To *We* or Not to *We*: Corpus-Based Research on First-Person Pronoun Use in Abstracts and Conclusions

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Abstract

A growing trend exists for authors to employ a more informal writing style that uses "we" in academic writing to acknowledge one's stance and engagement. However, few studies have compared the ways in which the first-person pronoun "we" is used in the abstracts and conclusions of empirical papers. To address this lacuna in the literature, this study conducted a systematic corpus analysis of the use of "we" in the abstracts and conclusions of 400 articles collected from eight leading electrical and electronic (EE) engineering journals. The abstracts and conclusions were extracted to form two subcorpora, and an integrated framework was applied to analyze and seek to explain how we-clusters and we-collocations were employed. Results revealed whether authors' use of first-person pronouns partially depends on a journal policy. The trend of using "we" showed that a yearly increase occurred in the frequency of "we" in EE journal papers, as well as the existence of three "we-use" types in the article conclusions and abstracts: *exclusive*, *inclusive*, and *ambiguous*. Other possible "we-use" alternatives such as "I" and *other personal pronouns* were used very rarely—if at all—in either section. These findings also suggest that the present tense was used more in article abstracts, but the present perfect tense was the most preferred tense in article conclusions. Both research and pedagogical implications are proffered and critically discussed.

Keywords

lexico-grammatical framework, first-person pronouns, EE journal papers

Introduction

It has long been argued that scientific writing seems hesitating for its personal or impersonal authorial stances (e.g., Harwood, 2005b; Hyland, 2002; Hyland & Jiang, 2018; Pho, 2008). For authors wishing to express themselves more "genuinely," the academy's highly impersonal "non-I" writing style can resemble an academic "straight jacket" (Tang & John, 1999). It is also considered uncommon to use first-person pronouns in academic writing (Enago Academy, 2019). A survey of academic writing manuals reveals conflicting opinions regarding the use of first-person pronouns (APA Style, 2020; Bennett, 2009), with some writing centers even admonishing writers to abstain from the use of pronouns altogether in scientific writing (e.g., Enago Academy, 2019; The Writing Center, The University of North Carolina at Chapel Hill, 2020).

Kuo (1999) maintains that the first-person pronoun "we" is used more frequently than other pronouns in scientific journals. Swales and Feak (2012) report that "we" is commonly used in the engineering genre by both single authors and co-authors, whereas the *IEEE Authorship Series* (published by IEEE, that is, the Institute of Electrical and

Electronics Engineers, n.d.) encourages writers to "write in the first-person to make it clear who has done this work and writing" (p. 17).

"I" and "we-use" varies in the academic writing of different fields (Hyland & Jiang, 2018). For example, "I" is less commonly used in computer science papers but more frequently found in philosophy papers (Hyland, 2001a). Harwood (2005a) found that "I" and "we" are used in sociology publications both to identify the methodology as the writer's own work and to highlight the study's contributions to the field. Similarly, authors of economics article conclusions use "I" and "we" to stress the innovative aspects and unique qualifications of their research (Harwood, 2005a).

Many authors also use first-person pronouns that do not necessarily refer to the same person(s). Harwood (2005b) argues that the inclusive "we" refers to both writers and

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readers in academic texts, whereas Tang and John (1999) claim that the first-person pronoun in academic writing is not a homogeneous entity because it plays multiple roles in depicting a writer's/writers' stance.

In addition, there is a growing trend for authors to employ a more informal writing style that uses "I" or "we" in academic writing to acknowledge their stance and engagement (Hyland, 2005; Hyland & Jiang, 2017). Hyland (2001b, p. 212) argued that "the pronouns 'we' and 'I' were the most commonly-used devices for self-representation." Ige (2010) even points out that "we equals I" is often used by South African writers of English academic articles. According to Ige, the plural personal pronoun "we" supersedes "I" to elucidate the consent of group members in the classroom; however, the singular pronoun "I" tends to become silent when used in group learning contexts.

More researchers examined how people used the first-person pronouns in abstracts (Pho, 2008); however, relatively few studies explored how these pronouns were employed in conclusions. Hence, we set out to investigate both whether the situation of "we equals I" occurred in abstracts and conclusions and whether or not single authors used "we" to represent "I" during the past decade.

First-Person Pronouns and Research Aim

This study aimed to investigate writers' stance by focusing on the use of the first-person pronoun "we" in the abstracts and conclusions of electrical and electronic (EE) engineering papers (Bunton, 2005). The function of a research article abstract is to present a concise and informative summary of an empirical study by including a succinct report on the gap in the literature that inspired the project, the research method and design employed, the key findings, and the study's contributions to the field (Bhattil et al., 2019; Samraj, 2014; Swales & Feak, 2012).

For example, the following text [1–12] illustrates how the invisible single author used "we" (i.e., "we is I") to express the authorial stance in an IEEE abstract as formulated in [1–12]: "In this paper, **we** investigate . . . **We** give . . . **we** investigate . . . Also, **we** investigate . . .":

> In this paper, we investigate the general form of the law of importation where is a norm and is a fuzzy implication, for the three main classes of fuzzy implications, i.e., . . . We give necessary and sufficient conditions under which the law of importation holds for XX, YY, and implications. In the case of implications, we investigate some specific families of implications. Also, we investigate the general form of the law of importation in the more general setting of uninorms and operators for the above classes of fuzzy implications. (1–12: Abstract)

In addition, it has been found that the personal pronoun "we" ("We is I") was employed to express the authorial stance in Abstracts at the outset of this study (see earlier [1–12]).

Along the same line, the Conclusion text shows how the single author "we" (= "I") interacted with the present participle, indicating the humble authorial stance with the completion of the current task by using the pattern, "we have + pp.": "In this paper, **we** have given . . . Also **we** have investigated . . ." in the conclusion section (see below):

> In this paper, **we** have given necessary and sufficient conditions under which the classes of fuzzy implications and implications satisfy the law of importation (LI). Also **we** have investigated the general form of law of importation in the more general setting of uninorms and -operators for all the above classes of fuzzy implications. (1–12: Conclusion)

Integrated Framework, Significance, and Research Questions

Numerous studies have examined the pronoun "we" and its collocations in terms of linguistic categorizations, impressionistic views, or descriptive statistics (Hyland & Jiang, 2016; Pho, 2008). The first-person pronoun "we" was found by Kuo (1999) to be used more frequently than other types of personal pronouns in scientific journal articles. The pronoun "we" has been divided into exclusive and inclusive (Harwood, 2005b), with a number of studies having examined "we equals I" use in various genres (Harwood, 2005a; Hyland & Jiang, 2018; Ige, 2010). Nevertheless, it remains difficult to distinguish the precise meanings of the ambiguous "we" in EE journal articles.

There is a dearth of quantitative studies investigating the statistical correlations (Hyland & Jiang, 2018; Oakes, 1998; Perry, 2005) between personal pronoun use in academic article abstracts and conclusions. The present study attempted to address this gap in the literature by, first, exploring the use of first-person pronouns with *Zipf's Law*, collocations, log likelihood (LL), and clusters (Ferrer-i-Cancho & Vitevitch, 2018; Gries & Ellis, 2015; Nesselhauf, 2005), and, second, comparing their use in the abstracts and conclusions of electrical engineering journal papers.

We also integrated "key resources of academic interaction" (Hyland, 2005) into a "lexico-grammatical profile" framework, based mainly on O'Keeffe et al. (2007), Hunston and Francis (2000), and Harwood (2005b). These aspects were integrated, quantitatively and qualitatively, along with a mixed-method design (Creswell & Plano Clark, 2007; Szudarski, 2018). The results of the quantitative analysis of the data collection offer information for the qualitative analysis.

On one hand, this study integrated quantitative and qualitative approaches (Pho, 2008) to explore the frequency and the functions of personal pronouns, the interaction between first-person pronouns and the texts in abstracts and conclusions, the inferential statistics and applications of Zipf's Law to bridge the research gaps and advance the field of academic writing (e.g., Ferrer-i-Cancho & Vitevitch, 2018; Gries &

Ellis, 2015). On the other hand, these aspects are significant and play a crucial role in academic writing. Their importance is shown by the amount of research that has focused on the use of first-person pronouns over time (Harwood, 2005a, 2005b; Hyland, 2011; Hyland & Jiang, 2017, etc.).

