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Revisiting John Stuart Mill's *The Subjection of Women*: A Computer-Assisted Stylometric Analysis

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According to John Stuart Mill's *Autobiography*, his mature work should be thought of as "the product not of one intellect and conscience but of three" (J. S. Mill [1873] 1981, 265). He claimed that *The Subjection of Women* (1869) was co-authored by himself, Harriet Taylor Mill, and Helen Taylor. Most of J. S. Mill's readers have been largely unconvinced both by his claims of co-authorship and by his encomiums of his co-authors. Rather than strengthening the claims of a common "fund of thought," collaboration, and co-authorship, his testimony to their abilities undermined them. Those who are most reluctant to take these claims at face value reject the idea that not only did Harriet Mill have an active, pervasive, and everlasting part in John Stuart Mill's writings, but also that she was the originator of some of his most characteristic ideas. Others, however, readily admit her influence and her originality. Unlike her mother, Helen Taylor has never actually gotten any consideration as her stepfather's co-author. Given the challenges of assessing authorship for this text through traditional methods, we apply computational stylometric analysis. Should we accept a key tenet of stylometric studies, that an author's mind engrafts itself onto the text, then we might be able to test J. S. Mill's claims of co-authorship. This paper presents the state of the question and the results of a supervised machine learning-based authorship identification analysis of the *Subjection*. We train three classifiers (SVM, K-NN, DT) on a dataset of essays by all three potential authors. These models are then used to attribute segments of the *Subjection* to individual authors. The most effective models attribute the majority of the text to John Stuart Mill, though stylistic traces suggest contributions from Harriet Mill and, to a lesser extent, Helen Taylor. This is a particularly difficult authorship identification issue to address.

Selon *Autobiography* de John Stuart Mill, son œuvre mûre doit être considérée comme « the product not of one intellect and conscience but of three » (J. S. Mill [1873] 1981, 265). Il affirmait que *The Subjection of Women* (1869) avait été coécrit par lui-même, Harriet Taylor Mill et Helen Taylor. La plupart des lecteurs de J. S. Mill sont restés largement sceptiques, tant face à ses affirmations de coécriture que face à ses éloges de ses collaboratrices. Au lieu de renforcer les

affirmations d'un « fonds commun de pensée », de collaboration et de co-auteurialité, ses témoignages sur leurs compétences les ont affaiblies. Ceux qui rejettent le plus nettement ces affirmations refusent l'idée que Harriet Mill ait eu un rôle actif, constant et durable dans les écrits de John Stuart Mill, et encore moins qu'elle ait été à l'origine de certaines de ses idées les plus marquantes. D'autres, en revanche, reconnaissent volontiers son influence et son originalité. Contrairement à sa mère, Helen Taylor n'a jamais été sérieusement considérée comme coautrice de son beau-père. Étant donné la difficulté d'évaluer l'auteur du texte par des méthodes traditionnelles, nous appliquons une analyse stylométrique computationnelle. Si l'on admet un principe fondamental des études stylométriques — qu'un texte porte l'empreinte cognitive de son auteur — alors il est possible de tester les affirmations de J. S. Mill concernant la coécriture. Cet article expose l'état de la question et les résultats d'une analyse d'attribution d'auteur fondée sur l'apprentissage supervisé appliquée à *The Subjection*. Nous entraînons trois classificateurs (SVM, K-NN, DT) sur un corpus d'essais des trois auteurs possibles. Ces modèles sont ensuite utilisés pour attribuer des segments du texte à chaque auteur. Les modèles les plus performants attribuent la majorité du texte à John Stuart Mill, bien que des traces stylistiques indiquent des contributions de Harriet Mill et, dans une moindre mesure, de Helen Taylor. Ce cas pose un problème d'attribution particulièrement difficile.

> It would perhaps not be possible to find two minds accustomed to think for themselves whose thoughts on any identical subject should take in their expression the same form of words.
>
> — Harriet Taylor Mill, "On Conformity"

In this article, we revisit a well-known authorship identification problem in John Stuart Mill's corpus. J. S. Mill claimed that *The Subjection of Women* (J. S. Mill [1869] 1984) should be considered as co-authored by himself and Harriet Taylor Mill. (As Helen McCabe points out, Harriet Taylor Mill's name was never "Harriet Taylor Mill": "she was Harriet Hardy, then Harriet Taylor, then Harriet Mill" [McCabe 2020, 57n]. For simplicity's sake, we use Harriet Mill and H. Mill throughout this paper.) He added that *Subjection* included passages directly from the hand of Helen Taylor, his stepdaughter. Thus, according to J. S. Mill, this foundational essay in the history of feminist political thought was the work of three minds rather than one. Most of J. S. Mill's readers, both then and now, have been largely unconvinced by his claims of co-authorship about *Subjection* but also about *Principles of Political Economy* (J. S. Mill [1848] 1965) and *On Liberty* (J. S. Mill [1859a] 1977). Plainly, J. S. Mill's readiness to share credit is not considered evidence enough to add two further names to the title/author page.

Those who are most reluctant to take J. S. Mill's claims at face value reject the idea that not only did Harriet Mill have an active, pervasive, and definite part in his writings, but also that she was the originator of some of his most characteristic ideas. They treat with suspicion whatever evidence exists for collaboration. It does not help his case that he did not think being "pretentious" was problematic, so long laudatory descriptions did not "pretend to more than is thought just by friends & admirers" (J. S. Mill [1837] 1963, 334). Here, he was referring to an inscription for his father's tombstone: "People expect that an epitaph shall contain what a man's admirers think of him—not what is thought by all the world" (J. S. Mill [1837] 1963, 334). Given that H. Mill's memorial engraving repeated the laudatory comments made by J. S. Mill, her partner and husband, and that she did not have other contemporary "admirers," even among J. S. Mill's friends (for a recent discussion, see Miller 2022), scholars tend to explain his encomiums away (i.e., as part of a "lifelong mission to deify Harriet"; Reeves 2007, 206–207).

There seems to be a huge gap between this group of scholars and those who claim that Harriet Mill has been deprived of an important place in the history of philosophy, both because of a prejudiced reluctance to award her the status of a co-author to J. S. Mill and a lack of a nuanced conceptual apparatus as regards authorship and collaboration.

It matters both that H. Mill was a woman and that the work under scrutiny was thought to be J. S. Mill's. At the same time, the conceptual tools regarding collaborative work in philosophy themselves are crude and unrefined (Jacobs 1994; Philips 2018; Millgram 2019, 74).

In Section 1, we go through the receptions of the J. S. Mill–H. Mill collaboration. We briefly present the dichotomous lines of the debate. No one seems to doubt Harriet Mill's effect on John Stuart Mill. Rather, what is debated is the shape of that effect on his philosophical output. A pattern emerged in the first one hundred years after the publication of *Autobiography*: the more important a text was, the less important Harriet Mill's role was thought to be in it. However, for the last fifty years or so, H. Mill's writings have attracted considerable attention. And with it, H. Mill receives the recognition J. S. Mill himself awarded to her. In Section 2, we briefly review J. S. Mill's discussion of authorship and especially his claim as regards *Subjection*'s co-authorship. We then proceed to a computer-mediated authorship identification analysis and present the results of our tests. To put it simply, in the most accurate tests, there was not much evidence of Harriet Mill's authorial signature. And Helen Taylor's was missing completely. Yet the difficulty of attaining accurate results is itself telling. This problem is particularly difficult to solve.

1 The receptions of the J. S. Mill–H. Mill collaboration

In *Autobiography*, John Stuart Mill made a simple request:

> Whoever, either now or hereafter, may think of me and of the work I have done, must never forget that it is the product not of one intellect and conscience but of three, the least considerable of whom, and above all the least original, is the one whose name is attached to it. (J. S. Mill [1873] 1981, 265)

John Stuart Mill's co-authors were two extraordinary women, Harriet Mill and Helen Taylor. "So elevated was the general level of her faculties," wrote J. S. Mill about his beloved partner and wife, who had passed away in 1858, "that the highest poetry, philosophy, oratory, or art, seemed trivial by the side of her, and equal only to expressing some small part of her mind" (J. S. Mill [1859b] 1984, 394). For J. S. Mill, Helen Taylor was "the inheritor of much of her [mother's] wisdom, and of all her nobleness of character" (J. S. Mill [1873] 1981, 264). In 1868, he replied to a request about publishing one of his letters, admitting that it was written by Helen Taylor: "we are so completely one in our opinions and feelings that it makes hardly any difference which of us puts them into words" (J. S. Mill [1868] 1972, 1,359).

