελφή, SISTER.SG.FEM.NOM|VOC) and dative ⟨adelphē⟩ (ἀδελφῇ, SISTER.SG.FEM.DAT, without adscript). While one might expect that an iota adscript would be used in forms like ⟨adelphē⟩ to disambiguate between potential homographs, this does not appear to have been the case. To understand this, it is helpful to think of adscript occurrences (how many instances of SISTER.SG.FEM.DAT are spelled ⟨adelphēi⟩) in contrast to opportunities (how many instances of SISTER.SG.FEM.DAT there are, however they are spelled, because all could theoretically be spelled ⟨adelphēi⟩). Looking at parts of speech which inflect for case, the 194 texts examined contain 20 adscripts. There are a further 114 opportunities (specifically, ones where the ending is not reconstructed, as editors rarely reconstruct adscripts in lacunae), which means the overall realization rate for these substantives is 15% (20/(20 + 114)). This is considerably lower than for substantives which end in ō(i) (106 adscripted forms, a further 283 undamaged opportunities, 106/(106 + 283) = 27%), even though unadscripted forms are more ambiguous for ē(i) datives than for ōi datives.

Morphological ambiguity therefore appears to decrease rather than increase the proportional rate of adscript use. Final -αι is particularly ambiguous, which may help account for its particularly low adscript rate: as well as acting as a plural morpheme, it also occurs commonly in aorist (perfective) infinitives (e.g. γράψαι *grapsai*, WRITE.AOR.INF.ACT) and in non-inflecting wordforms, e.g. the highly frequent conjunction καί (*kai*, 'and').

Further qualitative support for the importance of predictability comes from a trend in the sample. Of the 30 documents which preserve only one adscript,

11 E.g. ἔχωι == ἔχω, HAVE.1.SG.PRES.IND.ACT. (P.Oxy.Hels. 47a, l. 12).

24 place it on the masculine dative singular definite article, τῷι. Τῷι is the least variable part of the greeting frame, which at its most basic can be reduced to

[sender's name].NOM τῷι [recipient's name].DAT, [verb phrase]

assuming the recipient is a man.

It would be interesting to see whether the greater predictability of -ω(ι) in substantives translates to a higher rate of spelling variation in subjunctives, where -ω is more graphically ambiguous, compared to -η or -α, which are graphically ambiguous endings for nouns as well as verbs. However, this will have to wait for another time, as the sample does not provide enough material to answer this question. The 194 papyri preserve only 18 verb forms written with an adscript, compared to 261 adscripts in nouns, adjectives, articles, and pronouns:

TABLE 2.5 Adscripts in 194 papyri by inflection type

Inflection type	**Word class**	**Frequency counts**
declension	proper noun	76
	Article	69
	common noun	55
	Adjective	31
	Pronoun	30
conjugation	Verb	18
n/a	*Unclear*	*3*

As ever, raw frequency counts are problematic: virtually every letter will contain several definite articles which the writer may or may not choose to write a particular way, whereas not every letter contains a subjunctive. Without a fully part-of-speech tagged dataset, identifying the proportion of subjunctives that are adscripted is error-prone, as (ironically) many wordforms are morphologically ambiguous. I am planning to tag my dataset in the next stage of my work. Even without tagging, however, there is something other than raw frequency to suggest that writers are less comfortable adscripting verb forms than substantives. 9 of the 18 adscripted verbs are in fact etymologically incorrect, with adscripts used on indicative forms.

Overall, the distribution of adscripts thus shows a preference for substantive endings that are morphologically unambiguous. For verb forms, frequencies

are low, but the rate of irregularity suggests something similar: morphological ambiguity causes difficulty in writing adscripts in historically appropriate circumstances. The preference for unambiguous morphemes (i.e. dative -ω over -η or -α) is interesting given dative-genitive interchanges in Roman papyri suggest that changes leading to the eventual loss of dative case were already in progress (Stolk 2017, pp. 187–189). It is also worth linking this to the similar preference for writing adscripts on predictable words in predictable patterns and text positions. So, while 24 of the 30 texts with a single preserved adscript write it on τῶι as part of an opening greeting, the overall proportion of dative articles written with an adscript (23%, 69 of 228 tokens) is lower than that of some less frequent lexical items, e.g. the wordform *philtatōi*, (DEAR.DAT.ST.SUPERL). Here, the spelling φιλτάτῶι outnumbers φιλτάτῶØ 11 to 6 (65% of 17 tokens). The reason is that *philtatos* is strongly associated with greeting formulae (all instances in the sample are in greetings), while definite articles co-occur with nouns rather than with document sections. This further suggests that many writers used adscripts in pre-memorized lexicogrammatical patterns, with more pattern-based usage at the more confident end, and lexically restricted rules at the other, sometimes confined to τῶι. Equally, many writers' confidence is lower with first-declension forms and outside greetings or delivery notes. Letter-writing was a known exercise in Greek and Coptic schooling (Cribiore 2005, pp. 215–219). The evidence of adscripts in real-world letters provides further evidence that explicit rule-learning and memorization played a role in how writers learned to draft letters.

