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"Of" in Paradise Lost as evidence for the metrical line

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Abstract. In this paper I discuss the distribution of grammatical monosyllables in the iambic pentameter line. I show that in Milton's *Paradise Lost*, the word OF appears with greater than expected frequency at the beginning of the line; 27% of all instances of OF are in the first of the ten metrical positions, and 5% of all the lines begin with OF, making it the second most frequent line-initial word. I suggest that this might reflect the way that Milton uses enjambement in the poem. It also means that OF may function as a clue to the beginning of the line, in the context of other evidence for lineation, essential if the audience is to establish the metrical form of the poem. In contrast, in the eighteenth century blank verse long poems of Thomson and Cowper, the word AND is relatively frequent at the beginning of the line. But Wordsworth uses both OF and AND as frequent line-initial words, merging Milton's formal practice with the practice of other writers. The paper concludes by reflecting on the relation between statistical characteristics of text and probabilistic aspects of our knowledge of literary form.

Questo articolo prende in esame la distribuzione di monosillabi grammaticali nel pentametro giambico inglese. Qui mostro che, in *Paradise Lost* di Milton, la parola OF compare con frequenza maggiore all'inizio del verso di quanto ci si potrebbe normalmente aspettare; il 27% di tutte le occorrenze si trova nella prima delle 10 posizioni metriche, e il 5% dei versi comincia con OF, il che la rende così la seconda parola più frequente all'*incipit* del verso. Questo potrebbe riflettere, suggerisco, il modo in cui Milton adopera l'*enjambement* nel poema. Ciò significa anche che OF potrebbe funzionare come indizio dell'inizio del verso, nel contesto di altre evidenze per la divisione del poema in tale unità, essenziale se il pubblico deve determinare la forma metrica del poema. D'altro canto, nel verso sciolto del 1700 di Thomson e Cowper, è la parola AND a essere relativamente frequente all'inizio del verso. Invece Wordsworth usa sia OF che AND all'inizio dei propri versi, fondendo la pratica di Milton con quella di altri scrittori. L'articolo propone infine una riflessione sulla relazione tra le caratteristiche statistiche di un testo, e gli aspetti probabilistici della nostra conoscenza della forma letteraria.

Introduction

This paper is an exercise in word-counting, involving John Milton's long seventeenth century poem *Paradise Los*t and a selection of long verse texts. Word-counting is a standard practice in much digital humanities research, but this paper adds a contextual feature not often considered, and specific to verse, defined as text which is divided into lines. I count OF, AND, and some other common non-referential grammatical monosyllables, and I focus specifically on whether these monosyllables are in line-initial position or some other position. This question is particularly interesting for *Paradise Lost* (*PL*), a poem whose first two lines begin with the very frequent word OF, and in which 5% of lines overall begin with OF. The statistic on which I focus is that 27% of all instances of OF are line-initial. I look at a selection of other iambic pentameter poems after *PL*, such as Thomson's *The Seasons* and find in contrast that OF is not relatively frequent at line-beginning, but that instead the highly frequent word AND is relatively frequent at line beginnings (unlike *PL*). Wordsworth in the 1805 *Prelude* uses both OF and AND frequently at line beginning, thus merging Milton's OF pattern with the AND pattern of other predecessors who influenced him such as Thomson.

It is likely that these distributions are side-effects of another practice: that certain words appear at the beginning of the line because of the syntactic or discourse structure of the text, relative to the poet's enjambement practice; that is, OF may be particularly frequent in *PL* because noun phrases are easily split across lines, while AND may be particularly frequent in other poets who favour a more paratactic sequence with less radical phrase-splitting enjambements. However, even if the distributions of these words at line-beginning are side-effects of linguistic and poetic structure, it is also possible for them to function as clues to the line boundary. That is, if a word is relatively frequent at the beginning of the line, then it offers evidence for where the line boundary falls (evidence which is weak on its own, but strengthened in the context of other evidence). A hearer of the text (and a reader) must be able to establish line boundaries in order to parse the metre of the poem, which I suggest is a necessary part of the poem's reception.

The distribution of grammatical monosyllables in iambic pentameter poetry

The iambic pentameter line, and grammatical monosyllables in books 8-9 of Paradise Lost

All the poems to be considered here are in the metre iambic pentameter. The iambic pentameter line is matched to a metrical template of ten positions, alternating weak and strong. The line can also be thought of as a sequence of five iambic feet, each a pair of weak followed by strong.

W S W S W S W S W S

These ten positions are filled by ten syllables. Sometimes two syllables can fit a single position, and sometimes there is an extra syllable at the end. There is a characteristic rhythm, with stressed syllables tending to fall in the S positions, and unstressed or weakly stressed syllables tending to fall in the W positions. This rhythm is rarely completely periodic (i.e., alternating unstressed and stressed syllables across the line). The precise constraints on what rhythmic variations are possible have been much discussed in metrical theory; Robert Bridges [1] wrote a book on Milton's prosody, and recent theoretical approaches include Hanson and Kiparsky [12], Fabb and Halle [10], and Hayes, Wilson and Shisko [14].

In this paper, I focus on thirteen grammatical monosyllables. These include the ten words which Ingram and Swaim ([16]: ix) omitted from their printed concordance of Milton because they were of such high frequency: A, AND, BY, FOR, IN, OF, ON, THE, TO, WITH. To this I have added the preposition AT (the next most common of the prepositions in *PL*), and OR and BUT (more common in *PL* than some of the words listed by Ingram and Swaim). I have treated both A and AN as a single word. All of these words - prepositions, articles and conjunctions - tend to be unstressed, and they are much more likely to appear in W positions than in S positions. They are thus good candidates for the first position in the line. I have not included grammatical monosyllables which can carry reference, the pronouns and demonstratives, both because they are easily stressed and also because they carry significant semantic meaning, and thus their distribution is likely to be subject to different factors than the prepositions, articles and conjunctions under consideration here.

This paper centres on the distribution of OF in *PL*. Bruce Hayes has prepared a version of books 8 and 9 of the 1667 edition of *PL* in which syllables are separated into metrical positions, thus making it easy to discover how the grammatical monosyllables are distributed across the ten positions of the iambic pentameter line, as shown in Table 1. At 2,293 lines, these two books constitute just over a fifth of the whole poem.[1]

	W	S	W	S	W	S	W	S	W	S	
	1	2	3	4	5	6	7	8	9	10	total
AND	122	6	80	46	114	34	115	53	76	0	646
	19%	1%	12%	7%	18%	5%	18%	8%	12%	0%	
TO	109	36	47	40	56	31	79	75	73	0	546
	20%	7%	9%	7%	10%	6%	14%	14%	13%	0%	
THE	82	11	115	4	75	4	100	4	127	0	522

1 These books correspond to 9 and 10 of the second 1674 edition. In Hayes's preparation, the text of the two books is laid out on an Excel spreadsheet, where each column contains all the syllables in a particular metrical position. I further distinguished actual monosyllables from syllables which are part of a larger word, to separate e.g., the grammatical monosyllable 'for' from the syllable 'for' as part of the word 'forget'. Then I used the COUNTIF function to count instances of a particular word in the column.

