Moves, Move sequences, and Move Cycling in Computer Engineering and Electrical Engineering Research Article Abstracts

Rananda Rungnaphawet
Chulalongkorn University Language Institute

Abstract

Most studies on the structure of research article abstracts tend to address the use of the canonical five-move pattern. The present study aims to analyze research article abstracts in terms of the various other ways in which moves, move sequences, and move cycling are being used, and to identify newly emerging rhetorical organizations. The data comprised ninety computer engineering (CE) abstracts randomly selected from the entire collection of 2014 publications in IEEE Wireless Communications, IEEE Transactions on Neural Networks and Learning, and IEEE Network, and ninety electrical engineering (EE) abstracts randomly selected from the entire collection of 2014 publications in IEEE Transactions on Fuzzy Systems, IEEE Transactions on Industrial Electronics, and IEEE Transactions on Power Electronics. It was found that moves in these two closely-related engineering sub-disciplines did not conform to the prescribed organizational pattern with none of the moves being obligatory in computer engineering articles and the second and the third being obligatory only in electrical engineering articles. In addition, the move sequences showcased strings of as few as two and as many as eight moves arranged into up to fifty idiosyncratic combinations together with a myriad of instances of move cycling. Finally, some of the abstracts investigated were found to contain subtle representation of the organization of the accompanying article, a move most common in the last section of the introduction. It can be concluded, therefore, that genre theories should account for not only variations within and across disciplines but also rhetorical individuation in order to be able to truly manifest real use of language in discourse communities.

Keywords: moves, rhetorical structure, move sequences, move cycling

อัตถภาค การเรียงตัวของอัตถภาค และการเกิดซ้ำของอัตถภาค ในบทคัดย่อบทความวิจัยด้านวิศวกรรมคอมพิวเตอร์และวิศวกรรมไฟฟ้า

รนนท์ รุงนภาเวทย์
สถาบันภาษา จุฬาลงกรณ์มหาวิทยาลัย

บทคัดย่อ

การศึกษาด้านโครงสร้างบทคัดย่อส่วนใหญ่มักจะรายงานหลักฐานเชิงประจักษ์ที่สอดคล้องกัน โดยชี้ว่าบทคัดย่อประกอบด้วยห้าองค์ประกอบแบบแผน งานวิจัยนี้มีวัตถุประสงค์เพื่อศึกษาบทคัดย่อของบทความวิจัยในด้านอัตถภาค การเรียงตัวของอัตถภาค และการเกิดซ้ำของอัตถภาค รวมทั้งแนวโน้มการเกิดโครงสร้างอัตถภาครูปแบบใหม่ ข้อมูลที่ใช้ในงานวิจัยประกอบด้วยบทคัดย่อด้านวิศวกรรมคอมพิวเตอร์และบทคัดย่อด้านวิศวกรรมไฟฟ้าอย่างละ 90 ฉบับซึ่งสุ่มจากงานวิจัยทั้งหมดที่ตีพิมพ์ในวารสาร IEEE Wireless Communications, IEEE Transactions on Neural Networks and Learning, IEEE Network, IEEE Transactions on Fuzzy Systems, IEEE Transactions on Industrial Electronics และ IEEE Transactions on Power Electronics ในปีพ.ศ. 2557 ผลการศึกษาพบว่าอัตถภาคในสาขาย่อยของวิศวกรรมศาสตร์ที่สัมพันธ์กันอย่างใกล้ชิดทั้งสองสาขาไม่ได้เป็นไปตามโครงสร้างแบบแผน โดยไม่มีอัตถภาคใดเลยที่เป็นอัตถภาคบังคับในสาขาวิศวกรรมคอมพิวเตอร์ ในขณะที่อัตถภาคที่ 2 และ 3 เป็นอัตถภาคบังคับในสาขาวิศวกรรมไฟฟ้า นอกจากนั้นการเรียงตัวของอัตถภาคที่พบประกอบด้วยอย่างน้อยสองอัตถภาคและมากที่สุดถึงแปดอัตถภาคเรียงตัวในรูปแบบต่าง ๆ กันถึงราวห้าสิบรูปแบบ ซึ่งบางรูปแบบแสดงให้เห็นถึงการเกิดซ้ำของอัตถภาค ยิ่งไปกว่านั้น ยังพบว่าบทคัดย่อบางฉบับใช้กลยุทธ์แยบยลในการนำเสนอโครงสร้างของบทความหลัก ซึ่งเป็นอัตถภาคสามัญในส่วนสุดท้ายของบทนำงานวิจัย ดังนั้น จึงอาจสรุปได้ว่าทฤษฎีชนิดวาทกรรมควรจะพิจารณาไม่เพียงแค่ความแตกต่างระหว่างสาขา แต่ควรคำนึงถึงทั้งความแตกต่างภายในสาขาเดียวกันและการสร้างอัตลักษณ์ด้านวาทศิลป์ เพื่อให้สามารถสะท้อนการใช้ภาษาที่ปรากฏจริงในชุมชนวาทกรรม

คำสำคัญ: อัตถภาค โครงสร้างอัตถภาค การเรียงตัวของอัตถภาค การเกิดซ้ำของอัตถภาค

Introduction

Most researchers are required to go through a number of painstaking steps in order to be able to produce a piece of academic work: the seemingly never-ending task of reviewing the literature; the complicated tasks of formulating the research questions and conceptualizing the framework; the tedious tasks of setting out the research procedures, developing the research tools, and collecting, coding, and analyzing the data; the formidable tasks of reporting and discussing the findings; and the challenging task of putting everything together into a rhetorically coherent, academically comprehensive, and cognitively provoking research article contributing something new and insightful to academia. Once they have completed these, they may perhaps feel a sense of relief, mistakenly believing that everything has been completed. But another critical stage in the process lies ahead—writing the abstract.