5 Tremas

On this analysis, adscripts can be seen as a case of deliberate spelling variation which conveys respect to the reader. Tremas can also be interpreted as a reader-oriented feature, though perhaps in a more textual and less social sense. Most non-literary papyri are written largely without orthographic word division (a practice termed *scriptio continua*). In letters, (some) word spacing is fairly common, though by no means the default. Like adscripts, word spacing is concentrated in opening greetings, as illustrated in Figure 2.3.

A few letters in the sample use tremas to signal they are not following optional adscript and spacing conventions. In texts without word spacing, pen lifts are unlikely to coincide with word breaks, and may clash with them. P.Oxy. 41 2956 l. 22, for example, contains the sequence τωιδιω, *tōidiō*. Despite the line number, this is the beginning of a letter. There is a pen lift after the first iota, separating *tōi* from *diō*. Given option of word spacing in openings, this

could make it look as if the intended reading was τῶι διῶØ, 'to the divine …', with the dative article *tōi*, frequently adscripted in letter openings. However, the writer's intended reading is τῶØ ἰδίωØ, 'to (my) own …'. The trema indicates the beginning of the new word in a situation where word and spatial boundaries do not coincide, as shown in Figure 2.10:

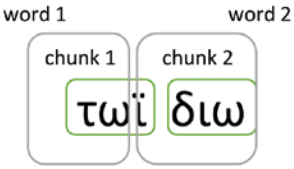


FIGURE 2.10
Space / word ambiguity in P.Oxy. 41 2956, l. 22

5.1 *Background*

This use of a trema as a word separator ties in well with an observation made in previous discussions of tremas in Greek papyrus documents: that they are more frequent at the beginning of words (so-called inorganic diaereses) than word-internally (organic diaereses) (Cribiore 1996, pp. 83–84; Ast 2017, p. 151, n. 29).

Tremas are less common in the sample than adscripts, occurring 124 times over 57 texts. These counts were derived from checking all papyri with images, since editions differ in noting tremas. The majority of the tremas, 106, are word-initial. However, saying tremas are more common word-initially (a description of occurrence patterns) is not quite the same as saying they function as word separators. When it comes to describing the function of tremas, scholars have tended to comment, if at all, on their "errati[c]" use (Cribiore 1994, p. 2). Part of the problem may be an expectation that tremas, when they occur, all signal the same thing. My discussion of tremas here will be tentative, as the overall figures are lower than for adscripts, but it appears they fulfil a variety of functions, some of which stand out more clearly from raw numbers than others.

5.2 *Textual Patterns*

While the trema in P.Oxy. 41 2956, l. 22 is apparently acting as a word separator, there is good reason to think the role of tremas is not that straightforward. For a start, why do tremas overwhelmingly occur over only two graphemes, iota ⟨ι⟩, (i) and upsilon ⟨υ⟩, (u)? If word separation is a useful feature to ancient as well as modern readers, then one might wonder whether tremas are used occasionally above other letters in ambiguous sequences.

Such usage, however, appears to be genuinely rare. All the tremas in the sample are over iota (92 tokens) or upsilon (32 tokens). Separately, I also looked

at 4,420 papyri, from all time periods, which contain the wordform *khairein* (GREET.PRES.IND.ACT.INF.). This is frequently, though not exclusively, associated with letters. As many of the letters in the smaller sample also contain *khairein*, the larger set of documents overlaps with the smaller one. 871 of the documents in the larger set contain at least one trema encoded in PN XML files using the *diaeresis* attribute:

<hi rend="diaeresis">.

There were 3,753 editorial tremas across these 871 documents, of which iota and upsilon together account for over 99% of the total:

TABLE 2.6 Letters with tremas in 871 papyrus texts

Character	Editorial tremas	% of total tremas
I	2271	60.51%
Y	1447	38.56%
O	17	0.45%
E	4	0.11%
Coptic ⟨ı⟩	3	0.08%
A	3	0.08%
n/a	2	0.05%
Γ	2	0.05%
H	2	0.05%
Latin ⟨i⟩	1	0.03%
T	1	0.03%
Total	3753	

The larger dataset also shows tremas occurring more frequently over iota than upsilon. Without knowing character counts (i.e. the frequency of iota and upsilon as characters), this may or may not be a meaningful difference. In the next stage of my work, I am gathering character counts to see whether tremas occur over a greater proportion of iotas. Nevertheless, the difference in raw frequencies makes it worth thinking about whether there are any qualitative differences in the contexts in which iota and upsilon appear.

