

Nineteenth-Century Gender Studies

article being considered for on-line publication:

Who wrote the Women's Movement articles in *The Saturday Review*?

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Additional information relevant to the article and its computational stylistic tests:

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Appendices

Appendix A

13 Women's Movement articles

(used in figures 2 3 & 4)

1. "Lectures to Ladies on Practical Subjects"
The Saturday Review, December 15, 1855 (1338 words)
2. "Man's Might and Woman's Right"
The Saturday Review, May 3, 1856 (1704 words)
3. "Law for Ladies"
The Saturday Review, May 24, 1856 (2022 words)
4. "Woman's Rights"
The Saturday Review, June 14, 1856 (1491 words)
5. "Marriage and Divorce"
The Saturday Review, July 5, 1856 (1696 words)
6. "Head or Woman?"
The Saturday Review, February 7, 1857 (1346 words)
7. "Industrial Occupations of Women"
The Saturday Review, July 18, 1857 (1740 words)
8. "Bloomeriana"
The Saturday Review, Sept. 12, 1857 (1653 words)
9. "Social Science"
The Saturday Review, October 17, 1857 (1382 words)
10. "A Woman's Thoughts about Women"
The Saturday Review, April 10, 1858 (1603 words)
11. "The Claims of Governesses."
The Saturday Review, Jan 30, 1858 (1962 words)
12. "The English Woman's Journal"
The Saturday Review, April 10, 1858 (1674 words)
13. "The Over-Education of Women"
The Saturday Review, May 8, 1858 (1919 words)

Our etext version of these articles was produced by transcription from a photocopy of the *Saturday Review* article.

The articles had been selected a number of years earlier by Dr. Ellen Jordan, as of interest to her research on the English Woman's Movement.

Appendix B

Frequency list of the 200 most common 'function' words of the CLLC periodical corpus.

1	the	48	will	95	less	142	ought
2	of	49	what	96	over	143	why
3	and	50	would	97	never	144	quite
4	to	51	may	98	you	145	herself
5	a	52	its	99	does	146	anything
6	in	53	she	100	might	147	within
7	is	54	him	101	about	148	above
8	that	55	such	102	while	149	whatever
9	it	56	only	103	against	150	till
10	as	57	us	104	another	151	off
11	which	58	can	105	nothing	152	since
12	we	59	any	106	though	153	towards
13	be	60	when	107	themselves	154	neither
14	with	61	these	108	cannot	155	beyond
15	for	62	other	109	still	156	instead
16	not	63	some	110	between	157	during
17	his	64	most	111	through	158	your
18	he	65	very	112	among	159	my
19	by	66	into	113	itself	160	used
20	but	67	those	114	here	161	round
21	are	68	must	115	few	162	everything
22	was	69	do	116	however	163	none
23	have	70	much	117	whose	164	unless
24	this	71	should	118	both	165	me
25	or	72	out	119	also	166	past
26	on	73	even	120	perhaps	167	several
27	they	74	like	121	always	168	doing
28	all	75	upon	122	whom	169	along
29	their	76	many	123	each	170	nevertheless
30	from	77	every	124	shall	171	hence
31	her	78	same	125	ever	172	until
32	at	79	I	126	thus	173	although
33	has	80	up	127	did	174	opposite
34	an	81	being	128	nor	175	am
35	who	82	without	129	rather	176	throughout
36	one	83	could	130	again	177	besides
37	no	84	how	131	something	178	behind
38	so	85	too	132	having	179	amongst
39	had	86	himself	133	down	180	below
40	more	87	after	134	often	181	around
41	if	88	before	135	just	182	wherever
42	there	89	then	136	least	183	everywhere
43	them	90	because	137	enough	184	outside
44	our	91	where	138	done	185	nobody
45	were	92	well	139	either	186	everybody
46	than	93	under	140	almost	187	don't
47	been	94	yet	141	ourselves	188	whenever

189 beneath
190 amid
191 ours
192 amidst
193 anyone
194 anybody
195 anywhere
196 across
197 mine
198 theirs
199 somewhere
200 somehow

Appendix C

72 Gender Marker Words

The 72 Gender “marker” words were obtained by means of a distribution test carried out on men’s and women’s periodical text sections using as variables the 200 most common function words of the CLLC periodical corpus. (Appendix B) Each text section was 5000 words in length.

(see below for more detailed description of the distribution test)

162 Periodical articles written by 6 women and 14 men: divided into 5000 word text sections for distribution test.

72 "marker" words used in figure 1

Women Positive (t-value above +2)

= words women use relatively more often

Indefinite Articles/Pronouns

anybody everything

1st person personal Pronoun

us

3rd person personal Pronouns

she her herself his

Relative Pronoun

who whose

Function Verbs & Modals

Conjunctions

and while than

Prepositions

of in for up over between
through throughout outside

Quantifier/qualifier

more less every other another

Adverbs

where here rather
somehow perhaps

Negative forms

nor

Men Positive (t-value above +2)

= words men use relatively more often

Indefinite Articles/Pronouns

it itself

1st & 2nd person personal Pronoun

I you

3rd person personal Pronouns

they them theirs

Relative Pronoun

that

Function Verbs & Modals

was were be been have had having did
shall will would should could might ought

Conjunctions

if but or unless although

Prepositions

without during against

Quantifier/qualifier

only some most least several

Adverbs

what well why

Negative forms

not

70 "marker" words used in figure 2

The word list used for the tests in this paper and the words underlying the plot seem in figure 2 were the same as Table 1 above, except for the omission of two words "somehow" and "theirs". These were low frequency words at the end of the list and did not appear in some of the shorter articles, and so were omitted from the tests.

Explanation of Marker Words

“Marker words” are identified by running a distribution test on the two groups under testing (here men versus women) using (in this case) the 200 most common function words of the CLLC Victorian Periodical Corpus as variables. The test identifies those words which are used significantly differently by the two groups. Of the 200 words tested 72 had a T-value greater than + or – 2, which we had chosen as our level of significance. All the words had a P score (probability) of less than 0.05, while at least half of them were in the “highly significant” probability range. The polarity (+ or -) of the t-value indicates the tendency of that group to use the marker word in question relatively more, or relatively less often. This way we were able to say that there were 40 words which the men (as a group) used more often than women and 32 words which the women (as a group) used more often.

Explanation of Distribution Tests

At the CLLC for comparisons between two groups, we use distribution tests such as Student's t-test, which treats of divergences from means, and the Mann-Whitney test, which treats of divergences from medians. “The principle on which both tests rely is that scores characteristic of two populations, each fairly homogeneous, can sometimes be distinguished from the pattern characteristic of a single heterogeneous population.”

“Since each test is better fitted to cope with a different kind of aberration in the pattern of the scores” we generally take advantage of both findings.