The role of the abstract can be viewed from at least two angles: "rhetorical" and "economic," to borrow Swales and Feak's (2004) terms. Rhetorically, the abstract functions as both "front matter" and "summary matter" (Swales, 1990, p. 179), appealing for readership of the accompanying article and assisting the audience throughout the reading process, especially the post-reading stage, where the audience seeks to obtain a 'snapshot' of the complete article (Doro, 2013; Lores, 2004; Salager-Meyer, 1990; Salager-Meyer, 1992). From the economic viewpoint, the abstract sells the main article for conference presentations and article publication and citation, determining the author's growth and success in his profession (Kanoksilapatham, 2009). Ulijn (as cited in Salager-Meyer, 1992) mentioned that some scholars even predict that the abstract will become the highest priority in the scholarly community in the near future. Salager-Meyer (1992) has even claimed that this short academic text "should be the starting point of any professional reading" (p. 94).

Due to its importance, the abstract has been investigated in regards to almost every aspect, such as verb tense and modality distribution (Salager-Meyer, 1992), linguistic realizations (Anderson & Maclean, 1997), thematic organization (Lores, 2004), evaluative constructions containing the complementizer *that* (Hyland & Tse, 2005), authorial stance (Pho, 2008), and discourse markers (Khedri, Heng & Ebrahimi, 2013). Most notable and abundant are studies examining the abstract in terms of its

rhetorical moves, i.e. the constituting segments that perform recognizable communicative functions (Swales, 1990, 2004). Research along this line includes Doro (2013), Hartley (2003), Yang (2009), Kanoksilapatham (2009), Martin-Martin (2003), Oneplee (2008), Pasavoravate (2011), Pho (2008), Ren & Li (2011), Saeeaw & Tangkiengsirisin (2014), Samraj (2005), Santos (1996), and Suntara & Usaha (2013), to name but a few. This enormous pool has enhanced linguists' current understanding of not only how the abstract is structured among closely-, moderately-, and remotely-related discourse communities but also how such rhetorical organizations can be followed and *exploited* to achieve the desired communicative purposes.

The discipline of genre analysis of the abstract, however, is more expansive, and the concept of genericity, i.e. the conventionalization, or the institutionalization, of moves in the abstract in a given genre or discourse community (Swales, 1990, 2004), is becoming less relevant. For instance, Kanoksilapatham (2009) found variations in terms of both the presence and the sequence of moves in her investigation of two biology sub-disciplines, biochemistry and microbiology, and two engineering sub-disciplines, civil engineering and software engineering.

Similar findings were reported in Doros (2013), who discovered that moves and the degree of instantiation of each move in the abstracts of such supposedly related disciplines as linguistics and literature were not compatible. This disparity alone proves to be a strong enough motivation for further research on moves in the abstract, either within or across different genres, for only through such an analysis can relevant decisions in EAP and ESP be made in a well-informed manner (Bhatia, 1997, 2008; Dudley-Evans, 2000; Flowerdew, 2015; Hyland, 2014; Swales, 2001, 2002).

Another issue to examine is where the current body of knowledge of this field stands since Swales' (1990) first introduction of genre analysis over two decades ago. Despite the countless number of subsequent works, advances in theories and research do not seem to keep up with more recent realities. As Bhatia reveals in his latest interview:

> "… Genre Analysis has been a powerful theoretical framework used very successfully for several decades and is still one of the most popular frameworks for pedagogical applications to language teaching at the post-secondary levels; *however*, when we look at the discursive practices in the real world of professions, it seems to be a bit constraining in that it fails to adequately account for the realities of the complex world, …" (Bhatia & Nodoushan, 2015, p. 126, emphasis added).

A similar hindrance also poses a challenge for scholars in the field of abstract move analysis. For this purpose, three frameworks have hitherto been applied, namely Weissberg & Buker's (1990) model, comprised of five moves: *background*, *purpose*, *method*, *results*, and co*nclusion*; Santos' (1996) framework, also consisting of five moves: *situating the research*, *presenting the research*, *describing the methodology*, *summarizing the findings*, and *discussing the research*; and Martin-Martin's (2003) proposal, adapted from Swales' (1990) Creating-a-Research-Space (CARS) model to reflect the abstract's representation of the structure of *research articles (RAs)*, made up of four moves: *introduction*, *methods*, *results*, and *discussion*[1] Unfortunately perhaps, the findings of research conducted based on these frameworks have always been in line with expectations.

To illustrate, Anderson and Maclean (1997), adopting Weissberg & Buker's (1990) model in their examination of abstracts in four medical fields, revealed that the majority adhered to the M1-M2-M3-M4-M5 move structure. Also basing her study on this framework, Kanoksilapatham (2009) went a step further, having been able to identify the omission of certain moves in a given discipline, such as M2 and M3 in biochemistry, M1 and M2 in microbiology, and M1, M2, and M3 in civil engineering, and compliance with the theoretical move sequence despite the absence of such moves.

