Two Tough Nuts to Crack: Did Shakespeare Write the 'Shakespeare' Portions of *Sir Thomas More* and *Edward III*?

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Abstract

Using 'new-optics' stylometric measures of comparative Shakespeare discrepancy we calculate the odds that the 'Shakespeare' scenes in *STMO* and *Edw3* could have come by chance from a person of Shakespeare's writing habits. For *STMO*, if written in the 1600's, the 'Shakespeare' Hand D-plus verse portion is seven to 26 times less likely to be Shakespeare's than Shakespeare's own farthest-outlier baseline threshold block. Shakespeare authorship for it in the 1600's seems to us improbable but not impossible. In Hand D-plus were written in the 1590's, it would be ten times less probable, and not such a close call. The odds that Shakespeare could have written the entire play at any time are vanishingly low. In terms of Shakespeare discrepancy, we would say that Hand D-plus belongs more in the high Apocrypha than in the Canon.

Taken separately, four of the five 'Shakespeare' blocks of *Edw3* fall inside our Shakespeare ballpark. So does a sixth block, scenes 4.05 to 4.09. If we followed the consensus strictly, all five Shakespeare blocks, taken as a group, would not make a probable solo Shakespeare ascription. However, if we switched 4.04 to

'non-Shakespeare,' and 4.05-.09 to 'Shakespeare,' the revised Shakespeare blocks would be a plausible Shakespeare ascription even as a group, justifying the inclusion of *Edw3* in the Canon as partly Shakespeare's: 1.02; 2.01-02; and 4.05-.09. The odds that the 'non-Shakespeare' scenes, collectively, or individually (except for 4.05–4.09) could be his are vanishingly low.

1 Easy Cases and Hard

In Shakespeare's case, it is now clear that all those old reports of the Death of the Author were grossly exaggerated. It's still big news when a 'new' Shakespeare work gets added to the Canon. Sometimes it is even news when an old one gets subtracted. A number of major contributions to authorship studies have appeared in the last few years,[2] and some authorship controversies have generated enough heat to be called the Shakespeare Wars.[3] If *wars* is the right name for these disputes, they are rarely fought over the twenty-odd High Canon of Core Shakespeare plays, such as *Hamlet* or *Romeo and Juliet*, which no one doubts are Shakespeare's, nor over the 300-odd Non-Canon, Non-Apocrypha plays, such as *Volpone* or *Cupid's Whirligig*, which no one believes to be by Shakespeare.[4] Most of the disputes have addressed what we call the Shakespeare Fringe Plays. These are either plays from the Shakespeare Dubitanda, or Low Canon – that is, plays like *Titus Andronicus*, assigned to the Canon, but insecurely or dividedly – or from the Shakespeare Apocrypha – plays like *King Leir*, which some assign to the Canon but which haven't been generally accepted as Shakespeare's.

Drawing on Wells and Taylor's *William Shakespeare: A Textual Companion* (1986), we would further subdivide the Apocrypha between a High Apocrypha of plays they deemed still in contention for the Canon, and a Low Apocrypha, of all the others. By 1987 their High Apocrypha consisted of no more than three plays: four scenes from *Edward III*, perhaps the entire play, and possibly *Edmond Ironside* and *Arden of Faversham*. No other Apocrypha play seemed to them worthy of consideration as Shakespeare's, and we agree with them in rejecting all of the other Apocrypha. Unlike them, we would also reject *Edmond Ironside* and *Arden*

of Faversham (Table 2 below), though MacDonald Jackson has made a recent case that one scene of *Arden* could be Shakespeare's.[5] By our rules, none of the whole Apocrypha plays could be by Shakespeare solo, not even *Edward III*, which everyone, including Wells and Taylor, now places in the Canon, thanks to its four 'Shakespeare scenes.' Some or all of these scenes are close to Shakespeare could-be's by our rules, though not the whole play. If so, it's enough to make the rest of it Canon-eligible by association in the same way that Fletcher's parts of *Two Noble Kinsmen* are Shakespeare Low-Canon-eligible, not because Shakespeare wrote them, but because they are part of a play which Shakespeare could have co-authored. In principle this reassignment could empty our new box, the High Apocrypha, by moving two of its three plays down to the Low Apocrypha and one up to the Low Canon. We would retain the box, however, as a suitable place for the 'Shakespeare' portion of *Sir Thomas More*.

The changing fortunes of plays like *Edward III* and poems like the *Funerall Elegye by W.S.* are examples of how quickly a work can pass into the Canon and out again, even in an era supposedly beyond concern with authorship. Mindful of this boundary-crossing traffic, and cautious about using terms which implicitly assign a work to one side or the other, we regularly use the term *Shakespeare Fringes* to refer to plays or passages which could be either Low Canon or High Apocrypha. We also use the phrase *tough nuts to crack*, borrowed from MacDonald Jackson in connection with *Edward III*, to describe some of the most challenging and interesting works from the Fringes.[6]

This article was originally written for a 2005 *Shakespeare Yearbook* compendium on the Shakespeare Apocrypha. Along with a companion article by Marina Tarlinskaja on the same two plays, it was postponed to the next volume – but the next volume never came, owing to the untimely illness and death of the editor, Douglas Brooks. While alive, he gave us leave to look elsewhere; we have done so; and *Literary and Linguistic Computing* has undertaken to print it in two parts. For us, our *SYB* article also served as a pilot effort to apply our new-optics stylometric methods, which by then had been plentifully validated on what now, in

retrospect, turned out to be easy targets – that is, whole, single-authored plays or long, single-authored verse passages -- to harder ones – shorter passages from presumptively co-authored Fringe plays. Contrary to our usual practice of working our way from easy cases to hard, we started with what seemed the hardest and most interesting ones for the *SYB*, then spent the next few years working our way through the rest of the Fringes (less *Timon of Athens*), then returned to update our pilot in the light of further advances in our long, draft Fringes working paper, and to take account of the sudden, universal promotion of *Edward III* into the Canon and several new studies reaffirming the 'Shakespeare' portion of *Sir Thomas More*'s place in the Canon.

We see the elevation of the *Edward III* 'Shakespeare scenes' much more as a change of heart about old evidence than as a response to new evidence, but both we and Marina Tarlinskaja do have new, mostly confirmatory evidence on it after the fact. The recent articles on *Sir Thomas More* do contain interesting new evidence, much of it contrary to ours, plus a valuable, point-by-point rejoinder to our working paper by MacDonald Jackson. Now is a good time (1) to describe our new evidence, which is mostly favorable to the elevation of some (but not all) of *Edward III* to the Canon, but not so favorable to the *Sir Thomas More* passages; (2) to compare it with other new evidence, pro and con; and (3) to start thinking how evidentiary divergences might best be resolved.

Readers interested in a description of our new-optics methodologies may consult the 1996 final report of our Claremont Shakespeare Clinic[7] for a description of all the tests we used, and a long 2004 article in the *Tennessee Law Review* describing how we arrived at measures of composite Shakespeare discrepancy and evaluating our tests for reliability, replicability and accuracy in distinguishing between known Shakespeare and known non-Shakespeare.[8] The bottom line of these articles is that, for whole plays, and for long, single-authored passages, we claim very high accuracy rates, but lower ones for shorter passages, because longer ones average out more variability. Table 1 summarizes these rates.

Table 1. Accuracy of our new-optics tests on samples of various lengths

Text	Blocks Tested	Shakespeare	Non-Shakespeare
Whole plays, 15-30,000 words	79	100%	100%
Poems, 3,000 words	101	100%	100%
Play Verse, 3,000 words	120	95%	100%
Poems, 1,500 words	54	100%	100%
Play Verse, 1,500 words	183	96%	88%
Poems, 750 words	82	93%	71%
Play Verse, 750 words	146	97%	75%
Poems, 470 words	129	92%	73%

Table 1. Accuracy of composite Claremont new-optics tests on passages of various sizes by known authors. All figures Discrete; Continuous scores are similar (see text for definitions). Source: Elliott and Valenza 2004, p. 357. Group accuracy for 2007-08 Golden Ear Elite Panel, for 150-word verse passages: Shakespeare: 94-95%; non-Shakespeare: 89% (Section 5 below).

Table 1 illustrates several key features of our new-optics methodology. Its central task is measuring stylometric discrepancy, using internal evidence. It shows how sensitive our profiles are to sample size. Its asymmetry, with much higher accuracy for Shakespeare (i.e., its low rate of false negatives) than for non-Shakespeare, is intentional. We weigh negative evidence much more heavily than positive and need very wide profiles and low rates of false negatives to make it work.

2. The Apocrypha as Whole Plays: None Could be by Shakespeare Alone.

Table 2 shows the power of our new-optics tests in a different way. While all 29 of our core Shakespeare baseline plays clustered tightly into the same tiny statis-

tical ballpark, with two or fewer individual rejections each, all of the 25 Apocrypha Plays we tested were on different statistical planets or galaxies (and so were all 51 plays by Shakespeare 'claimants' like Marlowe, Jonson, Middleton, and Fletcher). None had fewer than seven rejections. In almost every case, the discrepancy was so great that the probability of common authorship is far lower than the probability of winning the Irish Sweepstakes or getting struck by lightning. In our view, this more than justifies Wells and Taylor's dismissal of most of the Apocrypha plays as noncontenders for a solo Shakespeare ascription. We would dismiss them all as single-authored Shakespeare. We had something like Table 2 in mind when we bet an insistent, numeroskeptical critic a thousand dollars that he could not find *any* whole play by *any* other author than Shakespeare that would fit within our core-Shakespeare profile. The offer remains open to all and has been raised to a thousand pounds (at the time worth about $2,000) to encourage non-frivolous responses, while discouraging frivolous ones.[9] Our critic wisely declined on the spot, and no one else has taken us up. More important than whether or not we (or others) think we can win the bet – and distinguishing us from most other authorship scholars on offer today – is the bare fact than our standards of comparison are well enough defined that a neutral observer could easily tell who won, who lost, and by how much.

Table 2 tells us, in brief, that, though *Sir Thomas More* and *Leir*, with seven and eight Shakespeare rejections respectively, are closer to Shakespeare than *Locrine* and *The Second Maiden's Tragedy*, with 22 rejections each, no whole play anywhere in the Apocrypha is close enough to our Shakespeare core to pass muster as a plausible, single-authored Shakespeare work. It tells us that in three ways. The first, the simple rejections count in Column Three of Table 2, reflects the state of our art in 1994. Core Shakespeare had two or fewer rejections per play; all the Apocrypha had seven or more; and sole Shakespeare authorship of any Apocrypha play seemed extremely improbable, though we could not rule out his partial authorship. The second two ways, which we introduced in 2004, are registered in the last two columns: Discrete and Continuous Probabilities. Both

permit a more sophisticated comparison of the tested plays with the least-probable of Core Shakespeare plays by the tests we used. 'Discrete' asked, in effect, 'what are the composite odds that Shakespeare, at his normal rejection rates, could have produced the number of rejections observed?' 'Continuous' asked, in effect, 'What are the composite odds that the tested play would score as far from Shakespeare's mean, in standard deviations, as it did on each of the 48 tests used?' This is a truncated, non-technical summary for people who are more at home with letters than with numbers. A more detailed, eight-page version, with technical language suitable for numerate people, may be found in our 2004, pp. 348–58.[10]

Table 2. 25 Shakespeare Apocrypha Plays Ranked by Shakespeare Rejections

Play	Short Title	Discrete Rejections	Discrete Composite Probability	Continuous Composite Probability
Shakespeare thresholds		*2	**2.316E-01	**3.6895E-03
Sir Thomas More	STMO	7	3.323E-05	<1.0000E-15
Leir	LEIR	8	3.252E-06	<1.0000E-15
Arden of Faversham	ARDN	10	2.072E-08	5.3160E-14
Double Falsehood	FALS	11	1.376E-09	<1.0000E-15
Mucedorus	MUCE	11	1.376E-09	<1.0000E-15
Sir John Oldcastle	OLDC	11	1.376E-09	4.8620E-10
The Birth of Merlin	MERL	11	1.376E-09	<1.0000E-15
The Merry Devil of Edmonton	DEVL	11	1.376E-09	<1.0000E-15
Ironside	IRON	12	8.165E-11	<1.0000E-15
Edward III	EDW3	13	4.355E-12	2.6390E-12
Thomas Lord Cromwell	CROM	13	4.355E-12	3.3650E-11
A Yorkshire Tragedy	YKSH	14	2.092E-13	<1.0000E-15
Contention of York, Part 1	YRK1	14	2.092E-13	3.0600E-10
King John, Part 1	KJN1	14	2.092E-13	2.0630E-11
Richard III	RCD3	15	8.438E-15	<1.0000E-15
Taming of a Shrew	TOAS	15	8.438E-15	<1.0000E-15
Famous Victories of Henry V	FVH5	16	<1.000E-15	<1.0000E-15
King John, Part 2	KJN2	16	<1.000E-15	1.5040E-09
The London Prodigal	PROD	16	<1.000E-15	<1.0000E-15
Contention of York, Part 2	YRK2	17	<1.000E-15	<1.0000E-15

The Puritan	PURN	19	<1.000E-15	<1.0000E-15
Woodstock	WOOD	20	<1.000E-15	<1.0000E-15
Faire Em	FAIR	22	<1.000E-15	<1.0000E-15
Locrine	LOCR	22	<1.000E-15	<1.0000E-15
The Second Maiden's Tragedy	MAID	22	<1.000E-15	<1.0000E-15

Table 2. Of 25 plays in the Shakespeare Apocrypha, ranked by increasing discrepancy from Shakespeare, none has fewer than seven Discrete rejections in 48 individual tests. No Apocrypha play comes close to fitting within core Shakespeare profiles by any of the three composite-probability tests used (the three right hand columns). The probability of single Shakespeare authorship seems extremely low for all Apocrypha plays tested. Source: Elliott and Valenza, 2004, Appendix One. * = Shakespeare maximum; ** = Shakespeare minimum.

