

Stylistic Difference in Chinese and Greek

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Mendenhall (1877), following a suggestion of de Morgan (1851), found that Shakespeare preferred four-letter to three-letter words. It later appeared that Marlowe also preferred four-letter words. It followed for Mendenhall that Marlowe had written Shakespeare's works.¹ The problem with this "signature" approach is: How many authors are there? Does some Elizabethan dramatist own all the *five*-letter words?² Rather than assign a number to each of two texts, and then compare those numbers, we prefer to compare two texts, and assign a number *to the difference*. Why?

Because the differentness of a piece *depends on what it is being compared with*. Style varies with authorial mood or genre, so common authorship does not guarantee similarity of style. Nor does *dissimilarity* of style guarantee a *difference* in authorship. Variation *within* one author may merely display that author's manner of presentation. Is this narrative continuous or episodic? Are those passages independent or imitative? Is some passage in one text like one in another text?³ And what is style, anyway?

Style has many aspects.⁴ One is the contrast between nouns and verbs, which *convey* content, and function words, the connectives which *articulate* that content.⁵ The test here described is based on high-frequency connectives – words so common that they occur in even brief passages, and are little affected by changes of content.

¹For an overview of Mendenhall's work, see Williams **Studies**.

²Kenny **Study 1**, "Ideally, a stylometric test of authorship should be a feature which is characteristic of all the known works of a particular author, and which is unique to his works." For a doubt as to distinctive vocabulary profiles, see O'Donnell **Fingerprints** 254. Features used by Mosteller to separate Hamilton from Madison included "while" versus "whilst." That method is locally powerful, but has no generality; new contrasts must be found in each case. For that method applied to Shakespeare, see Craig **Shakespeare**, and compare Burrows **Delta**.

³Including a text by another author. One of Madison's Federalist papers varied notably in style from the others because he had in mind some essays on political theory, *and had absorbed their style* (Mosteller **Federalist** 252). We will see several instances of this phenomenon below.

⁴Including shrinkage of vocabulary in late Agatha Christie; see Fortini **Alzheimer's**.

⁵Said Mary McCarthy, of the memoirs of Lillian Hellman (on the Dick Cavett show, 1979; aired in 1980), "Every word she writes is a lie, including *and* and *the*." The wit of this (which led to a lawsuit) is that *and* and *the* do not carry message, and can neither lie nor tell the truth.

The Test Words

As in all languages so far studied, we use the 14 commonest function words which are not compromised by polysemy or idiomatic association.

English. The 14 function words found to be effective on material from the time of Queen Anne to the present,⁶ and their general frequencies, are:

the	0·0490	in	0·0155	but	0·0039
and	0·0239	that	0·0114	at	0·0039
of	0·0230	for	0·0073	from	0·0036
to	0·0226	with	0·0060	not	0·0036
a/an	0·0225	on	0·0055		

These make up 20·2% of an average text. The smallest text for which the test is fully functional (where the least frequent test word gives an E of at least 0·50) is 139 words.

Literary Chinese. The 14 function words found to be effective for the span of Chinese from the classical period to Táng,⁷ and their general frequencies, are:

之	0·0325	of, it	何	0·0068	what?	未	0·0040	not yet
不	0·0269	not	於/于	0·0068	in, at ⁸	亦	0·0029	also
其	0·0135	the	此	0·0054	this	已	0·0028	already
也	0·0120	[pause]	則	0·0049	then	矣	0·0023	[finality]
者	0·0110	that which	如	0·0045	if, like			

These make up 10·4% of an average text.⁹ The smallest text for which the test is fully functional (where the least frequent test word gives an E of at least 0·50) is 218 words.

Biblical Greek (NT, not including the Septuagint) is a corpus of 138,019 words. The 14 commonest function words in Biblical (NT) Greek are:

ὁ	0·1439	the	οὐ	0·0116	not	ἐπί	0·0064	upon
καί	0·0653	and	ὅτι	0·0094	because	πρός	0·0051	toward
δέ	0·0202	but	μή	0·0075	not	διά	0·0048	through
ἐν	0·0199	in	γάρ	0·0075	for	ἵνα	0·0048	so that
εἰς	0·0128	into	ἐκ	0·0066	from			

These make up 32·6% of an average text. The smallest text for which the test is fully functional (where the least frequent test word gives an E of at least 0·50) is 105 words.

Homeric Greek (Iliad and Odyssey; but not the Homeric Hymns) is a fully known corpus of 198,793 words. The 14 commonest function words in Homeric Greek are:

δέ	0·0544	but	μέν	0·0094	indeed	γάρ	0·0071	for
ὁ	0·0298	the	ἄρα	0·0093	thus	ἐπί	0·0069	upon
καί	0·0266	and	ἄν/κε	0·0073	if	ὥς	0·0062	as
τε	0·0206	and, both	οὐ	0·0073	not	οὐδέ	0·0056	nor
ἐν	0·0105	in	ἀλλά	0·0072	but			

These make up 20·8% of an average text. The smallest text for which the test is fully functional (where the least frequent test word gives an E of at least 0·50) is 90 words.

⁶Based on the Thorndike et al 1944 count of 18 million words.

⁷Based on a direct count of 1·5 million words; see Brooks **Frequency**.

⁸These two coverbs were distinct in classical Chinese, but not in the later language.

⁹The coverage is less because the corpus is larger: from classical to mediaeval Chinese.

