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Language and gender in Congressional speech

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Abstract

This study draws from a large corpus of Congressional speeches from the 101st to the 110th Congress (1989–2008), to examine gender differences in language use in a setting of political debates. Female legislators' speeches demonstrated characteristics of both a feminine language style (e.g. more use of emotion words, fewer articles) and a masculine one (e.g. more nouns and long words, fewer personal pronouns). A trend analysis found that these gender differences have consistently existed in the Congressional speeches over the past 20 years, regardless of the topic of debate. The findings lend support to the argument that gender differences in language use persist in professional settings like the floor of Congress.

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1 Introduction

Gender differences in language use have been studied for many years; however, general consensus has not been fully reached to date on the generalizability of the observed differences, i.e. to what extent do the differences depend on the communicative context (Krauss and Chiu, 1998; Newman *et al.*, 2008). On the one hand, many studies have found differential patterns in various contexts, such as emails, letters, phone conversations, creative writing, and online discussion (e.g. Lakoff, 1975; Herring, 1992; Holmes, 1993; Biber *et al.*, 1998; Coates and Johnson, 2001; Koppel *et al.*, 2003). Some patterns have been observed across multiple contexts. From the corpus linguistics perspective, men have been found to use more articles, nouns, long words, swear words, and numbers, while women have been found to use more personal pronouns, verbs, and emotion words (Koppel *et al.*, 2003; Newman *et al.*, 2008). These differences are commonly interpreted to mean that men tend to use language for the instrumental purpose of conveying information, whereas women are more likely to make social connections through language communication (Tannen, 1990; Newman *et al.*, 2008), or, as simply put by Pennebaker (2011), women talk more about people and men more about objects and things.

On the other hand, a number of studies have found evidence to support the claim that these gender differences may just be an artifact of the context of language use (e.g. Giles and Coupland, 1991; Krauss and Chiu, 1998; Janssen and Murachver, 2004; Herring and Paolillo, 2006). Here, the word 'context' is loosely defined as a combination of genre (e.g. conversation, letter, and novel), topic (e.g. politics, sports, family, and education), and communication mode (e.g. private versus public, face-to-face versus mediated). For example, diary writing has been described as a female genre and scientific writing as a male genre (Tillery, 2005; Herring and Paolillo, 2006). Rubin and Greene (1992) instructed students to write about the same controversial issue in one of two modes: addressed to a close friend versus to a vice president. Regardless of writer gender, letters to

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close friends displayed more feminine style, while letters to vice presidents displayed more masculine style. Pennebaker (2011) generalized this phenomenon with the idea that most people write or speak like prototypical men in formal settings and like prototypical women in informal settings.

In addition to the above gender–context correlation, human language adaptation behavior complicates the understanding of gender differences in language use. The communication accommodation theory literature suggests that people may subconsciously adapt their language styles to converge with their communicative partners' styles to gain social approval (Giles and Coupland, 1991). Gender accommodation behaviors have been observed in online forums and listservs where one gender predominates (Waseleski, 2006; Yu, 2011). For example, emotional expression has been seen as a signature characteristic of feminine language. Female participants used a high proportion of emotion words in their posts and replies to a female-predominant breast cancer forum, while female posts and replies in a predominantly male prostate cancer forum used significantly fewer emotion words (Yu, 2011). Furthermore, people can intentionally change their language styles for gender deception in text-based, computer-mediated communications such as emails, chats, forums, and newsgroups, where visible cues are masked and text is the sole source of identity recognition (Herring and Martinson, 2004). These conscious and subconscious language adaptation phenomena also support the notion of gendered language as social performance rather than merely biological fact (Birdwhistell, 1970; Janssen and Murachver, 2004).

Women in the workforce, especially those in traditionally male-dominated professions, such as politicians, physicians, managers, academics, and lawyers, have been expected to conform to the male norms of professional behavior (Bogoch, 1997). In general, differential patterns in language use, if found to exist across professional contexts, lend strong support to the idea of gendered language. However, the results of empirical studies have been mixed, with some studies finding reduced levels of gender differences, others finding counter-stereotypical patterns, and still others finding strong features of feminine style in women's professional communication. For example, both genders behaved similarly in some conversations among managers, lawyers, and doctors (Lorber, 1984; Morello, 1986; Hearn and Parkin, 1988; Bogoch, 1997). However, in other samples, female managers demonstrated counter-stereotypical patterns by using more references to numbers and fewer references to emotion when giving criticism, which is usually characteristic of masculine language (Mulac *et al.*, 2000). While these studies suggest that gender differences in language use, if they exist at all, are more blurred under the influence of professional contexts, other studies found that retaining certain characteristics of feminine style resulted in better outcomes in professional communication. West (1990) found that the indirect request, a typical indicator of feminine language, helped female doctors achieve higher patient compliance.

Understanding gender differences in professional settings is particularly useful for creating a harmonious work environment (Herring *et al.*, 2006). However, the aforementioned studies were not able to reach consensus on whether gender differences exist in professional settings. An important reason for the disagreement is that existing studies have used very small data sets, usually involving fewer than fifty participants and short samples of speech and writing. Small data sets are vulnerable to sample and contextual bias and thus undermine the robustness of conclusions. Newman *et al.* (2008) pointed out that gender differences often produce only a small effect and thus require a large amount of textual data to allow the effect to accumulate before it can be effectively measured. They analyzed the largest data set to date, pooling over 14,000 texts from seventy separate studies. Their study focused on discovering cross-context gender differences, but did not study language use in specific professional settings. Furthermore, some studies have used short text samples by each author, which may not contain sufficient data to allow for precise measurement. Language adaptation behaviors may further impair measurements of short text samples. Studies on lies and identity deception have shown that although short-term deception can be effective, long-term deception is difficult to achieve (Herring and

Martinson, 2004). Therefore, longer text samples would provide more reliable data for studying gender differences.