“When they are used to compare the scores for two known groups in trials of successive variables (frequency of word use) the function of the distribution tests is to attach a probability (for each word variable) to the hypothesis that the two groups do not differ from each other. The observer must decide upon an acceptable level of ‘statistical significance’ and establish how many of the results surpass that level.”

“A probability of 0.05 or one chance in twenty is often chosen as the point at which results are deemed 'significant' enough to be pursued. A probability of 0.001 or one chance in a thousand is usually regarded as ‘very highly significant.’”

Details in quotation marks taken from:

Burrows, John & D. H. Craig, (1994) *Lyrical Drama and the “Turbid Mountebanks”*: Styles of Dialogue in Romantic and Renaissance Tragedy, *Computers and the Humanities*, 28, 1-24.

Appendix D

Periodical text sections used as gendered background in tests

(used in figure 2)

Texts were divided into 2500 word sections with the remainder being added to the final section. These texts were chosen at random from the 162 periodical texts available.

Men's Sections: (number of sections indicated in parentheses)

Bagehot, Walter "Nation Making I" *Fortnightly Review*, July 1869 (1)

Bagehot, Walter "Nation Making II" *Fortnightly Review*, December 1871 (1)

Burton, J.H. "Sir J. Mackintosh's History of Revolution in 1688." *Westminster Review*, October 1834 (2)

Burton, J.H. "Pitcairn's Criminal Trials in Scotland" *Westminster Review*, October 1833 (3)

Cecil, Lord Robert "Conservative Surrender" *Quarterly Review*, October 1867 (5)

Cecil, Lord Robert "The Programme of the Radicals" *Quarterly Review*, October 1873 (4)

Cecil, Lord Robert "The Budget and the Reform Bill" *Quarterly Review*, April 1860 (6)

Froude, J.A. "South Africa Once More" *Fortnightly Review*, October 1879 (4)

Greg, W.R. "Priests, Parliaments and Electors," *Quarterly Review* 1872, (3)

Hayward, A. "The Republic of Venice: its Rise, Decline, and Fall" *Quarterly Review*, October 1874 (5)

Macaulay, T.B. "Moore's Life of Byron" *Edinburgh Review*, June 1830 (5)

Women's Sections:

Eliot, G. "German Wit: Heinrich Heine" *Westminster Review*, January 1856 (3)

Eliot, G. "Silly Novels by lady Novelists" *Westminster Review*, 1856 (3)

Eliot, G. "Three Novels" *Westminster Review*, October 1856 (1)

Mozley, A. "Recit D'une Soeur" *Bentleys Quarterly Review*, 1868 (4)

Oliphant, M. "Epic of Arthur" *Edinburgh Review*, 1870 (5 sections)

Oliphant, M. "Modern Novelists – Great and Small" *Blackwoods*, May 1855 (4)

Rigby, Lady Eastlake "Crowe and Cavalcaselle on the History of Painting" *Edinburgh Review*, January 1872 (4)

Rigby, Lady Eastlake "The Englishwoman at School" *Quarterly Review*, 1878 (4)

Appendix E

16 of Lord Robert Cecil's *Saturday Review* articles

(used in figure 4)

1. "Long Vacation Rambles"
The Saturday Review, March 21, 1857 (1745 words)
2. "French Novels"
The Saturday Review, Jan 09 1858 (1578 words)
3. "Manifest Destiny"
The Saturday Review, Feb 28 1859 (1967 words)
4. "Blunders of Benevolence"
The Saturday Review, Jan 12 1861 (2149 words)
5. "Ladies Spiritual and Temporal"
The Saturday Review, Feb 09 1861 (1506 words)
6. "Marriage Settlements"
The Saturday Review, Apr 06 1861 (1790 words)
7. "Marriage Market"
The Saturday Review, Jul 06 1861 (1959 words)
8. "Fashionable Factory Girls"
The Saturday Review, Jul 20 1861 (1866 words)
9. "Match Making Mamas"
The Saturday Review, Oct 12 1861 (1849 words)
10. "Cranbourne's Historical Essays"
The Saturday Review, Jan 25 1862 (1405 words)
11. "Which does she love?"
The Saturday Review, Mar 15 1862 (1839 words)
12. "Gossip"
The Saturday Review, May 31 1862 (1799 words)
13. "Haymarket"
The Saturday Review, Jun 07 1862 (1817 words)
14. "Heir Hunting"
The Saturday Review, May 30 1863 (1806 words)
15. "Bathing Abroad and at Home"
The Saturday Review, Sep 05 1863 (1855 words)
16. "Dress"
The Saturday Review, Sep 12 1863 (2263 words)

The texts of these articles were produced by transcribing a microfilm printout of *The Saturday Review*.

CLLC Methodology

Overview of the Methods used at the CLLC

1. using the most common words, function words, discriminating words
 - principal component analysis – word & text scatter plots
 - cluster analysis - dendrogram
 - discriminant analysis – scatter plot
2. using a longer list of the most common words
 - delta – a measure of difference
3. using the less common words
 - zeta – making use of words used consistently by the target author, but only sporadically by others
 - iota – making use of words used sporadically by the target author and hardly at all by others
 - zeta prime – IA experiments finding "marker" words for base and counter sets of texts

Computer Programs and Statistical Packages used at the CLLC

1. Lilac Suite



These programs were all custom written to manipulate texts in various ways; to identify different text sections; to prepare texts for counting; to produce frequency tables of words from various texts or parts of texts; to produce word frequency lists and so on.

2. Intelligent Archive – archives texts and allows them to be grouped into any number of text sets; produces word lists for the chosen text sets according to your instructions; results can be collected as either raw scores or normalized proportions
 - organizes groups of texts for the running of zeta prime and finds base and non-base words for each group of texts
3. Minitab 14/15 – used for running multivariate cluster analysis; row prop & eigen macros (=PCA word and text plot) ; distrib macro (=T-test)
4. SPSS – used for various statistical purposes – data reduction and factor analysis

Textual Corpora

Since its inception, the CLLC has engaged in corpus based stylistic study. An important part of the process therefore, is acquiring machine readable texts and preparing them for counting.

The steps are as follows:

- a group of texts is chosen for analysis and “copytexts” identified – these are the hard copy texts against which the electronic texts are proof read. Generally the earliest version or best editorial version available is preferred.