Formula

The **BIRD**¹⁰ logo¹¹ is shown at the head of this article. We first ascertain, for each test word, given its general frequency, how many we *expect* to find in a passage containing that many words (E), and how many we *actually* find (A).¹²

Departures from a small expectation, such as 3, are not remarkable (as when we average 3 pieces of mail, and today get 1). With larger E, a class of 300 last year and the same proportional reduction to 100 this year, the significance is obviously great. That scale factor is to some degree built into this elementary significance formula:¹³

$$(A - E) / \sqrt{E}$$

It would be convenient if this result were 1.00 when the unlikelihood of its being a result of random variation was 99%.¹⁴ This can be done by multiplying by 0.39.¹⁵ To avoid over-exaggerating high values, we shrink the result by taking its square root.¹⁶ The final S formula¹⁷ is then:

$$S = \sqrt{[(0.39)(A - E) / \sqrt{E}]}$$

The 14 S results for a text are that text's *stylistic profile*. If the profiles of two texts are such that, so to speak, one zigs when the other zigs, and zags when it zags, then the texts are *stylistically close*; they vary from the frequency norm *in a similar way*. For a formula, the gaps between each pair of S results for two texts (S₁ and S₂) are averaged, to get the difference value D *for those two texts*:

$$D = \text{sum of } (S_1 - S_2) / 14$$

D is not self-interpreting; it is presented to a human investigator *for* interpretation. Its advantage is its objectivity: anyone who does the counts and runs the arithmetic will get the same answer. Precisely that impersonality can help in cases of disputed attribution, where human impressions of the style of a passage differ.

Note that, in a small text, the test words have, as it were, less room to move, and “false positives” – results wrongly implying similarity – are accordingly more likely. Texts whose size is below the recommended minimum for that language are noted in the examples given below.

¹⁰Brooks Index of Rhetorical Difference. “Rhetorical” partly for the sake of the acronym, but one can also regard rhetoric as style applied to a specific expressive purpose.

¹¹after Ilmari Karonen 2006, to whom our thanks for making the drawing freely available.

¹²The text size in words multiplied by the general frequency (F) of a word gives expected (E) occurrences of that word; E is often a decimal. Actual (A) occurrences are found by counting; A is a whole number.

¹³For the basic formula (the Normal Approximation to Binomial), see Hoel **Elementary** 103-106. BIRD has affinities to the Product-Moment Correlation Coefficient (Pearson, 1896) and the Chi Squared test (Pearson, 1900), both of which are based on that formula.

¹⁴Thresholds of 95% or even 90% are also used, but 99% is the industrial-strength level.

¹⁵99% of all variations in a normal distribution are between ± 2.54 standard deviations. Multiplying by 0.39 is the same as dividing by 2.54, since $1 / 2.54 = 0.39$.

¹⁶This preserves 1.00 as the 99% threshold, since $\sqrt{1.00} = 1.00$.

¹⁷The absolute value of (A - E) is used in calculating; any minus sign should be appended to the final result. S is quite useful in its own right; see examples in Brooks **Departure**.

On the Use of the BIRD Test

We caution against using the test to identify authors, and suggest that it is most revealing when used on works of known authorship, to discern the interior structure of a story or argument. We have warned of the dangers of taking too small samples. We here add some notes on particular situations.

Adjacent Results. Of first interest in most cases are the values along the diagonal of a table, showing the closeness of successive segments. If D is **Low** (0.50 or less), we probably have a continuous narrative or argument. If **Normal** (0.51 to 0.75), the piece is episodic, not consecutive. **High** values (0.76-0.99) are increasingly less likely have the same origin; **Extreme** values (1.00 and up) preclude that possibility. Of special interest is the *crux*, the point where passages begin to be stylistically close, implying a transition from preliminary matters to the argument or narrative proper.¹⁸ Not all arguments proceed this way, and the typology of arguments may be enriched by studying their stylistic continuity. In Iliad 9, there is a suggestion that some literary forms involve not just an argument, but an *argument + response* unit.

Nonadjacent Results. An author (or interpolator), in ending a piece, may “have in mind” its beginning; what we call a *lookback*.¹⁹ The *horizon* to which one or more pieces in a group look back may indicate what they regard as the beginning of that group; the limit, so to speak, of their literary awareness.

In Hebrews (p32 below), the fact that a paragraph added by a *later* writer can be stylistically close to an earlier paragraph by the *original* writer refutes the whole notion of stylistic closeness as a firm indicator of same authorship, and suggests a more nuanced appreciation of the way texts come about, and are modified.²⁰

If each of several passages is close, not to the previous one, but to the first, we may have a *template* situation, where each was composed with the first as its model.²¹

A non-similar value between two similar ones, what we call a *gap*, may imply any of several things, from discomfort of the author (an uncharacteristic argument or a difficult transition) to an intrusion by a later author or editor.²²

BIRD supplies data on a matter not directly observable. Its value is that it is not influenced by the expectations of the one doing the calculations. The BIRD test has the same form, and works the same way, in all languages to which it has been applied. This seems to reflect a property that is common to all languages. In technical terms, *all languages have essentially the same cumulative frequency curve.*

¹⁸This principle of presentation, first the evidence and the precedents in law, and then the final consecutive argument to a judge or jury, is taught in law schools, but without attaching names to the two sections. (Personal communication, Sarah Ruth Rosenberg, 2017).

¹⁹An author may “have in mind” something outside the text; for Madison; see n3 above.

²⁰Efforts to imitate a previous style, or at any rate to resume a previous identity, are not always that successful. For an example, see 1 and 2 Peter (D = the modest 0.68).

²¹See for example Brooks **We**. Formulaic or stylized composition within in a poetic school (such as the Sons of Korah) might be expected to display a family closeness of style.

²²See for example Brooks **Interruptions**.

Interpretation

English and Chinese versions of BIRD have been tested over many years. It has been found that when the D or difference value is 0.50 or less (**Low**), the style is *highly similar*, implying an author writing consecutively, or one passage having another in mind. **Normal** values (0.51 ~ 0.75) imply a similar but not consecutive style, the usual thing in that particular text. **High** values (0.76 ~ 0.99) increasingly suggest extraneous matter, or the same author in a disturbed state.²³ With **Extreme** values (1.00 or more), the hypothesis of a common source is counter-indicated.

We here introduce the extension of the BIRD test to Biblical and Homeric Greek, where the same ranges seem also to be applicable.²⁴ For these languages, the smallest text for which all test words are active²⁵ is 139 words (English), 218 words (Literary Chinese), 105 words (Biblical Greek), or 90 words (Homeric Greek). Much of interest to researchers lies near that level, and in what follows, we will push that limit a little. Results are reported in tables testing each passage against the others. In those tables, D values indicating *significant similarity* (those at or below 0.50) are **highlighted**.