The new numbers, though they come from different starting points and travel very different analytical paths, one much more reliant on human judgment than the other, have turned out to be remarkably convergent and consistent with each other, and with the old evidence, and remarkably free from glaring inconsistencies with external, documentary evidence. They both say essentially the same thing as the old, but more precisely: that the odds of common authorship with Shakespeare are vanishingly low -- so low that we had to use scientific notation to avoid getting lost in the zeroes after the decimal point. In terms of Discrete probability, *Sir Thomas More*, taken as a whole, is about 7,000 times less likely to have come by chance from Shakespeare's pen than the farthest outlier of core Shakespeare, that is, any of the seven of Shakespeare's 29 core plays that got two Discrete rejections. In terms of continuous probability, STMO is 3.7 trillion times less likely than Shakespeare's outlier.[11]

Though we played a small part in the Shakespeare Wars and thereby endured years of persistent and intense assault from a few of our critics, no one has successfully challenged these figures, nor taken us up on our bet. We now consider our evidence the stronger for having survived highly adversary scrutiny.

2. Co-Authored Plays from the Shakespeare Fringe

On the other hand, eliminating Shakespeare as a single author of the Apocrypha, does not necessarily eliminate him as a co-author. When we pushed our analysis to shorter and shorter passages and still got usably high accuracy levels (Table 1), the inviting next step was to look at passages from the Shakespeare Fringes. This we did, fully expecting that our optics would be weaker, and the conclusive rejections by astronomical odds much more rare, since the passages were shorter, and single-authorship of any given passage much less assured and much less clearly demarcated. We were not expecting to place thousand-pound bets on our findings. Would our tests even work at all on passages so far from their sweet spot?

Having now tried them on all the Fringe plays but *Timon*, and on some artificial hybrids of plays by Shakespeare, Fletcher, and Peele [for example, a combination of every text block from Shakespeare's *Richard III* and from Peele's *David and Bethsabe*], we believe they are accurate enough to make clear that no such plays were entirely Shakespeare's, to confirm some theories of dates and disprove others, to yield a clearer, more fine-tuned, block-by-block analysis of Shakespeare discrepancy than was previously available, and to provide a kind of second-opinion on the consensus ascriptions of the various plays. In all, we tested 137 blocks with settled expectations, 57 from hybrids with known authors, 80 with consensus ascriptions. All of these blocks but one, the Hand D-plus passages from *Sir Thomas More*, were in the 1,500-word range, long enough for us to expect 96% accuracy with passages by Shakespeare, 88% with non-Shakespeare, from baseline (Table 1). In every case, we calculated Shakespeare discrepancy for each block, ranked all the blocks in ascending order of discrepancy, and then examined them to see whether the actual or ascribed Shakespeare blocks would float to the top, and the non-Shakespeare to the bottom.[12]

The known-authorship hybrids and half of the consensus blocks, that, is, the ones from late plays with known co-authors: *Pericles, Two Noble Kinsmen*, and *Henry VIII,* turned out to be surprisingly easy. Of 96 such ranked blocks, all the Shakespeare blocks floated to the top, all the non-Shakespeare to the bottom. It is

true that two of the known Shakespeare blocks[13] were close-call false negatives by our rules -- in the Shakespeare neighborhood, but not in the ballpark – but that is actually a bit better than we would have expected from baseline, and, again, neither of them overlapped with any non-Shakespeare block. The presence of a few borderline Shakespeare blocks like these in our baseline leaves room to argue that moderately discrepant passages like Hand D-plus are not unknown in Shakespeare and therefore possibly, if not probably his, but the space is cramped. The other 98% of the blocks showed surprisingly high convergence between our three composite measures of Shakespeare discrepancy (Discrete, Continuous, and raw rejections) with each other and with the old-optics consensus.

The remaining 41 consensus blocks were harder calls. They were mostly from early plays, often with unknown or uncertain co-authors and a weaker consensus as to who wrote what: *Edward III, Sir Thomas More, Henry VI, Part I,* and *Titus Andronicus*. Our discrepancy rankings were still largely consistent with each other, but only 34 of them (83%) converged with the old-optics consensus, leaving us, and perhaps also the old-optics authorities, a residue of Tough Nuts to Crack, where everyone has to guess how to weigh one set of evidence against another (see Note 6 for our list of the residual blocks we consider most in need of closer scrutiny). Our initial inclination, in making such judgments, was to suppose that we, not the consensus, should bear the burden of proof, and to give quality-matched negative evidence much greater weight than positive, regardless of whether it is new-optics or old (Sections 7 and 8 below).

4. *Sir Thomas More's* and *Edward III*'s Conventional Ascriptions

We now return to our initial subset of Tough Nuts, the 'Shakespeare' parts of *Sir Thomas More* and *Edward III*, and we present our results here for the first time in print. These two subsets are commonly and conveniently (though not quite accurately) referred to as the 'Hand D' scene of *Sir Thomas More* and the 'Countess' scenes of *Edward III*. We shall call them 'Hand D-plus' or 'Countess-plus' or 'Shakespeare' scenes (in quotes) here to try to keep cumbrousness and confusion

to a minimum.[14] Almost all of the *Edward III* scenes are in verse. Much of the *Sir Thomas More* scene is in prose, but our focus of comparison is overwhelmingly on the verse part, and we so indicate with names like 'Hand D-plus Verse.' Both 'Shakespeare' selections look to us (as *Edward III* looked to MacDonald Jackson) like 'tough nuts to crack,' more than sufficiently challenging, suitable in principle for our kind of analysis, and less firmly settled otherwise than many of the others, either by conventional scholarship or by our whole-play findings.

Hand D of *STMO* vaulted into the Shakespeare Dubitanda in 1871, when Richard Simpson thought its handwriting looked like Shakespeare's.[15] 'Most of the great paleographers of the twentieth century have concurred.'[16] In recent memory, two skeptics have supposed that John Webster was the author of Hand D-plus,[17] and some very distinguished scholars have doubted it was Shakespeare, but have not argued for an alternative author.[18] But we believe, following Wells and Taylor,[19] and recent reaffirmations by our favorite authorities,[20] that most scholars would rate it Low Canon or better—less Canonical than *Hamlet*, perhaps, but more accepted than, say, the other-authored sections of *Pericles*, *Titus Andronicus*, *Timon of Athens*, *Henry VI, Part I*, or *Henry VIII*.

Edward III has had an even longer sojourn than *Sir Thomas More* in the no-man's land between clear Shakespeare and clear non-Shakespeare. Catalogers Rogers and Ley first ascribed it to Shakespeare—along with Marlowe's *Edward II*—in a 'wholly unreliable' playlist published in 1656.[21] Edward Capell made the first serious Shakespeare ascription in 1760; and many others of note, including Tennyson, A.W. Ward, Alfred Hart, Kenneth Muir, Fred Lapides, Eric Sams, Georgio Melchiori, Brian Vickers, Stanley Wells, Gary Taylor, and G. Blakemore Evans, have concluded that at least part of *Edward III* is Shakespeare's. Sams and Lapides thought it was entirely Shakespeare's. Wells and Taylor did not exclude that possibility in 1986, when they assigned it to the High Apocrypha; it's not clear what they thought when they and everyone else elevated it to the Low Canon.

The challenge of cracking these two 'tough nuts' has elicited impressive displays of ingenuity, learning and technique from old-optics Shakespeare regulars, deploying external evidence—documents, quartos, theater records, fair and foul papers, watermarks, and such—and internal evidence—imagery, parallels, vocabulary, verse tests, handwriting, and such.[22] We would not presume to join in this conventional, external-evidence controversy, other than to note that all of it, like our own, is inferential. Instead, we shall present stylometric evidence that the *Edw3* sections, with a bit of tweaking, seem like a could-be for the Canon, but for us the *STMO* Hand D-plus's claim remains problematic.

5. Was Hand D of *Sir Thomas More* Written by Shakespeare? In 1593?

Let us start with the 832 words of verse from the 'Shakespeare' scene of *STMO*.[23] Appendix One gives the score ranges of 90 Shakespeare play verse blocks of about 750 words each. Only ten tests give us good mass discrimination between Shakespeare and non-Shakespeare at this level, and only three of our 90 Shakespeare baseline verse blocks have even two Discrete rejections in ten such tests. This amounts to an acceptably-low 3% Discrete false-negative rate for our Shakespeare baseline.[24] This is less reliable than the results we get for whole plays, or even for 3,000-word verse blocks, but it is enough to give us a rough estimate of the odds that Shakespeare could have written at least the verse portion of Hand D-plus.

A streamlined version of Appendix One, trimmed of non-rejections and concentrating on rejections only, appears below as Table 3.

The first thing to note about both Table 3 and Appendix One, from which it is drawn, is that there are many fewer tests available for 750-word samples than for whole plays, only ten instead of 48, and that, for Discrete analysis, only five of these are interesting, because only five could justify a Shakespeare rejection. The second thing to note, very much a function of the first, is that the composite probabilities at issue are not so astronomically low that you have to write them with scientific notation. Smaller samples generally mean more variance, wider Shakes-

peare profiles, fewer usable tests, and fewer of the astronomical, scientific-notated improbabilities that have made us feel safe offering our thousand-pound wager for whole plays (Tables 1 and 2). This is especially so where we have just one very short sample to compare with baseline. All these factors help explain why we think that Shakespeare authorship for Hand D-plus Verse is a tough nut to crack—that is, we think it is less probable than not, but not impossible—while sole Shakespeare authorship for *Sir Thomas More*, as a whole, seems to us neither plausible nor a difficult question to answer (Table 3).

Table 3. Five Shakespeare Tests on *STMO*, 'Shakespeare scene'

Sh. 750-wd range (auto)	GRL	HCW /20K	Fem. End % auto	Open Line % auto	BoB5	Max Rej's Total	Discrete Prob.	Cont. Prob.
Consolidated ranges	3-10	26-236	3-28	6-51	63-712	1		
To 1600			3-23	6-32		1		
From 1600			12-28	12-51		1		
Sh. threshold block	9	51	17	18	469	1	0.3352	0.1172
Hand D+, to 1600	13	24	13	45	765	3	0.0045	0.0045
Hand D+, 1600+	13	24	13	45	765	2	0.0478	0.0045
Sh. Ranges, manual								
To 1600			3-20	6-32				
From 1600			15-38	12-51				
Hand D+, to 1600	13	24	26	33	765	4	0.0003	0.0025
Hand D+, 1600+	13	24	26	33	765	2	0.0478	0.0025

Table 3. 'Shakespeare' verse from *Sir Thomas More* and one Shakespeare 'threshold block' compared to four Shakespeare 750-word verse profiles: early, late, and with both machine and manual counts of feminine endings. Shakespeare's 'threshold block,' R2vs750-7, has only one rejection (not shown). Hand D-plus, if written before 1600, would get three or four re-

jections (shaded), depending on whether the comparison uses manual or machine counts of feminine endings. If written after 1600, it would get two rejections by either count. Source: Appendix One. Hyphenated compound words (HCW, lighter shade) are considered a technical rejection only, and are not counted as a rejection in any of our composite numbers.

Nevertheless, the third lesson we may draw from Table 3 is that the verse part of Hand D-plus, about 850 words, still gets two to four Shakespeare rejections in our ten tests, depending on when it was written and whether we used manual or machine counts for feminine endings. This is more rejections than one would expect from our Shakespeare baseline of ninety 750-word play-verse blocks. These average less than half a rejection per block and include only three blocks (3%) with even two rejections. Hand D-plus Verse's grade-level is far too high for Shakespeare. Its hyphenated compound word percentage is a trifle too low, and needs to be mentioned as a technical rejection, but not to be counted as a real one for reasons explained below. Its open-line percentage, even after correction for possible *Riverside* underpunctuation, is too high for Shakespeare in 1593 (though not too high for 1603). Its BoB5 score is too high for Shakespeare at any time.[25]

These first-impression numbers make it look doubtful, though not impossible, that Shakespeare could have written Hand D-plus Verse, and especially doubtful that he could have written it in 1593, as some have supposed. By Continuous analysis, the composite odds of Shakespeare authorship of Hand D-plus Verse are twenty-six times lower than those for his own 'threshold block,' the least typical in-profile Shakespeare block (in this case Verse Block Seven from *Richard II*, 1.04.01–2.01.39, verse only).[26] By Discrete analysis, the raw composite probability of Shakespeare authorship depends on how many rejections we observed, which, in turn, depends on whether we compared the passage to a pre-1600 Shakespeare baseline or to a post-1600 one, and whether we machine-counted or hand-counted feminine endings.[27] Table 3 and Appendix One give all four variants, with three or four rejections for Hand D-plus Verse if compared with

Shakespeare's 1590's profiles, but only two if compared with his 1600's profiles. Four rejections in ten tests, at Shakespeare's observed 4% rejection rate for 750-word verse blocks, mean that the passage is 1,200 times less likely to have come from Shakespeare by chance than the threshold block. Three rejections means it is 75 times less likely to be Shakespeare's (see Appendix One). Neither seems to us particularly favorable for a Shakespeare ascription, though they don't quite say it is impossible. Two rejections would mean about seven times less likely than the threshold block, a close call, but one that still, on balance, argues against a Shakespeare ascription.[28] Roughly speaking, at this level, each additional rejection reduces relative Shakespeare probability by one order of magnitude.