	16%	2%	22%	1%	14%	1%	19%	1%	24%	0%	
OF	128	19	53	23	80	21	62	23	46	0	455
	28%	4%	12%	5%	18%	5%	14%	5%	10%	0%	
IN	51	29	34	24	22	17	41	32	34	1	285
	18%	10%	12%	8%	8%	6%	14%	11%	12%	0%	
WITH	49	18	30	15	38	14	36	16	26	0	242
	20%	7%	12%	6%	16%	6%	15%	7%	11%	0%	
OR	36	1	24	17	22	9	28	14	31	0	182
	20%	1%	13%	9%	12%	5%	15%	8%	17%	0%	
BUT	44	1	10	12	21	8	19	16	20	0	151
	29%	1%	7%	8%	14%	5%	13%	11%	13%	0%	
ON	19	15	8	11	13	15	7	13	4	4	109
	17%	14%	7%	10%	12%	14%	6%	12%	4%	4%	
FOR	36	4	5	9	20	3	10	4	10	0	101
	36%	4%	5%	9%	20%	3%	10%	4%	10%	0%	
BY	26	8	9	8	12	9	12	6	5	1	96
	27%	8%	9%	8%	13%	9%	13%	6%	5%	1%	
A/AN	13	2	20	0	15	0	17	0	18	0	79
	15%	2%	24%	0%	18%	0%	20%	0%	21%	0%	
AT	9	6	6	4	7	3	5	9	17	0	66
	14%	9%	9%	6%	11%	5%	8%	14%	26%	0%	
total	724	156	441	213	495	168	531	265	487	6	3480
	21%	4%	13%	6%	14%	5%	15%	8%	14%	0%	

Table 1: The distribution of the thirteen words in books 8 and 9 of PL (1667), ordered by overall frequency

The top two rows of Table 1 show the ten metrical positions of the iambic pentameter line, and whether that metrical position is weak or strong. The left-hand column shows the thirteen grammatical monosyllables under examination. The right-hand column shows the total number of tokens of that word in the text. The cells show the number of tokens in each position, and the percentage relative to the total for that word. In this table, the monosyllables are ordered vertically by order of frequency of each word in these two books of the poem. For comparative purposes, I will retain the same order throughout this paper (though the frequency order is not the same in all the poems).

Because the grammatical monosyllables tend to be unstressed or weakly stressed, the metrical rules for iambic pentameter mean that they tend to fall in W positions, and this can be seen in Table 1. Table 2 illustrates this, by showing nine lines, each with OF in a different metrical

position; the rightmost column indicates the overall percentage of OF in that position in *PL* as a whole. OF strongly tends to be in W positions rather than S positions.

	Book:line	Position	S/W	%
Of Man, with strength entire, and free will arm'd,	9: 9	1	W	28
Shorn of his strength, They destitute and bare	8: 1062	2	S	4
From out of Chaos to the out side bare	9: 317	3	W	12
O fairest of Creation, last and best	8: 896	4	S	5
Deep to the Roots of Hell the gather'd beach	9: 299	5	W	18
Satan in likeness of an Angel bright	9: 327	6	S	5
Wondrous indeed, if cause of such effects.	8: 650	7	W	14
Above all Cattle, each Beast of the Field;	9: 176	8	S	5
O Conscience, into what Abyss of fears	9: 842	9	W	10
(NO EXAMPLES)		10	S	0

Table 2: OF in the ten metrical positions in iambic pentameter in Books 8 and 9 of PL 1667 (equivalent to books 9 and 10 of PL 1674)

For comparison, Table 3 shows ten distinct lines from books 8-9 with ON in each of the ten positions. ON can be unstressed, weakly stressed or stressed, and even in the very strong tenth position. ON appears overall 46% in weak positions and 54% in strong positions.

	Line #	Position	S/W	%
On what thou hast of vertue, summon all,	8: 374	1	W	17
Till on a day roaving the field, I chanc'd	8: 575	2	S	14
Chiefly on Man, sole Lord of all declar'd,	9: 401	3	W	7
The evil on him brought by me, will curse	9: 734	4	S	10
To Beasts, whom God on thir Creation-Day	8: 556	5	W	12
Bitter ere long back on it self recoiles;	8: 172	6	S	14
Shall with a fierce reflux on mee redound,	9: 739	7	W	6
There dwell and Reign in bliss, thence on the Earth	9: 399	8	S	12
Meanwhile ere thus was sin'd and judg'd on Earth,	9: 229	9	W	4
Like a black mist low creeping, he held on	8: 180	10	S	4

Table 3: BY in the ten metrical positions in iambic pentameter in Books 8 and 9 of PL 1667

The grammatical words may thus differ in how likely they are to occupy various positions.

Iambic pentameter lines are sometimes considered to have a 'caesura', not a strict rule but an expectation that there is a major pause mid-way through the line, typically after the fourth or sixth syllable. I now consider whether placement of grammatical words is sensitive to this probabilistic mid-line boundary. Consider for example the use of OF after major pauses, as marked in the printed text by a comma or period in Books 8 and 9 of *PL*.[2] As Table 4 below shows, where OF appears after these major pauses, the pause is most likely to be after position 4 (the position of one of the 'caesurae').

2 This again uses Bruce Hayes's annotated text of books 8 and 9, marked for five levels of juncture. Here I focus on OF after a level 4 or 5 juncture, typically a comma or period in the printed text.

	W 1	S 2	W 3	S 4	W 5	S 6	W 7	S 8	W 9	S 10	total
OF	128	20	53	24	77	20	62	23	46	0	453
	28%	4%	12%	5%	17%	4%	14%	5%	10%		
OF after major pause	17	1	4	3	16	1	10	4	3	0	59
% of total OF in this position	13%	5%	8%	13%	21%	5%	16%	17%	7%		13%

Table 4: OF after a strong juncture in 1667 PL books 8 and 9

The interpretation of this finding is difficult, though it weakly supports the relevance of the caesura. It might suggest that where OF does not come at the beginning of a line, it is still drawn to the beginning of a half-line, thus marking out or responding to a metrical boundary, even if not the line boundary.