Literary Chinese Examples

Mwòdž 17 “Against War” is in three sections. At the top and left of the table are the section labels; the D values occupy the other cells. The difference between any passage and itself is obviously zero; to make the diagonal more visible, that value is replaced by ~. Follow the diagonal to see how similar the *successive* sections may be:

Section	Subject	Words
17a	The state knows that killing a man is evil	243
17b*	But the state makes war , killing many	113
17c*	Thus, those in charge of the state are morally confused	103

MZ	17a	17b*	17c*
17a	~	0.67	0.81
17b*	0.67	~	0.43
17c*	0.81	0.43	~

From the point reached in 17b, the conclusion (17c) follows smoothly: the D value for 17b and 17c is the low **0.43**. This argument is *forensic*: an indictment of the war state.

²³One of Jonathan Swift’s unsigned contributions to the Examiner, a political paper of Queen Anne’s time, differed markedly in style from the others, not because he did not write it, but because he wrote it while under the influence of the opium dream which it describes.

²⁴Some calculations for Chinese texts were done by Mary Cleary; the original BIRD test was implemented for Biblical and Homeric Greek by Keith L Yoder. To both, our thanks.

²⁵The E or expected value for any test word in a text of X words is its general frequency F multiplied by the text size X. A test word is “active” in the sense here meant when it is capable of assuming a value other than zero; that is, when $F \cdot X = E = 0.5$, which rounds up to $E = 1$. When the text is smaller, that word can only assume the value zero. As the text being examined becomes still smaller, more and more test words will reach that “automatically zero” condition. For the exact word frequencies in question, see p24, above.

Mencius 1A7 shows a similar pattern. Mencius seeks to convince the King of Chǐ that he needs only to extend his natural feelings of sympathy, in order to govern well. The stages are:

Section	Subject	Words
1A7a	The King had once pitied a sacrificial ox	220
1A7b	Mencius explains that feeling to the King	268
1A7c	The King will not say what he desires	234
1A7d	But Mencius knows , and criticizes his way of getting it	306
1A7e	He explains that benevolent government is the right way	285

MC	1A7a	1A7b	1A7c	1A7d	1A7e
1A7a	~	0.58	0.64	0.77	0.50
1A7b	0.58	~	0.69	0.61	0.58
1A7c	0.64	0.60	~	0.51	0.50
1A7d	0.77	0.61	0.51	~	0.49
1A7e	0.50	0.58	0.50	0.49	~

In 1A7a, the King sympathizes with an ox being led to sacrifice. MC 1A7 argues that he should extend equal sympathy to his people. He works past the subterfuges of the King (1A7a through 1A7c), and takes charge in 1A7d; his conclusion (1A7e) follows smoothly ($D = 0.49$). The point in a text where close stylistic similarity begins, we will call the *crux*. The endpiece, 1A7e, is stylistically close to the preceding 1A7d *crux*, and to much of the preceding text, 1A7a and 1A7c; it seems to have them in mind. This pattern of recollection at the end of a piece we will call a *lookback*.

Mwòdž 18. Not all arguments, not even all Mician arguments against war, have the same internal structure. An example is MZ 18, the second Mician antiwar tract. Years after the first antiwar tract, MZ 17, it became necessary to revise the policy to take account of political realities: the Micicians, who had begun as *critics* of the state, had in due course become to some extent *servants* of the state, holding positions of some responsibility. In that situation, opposing war on moral grounds was untenable: the Micicians did not wish to create a moral gulf between them and their colleagues. Some adjustment in their antiwar position was thus needed. This adjustment MZ 18 sought to provide. It argues not from morality, but instead from *history*:

Section	Subject	Words
18a	The costs and hardships of war	253
18b*	Rulers wrongly think they will benefit from war	188
18c*	Rulers wrongly think they follow ancient example	170
18d*	Arguments from history against offensive war	179
18e	Rulers think they are exceptions to history	223
18f*	Example from the past (Jī-bwó) in refutation	174
18g*	Concluding quote from Master Mwòdž	67

The table for MZ 18 is on the following page. We look along the diagonal, to see if low D values occur between *any two successive segments*. Despite the risk of false positives with these small texts, we find that no successive segments have D values which are low enough to imply stylistic continuity.

MZ	18a	18b*	18c*	18d*	18e	18f*	18g*
18a	~	0.74	0.68	0.74	0.51	0.66	0.80
18b*	0.74	~	0.51	0.70	0.54	0.78	0.59
18c*	0.68	0.51	~	0.66	0.54	0.57	0.59
18d*	0.74	0.70	0.66	~	0.62	0.61	0.73
18e	0.51	0.54	0.54	0.62	~	0.60	0.57
18f*	0.66	0.78	0.57	0.61	0.60	~	0.51
18g*	0.80	0.59	0.59	0.74	0.57	0.51	~

Successive D values are in the Normal range, compatible with same authorship but not suggesting consecutive composition. Sections 18b/c *nearly* reach that level, perhaps because they are both examples of deluded rulers. Similar closeness obtains between the last two segments, 18f and 18g, but 18g is merely the rhetorical conclusion of 18f.

In other words, there is no crux here. The argument is not forensic in the first place; *it does not progress*, but instead consists of parallel examples. This is a different way of proceeding than in the forensic pieces we have previously observed.

Gūngsūn Lúngdǔ. The supposed literary remains of this 03c sophist are:

Chapter	Subject	Words
1	[Introductory: information about Gūngsūn Lúng]	1109
2	Essay on the White Horse	493
3	Essay on Meanings and Objects	269
4	Essay on Understanding Change	544
5	Essay on Hard and White	502
6	Essay on Names and Realities	250

Graham noted²⁶ that the plausible GSLZ 2-3 are philosophically and grammatically distinct from GSLZ 4-6, which are obscure and sometimes “strung together out of misunderstood fragments of the Mohist Canons.” The D results agree in part,

GSLZ	1	2	3	4	5	6
1	~	0.83	0.69	0.76	0.84	0.88
2	0.83	~	0.32	0.85	0.69	1.13
3	0.69	0.32	~	0.66	0.57	0.97
4	0.76	0.85	0.66	~	0.41	0.82
5	0.84	0.69	0.57	0.41	~	0.88
6	0.99	1.13	0.97	0.82	0.88	~

since for GSLZ 2 and 3 we have the low D value **0.32**. But there is also a strong similarity between GSLZ 4 and 5 (**0.41**). GSLZ 4-5 are doubtless fraudulent, but may be *from the same writer*. GSLZ 6, on a topic popular in later centuries, has a high D number with *all other pieces*. It probably has a different, probably a still later, origin.

