**Hartmut Ilsemann**

## Unmasking *Pericles*: New Evidence Casts Out Wilkins as Early Acts' Author

**Abstract**

This study utilises the combined methodologies of modern non-traditional stylometry and distant reading procedures of common N-grams in contemporary texts to collate the actual attribution of acts in *Pericles* with the previous findings of literary criticism. The attribution of the first two acts to George Wilkins is no longer tenable in view of the widespread commonality of N-grams and vocabulary. Stylistic similarities also point to Shakespeare in the first two acts, despite the qualitative differences.

### Introduction

John Gower's *Confessio Amantis* (ca. 1390) is the most direct literary source for *Pericles*. Shakespeare must have adapted the story of "Apollonius of Tyre" from Gower's *Confessio Amantis*, a long English poem, as he lets Gower narrate the transitions between the acts, providing him with the ancient function of the chorus. The elements originate from the Latin archetypal prose romance *Historia Apollonii Regis Tyri* (ca. 3rd century AD) which tells the story of a young prince who solves a riddle, flees a tyrant, loses and regains his family, and is ultimately restored to honour. Lawrence Twine's *The Patterne of Painefull Adventures* (1576; reprinted 1607) is based on the *Apollonius* legend and may have served as a major immediate source for *Pericles* as many elements were used directly in the play, including (1) the riddle and incest motif, (2) the storm scenes and (3) the reunion with the lost daughter Marina. While Gower's *Confessio* presents the event with a focus on duty and the natural order, reflecting the didactic tone of his work, Shakespeare transforms this into a deeply personal and emotional moment, emphasizing themes of loss, fate, and the enduring bonds of family which suggests some orientation on Twine's more sensational and emotional tone that emphasizes Pericles' horror. But ever since the first observations of a qualitative difference [Nicholas Rowe (1709), George Steevens, Edmond Malone (1780), Charles Lamb (1807), Samuel Taylor Coleridge (up to 1825)] between the first scenes up to the middle of the third act and modern stylometric studies [Jackson, Vickers, Craig and Kinney, Freebury-Jones], the collaboration of George Wilkins seemed to be unquestionable. Ros Barber characterized such a situation with the following words:

> Beliefs acquired from authoritative sources and maintained over time, tend to achieve the status of truth. As a result, though there are many possible ways of interpreting historical data, consensus beliefs are so powerful a determinant of interpretative outcomes that new interpretations of historical evidence will tend to be rare (p. 83).

Of course, Barber did not refer to the Marlowe corpus, but even among Stratfordians *Pericles* is accepted as a collaborative play, a notion that will be challenged in this paper. The results of this investigation are based on the modern methods and procedures of non-traditional stylometry, as found in the R Stylo program suite (Eder, Rybicki, Kestemont). The advantage of Rolling Delta, Rolling Classify, and the General Imposters

method is that huge amounts of data can be compared with each other in a distant reading context. The supporting documents in the form of tables can be found for the most part in the appendix, technical program explanations in the notes. This paper deals with the uneven quality of Shakespeare's *Pericles*, and the mainstream belief paradigm that George Wilkins wrote the first two acts.

**Analyses**

This contribution however is based on the observation that distant reading and unsupervised methods filter out predominantly Shakespearean plays from the large number of text files as stylistically similar, but not the reference text *The Miseries of Enforced Marriage by* George Wilkins, not even in the first scenes in question. Instead, in Rolling Delta analyses with a window size of 5000 words and a 250-word overlap as well as character trigrams (mf3c) as variables, the three Shakespeare texts with the lowest delta values, i.e. the smallest stylistic difference, are followed by playwrights such as Webster, Fletcher (3 texts), Jonson (4 texts), Chapman (2 texts), Heywood (3 texts), Middleton (2 texts) and even Greene, who cannot be considered as an author, before Wilkin's reference text appears at position 20 (see http://www.shak-stat.engsem.uni-hannover.de/eallpericles.html). In contrast to the complete survey on the *Shakespeare Statistics* website **Table *1*** recalls only the position (column A) in the ranking order of the closest reference texts (column B) and their overall delta values (column C).

**Table 1** Excerpt from Rolling Delta analyses with 109 reference texts

| | A | B | C |
|---|---|---|---|
| 1 | **pos.** | **closest reference texts** | **Δ** |
| 2 | 1 | shak_winters1609 | 21,6 |
| 3 | 2 | web_duchess | 22,2 |
| 4 | 3 | shak_lear1606 | 22,6 |
| 5 | 4 | shak_hamlet | 23,0 |
| 6 | 5 | fletch_philaster1608 | 23,4 |
| 7 | 6 | jonson_volpone1605 | 23,4 |
| 8 | 7 | jonson_cynthia1600 | 24,0 |
| 9 | 8 | jonson_alchemist1610 | 24,1 |
| 10 | 9 | chap_allfools | 24,1 |
| 11 | 10 | chap_msd'olive1606 | 24,3 |
| 12 | 11 | heyw_royalking | 24,5 |
| 13 | 12 | middle_hengist1619 | 24,6 |
| 14 | 13 | heyw_engtravel1633 | 24,6 |
| 15 | 14 | jonson_outhumour1599 | 24,7 |
| 16 | 15 | middle_phoenix1603 | 24,7 |
| 17 | 16 | heyw_fairmaidwest | 24,8 |
| 18 | 17 | fletch_beggarsb1612 | 24,8 |
| 19 | 18 | greene_jamesiv | 24,8 |
| 20 | 19 | fletch_customcountry1619 | 24,8 |
| 21 | 20 | wilkins_misenfmarriage | 24,9 |

The results of modern non-traditional stylometry, the evidence for which can be found in the appendix, are obviously in stark contrast to previous analyses, so that it makes sense to question their foundations. Early critics remarked on the uneven quality of *Pericles*. Particularly the first two acts were regarded as inferior in poetic and dramatic quality. The question that arose was whether the entire play could be the work of Shakespeare alone. As George Wilkins published a novelized version of *Pericles* in 1607 the suspicion arose that he might have written the first two acts, or at least that he might have contributed heavily to the early acts. Alexander Dyce (p. 246) and William Fleay (pp. 158–159) represented this direction pointing to similarities in style, diction, and dramatic technique. Studies in the 20th century confirmed that the linguistic and metrical patterns of Acts I–II were different from those in Acts III–V, further supporting the theory of co-authorship. A major contribution came from Brian Vickers (*Shakespeare, Co-Author,* 2002) who analysed the play with the aim of distinguishing between the contributions of William Shakespeare and George Wilkins. Vickers compared *Pericles* with Wilkins's known solo play, *The Miseries of Enforced Marriage* (1607), identifying overlapping features in vocabulary, syntax, and characterization. Vickers used a plagiarism detection program in his investigation. If his approach is repeated, this time with Prof. Bloomfield's plagiarism program *WCopyfind*, an impressive list of common n-grams becomes visible:

**Pentagrams** *Pericles I, II* and *The Miseries of Enforced Marriage*

what do you think of ; left in trust with me ; but i must tell you ;

**Tetragrams** *Pericles I, II* and *The Miseries of Enforced Marriage*

what do you think of ; i thank you sir ; pray you let me ; o 'tis too true ; left in trust with me ; and have no more ; be ruled by me ; i will make you ; and she is fair ; a plague on them ; god give you joy ; you were not so ; but i must tell you ; the curse of heaven ; that i have done