More specifically, the current study by the authors of EE engineering papers in hopes of shedding new light on the use of first-person pronouns in EE article abstracts and conclusions examined whether the assumption "we equals I" (Ige, 2010) has been empirically upheld (Bhattil et al., 2019). The present study was thus guided by the following research questions (RQs):

> **Research Question 1 (RQ1):** What is the trajectory of the use of "we" in abstracts and conclusions across different EE journals?
> **Research Question 2 (RQ2):** To what extent is "we" used in abstracts and conclusions of EE journal papers?
> **Research Question 3 (RQ3):** In what ways is "we" used interactively with impersonal-authorship expressions in abstracts and conclusions of EE papers?
> **Research Question 4 (RQ4):** How would "we" collocate with auxiliary modals, tense choice, and various salient word-clusters in abstracts and conclusions of EE journal papers?
> **Research Question 5 (RQ5):** How can different types of we-patterns be identified and categorized in abstracts and conclusions?

Literature Review

Personal Pronouns in Abstracts and Conclusions

According to Martínez (2005), first-person pronouns are used to "play a key role in the construction of the writer's persona," which may occur across different sections of journal papers (cf. Hyland & Jiang, 2016). However, the section of abstracts has been ignored in her research. Hyland and Tse (2005) suggested how to indicate the authorial stance in abstracts. Samraj (2014) explored first-person pronouns in abstracts that function as the subject of sentences in terms of move theories. Pho (2008) explored the rhetorical moves of abstracts, the linguistic realizations of moves, and the authorial stances of different abstract moves (self-reference words such as "I, we, my, our, the author, the research"). Swales and Feak (2009, p. 4) proposed self-referring or "metadiscoursal" expression which was used in abstracts (e.g., "In the following section, we offer . . ."). Furthermore, Swales and Feak (2012) even employed genre conventions of academic writings in relation to personal pronoun use in abstracts and conclusions.

As can be seen, the studies on abstract genre have gained attention from many researchers (e.g., Kaya & Yagiz, 2020). However, comparatively fewer researchers often refer to their conclusions by using "I" or "we" as suggested in

writing guidelines such as the Thompson Writing Program, Duke University. (n.d.). Likewise, the journal style guides (e.g., IEEE Authorship Series) also have had an influence on first-person pronouns used in both abstracts and conclusions. Moreover, an article's conclusion (see examples earlier in "First-Person Pronouns and Research Aim" section) offers an overall synthesis of a study that extends beyond simply restating the project's major findings or regurgitating the information provided in the abstract; rather, it delineates directions for further study and enumerates the study's limitations. However, in his research on PhD conclusion chapters, Bunton (2005) failed to offer any example relating to first-person pronoun use.

Abstracts and conclusions are, therefore, extracted embodiments of a research project's pure essence, which is why we consider them to be fertile ground for investigating authorial stance and first-person pronoun "we-use" in EE engineering papers (see Swales & Feak, 2012, p. 22).

Stance and Personal Pronouns

"Stance" in written discourse is defined by Biber and Finegan (1989) as "the lexical and grammatical expression of attitudes, feelings, judgments, or commitment concerning the propositional content of a message" (p. 124). Hyland (2005) purports that writers maintain stance and engagement with readers via the use of selective adverbs, verbs, and adjectives that mark certainty, doubt, emphasis, hedges, necessity, possibility, and prediction (see Figure 1).

Related to *hedges*, personal pronouns express both authors' impersonal and personal stances (Hyland, 2005; Kitagawa & Lehrer, 1990). According to Kuo (1999), impersonality is considered a distinctive feature of scientific reporting. Koutsantoni (2006) reports that the collective personal pronoun "we" is more often used than "I" in the hedge research of engineering journal papers. Specifically, the frequently used first-person pronouns ("I" and "we") serve as the most noticeable expression of authorial stance in academic writing (Hyland, 2012). Among these, the pronoun *exclusive* "we" (i.e., the author[s] *only*), the *inclusive* "we" (i.e., writers *and* readers), and the *ambiguous* "we" are the most commonly employed engagement devices binding writers with their readers.

As for *self-mention* "we"-use, MacIntyre (2019) argued that student writers were unwilling to use personal pronouns because they considered it to show too much authority in their disciplines. However, Hyland and Jiang (2018) indicated how to name the author as the source of the evaluation in terms of the first-person pronoun, for example, "To this end, we note that . . ."; authors in the sciences (e.g., EE and biology) have increased their presence more than ever (Hyland & Jiang, 2016). Indeed, personal pronouns play various pragmatic functional roles (Harwood, 2005b) that allow writers and readers to "argue" via "acknowledgement, text organization and guidance, personal claims, and method
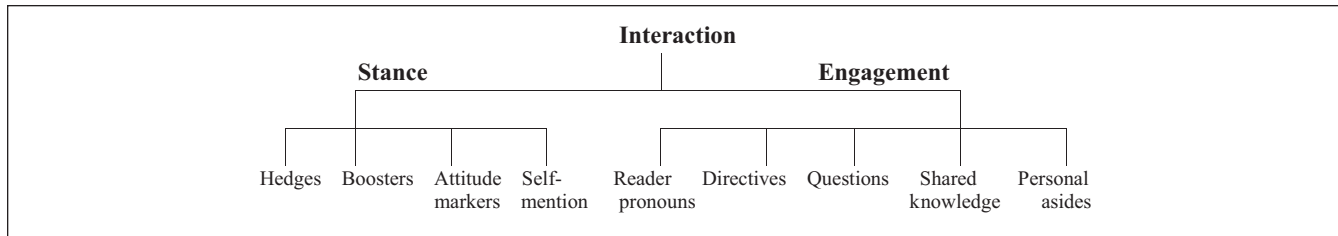
Figure 1. Key resources of academic interaction.
Source. Hyland (2005, p. 177).

Table 1. An Analytical Framework for the Lexico-Grammatical Profile of "We."

Subcorpus	Collocates/ collocation	Clusters	Syntactic patterns	Semantic types			Semantic prosody
				We-1	We-2	We-3	
abstract							
conclusion							

Source. Adapted from O'Keeffe et al. (2007, pp. 14–15).

and procedure." They also utilize pronoun functions to connect writers and readers, as well as maintain their authorial presence in the discourse community in question (e.g., "we report that," and "I will show that"; see Jiang & Hyland, 2015). Likewise, exclusive pronouns fall into the opinion-holder and originator category, with the use of inclusive pronouns being considered a low-risk strategy for the maintenance of an author's stance (Tang & John, 1999).

Lexico-Grammatical Profile

Table 1 depicts how "we" was analyzed in terms of the framework of *lexico-grammatical profiles* (Biber & Gray, 2013; O'Keeffe et al., 2007) in light of Hyland's (2005) *Stance-Engagement Model* as follows: (a) "we" in wordlists, collocates, clusters, syntactic patterns (Hunston & Francis, 2000); (b) semantic types of "we" ("we"-*1: exclusive*, "we"-*2: inclusive*, and "we"-*3: ambiguous* (Harwood, 2005b); and (c) semantic prosody (Cheng, 2013; Hauser & Schwarz, 2016).

Most lexico-grammatical features of English are "useful indicators of register and communicative task differences" (Biber & Gray, 2013, p. 20). According to O'Keeffe et al. (2007), a word's *lexico-grammatical profile* portrays typical contexts in terms of collocates/collocations, chunks/idioms (or clusters), syntactic restrictions, semantic restrictions, and semantic prosody.

Collocation is commonly explored from two perspectives. First, the *frequency-based approach* is used to define collocation as "the occurrence of two or more words within a short space of each other in a text" (Sinclair, 1991, p. 170). Second, the *significance-oriented approach* considers collocation as "a type of word combination, most commonly as one that is fixed to some degree but not completely"

(Nesselhauf, 2005, p. 12). Both perspectives are equally important in calculating LL, which is used to locate overused and underused phrases or collocations in a corpus to identify nonnormal distribution (Gries & Ellis, 2015; Oakes, 1998; Paul Rayson, 2016, see http://ucrel.lancs.ac.uk/llwizard. html). If the LL score is higher than 3.84 ($p < .05$), 6.64 ($p < .01$), or 10.83 ($p < .001$), the compared items or corpora are considered to be significantly different.

Likewise, Mutual Information (MI) examines the strength of association between two words, and what to look for in a concordance (Gries & Ellis, 2015). If MI scores are greater than 3, the association between two words is said to be significant (Szudarski, 2018). To give more weight to frequent events, the most effective coefficient was the cube of a, yielding the cubic association ratio of MI3 ($MI3 = \log_2 a^3 N / [a + b][a + c]$) (Oakes, 1998, p. 172). Then, Zipf's Law (Ferrer-i-Cancho & Vitevitch, 2018; Gries & Ellis, 2015) is applied to verify whether the frequency of any word in a corpus is inversely proportional to its rank in the frequency table.