We can follow three different streams of receptions of the J. S. Mill–H. Mill collaboration in the century and a half that has followed since the publication of *Autobiography*. The first stream began to flow upon the publication of J. S. Mill's *Autobiography* in 1873 by Helen Taylor. Second, Friedrich Hayek's publication of J. S. Mill and H. Mill's correspondence in the mid-twentieth century led to a reconsideration of their collaboration. In the last quarter of the twentieth century, Jo Ellen Jacob's revisionist work added volume to a third stream, which had made its initial appearance two decades earlier.

Soon after the publication of *Autobiography*, some rushed to dismiss J. S. Mill's credit to Harriet Mill, looking for cause in the only essay that bore (though not originally) her name: "The most that can be said [about "The Enfranchisement of Women"], is that it is a most respectable parody of Mill's worst style. Feebler arguments and more pompous words have rarely come together" (Palgrave 1874, 174). J. S. Mill's emotionally starved education, the reviewer thought, was the reason for the weakness and exaggeration exhibited in his eulogies to H. Mill. For another reviewer, "with the eyes of a lover he saw in her his own intellect and self reflected," the "Enfranchisement" being "just the sort of article which a woman of average abilities, in the constant habit of conversing and believing in Mill, would easily write" (Cowell 1874, 86–87). The essay did not validate his exaggerated praise (Cowell 1874, 87). The religious need for belief, reverence, and adoration found an outlet in the "idolatrous worship of Mrs. Taylor" (Cowell 1874, 89). For a third reviewer, "it was perhaps essential to Mr. Mill's happiness that he should imagine the woman whom he loved to be a logician and a political economist" (Anonymous 1873, 571). Not only was the "supposed share" of Harriet Mill in J. S. Mill's writings "the result of his wishes and his fancy" (Anonymous 1873, 571); but also "[w]hat he wrote under her influence, or supposed influence," another critic exclaimed, "strikes us to be mostly that which had better have been left unwritten, and what he wrote independently of her to be that on which his reputation will eventually be based" (Hayward 1873, 675). By 1911, a reviewer stated as a matter of fact that H. Mill exercised "an influence upon Mill which can only be considered as deleterious" (Anonymous 1911, 341). *Autobiography*'s immediate reception set the primary tone for the next century.

In 1882, Alexander Bain, close friend and collaborator of J. S. Mill, offered a more moderate, less dismissive account of J. S. Mill's relationship with H. Mill, trying to correct "conjectures" as those just quoted:

> Judging from my own experience of him, I should say that what he liked, was to have his own faculties set in motion, so as to evolve new thoughts and new aspects of old thoughts. This might be done better by intelligently controverting his views than by

merely reproducing them in different language. And I have no doubt that his wife did operate upon him in this very form. But the ways of inducing him to exert his powers in talk, which was a standing pleasure of his life, cannot be summed up under either agreement or opposition. It supposed independent resources on the part of his fellow talker, and a good mutual understanding as to the proper conditions of the problem at issue. (Bain 1882, 173)

According to Bain, Harriet Mill's "influence upon Mill, and upon the world through him, lay unmistakably" in *Subjection* (Bain 1882, 171). Further, he admitted that "there is probably no means of discovering" which of the "two co-operating minds" wrote which part—the excellent or the weak—in a work such as *Liberty*. But as regards *Principles*, Bain noted that J. S. Mill's earlier work included what he described as H. Mill's specific contribution to it, the chapter "On the Probable Futurity of the Labouring Classes." Still, he added "we must take his word for it when he says that his conversations with Mrs. Taylor helped him in giving it 'form and pressure'" (Bain 1882, 170). As the stakes rise even higher with *A System of Logic* (J. S. Mill [1843] 1973), H. Mill's guiding hand disappears altogether for Bain, except as regards the "minutiae of composition" (Bain 1882, 168). Although Bain did object to J. S. Mill's "hyperbolical language of unbounded laudation" (Bain 1882, 168), he was the only one to follow rather closely J. S. Mill's account in *Autobiography* as regards authorship, partnership, and collaboration (see Section 2.1 below).

Like Bain, William L. Courtney could not pass over J. S. Mill's relationship with H. Mill. And like Bain, he was respectful. However, Courtney employed all what had by then been established as common tropes: "For infatuation it can only be called when a man of Mill's intellectual eminence allows himself to describe his friend in terms of such unbounded adulation" (Courtney 1889, 115); "[t]o a man whose range of thought lies in the spheres usually of the abstract and the purely logical, there is a strange fascination in the lively presentation of the concrete and the practical" (Courtney 1889, 116); that he fell into the "common mistake which is made by men in their relation to clever women" that is, overestimating their abilities while underestimating their quick apprehension (Courtney 1889, 117); and that the "repression of feeling" of his upbringing brought "emotional conflagration" (Courtney 1889, 117). Courtney observed no substantial impact on *Logic* by H. Mill, while her impact on *Principles* led to contradiction; likewise, her influence on *Liberty* suggested "a slight visionariness of speculation" (Courtney 1889, 121). Finally, Courtney readily attributed "to her the parentage of one book of Mill, the *Subjection of Women*" (Courtney 1889, 122).

In the second half of the twentieth century, a second stream appeared. Scholars rallied behind two positions as to the question of the J. S. Mill–H. Mill collaboration:

either acknowledge her influence, but only on the weak or problematic parts of J. S. Mill's corpus; or reject her (intellectual) influence, but accept some role, though less significant, in J. S. Mill's writings (Rossi 1970, 44–45). The verdict was divided. However, some aspects of the late-Victorian portrait persisted, primarily because views of what "a real woman" was had not changed much (Jacobs 1994, 140).

On the one hand, there was a reversal of the late-nineteenth century appreciation of Harriet Mill's role in J. S. Mill's works. For example, it was argued that not only was H. Mill's "influence on his thought and outlook […] quite as great as Mill asserts" (Hayek [1951] 2015, 14); but also, that her "predominance was even more complete than he himself pronounced" (Packe 1954, 316). Yet, once again, H. Mill's influence on J. S. Mill's works came at a cost: "whatever in them cannot be ascribed to his lucid reasoning must be attributed to the sheer force of her personality" (Packe 1954, 317). Similarly, for Hayek, H. Mill's influence strengthened J. S. Mill's rationalism (Hayek [1951] 2015, 14), pushing him thus down a path that led from a "false" individualism to socialism or collectivism (Hayek [1945] 2010, 50; see further Caldwell 2008; see also Himmelfarb 1974, 126ff., 271n48).

On the other hand, in 1960, Helmut Otto Pappe rushed to correct Hayek's and Packe's estimate of H. Mill's intellectual influence, aiming "to dispel a myth which, I feel, threatens to distort our image of Mill's personality" (Pappe 1960, vii). The stakes are high in Pappe's account, not only because "Mill's personality is inseparably connected with his thought which has been of great importance for generations and whose vital message is by no means exhausted"; but also, because "the Harriet Taylor myth could arise only from a misinterpretation of Mill's thought" (Pappe 1960, vii–viii). Pappe was as worried about what sharing authorship of *Liberty* meant for J. S. Mill as a philosopher as Bain was about *A System of Logic*.

According to Robson, H. Mill was part of J. S. Mill's "intellectual and emotional life in an unusual degree, but not in an unexampled way, and she was not, in any meaningful sense, the 'joint author' of his works" (Robson 1966, 186). For Robson, "discussion before, and even during the composition of a work plays a smaller part in its final form than the actual day-by-day composition; the interplay of mind and hand is finally what determines the direction and effect, and to a major extent the content, of an argument" (Robson 1966, 175). Thus, J. S. Mill should be regarded as the sole author of *Liberty*, *Subjection*, and *Autobiography*. Harriet Mill offered her opinion on early drafts or on scraps of these works (rather than the last or final draft). Not only did J. S. Mill prepare the first draft, but also he had the choice to follow or ignore her advice. Robson admitted that things were more complicated as regards *Principles*. Without taking into consideration that "Harriet had a place in two important chapters, and can assume that she helped with perhaps four more," out of seventy-three chapters,

Robson reached the conclusion that ultimately it was J. S. Mill's hand that guided the pen (Robson 1966, 175–176, 175n). The key idea of what a meaningful sense of authorship entails is authority. The author makes the final decision. Authorship comes with authority and finality.