Returning to the sample of 194 letters, it turns out that tremas tend to cluster on a relatively small number of lexical items. 21 of the 117 total tremas in these documents (18%) appear on the subordinator ἵνα *hina*, SO_THAT.CONJ.,

TABLE 2.7 Top 10 lemmas with tremas in 194 letters

Word position	Aspiration	Trema letter	Rank (descending frequency)	Transliterated lemma	Raw counts	% of total tremas	Document spread
word-initial	aspirated	Iota	1	hina	21	18%	14
		upsilon	2	su (2 pl.: *hum-*)	9	8%	7
		iota	3	hieros	7	6%	5
	unaspirated		4	Iulius	6	5%	4
			5	idios	5	4%	5
	aspirated	upsilon	6	huios	5	4%	5
			7	hypo	5	4%	4
			8	hypomnēma	4	3%	4
word-internal	unaspirated	iota	9	Zoilos	3	3%	2
word-initial			10	Isidoros	3	3%	3

spread across 14 separate papyri.[12] Table 2.7 shows all lemmas (dictionary headwords, rather than a headword's constituent wordforms) in the sample with more than 2 tremas each.

The three leftmost columns mark up particular features of the character the tremas occur on. At first, there appears to be no neat correspondence between e.g. word position, aspiration, and character. However, if iota and upsilon are treated distinctly, it is possible to develop some hypotheses about usage patterns.

Starting with *hina*, it is interesting that the item most frequently equipped with a trema should be such a short word. 21 tokens with tremas is a remarkably high proportion of the 25 total instances of editorial *hina*, both read and restored. One hypothesis is that tremas become associated with ϊνα because -ιν- is graphically a highly ambiguous sequence in *scriptio continua*. For example, *-in* appears word-finally as or as part of several other inflectional suffixes, including:

-ιν for acc.sg. of -i-stem substantives (e.g. *polin*, CITY.ACC.SG.FEM.);

-ι(ν) in various 3rd person plural verb forms (e.g. *phēsi*(*n*), SAY.3.SG.PRES.IND.ACT.);

-ειν, an infinitival suffix (e.g. *graph*|*ein*, WRITE.PRES.INF.ACT., or *graps*|*ein*, WRITE.FUT.INF.ACT.).

12 P.Oxy. 77 5111; PSI 4 281; P.Oxy. 12 1482; P.Oxy. 41 2996; P.Iand. 7 139; P.Oxy. 6 932; P.Oxy. 10 1294; P.Oxy. 14 1758; P.Oxy. 14 1760; P.Oxy. 47 3341; P.Oxy. 73 4959; PSI 121248; P.Amh. 2 136; P.Oxy. 14 1673.

Given the range of suffixes that the sequence -ιν- could be involved in, having a three-character word beginning with ιν- written straight after the preceding word, without separation, has a clear potential to confuse.

Hina is frequent enough as an individual wordform to show a clear pattern for tremas on iotas: marking word division in morphologically ambiguous written sequences. This pattern is not restricted to *hina*, as shown by *tō*|*idiō*, but neither is it the only pattern. The other major use of tremas in the dataset, in proper names, generally involves clarifying syllable division within words rather than boundaries between them. 33 of the 124 total tremas occur in proper names, all on iota. 17 of these occur word-medially, e.g. in the male name Z**ōï**los. As seen above with adscripts, the sequences *-**ōi**-* and *-**ō*** could both correspond to /o/ at this period. The spelling *Zōïlos* helps to disambiguate the sequence, indicating that the iota is not part of a digraph, which would produce */zolos/*, but instead an independent grapheme (producing /zoilos/).

While this 'organic' use of diaereses is well-known (Turner 1987, pp. 10–11), it is interesting to note that 11 of the 17 medial tremas in the sample occur in etymologically non-Greek names, both Egyptian (e.g. Phmoïs, Thaïs, Talobaïs, Hēraïs) and Latin (alternative spellings of *Flauius*, e.g. Φλαουϊος *Phlaouïos*; Φλαυϊος *Phlauïos*). Transliterations of proper names are particularly variable cross-linguistically, since they often contain sound sequences which are difficult or impossible to represent using the grapheme-phoneme mappings of the borrowing language (Van Guilder 2007, pp. 25–26). With Roman names, for instance, there is considerable variation between ways of representing Latin ⟨u⟩ in Greek.[13] Tremas could be seen as a related transliteration tool, assisting readers with grapheme sequences which either have unusual phoneme mappings in etymologically foreign names (e.g. ⟨ai⟩ ~/ai/ in Thais, rather than the more usual ⟨ai⟩ ~ /e/ of e.g. ⟨καί⟩ *kai* /ke/ 'and' (Gignac 1976, pp. 192–193)) or are unusual full stop (e.g. ⟨υι⟩ in Φλα(ο)υιος[14]). Since the numbers in the sample are low, it is not possible to make more than a suggestion to explore in future work. Nevertheless, it would be interesting to see whether the