This study used a large data set consisting of 20 years of Congressional speeches (1989–2008), to examine gender differences in a professional setting. Congressional speeches make up an ideal data set for this context, in that political speech has been an important subject for studies on gender and professional discourse. Political language has long been considered to be masculine, and female politicians have been expected to conform to this normative masculine style (Campbell, 1989; Janssen and Murachver, 2004; Edwards, 2009).

This data set not only provides a large amount of data to measure gender differences but also provides an opportunity to examine trends in gender differences over the past 20 years. The existence of gender differences would be supported by additional evidence if consistent patterns were to be found in all Congresses from the 101st to the 110th. No previous study has conducted a longitudinal analysis on this scale, due to the difficulties in gathering adequate data.

Like the aforementioned language and gender studies, this study uses biological sex as the defining criterion for gender identification and then compares male–female differences at the group level. Specifically, a legislator's gender ('male' or 'female') is labeled based on their salutations (e.g. 'Mr', 'Mrs', 'Ms', and 'Miss') in the transcripts of the Congressional Record. It should be noted that because of the tangled relationships among sex, language use context, and human adaptation behavior, the 'binary sex' conceptualization and the corresponding quantitative measurements have been criticized as oversimplified and not conducive to accommodating variations within each sex group (Zimmerman, 1998; Wodak, 2003; Hultgren, 2008). However, as Hultgren (2008) has argued, language and gender research would be difficult, if not impossible, if sex is not taken as the starting point for analysis. The large corpus in this study also provides enough data to estimate both between-group differences and within-group variations.

This study seeks robust answers to the following research questions: (1) Do male and female legislators speak differently? (2) If they do speak differently, are the differential patterns consistent with those reported in previous studies? and (3) If different patterns are detected, are they consistent in Congressional speeches over the past 20 years?

2 Method

2.1 Linguistic features

Gendered language has been studied using rhetorical, sociolinguistic, psycholinguistic, and computational linguistic approaches. This study aims to measure gender differences in a very large text corpus; consequently, as a tradeoff, the types of linguistic features to be analyzed have to be limited to those suitable for processing by computers. Some features, such as 'intrusion' (Bogoch, 1997), require human coding and often lead to imperfect inter-coder agreement (Janssen and Murachver, 2004), while others, especially word- and phrase-level features, are more suitable for computer processing. Therefore, this study automatically measures gender differences in terms of 'computable' dimensions.

Two types of computable language style features have been explored in previous studies. First, psychologists, sociolinguists, and psycholinguists manually compiled words into categories that represent various aspects of social and psychological status, such as thought, emotion, and motivation. Automatic content analysis tools can then search for these words and count their occurrences. A few examples of commonly used tools are the 'Dictionary of Affect Language' (Whissell, 1989), 'The General Inquirer' (Stone *et al.*, 1962), and the 'Linguistic Inquiry and Word Count' (LIWC) (Pennebaker *et al.*, 2001). Newman *et al.* (2008) used the LIWC to measure gender differences in seventy-four language dimensions, with a focus on function words, and found that women use more pronouns and intensive adverbs, while men use more numbers, articles, long words, and swear words. Function words are small in number but account for more than half of the words in text. Medical and psychological science research also found that function words and content words are processed in different areas in the human brain, and patterns in function word use may disclose rich

information about a person's social and psychological status (Pennebaker, 2011).

Second, computer scientists and literary scholars use a set of stylistic features, such as vocabulary richness (type-token ratio), sentence length, function word use, and parts-of-speech distribution for authorship attribution, stylistic analysis, and genre analysis. For example, Biber *et al.* (1998) used factor analysis to study text registers and found that female authors use a more 'involved' style, characterized by more pronouns and present-tense verbs, while male authors tend to use a more 'un-involved' or 'informational' style, characterized by more nouns and long words. Using a machine learning approach, Koppel *et al.* (2003) found that in fiction writing, male authors used the words 'a', 'the', and 'as' more often, while female authors used 'she', 'for', 'with', and 'not' more; in non-fiction texts, male authors used 'that' and 'one' more, while female authors used for, with, not, and 'in' more. For part-of-speech features, they found that a higher percentage of determiners, numbers, and modifiers characterized the male style, and that a higher percentage of negation, pronouns, and certain prepositions characterized the female style.

This study draws on common gender indicators that have been observed in previous studies and examines them in Congressional speeches. These features are (1) function words, (2) parts of speech, and (3) social and psychological categories. To facilitate head-to-head comparisons with previous studies, especially Newman *et al.*'s 2008 study that used the LIWC to compute feature categories (1) and (3) (Table 1), (hereafter, NGHP), this study used the LIWC to compute feature categories (1) and (3), and OpenNLP, a widely used computational linguistics toolkit, to automatically tag parts of speech for feature category (2). Table 1 summarizes the language style features that were measured in this study.

Table 1 Language style features

Features	Meaning or example words
LIWC categories	
Pronouns	I, you, they, our
Articles	The, a, an
Social processes	Talk, share, mother, colleague
Long words	Six letters or longer
Swear words	Bastard, damn, dumb, hell
Emotion	Brave, peril, disaster, terrible
Parts of speech	
Nouns	Including singular and plural forms
Verbs	Including base forms and all tenses
Adjectives	Including base, comparative and superlative form
Adverbs	Including base, comparative and superlative form

2.2 Statistical measures and experimental procedure

This study conducted two rounds of analysis. In the first round, all of the speeches in the sample by each speaker were concatenated as one text document, forming the unit of analysis. Each speaker's language style was characterized by calculating the percentage of words that represent each language style feature. The average word percentage in each gender group was used to indicate the gender strength in that category. For example, each speaker's emotional level was measured by the percentage of emotion words used in his or her speeches. Then, each gender group's emotion level was averaged over those of all members. The effect size of the mean difference between female and male legislators was measured using Cohen's d, which is calculated by dividing the mean difference by the pooled standard deviation (Cohen, 1988). A positive effect size means higher average use by women, and a negative effect size means higher average use by men. Cohen (1988) suggested using $|d| = 0.2$ as the threshold for a small effect, 0.5 for a medium effect, and 0.8 for a large effect. In the second round, gender differences were measured per meeting of Congress, followed by trend analysis from the 101st to the 110th Congress.