Jack Stillinger, examining the history of the text that came to be *Autobiography*, defined authorship "as creation of the wording of a text" (Stillinger 1991, 50). This definition, much broader than Robson's, naturally led to a different conclusion: "Mill's *Autobiography*, in every form that we know it, is a collaboration by two authors" (Stillinger 1991, 53). However, that meant that, as *Autobiography* came to be published by Helen Taylor in 1873, there were seven authors for Stillinger. As regards H. Mill's role in its composition, Stillinger distinguished between the role of "Copy-Editor" (~130 markings), "Mother-Protector" (having an effect on ~60 passages), "Victorian" (~40 passages), as well as "Wicked Sister- and Daughter-in-law" (~6 passages). Stillinger, having once "underestimated Harriet's contributions" (Stillinger 1991, 65), suggested that there "is a strong likelihood that *On Liberty* and other works may indeed be the 'joint productions' that Mill repeatedly called them," if one is to draw an inference from Harriet Mill's role in *Autobiography* (Stillinger 1991, 68). Still, Stillinger qualified his conclusion by noting that "Harriet Mill cannot, on the evidence at hand, be said to have been a principal originator or shaper of the ideas in the *Autobiography*," but "a significant contributor to the style, tone, texture, characterizations, and even representation (and inclusion or exclusion) of events" (Stillinger 1991, 63). By extension, she was not a principal originator or shaper of ideas as regards *Liberty* either (see Miller 2022, for a similar argument).

Robson and Stillinger agreed in fact, even though they disagreed on the definition of what an author is. Still, in both cases, echoing Bain, H. Mill's role in J. S. Mill's most important works was demoted from the higher plane of collaborator in the shaping of, or originator of, important philosophical ideas to a collaborator in "the minutiae of composition" (Bain 1882, 168), notwithstanding her significance in J. S. Mill's emotional life. As Francis E. Mineka put it in 1963: "Neither he [Mill] nor his recent biographers have convinced us that she was the originating mind behind his work, but no one can doubt her importance in Mill's inner life, the well-springs of which had been threatened by drought" (Mineka 1963, 306). There is a long scholarly discussion about the place of reason and feeling in J. S. Mill's life and H. Mill's role in it (for a recent overview, see Loizides 2024). But this, as we saw, was one of the very first tropes in the reception of J. S. Mill's *Autobiography*. For more than a century, the Mills collaboration was drawn along the same lines.

The third stream in the reception of the J. S. Mill–H. Mill relationship has been critically assessing previous work for more than half a century now. Part of the reassessment of earlier studies takes place with reference to the embedded reproduction and reinforcement of stereotypical thinking about the proper sphere of women's philosophic activity (Jacobs 1994; Philips 2018). At the same time, recent work reevaluates the notion of collaborative work itself. In the most comprehensive survey of Harriet Mill's reception, Jo Ellen Jacobs wonders why no one believes J. S. Mill saying that "Harriet's ways of understanding complemented and furthered his" (Jacobs 1994, 156). Not only does the J. S. Mill–H. Mill collaboration threaten, as Jacobs tries to explain, predominant ideas of who is a philosopher and what a philosopher does, but also most lack the capacity to conceptualize, let alone understand, collaborative work in general and collaborative writing in particular (Jacobs 1994, 154ff.). Expanding on the theme of the limitations of scholarly understandings of intellectual labour, Menaka Philips argues that we do not need to think along dichotomous lines, that is, that either Harriet Mill was "the originating mind," "the true author" of J. S. Mill's most important ideas in *Subjection*, *Liberty*, or *Principles*, or that "her significance was minimal" (Philips 2018, 632). Rossi (Rossi 1970), Jacobs (Jacobs 1994), and Philips (Philips 2018) agree that the inability to think past such dichotomous lines fails to do justice to the true nature of the J. S. Mill–H. Mill collaboration.

The re-evaluation of their collaboration thus takes form as a correction to a long-standing injustice: giving credit where credit is due. Helen McCabe has pressed this point quite eloquently: "The circumstances of Harriet Taylor Mill's life and times mean her contributions to politics, economics, and philosophy went under-recognized and undervalued by her contemporaries. It is time for us to do better" (McCabe 2020, 62). Given the foundational place of *Liberty* in the history of liberalism, and given H. Mill's role in it, McCabe argues, "Taylor Mill deserves a more prominent place in the history of political thought" (McCabe 2023, 13). In contrast, as the author of "The Enfranchisement of Women" (1851 [H. Mill 1998]), Harriet Mill's contribution to the history of feminist political thought does not share a similar fate. She does receive recognition as "a penetrating and original thinker in her own right" (Chernock 2023).

Elijah Millgram cautions against "emotions and prejudices," taking the lead in the examination of the J. S. Mill–H. Mill/Helen Taylor collaboration, especially given the disagreement being developed along gender identification lines ("academic males who identify with Mill" versus "feminist scholars scouring history for role models" [Millgram 2019, 74]). For Millgram, the collaboration took a familiar (and familial)

form: "[Harriet] Taylor would make up her mind what she thought about some issue, and then [John] Mill would make up an argument for her view and write it up" (Millgram 2019, 75). Helen Taylor came to replace her mother, while H. Mill herself had replaced James Mill, his father. Even though Millgram seems to be critical of the motivation in the recent re-examination of the partnership by feminist scholars (and perhaps some factual statements involved, e.g., as regards H. Mill's abilities), his conclusion does not contradict theirs: if J. S. Mill pursued H. Mill's vision, then she does deserve more credit.

Dale E. Miller (Miller 2022) distinguishes between a "minimalist" and a "maximalist" position as regards assessments of the J. S. Mill–H. Mill collaboration. The "minimalist" camp does not take J. S. Mill's encomiums at face value: H. Mill was not his co-author in any meaningful sense. In contrast, the "maximalist" camp takes J. S. Mill's public statements of influence and collaboration at face value: H. Mill made a significant contribution to his work. This, Miller points out, did not necessarily mean that that contribution was always thought to be positive (as per Hayek or Himmelfarb). Miller identifies also a middle ground:

> Taylor Mill's greatest contribution to the Mills' collaboration, apart from any writing that she did herself, was to turn Mill's attention to the defense of a set progressive ideals and causes reflective of [human] possibilities: Socialism, women's rights, individual liberty, and above all a "utopian" view of humanity's improvability. (Miller 2022)

Bain, for Miller, is exemplary of this middle ground.

However, this "intermediate view" is not intermediate, really. On the one hand, as we saw, commentators and scholars contested the significance of the collaborated projects. For example, Bain did not consider socialism, women's rights, liberty, and perfectibility to be significant or valuable contributions by J. S. Mill, conceding all these areas of influence to H. Mill. Similarly, Hayek and Himmelfarb—particularly with regard to rationalism and socialism—lamented H. Mill's influence on J. S. Mill. On the other hand, the meaning of authorship itself is up for debate as soon as we raise the stakes. For example, as regards J. S. Mill's *Principles of Political Economy*, Miller was confident that only one important chapter "would not exist if not for Taylor Mill" (Miller 2022). Mill himself was much more generous than that. And as regards *Liberty*, Miller cites evidence from J. S. Mill and H. Mill's correspondence and from J. S. Mill's correspondence with others indicating that he was the sole author. Still, Miller is reluctant to draw any strong conclusion: the sparse and contradictory evidence does

not allow arriving at definitive answers. Miller's conclusion is itself confirmation that the most recent work on Harriet Mill has brought to the surface the underlying assumptions and prejudices of earlier work on the J. S. Mill – H. Mill partnership. Scholars are no longer at ease dismissing J. S. Mill's claims without a serious examination of the available evidence.