13 ⟨u⟩ is transliterated variously as ⟨ου, υ, ο, β⟩ (⟨ou, u, o, b⟩). For the name *Flauius*, a PN search on 01.07.2019 returned 1,603 hits for *Flaoui-*, 803 for *Flaui-* and 2 for *Flaoi-* (P.Strasb. 5 369; P.Rainer Cent. 94). Actual counts for *Flaoui-* in particular will be lower, as *Flaouios* often goes back to the abbreviation Φλ() expanded by editors.

14 Outside the frequent lexeme *huios* 'son', where variants like ⟨*uos*⟩ (e.g. BGU 7 1559, ll. 2, 4) and ⟨*ios*⟩ (e.g. *iois* son.dat.pl., P.Sarap. 67, l. 10) suggest that ⟨υι⟩ was a digraph in Roman Egypt (⟨υι⟩ ~/y/ or /i/), the sequence occurs overwhelmingly in loanwords. ⟨υι⟩ remains disyllabic in some etymologically Greek words (datives of u-stem nouns such as *ikth**ui***, fish.dat.sg.; *oph**rui*** eyebrow.dat.sg.; but these are often furnished with tremas themselves (e.g. P.Oxy. 1 73, l. 22; SB 10 10562, l. 15). This further suggests that ⟨υι⟩ was a sequence which was liable to cause difficulty in decoding.

association with proper names is borne out in a larger dataset, and especially to know whether there is a correlation with Egyptian names inflected as Greek dental stems, whose *aitos* | *-aidos* genitives appear unusual.

Seen in this way, the use of tremas, if not systematic, is internally consistent. In texts written largely without word division, the distinction between organic (medial) and inorganic (initial) diaereses based on lexical position is arguably less relevant than their functional similarity. Whether medial or initial, tremas most commonly act as sequence separators, clarifying boundaries between syllables and words. Used as sequence separators, tremas are also a clear sign of a writer's textual awareness. Since their primary purpose is to assist a reader by removing the ambiguity from a sequence where there are multiple ways of decoding spelling to sound, tremas are in itself an acknowledgement of how language as written differs from speech.

This does not mean that all tremas function neatly as separators between sequences that could be vowel digraphs. Initial upsilon with trema appears both in sequences that form graphically ambiguous combinations across word boundaries, e.g. *-au-* (/aw/ ~ /ay/) in *proskunēmaumōn* (προσκύνημα ὑμῶν, 'your respects', P.Amh. 2 136, l. 6) and in ones that do not, e.g. *-nu-* in *dēlonumein* (δ̣ῆ̣λον ὑμεῖν, normatively δ̣ῆ̣λον ὑμῖν, 'clear to you', P.Oxy. 73 4959, l. 14). For frequent forms such as *huios*, *humin*, and *hina*, the effect may be partly lexical: because tremas help establish e.g. *hina* as a separate word where there is the potential for confusion, and *hina* is frequent, one might hypothesize that tremas become associated with *hina* by default. However, this cannot account for more marginal uses of tremas, such as over letters other than ⟨υ *u*⟩ or ⟨ι *i*⟩, or over both elements of an initial ⟨ϋϊ *üi*⟩ sequence.[15] Tremas which do not appear to function solely as syllable separators require further exploration,[16] but the discussion I have provided of their main function—as a decoding aid at graphically ambiguous boundary points—cautions against assuming they are erratic or illogical because they are only used occasionally. Where tremas occur, their core function is logically motivated. Marginal usages, being by definition less frequent, remain harder to interpret. But even if not all tremas can be explained, it is reasonable to start from the default assumption that fringe uses are as much motivated by a desire to assist the reader as more frequent ones.

15 This particularly affects forms of *huios* (SON.NOM.SG.). In the larger sample, documents with this pattern are: PSI 15.1535; P.Oxy. 56.3855; PSI 14.1423; BGU 2.412; BGU 4.1080; P.Oxy. 14.1768; P.Oxy. 51.3612; SB 10.10725; BGU 20.2874.

16 For example, tremas may sometimes reflect quantity differences in formerly distinct phonemes whose quality had already merged to /i/. Parker (2000, p. 160) suggests this for a New Testament papyrus, and the larger sample has several cases of the conjunction *ei* 'if' (/i/, historically /e:/) written as ϊ.