2.3 Data set

All House floor debates from the 101st to the 110th Congress (1989–2008) were chosen as the data set. The speeches were automatically downloaded from the website Thomas.gov. 'Extensions of Remarks' and 'Daily Digests' have been excluded. Senatorial speeches were not included in this study because there were too few female senators. The downloaded

Table 2 Number of female and male House representatives

House	FD	FR	MD	MR	F	M	Total
101	15	13	241	162	28	403	431
102	19	9	246	157	28	403	431
103	33	11	219	166	43	385	429
104	32	18	168	211	43	379	429
105	36	17	171	213	52	384	437
106	39	17	171	205	55	376	432
107	42	17	170	209	59	379	438
108	38	20	168	206	57	374	432
109	43	23	158	208	61	366	432
110	50	21	184	177	71	361	432
Total					163	1,220	1,383

Notes: 'F' means 'female', 'M' means 'male', 'D' means 'Democrat', and 'R' means 'Republican'. Only House members from the 50 states were counted. Representatives from other regions were excluded. Representatives whose speeches were not found in the Thomas database were also excluded. House members who served more than one term were counted only once in the total count.

HTML files were converted to pure speech text by removing the HTML tags and other non-speech content. Details of this data-cleaning procedure can be found in Yu *et al.* (2008b). The 'Congressional Record' grouped the speeches by topic of debate, with titles and date stamps. Each debate contained a number of individual speeches. A speech was defined as a speaker's consecutive sequence of utterance before he or she was interrupted by another speaker. Therefore, individual speeches were separated by the salutations which marked the beginning of the next speeches. Short speeches with fewer than fifty words were removed. Debates with a small number of speeches are usually not real debates, but discussions within a small group of legislators. To focus on significant debates that involved more legislators, small debates with fewer than thirty speeches were also removed from the data set, resulting in 200 debates or so per Congress. Every speaker's speeches in all of the Congresses were then concatenated into one document. The gender of each speaker was recognized by the salutation Mr for men and 'Miss/Mrs/Ms' for women.

Table 2 shows the basic statistics for the House Speech data. It also demonstrates that the number of Congresswomen continues to increase, accounting for one-sixth of the 110th House members. The increase was largest in the 103rd House (1993–94).

Table 3 Corpus size (in millions of words)

	FD	FR	MD	MR	F	M	Total
101	0.40	0.40	5.60	4.85	0.80	10.45	11.25
102	0.78	0.43	7.65	6.81	1.20	14.45	15.66
103	0.83	0.32	5.37	6.63	1.15	11.99	13.14
104	1.73	0.52	6.55	8.23	2.25	14.78	17.03
105	1.28	0.41	5.27	7.25	1.69	12.53	14.22
106	1.98	0.57	6.62	8.60	2.55	15.23	17.78
107	1.86	0.39	5.35	6.17	2.24	11.52	13.76
108	2.04	0.38	6.59	6.49	2.42	13.07	15.49
109	2.29	0.63	6.26	6.66	2.92	12.92	15.84
110	2.53	0.72	6.98	7.69	3.25	14.67	17.92
Total	15.72	4.76	62.23	69.39	20.48	131.62	152.10

After data cleaning, the entire speech data set contained 152 millions words, including 21 million words from female legislators and 132 million words from male ones (see Table 3 for the corpus size for each subgroup in each Congress).

3 Results

3.1 Gender differences in selected LIWC categories

Table 4 summarizes the overall gender differences in the selected LIWC categories (denoted as 'HS') and compares them with the findings of the NGHP study. Some results in these two studies are consistent, but not all.

3.1.1 *Stereotypical gender differences in House Speech*

This study found NGHP-consistent gender differences in the categories of articles, social processes, and swear words, and in all emotion categories. The biggest gender difference was found in article use, an indicator of masculine language. On average, articles accounted for 7.86% of Congresswomen's words and 8.36% of Congressmen's words (medium effect $d = -0.62$). The percentage for both genders in the House was higher than the gender percentages observed in NGHP (6.0% by females; 6.7% by males), indicating the impact of

Table 4 Gender differences in selected LIWC categories

LIWC dimension	Corpus	Female		Male		Effect size (d)	Result
		Mean	SD	Mean	SD		
Pronoun	NGHP	14.24	4.06	12.69	4.63	0.36	Disagree
	HS	7.55	0.01	7.69	0.01	−0.1	
Article	NGHP	6.00	2.73	6.70	2.94	−0.24	Agree
	HS	7.86	0.01	8.35	0.01	**−0.62**	
Long words	NGHP	13.99	4.42	15.25	5.91	−0.24	Disagree
	HS	32.38	0.03	30.67	0.03	**0.56**	
Social processes	NGHP	9.54	4.92	8.51	4.72	0.21	Agree
	HS	7.26	0.01	6.98	0.02	0.19	
Swear words	NGHP	0.09	0.25	0.17	0.44	−0.22	Agree
	HS	0.002	0.0001	0.003	0.0001	−0.15	
Emotion	NGHP	4.57	1.99	4.35	2.07	0.11	Agree
	HS	3.78	0.55	3.41	0.62	**0.61**	
Positive	NGHP	2.49	1.34	2.41	1.40	Ns	Agree
	HS	2.60	0.40	2.34	0.49	**0.54**	
Positive Feeling	NGHP	0.61	0.61	0.51	0.65	0.15	Agree
	HS	0.42	0.13	0.36	0.16	**0.35**	
Optimism	NGHP	0.56	0.58	0.58	0.61	Ns	Agree
	HS	0.86	0.19	0.77	0.23	**0.41**	
Negative	NGHP	2.05	1.65	1.89	1.56	0.10	Agree
	HS	1.15	0.31	1.03	0.30	**0.39**	

HS values greater than 0.2 are indicated in bold.