Method

Data Collection

As for the journal selection, we consulted three information science professors (IE and EE), who, in turn, selected eight of the world's leading EE journals according to their high impact factors (2.828–8.785) in the science citation index (SCI) and their variety of genres/topics (Alotaibi, 2019; Hyland & Jiang, 2016), including (J-1) *IEEE Transactions on Fuzzy Systems*, (J-2) *IEEE Transactions on Industrial Electronics*, (J-3) *IEEE Transactions on Evolutionary Computation*, (J-4) *IEEE Transactions on Pattern Analysis*

and Machine Intelligence, (J-5) *IEEE Transactions on Power Electronics*, (J-6) *IEEE Journal of Selected Topics in Quantum Electronics*, (J-7) *IEEE Transactions on Industrial Informatics*, and (J-8) *IEEE/ASME Transactions on Mechatronics*. Fifty articles were randomly selected from each of these journals, resulting in 400 articles (3,164,942 running words) as the main corpus, and two subcorpora: 400 abstracts (64,586 running words) and 400 conclusions (93,781 running words).

Tools, Data Analysis, and Procedure

WordSmith Tools 8.0 was used to analyze frequency, LL, MI, wordlist, collocates, clusters, and concordances, and SPSS was used to calculate the significant differences between "we-use" in the abstracts and conclusions.

Inferential statistics were applied for significant tests and, as suggested by Perry (2005), *nonparametric* statistics were used to analyze frequencies, ranked data, and nonnormal distributional data. *Spearman's rank correlation coefficient* (Oakes, 1998) was used when both tested variables were ordinal, noncontinuous, or exhibited a combination of ordinal and continuous. This enabled us to ascertain whether the correlation between abstracts and conclusions was significant.

As the pronoun "we" was the most frequently occurring personal pronoun, a dispersion value was presented to display its distribution in the texts, with "the range from 0 (most uneven distribution possible) to 1 (perfectly even distribution throughout the corpus)" (cf. Gries & Ellis, 2015; Oakes, 1998, p. 190).

We approached the current project from both quantitative and qualitative perspectives via the following of a three-stage procedure: In Stage I, eight journals were decided upon according to their high impact factors. A total of 400 papers were downloaded from these journals to construct the main corpus, from which 50 were randomly selected, and their abstracts and conclusions extracted and converted into two subcorpora. We then assigned a coding number to each journal and journal paper.

Stage II comprised the quantitative analysis, which included the use of analytical tools to produce and analyze the wordlists, frequency, clusters, patterns, collocation, statistical correlation and calculation, the LL, the MI3, and the *dispersion rate* (Gries & Ellis, 2015). Relevant examples, extracted from the corpus, are provided to help explain first-person pronoun use. In Stage III, we analyzed the results and consulted the literature to reinforce the qualitative analysis, which we summarized in the lexico-grammatical profile.

Before we conducted statistical analyses with the two corpora, it was necessary to check whether the number of journal articles collected for the current investigation was sufficient for a further cross comparison. To this end, we applied Zipf's law (Ferrer-i-Cancho & Vitevitch, 2018; Gries
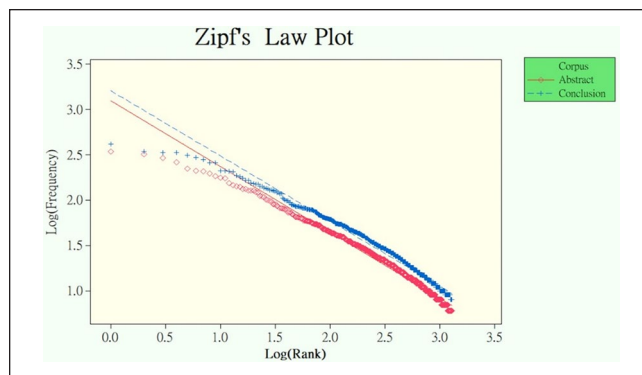

Figure 2. Zipf's law analysis of the abstract and conclusion corpora.

& Ellis, 2015) to examine the extent to which the frequency of words collected in the abstract and conclusion corpora had fulfilled the law's criteria. After the words in the two corpora were sorted by their frequency and rank, we implemented the log transformation of frequency and rank values for each word and paired the values of log (frequency) and log (rank) for correlation.

Results and Discussions

It is not simply assumed that a single author uses "I" to represent that sole author, but co-authors use "we" to refer to all of the authors as indicated in *APA Style* (2020; see https://apastyle.apa.org/style-grammar-guidelines/grammar/first-person-pronouns). As illustrated in Figure 2, except for a few cases of very high frequency words (e.g., "a, the, of"), nearly all the words in the two corpora could fall on their corresponding predicted regression lines, and the regression coefficients of the two corpora were found to be identically high and equal: $r_{abstract} = r_{conclusion} = .99$, $p < .001$. Thus, the results of Zipf's law analysis suggest that the abstract and conclusion corpora share very similar features to those of natural language expressions and have the same baseline upon which the use of "we" can be analyzed.

RQ1: What Is the Trajectory of the Use of "We" in the Abstracts and Conclusions Across the Different EE Journals?

The first-person pronoun ("we") was used in the eight selected journals to a great extent. Figure 3 shows the general trend of the use of "we" during the past 5 years, demonstrating that the trajectory regarding its frequency (from 2,398 up to 2,973) has increased per year in the EE genre (the solid line). This trend was in line with Hyland and Jiang (2016), who presented the increasing presence of "we" and "I" every 5-year period in EE. In contrast, the frequency of "we equals I" (the dotted line) as written by single authors has become
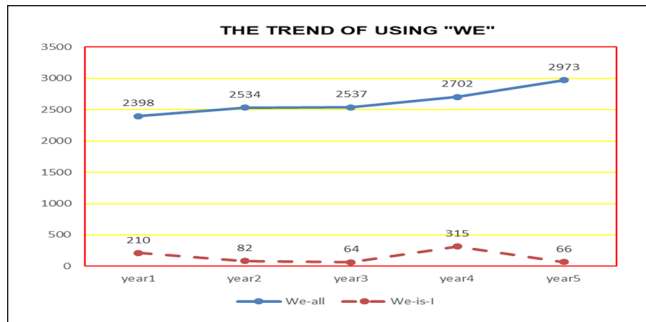
Figure 3. The general trend of using "we" in eight EE journal papers.
Note. EE = electrical and electronic.

rarely used in comparison with multiple authors and appears to be journal-specific.

Specifically, Table 2 further shows that "we" is strategically used differently in the case of either multi-author or single-author contexts across different types of IEEE journals. For some journals (e.g., J-1, J-3, J-4, and J-7), "we" is used predominantly, whereas for other journals (e.g., J-2, J-5, J-6, and J-8), the occurrence of "we" is nearly zero or completely zero. It, therefore, seems that the use of "we" is very likely conditioned upon the particular preference as customized by some EE journals to the extent that J-5 rarely allowed the use of "we" even in the case of multiple authorship in both abstracts and conclusions.

In addition, it has been presented that the personal pronoun we ("We is I") was employed to express the authorial stance in Abstracts at the outset of this study (see earlier [1–12] in "First-Person Pronouns and Research Aim" section). Along the same line, the Conclusion text shows how the single author "we" (= "I") interacted with the present participle, indicating the humble authorial stance with the completion of the current task by using the pattern, "we have + pp.," for example, "In this paper, **we** have given . . . Also **we** have investigated. . ." in the conclusion section (see below):

> In this paper, **we** have given necessary and sufficient conditions under which the classes of fuzzy implications and implications satisfy the law of importation (LI). Also **we** have investigated the general form of law of importation in the more general setting of uninorms and -operators for all the above classes of fuzzy implications. (in Conclusion)

RQ2: To What Extent Is "We" Used in the Abstracts and Conclusions of EE Journal Papers?

Table 3 reveals the most frequently used items in the abstracts and conclusions, that is, *paper* and *based*, which were both function words. Indeed, the stance pronoun "we" was ranked almost the same in both the abstracts (ranked 16th; 0.60%) and the conclusions (15th; 0.61%). The stance *AUX* modal *can* (19th; 0.56%) appears only in the article

conclusions, suggesting its frequent collocations with "we" in the conclusions.