Differently, Pho (2008) applied Santos' (1996) model to examine RA abstracts in applied linguistics and educational technology, indicating three prominent moves in

[1] The three models bear great resemblances. To illustrate, the background move in Weissberg & Buker (1990) is comparable to the situating-the-research-move in Santos (1996), and the introduction move in Martin-Martin (2003) can be seen as an amalgamation of the background and the purpose moves. For expository purposes, the moves, be they in the abstract or the introduction section, will henceforth be designated M1, M2, M3, etc. and should be interpreted as relevant in that context, unless otherwise stated.

both disciplines, namely M2, M3, and M4. Drawing on the same framework, Doro (2013) found in her investigation of English studies journals that linguistics abstracts exhibited more of M2, M3, and M4, whereas literature abstracts relied more on M4 and M5. Martin-Martin's (2003) model was applied in Lores (2004), who revealed that although most abstracts in linguistics journals generally followed the canonical IMRD structure of RAs, a sizeable number also employed the CARS organization.

An abundance of studies adopting the same analytical models and hence revealing *globally* similar results is tantamount to stagnation in research progress toward a deeper understanding of the rhetorical organization of the abstract. It has long been well known, for instance, that the abstract is likely to be constructed with four or five moves, that a certain move is more predominant in some disciplines than others, and that a certain move may be obligatory, conventional, or optional (refer to Kanoksilapatham, 2005, 2012, for more discussion on this topic), depending on disciplines and genres.

Two major questions, however, await further research. One is whether the moves in such a brief piece of writing as the abstract involves cycling or not, in comparison with those in more extended sections such as the introduction and the results and discussion. Second, it remains to be seen to what extent the three frameworks discussed above can account for the actual rhetorical manifestation of the abstract, particularly amid the diachronically changing nature of the abstract genre (Ayers, 2008).

The main objective of the present study is, therefore, to examine similarities and differences in the rhetorical organization of the abstract, using data from two engineering sub-disciplines: computer engineering and electrical engineering. Also, the research seeks to identify move sequences, move cycling, and especially possible divergence from the conventional move structure prescribed in the literature—an area of inquiry that has thus far been underexplored.

Literature Review

This section is divided into four parts. The first part introduces the rhetorical organizations widely applied for analyzing moves in the abstract. Discussed in the second part are the linguistic realizations of each move. In part three, the notion of move cycling is presented. The final part provides a critical review of previous studies on the organizational pattern of the abstract.

Rhetorical organizations of the abstract

Weissberg and Buker (1990) proposed in their genre-based textbook that the abstract should comprise five moves, namely background, purpose, methods, results, and conclusion, which, they claimed, would be applicable to experimental report writing as well as other disciplines. This move structure has undergone several modifications in the long-standing history of abstract analysis. For example, two of the moves are referred to slightly differently in Hyland (2000): the first as *introduction* and the fourth as *product*. In spite of such terminological discrepancies, the model has been applied in Anderson & Maclean (1997), Ren & Li (2011), Kanoksilapatham (2009), Saeeaw & Tangkiengsirisin (2014), Suntara & Usaha (2013), and Yang (2009), for example.

Santos (1996) has gone a step further, concluding based on his study of 94 abstracts from three leading applied linguistics journals that the abstract contains five moves, namely situating the research, presenting the research, describing the methodology, summarizing the findings, and discussing the research. He has also shown that M1 may be further made up of a maximum of four sub-moves, namely stating current knowledge, citing previous research, extended previous research, and stating a problem; M2 of a maximum of three sub-moves, namely indicating main features, indicating main purpose, and hypothesis raising; and M5 of a maximum of two sub-moves, namely drawing conclusions and giving recommendations. This framework has been followed in a number of move analysis studies, including Doro (2013), Oneplee (2008), and Pho (2008).

The last model that has also gained in popularity owes its origin to Swales' (1990) CARS model, comprised of three moves, namely establishing a territory, establishing a niche, and occupying a niche (p. 141). The first move is further classified into three

steps, namely claiming centrality, making topic generalization(s), and reviewing items of previous research. The second can be manifested by any one or some of these four steps, namely counter-claiming, indicating a gap, question-raising, and continuing a tradition. The last can be sub-divided into three steps, namely outlining purposes or announcing present research, announcing principle findings, and indicating RA structure.

Influenced by Swales (1990), Martin-Martin (2003) postulated four moves for the abstract, assuming that its organization would be characteristically represented in the same way as that of the accompanying article, namely introduction, methods, results, and discussion. Like its other two counterparts, this analytical scheme has been adopted in a number of studies, including Lores (2004), Martin-Martin (2003) himself, and Samraj (2005). It should be noted, however, that Samraj (2005) adhered more strictly to the CARS model, while Lores (2004) employed both the CARS and the IMRD structures in her analysis.