²⁶Graham **Composition** 126-127.

Biblical Greek Examples²⁷

Colossians and Ephesians. These Deutero-Pauline epistles are agreed to be close in style.²⁸ This consensus of the D test confirms, since the D reading for the two is **0·35**. But to see how *dramatically* it is confirmed, here is the table for the entire NT:

NT	Mt	Mk	Lk	Jn	Acts	Rom	1Cor	2Cor	Gal	Eph	Col	Php	1Th	2Th
	17665	10772	19140	15345	17660	5436	4072	4124	1793	2363	1582	1629	1244	823
Mt	~	1·13	0·77	1·68	0·76	1·50	1·52	2·01	1·53	1·21	1·08	1·33	1·50	1·27
Mk	1·13	~	0·91	1·23	1·26	1·86	1·74	1·42	1·45	0·98	1·07	0·94	0·94	0·96
Lk	0·77	0·91	~	1·67	0·80	2·09	1·73	1·97	1·72	1·49	1·52	1·45	1·38	1·47
Jn	1·68	1·23	1·67	~	1·79	1·75	1·49	1·19	1·09	1·49	1·43	1·47	1·45	1·33
Acts	0·76	1·26	0·80	1·79	~	1·84	2·01	2·00	1·84	1·31	1·54	1·68	1·61	1·55
Rom	1·50	1·86	2·09	1·75	1·84	~	0·92	0·88	0·84	1·29	1·19	1·26	1·04	1·13
1Cor	1·52	1·74	1·73	1·49	2·01	0·92	~	0·85	0·80	1·41	1·34	1·14	1·06	1·07
2Cor	2·01	1·42	1·97	1·19	2·00	0·88	0·85	~	0·71	1·04	1·16	0·83	0·68	0·75
Gal	1·53	1·45	1·72	1·09	1·84	0·84	0·80	0·71	~	1·37	1·21	0·86	0·97	0·82
Eph	1·21	0·98	1·49	1·49	1·31	1·29	1·41	1·04	1·37	~	0·35	0·76	0·83	0·66
Col	1·08	1·97	1·52	1·43	1·54	1·19	1·34	1·16	1·21	0·35	~	0·63	0·94	0·71
Php	1·33	0·94	1·45	1·47	1·68	1·26	1·14	0·83	0·86	0·76	0·63	~	0·66	0·45
1Th	1·50	0·94	1·38	1·45	1·61	1·04	1·06	0·68	0·97	0·83	0·94	0·66	~	0·59
2Th	1·27	0·96	1·47	1·33	1·55	1·13	1·07	0·75	0·82	0·66	0·71	0·45	0·59	~
1Tim	1·10	1·01	1·26	1·41	1·53	1·20	0·84	0·99	0·97	0·88	0·79	0·63	0·78	0·55
2Tim	1·15	0·98	1·27	1·53	1·32	0·98	1·09	0·89	0·93	0·70	0·77	0·48	0·53	0·57
Titus	1·23	0·94	1·24	1·17	1·53	1·37	0·98	0·92	1·00	0·88	0·87	0·81	0·81	0·74
Phm	1·14	0·90	1·15	1·25	1·46	1·36	1·03	0·90	0·92	0·70	0·73	0·47	0·69	0·47
Heb	1·21	1·19	1·62	1·48	1·45	0·81	1·09	0·93	0·86	1·08	1·14	1·03	0·73	0·82
Ja	0·98	1·26	1·24	1·27	1·58	0·90	0·95	1·11	0·83	1·37	1·05	0·92	0·82	0·86
1Pet	1·29	0·95	1·50	1·40	1·49	1·05	1·01	0·77	0·86	0·71	0·78	0·45	0·72	0·33
2Pet	0·98	1·15	1·25	1·55	1·50	1·01	0·90	1·05	0·99	0·89	0·72	0·54	0·61	0·75
1Jn	1·48	1·49	1·89	0·76	2·01	1·31	1·31	1·21	1·11	1·14	0·87	1·14	1·27	1·03
2Jn	1·35	0·93	1·37	1·09	1·62	1·13	0·97	0·75	0·92	0·73	0·73	0·72	0·48	0·47
3Jn	1·10	1·01	1·33	1·06	1·57	1·07	1·00	0·94	0·69	0·99	0·75	0·74	0·72	0·62
Jude	0·67	0·86	0·90	1·30	1·05	1·22	1·19	1·37	0·92	0·97	0·89	0·75	0·93	0·78
Rev	1·21	1·29	1·36	1·82	1·56	2·10	2·44	2·53	2·12	1·70	1·43	1·81	1·98	1·95

Colossians and Ephesians are quite close to each other, but to nothing else on the table. The scholarly view of the similarity of these texts is confirmed by the D results. The D results and the critics are, to this extent, *reporting the same situation*.

²⁷Based on the current critical text, and subject to change if interpolations are removed.

²⁸For a recent overview, see Lincoln **Ephesians** xlvii and following.

Revelation. Beginning with Origen (3rd century), it has often been said that the style of Revelation precludes grouping it with the other Johannine texts. The D test shows that Revelation cannot be grouped *with anything whatever*; its Septuagintal Greek distances it very strongly (*all D values exceed 1.00*) from the rest of the canon.