The dispersion of "we" illustrates where the target word "we" is used in (a) abstracts (freq. = 388), (b) conclusions (freq. = 574), and (c) the entire text (freq. = 13,109). The frequency of "we" occurs (i.e., 4.22, 6.35, and 6.30 per 1,000 words) in different subgenres of texts with high dispersion values of 0.795, 0.763, and 0.847, respectively, suggesting a similar dispersion in the bodies of EE journal articles (cf. Gries & Ellis, 2015).

Table 4 illustrates the similarities in the behavior of personal pronouns in the two article sections. The major personal pronouns "we, our and us" constitute the majority, appearing more often than other pronouns in both subcorpora. The total frequency and percentage of the use of "we, our, and us" also demonstrate that the "we" word family is more frequently used in both sections than other pronouns; alternatively, "you, your, he, his, and she" were rarely or never used in the article abstracts and conclusions.

As the frequency is considered nonparametric in corpora (Perry, 2005), Spearman's rho test was applied to indicate that the use of these 15 pronouns in the abstract and conclusion sections was significantly correlated at the .01 level ($\rho = .890**, p < .001$). Likewise, Table 4 ascertains that the difference in the usage of "we" in the two sections was significant ($p < .05$; effect size: Cohen's $d = 0.232$) when applied in equal proportion to both the abstracts (0.60%) and conclusions (0.61%).

The other personal pronouns used in the presentation of examples were found to be *exceptions*. The *reader pronoun* "you," for example, seldom or never occurs in either section, and the pronoun "they" (freq. = 67) appears to be an anaphoric use of the pronoun (e.g., "devices, functions, and systems") that does not, therefore, qualify as indicating a personal purpose.

Other than "we," most personal pronouns are not used in EE abstracts and conclusions. Hyland (2005) maintains that the self-mention "we" is associated with the application of identity and safeguards authors from offending or threatening others. According to Swales and Feak (2012), "we" is used with increasing frequency in co-authored papers due to the relatively recent proclivity of collaborative, rather than individual, research in engineering.

Table 5 presents a clear contrast regarding the use of "we" in that "we" appears to some extent in the abstracts and conclusions of most journals.

However, the authors ($n = 163$) in J-2 were found to seldom use "we" in their abstracts (freq. = 3) and conclusions (freq. = 8), whereas the authors ($n = 166$) in J-5 never use "we" in either section. J-6 and J-7 do not exhibit any examples of "we equals I" in the article conclusions. This is possibly a journal-specific convention, which runs contrary to the IEEE Authorship Series' suggested guidelines. Another important finding is that "we is I" is rarely used (i.e., 0.001% in all of the texts) in either section.

Table 2. The Frequency of "We" Used by Single and Multiple Authors.

Journals	Author	Number of we (multiple authors)			"We" is "I" (single author)	
		Whole text	Abstract	Conclusion	Abstract	Conclusion
J-1	122	2,364	47	79	8	4
J-2	163	281	3	8	0	0
J-3	151	2,854	78	150	4	6
J-4	146	4,487	123	163	2	17
J-5	166	110	0	0	0	0
J-6	224	964	61	82	1	0
J-7	172	1,490	50	52	2	0
J-8	210	594	26	40	1	2
Sum	1,354	13,144	388	574	18	29

Table 3. Top 20 Words in 400 Electrical and Electronic Abstracts and Conclusions.

N	Abstracts (size = 64,586 items)			Conclusions (size = 93,781 items)		
	Word	Freq.	%	Word	Freq.	%
1	THE	4,391	6.80	THE	7,351	7.84
2	OF	2,436	3.77	OF	3,607	3.85
3	AND	1,827	2.83	AND	2,402	2.56
4	A	1,799	2.79	TO	2,152	2.29
5	#	1,435	2.22	A	2,133	2.27
6	TO	1,360	2.11	#	2,109	2.25
7	IN	1,230	1.90	IN	2,013	2.15
8	IS	1,175	1.82	IS	1,460	1.56
9	FOR	792	1.23	FOR	1,207	1.29
10	THIS	614	0.95	THAT	942	1.00
11	WITH	564	0.87	WITH	825	0.88
12	ARE	540	0.84	THIS	785	0.84
13	ON	490	0.76	BE	780	0.83
14	THAT	488	0.76	ON	621	0.66
15	BY	405	0.63	WE	574	0.61
16	WE	388	0.60	ARE	561	0.60
17	AN	379	0.59	AS	561	0.60
18	AS	357	0.55	BY	561	0.60
19	PAPER	345	0.53	CAN	528	0.56
20	BASED	330	0.51	AN	509	0.54

RQ3: In What Ways Is "We" Used Interactively With Impersonal-Authorship Expressions in EE Papers?

Table 6 illustrates the number of authors, ranging from 1 to 17 (1,355 in total), of the 400 EE articles. Only 27 of the papers (6.8%) written by single authors use the pronoun "we" in seven abstracts (1.8%) and eight conclusions (2%), thereby elucidating the rarity of "we-use" in article abstracts and conclusions.

Scant pronoun "I" *use* in EE abstracts or conclusions is possibly explained by the fact, as noted, that co-authoring or teamwork is increasingly popular in engineering (Swales & Feak, 2012).

Impersonal authorial stance (single author vs. multiple authors). Table 7 shows that three keywords (i.e., "paper, study, and research") are formed, respectively, as clusters to replace first-person pronouns ("I" or "we") in EE abstracts and conclusions. The keyword "paper" is apparently more frequently used by multiple authors in terms of the patterns such as "This/The paper + reporting verbs (RV)" (e.g., "This paper examines") in Abstracts or "This/The paper + has + PP. (RV)" (e.g., "This paper has presented") mainly in Conclusions. Moreover, single authors rarely adopt an impersonal authorial stance across these sections.

Single author vs. multiple authors in abstracts: "We" and Impersonal author. First, Figure 4 shows that the Impersonal

Table 4. Personal Pronouns Used in Electrical and Electronic Abstracts and Conclusions.

Personal pronoun	Abstract (size = 78,606)		Conclusion (size = 111,818)	
	Freq.	%	Freq.	%
I	0		0	0
My	0		0	0
me	0		0	0
We	388	0.60	574	0.61
Our	90	0.13	217	0.23
Us	5		15	0.02
You	0		1	
Your	0		0	0
He	0		2	
His	2		5	
She	0		1	
Her	1		0	0
They	45	0.07	43	0.05
Their	67	0.10	82	0.09
Them	28	0.04	38	0.04

author, "This paper," represents the invisible "I" but not "we" ("we" is not "I"; see 2–30). Then, the *Inclusive* "we"-*2* (= author + readers) in ". . . we can" also represents the single author "I" (see 3–42) interacting with "this paper considers," represents the invisible "I" (Not "we"). "This paper" also interacts with the *exclusive* "we"-*1* and the *inclusive* "we"-*2* via lexical chains (i.e., the dotted thick lines) in context.

According to Hyland (2005), boosters such as "demonstrate" (e.g., "we demonstrate" or "we also demonstrate") in 3 to 42 allow authors to present their work with heightened assurance and certainty. Moreover, all of the *Exclusive* "we" (= author only) represent "we is I" in "we discuss," "we see," "we demonstrate," and "we also demonstrate."

Figure 5 shows that the impersonal subject, "This paper +RV" (with present tense), acts with the authorial stance. The impersonal "This paper proposes" in 1 to 13 interacts with "In this paper, we concentrate," referring to an exclusive "we"-*1*. The cluster suggests that "In this paper" represents an exclusive "we"-*1* (*author only*). According to Harwood (2005a), "we" is a self-promotion device used to emphasize authors' contributions to the field.

Single author vs. multiple authors in conclusions: "We" and impersonal author. The present participle "has + pp." tends to be used in Conclusions (see *This paper has provided* in 2–37 in Figure 6).

In addition, Hyland (2005) claims that directives such as "note" in "we note" (3–42) direct the reader to either undergo an action or adopt the author's viewpoint regarding the phenomenon in question. Finally, the pattern "the Impersonal author + has + pp." (see "This paper has introduced") has

made a conclusion by introducing a new tool applied to many different types of problems.

In Figure 7, the interaction between the exclusive "we" (author only: *In this paper*, "we") and the ambiguous "we" (see "For example, we could use") suggests the authorial "we" is either the writer or the reader, a point that has been overlooked by previous studies (Harwood, 2005b).