John Stuart Mill's request to acknowledge the collaboration between himself, Harriet Mill, and Helen Taylor was not received positively. Had their collaboration been unattached to hyperbolic encomiums, the question of "joint authorship" might have never been raised. It took more than a century and a half, but it seems that the tide has turned with reference to *On Liberty*. A new edition by Hackett Publishing is currently underway with John Stuart Mill and Harriet Mill as co-authors. The next Section focuses on *Subjection*.

2 Collaboration, partnership, co-authorship, and *The Subjection of Women*

2.1 John Stuart Mill on authorship and co-authorship

In the 1868 letter cited earlier, J. S. Mill noted his regret seeing "attributed to myself work which I think good and which is chiefly" Helen Taylor's (J. S. Mill [1868] 1972, 1,359). He objected to publishing an earlier letter with his signature on it as his, because it was an example of their unity of opinion taking form in a private communication, "by no means a solitary one," which was written entirely by her: "what she wrote expressed so perfectly all I could have wished to say, that I transcribed it unaltered" (J. S. Mill [1868] 1972, 1,359). Who wrote what does not really matter, he went on, "[i]f everything said in a private letter is the real opinion or feeling of the person who signs it" (J. S. Mill [1868] 1972, 1,359). However, J. S. Mill pointed out, "anything printed comes into the class of literary performances, and I should feel [i.e., seeing the letter published under his name] (only in a less degree) as if I were to publish a book written by my daughter with my own name instead of hers prefixed to it" (J. S. Mill [1868] 1972, 1,359). So, why were *Principles*, *Liberty*, and *Subjection* printed with just his name? Jacobs (Jacobs 2024) encourages us to distinguish between John Stuart Mill the individual, and "John Stuart Mill" the brand name. According to Jacobs, J. S. Mill and H. Mill thought that the brand name was more likely to influence society. It was a matter of a simple utilitarian calculation: change was the desired outcome, recognition was secondary. In what follows, we take our sight away from the brand name and focus on the individuals involved.

As we already noted, according to J. S. Mill, three authors, or minds, had a share in the writing of *Subjection*. "As ultimately published," he claimed, *Subjection*

was enriched with some important ideas of my daughter's, and passages of her writing. But in what was of my own composition, all that is most striking and profound belongs to my wife: coming from the fund of thought which had been made common to us both, by our innumerable conversations and discussions on a topic which filled so large a place in our minds. (J. S. Mill [1873] 1981, 265)

Discussing Harriet Mill's "direct share" in his writings, J. S. Mill himself thought it impossible to unravel parts contributed to a work by two persons, when those two persons, like them

have their thoughts and speculations completely in common; when all subjects of intellectual or moral interest are discussed between them in daily life, and probed to much greater depths than are usually or conveniently sounded in writings intended for general readers; when they set out from the same principles and arrive at their conclusions by processes pursued jointly. (J. S. Mill [1873] 1981, 251)

Under such circumstances, J. S. Mill added, "it is of little consequence in respect to the question of originality which of them holds the pen" (J. S. Mill [1873] 1981, 251). Thus, J. S. Mill concluded,

not only during the years of our married life, but during many of the years of confidential friendship which preceded, all my published writings were as much her work as mine: her share in them constantly increasing as years advanced. (J. S. Mill [1873] 1981, 251)

Still, J. S. Mill tried to immediately qualify this statement: "in certain cases, what belongs to her can be distinguished, and specially identified" (J. S. Mill [1873] 1981, 251). This seems to be an allusion to the notebook with which he kept track of his publications. A copy of the list can be found at LSE Library (Mill−Taylor Collection, Box 36, ff. 1−39; see also MacMinn, Hainds, and McCrimmon 1945). There he recorded different collaborative texts with Harriet Mill, with notations such as "a joint production" (5), or a joint production, "very little of which was mine" (11), or even as a work for which he "acted chiefly as amanuensis to my wife" (1) (O'Grady and Robson 1991, 19−61).

This bibliographical list complicates matters. Sometimes he took note of a collaborating project (J. S. Mill and Anonymous [1837] 1989; J. S. Mill and Anonymous [1842] 1986; J. S. Mill and Blanco-White [1836] 1985; J. S. Mill and Grote [1837] 1977). But sometimes he did not (J. S. Mill and Ellis [1825] 1967; J. S. Mill and Buller

[1837] 1989; J. S. Mill and Bulwer–Lytton [1833] 1981). The extant list itself does not include *Subjection*. The general editor of J. S. Mill's *Collected Works*, John M. Robson, ascribed the omission to an error on the part of the copyist (Robson 1984, lxx; see also Robson 1964). "Enfranchisement" was also not included in the list. Yet, John Stuart Mill assigned himself the role of amanuensis and copyeditor to Harriet Mill for that work elsewhere (J. S. Mill [1859b] 1984, 393). *Principles* received the notation of the aforementioned "a joint production." But *Liberty* received no such notation. J. S. Mill claimed in *Autobiography* that *Liberty* "was more directly and literally our joint production than anything else which bears my name" (J. S. Mill [1873] 1981, 257). Did that mean that J. S. Mill's earlier one, that all of his published writings were "as much her work as mine," was not to be taken literally and that her share in them was indirect? As we saw in the previous section, for the first two reception streams, the answer was "yes."

Subjection was published in 1869. J. S. Mill's *Autobiography* encourages us to think of it as "a joint production," even though he began its composition after H. Mill's death (J. S. Mill [1873] 1981, 265). J. S. Mill had supposedly "made good progress" already by December 1860 (J. S. Mill [1860] 1972, 716). Waiting for the right time to publish, he periodically returned to the manuscript for improvements and additions (J. S. Mill [1873] 1981, 265, 290.). Not only did J. S. Mill acknowledge that the work "was written at my daughter's suggestion that there might, in any event, be in existence a written exposition of my opinions on that great question, as full and conclusive as I could make it" (J. S. Mill [1873] 1981, 265), but he also admitted that Helen Taylor authored parts of it. However, the first time J. S. Mill mentioned *Subjection* in *Autobiography*, he confessed that he was "painfully conscious how much of her [Harriet Mill's] best thoughts on the subject I have failed to reproduce, and how greatly that little treatise falls short of what would have been given to the world if she had put on paper her entire mind on this question" (J. S. Mill [1873] 1981, 253f). Given his own "imperfect statement of the case" (J. S. Mill [1873] 1981, 253f), can the *Subjection* be considered as "a joint production"?

How we choose to answer this question must begin with J. S. Mill's distinction between a narrow sense and a broad sense of authorship. The narrow sense corresponds to those works in which an author's share can be distinctly identified (the second and third class of joint productions delineated above). The broad sense corresponds to those works in which no part of them can be disentangled from the rest and attributed to one author rather than another (the first category of joint productions). Should we take J. S. Mill's *Autobiography* at face value, unlike *Liberty*, which falls under the first category, *Principles* seems to fall under all three categories. First, the book, as an "attempt to explain and diffuse ideas many of which were first learned from

herself" (J. S. Mill [1848] 1965, 1,026), was (privately) dedicated to Harriet Mill as "the most eminently qualified of all persons known to the author either to originate or to appreciate speculations on social improvement" (J. S. Mill [1848] 1965, 1,026). Second, the scientific/theoretical parts were J. S. Mill's identifiable contributions, while the practical spirit and the look to the future that pervades the book were Harriet Mill's contribution (see further Robson 1966). And, third, "Futurity" was "wholly an exposition of her thoughts, often in words taken from her own lips" (J. S. Mill [1873] 1981, 255, 257n). This chapter was not included in the first edition.

Subjection seems at best to fall under the first category as regards J. S. Mill's and H. Mill's part, and the third as regards Helen Taylor's additions (even though, in Helen Taylor's description of her role in J. S. Mill's projects, she assumed the place once occupied by her mother; see Taylor [1869] 1937, 311–312). If authorship is characterized by authority and finality, only Helen Taylor could have had a claim in co-authorship, since her mother had passed more than a decade earlier. A computer-assisted stylometric analysis might be able to find passages by Helen Taylor's hand. And even though Harriet Mill had no part in writing *Subjection*, it is worthwhile to test for her authorial voice. It might not be prominent, but it could be significant.