- the electronic texts are acquired in a variety of ways – downloading, scanning, keyboarding. The only method in the early days was keyboarding and this is still used when the hard copy version is unsuitable for scanning.
- the e-texts are then proof-read since both keyboarding and scanning can produce unexpected errors.
- the next step is to prepare the electronic texts for counting. Burrows was very aware of the potential problems of machine counting and set high standards and various protocols for ensuring that when the counting took place, the machine was able to count only what it was supposed to count. Hence all extraneous material (page numbers, titles, chapter headings ...) was excluded. Ambiguous punctuation marks were altered so as not to be mistakenly counted as extra words. Quotations – that is, text which does not belong to the authorial voice being counted – were excluded. Foreign language phrases longer than two or three words and not an essential part of the sentence's syntax were excluded. Mixed genre texts – containing narrative and dialogue were identified as such, so each could be counted separately. Plays were marked up so that stage directions could be excluded and each character's speech could be separately identified when required.
- homographing of some common function words was carried out for the texts of the Centre's earliest Corpora, so that, for example, infinitive 'to' and prepositional 'to' were marked and counted as two separate words. This practice revealed some important and sometimes significant differences for some of the homographed words. Since it is such a labour-intensive task, the texts of the more recent corpora have generally been left unhomographed
- two words or one? for each corpus, a decision needs to be made about what to do with contracted words and with words which some authors write as one and other authors write as two. for example: (don't = do not/don't) (can not=cannot/can not) (any body = anybody/any body). Consistency is aimed for within each corpus.
- the Lilac suite of programs required that the texts appeared in a special fixed line format with a panel at the start of each line. Intelligent Archive is able to handle texts in TEI format, Lilac fixed line format or a "hybrid" format which can be a combination of other formats.

Word Lists

The main idea behind corpus based stylistics is that the larger the corpus, the more robust the resultant word list is likely to be. Once a corpus of texts has been assembled, the word counting programs can provide a frequency list of any length – say the 100, 200, 300 most common words of the particular corpus. A decision may be made to omit proper nouns which happen to be common enough to appear in the list. Alternatively, a decision may be made to use only function words so that any lexical words which appear in the chosen length list may be omitted. Since the boundary between lexical and function words is sometimes fuzzy, it can be necessary to declare and defend a set of function words, which the program can then arrange in the order of frequency for the relevant corpus. It is normal practice not to include the texts one is testing in the corpus from which the word frequency list is derived.

The list of word variables thus derived can then be counted in the texts or text units or text blocks as the experimental design requires. The resultant table of numbers is usually standardized – that is, divided by the number of words in the text and multiplied by 100. This procedure allows texts of different lengths to be compared without the smaller text being disadvantaged. The tables of numbers are read into a comprehensive statistics package such as Minitab or SPSS and a variety of tests are run, on an experimental design which is performance specific to each particular problem, and informed by subject expertise about the likely sources of variation. Appropriate comparisons take into account date and genre and other factors such as the gender, educational and regional background of the various writers involved.

Principal Component Analysis and the Use of Common Words at the CLLC

Holmes says of John Burrows' discovery of the "Burrows' method" used at the CLLC: "He achieved remarkable results, indicating that the way in which authors use large sets of common function words ... appears to be distinctive." and "The Burrows' 'method' has now become the standard first port-of-call for attributional problems in stylometry." (1998, 114)

Hoover says "The ground-breaking work of John Burrows on Jane Austen (1987) convincingly demonstrates that the frequencies of words such as *the*, *and*, *of*, *a*, and *to*, which intuitively seem insignificant both semantically and stylistically can nevertheless be used to distinguish authors, novels and even characters within a single novel from each other, and can be shown to have interesting and significant stylistic nuances." (2002, 157)

Principal component analysis finds "in order of importance the sets of weightings for the variables that account for the most significant variations in the data." (Craig 1992, 200) It highlights the most important likenesses and differences among the specimens. The first two or three of these components contain most of the information, and can be plotted against each other in a scatter plot to show the relationships between the variables in the data. Burrows and Craig point out that "The complexity of such relationships means that the outcome of principal component analysis is *always* subject to interpretation." (2001, 264) For this reason, they say, it is prudent "to begin an inquiry with exploratory tests in which the data are allowed to speak for themselves." (*loc. cit.*) Only after these initial tests have been carried out, can more precise hypotheses be made and tested.

Burrows has observed that the value of using a set of common or function words as the variables for the multivariate statistical comparison is that they "constitute the underlying fabric of a text, a barely visible web that gives shape to whatever is being said." (2004, 323) He uses the analogy of differently patterned or coloured hand-woven rugs, where "the principal point of interest is neither a single stitch, a single thread, nor even a single colour but the overall effect." (324) It is a particular author's use of one particular combination of words in the word set relatively more often than other authors and another particular combination of words relatively less often than the other authors that constitutes his distinctive use of language. Burrows adds that experience has taught him that "a wealth of variables, many of which may be weak discriminators, almost always

offer more tenable results than a smaller number of strong ones.” (2002, 679) This ties in with the idea that it is the comparison of different overall effects that is of more interest than isolated instances of difference.

Burrows and Craig (2001) offer an explanation of why the method works as well as it does.

“The fact that mere frequency-counts of common words can shed real light on the resemblances and differences between works of literature rests upon the logical principle of concomitant variation. The same principle lies at the heart of principal component analysis.” (263)

An additional advantage of Burrows’ principal component analysis testing is that it can be used to yield two related scatter plots, (a word plot and a text plot) each one of which helps the researcher interpret the results seen in the other. The first step in this process is to convert the table of word-score percentages to proportions of row totals. The word-score percentages ensure that longer texts don’t have an advantage over shorter ones, while the row proportions ensure that the more common words at the top of the list don’t have an advantage over those lower down. The next step involves producing a matrix of correlations of the rows, which now represent the word variables. Principal Components are then found for each matrix of correlations. These are plotted to produce the word plot. Finally, by multiplying the matrix of row-total proportions by the eigenvector matrix, coordinates for the columns of text samples can be found and plotted. By comparing the two plots the researcher is able to see which combination of words (used relatively more or relatively less often) have been responsible for the placement of the texts.

Select Bibliography

Burrows, John (2004) Textual Analysis. *A Companion to Digital Humanities*. Edd. Susan Schreibman et al. Blackwell, Oxford, 323-47.

Article can be viewed at: <http://etcl.uvic.ca/blackwell/burrows.html>

Craig, Hugh (2004) A Stylistic Analysis and Authorship Studies. *A Companion to the Digital Humanities*. Edd. Susan Schreibman et al. Blackwell, Oxford, 273-288.

Article can be viewed at: <http://etcl.uvic.ca/blackwell/craig.html>

Burrows, John (2002) “Delta”: a Measure of Stylistic Difference and a Guide to Likely Authorship. *Literary and Linguistic Computing* 17, 267-87.

Burrows, J. & Craig, H. (2001) Lucy Hutchinson & the Authorship of Two Seventeenth-Century Poems: a Computational Approach. *The Seventeenth Century* 16, 259-82.

Craig, Hugh (1999) Auth. attribution & computational stylistics: if you can tell authors apart, have you learned anything about them? *Lit & Linguistic Computing* 14, 103-13.

Burrows, John & Craig, H. (1994) Lyrical Drama and the “Turbid Mountebanks”: Styles of Dialogue in Romantic and Renaissance Tragedy, *Computers and Humanities*, 28, 63-86.