We believe that these figures argue strongly against the theory that Hand D-Plus was written in 1592–93, when everyone thinks the original *Sir Thomas More* was first submitted to Sir Edmund Tilney, Master of the Revels. Tilney called for drastic excisions, and the play appears to have been shelved for many years. Hand D-plus Verse's line-ending counts are too high for early Shakespeare, making the early-dating theory, in our view, an order or two of magnitude less likely than the theory that it was written around 1603 in an attempt to revive an old, unperformed play. Correcting for manual feminine-endings counts, as we have seen from Table 3, only makes this problem worse. One could argue that open lines could be more a reflection of the editor's tastes than of the author's, but the rejection persists even after re-editing for possible *Riverside* underpunctuation. We conclude that Shakespeare authorship of Hand D-plus Verse after 1600 is an order or two of magnitude more credible than before 1600.

What about the remaining three rejections, Hand D-plus Verse's too-high grade-level scores, its just-too-low hyphenated compound word (HCW) percentage, and its slightly too-high BoB5 score, which match neither early nor late Shakespeare? One of these we dropped immediately, the low HCW percentage. It is technically a rejection by our rules, but our HCW standard was already loose at this sample-length level and the violation of it was an accident of Hand D-plus Verse, at 832 words, being slightly oversize and coming out with marginally few-

er HCW's per 20,000 words than our baseline 750-word samples which, like Hand D-plus Verse, had just one HCW. When we rechecked, we found that 29% of our 90 baseline Shakespeare 750-word play-verse blocks had no more than one HCW.[29] 29% of a population is hardly atypical in the way that zero percent or one percent or five percent might be, and, hence, the nominal rejection does not provide a strong foundation for an argument that the odds that that sample belongs to the population are low. Therefore, we decided that the low-looking HCW score was not a real Shakespeare distinguisher, and we have not counted it as a meaningful rejection.

However, the other two rejections fall into the zero- or one-percent brackets and still seem to us a real problem, even after a bit of deflation by MacDonald Jackson, who has always been among the most prompt and discerning of our critics (below). Only one of our 90 play-verse blocks has a grade-level score higher than the 12th-grade observed for Hand D-plus Verse; the next-highest are three 11th-grade blocks. And, again, it seems unlikely that the difference could be the editor, since both our Hand D-plus sample and our Shakespeare baseline are taken from the *Riverside Shakespeare*.[30] Could there be some other reason that Shakespeare would wander a full standard deviation outside his normal play-verse range of third-to-tenth grade and lengthen his words and sentences to a level often found in his poems (eighth-to-sixteenth grade) but almost never in his play verse? Jackson suggests textual disturbances preserved too faithfully in the *Riverside* may have inflated the grade-level score, and it could be so, but every other version we have tested is even worse, so it is not obviously so. No other plausible explanation has occurred to us, but it is possible that others more wedded to the Shakespeare ascription could think one up. What the rejection means, at bottom, is that grade-level is still a significant prima facie obstacle to a Shakespeare ascription, and seems likely to remain so unless defenders of the ascription can think up more convincing ways to explain it away.

As for the other strong rejection, BoB5, none of our 90 Shakespeare play-verse blocks, nor any of our 54 Shakespeare 750-word poem blocks, has a BoB5

reading as high as Hand D-plus Verse's 765. The nearest Shakespeare play-verse block approach is one block with a 712, and four blocks in the 600's.[31] Only three 750-word verse blocks of 84 in our entire non-Shakespeare collection have higher, less Middletonian, more old-fashioned scores than Hand D-plus Verse. Two of these are from George Peele's *David and Bethsabe* (1594), and one is from John Ford's *Fame's Memorial* (1606). Could it have something to do with subject matter that would produce such a surfeit of Shakespeare's favorite-word 'badges' and such a deficit of Middleton's favorite-word 'flukes?' Again, we see no obvious explanation for the decisive Shakespeare rejection, but, of course, that does not mean that there is none. We do believe, as with grade level, that the rejection is too glaring for defenders of the Shakespeare ascription to ignore. The starting point for a critique might be a look at the description of the test, in note 25, and perhaps also a look at a few of the highest-scoring baseline blocks.[32] Do they have anything in common?

It is worth noting that BoB5 contrasts Shakespeare's distinctive, favorite-word 'badges' with Middleton's distinctive, favorite-word 'flukes,' and that Middleton's language was generally more modern and filled with contractions and colloquialisms than Shakespeare's. Could the radically non-Middletonian language of Hand D-plus Verse be whispering '1590's' of the same passage whose many open lines and feminine endings scream '1600's?' We doubt it. It was Hand D's relative frequency of contractions and later usages that led MacDonald Jackson to assign it to the seventeenth century.[33] Could it be a matter of subject matter, such as the presumptively all-male cast of the Hand D mob scene? Hand D-plus Verse has a dozen *he* variants, *he*, *his*, and *him*, but no *she* variants, *she* or *her*. All the former are Shakespeare badges relative to Middleton; the latter are flukes. You would think it could throw off the test—but a crude test of the first five Shakespeare blocks we could find with many *he* variants and no *she* variants (*Ant*750-8; *Lr*750-6; *R2*750-15, 16, and 19) says the problem is not crippling. None of these *he*-loaded passages had fewer than twelve *he* variants nor any *she* variants, yet their BoB5 scores were all in the 300's, well within our Shakespeare profile, and

not in the 700's like Hand D-plus Verse. The reason we bundled badges and flukes was to smooth out such variances in individual word frequencies by aggregating the badges and flukes into sizeable bundles and letting the law of large numbers average out the ripples to help us get a better view of the tides. In this case, it seems to have worked.[34]

BoB5 does show differences between playwrights. For whole plays, Shakespeare's average BoB5 score was 298, lower than older writers Greene (346) or Marlowe (365), but two or three times higher than younger writers such as Fletcher (112) or Middleton himself (109).[35] If there were only two claimant authors for Hand D-plus Verse, Shakespeare and Middleton, its improbably high BoB5 score would be a resounding rejection for Middleton and a 'hyper-rejection' for Shakespeare, 'more Shakespeare than Shakespeare,' and, hence, much more damaging to the case for Middleton than to the case for Shakespeare.[36] Unfortunately, the alternative in this case is not a known Middleton but an unknown 'other-than-Shakespeare,' and the gross departure from Shakespeare's norms, unless somehow plausibly explained, remains damaging to his case.

The problems discussed here, of 'narrow,' 'technical,' and 'gross' rejections, and 'hyper-rejections,' are problems typical of Discrete analysis, Elliott's favorite. They are not problems at all for Valenza's favorite, Continuous analysis. Instead of counting only the tests where the sample score was outside the boundaries of our Shakespeare profile, Continuous analysis aggregates the sample text's composite of statistical *distances* from Shakespeare's composite mean on every test, and compares it with those of Shakespeare's threshold block.[37] *Distances* from the baseline composite mean, not profile *boundaries*, are the issue. Every test is considered; little information is left out, and the task of figuring out what discrepancies have to be explained becomes a bit more quantitative and a bit less qualitative.[38] As we have seen, Continuous analysis, which in our case does not adjust profiles by time and, hence, misses the glaring line-ending rejections against 1590's profiles, nevertheless says that Hand D-plus Verse is 26 times less likely to be Shakespeare's than Shakespeare's own profile-threshold block.

Our bottom-line estimate for Hand D-plus: If it was written in 1603, and its discrepancies are not otherwise explained away, the verse portion of it is seven to 26 times less likely to be Shakespeare's than Shakespeare's farthest-outlier threshold block. If it was written in 1593 and its discrepancies are not explained away, the verse portion of it is 75 to 1200 times less likely to be Shakespeare's than Shakespeare's threshold block. If this is so, prima facie, of the easy-to-test verse portion, we would expect it to be true also of the harder-to-test prose portion, entered in the same addition in the same hand, to all appearances at the same time.

These numbers say that Hand D is a harder call than, say, the whole of *Sir Thomas More* or the *Funeral Elegy*, both of which are statistically on different planets from Shakespeare, while Hand D, under various assumptions, could be in the same town, county or state. But being in the same town, county, or state is not the same as being in the same ballpark with 97% of our pertinent Shakespeare play-verse baseline blocks, if Hand D were written in 1603. No pre-1600 Shakespeare block in our baseline is as Shakespeare-discrepant as Hand D. The available odds still weigh against it under 1603 Shakespeare profiles, and strongly against it under 1593 Shakespeare profiles.[39]

Another way of understanding these odds is this: Shakespeare at his fastest could turn out two plays a year, which means about one block per week the size of Hand D-plus Verse. Only three percent of our ninety baseline Shakespeare 750-word play verse blocks have Discrete probabilities as low as Hand D-plus Verse/1600s. Only four percent have such a low Continuous probability. Only two percent have both Discrete and Continuous probabilities as low as Hand D-plus Verse/1600's. That means Shakespeare, at his best, would have had to write for an entire year to produce one block as different from the rest as Hand D-plus Verse/1600's—along with 51 other, more typical blocks. Not a single block in our baseline is as atypical of Shakespeare's 1590's writing style as Hand D-plus Verse/1590s. It could have taken him a lifetime or more to have written a block so much at odds with his 1590's habits.

That said, we should caution that we are not betting a thousand pounds on this one for several reasons: it's a much closer call than whole plays; we don't have the comforting, astronomical safety margins; we haven't heard the rest of our critics' qualitative rejoinders (if any) to our evidence; and the quantitative case is a close enough call that convincing qualitative responses could make a difference. If this is so, subjective judgment could then be the deciding factor, and, unlike our bet on finding a whole play that passes our Shakespeare tests, there might well be no objective way to tell who won or lost the bet. On the other hand, suppose that this were a quiz show, that the quizmaster had perfect knowledge of who wrote the passage and when, and we had to choose between Shakespeare and non-Shakespeare. On present evidence, we would have to bet on non-Shakespeare because the passage is too atypical of Shakespeare's verse in the 1600's, and far too atypical of Shakespeare's verse in the 1590's, and none of the atypicalities have been explained away. Till they are, we think that, on the numbers, the 'Shakespeare scene' of *Sir Thomas More* belongs more toward the top of the Apocrypha than the bottom of the Canon.

How does this conclusion compare with those of other recent examinations of Hand D-plus? It is substantially at odds with those of three of our favorite authorship experts and mentors, two of whom were not simply recapitulating the traditional arguments, but applying important new methods of their own. The first and most famous is Sir Brian Vickers, using mostly traditional arguments.[40] The second, and least famous, but also one with the most intriguing new methods never before applied to Hand D-plus, is Marina Tarlinskaja. She wrote two articles for the same *Shakespeare Yearbook* volume on the Apocrypha as that for which we wrote our pilot version of this article. Like our pilot article, one of these was accepted but postponed for technical reasons, and neither has been published. But she did send us working-paper drafts too pertinent to our work to escape mention here. The first manuscript, 'Munday, Chettle, Shakespeare, and More,' is the more detailed and relevant. In it, after 55 pages of detailed versometric analysis of plays by Munday and Chettle, and of other sections of STMO, she

applied eight verse tests to Hand D-plus Verse: percentage of *rhymed lines*, *run-on lines*, and *feminine endings*; *word boundaries*, *syntactic breaks*, *stressing*, *enclitic phrases*, and '*rhythmical italics*.'[41] Most of her tests seemed to rule out Munday and Chettle as arguable authors of Hand D-plus. They also ruled out early Shakespeare, but not Shakespeare as of about the time of *Othello* and *King Lear*, that is, 1603-06. If she found a Shakespeare rejection for Hand D-plus, it would have been the percentage of *word boundaries* after position 4, which she considered too high for Shakespeare, but this might be explainable, she thinks, by Hand D-plus's being an oratorical soliloquy[42] We think she has made a persuasive case that Hand D-plus is more like later Shakespeare than like earlier Shakespeare, or like Munday or Chettle, and her evidence on these points is consistent with ours and with MacDonald Jackson's. But the many resemblances are only half the case that Shakespeare must actually have written Hand D around 1603. The other half is dealing with contrary evidence, and that, so far, has been more thoroughly addressed by MacDonald Jackson than by anyone else.

As we have seen, Jackson offered both a new affirmative case for Hand D plus as Shakespeare's, using both traditional evidence and LION links, and a probing set of direct rejoinders to our negative evidence.[43] We thought his LION-link evidence was a significant contribution to the case for the affirmative, giving his 'unique quirks' arguments more than just rhetorical support, and at least two of his rejoinder-discounts seemed plausible enough to call for further testing on our part -- but not enough, after the further testing, to adjust Hand D-plus into Shakespeare's normal range.[44] His clincher was a Bayesian argument that one-factor probability estimates can mislead where two factors are involved. The principle he invokes is true. If we knew that the test for West Nile disease is 96.7% accurate, but also that 99.9% of the population doesn't have the disease, the actual odds that someone who tests positive has the disease are not 96.7%, but 2.2%. It would also be true that, even if someone's test is 96.7% accurate in accepting known Shakespeare, getting a rejection on it doesn't mean that Hand D-plus has only a 3.3% chance of being Shakespeare's, if independent evidence makes it oth-

erwise 99.9% certain that it is Shakespeare. In that case, just as with West Nile, there would be only a 2.2% chance that it is not Shakespeare!

The problem with this is the supposed 99.9% Shakespeare certainty, independently arrived at with 'rigor, but also flair, common sense, an acute intuition, a fair dose of expertise, and a refined imagination'[45] – i.e., pulled from an illustrious mentor's proprietary black box. We have no objection to black boxes if they are validated; and Jackson's intuition, from our perspective, has to be one of the best in the world, since it is in 99.9% overall agreement with our own not-so-intuitive, massively validated, new-optics evidence. But the three exceptions are big ones; this is one of them;[46] and we think in this case that the affirmative evidence is still too soft, and the negative too strong, to support such a high level of assurance.