6 Conclusion

Looking beyond spelling irregularity to orthographic variation more broadly can thus prove interesting in a variety of ways. On the one hand, variation can reveal nuances of how writers perceived and dealt with phonemic ambiguity in ways that may not be obvious through spelling alone. In addition, the use of tremas to signal a mismatch between word spacing and word boundary, as in *tō|ï diō*, shows writers using graphic variation in an explicitly textual way. The same applies to adscripts. Even in writers whose confidence in selecting between ⟨ω⟩ and ⟨ωι⟩ is limited to the definite article in letter openings, the desire to write an adscript somewhere in a greeting section shows an awareness of the social meaning that can be conveyed by choosing one phonologically equivalent allograph over another.

As the data also provides empirical support for previous observations that many writers only felt comfortable writing adscripts in openings and delivery addresses, documents which preserve multiple adscripts outside these document sections may imply higher levels of familiarity with literate conventions. These texts thus emerge as a fertile group in which to explore the relationship between non-phonemic and phonemic spelling variation. P.Oxy. 73 4959, for instance, contains both tremas and adscripts, and is atypical of the set for including adscript *-ai*. At the same time, these marks of text awareness sit alongside iotacistic interchanges (*humein* for regular *humin*, /ymin/).[17]

Looking at the distribution of orthographic variants can thus help build a more nuanced picture of the practice of literacy in Roman Egypt. Several of the patterns discussed here are only preliminary sketches, and there is plenty to do in filling them in. Sometimes, this work might result in revising estimates of writers' literacy upwards, as spelling variation seen as error by editors clearly sits alongside non-error variation (adscripts) (e.g. adscripts) and trema use in texts which use them proficiently. At other times, it might lead to questions about what high or low literacy means. If the underuse of *-ai* compared to *-ōi* adscripts holds across a larger dataset, for example, this would confirm a potential area of uncertainty even for competent writers. Combining a quantitative approach to papyrus spelling with careful contextualization can thus help suggest gradations of literacy, clarifying what it initially seemed to complicate.

17 Ll. 4, 11, 11a, 14.

Appendix

UID	TM number	HGV_identifier	Images	Editorial adscripts	Editorial tremas	Additional adscripts found	Additional tremas found
1	20696	P.Oxy. 1 34 V	None	No	Yes	No	No
2	15658	P.Oxy. 49 3510	Img (ext.), Print	Yes	No	No	No
3	20707	P.Oxy. 1 45	None	No	No	No	No
4	21701	P.Amh. 2 136	None	No	Yes	No	No
5	20216	P.Cair. Preis. (2. Ed.) 3 2	Img (ext.), Print	No	No	No	No
6	22266	P.Col. 10 265	Img, Img (ext.), Print	Yes	No	No	No
7	20912	P.Corn. 46	Img (ext.)	Yes	Yes	No	No

FIGURE 2.11 Sample data

8	15725	PUG 1 12	Print	Yes	Tbc	No	No
9	17344	P.Iand. 7 139	Img (ext.)	Yes	Yes	No	No
10	21182	P.IFAO 3 18 Z. 1 – 22	Print	No	No	No	No
11	21217	P.Köln 3 142	Img (ext.), Print	Yes	No	No	No
12	21244	P.Laur. 3 63	Img (ext.), Print	No	No	No	No
13	21369	P.Mich. 11 623	Img (ext.)	No	Yes	No	No
14	78532	P.Mil. Vogl. 1 11	Print	Yes	Tbc	No	No
15	28900	P.Oslo 2 52	Img (ext.)	Yes	No	No	No
16	21531	P.Oslo 3 84	None	No	Yes	No	No
17	28401	P.Oxy. 1 40 Einleitung	Print	Yes	No	No	No
18	20706	P.Oxy. 1 44	Print	Yes	No	No	No
19	20707	P.Oxy. 1 45	Img (ext.)	No	No	No	No
20	20708	P.Oxy. 1 46	Img (ext.)	Yes	No	No	No
21	20709	P.Oxy. 1 47	None	No	No	No	No
22	20719	P.Oxy. 1 57	None	No	No	No	No
23	20723	P.Oxy. 1 61	None	No	No	No	No
24	20725	P.Oxy. 1 62 R	None	No	No	No	No

25	20724	P.Oxy. 1 62 V	None	No	No	No	No
26	20737	P.Oxy. 1 78 Z. 1 – 10	None	No	Yes	No	No
27	28405	P.Oxy. 1 113	Img (ext.)	Yes	No	No	No
28	28407	P.Oxy. 1 115	Img (ext.), Print	Yes	No	No	No
29	28408	P.Oxy. 1 116	None	No	No	No	No
30	20540	P.Oxy. 2 269	Img (ext.)	Yes	No	No	No
31	20570	P.Oxy. 2 297	Img, Img (ext.)	Yes	No	No	No
32	25672	P.Oxy. 2 299	None	No	No	No	No
33	25673	P.Oxy. 2 300	None	No	No	No	No
34	25686	P.Oxy. 2 396	None	No	No	No	No
35	25689	P.Oxy. 2 400	None	No	N/A	No	No
36	20609	P.Oxy. 3 474	None	No	No	No	No
37	20619	P.Oxy. 3 483	Img (ext.)	No	No	No	No
38	20621	P.Oxy. 3 485	None	No	Yes	No	No
39	28363	P.Oxy. 3 523	Img (ext.)	Yes	No	No	No
40	28366	P.Oxy. 3 526	Img (ext.)	No	No	No	No
41	28367	P.Oxy. 3 527	Img (ext.)	No	No	No	No