<i>1Tim</i>	<i>2Tim</i>	<i>Titus</i>	<i>Phm</i>	<i>Heb</i>	<i>Ja</i>	<i>1Pet</i>	<i>2Pet</i>	<i>1Jn</i>	<i>2Jn</i>	<i>3Jn</i>	<i>Jude</i>	<i>Rev</i>	<i>NT</i>
1581	1224	659	335	4192	1714	1531	1093	2141	245	219	461	9851	
1.10	1.15	1.23	1.14	1.21	0.98	1.29	0.98	1.48	1.35	1.10	0.67	1.21	<i>Mt</i>
1.01	0.98	0.94	0.90	1.19	1.26	0.95	1.15	1.49	0.93	1.01	0.86	1.29	<i>Mk</i>
1.26	1.27	1.24	1.15	1.62	1.24	1.50	1.25	1.89	1.37	1.33	0.90	1.36	<i>Lk</i>
1.41	1.53	1.17	1.25	1.48	1.27	1.40	1.55	0.76	1.09	1.06	1.30	1.82	<i>Jn</i>
1.53	1.32	1.53	1.46	1.45	1.58	1.49	1.50	2.01	1.62	1.57	1.05	1.56	<i>Acts</i>
1.20	0.98	1.37	1.36	0.81	0.90	1.05	1.01	1.31	1.18	1.07	1.22	2.10	<i>Rom</i>
0.84	1.09	0.98	1.03	1.09	0.95	1.01	0.90	1.31	0.97	1.00	1.19	2.44	<i>1Cor</i>
0.99	0.89	0.92	0.90	0.93	1.11	0.77	1.05	1.21	0.75	0.94	1.37	2.53	<i>2Cor</i>
0.97	0.93	1.00	0.92	0.86	0.83	0.86	0.99	1.11	0.92	0.69	0.92	2.12	<i>Gal</i>
0.88	0.70	0.88	0.70	1.08	1.37	0.71	0.89	1.14	0.73	0.99	0.97	1.70	<i>Eph</i>
0.79	0.77	0.87	0.73	1.14	1.05	0.73	0.72	0.87	0.73	0.75	0.89	1.43	<i>Col</i>
0.63	0.48	0.81	0.47	1.03	0.92	0.45	0.54	1.14	0.72	0.74	0.75	1.81	<i>Php</i>
0.78	0.53	0.81	0.69	0.73	0.82	0.72	0.61	1.27	0.48	0.72	0.93	1.98	<i>1Th</i>
0.55	0.57	0.74	0.47	0.82	0.86	0.33	0.75	1.03	0.47	0.62	0.78	1.95	<i>2Th</i>
~	0.65	0.41	0.51	0.98	0.62	0.57	0.56	1.10	0.63	0.64	0.66	1.82	<i>1Tim</i>
0.65	~	0.72	0.46	0.75	0.81	0.60	0.34	1.44	0.72	0.67	0.63	1.80	<i>2Tim</i>
0.41	0.72	~	0.55	1.04	0.73	0.81	0.73	1.20	0.58	0.56	0.80	1.74	<i>Titus</i>
0.51	0.46	0.55	~	1.02	0.83	0.55	0.55	1.21	0.58	0.56	0.74	1.84	<i>Phm</i>
0.98	0.75	1.04	1.02	~	0.95	0.81	0.78	1.54	0.94	0.68	0.90	1.85	<i>Heb</i>
0.62	0.81	0.73	0.83	0.95	~	0.94	0.63	1.00	0.72	0.55	0.58	1.63	<i>Ja</i>
0.57	0.60	0.81	0.55	0.81	0.94	~	0.68	1.19	0.67	0.74	0.69	1.94	<i>1Pet</i>
0.56	0.34	0.73	0.55	0.78	0.63	0.68	~	1.26	0.79	0.64	0.58	1.71	<i>2Pet</i>
1.10	1.44	1.20	1.21	1.54	1.00	1.19	1.26	~	0.96	1.00	1.27	1.61	<i>1Jn</i>
0.63	0.72	0.58	0.58	0.94	0.72	0.67	0.79	0.96	~	0.51	0.85	1.88	<i>2Jn</i>
0.64	0.67	0.56	0.56	0.68	0.55	0.74	0.64	1.00	0.51	~	0.74	1.61	<i>3Jn</i>
0.66	0.63	0.80	0.74	0.90	0.58	0.69	0.58	1.27	0.85	0.74	~	1.51	<i>Jude</i>
1.82	1.80	1.74	1.84	1.85	1.63	1.94	1.71	1.61	1.88	1.61	1.51	~	<i>Rev</i>

The Pauline Epistles have long been a focus of stylistic investigation, but with indifferent results. There are three possible reasons for this. First, no stylistic test is an authorship test; many factors besides author affect style. Second, Paul's letters are occasional: they focus on the situation of a given church. Third, they are interpolated, and must be cleaned up before a stylistic survey can be conducted. The values given above are therefore not based on the first state, the authorial state, of these texts. Pending further work, Paul's letters are unsuitable as subjects for stylistic analysis.

Hebrews. Except for its final personalia, which were probably added to give it the appearance of a standard Pauline epistle,²⁹ Hebrews is undoubtedly by a single person. Division by topic might suggest these stages:³⁰

Segment	Subject	Words
A 1-2:18	Jesus the Son	569
B 3-4:13	Salvation	524
C 4:14-6:20	Doctrine	583
D 7:1-28	Jesus the High Priest	456
E 8:1-9:28	The New Covenant	786
F 10:1-39	The Law	550
G 11:1-40	Faith	633
H 12:1-29	Hope (Endurance)	474
I 13:1-21	Love; original benediction (Amen)	330
J* 13:22-25	[Later Added Pauline Personalia]	48

Heb	A	B	C	D	E	F	G	H	I	J*
A	~	0.63	0.31	0.47	0.51	0.45	0.53	0.59	0.68	0.38
B	0.63	~	0.71	0.65	0.53	0.42	0.49	0.63	0.34	0.59
C	0.31	0.71	~	0.62	0.65	0.51	0.55	0.47	0.68	0.49
D	0.47	0.65	0.62	~	0.52	0.52	0.63	0.77	0.69	0.44
E	0.51	0.53	0.65	0.52	~	0.27	0.45	0.72	0.64	0.46
F	0.45	0.42	0.51	0.52	0.27	~	0.35	0.54	0.61	0.47
G	0.53	0.49	0.55	0.63	0.45	0.35	~	0.45	0.49	0.44
H	0.59	0.63	0.47	0.77	0.72	0.54	0.45	~	0.50	0.57
I	0.68	0.34	0.68	0.69	0.64	0.61	0.49	0.50	~	0.59
J*	0.38	0.59	0.49	0.44	0.46	0.47	0.44	0.57	0.59	~

All values are generally compatible, but the zone where *consecutive sections* are below **0.5** begins at HbE. The identification of Jesus as High Priest (in HbD, surely startling for those who had seen Jesus as a sacrificial *victim*) was a hard point to make, but a plateau is reached with the New Covenant (HbE). With that gained, the rest of the exposition follows without difficulty. The *crux*, the point from which consecutive segments become significantly similar, thus occurs at HbE.