**Trigrams** *Pericles I, II* and *The Miseries of Enforced Marriage*

to make men ; i tell you ; and full of ; which to prevent ; for his wife ; his life so ; and with a ; in this enterprise ; the fruit of ; should be like ; all good men ; to the earth ; to you thus ; ready for the ; they may be ; as you will ; if this be ; which makes me ; i loved you ; but i must ; is gone and ; their will and ; but i will ; so fair a ; you were not ; as near to ; the hands of ; to keep you ; no more but ; till you return ; as they are ; men for they ; if there be ; have power to ; for a prince ; that i should ; i have done ; since you have ; i think you ; in my absence ; take thy word ; of both this ; i am sure ; to be hanged ; be a villain ; shall not need ; left in trust with me ; you will be ; i know not ; to show his ; shall not be ; we have no ; ere you shall ; in hope to ; but like to ; which i have ; not so much ; the name of ; 'tis too true ; for want of ; be glad of ; man and wife ; to give them ; they will and ; we are half ; we hear you ; i pray you ; the curse of heaven ; the which i ; to make him ; the greatness of ; what say you ; a plague on them ; and at last ; he should have ; i would have ; now a days ; i have been ; and have no more ; to give my ; if you shall ; i am dead ; that i am ; i have a ; i thank you ; i'll tell you ; i'll tell you ; daughter and to ; of the world ; pray you let me ; to me with ; i know it ; and if that ; i'll show the ; i hope sir ; a pair of ; to make thee ; thee to the ; they are my ; it should be ; father and the ; father and the ; what is the ; he comes to ; no more than ; to me like ; to my father's ; for them to ; he will not ; here with a ; what is it ; are like to ; desire to know ; a gentleman of ; in the world ; a gentleman of ; i will not ; as well as ; here is a ; and i have ; as much as ; you would be ; have done well ; i know you ; he that will ; with me and ; in the world ; his funeral and ; you to this ; you shall like ; you know that ; well i do ; what do you think of ; and she is fair ;

you must be ; to have my ; i have not ; even in his ; i am glad ; i'll bring you ; be ruled by ; i will make you ; man and wife ; god give you joy ; you love me ; sir even as ; my life or ; so well that

Given the premise of comparing the first two acts with Wilkins's *The Miseries of Enforced Marriage*, Vickers' chosen method appears robust. From today's perspective, restricting the analysis to two actors is a mistake. The building of a corpus must entail a range of contemporary reference texts. It is only in the last ten years that the methodological extensions and possibilities of distant reading have led to the realisation that the degree of linguistic commonalities among contemporary authors was much greater than had previously been assumed. Pervez Rizvi's database in particular was able to demonstrate the extent of the dispersion of common N-grams. As far as the first two acts of *Pericles* are concerned Rizvi's html-summary contains a filter which "shows the top 25% of matches, according to a formula that ranks each n-gram match between two plays according to the number and commonness of the words in the n-gram and how many plays it occurs in" (https://www.shakespearestext.com/can/ngram_search.htm). If *Pericles* [Acts 1 to 2] is compared to Wilkins's *The Miseries of Enforced Marriage,* no results are given. In the respective csv-file with the ranking of texts according to their common n-grams Wilkins's play only turns up in line 489.

**Table 2 Excerpt from Pervez Rizvi's database**

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 1 | PLAY | YEAR | NO. OF WORDS | MATCHING PLAY | MATCHING PLAY YEAR | NO. OF WORDS IN MATCHING PLAY | NO. OF UNIQUE MATCHES | WEIGHTED NO. OF UNIQUE MATCHES |
| 489 | Pericles [Acts 1 to 2] | 1608 | 8095 | The Miseries of Enforced Marriage | 1605 | 24082 | 0 | 0 |

When the Wilkins csv file is retrieved with the filter on *Pericles*, similar relations are revealed. Acts 3 to 5 show the greater correspondence with *The Miseries of Enforced Marriage*, but both *Pericles* parts are at a considerable distance in their ranking with position values of 392 and 527, so that any co-authorship can be excluded.

**Table 3 Excerpt from Pervez Rizvi's database**

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 1 | PLAY | YEAR | NO. OF WORDS | MATCHING PLAY | MATCHING PLAY YEAR | NO. OF WORDS IN MATCHING PLAY | NO. OF UNIQUE MATCHES | WEIGHTED NO. OF UNIQUE MATCHES |
| 392 | The Miseries of Enforced Marriage | 1605 | 24082 | Pericles [Acts 3 to 5] | 1608 | 10125 | 2 | .000058 |
| 527 | The Miseries of Enforced Marriage | 1605 | 24082 | Pericles [Acts 1 to 2] | 1608 | 8095 | 0 | 0 |

However thorough Vickers' comparisons were, they suffered from the axiomatic positing of George Wilkins as a collaborator. When Prof. Bloomfield's plagiarism program *WCopyfind* was applied to the first two acts of *Pericles* and their matching n-grams in contemporary plays sorted trigrams returned the list in **Table *4***.

**Table 4 Sorted n-gram counts of contemporary plays**

| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | no. of words in | 5-grams | 4-grams | 3-grams | corresp. play |
| 2 | search_peri1-2 | 10 | 70 | 551 | jon_outhumour |
| 3 | search_peri1-2 | 0 | 48 | 531 | heyw_2edwiv |
| 4 | search_peri1-2 | 5 | 49 | 529 | shak_hamlet |
| 5 | search_peri1-2 | 0 | 48 | 528 | jon_cynthia |
| 6 | search_peri1-2 | 5 | 61 | 510 | fletch_philaster |
| 7 | search_peri1-2 | 5 | 61 | 510 | fletch_philaster |
| 8 | search_peri1-2 | 0 | 56 | 503 | jon_bartholomew |
| 9 | search_peri1-2 | 10 | 58 | 481 | shak_cymbeline |
| 10 | search_peri1-2 | 10 | 54 | 477 | shak_cymbeline |
| 11 | search_peri1-2 | 15 | 67 | 472 | shak_asyoulikeit |
| 12 | search_peri1-2 | 16 | 64 | 471 | jon_inhumour |
| 13 | search_peri1-2 | 0 | 32 | 468 | shak_coriolan |
| 14 | search_peri1-2 | 0 | 52 | 464 | shak_lear |
| 15 | search_peri1-2 | 5 | 41 | 457 | fletch_maidstrag |
| 16 | search_peri1-2 | 5 | 68 | 456 | row_whenyousee |
| 17 | search_peri1-2 | 15 | 63 | 455 | wilkins_misenfmar |
| 18 | search_peri1-2 | 11 | 63 | 452 | fletch_akingnoking |
| 19 | search_peri1-2 | 10 | 46 | 433 | jon_volpone |
| 20 | search_peri1-2 | 5 | 41 | 430 | shak_henryviii |
| 21 | search_peri1-2 | 0 | 44 | 428 | shak_othello |
| 22 | search_peri1-2 | 15 | 59 | 423 | day_bednalgreen |
| 23 | search_peri1-2 | 0 | 20 | 423 | shak_winters |
| 24 | search_peri1-2 | 5 | 41 | 417 | fletch_humlieutenant |
| 25 | search_peri1-2 | 10 | 52 | 412 | heyw_hoxton |
| 26 | search_peri1-2 | 16 | 56 | 410 | heyw_1edwiv |
| 27 | search_peri1-2 | 5 | 52 | 410 | chap_daysmirth |
| 28 | search_peri1-2 | 5 | 29 | 408 | fletch_customcountry |
| 29 | search_peri1-2 | 5 | 49 | 405 | jon_epicoene |
| 30 | search_peri1-2 | 5 | 29 | 403 | jon_sejanus |

Before Wilkins's play *The Miseries of Enforced Marriage* turns up in line 17 there are four higher rankings plays by Jonson, six by Shakespeare, three by Fletcher and one by Heywood and Rowley each.