2.2 Revisiting The Subjection of Women: *Selection and preparation of texts*

Authorship identification analysis is grounded on an important assumption: texts can expose their author's identity. A weak authorship identification thesis is that texts contain unique markers of their author's identity: frequent word combinations, idiomatic or idiosyncratic expressions, vocabulary richness, use of function words, etc. These markers are as unique as fingerprints. A stronger thesis is that authors cannot but engraft themselves onto the text. An author's textual choices are unconscious; they deterministically find their way into the text. John Burrows (Burrows 2007, 30) has suggested that an authorial set of 10,000 words and 500-word particular texts offer sufficient discriminatory power to reliably extract an authorial fingerprint. Maciej Eder reduces Burrows's word count to 5,000 per authorial set, demonstrating that smaller text segments—under 500 words—can still yield reliable results, even across languages. However, he cautions that while a lower threshold is feasible (with successful tests at 2,000 words; see Eder 2017), other factors may interfere with the authorial signal (Eder 2015; see also Luyckx and Daelemans 2011; for a recent introduction to authorship identification analysis, see Grant 2022; see also Love 2002; Juola 2008). This is not the first attempt at a computer-assisted authorship identification analysis as regards J. S. Mill's corpus (for the most recent, see Loizides, Neocleous, and Nicolaides 2023; see also, Schmidt-Petri, Schefczyk, and Osburg 2022).

The most important part of the corpus preparation process is the selection of the texts. We used the standard editions for John Stuart Mill's (J. S. Mill 1963–1991) and Harriet Mill's (H. Mill 1998) authorial sets. There was not much choice of texts in the case of Harriet Mill and Helen Taylor. In both cases, we used texts with little or no evidence of interference by J. S. Mill (e.g., when part of the manuscript was in his hand, or when he lists the piece as a "joint production"). In the case of Harriet Mill, this decision eliminated "Remarks on Mr. Fitzroy's Bill for the More Effectual Prevention of Assaults on Women and Children" (1853 [H. Mill 1998]; in J. S. Mill's list [O'Grady and Robson 1991, 51]) and "The Enfranchisement of Women" (1851 [H. Mill 1998]; not in J. S. Mill's list). Since this is our main difference as regards text selection with Neocleous and Loizides (Neocleous and Loizides 2020) and Neocleous, Kataliakos, and Loizides (Neocleous, Kataliakos, and Loizides 2022), as well as Schmidt-Petri, Schefczyk, and Osburg (Schmidt-Petri, Schefczyk, and Osburg 2022), our decisions need some justification.

First, we can never know the extent of J. S. Mill's influence on the style of the text for which he served as Harriet Mill's "editor and amanuensis." However, we do have some evidence of J. S. Mill influencing a decision in the writing of *Emancipation*. Following J. S. Mill's review of a new volume of George Grote's *History of Greece* (Grote 1846–1856) in March 1849 (J. S. Mill [1849a] 1972), it seems that H. Mill urged him to tone down his laudatory treatment of Athens as a fine "specimen of humanity," progress, and civilization, given the "barbarisms" persisting at the time and condoned by the Greek philosophers (presumably in relation to women) (J. S. Mill [1849b] 1972, 18). Mill admitted that he was not "sufficiently careful to explain that the praise is relative to the then state & not the now state of knowledge & of what ought to be improved feeling" (J. S. Mill [1849b] 1972, 18). But he could not let H. Mill's comment slide without a response: "You are not quite right about the philosophers, for Plato did condemn those 'barbarisms'" (J. S. Mill [1849b] 1972, 18). "Enfranchisement" included Plato in those eminent philosophers who had "made emphatic protests in favour of the equality of women" in the history of philosophy (H. Mill 1998, 55). Second, "Enfranchisement" and various short drafts by Harriet Mill share *Subjection*'s subject-matter. Since there is no other published or unpublished essay written exclusively by J. S. Mill on the subject, this could create bias in favour of H. Mill. If we opted to include these papers, as well as J. S. Mill's numerous speeches on women's rights, we would create a bias in favour of J. S. Mill, both on account of being delivered around the same time *Subjection* was written, and on account of the resulting enlarged corpus size. Third, as we saw, some *Autobiography* reviewers considered "Enfranchisement" to be an imitation of J. S. Mill's style (an early attempt perhaps to capitalize on the brand name), which would distort H. Mill's authorial set.

We did not include "Life of Caxton" in the experiments, as it is mistakenly attributed to Harriet Mill and John Taylor, H. Mill's first husband. Published in a stand-alone edition in 1828 from the Society for the Diffusion of Useful Knowledge (SDUK), the essay was attributed to William Stevenson (1772–1829) in 1830 (Anonymous 1830, 213). Should we need further evidence for the attribution of the essay to Stevenson, according to John Chapple, James Martineau, closely involved with SDUK, had marked the authors' full names of all articles in *Lives of Eminent Persons* (Anonymous 1833) in his copy. For "Caxton," Martineau had noted: "By – Stephenson" (Chapple 1997, 329). In his study of J. S. Mill and H. Mill, Hayek identified Stevenson as the author of "Caxton," and the Taylor manuscripts as drafts of a review (Hayek [1951] 2015, 22n11). Perhaps, Stevenson's death in 1829 influenced the couple's decision not to complete or publish their review. Jacobs, the editor of H. Mill's works, admits that "neither person's drafts very closely imitate" the published essay (Jacobs 1998, 237–238), but offers no evidence for the attribution of the essay to the Taylors. Neither does Jacobs discuss Hayek's earlier claim that their manuscripts were drafts of a projected review by the two. Schmidt-Petri, Schefczyk, and Osburg (Schmidt-Petri, Schefczyk, and Osburg 2022) also excluded this text from their tests, as they did not want to risk distortion in H. Mill's authorial set, given J. Taylor's supposed role as co-author.

For some of Helen Taylor's works, we used an edition for writings on sexual equality by J. S. Mill, H. Mill, and Helen Taylor (Robson and Robson 1994). For the rest, we transcribed the original articles as published in the nineteenth century. From her "Biographical Notice" of Henry Thomas Buckle (Taylor 1872, ix–lv), we have only included parts of the first ten pages (ix–xviii, ~2900w), since the remaining (~20,000w) were almost exclusively extracts from diaries and letters, as well as quotations from accounts by Buckle's family and friends. Helen Taylor made "no apology for offering them to the reader as they were written, without either transposition or alteration" (Taylor 1872, xxi). We kept all essays by Helen Taylor on women's rights, as we hoped to identify specific sections of *Subjection* in her hand (as per J. S. Mill's claim), even if this risked bias in favour of Helen Taylor. After all, the process was dynamic. Initial testing showed no evidence of Helen Taylor's involvement in *Subjection*, so it made sense to expand her authorial set to check for indications of her style.

The huge availability of texts made the selection for J. S. Mill's training set a much more complicated issue. On the one hand, we needed to avoid contamination of the training set: *Autobiography*, *Principles of Political Economy*, and *On Liberty* had to be eliminated as potential candidates for training, given the questions surrounding

Harriet Mill's role in the writing process. For a similar reason, we had to eliminate "Chapters on Socialism" (J. S. Mill [1879] 1967) and *Three Essays on Religion* (J. S. Mill [1874] 1979), even though they would have provided a good sample of J. S. Mill's style (even if unpolished) around the time *Subjection* was published. It is impossible to know the extent of Helen Taylor's editorial interventions to these texts prior to publication. On the other hand, given the limitations involved in corpus selection as regards Harriet Mill and Helen Taylor, caution was needed to avoid bias in favour of J. S. Mill. Being sensitive to the risk of distortion to authorial sets, we used different sets of texts for the tests between J. S. Mill and H. Mill, as well as J. S. Mill and H. Taylor.