RQ4: How Does "We" Collocate With Auxiliary Modals, Tense Choice, and Various Salient Word-Clusters in the Abstracts and Conclusions of EE Journal Papers?

Table 8 indicates the auxiliary "can" (freq. = 5) is the only collocation with "we" (LL = 7.46) used in both the abstract (MI3 = 6.29) and conclusion (MI3 = 13.05) sections. However, the first-person pronoun "we" was found to collocate with other auxiliaries such as "will" (MI3 = 9.88), "could" (MI3 = 8.34), "would" (MI3 = 7.91), and "should" (MI3 = 7.34). All are higher than 3, indicating that the strength of association between the two words is significant.

Five auxiliaries were discovered to be used to signify stance for the pattern of "we + __" in the conclusion sections. This suggests that the first-person pronoun "we" is rarely collocated with stance auxiliaries in conclusions and even less so in abstracts, whereas "we" appears more frequently in the bodies of EE journal papers.

Table 9 indicates that stance adverbials, such as "actually, particularly, and generally," are rarely collocated with "we." The LL (*between groups*) demonstrates that the difference of "we" collocating with both "particularly" (LL = 0.20) and "specifically" (LL = 2.25) is not significant across the abstract and conclusion subcorpora, but *only* (LL = 5.97) is significantly collocated with "we." However, the MI3 scores (*within groups*) show that the collocation of these three words with "we" is significant. The results also suggest that EE authors seldom use "we" to collocate with stance adverbials for their research arguments or findings in both sections.

Swales and Feak (2012) maintain that there are five types of tense choice. Table 10 indicates three-word "we-clusters" tend to collocate with the present tense in the abstracts, for example, "we propose a" (23), "we present a" (20), and "we show that" (17). Likewise, the three-word clusters found in the conclusions often collocate with the present perfect tense, such as in the following examples: for example, "we have presented" (32), "we have proposed" (19), and "we have shown" (18).

As for tense choice in Table 11, "we" tends to collocate with present tense verbs in the abstracts. The collocation of "we" varies in the conclusions, including the present perfect "we have + pp." (freq. = 108; 88.6%), "we + verb with present tense" (freq. = 7; 5.7%), and "we + verb with past tense" (freq. = 7; 5.7%). Moreover, the four-word clusters of

Table 5. "We" and "We Is I" Occurrence Frequency in the Eight Journals.

Journal	Author	Occurrences of "we"			"We" is "I" (=single author)	
		Whole text	Abstract	Conclusion	Abstract	Conclusion
J-1	122	2,364	47	79	8	4
J-2	163	281	3	8	0	0
J-3	151	2,854	78	150	4	4
J-4	146	4,487	123	163	2	9
J-5	166	110	0	0	0	0
J-6	224	964	61	82	1	0
J-7	172	1,490	50	52	2	0
J-8	210	594	26	40	1	2
Sum	1,723	13,109	388 (2.95%)	574 (4.38%)	18 (0.001%)	19 (0.001%)

Table 6. Authors for Papers "With and Without We" in Abstracts and Conclusions.

N of author	1	2	3	4	5	6	7	8	9	11	12	17	Sum
Abstract with "we" (%)	7	43	57	25	10	3	5	6	0	1	0	1	158
	1.8	10.8	14.3	6.3	2.5	0.8	1.3	1.5	0	0.3	0	0.3	39.5%
Abstract without "we" (%)	20	63	62	48	28	10	6	3	1	0	1	0	242
	5	15.8	15.5	12	7	2.5	1.5	0.8	0.3	0	0.3	0	60.5%
Sum (%)	27	106	119	73	38	13	11	9	1	1	1	1	400
	6.8	26.5	29.8	18.3	9.5	3.3	2.8	2.3	0.3	0.3	0.3	0.3	100%
Conclusion with "we" (%)	8	57	58	32	14	5	7	8	1	1	1	0	192
	2	14.3	14.5	8	3.5	1.3	1.8	2	0.3	0.3	0.3	0	48%
Conclusion without "we" (%)	19	49	61	41	24	8	4	1	0	0	0	1	208
	4.8	12.3	15.3	10.3	6	2	1	0.3	0	0	0	0.3	52%
Sum (%)	27	106	119	73	38	13	11	9	1	1	1	1	400
	6.8	26.5	29.8	18.3	9.5	3.3	2.8	2.3	0.3	0.3	0.3	0.3	100%

Table 7. The Frequency of Impersonal Authors.

Subgenre	No. of authors	This paper + RV	This study+ RV	This research+ RV
Abstracts	Multiple author	177	6	4
	Single author	10	2	0
Conclusions	Multiple author	90	9	5
	Single author	7	0	0

Note. RV = reporting verbs.

"we" in the abstracts tend to collocate with present tense verbs (≃100%), for example, "this paper we propose." However, most of the four-word clusters of "we" in the conclusions tend to collocate with present perfect tense, for example, "we have proposed a" (88.6%).

Table 12 demonstrates that writers employ the present tense (100%) for the five-word we-clusters (e.g., "in this paper we propose") in the abstracts; however, the present perfect tense for the collocation of "we" (e.g., "in this paper we have + _") is more frequently used in articles' conclusion sections. According to these data, we can surmise that "we" collocates more with the present perfect tense than with the past tense.

RQ5: How Can Different Types of We-Patterns Be Identified and Categorized in Abstracts and Conclusions?

We discovered that the three major types of "we" (i.e., the exclusive, inclusive, and ambiguous "we") all occur in EE

Code	Authorial Type	Examples (Conclusions by multiple authors)
2-12	Impersonal author +has + pp.	This paper has reported significant analytical results on a single-phase three-level rectifier.
1-19	1) Exclusive WE-1 ("We is WE") 2) Exclusive WE-1 ("We is WE") 3) Ambiguous WE-3 ("We is WE")	In this paper, we developed an MCE algorithm to train Choquet integrals for fusion, and tested the training algorithm against the better known LSE training in a complex multi-classifier fusion data set from the application of landmine detection. The MCE approach allows training of Choquet integrals without requiring desired outputs. Although LSE training can do as well as MCE training, on average, LSE does significantly worse. In addition, we used the MCE algorithm to train pattern classifiers for standard data sets and the results compare favorably with existing results... A consequence of the exponential nature of the full measure is that any attempt to learn would require a new way to calculate it. For example, we could use Monte Carlo methods, which are extreme for solving high-dimensionality problems,...

Figure 4. Interaction between impersonal author and We-1 (single author).

Code	Authorial Type	Examples (Abstracts by Multiple authors)
1-8	Impersonal author	**This paper** proposes a unified hybrid fuzzy model-based control scheme for uncertain nonholonomic systems.
1-13	1) Impersonal author + RV 2) In this paper, Exclusive We-1+ RV	**This paper** proposes a new method of merging parameterized fuzzy sets based on clustering in the parameters space… The results indicate that the proposed merging and rule base simplification approach leads to good navigation performance in the application considered and to fuzzy models that are interpretable by experts. **In this paper, we** concentrate mainly on fuzzy systems with Gaussian membership functions, but the general approach can also be applied to other parameterized fuzzy sets.

Figure 5. The exclusive we and impersonal stance in abstracts (multiple authors).
Note. RV = reporting verbs.

papers. Figure 8 presents the result of each type in the abstracts and conclusions. In the abstracts, 98.97% of "we" (freq. = 384) are used as the exclusive type, whereas only 1.03% (freq. = 4) belong to the inclusive type, and there is no ambiguous "we."

Likewise, in the article conclusions, 91.3% of "we" (freq. = 524) are the exclusive type, whereas 5.74% (freq. = 33) belong to the inclusive type. However, 2.96% of "we" (freq. = 17) are considered ambiguous. The exclusive "we" in the abstracts and conclusions was found to be significantly correlated at the .01 level ($\rho = .562^{**}, p < .001$). This suggests that the exclusive "we" occurs more frequently than other types of "we" in EE papers.