A corroboration of previous findings appeared in 2009 when Craig and Kinney published their much-acclaimed research volume *Shakespeare, Computers, and the Mystery of Authorship*. The methods they used and put down in chapter five "Case Studies" (p.p 131–148) seemed to be most forward, building a comparison corpus of plays by Shakespeare (especially late plays like *Cymbeline* and *The Winter's Tale, etc.),* then George Wilkins (*The Miseries of Enforced Marriage*) and other contemporary dramatists for control (e.g., Middleton, Dekker). They saw function words like "and", "but", "if", "the" as unconscious, style-revealing features and measured their top 100 – 300 relative frequencies in

*Pericles* and compared them to those in works by Shakespeare and Wilkins. For the first time they used rolling windows and divided Pericles into chunks of 1000 words, each of which was tested for stylistic similarity using delta-based distance measures. These chunks were then plotted to show stylistic shifts across the play in which Acts 1 and 2 had the highest similarity to Wilkins and Acts 3–5 showed a clear stylistic alignment with Shakespeare. Clustering algorithms and PCA to visualize authorial grouping revealed the same patterns. This matched closely with MacDonald P. Jackson's findings. In 2014 MacDonald P. Jackson (*Determining the Shakespeare Canon*) tested *Pericles* most thoroughly using a range of stylometric techniques, primarily focusing on linguistic habits, rare word usage, and metrical features, with a particular emphasis on comparing the text with the known works of George Wilkins and William Shakespeare.

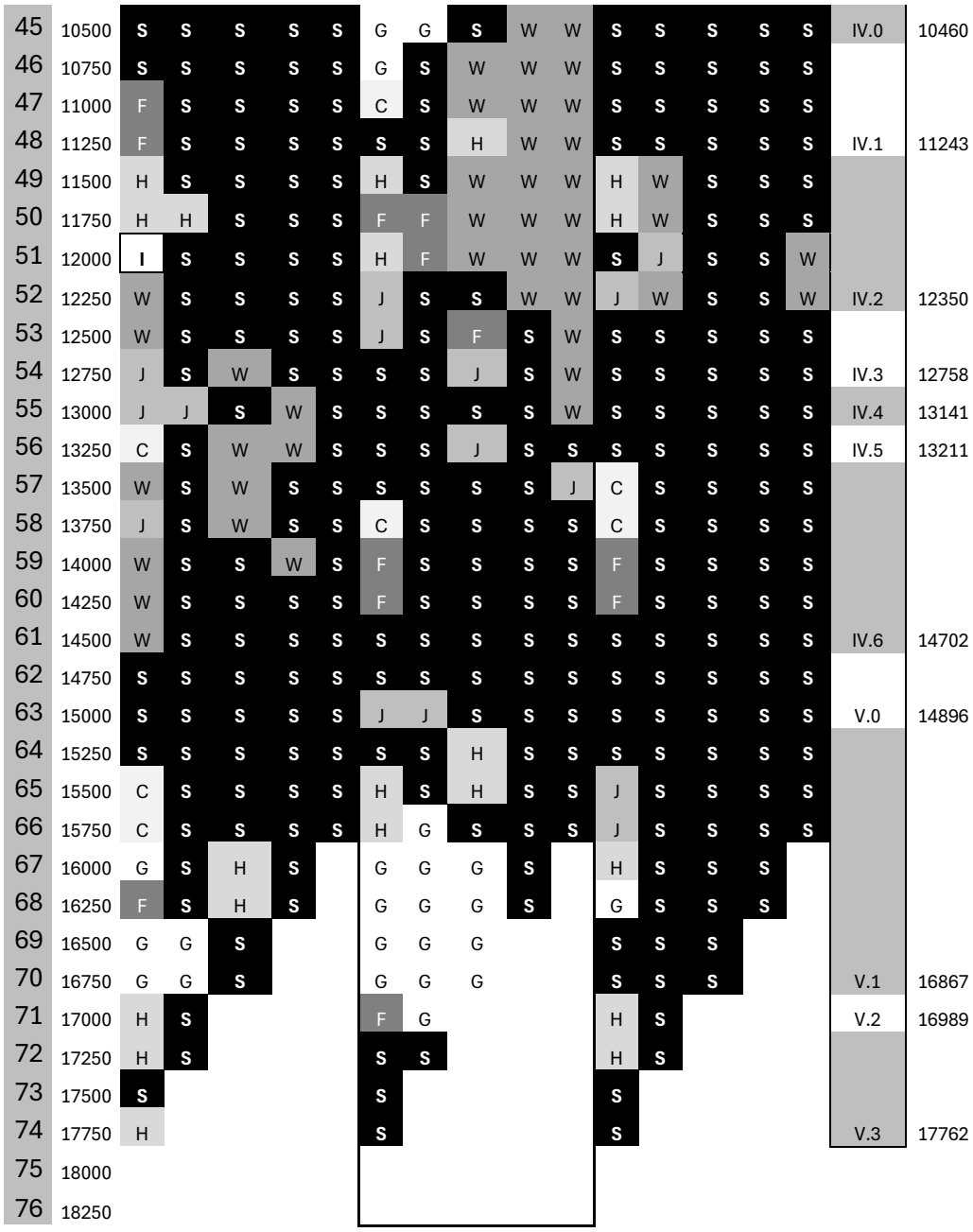
All in all, Vickers and his peers were certainly right in finding a simpler and more prosaic language in Acts I and II where more clichés and conventional phrasing are used. As far as verse is concerned it is more regular and less metrically complex. The writing style is more straightforward and narrative-driven, often with moralizing tones and there is a focus on domestic scenes. The latter acts are more poetic, structurally complex, and emotionally resonant—traits Vickers ascribes to Shakespeare. In a direct comparison moral commonplaces, flat dramatic rhetoric and narrative clarity without psychological depth are followed by complex emotional dynamics, rich metaphorical language and innovative verse rhythm.

One unavoidable question remains. Is there any doubt about the methodological robustness of the procedures used by Craig and Kinney? One answer could refer to the 1000-word test chunks. In his 2015 paper titled *"Does size matter? Authorship attribution, small samples, big problem"*, Maciej Eder notes that smaller text samples can lead to increased variability and reduced accuracy in authorship attribution tasks as there is more susceptibility to random noise. In his rolling delta program the default window size is 5000 words and the general experience of the past years in dealing with different window sizes says that 4000 or 5000 words per window provide good results. Nevertheless, *Tamburlaine 1* already proves the Marlowe authorship of *Tamburlaine 2* with 1000 words, just as Shakespeare's *King Lear* is determined by window sizes of 1000 words from *Hamlet*. Another crucial point is the number of the most frequent variables. While Craig and Kinney relied on 100 to 300 most frequent words, rolling delta makes use of 70% of all variables, and moreover it is not only words alone (mf1w), but also character bi- and trigrams (mf2c, mf3c) which offer reliable results.

While the rolling delta results of *Pericles*, which are shown in their entirety on the Shakespeare Statistics homepage, contain only the first twenty positions with stylistically similar reference texts in the extract of **Table *1*** and also list the closely spaced delta values in column C, indicating the large number of possible co-authors up to Wilkins, the following rolling delta analysis deals with the attribution behaviour of varying window sizes and the choice of variables.