The bottom two rows of Table 1 show that taken as a group the grammatical words have a relative distribution of 21% in first position and 79% in other positions. It is also notable that these words are almost never line-final: only 6 instances out of 3,480 are in tenth position. For all the poems discussed in this paper, for this set of grammatical words, a similar distribution is found: in the full *Paradise Lost* 20% of these grammatical words are line-initial, Milton *Paradise Regained* 22%, Shakespeare *Antony and Cleopatra* 20%, Dryden *Aeneid* 21%, Thomson *Seasons* 23%, Cowper *Task* 23% and Wordsworth *1805 Prelude* 22%. This a striking cross-textual correlation, given the multiple and varying causal factors which are probably involved.

In order to test statistical significance, I assume that a word belonging to this set of grammatical words has an expected distribution of 21% at the beginning of the line and 79% in the remaining nine positions, and I check actual distribution in any poem against this. Other alternatives might have been considered; for example, we might have assumed that these weakly stressed monosyllables appear at chance level in any of the five weak metrical positions, but this is not a realistic expectation because of the various other factors involved in determining the distributions of this kind of words. It remains unclear why these grammatical words tend to appear between 20%-23% of the time in first position. We might have expected a lower percentage, because grammatical words can appear in any of the first nine positions, and thus we might have expected several percent less than 20% in first position. I assume therefore that multiple factors conspire to make grammatical monosyllables of this kind appear 21% of the time in first position.

For each of the poems I examine in this paper, I produce a table as in Table 5, here illustrated by the findings for Books 8 and 9 of *PL* (1667 edition),[3] after preprocessing on available

3 For the determination of statistical significance I used R, using a version of this short program written by Chamil Rathnayake:
exp <- c(0.21,0.79) #defines the expected distribution of 21% of a word in initial position and 79% in other positions

digital editions.[4]

Word	Total	Position 1		Other Positions		χ^2	p
		n	%	n	%		
AND	646	122	19%	524	81%	1.741	0.187
TO	546	109	20%	437	80%	0.354	0.552
THE	522	82	16%	440	84%	8.809	0.003
OF	455	128	28%	327	72%	13.950	0.000
IN	285	51	18%	234	82%	1.657	0.198
WITH	242	49	20%	193	80%	0.083	0.774
OR	182	36	20%	146	80%	0.163	0.686
BUT	151	44	29%	107	71%	6.030	0.014
ON	109	19	17%	90	83%	0.837	0.360
FOR	101	36	36%	65	64%	13.055	0.000
BY	96	26	27%	70	73%	2.142	0.143
A/AN	79	13	16%	66	84%	0.983	0.321
AT	66	9	14%	57	86%	2.157	0.142
total	3480	724	21%	2756	79%		

Table 5: Books 8 and 9 of Milton: Paradise Lost (1667 edition)

The χ^2 test used here examines differences between the observed distribution of each word in first position vs. other positions, compared with the expected 21%-79% distribution (determined as described above). I constructed two categories (similar to a Yes-No scale) to report whether an observation occurs in the first position or not. Table 5 reports the distributions for two books of *PL*. It reports the specific χ^2 value and significance is based on ($p<0.05$), i.e., based on a 95% confidence interval. A p values below 0.05 indicate significant differences, either greater than expected frequency or lower than expected frequency. Values in the χ^2 and p columns are rounded to three decimal points.

obs.of <- c(557, 1494) #defines the observed distribution of a specific word, here OF in all of PL
lapply(mget(ls(pattern="^obs.*")),chisq.test,p=exp)

4 In the analysis of the whole of PL and other whole texts, I counted the total number of instances of a word, and the number of instances of that word at the beginning of a line. I found digital version of the texts and stripped off everything except the lines of poetry. Line boundaries were marked by replacing paragraph marks (showing ends of lines) with a random symbol, here the percentage sign %. I used AntConc to search either for e.g., 'of' to count all instances of OF in the text or '% of' to count the line-initial instances of OF.

Paradise Lost

Now consider Table 6, which expands Table 5 to show the distribution of initial vs. non-initial words in the all 10,565 lines of *Paradise Lost* (1674 edition, from [21]).[5]

Word	Total	Position 1		Other Positions		X^2	p
		n	%	n	%		
AND	3336	578	17%	2758	83%	27.141	0.000
TO	2227	446	20%	1781	80%	1.271	0.260
THE	2752	399	14%	2353	86%	70.117	0.000
OF	2051	557	27%	1494	73%	46.873	0.000
IN	1365	273	20%	1092	80%	0.823	0.364
WITH	1162	277	24%	885	76%	5.642	0.018
OR	714	134	19%	580	81%	2.145	0.143
BUT	588	171	29%	417	71%	23.149	0.000
ON	536	86	16%	450	84%	7.933	0.005
FOR	466	120	26%	346	74%	6.341	0.012
BY	515	137	27%	378	73%	9.742	0.002
A/AN	563	107	19%	456	81%	1.350	0.245
AT	272	46	17%	226	83%	2.740	0.098
total	16547	3331	20%	13216	80%		

Table 6: Milton Paradise Lost 1674

In *PL,* four words have a distribution in first position, which (at 26-29%) is significantly higher than the expected distribution of 21%: OF, BUT, FOR and BY. Of these four words, only OF is a highly frequent word in the text as a whole, a factor which will be important in my suggestion that OF is a clue to the location of the line boundary: the more frequent the word, the better it functions as a clue. In contrast, the overall highly frequent word THE shows a distribution in first position significantly lower than the expected distribution; I do not focus on such significantly low distributions in this paper, since it is not clear that they play any function in communicating the line boundaries to the audience.

Of the 2,051 instances of OF in *PL,* 557 are at the beginning of the line, 27% of the total. This is a statistically significant difference from what I have suggested is the expected 21% for a grammatical non-referential monosyllable in this position. 5% of the 10,565 lines in *PL* begin with OF, and with 557 instances this makes OF the second most frequent line-initial word in

5 Note that this shifts from the 1667 edition used (based on Hayes) for the two books to the 1674 edition (which has a different division of books), the latter being the digital edition provided by Project Gutenberg.

the poem.