Congressional speech, a very formal form of discourse, on article use. At the same time, male legislators still used more articles on average, indicating a persistent gender difference.

The second largest difference was found in the use of emotion words, a common feminine language feature. In floor debates, legislators tend to avoid emotionally charged words. Yu *et al.* (2008a) found that Senatorial Speech contains a much lower percentage of emotion words than customer reviews, and a slightly higher percentage than news articles. In this study, House Speech also exhibits a low level of overall emotion (3.78% emotion words used by females, 3.41% by males, medium effect $d = 0.61$) lower than the sample in the NGHP (4.57 for females, 4.35 for males, less than small effect $d = 0.11$), except for a higher level of optimism (the use of words such as 'win' and 'pride'), a characteristic of political language. However, although the overall emotional level was low, female legislators used more emotion words in all five emotion subcategories (positive feeling, optimism, anxiety, anger, and sadness).

Compared with NGHP, social words and swear words were also less used in House Speech. Both male and female legislators used fewer social words, but on average, female legislators still used more than their male colleagues (near small effect $d = -0.19$). The number of swear words was extremely low in the speeches. In NGHP, the average frequency was 900 per million words for women and 1,700 per million for men. In House Speech, the average frequency was 20 per million for females and 30 per million for males. Although legislators generally used sanitized language, men still swore with greater frequency in House Speech (less than small effect, $d = 0.15$).

3.1.2 *Counter-stereotypical gender differences in House Speech*

This study also found NGHP-inconsistent gender differences in two categories: personal pronouns

and long words (six letters or longer). A high percentage of long words is another masculine style feature. In comparison to NGHP (13.99% by females; 15.25% by males; small effect size, $d = -0.24$), long word use was more than twice as much in House Speech: 32.38% by females and 30.67% by males, indicating a formal language style. In this case, women used more long words in Congress (medium effect, $d = 0.56$).

The finding that Congresswomen used even fewer pronouns is striking, in that a higher percentage of pronouns was seen as a strong female language indicator in many previous studies (e.g. Biber *et al.*, 1998; Koppel *et al.*, 2003). It is the most significant gender difference in NGHP ($d = 0.36$). In comparison, legislators used half as many pronouns, indicating a formal language style, and the gender difference in pronoun use was fairly small ($d = 0.1$). The impact of the context may explain the low pronoun use, in that House speeches are usually well prepared in the form of written texts, and reduced pronoun use is a common indicator that distinguishes writing from speech (Biber, 1988). Nevertheless, does this mean that gender difference is diminished regarding pronoun use? Because of pronouns' unique importance to genre (Biber, 1988), personality, and social psychology studies (Pennebaker, 2011), this study divided the pronouns into smaller subcategories for further analysis, as will be explained in the next section.

3.2 Gender differences in pronoun use

In the LIWC, the pronouns were categorized into first-, second-, and third-person subcategories. NGHP found that women use more first-person singular and third-person pronouns, and men use more second-person pronouns. No significant difference was found in first-person plural use. This study found the same patterns in second- and third-person pronoun use (small effects $d = 0.30$ and $d = -0.23$, respectively, as seen in Table 5). However, a gender difference in first-person pronoun use is not obvious in House Speech: females used a slightly lower percentage of first-person pronouns, both singular ($d = -0.08$) and plural ($d = -0.03$).

Because personal pronouns can also be categorized by case, a new question arises: would female and male legislators differ in the cases of the pronouns they use? Previous studies have not examined this aspect of gender difference. This study further broke down first-person pronouns into to subjective ('I' and 'we'), objective ('me' and 'us'), and possessive cases ('my' and 'our'). Surprising patterns soon emerged: female legislators used more possessive case pronouns (medium effect size, $d = 0.64$, for our and small effect, $d = 0.36$, for my), and males used more subjective case pronouns (small effect size, $d = -0.39$, for we and -0.21 for I). No difference was found in objective case use (Table 5).

To understand why male and female legislators differ in pronoun case use, all bigram phrases (a bigram is a combination of two consecutive words), starting with first-person pronouns in the House Speech of the 110th Congress, were examined in terms of their gender-distinguishing strength, which was measured by the P-value in the χ^2 test (cutoff at $P = 0.05$; Table 6). The χ^2

Table 5 Gender differences in pronoun use

LIWC dimension	Corpus	Female		Male		Effect size (d)	Result
		Mean	SD	Mean	SD		
First-person singular	NGHP	7.15	4.66	6.37	4.66	0.17	Disagree
	HS	2.13	0.42	2.17	0.57	−0.08	
First-person plural	NGHP	1.17	2.15	1.07	2.12	Ns	Ns
	HS	2.20	0.58	2.22	0.65	−0.03	
Second person	NGHP	0.59	1.05	0.65	1.15	−0.06	Agree
	HS	0.24	0.21	29.5	0.24	**−0.23**	
Third person	NGHP	3.41	3.45	2.74	3.01	0.20	Agree
	HS	1.43	0.41	1.30	0.43	**0.30**	

HS values greater than 0.2 are indicated in bold.

Table 6 Gender differences in pronoun case use

Pronoun cases		Female		Male		Effect size (*d*)
		Mean	SD	Mean	SD	
Subjective	We	1.18	0.40	1.37	0.51	−0.39
	I	1.48	0.32	1.57	0.43	−0.21
Possessive	Our	0.76	0.30	0.58	0.28	0.64
	My	0.46	0.15	0.40	0.17	0.36
Objective	Us	0.22	0.10	0.22	0.10	0.00
	Me	0.15	0.07	0.15	0.08	−0.09

test in the software package R was used to test whether the use of a certain bigram was independent of a speaker' gender. For example, the 110th Congress sample included speeches from 432 speakers: 71 women and 361 men. Of these, eighteen women and twenty-four men used the bigram 'my community'. The χ^2 value was computed based on two observed frequencies, eighteen and twenty-four (forty-two in total), and two expected frequencies, 6.9 and 35.1, distributed based on gender ratio (6.9 = 42*(71/432), 35.1 = 42*(361/432)). The calculated χ^2 value was 21.367, and the P-value < 0.001. Therefore, my community was more likely to be used by females than by males.