**Table 5 Rolling Delta attributions with varying window sizes and variables**

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | **Rolling Delta attributions in *Pericles*** | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | **Sce-nes** | **Words** |
| 3 | 0 | **window sizes** | | | | | | | | | | | | | | | | |
| 4 | 250 | 1000 | 2000 | 3000 | 4000 | 5000 | 1000 | 2000 | 3000 | 4000 | 5000 | 1000 | 2000 | 3000 | 4000 | 5000 | I.0 | 278 |
| 5 | 500 | C | | **mf1w** | | | **S** | | **mf2c** | | | **C** | | **mf3c** | | | | |
| 6 | 750 | C | | | | | **S** | | | | | **S** | | | | | | |
| 7 | 1000 | R | **S** | | | | **S** | **S** | | | | **S** | **S** | | | | | |
| 8 | 1250 | R | **S** | | | | C | **S** | | | | C | **S** | | | | | |
| 9 | 1500 | R | R | **S** | | | **S** | **S** | **S** | | | **S** | **S** | **S** | | | I.1 | 1612 |
| 10 | 1750 | R | R | **S** | | | **S** | **S** | **S** | | | **S** | **S** | **S** | | | | |
| 11 | 2000 | H | R | R | **S** | | **S** | **S** | **S** | **S** | | **S** | **S** | **S** | **S** | | | |
| 12 | 2250 | H | H | R | **S** | | H | **S** | **S** | **S** | | F | **S** | **S** | **S** | | | |
| 13 | 2500 | **S** | H | R | **S** | **S** | H | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | | |
| 14 | 2750 | H | H | R | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | I.2 | 2643 |
| 15 | 3000 | H | R | R | **S** | **S** | **S** | **S** | **S** | **S** | **S** | H | **S** | **S** | **S** | **S** | I.3 | 2965 |
| 16 | 3250 | R | R | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | | |
| 17 | 3500 | R | R | H | **S** | **S** | **S** | **S** | **S** | **S** | **S** | R | **S** | **S** | **S** | **S** | | |
| 18 | 3750 | R | J | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | H | **S** | **S** | **S** | **S** | I.4 | 3806 |
| 19 | 4000 | R | H | R | **S** | **S** | **S** | **S** | **S** | **S** | **S** | R | H | **S** | **S** | **S** | II.0 | 4072 |
| 20 | 4250 | J | H | **S** | **S** | **S** | H | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | | |
| 21 | 4500 | H | R | **S** | **S** | **S** | H | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | | |
| 22 | 4750 | J | H | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | | |
| 23 | 5000 | M | **S** | **S** | **S** | **S** | H | **S** | **S** | **S** | **S** | H | **S** | **S** | **S** | **S** | | |
| 24 | 5250 | M | **S** | **S** | J | **S** | F | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | | |
| 25 | 5500 | J | **S** | J | J | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | II.1 | 5377 |
| 26 | 5750 | J | **S** | J | J | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | II.2 | 5815 |
| 27 | 6000 | **S** | **S** | J | C | **S** | **S** | **S** | **S** | **S** | **S** | J | J | **S** | **S** | **S** | | |
| 28 | 6250 | **S** | J | C | J | **S** | **S** | **S** | **S** | **S** | **S** | J | J | **S** | **S** | **S** | | |
| 29 | 6500 | J | J | C | J | **S** | **S** | **S** | **S** | **S** | **S** | J | J | **S** | **S** | **S** | | |
| 30 | 6750 | C | C | J | J | **S** | **S** | C | **S** | **S** | **S** | **S** | J | **S** | **S** | **S** | II.3 | 6719 |
| 31 | 7000 | C | C | J | **S** | **S** | C | C | **S** | **S** | **S** | C | C | **S** | **S** | **S** | | |
| 32 | 7250 | C | C | J | **S** | **S** | C | C | **S** | **S** | **S** | C | C | **S** | **S** | **S** | II.4 | 7175 |
| 33 | 7500 | H | C | J | **S** | **S** | C | C | **S** | **S** | **S** | C | C | **S** | **S** | **S** | | |
| 34 | 7750 | F | C | **S** | **S** | **S** | C | C | **S** | **S** | **S** | C | C | **S** | **S** | **S** | | |
| 35 | 8000 | C | **S** | **S** | **S** | **S** | C | **S** | **S** | **S** | **S** | C | **S** | **S** | **S** | **S** | II.5 | 7871 |
| 36 | 8250 | J | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | III.0 | 8246 |
| 37 | 8500 | J | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | | |
| 38 | 8750 | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | III.1 | 8856 |
| 39 | 9000 | R | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | | |
| 40 | 9250 | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | | |
| 41 | 9500 | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | **S** | III.2 | 9663 |
| 42 | 9750 | **S** | **S** | **S** | **S** | **S** | H | **S** | **S** | **S** | W | **S** | **S** | **S** | **S** | **S** | | |
| 43 | 10000 | **S** | **S** | **S** | **S** | **S** | F | **S** | **S** | **S** | W | **S** | **S** | **S** | **S** | **S** | III.3 | 10014 |
| 44 | 10250 | **S** | **S** | **S** | **S** | **S** | G | G | **S** | **S** | W | **S** | **S** | **S** | **S** | **S** | III.4 | 10143 |



Attributions based on words (mf1w) are registered in columns B to F, character bigram attributions (mf2c) in columns G to K, and trigram attributions (mf3c) can be found in columns L to P. Whereas the first measurement of the 1000-word window is listed in the middle of the window at 500 words (B5), the 2000-word window is in C7, etc. It is noteworthy that the consolidation of assignments is clearer in mf2c and mf3c analyses, and there is simultaneously a lot of statistical noise in the smaller windows of mf1w. And yet, despite the wild mixture of attributions, there is only one cell (B51) that named Wilkins as stylistically close. The overall result with its focus on larger windows names exclusively Shakespeare, and this applies to Acts I and II as well.

**Table 6 Attribution summary of Table 5**

| Authors | No. | % |
|---|---|---|
| **S**hakespeare | 686 | 73,8 |
| **J**onson | 45 | 4,8 |
| **W**ebster | 45 | 4,8 |
| **C**hapman | 43 | 4,6 |
| **H**eywood | 43 | 4,6 |
| **G**reene | 25 | 2,7 |
| **R**owley | 24 | 2,6 |
| **F**letcher | 16 | 1,7 |
| **M**iddleton | 2 | 0,2 |
| Wilkins | 1 | 0,1 |
| **total** | 930 | 100,0 |

The rolling classify analysis of **Table 9** shows the same situation of a large dispersion of possible contributors in Acts I and II before a consolidation of the Shakespeare indications prevails from about III.2 onwards. In any case, it is remarkable that Wilkins was not identified anywhere by the classifiers nsc, svm and delta. Whereas Table 9 made use of window sizes of 5000 words, the very reliable svm classifier already returns an impressive view when a window size of 2000 words is employed together with character trigrams.