Linguistic realizations of each move

Pho (2008), from her research on the linguistic realizations of rhetorical structure and authorial stance in applied linguistics and educational technology abstracts, proposes the following criteria for distinguishing one move from another: grammatical subjects, verb tense and aspect, voice, modal auxiliaries and semi-modal verbs (e.g. *may, can, should, have to*), epistemic adjectives, adverbs, and nouns (e.g. *likely, possible, probably, generally, possibility, assumption, tendency, need*), attitudinal adjectives, adverbs, and nouns (e.g. *important, significant, surprisingly, curiously, importance, significance*), self-reference words (e.g. *I, we, my, our, the author(s), the researcher(s)*), reporting verbs (e.g. *suggest*), and *that*-complement clauses (p. 235).

The grammatical subjects can be categorized into two main classes: "phenomenal" and "epistemic" (Pho, 2008, p. 235). According to MacDonald (as cited in Pho, 2008, p. 235), the phenomenal class subjects refer to "nouns referring to people or objects studied and their attributes…," as in *the participants in the study, variables, these strategies, scores for the 3-criterion variables*, whereas the epistemic class subjects encompass nouns associated with "the researcher or academics' reasoning". The epistemic class subjects can be further classified into those connected with self-

reference, other reference, audience and the generic *we*, reference to writer's own work, and anticipatory *it* and existential *there* (Pho, 2008, pp. 235-236).

According to Pho (2008, pp. 235-245), M1 is generally linguistically realized by other reference subjects, the present simple and the present perfect, the passive in some disciplines and the active in others, modal verbs, and attitudinal stance adjectives and adverbs. The linguistic realizations of M2 commonly involve reference to the writer's own work, the present simple and the simple past, and the active. The use of modal verbs and evaluative words is rare. As for M3, phenomenal class subjects are most common, with the past simple and passive verbs being preferred. Modal verbs and evaluative words are possibly untraceable. M4 is commonly linguistically realized by reference to the writer's own work or phenomenal class subjects, the past tense for reporting the findings and the present tense for making generalizations, epistemic and attitudinal words, and *that*-complement clauses. Finally, as regards the linguistic realizations of M5, reference to the writer's own work and phenomenal class subjects are common with a strong preference for the present tense, modal verbs, stance words, self-reference pronouns, reporting verbs, and *that*-complement clauses.

Anderson & Maclean (1997, pp. 3-22) is another study dealing with the linguistic realizations of moves in the abstract. They postulate that M2 is commonly linguistically realized by lexical subjects such as *purpose*, *aim*, and *objective*, followed by the copula *be*, and a non-finite *to*-infinitive clause with such lexical verbs as *examine*, *assess*, *study*, *evaluate*, *determine*, and *test*; meta-textual collocations of inanimate subjects and animate verbs, such as *this paper reports*; and statements containing implications of purpose. As for M3 and M4, common linguistic realizations include chronological ordering, the past passive, the co-occurrence of inanimate noun subjects and active present verbs, and self-reference *we* with past verbs. Finally, M5 is generally linguistically realized by change from the past tense to the present tense with the use of modals; anaphoric reference to the findings, such as *these data*; lexical verbs for making claims, such as *suggest*, *appear*, *show*, and *demonstrate*; modal verbs, such as *may* and *can*; attitudinal words, such as *important* and *useful*; modal or lexical verbs showing recommendations, i.e. *should* and *need*; and lexical verbs explicitly announcing conclusion, such as *conclude*; and logical connectors, i.e. *thus*, *therefore*, and *hence*.

Move cycling

The term *move cycling*, *move recycling*, *move repetition*, *move reiteration*, or *cyclical patterning* has been used elsewhere in the literature without being given a formal definition. In this article, it is tentatively defined as a textual feature characterized by the reiteration of a single move or more to accord with the organization of the accompanying text, to comply with the convention of the corresponding discourse community, or to serve an individual's communicative purposes, or a combination of these. An example of move cycling is provided below.

> *The adjacency parameter was first applied [M3]. . . Regarding the adjacency condition, the native group placed adverbs quite equally between the clause-initial and the clause-medial positions. On the other hand, the learner groups put [much] more adverbs clause-initially [M4]. . . In addition to the adjacency parameter, the lexical parameter was adapted [M3] . . . It was found that the natives placed adverbs in the majority of the 37 semantic classes in more positions than the advanced learners, whose range of positions of adjunction was broader than that of the intermediate learners... [M4] (Thai 7)*
>
> Pasavoravate (2011, p. 96)

Swales (1990) suggests that the moves in his CARS model do not flow from the first to the last in a linear pattern. This means although M1-M2-M3 is a likely rhetorical organization, it is *only* one among many other possibilities, such as M1-M2-M1-M2-M3, in which M1 and M2 are recycled, and M1-M2-M3-M2-M3, in which M2 and M3 are cyclical. Such a contention was later attested to in other studies addressing different sections of RAs, including Bunton (2002), Hyland (2000), Kanoksilapatham (2005), Ruiying & Allison (2003), and Samraj (2002). Bunton (2002), for example, found in his analysis of 45 Ph.D. thesis introductions that only three followed the conventional pattern of M1-M2-M3, whereas the vast majority contained moves that were recycled as often as up to 18 times and 5.5 times on average. Well aware of such counter-evidence, Swales (2004) has modified the CARS model, stipulating that it is possible for any of the moves to be recycled as more specific issues are introduced, especially M1 and M2 (p. 230). Evidently, empirical research has strengthened the theoretical underpinnings of genre analysis, particularly those relating to scholarly writing.