Various patterns of the first-person pronoun ("we") in the abstracts. As shown in Figure 3 above, Tables 13 (abstracts)

ode	Authorial Type	Examples (Conclusions by Single author)
2-37	Impersonal author + has + pp.	**This paper has provided** a survey of fabric defect detection methodologies reported in about 150 references.
3-42	1) Exclusive WE-1 ("We is I") 2) Impersonal author + has+ pp.	**We have shown** how biogeography, the study of the geographical distribution of biological species, can be used to derive algorithms for optimization. This new family of algorithms is called BBO. **We** have applied BBO to benchmark functions and to a sensor selection problem, and shown that it provides performance on a par with other population-based methods. **We** cannot conclude that BBO is universally better than other methods, or vice versa, in view of the no free lunch theorem. …**We** used linear and symmetric immigration and emigration curves, but perhaps other shapes could give better performance under certain conditions. …**We** formulated BBO to optimize functions of discrete variables…**We have seen** that BBO has features in common with other population-based methods. … **We note** that CPU time is a bottleneck to the implementation of many population-based optimization algorithms. … **This paper has introduced** a new optimization tool that can hopefully be applied to many different types of problems.

Figure 6. The exclusive "we" and impersonal stance in conclusions (single author).

Code	Authorial Type	Examples (Conclusions by multiple authors)
2-12	Impersonal author +has + pp.	This paper has reported significant analytical results on a single-phase three-level rectifier.
1-19	1) Exclusive WE-1 ("We is WE") 2) Exclusive WE-1 ("We is WE") 3) Ambiguous WE-3 ("We is WE")	**In this paper, we developed** an MCE algorithm to train Choquet integrals for fusion, and tested the training algorithm against the better known LSE training in a complex multi-classifier fusion data set from the application of landmine detection. The MCE approach allows training of Choquet integrals without requiring desired outputs. Although LSE training can do as well as MCE training, on average, LSE does significantly worse. In addition, **we used** the MCE algorithm to train pattern classifiers for standard data sets and the results compare favorably with existing results... A consequence of the exponential nature of the full measure is that any attempt to learn would require a new way to calculate it. For example, we could use Monte Carlo methods, which are extreme for solving high-dimensionality problems,...

Figure 7. The exclusive "we," ambiguous "we," and impersonal stance (multiple authors).

and 14 (conclusions) also portray three major categories of "we" (the exclusive "we," the inclusive "we," and the ambiguous "we") in terms of 13 types of "we"-patterns. However, it is important to note that no *ambiguous* "we" use was detected in the abstracts.

Table 10 shows that the pronoun "we" of Patterns 1 to 4 is used to express the research purpose and/or method in the abstract section (Kuo, 1999). For example, Pattern 2 demonstrates the pattern of "we" in "Prepositional phrase (In this article/paper/study/work), we . . ." changes from

Table 8. Collocation of "We" + *AUX/Modal*.

	Abstracts				Conclusions			
N	We + ____	Freq.	MI3	Stance	We + ____	Freq.	MI3	Stance
1	CAN	5	6.29	hedge	CAN	24	13.05	hedge
2					WILL	7	9.88	booster
3					COULD	4	8.34	hedge
4					WOULD	5	7.91	hedge
5					SHOULD	3	7.34	booster

Table 9. First-Person Pronoun "We" Collocated With Stance Adverbials in the Texts.

Three genres	Abstract corpus			Conclusion corpus			Whole corpus		
Adverbials	Collocated	Text	MI3	Collocated	Text	MI3	Collocated	Text	MI3
actually	0	3	NA	0	9	NA	19	210	12.86
generally	0	7	NA	0	10	NA	38	352	11.15
only	0	67	NA	5	139	16	201	3,458	19.09
particularly	0	11	NA	1	23	5.79	12	272	10.56
specifically	6	11	11.6	0	8	NA	24	49	14.54

Table 10. Top 10 "Three-Word of 'We'-Clusters" in Electrical and Electronic Abstracts and Conclusions.

N	In abstracts	Freq.	In conclusions	Freq.
1	we propose a	23	we have presented	32
2	we present a	20	we have proposed	19
3	we show that	17	we have shown	18
4	we introduce a	10	we have demonstrated	16
5	we present an	6	we have introduced	9
6	we demonstrate the	5	we showed that	9
7	we propose an	5	we proposed a	7
8	we show how	4	we have developed	7
9	we argue that	4	we believe that	7
10	we demonstrate that	4	we have also	7
	(98 clusters = "we + verb with present tense")	98	(108 clusters = "we + have + v-en")	122
			(7 clusters = "we + verb with present tense")	
			(7 clusters = "we + verb with past tense")	

Table 11. Top 10 "Four-Word We-Clusters" in Electrical and Electronic Abstracts and Conclusions.

N	In abstracts	Freq.	In conclusions	Freq.
1	in this paper we	56	in this paper we	53
2	this paper we propose	17	this paper we have	33
3	this paper we present	10	in this article we	24
4	paper we present a	7	we have proposed a	15
5	this paper we introduce	6	we have shown that	10
6	we present a novel	4	we have presented a	10
7	this paper we describe	4	paper we have presented	9
8	paper we propose an	3	we have presented an	9
9	we introduce a novel	3	paper we have proposed	8
10	we show that the	3	this article we have	7
Sum		113		178

Table 12. Top 5 "Five-Word We-Clusters" in Electrical and Electronic Abstracts and Conclusions.

N	In abstracts	Freq.	In conclusions	Freq.
1	in this paper we propose	15	in this paper we have	33
2	in this paper we present	9	this paper we have presented	9
3	this paper we propose a	8	this paper we have proposed	8
4	this paper we present a	7	in this paper we proposed	6
5	this paper we introduce a	6	paper we have proposed a	6
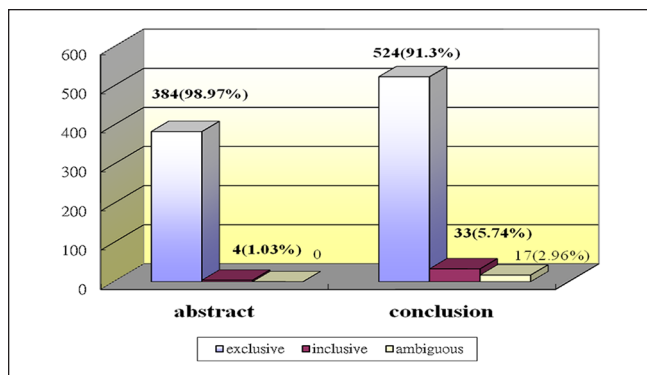
Figure 8. Three types of "we" in abstracts and conclusions.

the impersonal to the personal pronoun by using "we" followed by present tense (Swales & Feak, 2012), such as in "In this paper, we introduce a new way of looking at fuzzy intervals."

This pattern can be employed as a "testing device" to ensure that an invisible aim is being given here. Therefore, the pattern, "In this paper, we introduce . . .," can be changed from (1a), (1b), and (1c) (*impersonal*) to (1d) (*personal*).

The following examples imply that a research aim is understood by default:

(1a) This paper aims to introduce. . .
(1b) The aim of this paper is to introduce. . .
(1c) The purpose of this paper is to introduce. . .
(1d) In this paper, we aim to introduce. . .

Patterns 5 (2a) and 6 (2b) use present and past participle clauses to indicate how the exclusive "we" is used in texts. In general, according to Swales and Feak (2012), the present participle is preferred for the collocation of "we":

(2a) (1–12) Following this, **we** propose a novel modified scheme of compositional rule . . .
(2b) (8–25) Derived in closed form, **we** show how the DMP-models can be efficiently used . . .

Authors apply transitional signals and stance adverbials using the exclusive "we" to present the sequence of their ideas, ranging from general to specific (GS; Swales & Feak, 2012) in Patterns 7 (*First*), 8 (*Second/Then*), and 9 (*Specifically*).

(3a) (4–16) First, **we** can develop more general algorithms for inverse rendering problems . . .
(3b) (4–16) Second, **we** can check the consistency of an image to detect tampering or image splicing.
(3c) (9–34) Specifically, **we** focus on a widespread network configuration . . .

In addition, the pronoun "we" in the pattern "First, we + verb" (5a, Pattern 8) is exclusive (*authors only*), but "we" in "First, we + can" (5b, Pattern 12) becomes inclusive when it is followed by the hedge modal ("can"). Finally, the singular engineer (5c, Pattern 13) transforms into the plural inclusive "we" (*author + readers*) in the same text (5c, 3–42) to imply that the author is seeking recognition and/or agreement from readers and wishes to express a humble stance when the inclusive "we" is followed by the hedge modal (Harwood, 2005b):

(5a) (2–28) First, **we** design a flexible and reasonable intelligent recharging system for the mobile robot.
(5b) (4–16) First, **we** can develop more general algorithms for inverse rendering problems . . .
(5c) (3–42) The mindset of the engineer is that **we** can learn from nature.