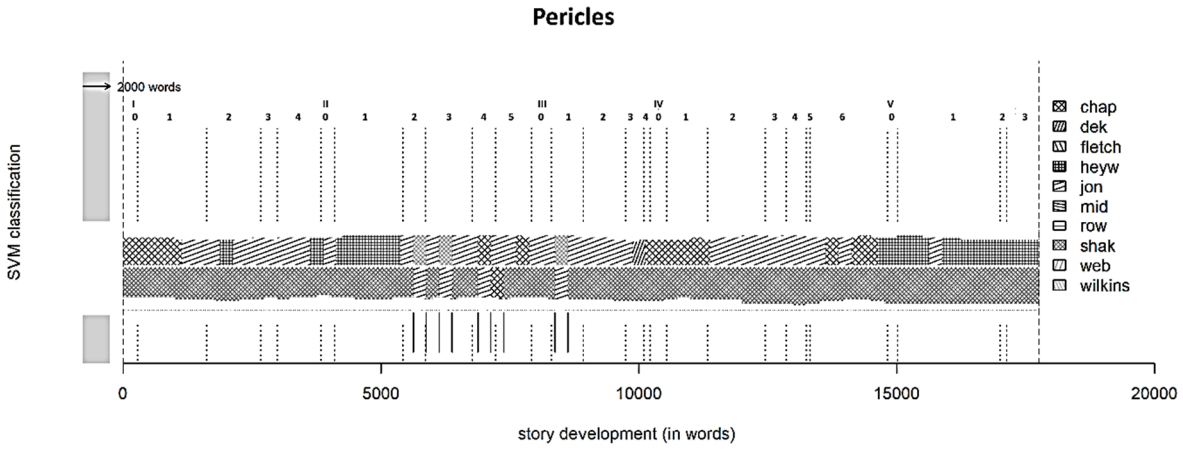



**Figure 1 svm attributions with 2000-word windows**

The overall Shakespeare attribution is interrupted in II.2, II.3, II.4 and III.1 for very brief Jonson segments, and at the beginning of II.5 there is an equally short Chapman reference. There is not even a Wilkins hint in the row of alternative assignments.

The crucial question is aimed at resolving the colourful mixture of possible co-authors in the overall account of **Table 9**. This can be achieved with the General Imposters Method (GI) which was implemented into R Stylo in 2018 by M. Eder who explained the advantages of the tool in a blog post of the Computational Stylistics Group (https://computationalstylistics.github.io/blog/imposters/). GI goes beyond the claim of stylistic similarity between two texts but rather aims "to assess whether two documents are

significantly more similar to one another than other documents." In this process the classic Burrowsian classifier (delta) and the cosine delta distance of the Würzburg Stylistics Group (wu) were used next to the Růžička metric (ru). When Kestemont et al. (2016) tested authorship verifications with the Růžička metric they came to a clear conclusion: "Comparative evaluations across a variety of benchmark corpora show that this metric yields better, as well as more consistent results than previously used metrics" (246). In my own investigations I used an optimised version of GI which was kindly provided to me in a script by Jan Rybicki who marked the grey area of unsecured assignments with the 'low' and 'high' boundaries. In a variety of tests, the more similar texts were searched for with *Pericles* as a complete text prefixed "aaa" (aaa_pericles) or "search" as far as parts of the text are concerned (search_peri1-2, search_peri3-5).

**Table 7 GI attributions**

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **delta** | low | high | **aaa** | **chap** | **fletch** | **heyw** | **jon** | **mid** | **search** | **shak** | **web** | **wilkins** | var. |
| 2 | aaa_pericles | 0.45 | 0.55 | | 0.15 | 0.02 | 0 | 0 | 0 | **1** | 0.05 | 0 | 0 | mf1w |
| 3 | aaa_pericles | 0.26 | 0.73 | | 0 | 0 | 0.01 | 0.02 | 0.06 | **0.78** | 0.23 | 0.18 | 0.05 | mf1c |
| 4 | aaa_pericles | 0.23 | 0.67 | | 0.01 | 0.16 | 0 | 0 | 0 | **1** | 0.09 | 0 | 0 | mf2c |
| 5 | aaa_pericles | 0.39 | 0.6 | | 0.01 | 0.08 | 0 | 0 | 0 | **1** | 0.19 | 0 | 0.02 | mf3c |
| 6 | | | | | | | | | | | | | | |
| 7 | **wu** | low | high | **aaa** | **chap** | **fletch** | **heyw** | **jon** | **mid** | **search** | **shak** | **web** | **wilkins** | var. |
| 8 | aaa_pericles | 0.39 | 0.61 | | 0 | 0 | 0 | 0 | 0 | **1** | 0.21 | 0.02 | 0 | mf1w |
| 9 | aaa_pericles | 0.38 | 0.6 | | 0 | 0.01 | 0.01 | 0.04 | 0.11 | **0.83** | 0.35 | 0.16 | 0.02 | mf1c |
| 10 | aaa_pericles | 0.39 | 0.5 | | 0 | 0.15 | 0.01 | 0.05 | 0.04 | **1** | 0.06 | 0 | 0 | mf2c |
| 11 | aaa_pericles | 0.24 | 0.75 | | 0 | 0.04 | 0.03 | 0 | 0 | **1** | 0.18 | 0 | 0 | mf3c |
| 12 | | | | | | | | | | | | | | |
| 13 | **ru** | low | high | **aaa** | **chap** | **fletch** | **heyw** | **jon** | **mid** | **search** | **shak** | **web** | **wilkins** | var. |
| 14 | aaa_pericles | 0.24 | 0.65 | | 0 | 0.01 | 0 | 0 | 0 | **1** | 0.18 | 0.05 | 0 | mf1w |
| 15 | aaa_pericles | 0.39 | 0.58 | | 0.02 | 0.01 | 0.02 | 0.01 | 0 | **1** | 0.05 | 0.16 | 0.1 | mf1c |
| 16 | aaa_pericles | 0.48 | 0.5 | | 0.01 | 0 | 0.02 | 0 | 0 | **1** | 0.16 | 0.11 | 0 | mf2c |
| 17 | aaa_pericles | 0.27 | 0.63 | | 0 | 0.01 | 0 | 0 | 0 | **1** | 0.2 | 0.06 | 0 | mf3c |
| 18 | | | | | | | | | | | | | | |
| 19 | **delta** | low | high | **aaa** | **chap** | **fletch** | **heyw** | **jon** | **mid** | **search** | **shak** | **web** | **wilkins** | var. |
| 20 | search_peri1-2 | 0 | 1 | **1** | 0.45 | 0.13 | 0.11 | 0 | 0.02 | 0.03 | 0 | 0 | 0.01 | mf1w |
| 21 | search_peri1-2 | 0.46 | 0.52 | **0.9** | 0.08 | 0.03 | 0.09 | 0 | 0.16 | 0.15 | 0.13 | 0.07 | 0.15 | mf1c |
| 22 | search_peri1-2 | 0.34 | 0.59 | **1** | 0.12 | 0.32 | 0 | 0.01 | 0 | 0.11 | 0.14 | 0 | 0.02 | mf2c |
| 23 | search_peri1-2 | 0.22 | 0.74 | **1** | 0.01 | 0.25 | 0.01 | 0 | 0 | 0.42 | 0 | 0 | 0.28 | mf3c |
| 24 | | | | | | | | | | | | | | |
| 25 | **wu** | low | high | **aaa** | **chap** | **fletch** | **heyw** | **jon** | **mid** | **search** | **shak** | **web** | **wilkins** | var. |
| 26 | search_peri1-2 | 0.41 | 0.56 | **1** | 0.45 | 0.01 | 0.12 | 0 | 0 | 0.15 | 0 | 0 | 0 | mf1w |
| 27 | search_peri1-2 | 0.34 | 0.63 | 0.52 | 0.29 | 0.1 | 0.07 | 0.04 | 0.33 | 0.1 | 0.07 | 0.07 | 0.14 | mf1c |
| 28 | search_peri1-2 | 0.39 | 0.59 | **1** | 0.08 | 0.28 | 0.1 | 0.01 | 0 | 0.19 | 0.04 | 0 | 0 | mf2c |
| 29 | search_peri1-2 | 0.19 | 0.43 | **1** | 0.36 | 0.06 | 0.03 | 0 | 0 | 0.38 | 0 | 0 | 0 | mf3c |