I propose that OF provides the reader (or listener) with evidence for line boundaries, evidence which is interpreted in the context of other evidence offered by the text. This enables the audience to establish lineation, and hence process the metre of the text. OF can perform this function because of its combination of high overall frequency and high initial frequency. Furthermore, the word OF is the first word in the first two lines of the poem, which might further contribute to its being taken as evidence of a line boundary. The first six lines of the poem are quoted below:

> **Of Mans First Disobedience, and the Fruit**
> Of that Forbidden Tree, whose mortal taste
> Brought Death into the World, and all our woe,
> With loss of Eden, till one greater Man
> Restore us, and regain the blissful Seat,
> Sing Heav'nly Muse, …

Here we see what Zwicky and Zwicky [32] refer to as 'patterns first', the tendency for regularities to be established at the beginnings of poems. Because *PL* refers to the *Aeneid* in its beginning, it is interesting to compare the beginning of Thomas Phaer's translation of Virgil's *Aeneid* [22] in iambic heptameter rhyming couplets. When completed by Thomas Twyne after Phaer's death, this became the first full translation of the poem into English. Here are the first six lines (with several new lines before the translation proper begins in line 4):

> I that my slender Oten Pipe in Verse was wont to sounde
> Of woods, and next to that I taught for husbandmen the ground,
> How fruite unto their greedy lust they might constraine to bring,
> A work of thankes: Lo now of Mars, and dreadfull warres I singe,
> Of armes, and of the man of Troy, that first by fatall flight
> Did thence arrive to Lauine Land, that now Italia hight.
> (Lally, 1987: 7)

Two of the first six lines begin with OF, and the fifth line has three instances of OF.[6] Virgil's *Aeneid* is relevant because the beginning of *PL* alludes to the beginning of *Aeneid* in various ways and specifically with reference to the first three words of that poem: "arma virumque cano", literally "arms man-the-and sing-I", whose second and third words are picked up in the first six lines of the poem (quoted above). 'Arms' and 'man' are in the accusative case in Latin, and some of the English translations choose to translate this literally as "Arms and the man I sing who first did come" (John Ogilby, 1649), or "Arms, and the Man I sing, who, forc'd by Fate" [5]. Milton is of course not translating *Aeneid* in *PL,* but his use of OF in "Of man's ..." echoes Phaer.

Milton's distinctive placement of OF at the beginning of the line is amplified by John Philips in

6 Apart from this striking beginning, OF does not have any special status at the beginning of the line in their translation. In the first hundred lines, there are four lines which begin with OF, out of a total of 25 uses of OF overall; though this is a small sample, it shows a distribution of 16% line-initial OF.

his 1701 parody of Milton, 'The Splendid Shilling', a poem of 141 blank verse lines ([15]: 112), in which 7 of the 21 uses of OF are line-initial. This is a higher proportion than in *PL*, but we might expect distortions in a parody. The poem is so small as a sample that significance tests are unreliable.

Word	Total	Position 1		Other Positions		χ^2	p
		n	%	n	%		
AND	33	4	12%	29	88%	1.568	0.211
TO	15	4	27%	11	73%	0.290	0.590
THE	41	8	20%	33	80%	0.055	0.815
OF	21	7	33%	14	67%	1.926	0.165
IN	19	3	16%	16	84%	0.311	0.577
WITH	25	9	36%	16	64%	3.391	0.066
OR	23	5	22%	18	78%	0.008	0.931
BUT	4	3	75%	1	25%	7.031	0.008
ON	4	1	25%	3	75%	0.039	0.844
FOR	2	0	0%	2	100%	0.532	0.466
BY	5	1	20%	4	80%	0.003	0.956
A/AN	20	4	20%	16	80%	0.012	0.913
AT	6	0	0%	6	100%	1.595	0.207
total	218	49	22%	169	78%		

Table 7: Philips 'The Splendid Shilling'

If we return now to *Paradise Lost*, what might we say about other grammatical words? In terms of relative distribution in first position compared with other positions, BUT and BY are both about as relatively frequent as OF, and WITH and FOR are slightly less frequent than OF. These words might also constitute evidence for the line boundary, but because they are much less frequent overall, their status as evidence is weak. It is worth noting the relatively low percentage (17%) of instances of AND at the beginning of the line; this is interesting, because we will see that in non-Miltonic blank verse, AND is in contrast quite frequent at the beginning of the line.

I have suggested that the effect of having a higher than expected distribution of OF is that it allows OF to be evidence for the line boundary, if combined with other evidence (as discussed below). But this effect might arise from a reason unconnected from the cause: OF may appear with higher than expected distribution at the beginning of lines in *PL* as a side-effect of some other characteristic of the poem, such as its enjambements. For example, it is entirely plausible that Milton favours a kind of enjambement which splits a noun phrase across the line boundary, after the line-final noun, such that the next line begins with a preposition phrase

including an OF-phrase. Table 8 shows the first twenty instances of line-initial OF in *PL*; all but two have the OF-phrase as the complement of a noun, within a noun phrase.[7]

		line
/ Of Mans First Disobedience	not a complement within an NP	1
the Fruit / Of that Forbidden		2
on the secret top / Of Oreb		7
with all his Host / Of Rebel Angels		38
now / Of force believe Almighty	not a complement within a NP	145
from the Precipice / Of Heav'n		174
the force / Of subterranean wind		231
the shatter'd side / Of thundring Aetna		233
the sole / Of unblest feet		238
their liveliest pledge / Of hope		275
on the perilous edge / Of battel		277
the Mast / Of some great Ammiral		294
on the Beach / Of that Inflamed Sea		300
all the hollow Deep / Of Hell		315
the potent Rod / Of Amrams Son		339
a pitchy cloud / Of Locusts		341
th' uplifted Spear / Of their great Sultan		348
the greatest part / Of Mankind		368
with blood / Of human sacrifice		393
to the stream / Of utmost Arnon		399

Table 8: Phrasal contexts for line-initial OF in PL

Corns ([3]: 37) discusses the organization of sentences relative to lineation in *PL* and other poems by Milton and other writers: "Milton's practice in organizing the arrangement of sentences within the ten-syllabled line may be distinguished generally from the norms contemporaneously obtaining and his practice in *Paradise Lost* is singularly unusual." 20% of the sentences in *PL* overlap both beginning and end of the line, compared with 11.3% in *Paradise Regained*, and none at all in the samples Corns takes from three other poems from the 1640s-60s, Cowley's *Civil War*, Dryden's *Annus Mirabilis* and Fanshawe's translation of the *Lusiads*. This difference relates to Milton's "generally freer notion of the relationship between lineation and all syntactic structures down to the intraclausal level", and this in turn may have as one of its consequences the relatively larger number of lines beginning with OF in *PL*. However, even if, as seems likely, the distribution of line-initial OF is related to the author's willingness to split a noun phrase across a line, such a cause may be unconnected to the effect. That is, the enjambement practice or whatever else causes OF to appear at the beginning of the line with such frequency may have no bearing on the use of OF as evidence of a line boundary.

7 To produce a list of all the lines containing OF, in sequence, I used Alpha (https://sourceforge.net/projects/alphacocoa/) and the 'Find matching lines' command.