For comparisons to H. Mill's corpus, we opted for the first 2,200–2,500 words of J. S. Mill's first seven essays published in the *Monthly Repository.* First, as most of the writing samples from H. Mill are from the same periodical around the same time, this choice protects against time variation of writing samples (e.g., by choosing essays that had been written closer to the time of *Subjection*'s publication). Second, this choice minimizes the risk of distortion of the samples from editorial interventions to the text (the editor was the same for both H. Mill's and J. S. Mill's essays). Third, the word limit allows more essays by J. S. Mill to be included in his training set, thus offering more subject-matter variation (which is something that characterizes H. Mill's texts), and fourth, it keeps the corpus size balanced. Finally, this text-selection process addresses a potential objection, that is, that we are cherry-picking J. S. Mill's texts. We also included part of J. S. Mill's manuscript essay on marriage. This was a mirror essay to that of H. Mill, included in her own authorial set.

For comparisons to H. Taylor, we chose various essays on dissimilar subjects by J. S. Mill published in 1860s. As in the previous case, we tried to eliminate potential bias in favour of J. S. Mill, especially as regards subject-matter variety, since Helen Taylor's corpus is made by a group of dissimilar subjects. It would have been enough to use just one book by J. S. Mill, but we opted for variety, given the external constraints (potential editorial interference, word limit, necessity of including excerpts, etc.) to Helen Taylor's work. For the full list of texts, see **Table 1**.

As regards the clean-up part of the corpus preparation process, we removed extracts and long quotes, and we removed title/chapter headings, pagination, notes, references, italicization, and editorial notes/comments/variants (including characters/symbols to this purpose). Trying to intervene minimally with the text of the manuscripts, articles, chapters, or notices that make up our corpus, we preserved spelling and punctuation.

Author	Essay/Work	Year	Words
JSM	On Genius	1832	2390
	What Is Poetry	1833	2593
	Writings of Junius Redivivus	1833	2206
	Alison's History of the French Revolution	1833	2417
	Views of the Pyrenees	1833	208
	Blakey's History of Moral Science	1833	2574
	Two Kinds of Poetry	1833	2433
	On Marriage	MS c1832–1833	1458
	Centralisation	1862	13901
	The Slave Power	1862	7561
	Austin on Jurisprudence	1863	15575
	England and Ireland	1868	12130
	Endowments	1869	6826
HM	Australia	1831	241
	German Prince	1832	225
	Manners	1832	1331
	Hampden	1832	2635
	Mirabeau	1832	1416
	Plato	1832	623
	French Revolution	1832	2536
	Seasons	1832	1613
	Conformity	MS c1831	1934
	Laconicisms	MS c1832	1652
	On Marriage	MS c1832–1833	1265
	Alroy	MS c1833	601
	The Enfranchisement of Women	1851	10012
	Fitzroy's Bill	1853	2372
HT	The Education of Women	c1860	1976
	Greece and the Greeks	1863	6532

(Contd.)

Author	Essay/Work	Year	Words
	Personal Representation	1865	9345
	Women and Criticism	1866	3728
	The Ladies' Petition	1867	7590
	On Fox-Hunting	1870	2495
	On T. More	1870	3519
	Paris and France	1871	3717
	New Attack on Toleration	1871	4555
	T.H. Buckle Biographical Note	1872	2919
	Too Late and Too Soon	1873	1695
	Women's Rights as Preached by Women	1881	2727

Table 1: Author Corpus.

2.3 Revisiting **The Subjection of Women**: *Method, tests and results*

Neocleous and colleagues (Neocleous and Loizides 2020; Neocleous, Kataliakos, and Loizides 2022) developed a machine learning system to address various authorship identification problems in John Stuart Mill's corpus. Using computational text analytics techniques, they ran a series of tests to determine the authorship of *On Liberty* (J. S. Mill [1859a] 1977), *The Subjection of Women* (J. S. Mill [1869] 1984), and *On Social Freedom* (J. S. Mill 1907). In the first article, they focused on feature selection by building models using different combinations of extracted features to classify the three "disputed" texts into one of three possible authors (J. S. Mill, H. Mill, H. Taylor) or in a class called "joint productions" (collaborative work by J. S. Mill and H. Mill). The essays were attributed to J. S. Mill, though there was evidence of possible influence (with no indication of any specific text segment written by any other author than J. S. Mill). In the second attempt, they simplified the models into training binary classifiers to distinguish between two authors (J. S. Mill and Harriet Mill), focusing on *Liberty* and *Subjection*. The author corpus was divided into text segments of varied length used as separate instances, instead of feeding the entire corpus as a single instance. Neither article engaged in a detailed discussion of the problems of co-authorship involved. To further validate the effectiveness of the proposed methodology, Neocleous and colleagues (Neocleous, Kataliakos, and Loizides 2022) applied the same approach to a Benchmark Dataset, with results, according to the authors, that matched the scholarly consensus. A third article by Loizides and colleagues (Loizides, Neocleous,

and Nicolaides 2023) focused exclusively on *Social Freedom*, conducting both a traditional and non-traditional authorship identification analysis of said text. In the non-traditional analysis, Loizides and colleagues used the methodology developed by Neocleous and colleagues (Neocleous, Kataliakos, and Loizides 2022).

In the present iteration of the investigation, we used the same ML system as Neocleous and colleagues (Neocleous, Kataliakos, and Loizides 2022) to focus on *Subjection*. We began with the construction of a dataset of 39 texts. As already discussed, specific texts from this dataset were selected to create authorial profiles, where each corpus was assigned a class corresponding to its known author (e.g., Class 1 for Harriet Mill; Class 2 for John Stuart Mill in the first test; Class 1 for Helen Taylor; Class 2 for John Stuart Mill in the second test).

Each author's texts were first combined into one long text. Then, from that long text, we created a series of instances of a pre-defined number of words, that is, segment lengths (50, 100, 200, 500, up to 1000 words). There was no overlap between consecutive instances (an instance starts one word after the last word of the previous instance). Breaking texts into many segments provided more training instances, which helped the machine learning algorithms learn more reliably from limited data. Using segments of uniform length controlled for variation in essay length. It ensured that classification was based on stylistic patterns rather than text length, since all author corpora were comparable in size. Despite the well-known limitation of using small text sizes (at least up to 500 words, as we saw), the division into text segments allowed the models to classify different parts of *Subjection* to different authors. This was crucial for this study. It enabled us to attempt to detect whether portions of *Subjection* resemble H. Mill's style or H. Taylor's style, even if *Subjection* is largely attributed to J. S. Mill. This was the only way to test J. S. Mill's claims of specific parts of authorship by H. Taylor and H. Mill.

Before classification, the texts underwent preprocessing to ensure consistency and comparability. This involved converting all documents to a standardized format, preserving punctuation, segmenting the text into structural units (sentences and words), and tagging words with their grammatical categories using the CLAWS part-of-speech tagger. By maintaining function words and punctuation, we retained key stylistic markers essential for authorship identification.

For the analysis itself, we extracted a diverse range of linguistic features chosen to capture stylistic and structural patterns that may distinguish the author: counts, punctuation usage, CLAWS grammatical tags, and n-grams (both unigrams and bigrams). First, the "Counts" category includes statistical measures such as the average and standard deviation of sentence and word lengths. Second, the "Punctuations"

category covers 12 specific punctuation marks. Third, the "CLAWS tags" category refers to 138 predefined grammatical tags assigned to words by the Constituent Likelihood Automatic Word-tagging System (CLAWS), a tool developed by the University Centre for Computer Corpus Research on Language (UCREL) and accessible online (UCREL 2025). Fourth, the "n-grams" category comprises Unigrams (which count the occurrences of individual words) and Bigrams (which track the frequency of consecutive word pairs). Also, all these features were combined into a single feature set (All_Features). Additionally, we applied dimensionality reduction techniques. Specifically, we used two methods: one statistical approach that selected the most discriminative features based on frequency thresholds, and Principal Component Analysis (PCA), which retained 95% of the variance in the data.

With the refined feature sets, we proceeded to train three machine learning classifiers: k-nearest neighbours (k-NN 1 and 2), support vector machines (SVMs), and decision trees (DTs). The ML system employed for each author a cross-validation approach. This means that for each classification model, the author's corpus was split into two parts: the training set and the validation set. The training set was chosen randomly to form 70% of the initial author's dataset, and the remaining 30% was used for validation. This yielded a validation accuracy score. The higher the training and validation accuracy score, the higher the confidence in the results of the classification. Still, validation accuracy scores are just indications of probable efficiency in the performance, not an absolute indicator. (For more information on the methodology, see Neocleous and Loizides 2020 and Neocleous, Kataliakos, and Loizides 2022).