It is unfortunate, however, that while move cycling has been extensively investigated in studies on other RA sections, it has not been substantiated in research on the rhetorical structure of the abstract. The issue was addressed *en passant* in Bunton (2002), Hyland (2000), Kanoksilapatham (2013), and Swales (1990, 2004), and more thoroughly only in Pasavoravate (2011). Pasavoravate (2011) compared thesis and dissertation abstracts in linguistics authored by graduate students in Thailand and England. Examining 35 abstracts from different Thai universities and 35 abstracts from different British universities, she found marked differences between the abstracts in the two corpora. Specifically, only three in the Thai corpus involved cyclical patterning with two repeating M3 and one reiterating M2, whereas as many as twenty abstracts in the British corpus illustrated move cycling with M2 being most reiterated, followed by M4 and M1, respectively.

Related research

This part discusses previous research on the rhetorical pattern of the abstract in three aspects: sample size, representativeness, and coding reliability. Kanoksilapatham (2015) emphasizes the importance of validity in genre studies, specifying that this can be achieved by collecting sizeable data in ways that ensure representativeness from sources that reflect the discourse community of the text under investigation and analyzing the data using a protocol that minimizes subjectivity.

In Kanoksilapatham (2013), twelve abstracts were randomly selected from each of the top five journals in civil engineering. No specifications were made as to how coding reliability was established, however. Using these three criteria as a point of departure, in terms of sample size, Ren and Li (2011) collected only five abstracts from five journals and 25 abstracts from Chinese master's theses, while Kanoksilapatham (2009) did not reveal any information in this regard. This problem was spotted in Lores (2004), who selected nine abstracts from four journals; Doro (2013), who included ten abstracts from two journals; Pho (2008), who analyzed ten abstracts from three journals; and Samraj (2005), who examined twelve abstracts from two journals. Saeeaw and Tangkiengsirisin (2014), Suntara and Usaha (2013), and Oneplee (2008), fared much

better, constructing their corpora from 25 abstracts in eight journals, approximately thirty abstracts in six journals, and as many as fifty abstracts in two journals, respectively.

As regards representativeness, Kanoksilapatham (2005, 2015) considers the selection of journals and sampling procedures as important criteria, attaching importance to journal impact factors and random sampling. Doro (2013), Lores (2004), Pho (2008), Ren and Li (2011), Samraj (2005), Santos (1996), and Suntara and Usaha (2013) either made no reference to the journals from which their data were collected or reporting the source journals without providing additional information regarding their impact factors.

More impressive are Kanoksilapatham (2009), Oneplee (2008), and Saeeaw & Tangkiengsirisin (2014), who gathered their data from the top journals according to the impact factors of such scholarly publications. To illustrate, Saeeaw and Tangkiengsirisin (2014) derived their corpora from 25 abstracts in eight journals with the highest impact factors, namely Water Research, Journal of Environmental Sciences, Waste Management and Research, Bioresource Technology, Applied Linguistics, System, English for Specific Purposes, and TESOL Quarterly.

Finally, with respect to coding reliability, Kanoksilapatham (2009, 2013), Lores (2004), and Samraj (2005) did not detail their schemes, while Doro (2013) relied on double rating carried out three months apart by the same coder. A more stringent protocol was followed in Ren & Li (2011), Saeeaw & Tangkiengsirisin (2014), and Suntara & Usaha (2013), all of whom employed an expert rater, usually an academic specializing in discourse analysis, to independently code their data. The most rigorous procedures to ensure reliability in the classification of moves were reported in Oneplee (2008), who involved five raters in the coding process, namely two science experts, two linguistics academics, and herself.

Research Methods

This section details the construction of the corpora, the procedures for establishing inter-coder reliability, and the realizations of each move and analytical scope.

Corpus construction:

The construction of the corpora commenced with the determination of the two sub-disciplines to be investigated. In the present article, *computer engineering (CE)* and *electrical engineering (EE)* were of interest because they are the two departments with the highest number of students in 2014 at one of the oldest and most prestigious universities in Thailand. Furthermore, the two sub-disciplines can be considered closely-related, as reflected in the title of a leading scholarly publication Computers and Electrical Engineering, available on *Elsevier* and *ScienceDirect*. Thus, it should be beneficial to explore whether such *sister* sub-disciplines will bear greater similarities or differences in terms of rhetorical organization.

To this end, the top three journals in each sub-discipline were determined based on their impact factor. According to the 2014 Journal Citation Report, *IEEE Wireless Communications, IEEE Transactions on Neural Networks and Learning,* and *IEEE Network*[2] were the computer engineering publications with the highest impact factors of 5.417, 4.291, and 2.54, respectively, while *IEEE Transactions on Fuzzy Systems, IEEE Transactions on Industrial Electronics*, and *IEEE Transactions on Power Electronics* were the electrical engineering publications with the highest impact factors of 8.746, 6.498, and 6.008, respectively. To attain representativeness, thirty abstracts were randomly selected from the entire 2014 publications of each journal, excluding those that belonged to theoretical or review papers. This yielded a total of 180 abstracts running approximately 33,000 words. For ease of reference, the CE and the EE abstracts were indexed CE1, CE2, CE3, EE1, EE2, EE3, and so on.