Table 7 lists all the we and our bigrams that indicate significant gender differences ($P < 0.05$). Each column contains the bigrams that are more likely to be used by one gender: the left column for females and the right for males. The female column includes thirty-eight we and our bigrams, among which only four are we bigrams: 'we protect', 'we honor', 'we share', and 'we choose'. In the thirty-four our bigrams, the words that directly follow our are nouns that represent topics regarding family, education, and social welfare.

The male column includes thirteen we and our bigrams, among which only two are our bigrams: 'our enemy' and 'our side'. Thirty-seven Congressmen used our enemy, thirty-four Republicans, and three Democrats, but no Congresswomen used this bigram (note that an instance might occur in the small debates that were excluded from this data set). We is usually followed by a verb, and the verbs in question are found more in the past tense ('gave', 'said', 'tried', 'took',

Table 7 Gender differences in we and our bigrams

Bigram	#F	#M (D+R)	*P*-value
Feminine			
Our community	22	45 (26 + 19)	0.000
Our communities	41	123 (80 + 43)	0.003
Our returning	13	25 (17 + 8)	0.003
Our dear	7	9 (7 + 2)	0.003
Our vital	7	9 (6 + 3)	0.003
Our elderly	6	7 (5 + 2)	0.004
Our workforce	11	20 (17 + 3)	0.004
Our overall	11	20 (9 + 11)	0.004
Our new	19	45 (23 + 22)	0.004
Our students	21	52 (39 + 13)	0.004
Our highways	7	10 (7 + 3)	0.006
Our diplomatic	7	10 (8 + 2)	0.006
Our coastal	8	14 (7 + 7)	0.012
We protect	12	26 (17 + 9)	0.012
Our caucus	9	17 (15 + 2)	0.012
Our entire	14	33 (16 + 17)	0.014
Our action	6	9 (5 + 4)	0.014
Our reputation	6	9 (5 + 4)	0.014
Our families	25	73 (45 + 28)	0.015
Our brave	32	101 (58 + 43)	0.018
Our gratitude	5	7 (6 + 1)	0.018
Our veterans	35	114 (76 + 38)	0.020
Our family	11	25 (12 + 13)	0.022
Our children	51	181 (112 + 69)	0.023
Our public	19	53 (34 + 19)	0.023
Our seniors	27	84 (49 + 35)	0.025
Our strong	8	16 (5 + 11)	0.025
We honor	12	29 (20 + 9)	0.027
Our moral	12	29 (20 + 9)	0.027
Our democracy	14	37 (23 + 14)	0.033
Our struggling	6	11 (8 + 3)	0.036
Our celebrate	6	11 (8 + 3)	0.036
Our state's	6	11 (6 + 5)	0.036
Our breaches	7	14 (6 + 8)	0.037
Our promise	11	27 (20 + 7)	0.037
We share	12	31 (15 + 16)	0.042
We choose	9	21 (10 + 11)	0.045
Our continued	11	28 (18 + 10)	0.047
Masculine			
We ought	10	126 (58 + 68)	0.0043
We gave	1	51 (21 + 30)	0.0047
Our enemy	0	37 (3 + 34)	0.0070
Our side	8	103 (45 + 58)	0.0087
We actually	4	62 (27 + 35)	0.023
We seem	0	23 (9 + 14)	0.033
We said	7	80 (35 + 45)	0.035
We tried	5	65 (34 + 31)	0.036
We took	10	99 (47 + 52)	0.041
We lose	2	40 (20 + 20)	0.041
We found	7	77 (40 + 37)	0.045
We dealt	0	20 (7 + 13)	0.047
We proceed	0	19 (11 + 8)	0.053

'found', and 'dealt') than the present ('seem', 'lose', and 'proceed'), indicating a tendency to reflect on past activities.

The usage of the word gave is an interesting example of how male legislators used the 'we + verb' format to reflect on past activities. Females seldom used gave after either we (one female versus fifty-one male) or I (zero female versus twenty-three male). A further examination of the relevant sentences reveals that the bigram 'we gave' was often used for blaming. For example: 'And yet we gave the insurance industry these incredible ''responsibilities,'' and I can tell you, ''they misused it,'' ' said by Taylor (MS-D). Very few examples can be found in female speeches. One example is 'We gave them another 15 days and they said, well, we really haven't had the time to look at this paper', said by Wilson (NM-R).

Gender differences in pronoun case use also appear in the use of the singular forms; however, the effects are not as large compared with the plural forms. Table 8 lists all I and my bigrams that indicate significant gender difference ($P < 0.05$). The female column includes twelve I and my bigrams, among which only four are I bigrams: 'I chair', 'I reiterate', 'I often', and 'I refuse'. Nearly all words that directly follow my are nouns ('husband', 'community', 'vote', 'constituents', 'thoughts', 'pleasure', 'support', and 'work'). The male column includes fourteen I and my bigrams, among which only five are my bigrams: 'my wife', 'my friends', 'my point', 'my word', and 'my friend'. Nearly all the words that follow I are also verbs, in both the present tense ('suspect', 'say', 'agree', 'get', and 'challenge') and past tense ('brought', gave, 'submitted', and 'wasn't').