Against our mentors' unanimous opinion, besides our own evidence, must be set that of some major scholarly skeptics,[47] plus another recent, small-baseline, black-box indicator which looks very powerful at first glance, but is so new that no one knows quite how to weigh it: the collective intuition of our 23-member Shakespeare Golden Ear Elite Panel. These sharp-eared intuitives are hardly as famous as our mentors, but they were the highest scorers of 310 tested on our online Golden Ear tests in 2007-08; their group accuracy with texts of known authorship is well-documented and remarkably high, 90%, and three-quarters of them (not including the few who recognized it) thought that a sonnet-length snippet of Hand D-plus did not sound like Shakespeare.[48]

So how does our evidence weigh against that of our mentors and the current consensus? A short answer is that it is consistent on everything but the central question of whether Shakespeare could have written Hand D at any time. Like Jackson, Tarlinskaja, and the rest, we see no way that Shakespeare could have written the whole of *Sir Thomas More*, and no very plausible way he could have written the Hand D-plus section in 1593. We depart from the consensus in doubting that Shakespeare is a likely author of Hand D-plus even after 1600. Our problem is that we have found too much discrepancy to support a likely Shakes-

peare ascription and, though Jackson has plausibly explained away some of the discrepancy, we don't think that he has gotten it all.

Hand D-plus does bear many soft strands of resemblances to Shakespeare, so many that scholars have supposed that their sheer numbers, in convergence, are enough to harden them.[49] Jackson and Tarlinksaja added yet more such strands. So do we, for that matter, since more of our tests accept Hand D-plus as a Shakespeare *could-be* than reject it. But for us a jigger of hard *couldn't-be*'s is enough to outweigh a gallon of soft *could-be*'s. It is one thing to suppose that convergence hardens all those many strands of soft evidence when they all actually converge. It is another to consider them hardened when there is not-so-soft evidence which does not converge. Six to eight of our own ten tests 'converged' in putting Hand D-plus into Shakespeare's range, but the last two-to-four don't fit, nor does the Elite Panel's verdict. In our view, the many soft could-be's are trumped by the few harder couldn't-be's, and it is the negative evidence that tells the real story: the shoe doesn't quite fit, and it's damaging to the argument that the girl is Cinderella, even if the eyes, the hair, the height, and the blood type are perfect matches.

We don't want to overstate the hardness of our evidence at this level, nor the softness of the positive evidence for Shakespeare. Hand D plus still seems to us an improbable but not impossible Shakespeare ascription. We are not asking anyone to banish it from the Complete Works or taboo further discussion of it, and we aren't betting a thousand pounds on it. But, again, if this were a quiz show and the quizmaster had perfect knowledge of who wrote the passage and when, and we had to choose between Shakespeare and non-Shakespeare, we would hesitate to bet on Shakespeare. It's too atypical of Shakespeare, even in the 1600's, and far too atypical for the 1590's. Not all the discrepancies have been explained away, and the self-confirming Bayesian arguments haven't fixed it. Till they are, on the numbers, the 'Shakespeare scene' of *Sir Thomas More* is still a Shakespeare long-shot which belongs more properly in the High Apocrypha than in the Low Canon.

We would also suppose that the newest evidence has done more to weaken the case for Hand D-plus than to strengthen it; that it still should be considered a tough nut to crack; and that, for now, the best resolution of the conflicting evidence would be greater willingness on both sides to confess uncertainty.

6. *Edward III*: Is Any of It Shakespeare's?

What about the 'Shakespeare scenes' from *Edward III*? We have had a longer involvement with it than with Hand D-plus, starting with observing its fatal thirteen rejections as a whole play in 1994 (Table 2) and responding to G. Blakemore Evans' request to analyze its 'Shakespeare scenes' separately, in 1996, before we had our validated profiles for 1,500-word Shakespeare blocks. Fortunately for us, *Edw3* is almost all verse. It cannot have been written later than 1595, when it appeared in the Stationers' Register. We have seen that it has had a wave of recent Shakespeare ascribers, including a few who think that all of it could be by Shakespeare, with no corresponding wave of recent naysayers – though the available evidence has changed very little since E.K. Chambers' time. *Edw3*'s admission to the Low Canon looks much more like a change of heart than like a response to new evidence.

Nevertheless, there is significant new *ex post* evidence, ours and Tarlinskaja's; ours seems roughly consistent with Tarlinskaja's, and mostly, but not completely, in line with what we take to be the current consensus. It is not too late, nor too soon, to consider it. *Edw3* offers much more material to analyze than Hand D, and that, we shall see, can make a big difference. Its 'Shakespeare scenes,' taken one by one, in statistical terms are vastly more Shakespearean than its 'non-Shakespeare scenes' and are hard to rule out individually by our tests. Taken as a group, their anomalies rise and their Shakespeare plausibility falls to unlikely levels. On the other hand, if the group were revised slightly, by reclassifying the pre-battle scene, 4.04 as 'non-Shakespeare,' and the battle scenes, 4.05-.09 as 'Shakespeare,' the discrepancy falls, and the aggregate becomes an arguable, though still not an open-and-shut Shakespeare could-be. Table 4 gives the highlights.

Table 4. Highlights of 13 Shakespeare Tests on All-Verse Blocks from *Edward III*

Scene	Grade Level	Proclitics	Rare Words	Total Rej.	Discrete Probability	Continuous Probability
Shakespeare range/threshold	4-9	235-561	(-40) - 116	0-1	2.52E-01	2.03E-01
'Shakespeare' scenes or blocks						
1.02	7	192	-12	1	2.90E-01	3.85E-02
2.01a	8	271	23	1	2.90E-01	3.06E-02
2.01b	9	212	82	1	2.90E-01	1.07E-01
2.02	7	199	48	1	2.90E-01	5.57E-01
4.04	12	200	8	2	4.36E-02	1.29E-03
'Non-Shakespeare'						
1.01	10	89	-73	4	2.71E-04	5.17E-06
3.01	11	171	-101	4	2.71E-04	6.43E-08
3.03	11	118	-49	3	4.13E-03	4.20E-06
3.02, 04, 05	8	167	-65	2	4.36E-02	3.13E-03
4.01-03	9	75	18	2	4.36E-02	7.44E-04
4.05-09	7	246	3	0	1.00E+00	2.97E-01
5.01	10	223	-51	3	4.13E-03	5.46E-03

Table 4. Five all-verse 'Shakespeare' blocks of *Edward III* get a total of five Discrete rejections (darker shading, left)—but only one of these has more than one Discrete rejection and gets a composite Discrete rejection (lighter shading, right). But four of the five get composite Continuous rejections (lighter shading, right). Only 2.02 looks like a Shakespeare 'could-be' by both tests. Of seven 'Non-Shakespeare blocks, six get composite 'couldn't-be's' by both Discrete and Continuous analysis. 4.05–09 passes both Discrete and Continuous. Stylometrically, it is the least Shakespeare-discrepant block in the play.

To get to Table 4, and Appendices Two and Three, we put aside our old Lou Ule-edited *Edward III* and scanned the 1997 *Riverside Edward III* from scratch, seeking the closest match we could find to the spelling and punctuation practices of our 1974 *Riverside* baseline. Beyond that, we actually changed 17 words to spellings more in conformity with the *Riverside*, for example, 'loath' in place of 'loth.' This may sound presumptuous, but measuring discrepancy is our stock in trade, and it is important to make sure it is Shakespeare's, not the editor's. We made up a fat, searchable *Riverside* lexicon 20 years ago, and a custom *Riverside* spellchecker, and have used them since to help commonize spelling with the *Riverside*. Evans's co-editor for *Edward III*, J.J.M. Tobin, had no such templates, and let some alternative spellings creep in. Since in this case we were acting as Evans's research consultants, we saw no good reason to leave editorial artifacts in *Edward III* that could make it look less Shakespearean than it actually was; and we dutifully reported our extra precautions to him. We then divided or aggregated 'Shakespeare' and 'non-Shakespeare' scenes into easily comparable all-verse blocks, each roughly 1,500 words in length, and gave each block the thirteen tests we had validated for such blocks. *Edw3* offered more and longer blocks and more usable tests than Hand D. It yielded some probabilities low enough to require scientific notation.

For example, it showed that, apart from one block, 4.05-4.09, all of the old-consensus 'non-Shakespeare' blocks have much too low Shakespeare probabilities to pass as Shakespeare's. Table 2, above, makes a macrocase that the odds that Shakespeare could have written the whole of *Edward III* by himself are 53 billion times lower than those for Shakespeare's own most discrepant baseline block, not a close call. Table 4 and Appendix Two show that the collective odds of Shakespeare authorship of the non-Shakespeare blocks are absurdly low, even if they include 4.05 through 4.09, which is an easy Shakespeare could-be block by our rules. Six of these seven 'non-Shakespeare' blocks fall outside Shakespeare's range for proclitic microphrases. The odds of this, at the regular 3.7% rejection rate found in the Shakespeare baseline for 1,500-word blocks, are about eleven

billion to one, many orders of magnitude worse than the ‘Shakespeare’ blocks. This is not a close call either.

The ‘Shakespeare’ blocks and 4.05–4.09, taken by themselves, are not so easily dismissed. Four of the five ‘Shakespeare’ blocks have just one rejection each, not enough for a composite Discrete rejection. 4.05–4.09, though not conventionally ascribed to Shakespeare save by those who give Shakespeare the whole play, has no Discrete rejections at all. 4.04 gets two Discrete rejections and is outside the Shakespeare ballpark, but in the same city. Every ‘Shakespeare’ block but one, 2.02, and every ‘non-Shakespeare’ block but one, 4.05-4.09, gets a Continuous rejection, the ‘Shakespeare’ ones narrowly, most of the ‘non-Shakespeare’ ones decisively. Of all the scenes, only 2.02 and 4.05-4.09 get a composite pass by both tests. This means that four out of five ‘Shakespeare’ blocks pass Discrete Composite, and four out of five fail Continuous Composite, three narrowly.

On this evidence, in the hypothetical quiz show, we would not hesitate to bet our thousand pounds that most of the non-Shakespeare scenes are, in fact, non-Shakespeare. We would not bet big money against the ‘Shakespeare scenes,’ taken individually, because all but one of them are Shakespeare could-be’s, or close to it, by our rules. We would guess that the one exception, 4.04, may not be pure Shakespeare, and that 4.05-4.09, counter to scholarly consensus, may be close to pure Shakespeare, and we would be troubled by the large number of Shakespeare rejections in the consensus aggregate, large enough to argue that the conventional aggregate probably has some non-Shakespeare in it somewhere.

Where the call is close, the quality of the disqualifying evidence needs closer scrutiny, especially here, where just one Tarlinskaja test, proclitic microphrases per thousand lines, accounts for four of the six rejections found for the five ‘Shakespeare’ blocks.[50] If this test is misconceived or misapplied, the case against the five blocks, which we already think could be made a close call by reclassifying 4.04 as non-Shakespeare and 4.05-4.09 as Shakespeare, could collapse altogether. However, we think the test is neither misconceived nor misapplied and should explain why.

A short, low-tech explanation of why we find Tarlinskaja's proclitic counts persuasive would go straight to our baseline and comparison charts for all tests at 1,500 words.[51] These show very high Shakespeare consistency in proclitic frequencies and exceptionally high discrimination between Shakespeare and non-Shakespeare. Of 100 Tarlinskaja-counted 1,500-word Shakespeare verse blocks in our records, only three (3%) have proclitic scores under 235. Of 38 such blocks not by Shakespeare, 58% scored lower than 235, just like 80% of *Edward III*'s 'Shakespeare' blocks and 86% of its 'non-Shakespeare' blocks. 83% of our *Edward III* blocks fall below 97% of our Shakespeare baseline blocks on this test, not a strong support for a Shakespeare ascription for most of *Edward III*. All these counts are Tarlinskaja's own counts.

A longer, more technical discussion would note that enclitics and proclitics are just two of many verse tests on offer from the leading authority, Marina Tarlinskaja. For examples of others, see her *Shakespeare's Verse*, and her unpublished article, 'Shakespeare Among Others' (her 2006), which, like ours, was held over from the 2005 Apocrypha volume of the *Shakespeare Yearbook*, which, sadly, may turn out to be its last. Enclitics and proclitics are the ones we tried hardest to replicate and validate for samples of varying sizes, including those at issue here. Shakespeare's rates did not change much during his lifetime; they did not vary between his poems and play verse, and they are not sensitive to editorial variances. Both tests are slower, more complicated and judgmental than our other tests, and harder than our other tests to replicate perfectly. But rough replicability is enough for most purposes, and tight replicability was often available for critical counts, such as those cited here, simply by our asking for Tarlinskaja's help, which she has given us generously.[52] We acknowledge that three quarters of the 'Shakespeare-scene' rejections are from one test only, proclitic microphrases per thousand lines, and that for *Edward III*'s many Shakespeare-ascribers, the quickest way to put *Edward III* more firmly in the Shakespeare could-be column would be somehow to limit or discredit the test. But we are doubtful that they will find this an easy task, not only from our own years of experience with the test, but also

from our successful efforts to validate it against scores of text samples of varying size. As always, we are open to alternative views, but, from what we know now, these tests, and the rejections they show, seem to us solid ones.

That brings us to aggregate analysis of the Shakespeare and non-Shakespeare sections. Again excepting 4.04–4.09, the last three columns of Table 4 offer too many rejections per block, and too many zeroes after the decimal for even the individual non-Shakespeare blocks to have much Shakespeare plausibility. The odds that six out of seven of them would have proclitic scores lower than 97% of Shakespeare's baseline blocks are worse than daunting. The odds of this happening by chance, at our normal 3.7% overall baseline rejection rate for all 13 tests on blocks of this size, are about two in a hundred million, many orders of magnitude lower than the 'Shakespeare' blocks. Bottom line: except for 4.05–4.09, the per-block probabilities are too low for Shakespeare, and the aggregate odds for all the blocks are far too low.