42	28368	P.Oxy. 3 528	None	No	No	No	No
43	28369	P.Oxy. 3 529	Img (ext.)	No	No	No	No
44	28370	P.Oxy. 3 530	None	No	Yes	No	No
45	28371	P.Oxy. 3 531	Img (ext.)	Yes	Yes	No	No
46	28372	P.Oxy. 3 532	Img (ext.)	Yes	No	No	No
47	28373	P.Oxy. 3 533	Img (ext.)	Yes	Yes	No	No
48	28379	P.Oxy. 3 582	None	No	No	No	No
49	28381	P.Oxy. 3 587 R	None	No	No	No	No
50	28384	P.Oxy. 3 589	Img (ext.), Print	Yes	No	No	No
51	28393	P.Oxy. 3 642	Img, Img (ext.)	No	No	No	No
52	28395	P.Oxy. 3 644	Img (ext.)	No	Reject	No	Reject
53	20456	P.Oxy. 4 801	None	No	N/A	No	No
54	20353	P.Oxy. 6 890	Img (ext.)	Yes	Yes	No	No
55	28342	P.Oxy. 6 931	None	No	No	No	No
56	28343	P.Oxy. 6 932	Img (ext.)	Yes	Yes	No	No
57	28345	P.Oxy. 6 967	None	No	No	No	No
58	28331	P.Oxy. 7 1062	None	No	Yes	No	No

59	20351	P.Oxy. 7 1064	Img (ext.)	Yes	No	No	No
60	21725	P.Oxy. 8 1100	Print	No	Yes	No	No
61	25928	P.Oxy. 8 1154	Img (ext.)	No	No	No	No
62	21769	P.Oxy. 10 1293	None	No	No	No	No
63	28986	P.Oxy. 10 1294	Img (ext.)	Yes	Yes	No	No
64	28987	P.Oxy. 10 1295	Print	Yes	Yes	No	No
65	28985	P.Oxy. 10 1346	None	No	No	No	No
66	28994	P.Oxy. 12 1482	Img (ext.)	Yes	Yes	No	No
67	21887	ChLA 4 265	Print	Exclude	N/A	Exclude	No
68	21962	P.Oxy. 14 1661	None	No	No	No	No
69	21963	P.Oxy. 14 1662	None	No	Yes	No	No
70	21964	P.Oxy. 14 1664	None	No	No	No	No
71	29014	P.Oxy. 14 1673	None	No	Yes	No	No
72	29020	P.Oxy. 14 1755	Img (ext.)	No	No	No	No
73	22005	P.Oxy. 14 1757	None	No	No	No	No
74	29021	P.Oxy. 14 1758	Img (ext.)	Yes	Yes	No	No
75	29022	P.Oxy. 14 1759	None	No	No	No	No

76	29023	P.Oxy. 14 1760	Img (ext.)	No	Yes	No	No
77	22006	P.Oxy. 14 1763	None	No	No	No	No
78	22162	P.Oxy. 18 2183	Img (ext.)	Yes	No	No	No
79	45339	P.Oxy. 18 2184	Img (ext.)	Yes	No	No	No
80	25933	SB 22 15708	Img (ext.)	Duplicat e	No	Duplicate	No
81	29029	P.Oxy. 18 2192	Img (ext.), Print	Yes	No	No	No
82	29030	P.Oxy. 18 2198	Img (ext.)	No	No	No	No
83	29031	P.Oxy. 18 2200	Img (ext.)	No	No	No	No
84	16927	P.Oxy. 24 2411	Img (ext.)	No	No	No	No
85	26938	P.Oxy. 31 2594	Img (ext.), Print	Yes	No	No	No
86	16579	P.Oxy. 34 2705	Img (ext.)	No	No	No	No
87	16596	P.Oxy. 34 2725	Img (ext.), Print	No	No	No	No
88	26874	P.Oxy. 34 2726	Img (ext.)	Yes	Yes	No	Yes
89	26870	P.Oxy. 36 2781	Img (ext.)	No	Yes	Yes	No
90	16570	P.Oxy. 36 2782	Img (ext.)	No	Yes	No	No
91	26871	P.Oxy. 36 2787	Img (ext.)	Yes	No	No	No
92	22227	P.Oxy. 38 2838	Img (ext.)	Yes	No	No	No