Pattern 10 (1–33) presents how the *exclusive* "we" interacts with its possessive "our": "In our research, **we** study two basic sensor placement schemes . . ." to identify or emphasize the authorial stance ("we"). Likewise, the exclusive "we" interacts with the invisible subject "I" (Ige, 2010), which is the genuine single author ("we equals I") in Pattern 11, for example, "In the case of implications, we investigate . . ." (1–12).

At first glance, Example (4a) appears to indicate exclusive/inclusive ambivalence; further inspection reveals, however, that the invisible single author "I" uses exclusive "we" to express author only ("I = we"). Put concisely, Patterns 1 to 11 display the authors' stance via their use of the exclusive "we." As demonstrated earlier, few authors use "we is I" in either the abstracts or conclusions of EE journal papers:

(4a) (1–12) In the case of implications, **we** investigate some specific families of implications.

Various patterns of first-person pronoun ("we") in conclusions. Table 11 indicates that the "we"-*patterns* in articles' conclusion sections are similar to those appearing in the article abstracts.

Table 13. Semantic Patterns for the Function of "We" in in Abstracts.

(i) Exclusive we: 1–11, (ii) inclusive we: 12, and (iii) ambiguous we: 0

1. We + V (expressing what method is used and what to be done)
E.g.: (3–19) **We** apply an evolutionary algorithm (EA) to construct models consisting of logic trees.

2. Prepositional phrase (In this article/paper/study/work), we (switching from the impersonal to the personal pronoun to express research aim/method)
E.g.: (1–31) In this paper, **we** introduce a new way of looking at fuzzy intervals.

3. Prepositional phrase, we (expressing authors' purpose/methods)
E.g.: (8–4) For this purpose, **we** design a feedback controller . . .

4. To + VP, we (expressing authors' purpose/methods)
E.g.: (1–36) To obtain such information to better infer GRN structures, **we** propose a fuzzy data mining technique here.

5. Present Participle clause, we (Using the present participle clause to express authorship)
E.g.: (1–12) Following this, **we** propose a novel modified scheme of compositional rule of inference (CRI) . . .

6. Past Participle clause, we (Using the past participle clause to express authorship**)**
E.g.: (8–25) Derived in closed form, **we** show how the DMP-models can be efficiently used to characterize the magnetic fields for computing magnetic forces and torques.

7. Transitional signals (ordinal), we (to express the sequence of authors' idea)
E.g.: (2–28) First, **we** design a flexible and reasonable intelligent recharging system for the mobile robot.

8. Transitional signals (adv/conj.), we (to express the sequence of authors' idea)
E.g.: (7–15) Then **we** study a practical design procedure of the time delayed control systems.

9. Stance adv, we (Using the adverbial, stance marker or self-mention to emphasize authorial ideas)
E.g.:(1–22) Specifically, **we** present a new iterative fuzzy clustering algorithm that incorporates a supervisory scheme into an unsupervised fuzzy clustering process.

10. Interaction: Exclusive we (Interaction between "possessive" and "exclusive we")
E.g.: (1–33) In our research, **we** study two basic sensor placement schemes: square-grid and hex-grid.

11. Exclusive/inclusive ambivalence: "I = we" (the invisible single author [I] using exclusive "we")
E.g.: (1–12) In the case of implications, **we** investigate some specific families of implications.

12. If we (Using conditional *If* to express "inclusive we")
E.g.: (3–14) The complexity of the selection procedure of a genetic algorithm that requires reordering, if **we** restrict the class of the possible fitness functions to varying fitness functions . . .

13. We + can/could/are able to (Using the inclusive we followed by "can" or "be able to")
E.g.: (3–42) The mindset of the engineer is that **we** can learn from nature.

However, the more commonly used pattern to express self-mention or authorship is Pattern 1 (6a), "We have + pp" (e.g., "we have presented"), which refers to author(s) only (exclusive "we"). The next common types (Patterns 2 and 3) use prepositional clusters to specify the exclusive "we." The pronoun "we" in Patterns 1 to 4 (6b) is used to express the research aim, methods, or completion via the present perfect (or present tense). Patterns 5 and 6 (6c) use the present or past participle clauses to indicate the use of the exclusive "we" in texts (cf. Kuo, 1999):

(6a) (7–13) **We** have presented the one-shot task model for real-time control systems.
(6b) (1–6) In this paper, **we** have introduced a novel two-level time-series prediction that exploits FCMs.
(6c) (3–6) Derived in closed form, **we** show how the DMP-models can . . .

Transitional signals and stance adverbial(s) are applied for the exclusive "we" in Patterns 7, 8, and 9 to express the sequence of the authors' ideas, from general to specific or

from specific to general (Swales & Feak, 2012). The exclusive "we" interacts with its possessive "our" in Pattern 10 to identify authorial stance. Put simply, Patterns 1 to 11 are the exclusive "we," which is used to express authors' research aims, methods, authorship, and/or sequence of their ideas. Pattern 11 (6d) is a typical example of "we is I" because the pronoun ("we") is equal to the invisible single author ("I").

(6d) (8–10) **We** presented a prototype of a wheel tread deformation
(6e) (3–39) **If we** call the strategies in Table III the common strategies for this experiment, then all common strategies . . .
(6f) (3–43) By applying heuristics to reorder objectives, **we** are able to increase the size of the fronts **we** are able to process.

Harwood (2005b) argues that authors vacillate between exclusive and inclusive "we-use" for their own ends, such as making readers feel involved in or more receptive to their claims for rhetorical effect. Thus, Pattern 12 (6e) uses the conditional-if clause to express the inclusive "we" as the

Table 14. Semantic Patterns for the Function of "We" in Conclusions.

(i) Exclusive we: 1–11, (ii) inclusive we: 12, and (iii) ambiguous we: 13

1. **We have + pp** (expressing completion)
E.g.: (7–13) **We** have presented the one-shot task model for real-time control systems.
2. **Prepositional phrase (In this article/paper/study/work), we** (emphasizing completion/methods)
E.g.: (1–6) In this paper, **we** have introduced a novel two-level time-series prediction that exploits FCMs.
3. **Prepositional phrase, we** (expressing authors' purpose/methods)
E.g.: (1–22) By this interpretable fuzzy rule-based approach, **we** find it easy to analyze accumulated knowledge, modify knowledge partially, and combine with expert knowledge.
4. **To + VP, we** (expressing authors' purpose/methods)
E.g.: (1–7) To be more precise, **we** narrow our study to a subclass of max t-norm fuzzy relational equations called Archimedean t-norm fuzzy relational equations.
5. **Present Participle clause, we** (Using the present participle clause to express authorship)
E.g.: (3–6) Experimenting with a wide range of benchmark functions, **we** show that the proposed new version of DE, with the adaptive LS, performs better. . .
6. **Past Participle clause, we (**Using the past participle clause to express authorship**)**
E.g.: (8–25) Derived in closed form, **we** show how the DMP-models can be efficiently used to characterize the magnetic fields. . .
7. **Transitional signals (adv/conj.), we** (to express the sequence of authors' ideas)
E.g.: (3–18) Thus, **we** believe that the experimental findings can be extrapolated to other medical image registration problems.
8. **Transitional signals (ordinal), we** (to express the sequence of authors' ideas)
E.g.: (4–16) **First**, **we** can develop more general algorithms for inverse rendering problems, which can directly relight and change material properties . . . **Second**, we can check . . .
9. **Stance adv, we** (Using the adverbial, stance marker or self-mention to emphasize authorial ideas)
E.g.: (3–26) Particularly, **we** recommend the use of probabilistic models for the solution of coarse-grained protein folding problems . . .
10. **Interaction: Exclusive we** (Interaction between "possessive" and "exclusive we")
E.g.: (1–7) Based on **our** results, **we** propose four rules to reduce the problem size so that the complete set of minimal solutions can be yielded efficiently.
11. **Exclusive/inclusive ambivalence: I =** "we" ("we is I")
E.g.: (8–10) **We** presented a prototype of a wheel tread deformation sensing system for "smart tire" applications for mobile robots and vehicles.
12. **If we** (Using conditional *If* to express "inclusive we")
E.g.: (3–39) If **we** call the strategies in Table III the common strategies for this experiment, then all common strategies for neural nets were able to answer cooperation with defection at some point.
13. **We + can/could/are able to** (Using the ambiguous we followed by "can" or "be able to")
E.g.: (3–43) By applying heuristics to reorder objectives, **we** are able to increase the size of the fronts **we** are able to process.

author shifts between the exclusive and inclusive "we" to elicit readers' agreement and/or understanding.