What about the five 'Shakespeare' blocks? We have seen that, individually, four of the five are narrow Shakespeare could-be's by Discrete analysis and mostly narrow couldn't-be's by Continuous analysis (Table 3). We are in the process of 'detuning' Continuous to reduce its baseline false negatives to less than 5 percent, like Discrete. Had we done this for *Edw 3 Sh*, all the Shakespeare blocks but 4.04 would be easy Shakespeare could-be's.[53] As it is, even with no detuning, 2.02 is a could-be by both methods; 4.04 is a couldn't-be by both, but with only one or two zeroes after the probability decimal. All of these 'Shakespeare' blocks but 4.04 seem to us no worse than close calls, taken separately, and all seem to us much more likely Shakespeare than any of the non-Shakespeare blocks except 4.05–4.09.

On the other hand, the consensus is that *all five* of these blocks are Shakespeare's work. What are the odds that *all five* of them would have six rejections between them, bearing in mind that only a third of our 140 Shakespeare baseline 1,500-word play verse blocks have even one rejection? The aggregate Discrete odds are about seven in a thousand—millions of times more likely than the seven

'non-Shakespeare' blocks, taken as a group, since these have 18 rejections among them, but 36 times less likely than our Shakespeare threshold block on this test, which is closer to 2.5 in a hundred (Appendix Two). By this test, the 'Shakespeare' blocks, as a group, are outside Shakespeare's ballpark by an order or two of magnitude—that is, out of the ballpark and city, but still in the same county. We would guess that they contain some non-Shakespeare, but it is a much closer call than the 'non-Shakespeare' blocks.

Aggregate Continuous probability is an even closer call. Taken as a group, the 'Shakespeare' blocks have composite Continuous probability only five times lower than our Shakespeare threshold block (Appendix Two).

To recur to our earlier calendar image, Shakespeare at his peak could have produced a 1,500-word text block every fortnight. From his typical style habits, specifically from the proclitic microphrase counts discussed above, we could expect about one block a year that tested like most of his *Edward III* 'Shakespeare' blocks,[54] and two to six years to produce four such blocks by chance. From this we would conclude that the consensus 'Shakespeare' blocks are much closer to Shakespeare than the 'non-Shakespeare' blocks but still not convincingly Shakespeare as an aggregate.

What about 4.05–4.09? These scenes have not been traditionally ascribed to Shakespeare except by those who think, contrary to our evidence, that the whole play is Shakespeare's. But, aggregated into one block of 1,963 words, they have no Discrete rejections at all and a Continuous composite probability which is within Shakespeare's range with no detuning. On the numbers, this block and 2.02 are the most Shakespearean on the chart, certainly more Shakespearean than Hand D-plus. Could they be gold? It is not our part to say that they *are* Shakespeare's. We are the silver-bullet people, not the smoking-gun people, the ones whose main stock in trade is disproof, not proof. Moreover, we have five live examples of false composite positives, among our 43 like-sized blocks of known non-Shakespeare, four Discrete only, one both Discrete and Continuous. The lucky double-pass is Block 4 of Anthony Munday's *John a Kent and John a Cumber*.[55]

We are confident enough in our negative evidence to believe that Shakespeare probably could not have written the *other* blocks of *JKJC*, but not so confident in our positive evidence, absent suitable corroboration beyond pure stylometrics, to suppose that Shakespeare could have, let alone must have, written Block 4 of *JKJC*. Nor is it our part to lead the hunt for qualitative resemblances to Shakespeare; after all, we are the new-optics people, not the old. But, if we were old-optics people, we would be strongly tempted to take another look at 4.05–4.09 to see whether a Shakespeare ascription could be argued. Could this dark omen be a Shakespeare precursor to the ones in *Julius Caesar* and *Macbeth*?

> A flight of ugly ravens
> Do croak and hover o'er our soldiers' heads,
> And keep in triangles and cornered squares,
> Right as our forces are embattled.
> With their approach there came this sudden fog
> Which now hath hid the airy flower of heaven
> And made at noon a night unnatural
> Upon the quaking and dismayed world.
> In brief, our soldiers have let fall their arms
> And stand like metamorphised images,
> Bloodless and pale, one gazing on another. (4.05.28–38)

If we departed a bit from the consensus, by switching 4.04 to non-Shakespeare and 4.05-4.09 to Shakespeare, it would greatly alleviate the problem of aggregate Shakespeare discrepancy. The revised *Edw3 Sh* would then be only two or three times more discrepant than our Shakespeare thresholds; that is, it would be in the ball park, if not on the field, by both composite tests, and close enough to suppose that it is already a more arguable could-be. A bit of further tweaking might well make it an easy could-be by our rules, as is already true of the individual blocks. We probably have not squeezed every last bit of non-Shakespeare from the 'Sha-

kespeare' portions of *Edw3*, but switching the two blocks gives *Edw3 Sh* 0.8 rejections per block, higher than 93 percent of the 4-5-block aggregates in our Shakespeare baseline, but lower than any such aggregate in our non-Shakespeare baseline.

As with Hand D-plus, we turned to our Golden Ear Elite Panel for a second opinion on short snippets from the two blocks we switched, but this time they disagreed with both our re-ascriptions. Only 35% of the panel thought the 'ugly ravens' passage above sounded like Shakespeare; and 57% thought that a passage from 4.04 *did* sound like Shakespeare. So much for our vaunted tweaked intuition! Or could it be so much for our new optics? Our initial inclination is to go with the new optics in both cases, rejecting 4.04 under our normal rules, because its excessive negative evidence still outweighs the additional positive, and keeping 4.05-4.09 as a could-be, as if the Golden Ear Panel were the equivalent of a well-validated new-optics negative, but the only one we could find in 14 tests, and not quite enough, by itself, to rule out the block. But it's only a first reaction. We would be very interested in other evidence and perspectives on these two blocks.

7. Conclusions

How close have we come to cracking the tough nut of *Edward III*? The odds seem overwhelmingly against the whole play being Shakespeare's work. But they are quite favorable to most of the 'Shakespeare' scenes individually, and they now seem to us, with a couple of blocks reattributed, closer than not to an aggregate Shakespeare could-be. This is a much more hopeful prognosis for *Edw3 Sh* than we had from following the strict consensus, and we consider this tough nut several steps closer to being cracked. We are relieved to have gotten this far after many years of struggling with *Edward III*, and sorry we couldn't get it done before the death of G. Blakemore Evans, who started us on this quest, to let him know in broad terms that it looks like he, and the many other scholars of late who thought Shakespeare had a hand in *Edward III* could well be right.

Like *Edward III*, we thought that *Sir Thomas More* was an easy nut to crack as a whole play. It has far too many rejections and composite Shakespeare probabilities far too low for Shakespeare to have written it. Whether the Hand D addition was written in 1592–93 also seems to us an easy nut to crack. It likewise has too many rejections and too low composite Shakespeare probabilities to have come from Shakespeare in the 1590's. Whether it was written by Shakespeare in the early 1600's is a closer call, and not such an easy nut to crack, but, by our best calculation, the odds against Shakespeare authorship seem to be seven to twenty-six times stronger than the odds for it. Blocks as discrepant from the rest of Shakespeare as Hand D/1600's are not unknown, but they are very rare.

8. Cautions and Caveats

How would you go about challenging our new-optics evidence? The first and most important thing to say about methods like ours is that they don't directly measure authorship. All they measure is discrepancy from the baseline works of a given author, in our case, typically Shakespeare. Not all discrepancy is authorial. If some can be explained away as a function of subject matter, dating, editorial or other non-authorial quirks, it should be discounted. We have tried in many ways to control for all of these, but who is to say we have exhausted all the possibilities? The second is that we see our methods as a complement to old-optics analysis, not a substitute. Unsurprisingly, new optics reveal some things that the old optics miss, but, also unsurprisingly, they can miss or bypass much that the old optics have revealed and should continue to reveal in the future. The world is better off with both than with just one or the other, especially where there turns out to be a lot of convergence, but enough divergence to make things interesting. Where divergence persists, as it seems to with at least ten of the 137 blocks addressed in our fringes working paper, it permits a tighter focus on the ones that are most problematic. In general, where one set of optics shows Shakespeare discrepancy, and the other doesn't, we, as silver-bullet, negative-evidence people, would go with the one that does, whether it's ours or not. We can think of two blocks

from *Henry VI, Part I* where two of Gary Taylor's couldn't-be's could supersede our could-be's, and these are not the only ones which raise the question.

The third is methodological strengths and weaknesses. We have given many admonitions about where we think our analysis is at its strongest—where our baseline and sample blocks are clean and single-authored, our sample size is ample, our evidence is the kind that comes from authors themselves, and so on – and where, when these elements are not present, we think it is weakest. We think we have taken several steps toward cracking some of the toughest nuts in the Shakespeare Fringes, but all you have to do to make the nut uncrackable again is to cut it into pieces so small that they can't be tested with our methods, or show that the scenes we thought were single-authored were, in fact, double- or multiply-authored, or that we picked the wrong starting and stopping points to test. We can easily rule out solo Shakespeare by the pound, but it's harder for us with ounces.[56]

A favorite argument with Oxfordians to counter evidence like ours has been the 'caterpillar' argument, that, yes, the candidate's verse might not match Shakespeare's, but caterpillars don't match butterflies either. Couldn't the young Oxford/Shakespeare have had a Blue Period of drastically different style, like the young Picasso, but never recorded? A variant of this is the 'magpie' or 'chameleon' argument that some authors are clever and compulsive mimics picking up bits and scraps from other writers and never developing a consistent style of their own. None of these theories fits what we know of Shakespeare, most of whose stylistic quirks that we count were extremely consistent during his life time. The ones that changed, such as line endings and midline speech endings, changed consistently, with very little backtracking, so that you can say with confidence that Hand D-plus might possibly have been written in 1603, but not in 1593.[57]

Could there be a plausible 'co-author chameleon' argument that collaborators, in particular, try to blend their stylistic habits to match each other? We haven't seen much sign of it, either among features that Shakespeare and his contemporaries were aware of, such as feminine endings or open lines, or features they were not aware of, such as semantic bucketing, though it is true that it is much easier to

tell Shakespeare from Peele when we hybridize two single-authored plays than when we try to disentangle one co-authored play like *Titus Andronicus*. But we would guess that the difference is more likely to be a matter of co-authored scenes than to a matter of mutual imitation. Some authorities who are quick to see co-authorship of whole plays are much more reluctant to imagine it within a single scene, as if the old co-authors wanted to make it easier for future stylometricians to tell them apart. We are much less inclined to exclude co-authorship at the microlevel, and *Sir Thomas More* is full of it. For other plays it remains more a hunch than a proof, but analysis like ours at least shows which blocks bring such hunches most into play.

Finally, there is the matter of novelty. We have been warning our readers about it for twenty years, saying that you have to be more cautious about something that hasn't been through the mill with critics than with something that has. That is still true of our latest ventures, such as our fancy composite discrepancy measures, many of our current Fringe studies, our new Badges tests, and our Golden Ear Panel. But it is no longer quite so true of the basic premises of our New Optics. These are now 20 years old and have not just been put through the mill with gentle, courtly, but diligent and discerning critics like MacDonald Jackson, they have also been put through the Shakespeare Wars against not-so-courtly adversaries who told us to expect a public whacking and did their best to deliver it with pages and pages of 'demolition' of our position. When the dust settled, the reports of our demolition turned out to be greatly exaggerated, and it was our findings which were still standing unscratched, while our adversaries' ascriptions lay abandoned or in ruins. It was a real trial of fire for our New Optics, and we can't help feeling more confident in them after the trial than before.

On the other hand, tried or not, they are still new to most people, and many of them are too new to have gone through the old trials. Certainly, many tough nuts remain to crack, ten of them listed in Note 6. And there is this further question about Hand D and the non-Shakespeare scenes of *Edward III*: if not Shakespeare, who? We are not among those who feel that, if you can't find any other author to

fit a passage that might be Shakespeare, it therefore must be by Shakespeare by a process of elimination. But we do hope to have a small role in examining one or two of these questions, and we hope that others will try some of our methods before we or our platforms evaporate. We don't claim to have solved forever the question of whether Shakespeare wrote Hand D or the 'Shakespeare part' of *Edward III*, but we hope we've helped narrow the possibilities a bit, as to *when* Hand D could have been written, *how likely* it is to be Shakespeare's, and *which parts* of *Edward III* could be Shakespeare's.

Quite a few once-tough-looking nuts are not so tough once you are willing to look at their sheer discrepancy from Shakespeare's baseline. These numbers say that many of the ones we *have* tested are on a different statistical planet from Shakespeare, and that the odds of his authorship are in many cases lower than those of getting struck by lightning. We acknowledge that our methods are still novel to most literature-department regulars, and, indeed, that our latest findings on shorter, co-authored passages are still new territory for us. But we hope the net result is a much clearer notion of what you can bet on, and with what degree of confidence. Where the passages are many and long, our confidence is high enough to support our big wager. We have yet to find a taker.

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provided critiques of our various conclusions on *Sir Thomas More*. We are also indebted to the Final Elite Panel of our Golden Ear test, a group of keen intuitives whose collective accuracy in identifying texts of known authorship is nine out of ten. They say we are right about Hand D-plus, but wrong about our proposed reascription of *Edw3* scenes. All surviving errors are ours alone. The Shakespeare text we used for our baseline is the 1974 *Riverside Shakespeare*, except for *Edward III*, which is from the 1997 *Riverside Shakespeare* (Evans, 1997). All Shakespeare references used in this article are based on these two editions.