[2] Communications of the ACM is actually the publication with the third highest impact factor of 3.621. The journal, however, features many types of articles that are characteristically different from those published in its computer engineering counterparts, and was thus replaced with IEEE Network.

Inter-coder reliability:

The procedures to sustain inter-coder reliability were as follows. One assistant professor in applied linguistics served as the second coder in this study. The coder received one-hour training on move classification in which the coding scheme based on Santos' (1996) model was provided, explained, and clarified (see 3.3 below for further details). Following this step, the coder spent an hour practicing coding five abstracts in CE and EE from the same journals under investigation but from a different publication year. The ten abstracts were purposively selected to represent instances of linear progression from M1 to M5, the omission of certain moves, and move cycling, for instance, in order to expose the coder to different rhetorical patterns involving various degrees of analytical difficulty. After that, discussion was made to resolve possible problematic areas and negotiate potential disagreements.

Subsequently, the coder was given ten CE and ten EE abstracts randomly selected from the larger pool of data, and classified moves in those abstracts independently. The coder was also advised to scrutinize the classifications a second time or more as deemed appropriate. Once the coding was completed, inter-coder reliability was calculated using Cohen's Kappa (Kanoksilapatham, 2005, 2015), to ensure correspondence in the identification of move boundaries conducted by the present author and the second coder. The Cohen's Kappa coefficient stood at 89.97%, indicating high inter-coder reliability and thus a satisfactory degree of coding agreement.

Realizations of each move and data analysis:

Following Santos (1996) and Swales (1990), each move was identified based on both content and linguistic criteria in order that the analysis was least arbitrary, subjective, and circular. Move classification was performed according to Santos' (1996) framework for two reasons. First, despite being developed originally for an analysis of abstracts in applied linguistics, the model has been successfully applied in research exploring scientific abstracts (e.g. Oneplee, 2008). Second, as Pho (2008) rightly notes, the nomenclature of each move in Santos (1996) carries more meaning than that in other studies, e.g. labeling the first move as situating the research instead of background or introduction, and so on. Following Suntara & Usaha (2013), when move embedding, i.e.

the incorporation of more than one move into a sentential or clausal unit, was found, the classification proceeded as such.

To recapitulate, Santos (1996) proposes that the abstract is comprised of five rhetorical moves. The realization of each move together with its linguistic exponents is presented in the examples below.

> Situating the research
> *Energy efficiency and bandwidth efficiency are **two paramount important performance metrics** for device-to-device communications.* [CE10]
> Presenting the research
> ***The main aim of this article** is to propose a healthcare traffic control over the modern heterogeneous wireless network…* [CE12]
> Describing the methodology
> *We **design** a unified protocol stack that includes all the original functions of both LTE and WLAN systems.* [CE23]
> Summarizing the findings
> *Compared with the fuzzy linear regression and back propagation network approach, the proposed methodology **reduced** the average range and mean absolute percentage error **by 18% and 99%**, respectively.* [EE6]
> Discussing the research
> *We **explain how ACWW problems can solve some potential prototype engineering problems** and connect the methodology of this paper with Perceptual Computing.* [EE19]

Upon the completion of the classification, the frequency of each move was counted to determine its status as being obligatory, conventional, or optional. Based on Kanoksilapatham (2005, 2015), a move was considered obligatory, conventional, or optional if located in 100%, between 60% and 99%, and lower than 60% of the data, respectively. In addition to the assignment of the status of each move, the preferred move sequences were also identified in conjunction with the determination of move cycling, if any. Finally, attempt was made to highlight instances of moves not having been pinpointed in previous research.

Results

The present study aims to investigate the organization of the abstract in three aspects: the status of each move, move sequences and move cycling, and emerging rhetorical patterns. To better represent the results, the moves are abbreviated as follows.

M1 = Situating the research
e.g. *Yield forecasting is an **important** task for the manufacturer of semiconductors. Owing to the uncertainty in yield learning, it is, however, often **difficult** to make precise and accurate yield forecasts.* [EE6]

M2 = Presenting the research
e.g. ***This paper addresses** the universal fuzzy integral sliding-mode controllers' problem for continuous-time multi-input multi-output nonlinear systems…* [EE9]

M3 = Describing the methodology
e.g. *Fuzzy logic systems **are used to identify** the unknown nonlinear functions, and a fuzzy state filter observer **is designed to estimate** the unmeasured states.* [EE22]

M4 = Summarizing the findings
e.g. *… we demonstrate that TOSS can reduce by 63.8-86.5 percent of cellular traffic while satisfying the access delay requirements of all users.* [CE14]

M5 = Discussing the research
e.g. *We also discuss some fundamental research issues arising with the proposed architecture to illuminate future research directions.* [CE22]

Moves:

To determine the status of a move as obligatory, conventional, or optional, Kanoksilapatham's (2005, 2015) criteria were adopted. Table 1 presents the number of abstracts containing each of the five moves together with the corresponding percentages.