The second or Pauline ending, Heb J, is too small for the test results to be taken too seriously, but in favor of its being nonintegral to Heb is its D reading with the previous segment (D = 0.59, breaking the consecutive series of low D readings). It is however near to most of the *earlier* segments, a retrospective trait seen also in the final segment of MC 1A7, and elsewhere as well. This we have above called the *lookback*. It links the concluding segment of a text, whether or not original, to the rest of the text, and shows the writer (or interpolator) being mindful of the preceding argument.

²⁹For this authorial repositioning, which occurs in many late 1c texts, see Brooks **Apostolic**.

³⁰These differ slightly from those in Attridge **Hebrews** 19, which also see. Notice the “faith, hope, love” passage, Heb 10:19-25 (in F), repeated on a large scale in segments G, H, and I.

Complaint. It might be objected that the distinctiveness of Revelation, and the similarity of Colossians and Ephesians, not to mention the consecutiveness of Hebrews, are common knowledge. Why waste time on such matters? The answer is that no statistical test is worth anything until it has been calibrated on known material. These studies are that calibration. Their agreement with the literary consensus suggests that the test may be useful where opinions are divided, or where nothing of interest has been suspected. The existence of a form of argument common to Hebrews and other texts is an example of such unexpected but useful information. Beyond confirming the known, the test may offer suggestions, not just about authorship, but about authors.³¹ Such suggestions are more credible if supplied by a test which has itself been tested.

Acts. Torrey in 1916 found that the first half of Acts was much more Semitic in character than the second half. He posited an Aramaic original. The Aramaic idea has not found favor (the language of Acts I may be Septuagintal, for a “Biblical” effect). But whatever its *meaning*, the stylistic *difference* is confirmed by the BIRD test:

$$D (\text{Acts I/II}) = 0.58$$

compatible with same authorship, but not suggesting consecutive composition.

Also of interest are the “we” passages in Acts. Are they an incorporated source, or a sly hint that Luke himself was the companion of Paul, and was with him in Rome? This too is a matter that can be adjudicated by the BIRD test, with this result:

$$D (\text{Acts II minus “we” / the “we” passages}) = 0.45$$

It is here implied that Luke wrote these “we” passages himself.³² This does not tell us that Luke accompanied Paul, but it suggests that Luke invites that inference. Did he? We might turn to the spurious 2 Timothy, which includes what claims to be Paul’s final letter from his Roman captivity. That letter says clearly, “Luke alone is with me.” This becomes the next problem; one which is not within the scope of the present essay.

Homeric Greek Examples³³

Dolon (Iliad 10). It was suggested already in antiquity that the Doloneia, Iliad 10, was not originally part of the Iliad.³⁴ D values for it and its neighbors are as follows:

<i>Iliad</i>	9	10	11
9	~	1.17	1.02
10	1.17	~	0.83
11	1.02	0.83	~

in which the value $D = 1.17$ is fatal for same authorship. The ancients were right.

³¹Whoever wrote MZ 17, the earliest Mician text, was familiar with legal procedures. Is this plausible for the Mician founder, Mwò Dí? One story makes him a branded criminal; another makes him a high official. Both imply contact with legal procedures. Legal procedures require precision in language, and it is relevant that the Mician school also developed the art of logic.

³²For further detail, see Brooks **We**.

³³Based on the current critical text, and subject to change if interpolations are removed.

³⁴See the discussion in Hainsworth (Kirk 3/151-155).

The Embassy to Achilles in Iliad 9. At the beginning of Iliad 9, *three* envoys are sent to Achilles, but their progress is described by *dual* verbs, implying *two* envoys. This is perhaps the most famous of all Homeric problems. Here is all of Book 9:

Section	Subject	Words
9a. 1-88	Setting the Watch	624
9b. 89-181	Consultation of the Leaders	655
9c. 182-224	The Embassy and Its Reception	310
9d. 225-306	Speech of Odysseus	593
9e. 307-431	Achilles' Reply to Odysseus	923
9f. 432-605	Speech of Phoinix	1231
9g. 606-622	Achilles' Reply to Phoinix	136
9h. 623-642	Speech of Aias	143
9i.* 643-655	Achilles' Reply to Aias	87
9j. 656-713	Return of the Embassy	415

Iliad	9a	9b	9c	9d	9e	9f	9g	9h	9i*	9j
9a	~	0-39	0-93	0-58	0-55	0-62	0-77	0-67	0-76	0-69
9b	0-39	~	0-98	0-53	0-40	0-45	0-60	0-58	0-62	0-81
9c	0-93	0-98	~	1-15	1-24	1-07	0-58	0-79	0-87	0-54
9d	0-58	0-53	1-15	~	0-48	0-68	0-69	0-70	0-69	0-81
9e	0-55	0-40	1-24	0-48	~	0-56	0-75	0-60	0-61	0-84
9f	0-62	0-45	1-07	0-68	0-56	~	0-70	0-51	0-59	0-86
9g	0-77	0-60	0-58	0-69	0-75	0-70	~	0-52	0-70	0-62
9h	0-67	0-58	0-79	0-70	0-60	0-51	0-52	~	0-51	0-85
9i*	0-76	0-62	0-87	0-69	0-61	0-59	0-70	0-51	~	0-75
9j	0-69	0-81	0-54	0-81	0-84	0-86	0-62	0-85	0-75	~

One explanation of the dual-verbs anomaly is that Phoinix, one of the three envoys, is a late addition to the book. In the table above there lurks a subtle confirmation of that possibility. We will need to follow the entire plot to see it.