93	25939	P.Oxy. 38 2844	Img (ext.)	Yes	No	No	No
94	16519	P.Oxy. 41 2956	Img (ext.)	No	Yes	No	No
95	16522	P.Oxy. 41 2958	Img (ext.)	Yes	No	No	No
96	16523	P.Oxy. 41 2959	Img (ext.)	Yes	No	No	No
97	16524	P.Oxy. 41 2960	Img (ext.)	Yes	No	No	No
98	26859	P.Oxy. 41 2976	Img (ext.)	Yes	No	No	No
99	26860	P.Oxy. 41 2980	Img (ext.)	Yes	No	No	No
100	26861	P.Oxy. 41 2981	Img (ext.)	Yes	No	No	No
101	26868	P.Oxy. 41 2996	Img (ext.)	No	Yes	No	No
102	16423	P.Oxy. 42 3024	Img (ext.)	No	No	No	No
103	16424	P.Oxy. 42 3025	Img (ext.)	Yes	No	No	No
104	16426	P.Oxy. 42 3027	Img (ext.)	Yes	No	No	No
105	16427	P.Oxy. 42 3028	Img (ext.)	No	No	No	No
106	26810	P.Oxy. 42 3058	Img (ext.)	No	No	No	No
107	26811	P.Oxy. 42 3059	Img (ext.)	Yes	No	No	No
108	26812	P.Oxy. 42 3060	Img (ext.)	No	Yes	No	No
109	26813	P.Oxy. 42 3063	Img (ext.)	Yes	No	No	No

110	15968	P.Oxy. 43 3088	Img (ext.), Print	No	No	No	No
111	15973	P.Oxy. 43 3094	Img (ext.)	No	Yes	No	No
112	15981	P.Oxy. 43 3102	Img (ext.)	No	Yes	No	No
113	15997	P.Oxy. 43 3118	Img (ext.), Print	No	Yes	No	No
114	16009	P.Oxy. 43 3131	Img (ext.)	Yes	No	No	No
115	16011	P.Oxy. 43 3133	Img (ext.), Print	No	No	No	No
116	15937	P.Oxy. 44 3173	Img (ext.)	No	No	No	No
117	15940	P.Oxy. 44 3176	Img (ext.)	No	No	No	No
118	26699	P.Oxy. 44 3199	Img (ext.)	No	No	No	No
119	15906	P.Oxy. 45 3240	Img (ext.)	Yes	No	No	No
120	26645	P.Oxy. 46 3312	Img (ext.), Print	No	No	No	No
121	26646	P.Oxy. 46 3313	Img (ext.), Print	No	Yes	No	No
122	22452	P.Oxy. 47 3339	Img (ext.)	No	Yes	No	No
123	22454	P.Oxy. 47 3341	Img (ext.)	No	Yes	No	No
124	22456	P.Oxy. 47 3343	Img (ext.)	Yes	No	No	No
125	22463	P.Oxy. 47 3348	Img (ext.)	Yes	Yes	No	No
126	22470	P.Oxy. 47 3356	Img (ext.), Print	Yes	No	No	No

127	25948	P.Oxy. 47 3357	Img (ext.)	Yes	No	No	No
128	15625	P.Oxy. 49 3463	Img (ext.), Print	Yes	No	No	No
129	15626	P.Oxy. 49 3464	Img (ext.)	Yes	No	No	No
130	15628	P.Oxy. 49 3466	Img (ext.)	Yes	No	No	No
131	15632	P.Oxy. 49 3472	Img (ext.), Print	No	No	No	No
132	24965	P.Oxy. 49 3503	Img (ext.)	No	No	No	No
133	26609	P.Oxy. 49 3505	Img (ext.)	Yes	No	No	No
134	15380	P.Oxy. 50 3556	Img (ext.)	Yes	No	No	No
135	15385	P.Oxy. 50 3563	Img (ext.)	No	No	No	No
136	15342	P.Oxy. 51 3607	Img (ext.), Print	No	No	No	No
137	15350	P.Oxy. 51 3615	Img (ext.), Print	Yes	Yes	No	No
138	26518	P.Oxy. 51 3642	Img (ext.), Print	Yes	Yes	No	No
139	26519	P.Oxy. 51 3643	Img (ext.), Print	Yes	Yes	No	No
140	25949	P.Oxy. 55 3808	Img (ext.)	Yes	No	No	No
141	28936	P.Oxy. 56 3852	Img (ext.)	Yes	No	No	No
142	17908	P.Oxy. 58 3925	Img (ext.)	Yes	No	No	No
143	19260	P.Oxy. 59 3974	Img (ext.)	No	Yes	No	No