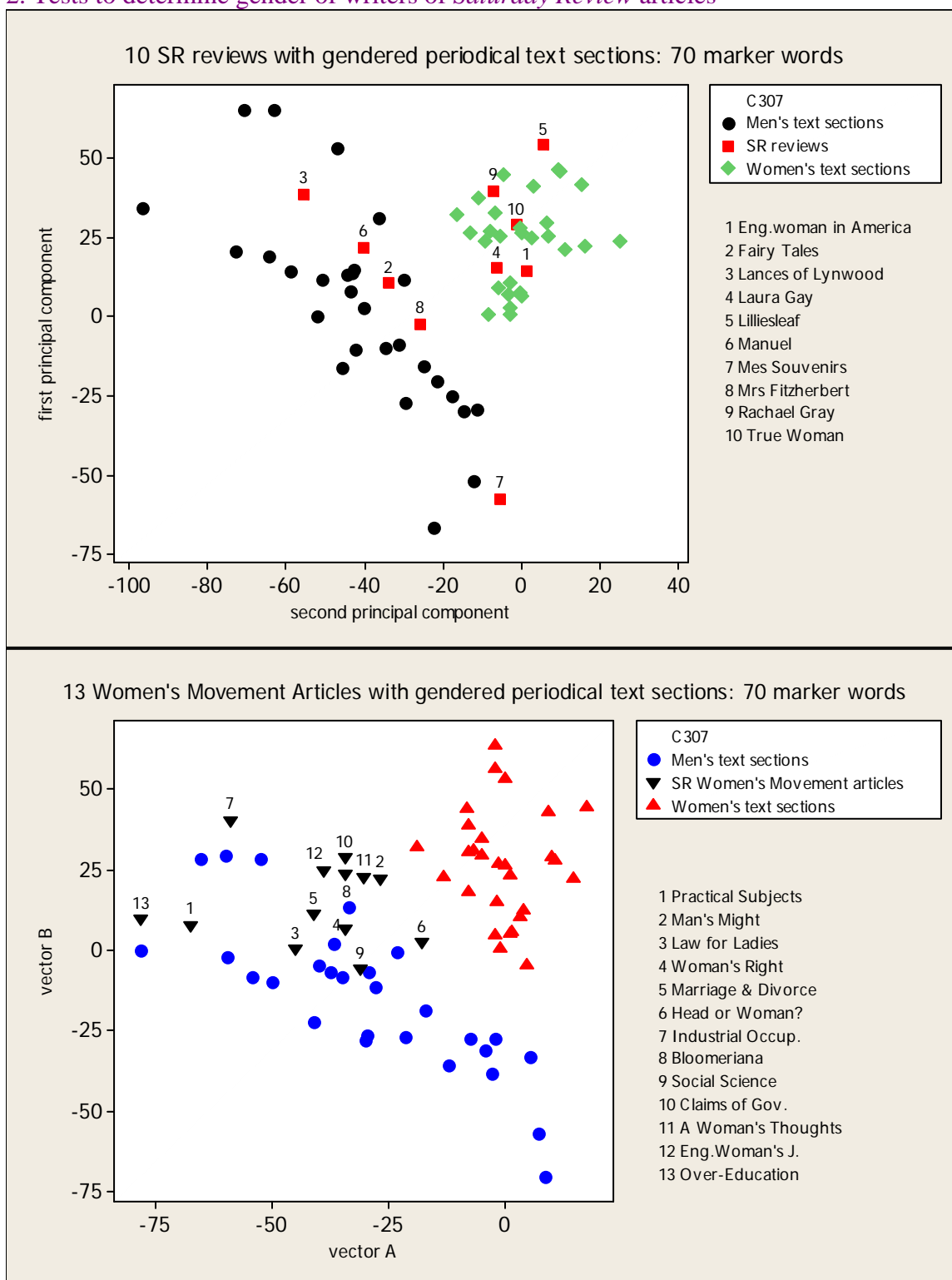
Burrows, John (1992) Computers and the Study of Literature, in C. Butler (ed.), *Computers and Written Texts: an Applied Perspective*, Blackwell, Oxford, 167-204.

but each writer has a tendency to use some of them relatively more than other writers and some of them relatively less than other writers. In the authorial texts plot the six women authors form a fairly compact group spreading from the centre of the plot towards the right hand border, while the fourteen men authors form a much looser group spreading in both directions in the left half of the plot. This shows us that there is more variation among the men in the usage of the words which they (as a group) favour. An examination of the word plot reveals that the three most northerly men (Stephen, Carlyle and Bagehot) make more use of *I* and *you*, while the three most southerly (Macaulay, Burton and Hayward) make less use of these personal pronouns, and more use of the verb forms *was*, *were*, *had* and *having*. The women, on the other hand, show more uniformity in their usage of the words which they (as a group) favour. Nevertheless, the word plot is able to account for the spread of the female authorial groups across the plot, revealing that it is Mozley's greater use of such words as the feminine personal pronouns which accounts for her easterly placement. The location of Martineau and Cobbe at the central edge of the women's section of the plot, and closer to the men's section, suggests that their tendency to use the words "favoured by women writers" is somewhat less than say Mozley and Oliphant.

The gender marker words were obtained by subjecting the 200 most common function words of the CLLC Victorian Periodical corpus to a distribution test to isolate those words which were used significantly differently by the two groups of men and women authors. Of the 200 words tested 72 words had a T-value exceeding + or - 2 which we had chosen as our level of significance. The polarity of the T-value indicates the tendency of one group to use the word significantly more often than the other group. This allows us to group the words into gender markers - words which women (as a group) favour and words which men (as a group) favour.

Using these 72 gender marker words as variables a principle component analysis test was run on the 20 authorial groups of texts. The text plot shows a clear gender demarcation of the two authorial groups of texts, while the word plot reveals which particular words or group of words accounts for the text placements.

2. Tests to determine gender of writers of *Saturday Review* articles



These two plots were typical of the series of tests carried out to see if the gender markers could be used to separate *Saturday Review* articles where the identity of the author was unknown. In the first of the two plots ten review articles were introduced into the background set of men's and women's periodical text sections to see where they would

distribute themselves. In this plot five of the Review articles grouped with the women's text sections and five with the men's. In the second plot, the thirteen women's movement Saturday Review articles were introduced into the same background and all thirteen articles grouped themselves around or within the men's text sections. Since the *Saturday* articles are unattributed, the only way we could test the result further was to run multiple tests. These seemed to us to confirm our suspicion that the women's movement articles were all written by men.

3. Tests on CLLC corpus contributors to *Saturday Review*

The methods of computational stylistics are very good at helping "solve" questions of authorship: - they can help us pronounce with a high degree of confidence that X rather than Y or Z was the likely author of some work of dubious provenance. In this case however, we had no idea who X Y and Z might be, though we thought it probable that the authors were men.