| ru | low | high | aaa | chap | fletch | heyw | jon | mid | search | shak | web | wilkins | var. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| search_peri1-2 | 0.15 | 0.62 | **1** | 0 | 0 | 0.14 | 0 | 0 | 0 | 0.39 | 0.05 | 0.01 | mf1w |
| search_peri1-2 | 0.38 | 0.54 | **1** | 0.01 | 0 | 0.03 | 0.01 | 0.15 | 0.35 | 0.12 | 0.01 | 0.05 | mf1c |
| search_peri1-2 | 0.36 | 0.55 | **1** | 0.01 | 0.02 | 0 | 0 | 0 | 0.13 | 0.46 | 0.17 | 0 | mf2c |
| search_peri1-2 | 0.22 | 0.6 | **1** | 0.01 | 0.18 | 0 | 0 | 0 | 0 | 0.48 | 0.09 | 0 | mf3c |

| delta | low | high | aaa | chap | fletch | heyw | jon | mid | search | shak | web | wilkins | var. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| search_peri3-5 | 0.45 | 0.55 | **1** | 0.58 | 0.07 | 0.01 | 0 | 0.08 | 0.05 | 0.14 | 0.01 | 0 | mf1w |
| search_peri3-5 | 0.41 | 0.55 | **1** | 0 | 0.07 | 0.01 | 0.02 | 0 | 0.09 | 0.17 | 0.35 | 0.01 | mf1c |
| search_peri3-5 | 0.43 | 0.49 | **1** | 0.01 | 0.31 | 0 | 0.03 | 0 | 0.02 | 0.45 | 0 | 0.01 | mf2c |
| search_peri3-5 | 0.23 | 0.71 | **1** | 0 | 0.11 | 0.01 | 0 | 0 | 0.21 | 0.48 | 0 | 0.04 | mf3c |

| wu | low | high | aaa | chap | fletch | heyw | jon | mid | search | shak | web | wilkins | var. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| search_peri3-5 | 0.41 | 0.57 | **1** | 0.48 | 0.02 | 0 | 0 | 0.01 | 0.18 | 0.13 | 0 | 0 | mf1w |
| search_peri3-5 | 0.37 | 0.62 | **0.82** | 0.01 | 0.07 | 0.05 | 0.02 | 0.09 | 0.1 | 0.22 | 0.26 | 0 | mf1c |
| search_peri3-5 | 0.41 | 0.54 | **1** | 0.01 | 0.13 | 0 | 0.05 | 0.12 | 0.18 | 0.21 | 0 | 0 | mf2c |
| search_peri3-5 | 0.25 | 0.43 | **1** | 0.07 | 0.02 | 0 | 0 | 0 | 0.38 | 0.18 | 0.01 | 0 | mf3c |

| ru | low | high | aaa | chap | fletch | heyw | jon | mid | search | shak | web | wilkins | var. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| search_peri3-5 | 0.11 | 0.66 | **1** | 0 | 0.11 | 0 | 0.03 | 0 | 0 | 0.48 | 0.05 | 0 | mf1w |
| search_peri3-5 | 0.41 | 0.56 | **1** | 0.05 | 0.05 | 0.01 | 0.03 | 0 | 0.31 | 0 | 0.22 | 0.13 | mf1c |
| search_peri3-5 | 0.39 | 0.54 | **1** | 0 | 0.03 | 0 | 0.02 | 0.03 | 0.04 | 0.26 | 0.39 | 0 | mf2c |
| search_peri3-5 | 0.26 | 0.61 | **1** | 0 | 0.02 | 0 | 0 | 0 | 0 | 0.51 | 0.18 | 0 | mf3c |

There is a very clear indication that "aaa" corresponds best to the "search" files and vice versa. Even the first two acts which are clearly distinct from the latter acts are in no way related to Wilkins. Stylistically their adherence to Shakespeare is confirmed even when the remainder of *Pericles* is not taken into consideration as in **Table *8***.

**Table 8 Růžička confirms *Pericles* [Acts 1 to 2] to be more similar to Shakespeare than to anybody else**

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **Růžička** | low | high | **chap** | **chettle** | **dekker** | **fletch** | **heyw** | **jon** | **lodge** | **nashe** | **row** | **shak** | **web** | **wilkins** | var. |
| 2 | search_peri1-2 | 0.36 | 0.64 | 0.05 | 0.01 | 0 | 0.06 | 0.2 | 0 | 0 | 0 | 0 | **0.99** | 0.12 | 0.08 | mf1w |
| 3 | search_peri1-2 | 0.43 | 0.5 | 0.04 | 0.06 | 0 | 0.01 | **0.81** | 0 | 0.07 | 0.02 | 0 | 0.25 | 0.15 | 0.18 | mf1c |
| 4 | search_peri1-2 | 0.23 | 0.66 | 0.09 | 0 | 0.01 | 0.13 | 0.07 | 0 | 0 | 0 | 0 | **0.78** | 0.55 | 0.04 | mf2c |
| 5 | search_peri1-2 | 0.15 | 0.79 | 0.01 | 0 | 0 | 0.26 | 0.03 | 0 | 0 | 0 | 0 | **0.97** | 0.34 | 0.01 | mf3c |
| 6 | | | | | | | | | | | | | | | | |

Bearing in mind that **Table *9*** contains a considerable number of Greene attributions (G69), who described Shakespeare in his *Groatsworth of Wit* (1592) as "an upstart crow beautified with our feathers", the suspicion can no longer be suppressed that the first two acts of *Pericles* might represent an early phase in the writing style of Shakespeare, which

left its impact on the first two acts. The idea of genius may also have played a role here, in that the stylistic design from Shakespeare's apprenticeship period was mentally excluded from his work. When a totality of 171 reference texts was analysed with mf3c and window sizes of 4000 words at a centroid distance of 250 words, the stylistically closest texts all belonged to Shakespeare (see **Table *10***). All in all, **Table *10*** lists Wilkins only at position 47, but there are 26 plays with Shakespeare's stylistics that form the first two acts of *Pericles*.

**Conclusion**

While earlier research results were dependent on incorrect corpus preparations and insufficient numbers of variables, distant reading procedures and non-traditional stylometry provide ample evidence that the first two acts of *Pericles* were not written by George Wilkins. Instead, there are quite a number of indications hinting at Shakespeare. The difference in quality between Acts I and II and the remaining parts of *Pericles* could on the one hand be due to the resumption of an early text, on the other hand contemporary Shakespeare reference texts are favoured by the analysis results in their similarity to the first two acts. In this context, some remarks by Chambers are interesting, who points out that "the year [1608] was in many ways an eventful one for the King's men. They had [...] to face a growing detachment of Shakespeare from London and the theatre" (vol. II, p. 213). ... "In fact, the plague kept the London theatres closed from July 1608 to December 1609." ... "The plague did not prevent them from appearing at Court during the winter of 1608–9, and they gave twelve plays on unspecified dates." (p.214). One of the plays was *Pericles*, and the special production conditions, also in view of the new mix of shareholders after the death of William Sly (16 August 1608), may well have had an artistic effect on the qualitative differences between the acts.