Table 8 Gender differences in I and my bigrams

Bigram	#F	#M (D + R)	*P*
Feminine			
My husband	11	8 (4 + 4)	0.000
My community	18	22 (14 + 8)	0.000
I chair	9	13 (13 + 0)	0.002
My vote	19	46 (25 + 21)	0.005
My constituents'	7	10 (3 + 7)	0.006
My thoughts	9	19 (12 + 7)	0.025
My pleasure	8	16 (11 + 5)	0.025
I reiterate	5	8 (4 + 4)	0.032
I often	9	20 (11 + 9)	0.034
My support	26	85 (49 + 36)	0.047
My work	8	18 (9 + 9)	0.049
I refuse	5	9 (4 + 5)	0.052
Masculine			
My wife	1	62 (26 + 36)	0.002
I suspect	1	45 (19 + 26)	0.009
I wasn't	2	48 (23 + 25)	0.018
My friends	16	150 (78 + 72)	0.018
My point	3	54 (23 + 31)	0.023
I brought	0	25 (6 + 19)	0.027
I say	21	175 (85 + 90)	0.030
I agree	21	174 (87 + 87)	0.031
I gave	0	23 (11 + 12)	0.033
My word	1	32 (12 + 20)	0.038
I submitted	0	21 (7 + 14)	0.042
I get	6	70 (34 + 36)	0.045
I challenge	0	20 (6 + 14)	0.047
My friend	29	216 (110 + 106)	0.052

3.3 Gender differences in part-of-speech use

Male and female legislators also differ in their use of parts of speech (Table 9). Females used more nouns (small-to-medium effect, $d = 0.36$) and adjectives (near medium effect, $d = 0.49$), whereas males used more verbs (less than small effect, $d = -0.14$) and adverbs (small effect, $d = -0.22$). This result contradicts the finding of Biber *et al.* (1998) that males tend to use more nouns. A further examination reveals that the gender differences in noun use mainly involved regular nouns, especially plural nouns (large effect $d = 1.0$). No significant difference was found in proper noun use, either singular or plural.

Table 9 Gender differences in the use of parts of speech

Parts of speech	Female		Male		Effect size (*d*)
	Mean	SD	Mean	SD	
Noun	29.20	2.33	28.31	2.49	**0.36**
singular	14.42	1.099	14.31	1.01	0.11
Plural	6.27	0.69	5.54	0.73	**1**
Verb	16.33	1.28	16.51	1.33	−0.14
Adjective	6.97	0.72	6.60	0.78	**0.49**
Adverb	4.33	0.64	4.48	0.66	**−0.22**

Values greater than 0.2 are indicated in bold.

3.4 Trends of gender differences in Congress

The trend analysis results are presented in Figs 1–6. For each language style category, the graph in the upper panel plots the average percentages of words used by females (shown by a gray curve) and males (shown by a black curve) in each Congress. The graph in the lower panel plots the effect size of the mean difference between females and males. The curve is solid if the average effect size was larger than 0.20 (at least small effect). The color of the curve is solid gray if the category was used more often by females, and solid black if it was used more often by males. The curve is a dotted line if the average effect size is smaller than 0.20.

Two patterns emerged from the trend analysis. First, the percentages of words in each category were seen to change over time. Second, such changes followed similar trends for both genders in the categories, with an at least small effect in gender difference (see the solid black and solid gray effect-size curves).

The first pattern may be caused by the impact of the context. All House speeches belong to the same genre and communication mode, but new topics were introduced in each Congress, and thus changes in word use may be explained as a consequence of topic change. For example, Fig. 2 shows that both genders used the highest number of emotion words in the 107th Congress (2001–02). This surge was mainly caused by discussions of the terrorist attack on 11 September 2001. Patterns of change in word use may even be affected by a broader, society-wide context. For example, Fig. 1 shows that both genders used fewer and fewer articles over the past 20 years. Decreasing article use may suggest a gradual change from formal to informal styles. Interestingly,