Accordingly we looked for men who were known to have written articles for *The Saturday Review* between the years 1855 and 1859 which were the years during which most of *The Saturday's* woman's movement articles were produced. Since we were restricted to the Centre's existing periodical corpus, this meant that we could only consider men already included in that corpus. Relying on Bevington's attributions and dates of authors writing for the *Saturday*, we came up with:

Walter Bagehot (1826-77)

Lord Robert Cecil (1830-1903)

James Anthony Froude (1819-1894)

William Rathbone Greg (1809-1881)

Abraham Hayward (1801-1884)

(we excluded Thomas Henry Huxley who only contributed scientific articles)

Charles Kingsley (1819-1875)

George Henry Lewes (1817-1878)

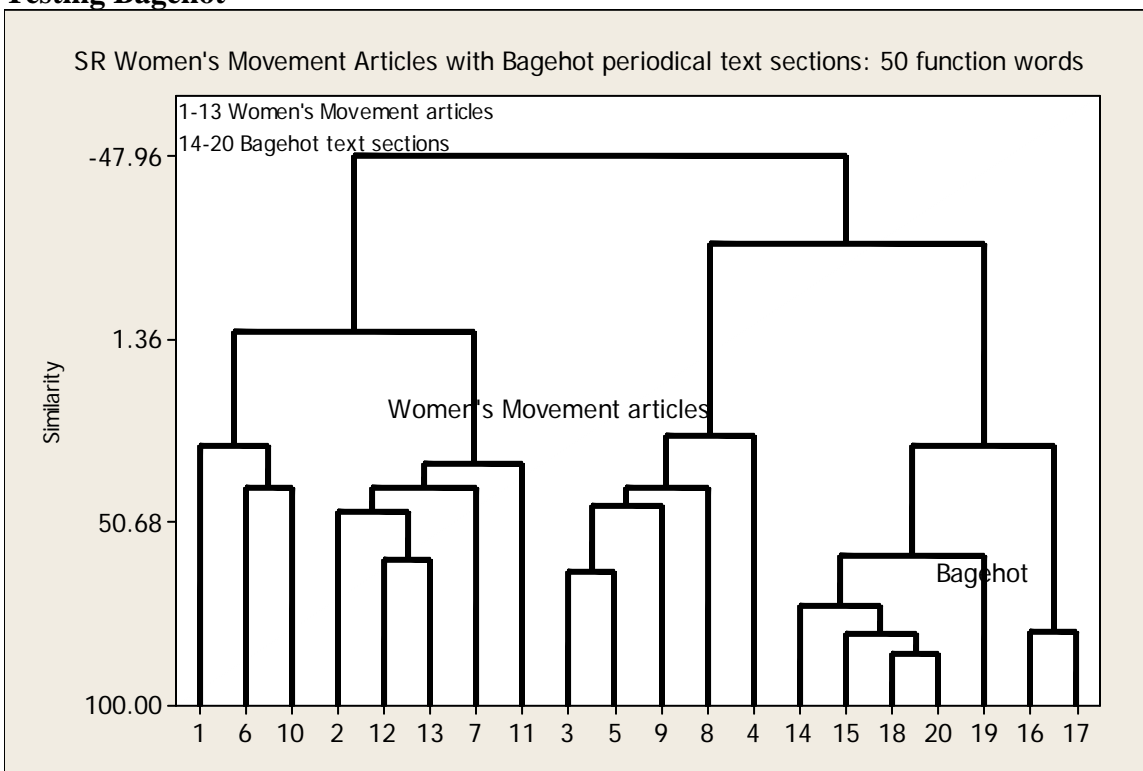
(we excluded Sir Leslie Stephen whose contributions were too late)

These men were all represented in the corpus by at least four and, in some cases, as many as ten periodical articles.

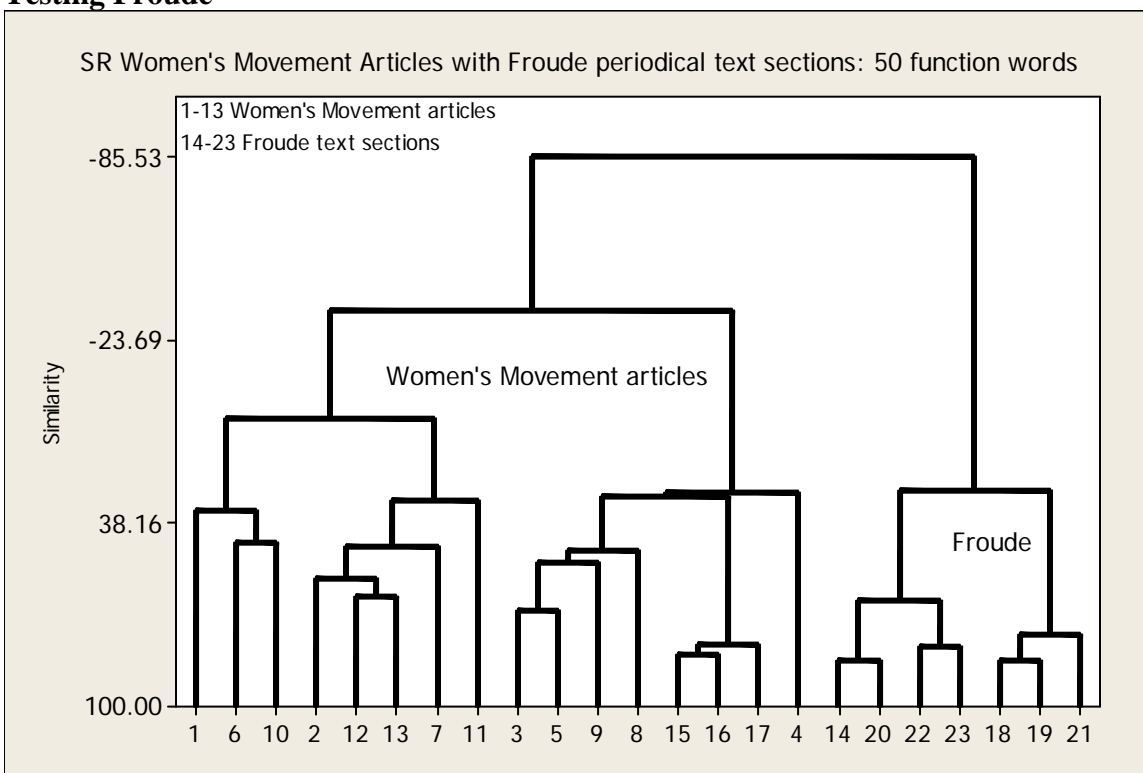
Testing the seven candidates

Using 5000 word text sections of some of the periodical articles of each candidate and the thirteen women's movement articles, we ran a series of cluster analyses based on the 75 50 and 35 most common function words of the CLLC periodical corpus. The results for six of the seven candidates showed a complete separation for each of the three trials, suggesting that none of these authors (Bagehot, Froude, Greg, Hayward, Lewes, Kingsley) had a hand in writing the women's movement articles. On the other hand, Cecil's periodical texts attracted four, five or six of the articles depending on the length of the word list. A selection of the plots for these trials can be seen below.