**Notes**

In 2002, John Burrows provided a definition of Delta as 'the mean of the absolute differences between the z-scores for a set of word-variables in a given text group and the z-scores for the same set of word-variables in a target text.' In the 2004 study, D. L. Hoover conducted a series of tests on Burrows' Delta, the results of which indicated that optimal z-score comparisons were achieved when specific criteria were met. More specifically, these criteria entailed the exclusion of words from a given corpus. The implementation of a culling value of 70% resulted in the exclusion of idiosyncratic vocabulary, thereby achieving a harmonising effect. In 2007, Jack Grieve conducted a study in which he examined various variables and concluded that character bi- and trigrams exhibited a greater degree of reliability in comparison to words alone. This phenomenon becomes evident upon examination of the number of available variables in 1000-word chunks. It has been established that words (mf1w) yield approximately 90 variables, character bigrams (mf2c) yield approximately 280, and character trigrams yield approximately 750 variables. From 2012 onwards, M. Eder, J. Rybicki and M. Kestemont developed a methodology known as Rolling Delta. This methodology provides not only a single Delta value of a reference text,

but also a series of values derived from windows of a particular size that are moved through the entire text with an overlap. The result of this process is a row of lowest deltas that highlight the smallest stylistic differences between reference texts and the target text. Consequently, the capacity to discern collaborative networks became a possibility. In 2015 Eder argued that larger windows offer more reliable statistical signals because they reduce noise and smooth out local variations. This is particularly important when using methods based on relative word frequencies, as smaller samples might not reflect an author's overall stylistic tendencies. If a window is too small, it may not contain enough tokens to yield robust frequency distributions, leading to high variability and less reliable attribution.

Rolling Classify, just like the function classify(), provides a number of supervised machine-learning methods which can be operated in batch mode. The following command line

nsc.5000words = rolling.classify(colors.on.graphs = "greyscale", shading=TRUE, write.png.file = TRUE, classification.method = "nsc", mfw=1000, training.set.sampling = "normal.sampling", slice.size = 5000, slice.overlap = 4750)

opens with the variable "***nsc.5000words***" where ***nsc*** (nearest shrunken neighbours) refers to the classifier and ***5000*** gives the window size, in which ***words*** are evaluated. These parameters allow for a large set of investigations, as ***nsc*** could be replaced by ***svm*** (support vector machine) or ***delta*** (classic Burrowsian). The window sizes can be tested as well, and here Eder's warning that smaller windows might cause unreliable results applies as well. Finally, the investigation of word frequencies can be extended to character bigrams (mf2c) and character trigrams (mf3c). In such a case "mfw=1000" is replaced by "analyzed.features = "c", ngram.size = 2" or "3". If you want to compare Rolling Classify results with Rolling Delta attributions, where the window centroid was moved through the text at a distance of 250 words, the *slice overlap* that goes with a 5000-word window is 4750.

## Appendix

**Table 9** Rolling Classify attributions with 5000-word window sizes, overlap 250 words

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **words** | mf1w | | | mf2c | | | mf3c | | | **Scenes** | **Words** |
| 2 | 0 | **n** | **s** | **d** | **n** | **s** | **d** | **n** | **s** | **d** | | |
| 3 | 250 | **s** | **v** | **e** | **s** | **v** | **e** | **s** | **v** | **e** | I.0 | 278 |
| 4 | 500 | **c** | **m** | **l** | **c** | **m** | **l** | **c** | **m** | **l** | | |
| 5 | 750 | | | **t** | | | **t** | | | **t** | | |
| 6 | 1000 | | | **a** | | | **a** | | | **a** | | |
| 7 | 1250 | | | | | | | | | | | |
| 8 | 1500 | Checked against 109 reference texts | | | | | | | | | I.1 | 1612 |
| 9 | 1750 | | | | | | | | | | | |
| 10 | 2000 | G | S | G | G | S | S | G | G | J | | |
| 11 | 2250 | G | S | G | G | S | S | G | G | J | | |
| 12 | 2500 | G | S | N | G | S | S | G | G | G | | |
| 13 | 2750 | G | S | G | G | S | S | G | F | J | I.2 | 2643 |
| 14 | 3000 | G | S | G | G | S | S | G | F | S | I.3 | 2965 |
| 15 | 3250 | G | S | S | G | S | S | G | S | S | | |
| 16 | 3500 | G | S | S | G | S | S | G | F | S | | |
| 17 | 3750 | G | S | S | G | S | S | G | S | S | I.4 | 3806 |
| 18 | 4000 | G | S | S | G | S | M | G | S | H | II.0 | 4072 |
| 19 | 4250 | G | S | F | G | S | M | G | S | H | | |
| 20 | 4500 | G | S | F | G | S | M | G | J | S | | |
| 21 | 4750 | G | S | H | G | S | M | G | J | S | | |
| 22 | 5000 | G | F | H | G | S | M | G | J | S | | |
| 23 | 5250 | G | F | F | G | S | M | G | F | S | | |
| 24 | 5500 | H | S | S | S | S | M | G | F | S | II.1 | 5377 |
| 25 | 5750 | G | S | S | S | S | F | C | S | S | II.2 | 5815 |
| 26 | 6000 | H | S | J | M | S | F | C | J | F | | |
| 27 | 6250 | H | S | W | M | S | W | C | J | S | | |
| 28 | 6500 | S | S | J | S | S | W | C | J | F | | |
| 29 | 6750 | S | S | J | C | S | W | C | J | F | II.3 | 6719 |
| 30 | 7000 | S | S | J | C | S | W | S | J | S | | |
| 31 | 7250 | S | S | J | C | S | W | C | J | W | II.4 | 7175 |
| 32 | 7500 | S | S | J | C | S | W | C | J | W | | |
| 33 | 7750 | S | S | J | C | S | W | C | J | W | | |
| 34 | 8000 | S | S | J | C | S | W | C | S | S | II.5 | 7871 |
| 35 | 8250 | S | S | S | C | S | S | C | S | M | III.0 | 8246 |
| 36 | 8500 | S | S | S | C | S | W | C | S | S | | |
| 37 | 8750 | S | S | S | C | S | W | C | S | M | III.1 | 8856 |
| 38 | 9000 | S | S | S | C | S | W | S | S | S | | |
| 39 | 9250 | S | S | S | C | S | W | S | S | S | | |
| 40 | 9500 | S | S | S | C | S | W | S | S | S | III.2 | 9663 |
| 41 | 9750 | S | S | S | C | S | W | S | S | S | | |
| 42 | 10000 | S | S | S | W | S | J | S | S | W | III.3 | 10014 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 43 | 10250 | S | S | S | W | S | J | S | S | S | III.4 | 10143 |
| 44 | 10500 | S | S | S | W | S | J | S | S | J | IV.0 | 10460 |
| 45 | 10750 | S | S | S | W | S | J | S | S | S | | |
| 46 | 11000 | S | S | S | W | S | W | S | S | S | | |
| 47 | 11250 | S | S | S | S | S | S | S | S | S | IV.1 | 11243 |
| 48 | 11500 | S | S | S | S | S | S | S | S | J | | |
| 49 | 11750 | S | S | S | S | S | S | S | S | J | | |
| 50 | 12000 | S | S | S | S | S | S | S | S | J | | |
| 51 | 12250 | S | S | S | S | S | S | S | S | S | IV.2 | 12350 |
| 52 | 12500 | S | S | S | S | S | S | S | S | S | | |
| 53 | 12750 | S | S | S | S | S | S | S | S | S | IV.3 | 12758 |
| 54 | 13000 | S | S | S | S | S | S | S | S | S | IV.4 | 13141 |
| 55 | 13250 | S | S | S | S | S | S | S | S | S | IV.5 | 13211 |
| 56 | 13500 | S | S | S | J | S | S | S | S | S | | |
| 57 | 13750 | S | S | S | S | S | S | S | S | S | | |
| 58 | 14000 | S | S | S | S | S | S | S | S | S | | |
| 59 | 14250 | S | S | S | S | S | S | S | S | S | | |
| 60 | 14500 | S | S | S | S | S | S | S | S | S | IV.6 | 14702 |
| 61 | 14750 | S | S | S | S | S | S | S | S | J | | |
| 62 | 15000 | S | S | S | S | S | S | S | S | J | V.0 | 14896 |
| 63 | 15250 | S | S | S | H | S | S | S | S | J | | |
| 64 | 15500 | S | S | S | H | S | S | S | S | S | | |
| 65 | 15750 | S | S | S | S | S | S | S | S | S | | |
| 66 | 16000 | | | | | | | | | | | |
| 67 | 16250 | | | | | | **no.** | **%** | | | | |
| 68 | 16500 | | Shakespeare | | | | 332 | **66** | | | | |
| 69 | 16750 | | Greene | | | | 52 | **10** | | | V.1 | 16867 |
| 70 | 17000 | | Jonson | | | | 34 | **7** | | | V.2 | 16989 |
| 71 | 17250 | | Webster | | | | 25 | **5** | | | | |
| 72 | 17500 | | Chapman | | | | 25 | **5** | | | | |
| 73 | 17750 | | Fletcher | | | | 15 | **3** | | | V.3 | 17762 |
| 74 | | | Middleton | | | | 11 | **2** | | | | |
| 75 | | | Heywood | | | | 9 | **2** | | | | |
| 76 | | | Nashe | | | | 1 | **0** | | | | |
| 77 | | | | | | Σ | 504 | | | | | |