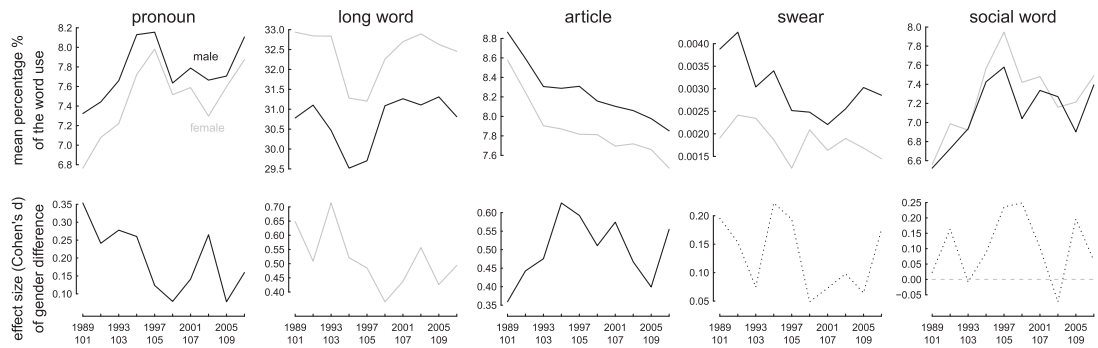

Fig. 1 Trends of gender differences in selected LIWC categories

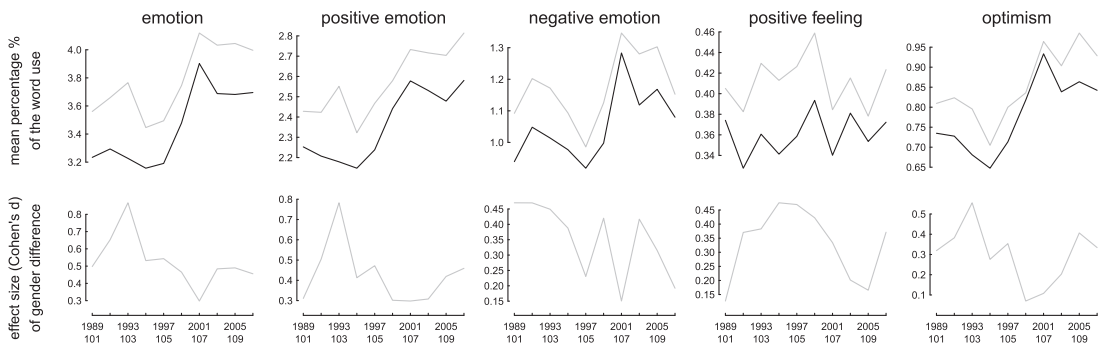

Fig. 2 Trends of gender differences in emotion word use

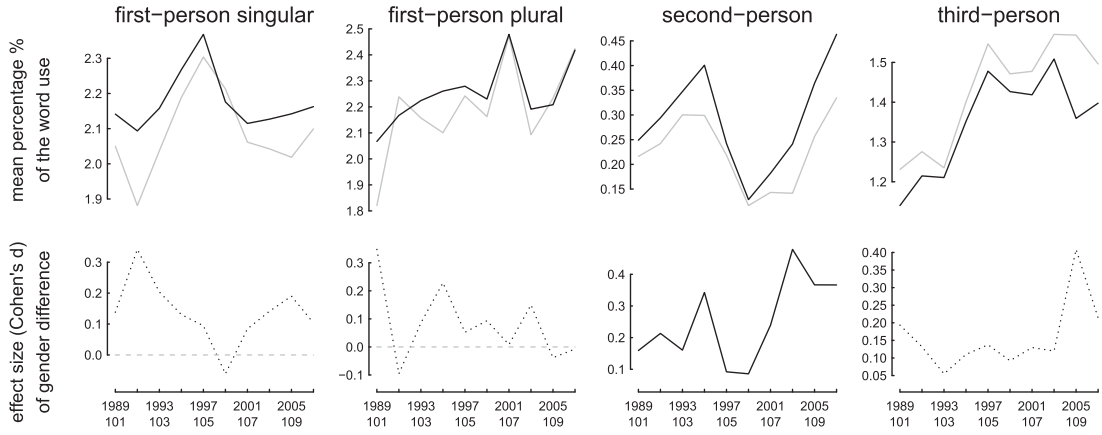

Fig. 3 Trends of gender differences in pronoun use

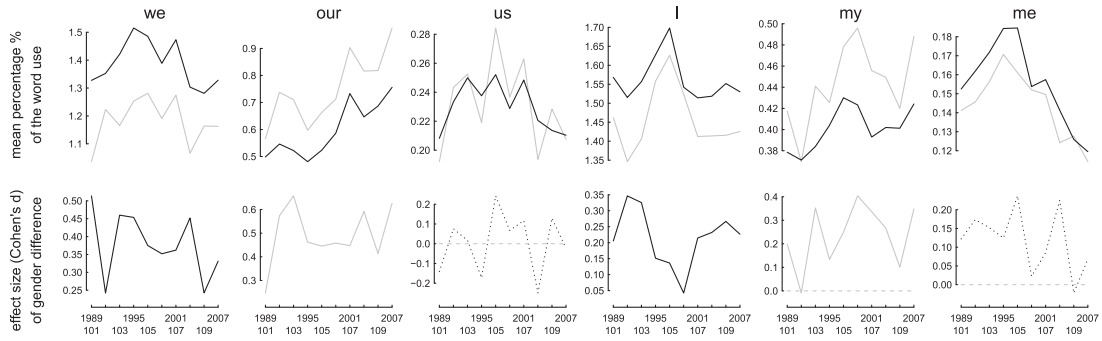

Fig. 4 Trends of gender differences in the use of pronoun cases

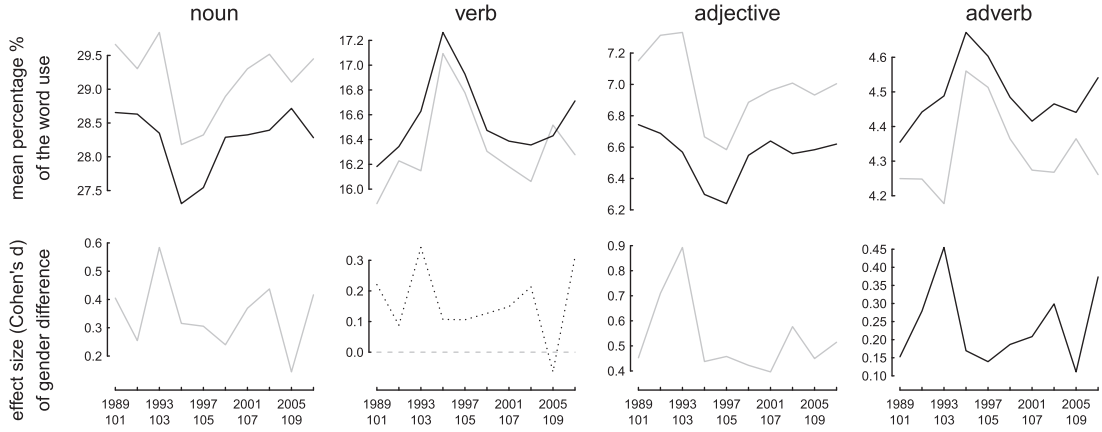

Fig. 5 Trends of gender differences in the use of parts of speech

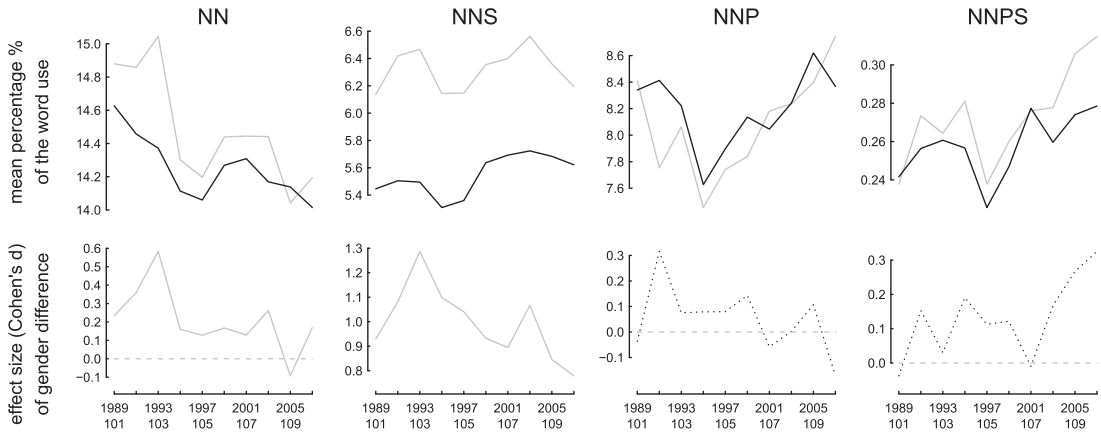

Fig. 6 Trends of gender differences in noun use

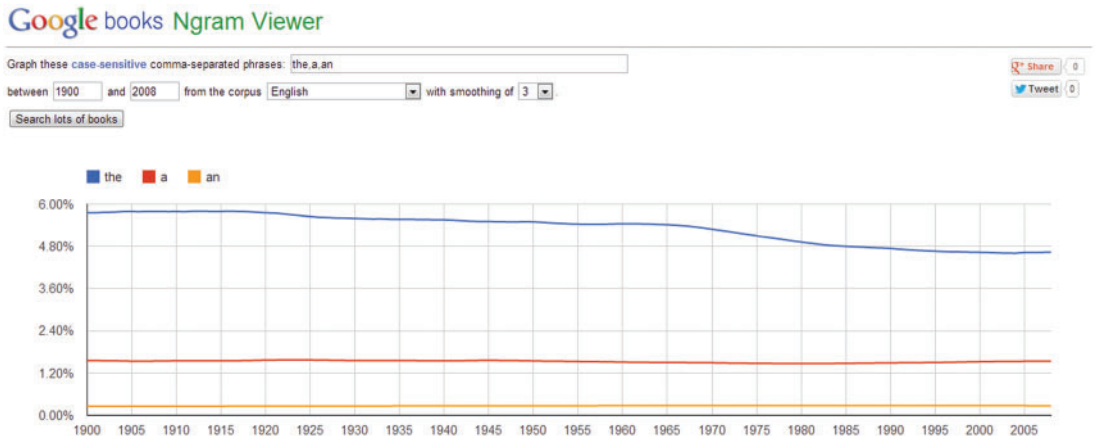

Fig. 7 Trend of article use in Google Books Ngram database ('the' corresponds to the curve on top, 'a' to the middle, and 'an' to the bottom)

this change may not be unique to Congressional speech. Similar patterns have been found in the Google Books Ngram database. Since 1960, books written in American English have also used 'the' less and less (the first curve in Fig. 7), while the use of a and an (the second and third curves in Fig. 7) have remained stable. Given that Congressional speech is supposedly formal, these results seem to suggest an overall trend of a growing, less formal, writing style in American English in recent years.

Although the first pattern indicates that word use changes over time, the second pattern indicates that gender differences in some categories have persisted in Congressional speech, regardless of time and debate topics: male legislators consistently used more articles, verbs, adverbs, second-person pronouns, and subjective first-person pronouns; female legislators consistently used more emotion words, long words, nouns, adjectives, third-person pronouns, and possessive first-person pronouns.

Some of these persistent differences are consistent with the findings in NGHP and other studies: men use more articles and women use more emotion words. Some contradict the findings of previous studies, such as the observation that men use more personal pronouns and women use more nouns and long words. Finally, some are newly discovered patterns, such as that men use more subjective case

pronouns (I and we), while women use more possessive case pronouns (my and our).

The number of female legislators in the House has more than doubled in the past 20 years, and women's substantive representation affects many aspects of the political process (Dahlerup, 1988; 2005). It may affect language styles in floor debates as well. However, the gender differences observed in this study, having remained consistent over the years, do not seem to be affected by the percentage of female legislators. Nevertheless, this finding does not necessarily mean that the number of female legislators and their language use are irrelevant, because females remain a minority group which accounts for less than 20% of House representatives, and it may take time to reach critical mass.

4 Conclusion and Discussion