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Notes

1 This essay was originally written for a *Shakespeare Yearbook* symposium on the Shakespeare Apocrypha, but it got postponed several years for technical reasons, and ultimately released for publication elsewhere when the editor's tragic illness and death cast doubt on the future of the *SYB*.

[2] For example, Vickers (2002 and 2002a); Jackson (2003); and Taylor (1995).

[3] See Rosenbaum (2006).

[4] Our 'core Shakespeare' plays are: *Richard III*; *The Taming of the Shrew*; *Two Gentlemen of Verona*; *The Comedy of Errors*; *Richard II*; *Love's Labor's Lost*; *King John*; *A Midsummer Night's Dream*; *Romeo and Juliet*; *Henry IV, Parts I and II*; *The Merry Wives of Windsor*; *The Merchant of Venice*; *Julius Caesar*; *Much Ado About Nothing*; *As You Like It*; *Hamlet*; *Twelfth Night*; *Troilus and Cressida*; *Measure for Measure*; *All's Well that Ends Well*; *Othello*; *King Lear*; *Macbeth*; *Antony and Cleopatra*; *Coriolanus*; *Cymbeline*; *The Tempest*; and *A Winter's Tale*. We did not consider the 41 Middleton 'Hecate' lines in *Macbeth* enough to justify moving the other 98% of the play out of the core. We cut out the 41 lines and kept the rest of the play in baseline. Like other Core Shakespeare plays, the purged *Macbeth* got only one rejection in our 48 tests.

[5] Jackson (2006).

[6] After applying our new-optics tests to all of the Fringes except *Timon of Athens*, which is deemed too thoroughly intermingled to tackle at all with our methods, and in no particular order, our top-ten list of still-problematic tough-nut blocks include the following: *Edw3*, 4.04 and 4.05-.09; *Sir Thomas More*, Hand D-plus; *Titus Andronicus*, 1.01.258 to end; 2.01-.02, and 4.01; *Henry VI, Part I*, 2.01-.03, 1.03.69-1.06, 4.02..04, and 4.05-.4.07.32. We consider the first three here, the others in our long working paper on the Fringes, which is available on request.

[7] Elliott and Valenza (1996).

[8] Elliott and Valenza (2004).

[9] People who would like to accept our bet are free to pre-test as many untested plays as they wish, using our software, so the only real cost to them would be the time costs of however much pre-

testing they had to do to find a match. Our guess is that these would be high, and that they would still not find a match, but it's only a guess. We have tested more than 80 of the 400 or so single-authored plays of Shakespeare's lifetime, mostly by Shakespeare Claimants. Another 146 are by the same Claimant playwrights we have already tested, leaving a residue of 80 or so where we have tested neither play nor author – but these are the very ones that no one, in 400 years of desperately seeking Shakespeare, has ever associated with Shakespeare. If one of these turned out to match Shakespeare, it would be either a small exception to our known results or the Lost Shakespeare itself found at last. Either of these would be a tremendous bargain for a thousand pounds.

[10] For example, '[W]henever we say 'written by chance,' in lay language, we … refer to the odds that the specific features for which we test could have arisen by chance assuming the statistics and modeling that we have imputed to the baseline.' Our 2004, p. 338.

[11] That is, the seven least typical Core Shakespeare plays, including *Hamlet* and *The Tempest*, among others, had a Discrete rejection probability of 2.316×10^{-1}. This probability, divided by *STMO*'s Discrete rejection probability of $3.323 \times 10^{-5} = 6.9696 \times 10^{3} = 6{,}967$ times less likely than *The Tempest* to have come from Shakespeare's pen by chance. For Continuous Composite Probability, the Core Shakespeare threshold outlier is also *The Tempest*, with a probability of 3.6895×10^{-3}. *Sir Thomas More*'s Continuous Composite Probability is less than 1×10^{-15}, too low to compute with standard, double-precision PC software, and far lower than the odds of being hit by lightning. *STMO* is therefore at least $3.7 \times 10^{12} = 3.7$ trillion times less likely than *The Tempest* to have come from Shakespeare's pen by chance.

[12] We also tested 16 blocks for which we know of no consensus, 15 from *Henry VI, Part III*, and one from *Arden of Faversham*.

[13] Both of the close calls were from High-Canon plays, *Richard III* and *King John*.

[14.] 'Hand D,' technically described as 'Addition II' to the *STMO* manuscript, is one of six different hands found in the much-amended manuscript play *Sir Thomas More* (British Library, Harleian MS 7368). The other hands were Hand S (Anthony Munday); Hand A (Henry Chettle); Hand B (probably Thomas Heywood); Hand C (an unidentified scribe); and Hand E (Thomas Dekker). Evans (1997, p. 1775). Several respected paleographers have judged that Hand D is Shakespeare's. Vickers (2002, p. 39). Most Shakespeare scholars think from internal evidence that Shakespeare was not just the scribe, but also the author of the 147-line Hand D section. They also think that 'Addition III,' 21 further lines in a different hand (C), and pasted into the MS some lines after the Hand D section, is Shakespeare's. Evans (1997, pp. 1775–79); Wells and Taylor, (1987, pp. 124–25); Howard-Hill (1989); Gabrieli and Melchiori (1990); Jackson (1981, 2006, 2007); Vickers (2002a, pp 39-43). Jackson (2007) is particularly useful, both for recapitulating and re-

evaluating older 'unique resemblance' arguments for Hand D-plus's Shakespeare authorship (such as handwriting and spelling) and also for adding LION-linked word-echoes of his own, whose uniqueness he could check against the entire LION (Literature Online) database. We take his LION-link-validated uniqueness claims much more seriously than other such claims without such a broad validation.

The 'Shakespeare' sections of *STMO*, Hand D and Addition III, are commonly lumped together as 'Hand D.' If we were Shakespeare regulars, we would probably follow this handy, imprecise convention in preference to using the cumbrous 'Additions II and III.' Everyone would know what it meant. But we are newcomers offering strange new methods for covering sensitive territory, and think it wisest to use terms like ''Shakespeare' scene' or 'Hand D-plus.' Where the reference actually is to Hand D alone, we can call it 'Hand D proper.' Our actual preferred unit of analysis is the verse lines of 'Hand D-plus,' referred to as 'Hand D-plus Verse.'

Something similar may be said of the 'Shakespeare' scenes of *Edward III*, identified for us by G. Blakemore Evans in 1996. These are 1.02 (that is, Act I, Scene 2); 2.01; 2.02; and 4.04. All but 4.04 involve the Countess of Salisbury, being hotly but to all appearances vainly, pursued by King Edward, and most people use the shorthand 'Countess scenes' to describe all four scenes. Since the Countess does not appear in 4.04, where Prince Edward, surrounded by a huge French army, shrugs off their invitations to surrender and prepares to do battle, we shall likewise use something like 'Countess-plus' or ''Shakespeare' scenes' for all of Shakespeare's supposed contributions and 'Countess-proper' for scenes where she appears.

[15] Simpson (1871).

[16] Wells and Taylor (1987, p.39).

[17] Chillington (1980); *accord*, Williams (1982); but see Forker (1989).

[18] Werstine (1999); Hays (1975).

[19] Wells and Taylor (1987, p. 125).

[20] Vickers (2002a, pp. 39-45); Jackson (2006, 2007); Tarlinskaja (2006, 2006a).

[21] Dobson and Wells, eds. (2001, p. 124).

[22] Metz (1989); Wells and Taylor (1987).

[23] But not the entire 1,394-word verse-and-prose selection of Hand D-plus, since four of our ten validated tests at this block-size level apply to verse only.

[24] By contrast, 75% of non-Shakespeare verse blocks of the same size are rejected by the same rules, for a net discrimination rate of 72%. Elliott and Valenza (2004, p. 357, Appendix Eight).

'Net discrimination' is the percentage of true Shakespeare positives, 97%, minus false positives for non-Shakespeare, 25%, which then is 72%.

[25] BoB5, based on a Shakespeare-Middleton comparison (between *Macbeth*, 1605, and *The Witch*, 1616), used *the*, *is*, *to*, *you*, *he*, *his*, *your*, *we*, *him*, *as*, and *an* for Shakespeare badges (that is, words more common with him than with Middleton). It used *a*, *sir*, *I*, *now*, *I'll*, *'tis*, *all*, *come*, *her*, and *she* for Shakespeare flukes (words less common with Shakespeare than with Middleton). Our test procedure was to 'bundle' the sums of badges and flukes, subtract flukes from badges, and divide the result by the sum of all badges and flukes. The formula is: badges minus flukes, divided by badges plus flukes, times 1000. BoB5, though derived from a Shakespeare-Middleton comparison, also distinguishes Shakespeare from many other authors (our 1996, p. 196).

[26] That is, our Shakespeare threshold-block's Composite probability of 0.1171 divided by observed Hand D-plus Verse's Composite probability of 0.0047 = 24.9 (see Table 3).

[27] A feminine ending is a verse line ending with an unstressed syllable; for example, *coming*; *gotten*; *woman*. We used our generic machine counter for all comparisons, but cross-checked with slower, more accurate manual counts for Hand D-plus Verse, with essentially the same profiles and outcomes. The early ranges were auto: 2–23; manual: 3–20. The late ranges were auto: 12–28, manual, 15–38. The only effect of adding a manual recount was to incur yet another Discrete rejection for Hand D-plus Verse when compared to our early-Shakespeare profile. Our other line-ending machine count, open lines, exactly matches manual counts of the same edition and does not need a manual cross-check.

[28] In every case, to find relative Shakespeare probability, we divide the Shakespeare threshold block's raw probability, 0.3352, by the sample block's raw probability, let us say, 0.05815 for two rejections, giving the sample block a probability 5.76 times lower than the threshold. See note 37 below for a definition of threshold and boundary blocks. We make no claim that raw probability estimates define absolute authorship odds, but *relative* probabilities, compared with Shakespeare's own threshold blocks, can be very telling. See our (2004, pp. 348–356).

[29] See our (2004, Appendix Eight). Ten percent had no HCW's at all.

[30] The alternative we chose was to run the same grade-level test on someone else's edition of Hand D-plus, that of Tom Merriam and Lou Ule. Its recorded grade-level score was even higher than the *Riverside*, 14th-grade, four standard deviations distant from Shakespeare's pertinent median of 6th-grade. We also tested the *Riverside* Hand D Proper Verse, stripped of the 21 lines in Hand C. The results, summarized in Appendix One, were essentially the same as those of Hand D-plus Verse. More could be done with grade level, such as a comparison of repunctuations of Hand D-plus by us and its principal Shakespeare ascribers, or, better, further examination of yet other versions –

Oxford, Variorum, RSC, Bevington, etc.— by scholars with less of a stake in the outcome than the parties now most involved. Would the resultant ranges be more favorable to a Shakespeare ascription than what we have now? Perhaps. But this kind of analysis is only in its earliest stages.

We also did several follow-on tests in response to Jackson, 2007. Jackson's article, based on our earlier unpublished working paper, is the best critique of our methods that we have yet seen. His most powerful argument was that our grade-level and BoB5 tests are 'black boxes' which can't easily be deconstructed and replicated by hand (which is mostly true) and that they must therefore be considered dubious when applied to passages like Hand D-plus with disturbed text and a subject matter, of a confrontation with a male mob, which could give artificially high BoB5 readings by multiplying 'badges,' such as *he* and *you* variants and minimizing 'flukes,' such as *she* variants (see note 25 above for a definition of BoB5). Both of these could be so, we think, but probably not enough so to rescue Hand D-plus Verse from being a gross outlier from our Shakespeare baseline. We have already seen that using other editions than the *Riverside* only increased the grade-level discrepancy (above). Our spot check of several Shakespeare passages with many *he* variants, and no *she* variants at all, turned up none with BoB5 scores nearly as high as HDPV's. Our second spot check of seven Shakespeare mob-confrontation scenes did turn up twice as many *you* variants as Shakespeare's average, and significantly higher BoB5 scores, exactly as Jackson supposed, but only one of the seven had a BoB5 score in HDPV's range, and none had grade-level scores approaching HDPV's level. In the current draft of our ongoing Shakespeare Fringes working paper, available on request, we devote 15-pages to a fuller exploration of Jackson's points, and the grade-level issue is still to be fully explored, but so far we haven't been able to deflate the passage's Shakespeare discrepancy enough to make HDP an easy Shakespeare could-be. We also addressed several arguments that we consider less convincing: that our Shakespeare data base was too small (ours is twenty times larger than the ones he used); that it didn't have enough histories or tragedies (it did); that it didn't have set-asides (it had several); and that Bayesian analysis would greatly change the outcome (it could, but only if your black-box intuition tells you in advance that it's Shakespeare with 99.9% certainty, and only if you believe it). We are very much in Jackson's debt for his prompt and characteristically genial, thoughtful, and penetrating analysis of our pilot working paper, but, even after due deflation, so far, we still think that Hand D-plus has too much discrepancy to make it a probable Shakespeare ascription, far less a 99.9% probable one..

[31] See our (2004, Appendix Eight).

[32] See our (2004, pp. 438–46).

[33] Jackson (1978, pp. 155–56).

[34] See note 30 above for our response to Jackson's argument that BoB5 scores should be higher in mob-confrontation scenes like Hand D-plus. They are, but not enough to make Hand D-plus an easy Shakespeare could-be.

[35] Our (1996, p. 219).

[36] See our (2004, p. 351, note 61).