**Table 10 Excerpt of Rolling Delta attributions from 171 reference texts**

| | A | B |
|---|---|---|
| | mf3c,4000 | **Δ** |
| 1 | search_peri1-2 | 0,0 |
| 2 | shak_macbeth | 22,7 |
| 3 | shak_cymbeline | 23,4 |
| 4 | shak_winters1609 | 24,3 |
| 5 | jonson_sejanus1605 | 24,5 |
| 6 | shak_coriolan1608 | 24,8 |
| 7 | shak_troilus1602 | 24,8 |

| | | |
|---|---|---|
| 8 | shak_lear1606 | 24,8 |
| 9 | shak_hamlet1600 | 24,8 |
| 10 | web_duchess1614 | 24,9 |
| 11 | shak_2henry6 | 25,1 |
| 12 | anon_moregut | 25,4 |
| 13 | shak_2henry4 | 25,4 |
| 14 | heyw_2edward4 | 25,5 |
| 15 | shak_richiii1592 | 25,6 |
| 16 | jonson_catiline1611 | 25,6 |
| 17 | heyw_1edwiv | 25,6 |
| 18 | fletch_philaster1608 | 25,6 |
| 19 | dekker_whorebabel1605 | 25,7 |
| 20 | shak_john1596 | 25,7 |
| 21 | heyw_engtravel1633 | 25,7 |
| 22 | anon_weakwall | 25,9 |
| 23 | shak_tempest1611 | 25,9 |
| 24 | anon_edwardiii | 26,0 |
| 25 | anon_bloodybanquet1600 | 26,0 |
| 26 | anon_ironside | 26,0 |
| 27 | row_whenysee1603 | 26,0 |
| 28 | shak_henry8 | 26,1 |
| 29 | jonson_cynthia1600 | 26,1 |
| 30 | shak_richii1595 | 26,2 |
| 31 | shak_lovelab1594 | 26,2 |
| 32 | chettle_mshoffman1599 | 26,2 |
| 33 | lodge_lookingglass1589 | 26,2 |
| 34 | heyw_royalking1602 | 26,3 |
| 35 | shak_h5 | 26,3 |
| 36 | shak_3henry6 | 26,3 |
| 37 | shak_1henry6 | 26,4 |
| 38 | chap_msd'olive | 26,4 |
| 39 | shak_merchant1596 | 26,5 |
| 40 | anon_oldcastle | 26,5 |
| 41 | nashe_summers | 26,5 |
| 42 | shak_1henry4 | 26,5 |
| 43 | shak_mfm1603 | 26,6 |
| 44 | jons_volpone | 26,6 |
| 45 | anon_kingleir1594 | 26,7 |
| 46 | chap_bussydambois1607 | 26,7 |
| 47 | wilkins_misenfmar | 26,7 |

**References**

**Barber, R.** (2009). Shakespeare Authorship Doubt in 1593. Critical Survey, 21(2):83–110.

**Burrows, J.F.** (2002). 'Delta': a measure of stylistic difference and a guide to likely authorship. Literary and Linguistic Computing, 17(3): 267–287.

**Chambers, E.K.** (1923). The Elizabethan Stage, Vol. II. Oxford: Clarendon Press.

**Craig, H. and Kinney, A. F.** (2009). Shakespeare, Computers, and the Mystery of Authorship. Cambridge: Cambridge University Press.

**Dyce, A. (ed.)** (1857). The Works of William Shakespeare, Vol. X. London: John Russell Smith, p.246.

**Eder, M., Rybicki, J. and Kestemont, M.** (2016). Stylometry with R: a package for computational text analysis. R Journal, 8(1): 107–121. Available at: <https://journal.r-project.org/archive/2016/RJ-2016-007/index.html> [Accessed 27 May 2025].

**Fleay, F.G.** (1876). A Shakespeare Manual: A Hand-book to the Text and Illustrations of the Dramatic Works of Shakespeare. London: John Russell Smith: 158–159.

**Fleay, F.G.** (1891). A Biographical Chronicle of the English Drama, 1559–1642. London: Reeves & Turner: 112–114.

**Freebury-Jones, D.** (2024). Shakespeare's Borrowed Feathers: How Early Modern Playwrights Shaped the World's Greatest Writer. Manchester: Manchester University Press.

**Grieve, J.** (2007). Quantitative Authorship Attribution: An Evaluation of Techniques. Literary and Linguistic Computing, 22(3): 251–270.

**Hawkes, T. (ed.),** (1969). Coleridge on Shakespeare. Harmondsworth: Penguin.

**Hoover, D.L.** (2004). Testing Burrows's Delta. Literary and Linguistic Computing, 19(4): 453–475.

**Jackson, M.P.** (2003). Defining Shakespeare: "Pericles" as Test Case. Oxford: Oxford University Press.

**Jackson, M.P.** (2014). Determining the Shakespeare Canon: Arden of Faversham and A Lover's Complaint. Oxford: Oxford University Press.

**Kestemont, M. et al.** (2016). Authorship verification with the Ruzicka metric. In: Digital Humanities 2016: Conference Abstracts. Kraków: Jagiellonian University & Pedagogical University: 246–249. Available at: <http://dh2016.adho.org/abstracts/402> [Accessed 27 May 2025].

**Lamb, C. and Lamb, M.** (1807). Tales from Shakespeare. London: Longman, Hurst, Rees, Orme, and Brown.

**Malone, E. (ed.)** (1790). The Plays and Poems of William Shakespeare, Vol. 1. London: H. Baldwin.

**Rowe, N.** (1709). Some Account of the Life of Mr. William Shakespear. In: B. Vickers, ed. 1974. Shakespeare: The Critical Heritage, Volume 1: 1623–1692. Oxford: Oxford University Press.

**Steevens, G.** (1793). In: S. Johnson and G. Steevens, eds. The Plays of William Shakespeare, rev. I. Reed, Vol. 21. London: T. Longman et al., p.11.

**Vickers, B.** (2002). Shakespeare, Co-Author. Oxford: Oxford University Press.

**Wilkins, G.** (1608). The Painful Adventures of Pericles. In: G. Bullough, ed. 1966. Narrative and Dramatic Sources of Shakespeare, Vol. 6. London: Routledge and Kegan Paul.