Poetry which does not show the PL pattern of line-initial OF

In this section I examine three other long blank verse poems, and one poem in rhyming couplets, and show that they do not have the distribution of OF found in *PL.*

I begin with Milton's other long poem in blank verse, *Paradise Regained* (1671) (2070 lines in total, text from [21]).

Word	Total	Position 1		Other Positions		χ^2	p
		n	%	n	%		
AND	695	146	21%	549	79%	0.000	0.996
TO	478	113	24%	365	76%	2.008	0.156
THE	554	92	17%	462	83%	6.446	0.011
OF	435	88	20%	347	80%	0.156	0.693
IN	243	50	21%	193	79%	0.026	0.871
WITH	179	35	20%	144	80%	0.226	0.635
OR	167	36	22%	131	78%	0.031	0.860
BUT	120	48	40%	72	60%	26.112	0.000
ON	94	22	23%	72	77%	0.328	0.567
FOR	92	36	39%	56	61%	18.229	0.000
BY	130	45	35%	85	65%	14.526	0.000
A/AN	147	25	17%	122	83%	1.413	0.235
AT	71	16	23%	55	77%	0.101	0.751
total	3405	752	22%	2653	78%		

Table 9: Milton: Paradise Regained

Here OF is at the beginning of the line for 20% of its instances, which is roughly the expected frequency for a grammatical monosyllable, and hence OF is not able here to function as evidence for the line boundary. Note that FOR (39%), BY (35%) and BUT (40%) show a significant initial distribution, just as they do in *PL,* though they are not overall frequent. In this poem there are no grammatical words which combine both a high overall frequency and a high line-initial frequency, and hence there is no good reason to think that grammatical words here function as evidence for the line boundary. Note incidentally that the overall distribution of monosyllables in first position is about the same as in *PL* (at 22%).

Now I consider one of Milton's major influences, Shakespeare's blank verse, an example of what Milton in the second edition of *PL* called "our best English tragedies". Shakespeare's blank verse in general does not make prominent use of line-initial OF. *Antony and Cleopatra* is the first play to rise in the use of line-initial OF, with 11% and all of the subsequent plays also have

between 9-11%.[8] Table 10 shows the results for *Antony and Cleopatra* (the text used includes some prose and some non-iambic pentameter lines, so it is not exactly comparable to the blank verse poems discussed in this paper).

Word	Total	Position 1		Other Positions		X^2	p
		n	%	n	%		
AND	600	166	28%	434	72%	16.074	0.000
TO	554	115	21%	439	79%	0.020	0.889
THE	829	168	20%	661	80%	0.270	0.604
OF	433	46	11%	387	89%	28.102	0.000
IN	258	33	13%	225	87%	10.481	0.001
WITH	182	35	19%	147	81%	0.343	0.558
OR	61	19	31%	42	69%	3.786	0.052
BUT	181	50	28%	131	72%	4.788	0.029
ON	95	7	7%	88	93%	10.641	0.001
FOR	190	34	18%	156	82%	1.104	0.293
BY	102	23	23%	79	77%	0.148	0.701
A/AN	341	59	17%	282	83%	2.811	0.094

8 For this finding, I used LIWC, dividing the complete dramatic texts (including some prose and non blank verse) into sections, and ran it through a custom dictionary consisting of the grammatical words. The outputs of LIWC are in percentages of words per section not numbers of words per section as in ANTCONC, but proportions can still be established reliably. The results for OF are as follows, with plays in date order and the percentage of line-initial OF in parentheses: The Taming of the Shrew (4), The Second Part of King Henry VI (2), The Third Part of King Henry VI (3), The Two Gentlemen of Verona (5), Titus Andronicus (5), The First Part of King Henry VI (4), The Tragedy of King Richard III (4), The Comedy of Errors (6), Love's Labour's Lost (6), A Midsummer-Night's Dream (6), Romeo and Juliet (7), The Tragedy of King Richard II (6), The Life and Death of King John (6), The Merchant of Venice (7), The First Part of King Henry IV (7), The Second Part of King Henry IV (3), Much Ado About Nothing (1), The Life of King Henry V (4), As You Like It (5), Julius Caesar (5), Hamlet, Prince of Denmark (6), The Merry Wives of Windsor (2), Twelfth Night; Or What You Will (3), Troilus And Cressida (5), Othello, The Moor of Venice (6), Measure For Measure (5), All's Well That Ends Well (6), Timon of Athens (8), King Lear (4), Macbeth (7), Antony and Cleopatra (11), Coriolanus (9), Pericles, Prince of Tyre (9), Cymbeline (10), The Winter's Tale (11), The Tempest (10), The Famous History of the Life of King Henry VIII (11).

AT	74	16	22%	58	78%	0.017	0.896
total	3900	771	20%	3129	80%		

Table 10: Shakespeare: Antony and Cleopatra

The word AND combines high frequency with high initial position (a pattern we will see in most other blank verse other than *PL*). But in stark contrast to *PL*, the word OF is the second least likely word to appear at the beginning of a line. Milton's blank verse *PL* is thus not imitating a Shakespearean model in this regard. Note that the aggregate frequency of these grammatical words at the beginning of the line is 20%, which is comparable to the frequencies found in blank verse in general.

Next I consider a poem not in blank verse (which is always unrhymed), but instead in rhyming iambic pentameter (in the pattern of heroic couplets). This is Dryden's 1697 translation of the *Aeneid* in 13,700 lines. I have chosen this for comparison because it is a long poem within the same century as *PL,* as well as being a translation of Virgil's *Aeneid*, an epic poem which in its original form has links to *PL*.

Word	Total	Position 1		Other Positions		X^2	p
		n	%	n	%		
AND	5042	1724	34%	3318	66%	528.970	0.000
TO	2194	375	17%	1819	83%	20.197	0.000
THE	7657	1306	17%	6351	83%	71.783	0.000
OF	2007	181	9%	1826	91%	173.670	0.000
IN	1586	195	12%	1391	88%	72.441	0.000
WITH	1929	413	21%	1516	79%	0.196	0.658
OR	327	137	42%	190	58%	86.065	0.000
BUT	526	336	64%	190	36%	582.930	0.000
ON	752	69	9%	683	91%	63.377	0.000
FOR	531	136	26%	395	74%	6.808	0.009
BY	581	88	15%	493	85%	12.000	0.001
A/AN	1538	177	12%	1361	88%	83.519	0.000
AT	351	72	21%	279	79%	0.050	0.823
total	25021	5209	21%	19812	79%		

Table 11: Dryden: Aeneid

The overall pattern presented here is very different from that seen in the Milton's poems. Though the overall distribution of grammatical monosyllables in first position is 21%, the same as *PL,* there is a great deal of variation away from this, with many of the words showing a

statistically significant variation above or below. Here, unlike *PL,* OF (9%) is at a very low frequency at the beginning of the line. Again unlike *PL* (but like Shakespeare) AND (34%) is the word which most combines overall frequency with relative frequency in first position. Furthermore, as in other poems BUT (64%) and OR (42%) are also relatively frequent at the beginning of the line, and here at a higher degree than in *PL*. It is likely that the major differences from Milton, including the much lower percentage of line-initial OF, come from the different form of the poem, where the rhyming couplets lead to a different kind of syntax with less enjambement. All the remaining poems to be discussed are in blank verse.