The introductory Setting of the Watch and the ensuing Consultation of the Leaders are stylistically consecutive (D = **0-39**): situation and outcome. So also are Odysseus' speech and Achilles' reply (D = **0-48**), despite the fact that much of Odysseus' speech simply repeats the terms of Agamemnon's offer, made in the Consultation section. Again a situation and outcome. Aias speaks third, and his speech and Achilles' reply are *almost* consecutive (D = 0-51). Then in the first speech, and possibly in the third, the author of Iliad 9 may have thought of a speech and its reply as another kind of situation-and-outcome; a composite unit rather than two entirely separate units.

It is then notable that the speech of Phoinix and its reply *do not show* such stylistic closeness; D = 0-70, consistent with same authorship, but not implying a closely consecutive relationship. *In Homeric terms, Phoinix' speech is stylistically anomalous.*

Is it also *narratively* anomalous? Is Phoinix himself anomalous, and did the original Embassy consist of only two envoys (Odysseus and Aias), as the famously problematic dual verbs would seem to require?

That question can perhaps be pursued one step further.

Odysseus (here assumed to be an original envoy) and Phoinix (here assumed to be a later added envoy) might also be compared by analyzing their speeches stylistically. Both appeal to Achilles to relent; both end by begging Achilles to accept the gifts offered by Agamemnon. One writer, composing these speeches at the same time, might be expected to construct them in a similar way. Here is the speech of Odysseus:

Section	Subject	Words
9d1. 225-251	Direct appeal for assistance	185
9d2.* 252-260	Imagines parental advice	71
9d3. 261-299	Offers gifts from Agamemnon	277
9d4.* 300-306	Final appeal	60

<i>Iliad</i>	9d1	9d2*	9d3	9d4*
9d1	~	0.76	0.81	0.64
9d2*	0.76	~	0.58	0.56
9d3	0.81	0.58	~	0.50
9d4*	0.64	0.56	0.50	~

Though the second and especially the final segment are too small for secure testing, as far as they go, the results suggest a speech on the now familiar forensic pattern, where the argument is assembled in the early sections, reaches a crux in which the final position is stated, and then proceeds smoothly from that point on.

Here, for comparison, is the speech of Phoinix, which, though much longer, has much the same internal arrangement, including a second section which appeals to parental authority (here, by giving Phoinix himself the status of a parent to Achilles) and a final appeal. We might reasonably expect a somewhat similar stylistic profile.

Section	Subject	Words
Id 9f1.* 434-445a	Reply to Achilles: He will not be left behind	84
Id 9f2. 445b-495	Autobiography: Claims parental status	356
Id 9f3. 496-523	Direct appeal to honor	215
Id 9f4. 524-599	Historical example: Meleagros	517
Id 9f5.* 699-605	Final appeal	45

<i>Iliad</i>	9f1*	9f2	9f3	9f4	9f5*
9f1*	~	0.72	0.73	0.64	0.71
9f2	0.72	~	0.87	0.61	0.62
9f3	0.73	0.87	~	0.53	0.78
9f4	0.64	0.61	0.53	~	0.87
9f5*	0.71	0.62	0.78	0.87	~

But we don't get it. Again, two of these segments are below the recommended minimum size, but as far as these and the others show, we have here a pattern notably different from that in the speech of Odysseus. There is no crux, and no conspicuous continuity at the end of the speech, or anywhere else within it.

Then the speech of Phoinix departs from the *Iliad* 9 norm, and Phoinix the envoy was probably a later addition to *Iliad* 9. If we should accept this hint from stylistics, then the "problem of the duals" has in fact been solved. There were only two envoys.

The Oral Iliad. Authorship is not what these or any D results give us. At most, they give us values compatible or incompatible with a hypothesis of same authorship. But there is one authorship theory for which D results *can* be decisive. This is the theory that the Iliad was improvised continuously by one poet on a single occasion.

If so, then successive Iliad books ought to show the kind of stylistic similarity that is associated with continuous narrative elsewhere. The Iliad 10 result, above, suggests that this is not the case. But that is unfair, since Iliad 10 has long been thought to be post-Iliadic, and there is reason to believe that Iliad 9 also is not in its original form. We should instead consider the whole Iliad. Here, in BIRD terms, is the whole Iliad:

<i>Iliad</i>	1	2	3	4	5	6	7	8	9	10	11	12
	4504	6018	3246	3814	6437	3746	3398	4019	5117	4156	6017	3296
1	~	0.84	0.99	0.64	0.69	0.88	1.04	0.66	0.71	0.55	0.99	0.76
2	0.84	~	0.63	0.55	0.86	0.85	0.97	1.04	0.83	0.80	0.94	0.77
3	0.99	0.63	~	0.65	0.89	0.61	0.59	0.66	0.69	1.02	0.88	0.70
4	0.64	0.55	0.65	~	0.70	0.88	0.66	0.71	0.75	0.78	0.64	0.69
5	0.69	0.86	0.89	0.70	~	0.95	0.69	0.57	1.03	0.65	0.61	0.84
6	0.88	0.85	0.61	0.88	0.95	~	0.57	0.73	0.68	0.66	1.02	0.72
7	1.04	0.97	0.59	0.66	0.69	0.57	~	0.74	0.88	0.93	0.69	0.87
8	0.66	1.94	0.66	0.71	0.57	0.73	0.74	~	0.69	0.83	0.71	0.97
9	0.71	0.83	0.69	0.75	1.03	0.68	0.88	0.69	~	1.17	1.02	0.88
10	0.55	0.80	1.02	0.78	0.65	0.66	0.93	0.83	1.17	~	0.83	0.63
11	0.99	0.94	0.88	0.64	0.61	1.02	0.69	0.71	1.02	0.83	~	0.94
12	0.76	0.77	0.70	0.69	0.84	0.72	0.87	0.97	0.88	0.63	0.94	~
13	0.72	0.78	0.96	0.72	0.69	0.69	0.87	0.85	0.97	0.56	0.82	0.60
14	0.79	1.02	0.85	0.96	0.62	0.69	0.62	0.72	0.78	0.85	0.81	0.88
15	0.90	0.76	0.66	0.49	0.69	0.65	0.45	0.77	0.77	0.82	0.54	0.74
16	1.25	1.02	0.77	0.88	0.74	0.71	0.64	0.87	1.04	0.88	0.52	0.86
17	0.71	0.98	0.73	0.73	0.88	0.83	0.96	0.67	0.92	0.77	1.05	0.55
18	1.09	0.83	0.86	0.75	0.63	0.92	0.71	0.88	0.99	0.97	0.48	1.05
19	0.61	1.03	0.75	0.78	0.86	0.43	0.76	0.55	0.58	0.75	0.85	0.99
20	0.58	0.95	0.82	0.71	0.62	0.62	0.57	0.60	0.81	0.66	0.90	0.85
21	0.87	0.98	0.87	0.75	0.68	0.70	0.56	0.95	0.99	0.68	0.84	0.65
22	0.71	0.93	0.54	0.75	0.84	0.63	0.83	0.57	0.67	0.81	0.99	0.69
23	0.88	1.13	1.06	0.70	0.58	0.82	0.68	0.80	1.17	0.59	0.55	0.78
24	0.58	0.91	0.77	0.76	0.92	0.59	0.84	0.71	0.69	0.70	0.89	0.56