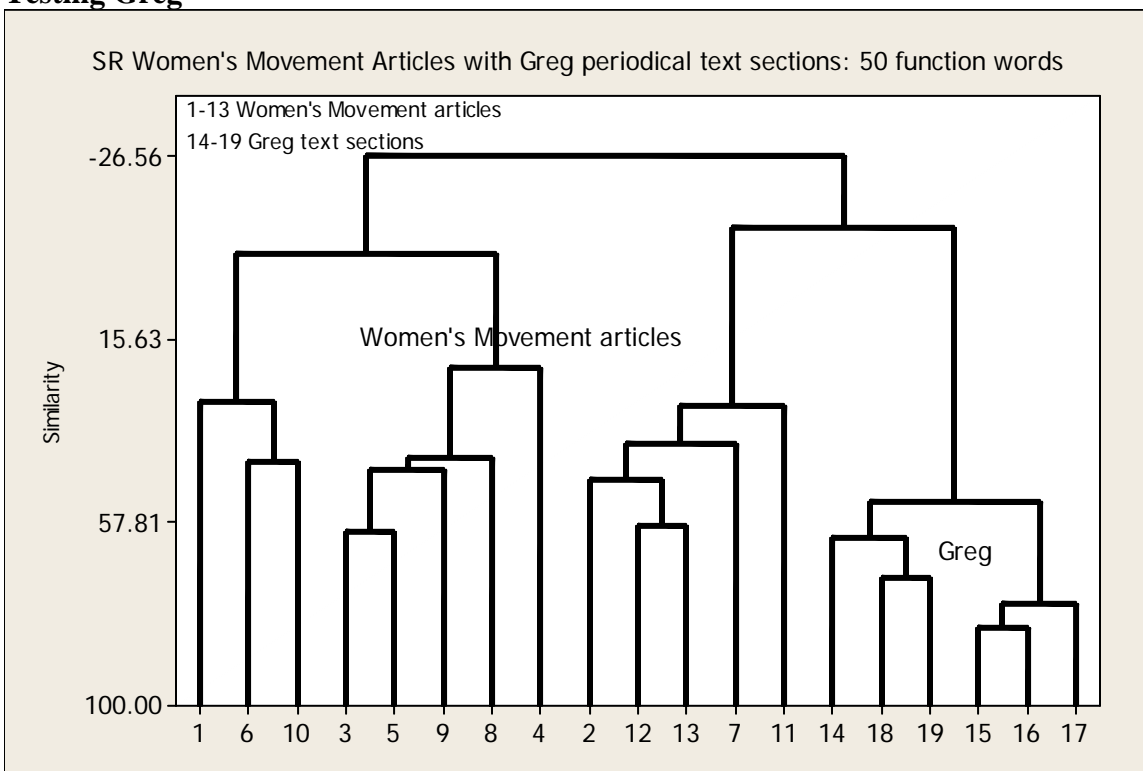
Testing Bagehot



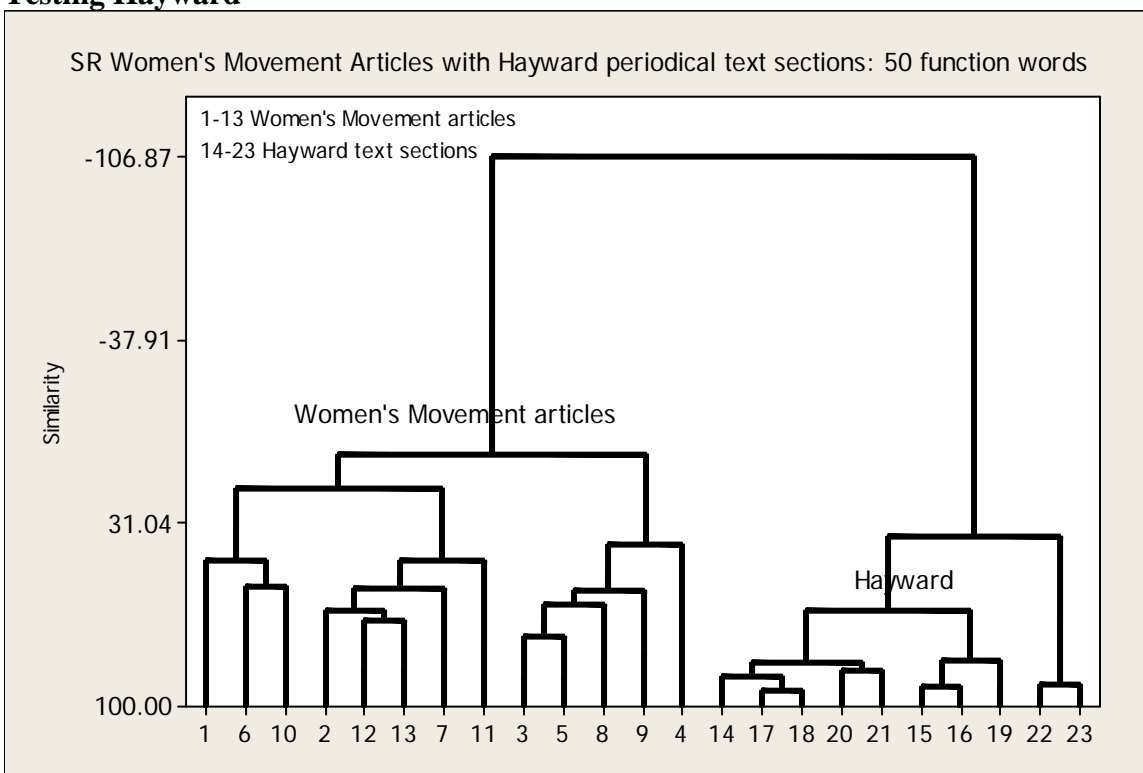
Testing Froude



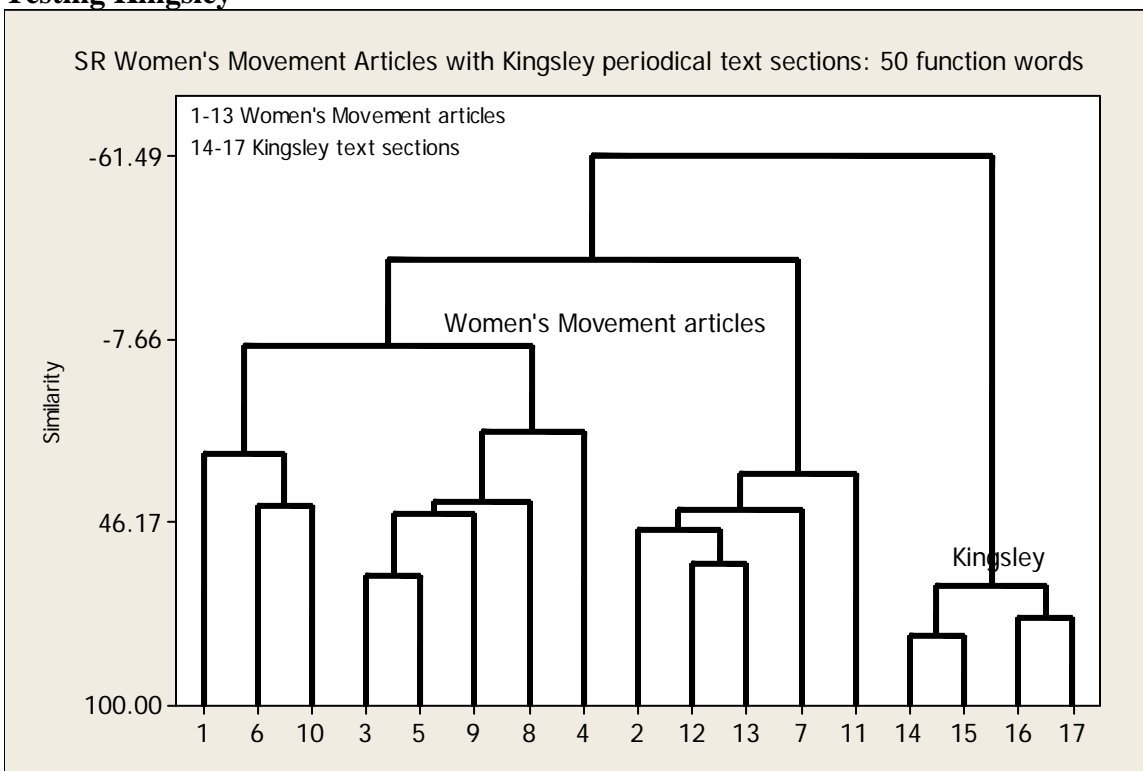
Testing Greg



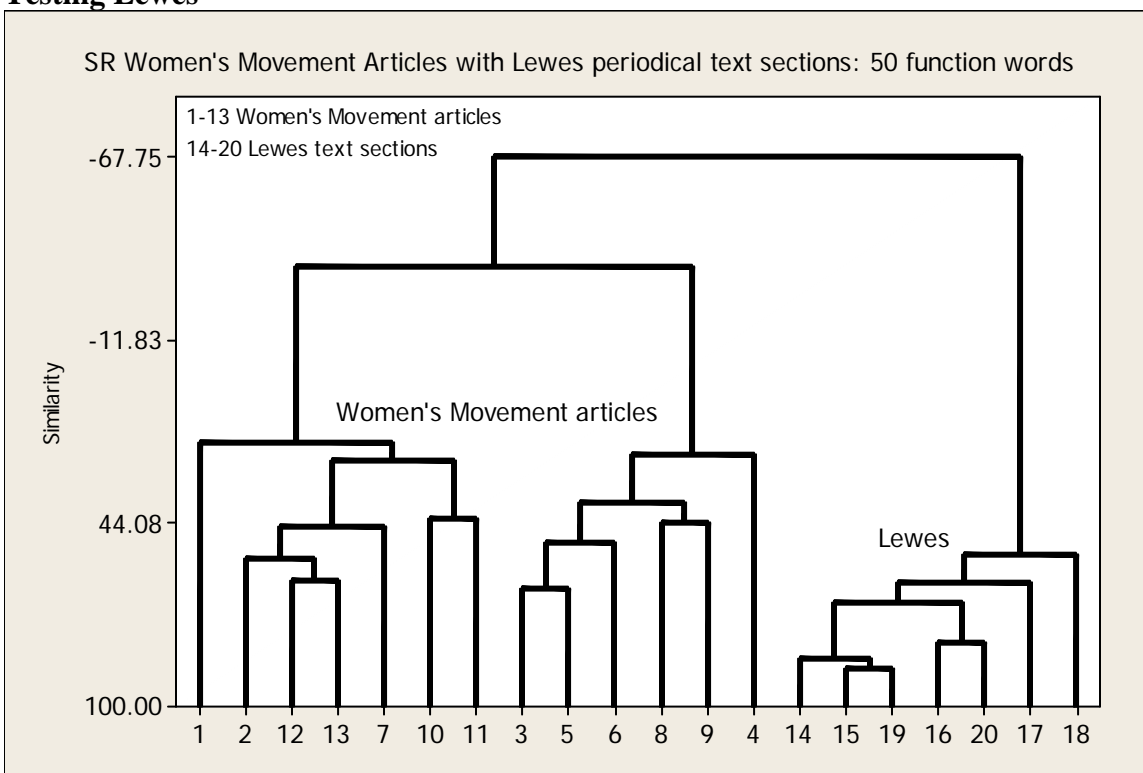
Testing Hayward



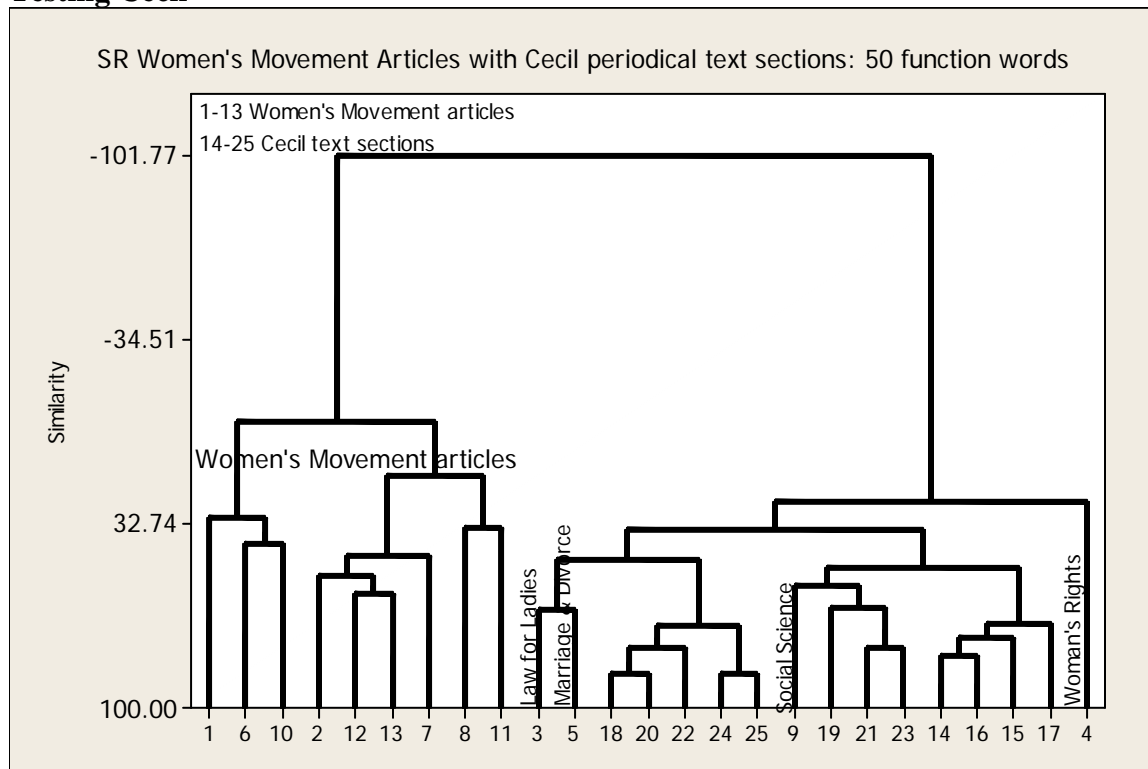
Testing Kingsley



Testing Lewes

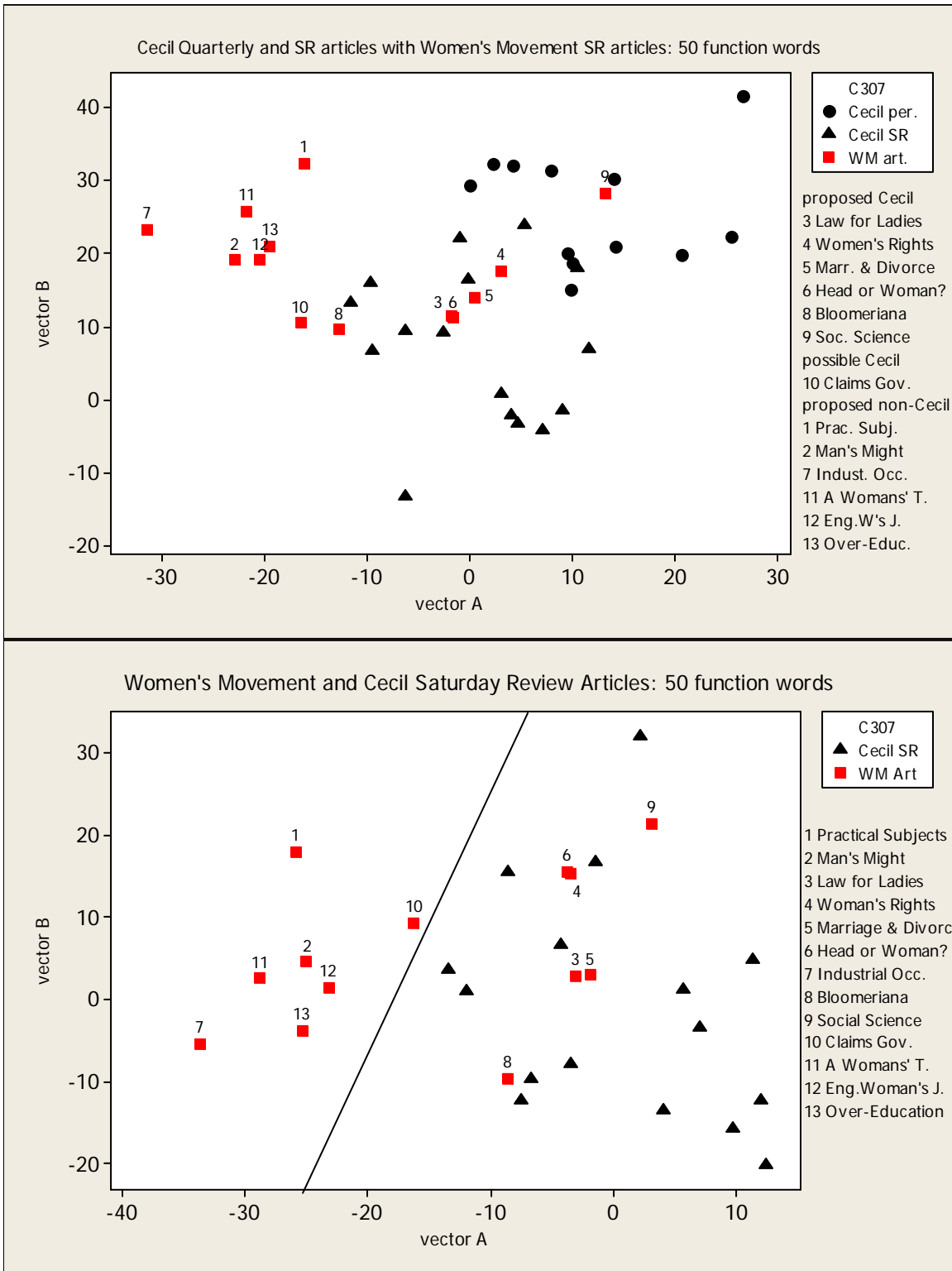


Testing Cecil



In these sorts of tests (cluster analyses) the greatest similarity is seen between those texts which unite earliest, whilst the greatest difference is seen between the last joining of the major branches. A close examination of the seven plots reveals three patterns: the first pattern shows a complete separation of the woman's movement articles from the periodical writer's articles with these two sets forming the two major branches of the plot. This pattern is seen with Froude, Hayward, Kingsley and Lewes, suggesting that their work is very unlike the woman's movement articles. The second pattern, seen with Bagehot and Greg, shows two