Pattern 13 (6f) depicts the ambiguous "we" (3–43) that skirts the borderline between the exclusive and inclusive types, as exemplified in the conclusions, when followed by the hedge cluster, *are able to.*

Discussion

In this study, we have presented how the first-person pronoun "we" was integrated into the *lexico-grammatical profile framework* in Table 15 (note: "we"-*1*: exclusive, "we"-*2*: inclusive, "we"-*3*: ambiguous). Three types of "we" and semantic prosody were already investigated in both the abstract and conclusion subcorpora, the "we"-collocation, clusters, and syntactic patterns. Particularly, it is noted that the semantic prosody after the pattern "we+ __" is often positive. For example, both "a new way" and "a novel two-level" also imply the notion that the author is expressing a positive idea or topic.

First, we found that a writer's guide might suggest that (a) authors write in the first-person for self-mention or self-contribution (e.g., IEEE Authorship Series), and (b) authors refrain from using first-person pronouns, which could be either a specific journal's policy or journal-specific reasons (e.g., J-2 and J-5). That is, multiple authors never use "we" in J-5 across either abstracts or conclusions; single authors seldom or never use "we" in the two sections (e.g., J-2 and J-5). We also discovered the general tendency of using "we" in EE journals (e.g., J-1, J-4, J-6, J-7, and J-8). A growing trend in line with Hyland and Jiang (2016, 2017) suggests that authors use a more informal writing style to claim their stance, and even use "we" much more frequently than "I" in EE writing.

Likewise, in the second finding, we examined frequently used pronouns and their dispersion values in EE journal abstracts and conclusions. Quantitatively, the occurrence of "we" in these two sections was found to be significantly correlated. The quantitative results strongly support the notion that "we" is the most frequently used pronoun in both

Table 15. Lexico-Grammatical Profile of "We" in Abstracts and Conclusions: Examples.

Subcorpus	Collocates/ collocation	Clusters	Syntactic patterns	Semantic types (freq.)			Semantic prosody
				We-1 (%)	We-2 (%)	We-3 (%)	
Abstracts	"we can" (freq. = 5)	"In this paper, we propose" (freq. = 56)	"In this paper, we +_"	384 (98.97%)	4 (1.03%)	0 (0%)	[+positive] (e.g., "In this paper, we introduce a new way")
Conclusions	"we can" (freq. = 24)	"In this paper, we have" (freq. = 53)	"In this paper, we have + _(pp.)"	524 (91.3%)	33 (5.74%)	17 (2.96%)	[+positive] (e.g., "In this paper, we have introduced a novel two-level")

sections. The findings also demonstrate the scant use of other personal pronouns in EE journal articles' conclusions.

Third, we explored how single authors versus multiple authors "behave" in EE papers regarding how they use first-person pronouns to regulate their interactions with readers and display impersonal authorial stance. Four examples were presented to strengthen their interactions. We discovered that a number of "we" as authors, single authors, and "we equals I" are used in EE articles. Moreover, the first-person pronoun "we" is utilized to express authorial stance and reduce personal attributions to express a humble attitude (Hyland, 2001a, 2001b).

Another significant finding is that single authors seldom use "we" in EE abstracts and conclusions. Instances of "we equals I" were not even detected once in the conclusion sections of four of the journals, and "we equals I" was very rarely used (0.001%) in either the article abstracts or conclusions. This begs the question as to why "we" but not "I" is used more often in the two investigated sections of EE academic articles. This may be because teamwork or co-authoring (93.2%) is more prevalent than single-authoring in engineering research projects (Swales & Feak, 2012).

We also explored the use of auxiliary modals, tense choice, and "we"-clusters in RQ4. Our findings reveal that "we"-clusters tend to collocate with present tense verbs in the abstracts, but with the present perfect tense in the article conclusions. The two most frequently used five-word clusters in the abstracts were "in this paper, we propose" and "in this paper, we have + pp," with the latter appearing the most frequently in article conclusions.

Qualitatively, this study applied integrated perspectives to analyze how stance markers are used with the first-person pronoun "we" in abstracts and conclusions. According to Kuo (1999), "we" is also used to express the study in question's aim or methods, which can be found in the given examples.

An additional "we" function was detected in the article conclusions: "In this paper, we have + pp," which expresses what the authors ("we") have completed in the study. This finding, to our knowledge, has yet to have been reported in the literature.

Furthermore, we exemplified three discourse functions of "we" and "we"-patterns in the two sections. We found that

the exclusive "we" was used more frequently than the inclusive "we," which was rarely used in either section. However, the ambiguous "we" was not at all present in the abstracts, a point which has also been overlooked in previous studies (Harwood, 2005b).

Another contribution of our study is the identification of 13 different "we"-patterns in the two article sections. As argued in Tables 13 and 14, Patterns 1 to 4 were found to express the research aim or method in abstracts, whereas Patterns 5 and 6 used the present and past participle clauses to indicate applications of the exclusive "we." The present participle was preferred for the collocation of "we," and transitional signals and stance adverbials are applied from general to specific in Patterns 7, 8 and 9.

Put simply, Patterns 1 to 11 display authorial stance (exclusive "we"). We also discovered that few authors use "we equals I" in either the abstracts or conclusions of EE journal papers. Likewise, Patterns 1 to 11 portray the authorial stance in conclusions. Pattern 12 uses the conditional-if clause to express *inclusive we*, and Pattern 13 is the *ambiguous* "we" when followed by hedge clusters.

In addition, we found that "In this paper, we + verb" could be replaced by four testing devices to identify whether the author(s) is/are introducing an implicit goal or mission: "This paper aim(s/ed) to + verb," "The aim of this paper is/was to + verb," "The purpose of this paper is/was to + verb," and "In this paper, we aim(ed) to + verb." This replacement technique could help reassure readers of the research study's aims and objectives; few studies, however, have explored this technique.

Conclusion: Findings, Limitations, and Implications

This study has integrated authorial aspects (e.g., Harwood, 2005b; Hyland, 2005) into a lexico-grammatical profile (e.g., O'Keeffe et al., 2007) to explore first-person pronouns in abstracts and conclusions of EE journal papers. Indeed, the reasons whether or not authors use "we" or "I" are various.

We believe the following summary of our main findings proffers instructors invaluable insights into the pedagogical application of writing EE academic journal articles' abstracts and conclusions. It is our hope that our findings can provide

instructors and researchers, alike, with an enlightened understanding of the use of stance pronouns, collocations, and clusters in EE journal articles. Students should, therefore, be encouraged to express their authorial stance for self-promotion or self-mention along the following lines:

1. The trend of using first-person pronouns shows that more people employ "we" in EE journal papers; however, it is also journal-specific to avoid using "we" in the area of EE (e.g., a journal's policy).
2. The example of "we equals I" is rarely used by single authors in EE abstracts and conclusions.
3. A single author should avoid overusing subjective expressions of "we," and, instead, employ a variation of impersonal pronouns such as "This paper, This study, or This research" to lend an objective voice of authorship to his or her findings.
4. The pattern, "In this paper, we . . .," is commonly used in both sections to imply the research aim and methods; "we" is also a self-promotion device to highlight authors' innovations to the field. Furthermore, "In this study, we have + pp" is used to express the completion in the conclusion section.
5. The tense choice for the collocation of "we" with the verbs tends to be present in abstracts, and present perfect in conclusions.
6. Three semantic types of "we" may or may not appear in both sections of EE journal papers.

The results of the study may, therefore, assist research fellows, as well as students or university professors, to cultivate a heightened awareness of the existence of different move structures in article abstracts and conclusions. Moreover, we hope this study helps researchers become more cognizant of the potential interactions between "we" and different moves and the relevant language use such as collocation, clusters, formulaic sequences, and other common inquiry issues such as when to use personal or impersonal pronouns and how to self-mention in academic writing.

Finally, it should be noted that the subject of this study is concerned with empirical research papers collected from the EE area only. Other genres may have different move structures and linguistic realizations. Further research is needed that examines whether the use of "we" and "I" continues to increase or decline in specifically chosen genres or other disciplines. The present study has shed new light on the use of first-person pronouns in EE journal papers. The results of integrating quantitative data into qualitative analysis are useful in the chosen field for a deeper understanding regarding the trends about the use of authorial stances of academic papers.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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