The results show that conventional and optional moves were more common than obligatory ones in both sub-disciplines. In CE, no obligatory moves were identified. EE, in contrast, involved two obligatory moves, namely M2 and M3. Analyzed individually, CE demonstrated a lower status of M4 as a conventional move than M2 and M3. The findings in the literature being considered, it came as a surprise that M4 was in fact closer to being an optional move in this sub-discipline. As for EE, apart from the two obligatory moves, it is interesting to find that M1 seems to be an optional move. The

standing of M4 as a conventional move and M5 as an optional move with such a low frequency of occurrence was also contrary to expectations.

Table 1 Moves in CE and EE abstracts

Moves (M)	Computer engineering (CE)		Electrical engineering (EE)	
	No. of abstracts containing move (N = 30)	Percentage	No. of abstracts containing move (N = 30)	Percentage
1	69	76.67	46	51.11
2	88	97.78	90	100.00
3	85	94.44	90	100.00
4	70	77.78	79	87.78
5	31	34.44	34	37.78

Move sequences and move cycling:

Move sequence is the order or the pattern in which the five moves are structured. To identify this, moves in all the abstracts were classified before the frequency of each move pattern found was counted. Table 2 exhibits the number of abstracts in each sub-discipline containing each instance of move sequences with the corresponding percentage.

According to the results, the number of move sequences was greater in EE than in CE, suggesting that there may be more structural variations in the former. For the CE abstracts, the most common move sequence was M1-M2-M3-M4, whereas the EE abstracts made equal use of the M1-M2-M3-M4 and the M2-M3-M4-M3-M4 patterns, but the occurrence of these three organizations was not frequent relative to the total number of abstracts. Contrary to expectations, the conventional M1-M2-M3-M4-M5 structure was not common, occurring in only eleven abstracts in both sub-disciplines combined. When an alternative representation of the conventional five-move structure, i.e. M2-M1-M3-M4-M5, was considered, it appeared in only three EE abstracts but not the CE ones.

Table 2 Move sequences in CE and EE abstracts

No.	Move sequences	Computer engineering (CE)		Move sequences	Electrical engineering (EE)	
		Frequency	Percentage		Frequency	Percentage
1	1-2-3-4	17	18.89%	1-2-3-4	8	8.89%
2	2-3-4	6	6.67%	2-3-4-3-4	8	8.89%
3	1-2-3-5	5	5.56%	2-3-4	7	7.78%
4	1-2-3-4-5	5	5.56%	2-3-4-5	6	6.67%
5	2-3-4-3-4	5	5.56%	1-2-3-4-5	6	6.67%
6	1-2-3	4	4.44%	2-3	3	3.33%
7	1-2-4-3-4	4	4.44%	2-4-3	3	3.33%
8	1-2-5	2	2.22%	2-1-3-4-5	3	3.33%
9	2-3-4-5	2	2.22%	2-1-3-4	2	2.22%
10	1-2-3-2-3	2	2.22%	1-2-3-2-4	2	2.22%
11	1-2-3-4-3	2	2.22%	1-2-3-4-3-4	2	2.22%
12	2-3-2-3-4	2	2.22%	1-2-3-4-3-4-5	2	2.22%
13	1-2-3-2-4-5	2	2.22%	1-2-3	1	1.11%
14	1-2-3-4-3-4	2	2.22%	2-3-5	1	1.11%
15	1-2-4-2-3-4	2	2.22%	1-2-1-3	1	1.11%
16	1-2-4	1	1.11%	1-2-3-2	1	1.11%
17	1-4-5	1	1.11%	1-2-4-3	1	1.11%
18	1-2-3-2	1	1.11%	2-1-4-3	1	1.11%
19	1-2-4-3	1	1.11%	2-3-2-3	1	1.11%
20	1-2-4-5	1	1.11%	2-3-4-3	1	1.11%
21	2-4-3-4	1	1.11%	1-2-4-3-4	1	1.11%
22	3-4-3-4	1	1.11%	2-1-4-3-4	1	1.11%
23	1-2-1-3-4	1	1.11%	2-1-4-3-5	1	1.11%
24	1-2-3-5-2	1	1.11%	2-3-1-2-5	1	1.11%
25	1-2-5-1-4	1	1.11%	2-3-2-3-4	1	1.11%
26	1-2-5-2-5	1	1.11%	2-3-2-4-5	1	1.11%
27	2-1-2-3-5	1	1.11%	2-3-4-3-5	1	1.11%
28	2-4-3-4-5	1	1.11%	2-3-4-5-4	1	1.11%