major branches with one of the branches subdividing early. In this case, the woman's movement articles have separated into two groups, one of which shows more similarity with the periodical writer's texts than with the other group of women's movement texts. This suggests that the work of Bagehot and Greg shows some affinity with the women's movement texts; nevertheless, the separation is still clearly marked. The final pattern is seen in the last plot – that of Lord Robert Cecil. In this plot, four of the woman's movement articles were attracted to Cecil's branch of the plot; in other tests (with differing length wordlists) two other articles (“Head or Woman?” and “Blommeriana” were attracted to Cecil's branch. This suggested the possibility that Cecil had written at least four and as many as six of the woman's movement articles. Further tests were carried out to investigate the hypothesis.

4. Cecil Tests



These two plots are examples of the many different tests which were carried out to determine which of the thirteen women's movement articles we could "attribute" to Cecil, using the internal evidence of our tests. Only one of the articles ("Bloomeriana") can be attributed to him by means of external evidence. In the first of the two plots a

principal component analysis test was carried out on the women's movement articles and examples of Cecil's firmly attributed *Quarterly* article texts sections and his *Saturday Review* articles. In this test six of the women's movement articles are located in Cecil territory, though "Bloomeriana" (the one known to be written by Cecil) is located on the edge of the Cecil group. In the second plot the women's movement articles were compared to Cecil's *Saturday Review* contributions without the intervention of his other writings. Here, his authorship of the six articles in question appears even more likely, while the results offer further support for the hypothesis that the Women's Movement articles divide into at least two distinct authorship groups.