Table 12 shows the results for James Thomson's 1746 *The Seasons*, a blank verse poem in 5,541 lines [29].

Word	Total	Position 1		Other Positions		χ^2	p
		n	%	n	%		
AND	1598	516	32%	1082	68%	122.790	0.000
TO	724	149	21%	575	79%	0.077	0.782
THE	3479	500	14%	2979	86%	92.126	0.000
OF	1113	257	23%	856	77%	2.933	0.087
IN	629	157	25%	472	75%	5.946	0.015
WITH	444	149	34%	295	66%	42.210	0.000
OR	234	104	44%	130	56%	77.526	0.000
BUT	131	64	49%	67	51%	61.267	0.000
ON	243	31	13%	212	87%	9.952	0.002
FOR	119	42	35%	77	65%	14.656	0.000
BY	236	54	23%	182	77%	0.504	0.478
A/AN	441	110	25%	331	75%	4.134	0.042
AT	138	30	22%	108	78%	0.045	0.831
total	9529	2163	23%	7366	77%		

Table 12: Thomson: The Seasons

The distribution in initial position of OF (23%) is not significantly different from the expected distribution. However, again we see that AND is both highly frequent overall and also has 32% of its instances at the beginning of the line; 9% of the lines in the poem begin with AND. This makes AND a possible cue to the line boundary. We saw the same in Dryden's poem, and will see a similar pattern in the next poem as well. We can also see that the relatively infrequent overall words BUT, OR and FOR are all common at the beginning of the line, which we saw also in Milton and does not seem to vary much between poets.

Table 13 shows William Cowper's 1785 *The Task,* a blank verse poem in 5,184 lines (text from

Cowper [4]).

Word	Total	Position 1		Other Positions		X^2	p
		n	%	n	%		
AND	1948	604	31%	1344	69%	117.560	0.000
TO	771	200	26%	571	74%	11.343	0.001
THE	2225	434	20%	1791	80%	2.995	0.084
OF	1121	196	17%	925	83%	8.351	0.004
IN	661	96	15%	565	85%	16.713	0.000
WITH	502	121	24%	381	76%	2.915	0.088
OR	238	68	29%	170	71%	8.224	0.004
BUT	278	125	45%	153	55%	96.232	0.000
ON	136	17	13%	119	88%	5.923	0.015
FOR	227	48	21%	179	79%	0.003	0.957
BY	209	68	33%	141	67%	16.765	0.000
A/AN	796	108	14%	688	86%	26.503	0.000
AT	225	22	10%	203	90%	17.080	0.000
total	9337	2107	23%	7230	77%		

Table 13: Cowper: The Task

Here OF, the third most frequent word overall, is distributed 17% in line-initial position, hence at a significantly low frequency. This is a pattern more in line with Dryden or Thomson, and not at all like *PL*. As in Thomson and Dryden, the word AND combines high frequency with a 31% possibility of being at the beginning of the line, making it a potential alternative marker of the line boundary. BUT, BY and OR are also frequent at the beginnings of lines (but, as elsewhere, not very frequent overall).

The conclusion to the discussion of *Paradise Regained,* the three non-Milton iambic pentameter poems, and the Shakespeare play, is that OF is not used with a significantly high frequency at the beginning of the line: thus, they differ from *PL*. However, in the three poems published after Milton, AND is used with unexpected frequency at the beginning of the line, and since it is also a very common word it might function as a line-initial marker. It is possible that the differences in the uses of OF and AND arise from causal factors relating to the difference in how enjambement works, and this is the difference between *PL* and the other poets discussed here. OF is often found mid-way through a noun phrase, and if line-initial may involve the more extreme forms of enjambement characteristic of *PL,* while AND can be clause-initial or phrase-initial rather than splitting a phrase.

Wordsworth

In William Wordsworth's short 1798 poem in blank verse usually titled 'Tintern Abbey' 38% of the instances of OF are at the beginning of the line (edition from Wordsworth [31]).

Word	Total	Position 1		Other Positions		X^2	p
		n	%	n	%		
AND	60	15	25%	45	75%	0.579	0.447
TO	18	5	28%	13	72%	0.498	0.480
THE	71	12	17%	59	83%	0.719	0.397
OF	61	23	38%	38	62%	10.261	0.001
IN	23	7	30%	16	70%	1.234	0.267
WITH	18	7	39%	11	61%	3.472	0.062
OR	6	1	17%	5	83%	0.068	0.794
BUT	4	1	25%	3	75%	0.039	0.844
ON	6	1	17%	5	83%	0.068	0.794
FOR	11	3	27%	8	73%	0.261	0.610
BY	5	1	20%	4	80%	0.003	0.956
A/AN	27	5	19%	22	81%	0.100	0.752
AT	1	0	0%	1	100%	0.266	0.606
total	60	15	25%	45	75%		

Table 14: Wordsworth: Tintern Abbey

More than half of the 159 lines of the poem begin with one of these grammatical words, while OF is used at the beginning of 23 lines. 14% of all the lines begin with OF, and in a possible echo of *PL*, it initiates the second line of the poem:

> Five years have past; five summers, with the length
> Of five long winters! and again I hear

Perhaps in this poem overall, Wordsworth is imitating Milton's line-initial use of OF. It is also possible that Wordsworth is imitating some aspect of Milton's enjambement of phrases such that OF appears frequently at the beginning of lines as a consequence. McCully ([20]: 209) describes the extensive influence of Milton on Wordsworth, including on subtle aspects of his use of iambic pentameter.

If we now consider Wordsworth's long blank verse poem *The Prelude* in 8,483 lines (1805 version, text from Wordsworth [31]), we see not only the same distribution of OF as in *PL* (27% at line beginning), but significantly that it is now combined with the same frequent use of AND (28% at line beginning) which was seen in eighteenth century poets such as Thomson.