This study used a large corpus, Congressional speeches from the 101st to the 110th Congresses (1989–2008), to measure gender differences in language use in a professional setting where female legislators are expected to conform to a male norm of professional behavior. This study found that the House speeches demonstrate a strong formal language style, characterized by a low percentage of pronouns, social words, swear words, and emotion words, and a high percentage of articles and long words. The within-group standard deviations are small for both genders, indicating a strong influence of professional norms on all group members.

Despite the unanimous conformity to a formal style, female legislators used more long words and nouns and fewer pronouns, all commonly observed as masculine language characteristics. On the other hand, female legislators also used fewer articles and more emotion words, which is consistent with stereotypical feminine language characteristics. The trend analysis further discovered that all of the differential patterns that exhibited more than small effect have actually remained consistent over the past 20 years, regardless of the topics of debate and the number of Congresswomen in the House. While conforming to the normative masculine language, female legislators seem to have formed a unique style that combines female characteristics and professional expectations. This study also found a new pattern of gender difference that has not been reported in the literature: female legislators used more possessive first-person pronouns (our and my), while males used more subjective ones (we and I).

The generalizability of the above results is constrained by a few limitations regarding the representativeness of Congressional speech as typical professional discourse. First, one may question whether the speeches authentically represent the speakers' language styles, because their speech writers may have contributed significantly to speech preparation. However, a speaker must personalize the speeches to attain a consistent personal style, a style deemed to fit the speaker's public image. Second, the speeches, although orally presented, are usually well-prepared and formalized in advance. Their language style may resemble both spoken and written forms and may differ from either improvised speech or formal writing. Therefore, the patterns found in political debate may not be applicable to speeches in other professions and communication contexts, such as physicians' conversation with patients. Third, due to the minority position of Congresswomen, further investigation is needed to determine whether the gender differences that have been observed in House Speech correlate to language style differences between a 'powerless' group and a 'powerful' group. A follow-up study is under way to compare language use among legislators of different ethnic backgrounds and to examine whether similar differences can be found between the white majority and other minority groups besides female legislators.

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