The validated models were applied to *Subjection*. Each classifier was tested to identify the optimal combination for distinguishing between the two possible author classes—John Stuart Mill or Harriet Mill, and John Stuart Mill or Helen Taylor. By analyzing the classification probabilities over the trained authorial classes, the ML system classified the most likely author for the n-word (n = 50, 100, 200, and so on) text segments from the disputed text.

In total, we ran three sets of tests: first, we compared texts by J. S. Mill and H. Mill written in the early 1830s; second, we compared texts by J. S. Mill (from 1862 to 1869) and H. Taylor (from 1860 to 1881); third, we also compared texts by J. S. Mill and H. Mill written in the early 1830s, with the addition of *Emancipation* (1851 [H. Mill 1998]) and "Fitzroy's Bill" (1853 [H. Mill 1998]) for H. Mill's authorial set and "Centralisation" (J. S. Mill [1862] 1977) for J. S. Mill's authorial set. In this case, like in the second set of tests, this selection maintained relative corpus size balance, even though it created a subject-matter bias in favour of Harriet Mill. For simplicity's sake, we call the first set of tests HM1vJSM1, the second set HTvJSM, and the third set of tests HM2vJSM2 (see **Table 2**).

TEST	John Stuart Mill	Harriet Mill	Helen Taylor
HM1vJSM1	16279	16072	N/A
HTvJSM	55993	N/A	50798
HM2v|SM2	30180	28456	N/A

Table 2: Author training set size per test.

SVMs performed best in this classification task, demonstrating robust performance across different conditions and being the most accurate both in the training and the validation phases of the three tests. It was the only classifier that achieved 100% training accuracy in all word-group sizes (on SVM, see, e.g., Cortes and Vapnik 1995; Tong and Koller 2001; Cervantes et al. 2020). The article's supplementary material contains full details on the validation accuracy scores of all classifiers across different feature sets and text sizes (see Supplementary Material).
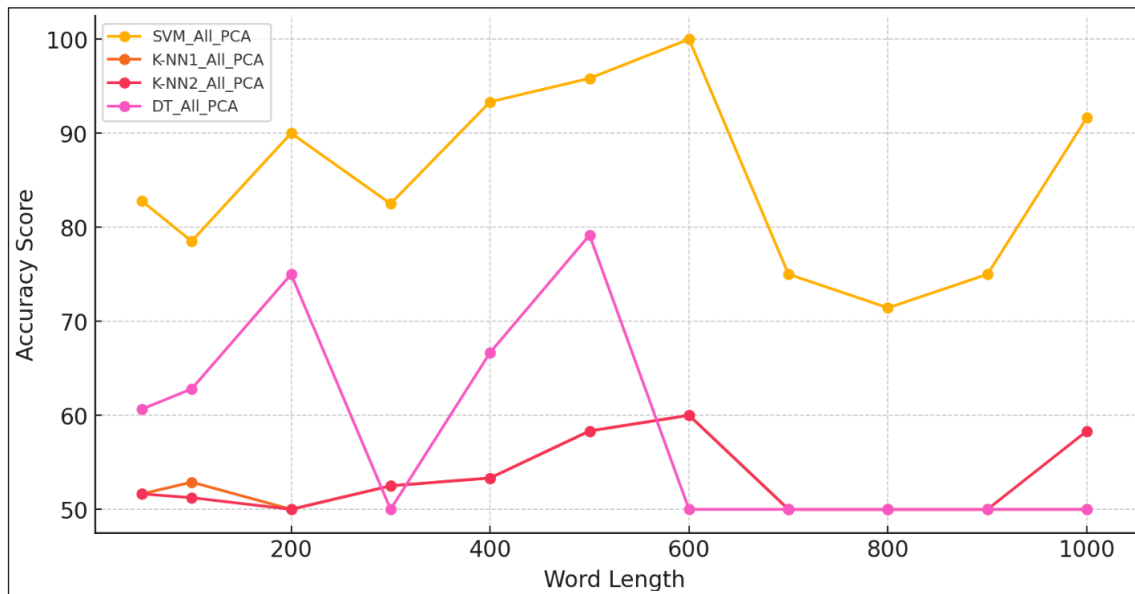

Figure 1: Classifier validation accuracy by using the first components of PCA applied to all features (HM1vJSM1).

The choice of features affected accuracy. The optimal feature set varied depending on the classifier and text segment size (see **Figure 1**). SVM was most accurate with unique words (unigrams), unigrams with Principal Component Analysis (PCA), or all features combined with PCA (on PCA, see, e.g., Jolliffe 2002; Abdi and Williams 2010). Unique pairs of words (bigrams) or bigrams combined with PCA performed well, but not as well as unigrams (see **Figure 2**).
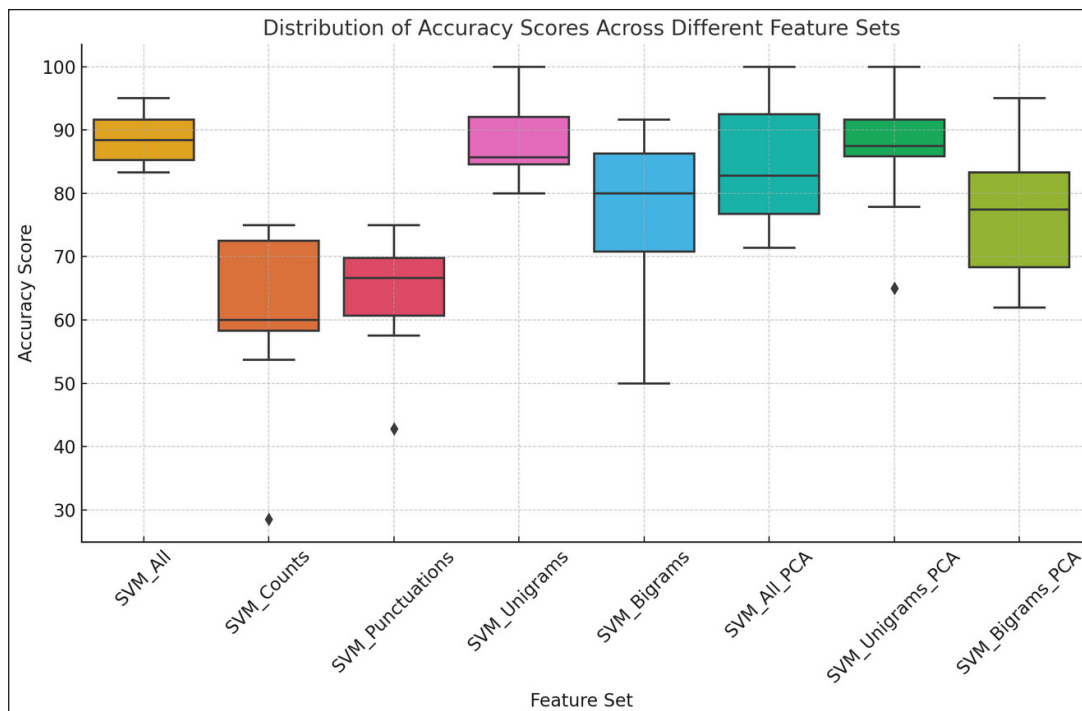
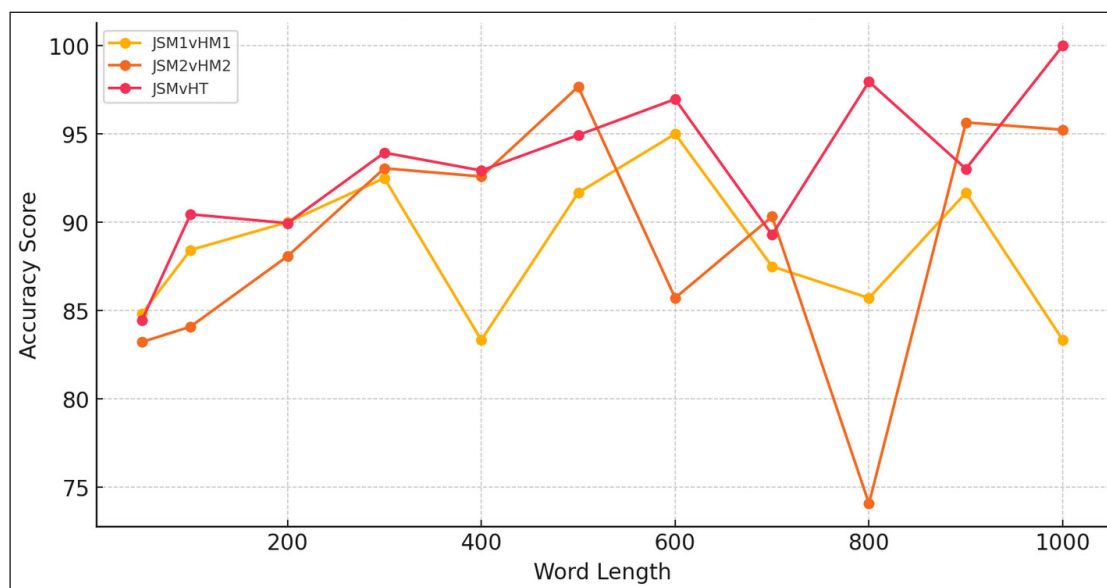**Figure 2:** SVM validation accuracy variability per feature across word length (HM1vJSM1).