Word	Total	Position 1		Other Positions		X^2	p
		n	%	n	%		
AND	2333	643	28%	1690	72%	60.537	0.000
TO	1243	275	22%	968	78%	0.946	0.331
THE	2916	386	13%	2530	87%	105.920	0.000
OF	2130	570	27%	1560	73%	42.605	0.000
IN	1152	260	23%	892	77%	1.710	0.191
WITH	753	208	28%	545	72%	19.908	0.000
OR	415	108	26%	307	74%	6.314	0.012
BUT	304	104	34%	200	66%	31.979	0.000
ON	304	60	20%	244	80%	0.292	0.589
FOR	393	108	27%	285	73%	9.950	0.002
BY	451	107	24%	344	76%	2.019	0.155
A/AN	1424	292	21%	1132	79%	0.210	0.647
AT	256	31	12%	225	88%	12.197	0.000
total	14074	3152	22%	10922	78%		

Table 15: Wordsworth: The Prelude, 1805

Wordsworth appears to be combining the practices of Milton in *PL* with eighteenth-century predecessors such as Thomson. His frequent line-initial uses of both AND and OF are evidence for the line boundary. This is true even if the appearance of these words in line-initial position is a result of Wordsworth mixing the enjambement practices of Milton and Thomson.

Different authors have different versions of iambic pentameter; they all use the same basic template, but control the matching of syllables to positions in different ways: this is true for the difference between Shakespeare and Milton, for example, as Kiparsky [17] and Hayes [13], among others, have shown. McCully argues that Wordsworth merges elements of Shakespeare's practice with elements of Milton's practice in his iambic pentameter. This is an example of Wordsworth's poetic hybridity, parallel to his hybrid use of line-initial grammatical words.

The determination of the line boundary

Evidence for the line

In this part of the paper I explore the possibility that in *Paradise Lost* the word OF functions as a clue to the location of the line boundary, when combined with other evidence. The word may function in this way, even if its appearance at the beginning of the line is caused as a side-effect

of enjambement.

The audience needs to know where the line boundaries are in order to establish the metrical form of the text. Metre is dependent on the division of a text into lines: the line is the linguistic material which is matched to the fixed-length and fixed-shape metrical template (ten syllable line fitting a ten-position template, in the case of the iambic pentameter). So if the metre is to be established by the audience, they must also establish line boundaries. Once the metre is established, experiential effects can arise which depend on the relation of metre to rhythm; these can include the variations in relative regularity or irregularity (in the relation of rhythm to metre) which for example produce the closural effects described for poems in general by Smith [15], or for *PL* in particular by Corns [3]. Once the text is divided into lines, then the mismatch of syntactic structure and lineation can produce particular effects, as argued for Milton's enjambements by Hollander [15]. Fabb [8] also argues that metrical form is processed in working memory, which requires the text to be processed one line at a time, and in turn this should influence how the poem is experienced. Division into lines may also aid long-term memory for the text [30], which is a further motivation for identifying the line boundary.

There are various kinds of evidence for the line boundary in a poem (as discussed in detail by Fabb ([7]: chapter 5)). An audience relates to a poem by reading it, hearing it, or remembering it. The audience can find evidence for the line boundary from either textual or non-textual sources. There are several non-textual kinds of evidence. If read, the visual presentation of the poem shows the line boundaries. If heard, the poem can be performed in a way which indicates the line boundary, for example by pausing distinctively at the line boundary. If recalled from memory, both the visual and aural experience of the poem might be recalled as part of the evidence.

The kinds of textual evidence for the line boundary are either linguistic or poetic. Poetic evidence can come from line-final rhyme, in rhyming poems (but not in the unrhymed blank verse poems discussed here). Poetic evidence can also come from the metre, if the metre can be established by the audience. In iambic pentameter texts, line-final syllables are ten syllables apart and must be word-final, so if the poem is parsed correctly, each ten syllable sequence forming a line must end at the end of a word. The first position of the line has a distinctive metrical/rhythmic potential, which is that although it is a weak position, it is more likely than any other weak position to be occupied by a stressed syllable ('trochaic inversion'), so that rhythmic aperiodicities are most likely to arise at the beginning of the line. The last syllable in the line is almost always stressed, and as in many metrical traditions, the line tends to be more rhythmically regular in its later part; this is noted for example by Corns ([3]: 92), who notes for a particular coherent passage in *PL* that the concluding lines have fully periodic rhythm in the last four positions, but a more variable rhythm in the first six (passages I: 730-7 and IV: 935-45). In this paper I also argue that there is linguistic evidence for the line boundary, in the deployment of particular words such as OF with greater than expected frequency at the beginning of the line. These kinds of poetic and linguistic evidence may play a relatively small role if the poem is read on the page, a larger role if heard (particularly in a performance style where there are no line-final pauses), and an even larger role when the poem is held in memory. The remembering of the poem has a particular relevance for Milton, who was losing or had lost

his sight while he was composing *PL*, and would have needed to develop ways of remembering and keeping track of the lineation of stretches of the text when he was composing it, so that he could later dictate it. The use of OF as partial evidence for line boundary may have played a function for him during this early period of blindness, different from that of his previous poems, and also different from the later *Paradise Regained*, which was composed more quickly after he had been blind for a while.[9]

OF, as evidence for the line boundary in *PL*, combines a 27% probability of being at the beginning of a line with a high frequency of overall occurrence (there are 2,051 instances of OF in the whole poem). It is possible to find a grammatical word with a higher probability of being line-initial, but at much lower frequency. For example BUT is relatively more frequent at the beginning of the line in *PL* (29%), but relatively infrequent overall in comparison to OF, with 588 instances of BUT in the poem. If BUT is also sentence-initial, there is a 68% probability of its being line-initial, but it is even less frequent in this instantiation: 73 instances in the poem. Here we balance two issues. On the one hand, the word OF or the word BUT are both probabilistic clues to the line beginning, irrespective of how many lines actually begin with these words. On the other, the clues will be more useful if more lines begin with these words, hence the overall frequency of the word in the text plays a role; of the 10,565 lines in *PL,* 557 (5%) begin with OF and 171(2%) begin with BUT. The addition of context to a word such as its being sentence-initial also requires greater processing effort. In the case of OF, we can increase the reliability of the word as a line-marker by excluding all cases of OF which are preceded by an unstressed syllable, on the fairly reliable assumption that the preceding line-final syllable will always be stressed; but this contextual information requires more processing effort and hence is less useful.