[37] For Discrete analysis, *boundary blocks* for each individual test are chosen by eye, Elliott's eye, to mark the outer boundary of the Shakespeare baseline profile, and at a level designed to say 'could-be' to at least 95% of the Shakespeare baseline. For Continuous analysis, no boundaries or thresholds are computed for individual tests. What is interesting for Continuous is not *whether a block exceeds a boundary*, but *how far it lies from the test's Shakespeare mean*. For *composite* scores, both Discrete and Continuous, baseline *threshold blocks* are chosen automatically by a formula designed to *maximize discrimination* between Shakespeare and non-Shakespeare. The threshold block introduces a kind of composite working boundary to Continuous, which otherwise does not rely on boundaries. In both cases, the threshold block is the most atypical, least Shakespearean block which is still inside the baseline profile. With its original threshold, used in this article, Continuous rejects 16% of 1,500-word blocks known to be by Shakespeare. In our long Fringes working paper we develop, define, and use a 'detuned' or 'desensitized' version of Continuous which only rejects 5% of known Shakespeare. In this article, it makes a difference for some 'Shakespeare' blocks of *Edward III* and is so noted.

[38] See our (2004, pp. 348–356).

[39] See Lake (1977, pp. 114–16); Jackson (1978, pp. 155–56, 1981, p. 146); Taylor (1989, pp. 101-129); and Tarlinskaja (2006a) for similar skepticism about a 1590's date of composition; *contra*: Blayney (1972, pp. 167-91). Tarlinskaja agrees with us that the 'non-Shakespeare' parts of *STMO* do not match Shakespeare, and that the 'Shakespeare' parts do not match early Shakespeare, but she concludes from Hand D Plus Verse's many resemblances to late Shakespeare, that it is his work. See her (2006). From our perspective, the many Shakespeare resemblances make Hand D Plus Verse the more interesting, but do not override our normal presumption that it only takes a few negatives to overcome many positives.

[40] Vickers, (2002a, pp. 39-43).

[41] Tarlinskaja, (2006, 2006a). Oddly, she omitted from both articles a powerful ninth verse test, *proclitic microphrases*, which also would pass Hand D-plus as a Shakespeare could-be (see Appendix One, which uses her proclitic counts, and our discussion of *Edward III* below, where her

low proclitic counts were the principal obstacle to an easy 'could-be' for its 'Shakespeare' scenes).

[42] Tarlinskaja (2006a, pp. 56-57).

[43] Jackson, (2006 and 2007).

[44] See note 30 above.

[45] Jackson (2007, para. 16).

[46] *A Lover's Complaint* and the Quarrel Scene from *Arden of Faversham* are the others. In all three cases, he is the generous Santa Claus with Shakespeare ascriptions, and we the tight-fisted Scrooges. Of course, Jackson is a top-of-the line stylometrist, and intuition is only a small part of what he relies on to make an ascription, but it does loom larger in his arguments than it does in ours.

[47] See Note 18 above.

[48] Elliott and Valenza (2008).

[49] Metz (1989, pp. 22-25).

[50] In any kind of verse, iambic pentameter, for example, the poet seeks to fit words with their own natural, spoken syllabic stress into lines with their own natural metric stress. The two stress patterns don't always coincide. If they did, the lines would look like neat rows of bricks with each brick's heavy end placed exactly where it belongs in the row, ta *DAH* ta *DAH* ta *DAH* ta *DAH* ta *DAH*, where italics indicate natural spoken stress and capitals indicate metric stress. Where they don't coincide, metric stress prevails over natural; some of the bricks lose their natural stress for metric reasons; and their naturally heavy ends get bent out of stress by meter and treated as if they were light: ta *DAH* <u>*ta DAH*</u> ta *DAH* ta <u>DAH *ta*</u> *DAH* . To see an actual Tarlinskaja example of the two odd bricks in the last line, consider the underlined microphrases in the following line: 'Or WHAT <u>*strong* HAND</u> could HOLD his <u>SWIFT *foot*</u> BACK (Sonnet 65, line 11, see her (1987, p. 203). *Strong* and *foot* are 'clinging monosyllables' which lose their natural stress for metric reasons. Where the stress-losing monosyllable precedes the word to which it clings, for example, <u>*strong* HAND,</u> it is called a *proclitic* microphrase, from the Greek προκλινειν, 'leaning forward.' Where it follows the word to which it clings, for example, <u>SWIFT *foot*</u> , it is *enclitic*, from ενκλινειν, 'leaning backward.' Every poet we know uses at least a few such odd, stress-losing bricks, but some use them much more abundantly than others. For example, Shakespeare seems to have had three to five times as many enclitic phrases per thousand lines of iambic verse as Marlowe or Pope, and perhaps half, or a quarter, as many as Beaumont, Fletcher, Chapman, or Massinger (her 1987, pp. 215-16).

[51] See our (2004, pp. 431–37), including both poems and play verse.

[52] Further technical discussion of her methods may be found in our (1996, p. 201), and in her (1987, pp. 208–22).

[53] We have also detuned our Continuous composite scoring for aggregates of several blocks, from the direct raw scores indicated in the Appendices to a score based on geometric means, which is less sensitive to selection bias.

[54] That is, 26 fortnights a year times a no-better-than 3-percent rate of occurrence in Shakespeare's baseline = 0.78 expected occurrences a year of proclitic rates as low as those observed in *Edward III*'s 'Shakespeare' scenes.

[55] See our (2004, p. 437).

[56] Though not so hard, it seems, for our Golden Ear Panel, which has been remarkably accurate with very short samples.

[57.] See our (2004, pp. 390–96).

Legend for Appendices

Appendix One: Riverside Hand D Verse and Hand D-plus Verse versus Shakespeare Baseline, 750-word Blocks

Hand D Verse and D-plus Verse sections of *Sir Thomas More* compared to Shakespeare under various assumptions. (See text.) While only 3% and 11% of our 90 Shakespeare baseline blocks score lower than the listed 'Discrete Probabil ity' and 'Continuous Probability' thresholds, respectively, neither the Hand D nor the Hand D-plus block falls within either Shakespeare envelope. Hand D-plus Verse's best Shakespeare fit is after 1600, when it is seven times less Shakespeare-probable than the Discrete threshold, and 26 times less Shakespeare-probable than the Continuous threshold. Shaded regions on left indicate blocks that lie outside of the Shakespeare profile for a given individual test. Absence of shading on the right means that no combination of blocking, testing, or analyzing composite results could quite fit the passage into the relevant Shakespeare profile.

Appendix Two: Edward the Third, Scenes versus Shakespeare Baseline, 1500-word Blocks

Appendix Two is organized by 1,500-word blocks in sequential order. As with Appendix One, lightly shaded blocks in the test results area (left) indicate individual-test scores *outside* the Shakespeare profile. Shaded areas to the right indicate blocks that fall below the *composite* Shakespeare threshold either by rejection count, Discrete probability, or Continuous probability. Such composite-shaded areas fall *inside* our Shakespeare composite profile and count as Shakespeare 'could-be's' by each analyzing convention. Only one 'Shakespeare' block, 2.02, is a Shakespeare could-be by both conventions; so is one 'non-Shakespeare' block, 4.05-.09. Most of the other 'Shakespeare' blocks, considered separately, are much closer calls than most of the 'non-Shakespeare' blocks. Composite analysis shows that the 'Shakespeare' scenes are collectively beyond the Discrete threshold by a factor of 36 and beyond the Continuous threshold by a corrected factor of five (calculated from Appendix Four). However, if 4.05-.09 were re-

assigned to Shakespeare, and 4.04 reassigned to non-Shakespeare, the revised 'Shakespeare' aggregate would be only two or three times more discrepant than our Shakespeare thresholds (calculated from Appendix Four). This is inside our Shakespeare ballpark, and just a bit of further tweaking could well put most of it on the playing field. It is close enough that we consider all the revised Shakespeare scenes to be arguable Shakespeare could-be's. The non-Shakespeare scenes, taken separately, are improbable or worse; as an aggregate, they are wildly improbable; that is, it would take 96 years – or 44 billion years -- to produce the average amount of discrepancy found in each of the seven non-Shakespeare blocks. All blocks compared in both appendices are verse-only.

Appendix Three: Edward the Third, Scenes versus Shakespeare Baseline, Grouped by Attribution

Appendix Three is similar to Appendix Two, but the blocks are grouped by our best guess as to which are Shakespeare could-be's and which are not.

Appendix Four: Edward the Third versus Play Verse Baseline: Aggregate Comparisons by Geometric Mean

Appendix Four calculates the aggregate composite Shakespeare probability of multiple blocks from eight baseline Shakespeare plays, the 'Shakespeare' parts of three presumed Shakespeare collaborations, *Pericles, Two Noble Kinsmen,* and *Henry VIII*, and from the 'Shakespeare' and 'non-Shakespeare' parts of *Edward III*, both in the conventional division and in our slightly revised one. 'CCP Aggregate Raw Score' is Continuous Composite Probability, measured by geometric means to avoid sample bias. Any probability greater than 2.03E-1 (that is, greater than 0.203) makes the aggregate look like a Shakespeare could-be by continuous testing (see text).

'DCP Aggregate Raw Score' is Discrete Composite Probability, measured directly. Any probability greater than 2.52E-1 (that is, greater than 0.252) makes the aggregate look like a Shakespeare could-be by Discrete testing (see text).

Other scores listed show in different ways how much more or less discrepant the aggregates are than our Shakespeare composite profile thresholds. All but two of the baseline Shakespeare aggregate blocks listed are could-be's by Discrete and Continuous testing, and the two exceptions, *Tro* and *1H4*, respectively, are close calls for one test, but not the other. The 'Shakespeare' blocks of *Two Noble Kinsmen* Shakespeare, as a group, are could-be's by Discrete testing, and almost could-be's by Continuous. The revised 'Shakespeare' blocks of *Edward III* are almost could-be's by both Discrete and Continuous testing. The 'non-Shakespeare' blocks of *Edward III*, as a group, have vanishingly low Shakespeare probabilities.

Appendix One: Riverside STM Hand D Only Verse and Hand D-plus Verse versus Shakespeare Baseline, Blocksize = 750

Verse Block	Words	Lines	Grade Level	Fem Endings*	Open Lines**	Enclitics /1000 lines	Proclitics /1000 lines	BoB5	BoB7	BoB8	Buckets Block	Number of Tests	Discrete Rejections	Discrete Composite Probability (4.0%)	Ratio: Threshold to DCP	Continuous Composite Error	Continuous Composite Probability	Ratio: Threshold to DCP
Hand D only																		
Early - auto	660	81	12	12	43	49	321	762	556	-739	5.08	9	3	4.482E-03	75	4.3535	2.5596E-02	5
Late - auto	660	81	12	12	43	49	321	762	556	-739	5.08	9	2	4.777E-02	7	4.3535	2.5596E-02	5
Early - manual	660	81	12	27	28	49	321	762	556	-739	5.08	9	3	4.482E-03	75	4.6145	1.1409E-02	10
Late - manual	660	81	12	27	28	49	321	762	556	-739	5.08	9	2	4.777E-02	7	4.6145	1.1409E-02	10
Hand D-plus																		
Early - auto	832	101	13	13	45	79	317	765	692	-625	9.40	9	3	4.482E-03	75	4.8873	4.4857E-03	26
Late - auto	832	101	13	13	45	79	317	765	692	-625	9.40	9	2	4.777E-02	7	4.8873	4.4857E-03	26
Early - manual	832	101	13	26	33	79	317	765	692	-625	9.40	9	4	2.743E-04	1,222	5.0440	2.5193E-03	47
Late - manual	832	101	13	26	33	79	317	765	692	-625	9.40	9	2	4.777E-02	7	5.0440	2.5193E-03	47

Discrete Discrimination Statistics										*Aggregates*	*Composite Discrimination Statistics*	
Rejections	8	2	3	0	0	8	0	0	0	21	8	8
Percentage	100%	25%	38%	0%	0%	100%	0%	0%	0%	29%	100%	100%
Blocks Tested	8	8	8	8	8	8	8	8	8	72	8	8

Shakespeare Corpus Baseline: Consolidated Discrete Profile

	Grade Level	Fem Endings*	Open Lines	Enclitics /1000 lines	Proclitics /1000 lines	BoB5	BoB7	BoB8	Buckets Block
Global Min	3	3	6	10	152	63	-146	-929	-69
Global Max	10	28	51	157	505	712	1000	-83	81
Min to 1600	3	3	6	10	152	63	200	-929	-69
Max to 1600	10	23	32	157.303371	505.376344	712	1000	-83	81
Min from 1600	3	12	12	10	152	63	-146	-929	-69
Max from 1600	10	28	51	157.303371	505.376344	712	1000	-83	81

Composite Thresholds

Discrete	Composite
3.352E-01	1.1715E-01

Sh Discrete Rejection Profile (See note in key)

Minimum	0
Maximum	1

Note: HCW/20K is omitted from this analysis; see text.

*Ranges given below are for machine counts; FE manual ranges are: 3-20, early; 15-38, late.

**Manual open-line counts are adjusted from Marina Tarlinskaja counts March 2005 and do not always follow Riverside punctuation.