144	27845	P.Oxy. 59 3989	Img (ext.)	Yes	Yes	No	No
145	22535	P.Oxy. 60 4058	Img (ext.)	Yes	No	No	No
146	22536	P.Oxy. 60 4059 Z. 1-6	Img (ext.)	Yes	No	No	No
147	22545	P.Oxy. 60 4061	Img (ext.)	No	No	No	No
148	22546	P.Oxy. 60 4062	Img (ext.)	No	No	No	No
149	78583	P.Oxy. 65 4483	Img (ext.), Print	No	No	No	No
150	92164	P.Oxy. 70 4773	Img (ext.), Print	No	No	No	No
151	92166	P.Oxy. 70 4775 R	None	No	Yes	No	No
152	118649	P.Oxy. 73 4959	Img (ext.)	Yes	Yes	No	No
153	118650	P.Oxy. 73 4960	Img (ext.)	Yes	No	No	No
154	128289	P.Oxy. 74 4984	Img (ext.)	No	No	No	No
155	128290	P.Oxy. 78 5176	Img (ext.)	Yes	No	No	No
156	128890	P.Oxy. 75 5049	Img (ext.), Print	Yes	No	No	No
157	128892	P.Oxy. 75 5051	Img (ext.)	Yes	No	No	No
158	128895	P.Oxy. 75 5054	Img (ext.), Print	Yes	No	No	No
159	128896	P.Oxy. 75 5055	Img (ext.), Print	Yes	Yes	No	No
160	140171	P.Oxy. 76 5099	Img (ext.), Print	Yes	No	No	No

161	140172	P.Oxy. 76 5100	Img (ext.)	Yes	No	No	No
162	140177	P.Oxy. 77 5111	Img (ext.)	No	Yes	No	No
163	140178	P.Oxy. 77 5112	Img (ext.)	Yes	No	No	No
164	170060	P.Oxy. 78 5177	Img (ext.)	Yes	No	No	No
165	170061	P.Oxy. 78 5178	Img (ext.), Print	Yes	Yes	No	No
166	170062	P.Oxy. 78 5179	Img (ext.)	Yes	No	No	No
167	31352	SB 22 15350	Print	No	No	No	No
168	20797	SB 22 15351	Print	No	No	No	No
169	20798	SB 22 15354	Print	Yes	No	No	No
170	20799	SB 22 15355	Print	No	No	No	No
171	31355	SB 22 15357	Print	No	No	No	No
172	26655	P.Oxy. Hels. 47 a	Print	Yes	No	No	No
173	26656	P.Oxy. Hels. 47 b	Print	Yes	No	No	No
174	26657	P.Oxy. Hels. 47 c	Print	Yes	No	No	No
175	17352	P.Princ. 2 22	Img, Img (ext.)	No	No	No	No
176	27850	PSI 4 281 Z. 1 – 48	Img (ext.)	Yes	Yes	No	No
177	19277	PSI 4 282	Img (ext.)	No	Yes	No	Yes

178	19293	PSI 5 447	Img (ext.)	No	Yes	No	No
179	17411	PSI 12 1248	Img (ext.), Print	Yes	Yes	No	No
180	17257	PSI 13 1357	Img (ext.), Print	No	Yes	No	No
181	27055	PSI 14 1414	Img (ext.)	No	No	No	No
182	22652	PSI Congr. 21 8	Print	No	No	No	No
183	18869	SB 3 7258	None	No	No	No	No
184	19134	SB 6 9617	Print	Yes	Yes	No	No
185	22926	SB 8 9903	None	No	No	No	No
186	16752	SB 10 10275	Print	No	Yes	No	No
187	16772	SB 10 10493	Img (ext.), Print	No	Yes	No	No
188	26548	SB 14 11899	Img (ext.)	Yes	No	No	Yes
189	17451	SB 16 12698	Img (ext.), Print	No	No	No	Yes
190	16334	SB 16 12987	Img (ext.)	Yes	No	No	No
191	16338	SB 16 12994	Img (ext.), Print	No	Yes	No	No
192	16360	SB 16 13058	Img (ext.), Print	Yes	No	No	No
193	23777	SB 20 14635	None	No	No	No	No
194	23907	SB 20 15180	Print	Yes	No	No	No

195	31352	SB 22 15350	Print	Exclude	Exclude	No	No
196	20797	SB 22 15351	Print	Exclude	Exclude	No	No
197	20798	SB 22 15354	Print	Exclude	Exclude	No	No
198	20799	SB 22 15355	Print	Exclude	Exclude	No	No
199	31355	SB 22 15357	Print	Exclude	Exclude	No	No
200	25933	SB 22 15708	Img (ext.)	Yes	No	No	No
201	79283	SB 24 16010	Print	Exclude	No	No	No
202	79411	SB 24 16251	Print	No	Yes	No	No

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