Previous authors have shown that a grammatical word can be used to mark a boundary in a literary text (see summary in Fabb ([6]: 193-212)). For example, Ghezzi [11] argues that in Ojibwe narratives, the overall narrative is divided into sections (in twos and fours, some as small as a clause), which can be referred to as 'lines' (following the approach to North American indigenous oral literatures proposed by Dell Hymes). Here, some but not all of the 'lines' begin with the word *ninguting* ('now presently'), a word with little contribution to the meaning of the text and which functions primarily as a boundary marker. Rubin, Wallace and Houston ([25]: 447) discuss the frequent use of AND at the beginning of the line in ballads (almost a fifth of the ballad lines begin with AND in their small corpus); they suggest that AND functions usefully as an unstressed word which fits into a metrically weak initial position, and can be used as a relatively meaningless filler which allows the next word to be a stressed and important content word. Their experimental subjects who had to remember and recall the corpus ballads and compose new ballads also tended to use AND at the beginning of lines: "after learning only five ballads, the subjects did begin their ballad lines with the word AND". This suggests that the experimental subjects learned that AND had a relatively high probability of being line-initial.

Several kinds of evidence can be combined to give stronger overall evidence. For example, on

9 Thanks to Thomas Corns, personal communication, for suggestions relating to Milton's blindness; see also Lancashire ([19]: 89).

its own the distribution of OF cannot tell us where the line boundaries fall in *PL* because only 27% of instances of OF are line-initial, and OF comes at the beginning of only 5% of the lines in the poem. However, in the context of other evidence, whether textual or non-textual, OF may offer some additional evidence to strengthen the judgment of where the line boundary falls. The 'patterns first' fact that OF is used at the beginning of the first two lines of the poem may be interpreted also as an indication that OF should be taken as a (weak) clue in this way.

Probabilistic judgments of literary form

Fabb [7] argues that for many aspects of literary form, the literary text has that form by virtue of the form being attributed to it by its reader or hearer, with a certain degree of probability. This includes the attribution of the form 'line' to a sequence of words. The balance of evidence, each with its own probability, can lead to the decision that a sequence of words is a line.

A different but compatible approach to probabilistic literary form is offered by current theories of generative metrics such as Hayes et al. [14] or Kiparsky [17]. In the Hayes et al. [14] theory, iambic pentameter involves a template to which a line is matched. Successful matching depends on the prosodic structure of the line, including the pattern of syllables and stress, and the division into words and prosodic phrases. Shakespeare and Milton both use a slightly different metrical grammar for iambic pentameter; the different grammars constrain the matching of line to template in slightly different ways, even if they are all using the same general metre, e.g., iambic pentameter. This means that the distributions of prosodic variants of the iambic pentameter line are different for the different poets. The prosodic variants can be described in statistical terms for the different authors' corpora. Each specific line of the poem belongs to a set of lines which all have the same prosodic structure, and the probability of that prosodic structure fitting the metrical template is assessed by the specific metrical grammar used by the poet. The probability of the match correlates with the frequency with which lines of each prosodic type will appear in the text. Highly probable matches will describe the prosodic structures of highly frequent lines. In this way, the statistical characteristics of the text correspond to the metrical grammars which guide the psychological processes by which the poems are produced. Hayes et al. focus on the authorial production of these regularities, but it is possible that an audience, too, can learn to distinguish the different forms of iambic pentameter used by Shakespeare or by Milton, and so may internalize the statistical properties of the data as mental metrical grammars. Thus, McCully [20] argues that Wordsworth internalized a metrical grammar by learning from the distribution of metrical variants in Shakespeare's and Milton's poems.

There is good reason to think that our interactions with the world in general can be understood in terms of probabilistic psychological processes and states (in ways inaccessible to introspection). This is the basis for example of Clark's [2] account of the predictive brain. It is also seen in statistical learning, where subjects are able to learn statistical characteristics of the data presented to them. Thus there is precedence for the claim that, in the right circumstances, an audience can learn the statistical characteristics of a text. For our purposes, the two key distributions are that we generally expect the grammatical monosyllables to appear 21% of the

time at the beginning of the line, and that we learn that in *PL,* OF appears 27% of the time at the beginning of the line, hence more than expected, given that it is a grammatical monosyllable. The right circumstances might involve some strong clues (e.g., the use of OF at the beginning of the first two lines of *PL*), and will depend on what the audience is exposed to, and able to learn. It may be that the first time an audience hears *PL,* it is hard to learn that OF is a statistically frequent line-initial word, but poems like *PL* can be encountered several times and on re-reading, or re-listening, an increased familiarity with the poem will enable the audience better to learn the statistical characteristics of it.

These discussions all raise the question of how the audience for poetry acquires these sorts of probabilistic understandings of textual form. This might arise in part from inherent biases or from explicit learning (e.g., learning about the iambic pentameter), or, most interestingly, from exposure to texts. Exposure to texts with particular statistical characteristics may result in the audience learning how to predict the properties of the text, including for example learning that OF has a 27% likelihood of being at the beginning of the line in *PL,* or (following Hayes et al.), that there is a higher probability of some line types in *PL* than others. If an author engages consistently in a particular textual practice, then they have internalized a probabilistic system, which can also in part come from learning (e.g., learning from other poets, learning from their own practice). These considerations in turn raise two further interesting questions. Consider first the possibility that these predictions are acquired by statistical learning. Siegelman and Frost [26] show that an individual can vary in their ability to learn statistically, depending on what is learned; and furthermore that there is inter-individual variation in the ability to learn statistically (with some experimental subjects entirely unable to learn statistically, for specific kinds of learning). Individual authors and individual audience members might thus vary in their ability to learn the properties of a metre, or the distributional characteristics of words. If the individual is a poor statistical learner, then they may produce inconsistent texts (and hence have an attenuated stylistic fingerprint), or they may be unable to learn textual regularities. The second question relates to surprise (or more technically, surprisal): one of the basic claims of many literary critical approaches to metre is that the changing relation between the metrical template and the rhythmic line of poetry can be experienced. Thus the listener can experience 'tension' if the prosody of the line is not exactly matched to the template. And, following Smith [28], the listener can experience 'closure' if relative irregular rhythms give way to regular rhythms at the end of a poem (or irregular gives way to irregular, as Fabb [9] argues). If, however, the listener has internalized the range of possible variations, with probabilities attached to them, this might mean that no variation is surprising or has any experiential effect, because all the variations are already predicted. This raises some difficult but also very large questions about the relation between variations in literary language, the knowledge of variation, and the ability to be surprised by variation.

Conclusion

Much digital humanities work, for example in stylometrics, focuses on the 'small' words, such as the grammatical monosyllables discussed here. This paper has explored the distribution of

these words relative to position in the metrical line. The distribution of these words may tell us about aspects of the syntax of the poetry, as regards syntactic structure across line boundaries. The distributions also characterise different works, and different traditions of composition, and Wordsworth combines two different traditions in his poetry. I have also shown how the findings of textual analysis can be understood in terms of probabilistic judgments of literary form, here using the statistical behaviour of a grammatical word as evidence for the line boundary. This is part of a broader project of exploring the statistical properties of texts as they relate to human psychology and the possibility of statistical learning.

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