Appendix Two: Edward the Third, Scenes versus Shakespeare Baseline, Blocksize = 1,500

Scene	Grade Level	HCW /20K	Fem Endings (%C)	Open Lines (%C)	Enclitics /1000 lines	Proclitics /1000 lines	BoB5	BoB7	BoB8	T-E Slope Test	T-E Rare Words	T-E New Words	Buckets Block	Number of Tests	Discrete Rejections	Discrete Composite Probability (2.6%)	Continuous Composite Error	Continuous Composite Probability
1.01	10	47	4	16	6	89	517	739	-722	-0.13	-73	-13	7	13	4	2.706E-04	6.9716	5.1666E-06
1.02 (Sh?)	7	61	4	14	36	192	259	1000	-724	-0.11	-12	-8	-58	13	1	2.900E-01	4.8245	3.8483E-02
2.01a (Sh?)	8	78	9	15	71	271	144	1000	-600	-0.10	23	-23	-98	13	1	2.900E-01	4.9044	3.0645E-02
2.01b (Sh?)	9	55	11	20	44	212	300	1000	-889	0.01	82	0	44	13	1	2.900E-01	4.4236	1.0651E-01
2.02 (Sh?)	7	100	15	20	20	199	338	900	-552	-0.08	48	-5	-24	13	1	2.900E-01	3.4122	5.5710E-01
3.01	11	156	4	14	21	171	500	294	-563	-0.24	-101	-21	16	13	4	2.706E-04	7.7142	6.4298E-08
3.03	11	129	4	13	18	118	464	789	-630	-0.21	-49	-18	-9	13	3	4.133E-03	7.0093	4.2006E-06
3.02, 04, 05	8	171	6	16	44	167	410	500	-684	-0.02	-65	-21	-1	13	2	4.360E-02	5.5872	3.1340E-03
4.01-03	9	12	7	17	23	75	464	778	-872	0.03	18	3	70	13	2	4.360E-02	5.9469	7.4379E-04
4.04	12	94	11	22	75	200	596	1000	-867	-0.05	8	-1	43	13	2	4.360E-02	5.8141	1.2890E-03
4.05-09 (Sh?)	7	163	8	22	44	246	349	778	-709	-0.09	3	-18	-24	13	0	1.000E+00	3.8952	2.9670E-01
5.01	10	76	5	17	29	223	524	714	-837	-0.11	-51	0	13	13	3	4.133E-03	5.4365	5.4553E-03

Discrimination Statistics: Full Play														*Aggregates*	*Composite Discrimination Statistics*	
Rejections	5	1	0	0	1	10	0	0	0	1	5	0	1	24	7	10
Percentage	42%	8%	0%	0%	8%	83%	0%	0%	0%	8%	42%	0%	8%	15%	58%	83%
Blocks Tested	12	12	12	12	12	12	12	12	12	12	12	12	12	156	12	12

Discrimination Statistics: Shakespeare Ascriptions																
Rejections	0	0	0	0	0	3	0	0	0	0	0	0	1	4	0	3
Percentage	0%	0%	0%	0%	0%	60%	0%	0%	0%	0%	0%	0%	20%	6%	0%	60%
Blocks Tested	5	5	5	5	5	5	5	5	5	5	5	5	5	65	5	5

Discrimination Statistics: Other Scenes																
Rejections	5	1	0	0	1	7	0	0	0	1	5	0	0	20	7	7
Percentage	71%	14%	0%	0%	14%	100%	0%	0%	0%	14%	71%	0%	0%	22%	100%	100%
Blocks Tested	7	7	7	7	7	7	7	7	7	7	7	7	7	91	7	7

Aggregate Composite Probabilities		
Sh Ascriptions	8.912E-02	3.3404E-08
Other Scenes	2.216E-13	<1.0000E-15
Comparison Ratio	4.022E+11	>3.3404E+07

Shakespeare Corpus Baseline: Consolidated Discrete Profile	Grade Level	HCW /20K	Fem Endings	Open Lines	Enclitics /1000 lines	Proclitics /1000 lines	BoB5	BoB7	BoB8	T-E Slope Test	T-E Rare Words	T-E New Words	Buckets Block
Global Min	4	24	3	8	18	235	93	0	-889	-0.22	-40	-24	-77
Global Max	9	243	29	55	123	561	761	1000	-209	0.15	116	12	100
Min to 1600	4	24	3	8	18	235	93	188	-889	-0.2236	-40	-24.3735	-77
Max to 1600	9	243.4077	23	33	123.37662	561	761	1000	-209	0.15	116	12.3612	100
Min from 1600	4	24	3	13	18	235	93	0	-889	-0.2236	-40	-24.3735	-77
Max from 1600	9	243.4077	29	55	123.37662	561	761	1000	-209	0.15	116	12.3612	100

Composite Thresholds	Discrete	Continuous
	2.516E-01	2.0299E-01
	Sh Discrete Rejection Profile (See note in key)	
	Minimum	0
	Maximum	1

Appendix Three: Edward the Third, Scenes versus Shakespeare Baseline, Grouped by Ascription

Scene	Grade Level	HCW /20K	Fem Endings (%C)	Open Lines (%C)	Enclitics /1000 lines	Proclitics /1000 lines	BoB5	BoB7	BoB8	T-E Slope Test	T-E Rare Words	T-E New Words	Buckets Block	Number of Tests	Discrete Rejections	Discrete Composite Probability (2.6%)	Continuous Composite Error	Continuous Composite Probability
Shakespeare Scenes or Blocks																		
1.02 (Sh?)	7	61	4	14	36	192	259	1000	-724	-0.11	-12	-8	-58	13	1	2.900E-01	4.8245	3.8483E-02
2.01a (Sh?)	8	78	9	15	71	271	144	1000	-600	-0.10	23	-23	-98	13	1	2.900E-01	4.9044	3.0645E-02
2.01b (Sh?)	9	55	11	20	44	212	300	1000	-889	0.01	82	0	44	13	1	2.900E-01	4.4236	1.0651E-01
2.02 (Sh?)	7	100	15	20	20	199	338	900	-552	-0.08	48	-5	-24	13	1	2.900E-01	3.4122	5.5710E-01
4.05-09 (Sh)	7	163	8	22	44	246	349	778	-709	-0.09	3	-18	-24	13	0	1.000E+00	3.8952	2.9670E-01
Composite probabilities for Shakespeare blocks																8.912E-02		3.3404E-08
Ratio of baseline threshold probability to composite sample probability																2.823E+00		6.0769E+06
Ratio of baseline threshold probability to composite sample probability, layman's numbers																3 to 1		6 million to 1
Non-Shakespeare Scenes or Blocks																		
1.01	10	47	4	16	6	89	517	739	-722	-0.13	-73	-13	7	13	4	2.706E-04	6.9716	5.1666E-06
3.01	11	156	4	14	21	171	500	294	-563	-0.24	-101	-21	16	13	4	2.706E-04	7.7142	6.4298E-08
3.03	11	129	4	13	18	118	464	789	-630	-0.21	-49	-18	-9	13	3	4.133E-03	7.0093	4.2006E-06
3.02, 04, 05	8	171	6	16	44	167	410	500	-684	-0.02	-65	-21	-1	13	2	4.360E-02	5.5872	3.1340E-03
4.01-03	9	12	7	17	23	75	464	778	-872	0.03	18	3	70	13	2	4.360E-02	5.9469	7.4379E-04
4.04	12	94	11	22	75	200	596	1000	-867	-0.05	8	-1	43	13	2	4.360E-02	5.8141	1.2890E-03
5.01	10	76	5	17	29	223	524	714	-837	-0.11	-51	0	13	13	3	4.133E-03	5.4365	5.4553E-03
Composite probabilities for non-Shakespeare blocks																2.216E-13		<1.0000E-15
Ratio of baseline threshold probability to composite sample probability																1.135E+12		>2.0299E+14
Ratio of baseline threshold probability to composite sample probability, layman's numbers																1 trillion to 1		>200 trillion to 1
Comparison ratio, Shakespeare composite to non-Shakespeare composite																4.022E+11		>3.3404E+07

Shakespeare Corpus Baseline: Consolidated Discrete Profile

	Grade Level	HCW /20K	Fem Endings	Open Lines	Enclitics /1000 lines	Proclitics /1000 lines	BoB5	BoB7	BoB8	T-E Slope Test	T-E Rare Words	T-E New Words	Buckets Block
Global Min	4	24	3	8	18	235	93	0	-889	-0.22	-40	-24	-77
Global Max	9	243	29	55	123	561	761	1000	-209	0.15	116	12	100
Min to 1600	4	24	3	8	18	235	93	188	-889	-0.2236	-40	-24.3735	-77
Max to 1600	9	243.4077	23	33	123.37662	561	761	1000	-209	0.15	116	12.3612	100
Min from 1600	4	24	3	13	18	235	93	0	-889	-0.2236	-40	-24.3735	-77
Max from 1600	9	243.4077	29	55	123.37662	561	761	1000	-209	0.15	116	12.3612	100

Composite Thresholds

Discrete	Continuous
2.516E-01	2.0299E-01

Sh Discrete Rejection Profile (See note in key)	
Minimum	0
Maximum	1

Appendix Four: Edward the Third versus Play Verse Baseline, Aggregate Analysis by Geometric Mean

	Shakespeare Baseline											Edward the Third			
Group Name	Richard III	Richard II	Romeo	1H4	Hamlet	Troilus	Measure	Othello	Pericles Sh	TNK Sh	H8 Sh	Ed3 Sh	Ed3 Sh Rev	Ed3 NS	Ed3 NS Rev
CCPs by Block															
1	2.72E-01	7.63E-01	4.37E-01	1.98E-04	3.73E-01	9.91E-02	8.19E-01	8.88E-01	4.25E-01	1.01E-01	1.30E-01	3.85E-02	3.85E-02	5.17E-06	5.17E-06
2	9.43E-01	6.36E-02	2.56E-01	4.75E-01	2.18E-01	2.52E-04	4.85E-01	8.75E-01	7.33E-01	5.25E-02	7.33E-01	3.06E-02	3.06E-02	6.43E-08	6.43E-08
3	9.90E-01	2.18E-01	8.72E-05	9.98E-01	3.98E-01	2.48E-01	6.16E-01	9.99E-01	7.98E-01	9.45E-01	2.07E-01	1.07E-01	1.07E-01	4.20E-06	4.20E-06
4	7.87E-01	2.07E-01	7.48E-02	2.72E-01	6.48E-01	3.23E-01	9.59E-01	9.33E-01	7.74E-01	3.42E-03	6.32E-01	5.57E-01	5.57E-01	3.13E-03	3.13E-03
5	8.26E-01	7.08E-01	2.60E-01	8.48E-01	3.61E-01	8.90E-01	9.87E-01	5.77E-01		6.36E-01	1.34E-01	1.29E-03	2.97E-01	7.44E-04	7.44E-04
6	5.94E-01	3.89E-01	3.80E-02	7.47E-01	8.26E-01	7.22E-01	8.19E-01	4.34E-01		4.42E-01	1.48E-01			2.97E-01	1.29E-03
7	8.66E-01	3.57E-01	2.29E-09	6.00E-01	7.42E-01	9.57E-01	9.57E-01	5.04E-01						5.46E-03	5.46E-03
8	1.79E-02	2.98E-01	4.79E-02	2.03E-01	7.42E-01	9.75E-01	9.73E-01	1.87E-01							
9	1.87E-01	8.72E-01	1.14E-01			8.28E-01									
10	8.34E-01	9.28E-01	2.83E-02			6.38E-01									
11	2.77E-01	8.66E-01	9.57E-01			3.24E-01									
12	8.80E-01	5.07E-01	1.42E-01												
13	7.07E-01	4.63E-01	4.82E-01												
14	1.90E-01	8.87E-01	6.51E-01												
15	5.98E-01														
16	4.65E-01														
17	6.08E-01														
18	9.32E-01														
Continuous Aggregates	Threshold =0.203														
Raw Score	4.69E-01	4.37E-01	2.70E-02	1.94E-01	4.92E-01	2.47E-01	8.05E-01	6.02E-01	6.63E-01	1.30E-01	2.50E-01	3.90E-02	1.16E-01	1.76E-04	8.10E-05
Normalized Score	2.31E+00	2.15E+00	1.33E-01	9.53E-01	2.43E+00	1.21E+00	3.97E+00	2.96E+00	3.26E+00	6.40E-01	1.23E+00	1.92E-01	5.70E-01	8.68E-04	3.99E-04
Two-week Score	8.65E-01	9.28E-01	1.50E+01	2.10E+00	8.25E-01	1.65E+00	5.04E-01	6.75E-01	6.13E-01	3.12E+00	1.62E+00	1.04E+01	3.51E+00	2.30E+03	5.01E+03
Year Score	1.66E-02	1.79E-02	2.89E-01	4.03E-02	1.59E-02	3.17E-02	9.70E-03	1.30E-02	1.18E-02	6.01E-02	3.12E-02	2.00E-01	6.75E-02	4.43E+01	9.64E+01
Discrete Aggregates	Threshold = 0.252														
Number of Failures	5	3	6	2	3	6	1	2	1	3	3	6	4	18	20
Number of Blocks	234	182	174	88	88	139	88	88	52	72	74	65	65	91	91
Raw Score	7.30E-01	8.54E-01	3.00E-01	6.70E-01	4.02E-01	1.55E-01	9.02E-01	6.70E-01	7.46E-01	2.88E-01	3.02E-01	6.89E-03	8.91E-02	2.27E-11	2.22E-13
Normalized Score	2.90E+00	3.40E+00	1.19E+00	2.66E+00	1.60E+00	6.17E-01	3.58E+00	2.66E+00	2.96E+00	1.15E+00	1.20E+00	2.74E-02	3.54E-01	9.01E-11	8.81E-13
Two-week Score	6.90E-01	5.89E-01	1.68E+00	7.51E-01	1.25E+00	3.24E+00	5.58E-01	7.51E-01	6.75E-01	1.75E+00	1.66E+00	7.31E+01	5.65E+00	2.22E+10	2.27E+12
Year Score	1.33E-02	1.13E-02	3.22E-02	1.44E-02	2.41E-02	6.23E-02	1.07E-02	1.44E-02	1.30E-02	3.36E-02	3.20E-02	1.40E+00	1.09E-01	4.27E+08	4.37E+10