The key is found on the diagonal: the results for books in consecutive order, where the continuous-improvisation model should be most in evidence. It is *not* in evidence. The only two consecutive books with a D value of **0.50** or less are Iliad 20 and 21. And these are not separate books, divided by a hero's exit in one and a rosy-fingered dawn in the next. They are a continuous narrative of Achilles' pursuit of Hector. Stylistically speaking, the continuous-improvisation model *does not fit the Iliad*.

The hypothesis must thus be given up. The figures suggest that the Iliad books are separate modules, whether written by one poet or by several in a poetic tradition.

So far the adjacent books. For seeming stylistic contact between nonadjacent books, we remember that when an author has another text in mind, that text may color his style; what we have called a “lookback.” The closeness of Iliad 17 (the death of Patroclus) and 22 (the death of Hector) may be an example. To the dying Hector, in 22:331 and 336, Achilles *refers* to Patroclus, and taunts Hector with the thought that he will be unburied, though “the Achaians will bury Patroclus.” At least in this case, we are probably not dealing with a false positive.

13	14	15	16	17	18	19	20	21	22	23	24	
5889	3722	5313	6078	5409	4415	3042	3572	4415	3778	6336	5973	
0.72	0.79	0.90	1.25	0.71	1.09	0.61	0.58	0.87	0.71	0.88	0.58	1
0.78	1.02	0.76	1.02	0.98	0.83	1.03	0.95	0.98	0.93	1.13	0.91	2
0.96	0.85	0.66	0.77	0.73	0.86	0.75	0.82	0.87	0.54	1.06	0.77	3
0.72	0.96	0.49	0.88	0.73	0.75	0.78	0.71	0.75	0.75	0.70	0.76	4
0.69	0.62	0.69	0.74	0.88	0.63	0.86	0.62	0.68	0.84	0.58	0.92	5
0.69	0.69	0.65	0.71	0.83	0.92	0.43	0.62	0.70	0.63	0.82	0.59	6
0.87	0.62	0.45	0.64	0.96	0.71	0.76	0.57	0.56	0.83	0.68	0.84	7
0.85	0.72	0.77	0.87	0.67	0.88	0.55	0.60	0.95	0.57	0.80	0.71	8
0.97	0.78	0.77	1.04	0.92	0.99	0.58	0.81	0.99	0.67	1.17	0.69	9
0.56	0.85	0.82	0.88	0.77	0.97	0.75	0.66	0.68	0.81	0.59	0.70	10
0.82	0.81	0.54	0.52	1.05	0.48	0.85	0.90	0.84	0.99	0.55	0.89	11
0.60	0.88	0.74	0.86	0.55	1.05	0.99	0.86	0.65	0.69	0.78	0.56	12
~	0.65	0.73	0.71	0.62	0.71	0.84	0.55	0.51	0.65	0.68	0.71	13
0.65	~	0.74	0.73	0.74	0.71	0.75	0.57	0.48	0.70	0.70	0.76	14
0.73	0.74	~	0.53	0.91	0.69	0.67	0.69	0.65	0.82	0.58	0.84	15
0.71	0.73	0.53	~	0.89	0.60	0.82	0.86	0.61	0.71	0.60	1.13	16
0.62	0.74	0.91	0.89	~	1.10	0.89	0.79	0.69	0.44	0.81	0.66	17
0.71	0.71	0.69	0.60	1.10	~	0.80	0.81	0.85	1.01	0.66	0.85	18
0.84	0.75	0.67	0.82	0.89	0.80	~	0.58	0.87	0.69	0.81	0.64	19
0.55	0.57	0.69	0.86	0.79	0.81	0.58	~	0.46	0.64	0.77	0.70	20
0.51	0.48	0.65	0.61	0.69	0.85	0.87	0.46	~	0.63	0.69	0.94	21
0.65	0.70	0.82	0.71	0.44	1.01	0.59	0.64	0.63	~	0.96	0.78	22
0.68	0.70	0.58	0.60	0.81	0.66	0.81	0.77	0.69	0.96	~	0.68	23
0.71	0.76	0.84	1.13	0.66	0.85	0.64	0.70	0.94	0.78	0.68	~	24

Other seemingly intelligible contacts are 6 and 19 (theme), or 14 and 21 (theme). But why should Iliad 15 resemble both 4 (single combat) and 7 (Hector and Helen)? And what’s up with 11 and 18? Such questions are perhaps best asked, not of the received text, but of one from which the major interpolations have been removed, and when individual segments, not whole Books, can be considered on their several merits.

That task lies beyond the limits of the present study.

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