Figure 3: SVM validation accuracy score by using all features.

In all sets of tests, SVM had consistently high accuracy across different feature sets and word groups (see **Figure 3**). In the 600-word group, for an example from the HM1vJSM1 tests, SVM (combined PCA) reached 100% (and 95% overall) validation

accuracy. In the HTvJSM tests, thanks to larger training sets by Helen Taylor and John Stuart Mill, the four classifiers were more accurate overall as regards validation. Here, in the 1000-word group, SVM with All_Features without PCA reached 100% validation accuracy (but 86.61% All_Features_PCA). In the 600-word group, SVM_All_Features_PCA reached 100% validation accuracy (and 96.96% All_Features). In the HM2vJSM2 test, this time thanks to a larger training set by both Harriet Mill and John Stuart Mill, SVM improved its validation accuracy overall, but Unigram_PCA or Bigram_PCA was steadily less accurate than in the previous two sets of tests. Still, SVM was consistently more accurate than any other feature extraction from the other classifiers. In the 500-word group, SVM reached 97.67% All_Features validation accuracy (but 53.48% for All_Features_PCA). We highlight these three cases because they had the best All-Features validation accuracy from each test.

So, are there traces of H. Mill's and H. Taylor's authorial hands in *Subjection*? If we opt for a simple answer, then "no." There is not much evidence in the most accurate of the classification attempts. In the HM1vJSM1 tests, the highest validation accuracy with SVM_All_Features was reached in the 600-word group (95%). In the HTvJSM tests, the highest validation accuracy with SVM_All_Features was reached in the 1000-word group (100%). In the HM2vJSM2 tests with the enlarged corpus by both Harriet Mill and John Stuart Mill, the highest validation accuracy with SVM_All_Features was reached in the 500-word group (97.67%). Only in the first case (HM1vJSM1) was some text from *Subjection* classified under an author different from John Stuart Mill. Of the 81 instances created for this comparison, just four were classified under H. Mill (two from the first chapter, one from the second chapter, and one from the third chapter).

To opt for a more complex answer, we need only to look at the second-best validation accuracy score and the resulting classification for each test. The picture changes significantly. In the HM1vJSM1 tests, the second-highest validation accuracy with SVM_All_Features was reached in the 300-word group (92.5%). Now, no text is classified under H. Mill. When we look at the same word-group for the HM2vJSM2 test, 22 out of 162 instances are classified under H. Mill. In the HTvJSM tests, the second-highest validation accuracy with SVM_All_Features was reached in the 800-word group (97.67%). Helen Taylor had a share of 14 instances out of 60 total. In the HM2vJSM2 set, the second-highest validation accuracy with SVM_All_Features was reached in the 900-word group (95.65%). This time, the algorithm classified 13 out of 54 instances under H. Mill. Yet, no text is classified under H. Mill in the same word-group for the HM1vJSM1 test. Looking at the two sets of tests with the larger authorial sets, the validation accuracy of the algorithm increases, but so does the share of text instances of both mother and daughter. However, we should be cautious in generalizing

from less accurate models. More importantly, the subject-matter bias in favour of J. S. Mill's collaborators in the HM2vJSM2 and HTvJSM tests further reduces confidence in these results (see **Table 3**).

Test	Text Size	Classification Segment/ Author		All Features Validation Accuracy (%)	Feature with Highest Validation	Feature Valida- tion Accuracy (%)
		HM	**JSM**			
HM1vJSM1	500	1	96	91.66	All_PCA/ Unigrams_PCA	95.83
	600	4	77	95	All_PCA/ Unigrams_PCA	100
	700	0	69	87.5	Unigrams	100
	800	0	60	85.71	Unigrams_PCA	85.71
	900	0	54	91.66	Unigrams_PCA	91.66
	1000	0	48	83.33	Unigrams	100
		HM	**JSM**			
HM2vJSM2	500	0	97	97.67	Unigrams	93.02
	600	0	81	85.71	Unigrams	100
	700	4	65	90.32	Unigrams	90.32
	800	10	50	74.07	Unigrams_PCA	88.88
	900	13	41	95.65	Unigrams	95.65
	1000	0	48	95.23	Unigrams	95.23
		HT	**JSM**			
HTvJSM	500	19	78	94.93	Bigrams/All_PCA	97.46
	600	30	51	96.96	Bigrams/All_PCA	100
	700	13	56	89.28	Bigrams/ Unigrams_PCA	96.42
	800	14	46	97.95	Unigrams/ Bigrams/ Unigrams_PCA	97.95
	900	0	54	93.02	Unigrams	100
	1000	0	48	100	Unigrams	100

Table 3: SVM classification results of *Subjection* text segments (>400 words). (The article's Supplementary Material includes results across different classifies and word lengths.)

3 Conclusion

If the series of tests described in the previous section were intended only to identify the author of *Subjection*, the results would be overwhelmingly in favour of John Stuart Mill. But we already knew that. As we saw, he claimed that *Subjection* contained "passages" of Helen Taylor's writing and some of her ideas. And, he began writing the book at her suggestion, two years after her mother's death. However, though the most accurate classification attempts favour J. S. Mill, less accurate models show a noticeable share of text attributed to Harriet Mill and Helen Taylor, though not always. Limitations notwithstanding, this suggests an echo of their authorial voice in *Subjection*, aligning to some extent with J. S. Mill's own claims. This is in line with the previous attempts on this and related co-authorship investigations into the collaboration between H. Mill and J. S. Mill.

At the same time, our analysis reinforces the notion that collaborative writing can be difficult to classify under a single author. The challenges collaboration poses to stylometric analysis are well known (e.g., see Glover and Hirst 1996; Kestemont, Moens, and Deploige 2015; Eldin, Lavin, and Look 2017). But J. S. Mill's corpus is presented with an additional complication. Both Harriet Mill and Helen Taylor most likely did their best to mimic his style in their cooperative projects. A new style of writing, or a text with inconsistent prose, would be most likely counterproductive: without J. S. Mill's authority and influence, *Subjection*'s message would have been dismissed to an even more extensive degree than it was. Future studies might explore alternative methodologies or combine stylometric analysis with other forms of textual analysis to gain a more comprehensive understanding of the complex dynamics of their partnership, collaboration, and co-authorship. (For the application files, each author's training corpus, the test corpus, and comprehensive results, see Supplementary Material.)

Supplementary material

The article's data files and application files, including each author's training corpus, the test corpus, and comprehensive results, are available at https://doi.org/10.5281/zenodo.15128566.

Competing interests

The authors have no competing interests to declare.

Contributions

Authorial

Authorship in the byline is by significance of contribution to the writing of this article. Author contributions, described using the NISO (National Information Standards Organization) CrediT taxonomy, are as follows:

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Training Corpora

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