No.	Move sequences	Computer engineering (CE)		Move sequences	Electrical engineering (EE)	
		Frequency	Percentage		Frequency	Percentage
29	1-2-1-2-3-4	1	1.11%	2-3-5-4-3	1	1.11%
30	1-2-3-1-3-4	1	1.11%	2-4-3-5-3	1	1.11%
31	1-2-3-2-3-4	1	1.11%	1-2-3-2-3-5	1	1.11%
32	1-2-3-2-3-5	1	1.11%	1-2-3-2-4-5	1	1.11%
33	1-2-3-5-3-4	1	1.11%	1-2-4-2-4-3	1	1.11%
34	2-3-2-4-3-4	1	1.11%	1-2-4-3-4-3	1	1.11%
35	2-3-4-3-4-3	1	1.11%	1-3-2-4-3-4	1	1.11%
36	2-5-3-1-3-5	1	1.11%	2-1-2-3-4-5	1	1.11%
37	1-2-3-1-2-4-5	1	1.11%	2-1-3-1-3-5	1	1.11%
38	1-2-3-1-3-4-5	1	1.11%	2-1-3-4-2-5	1	1.11%
39	1-2-3-2-3-4-5	1	1.11%	2-3-1-3-4-3	1	1.11%
40	1-2-3-2-5-4-5	1	1.11%	2-3-2-3-4-5	1	1.11%
41	1-2-3-5-2-3-5	1	1.11%	2-3-4-3-4-5	1	1.11%
42	2-3-2-3-4-5-4	1	1.11%	2-4-2-3-4-3	1	1.11%
43	1-2-3-4-3-4-3-4	1	1.11%	2-4-2-4-3-4	1	1.11%
44				2-4-3-4-3-4	1	1.11%
45				3-2-3-4-3-4	1	1.11%
46				1-2-3-4-3-4-3	1	1.11%
47				2-3-1-3-4-3-4	1	1.11%
48				1-2-3-2-4-5-2-3	1	1.11%
49				1-2-5-1-2-3-4-5	1	1.11%
50				2-3-4-3-4-2-3-4	1	1.11%
Total		**90**	**100.00**	**Total**	**90**	**100.00**

Another striking finding was the number of moves employed in the abstracts in each sub-discipline. In CE, except for those associated with the three most frequent sequences, a large number of abstracts contained more than five moves. For instance, six abstracts were made up of as many as seven moves and eight abstracts of six moves in CE. In comparison, the figure went slightly higher for EE with three abstracts being

comprised of up to eight moves and 21 abstracts of six to seven moves. Abstracts with less than five moves, on the other hand, were not rare either. In CE, fourteen abstracts consisted of only three moves, a phenomenon also characterizing the EE abstracts. All this suggests that following the conventional five-move structure is not considered essential, at least in the two sub-disciplines under investigation.

The final issue that deserved attention was uniformity. From the findings, it is apparent that there was hardly any preferred pattern. Although conventional structures were employed in slightly more abstracts, the number of those with idiosyncratic organizations was, in fact, much greater. In EE, only fifteen abstracts illustrated compliance with the convention (M1-M2-M3-M4, M1-M2-M3-M4-M5, and M1-M2-M3), whereas the great majority reflected instances of rhetorical individuation. Likewise, CE involved 64 abstracts that did not follow the prescribed structure with only 26 that did (M1-M2-M3-M4, M1-M2-M3-M4-M5, and M1-M2-M3). This is strong evidence that scholars are probably on the right track in realizing the need to steer away from genericity and toward specificity in approaches, and to account for individual variations in, genre studies.

As regards move cycling, all the abstracts were scrutinized again for recurring moves and then those demonstrating cyclical patterning were recorded. Presented in Table 3 is the number of times each of the five moves was reiterated in the two sub-disciplines.

Table 3 Move cycling in CE and EE abstracts

Moves (M)	Computer engineering (CE)	Electrical engineering (EE)
1	6	3
2	21	17
3	26	32
4	20	26
5	4	1
Total	**77**	**79**

The findings revealed a high degree of move cycling in both sub-disciplines with a greater extent of such a rhetorical phenomenon in EE than in CE. That is, moves were

cyclical in 79 EE abstracts but only 77 CE abstracts. On the other hand, the moves recycled in CE ranged across all the five types, whereas in EE, cyclical patterning was spotted for almost all except for M5, for which only one instance was identified. A closer look at the figures revealed another intriguing pattern. That is, for both sub-disciplines, M3 was reiterated the most, followed by M4 and M2. For instance, in EE, M3 was repeated in 32 abstracts, M4 in 26, and M2 in 17. A caveat is in order, however, since the cycling of each move occurred only once or twice throughout all the abstracts, it might be premature to make any conclusive generalizations. An example of the abstracts involving the cycling of M2 is provided below.

> *This paper* ***is concerned with*** *the fault detection (FD) problem for Takagi-Sugeno (T-S) fuzzy systems with unknown membership functions [M2]. If the membership functions are unknown, the linear FD filter designs with fixed gains* ***have been considered in the literature*** *[M1]. To reduce the conservatism of the existing results, a switching mechanism that depends on the lower and upper bounds of the unknown membership functions* ***is provided to construct*** *an FD filter with varying gains [M3].* ***It is shown*** *that the switching-type FD filter with varying gains* ***can achieve a better FD performance*** than *the linear FD filter with fixed gains [M4].* ***In addition****, based on some time-domain inequalities, a novel weighting matrix design approach* ***is introduced*** *to transform the fault sensitivity specification into an H∞ constraint [M2]. Finally, two examples are given to* ***show the advantages*** *of the proposed FD method [M5].* [EE4]

The abstract opens with M2, stating the objective of the research, signaled with a verb phrase containing the lexical adjective '*concerned*' before providing the background that situates the study, i.e. M1, typified with a verb phrase with the lexical verb '*considered*' and an adverbial containing the epistemic noun '*literature*.' Then the methodology, i.e. M3, is explained using a verb phrase comprised of the lexical verb '*provided*' followed by a *to*-infinitive construction and the lexical verb '*construct*.' The presentation proceeds with M4, demonstrated by the use of a matrix clause containing the lexical reporting verb '*shown*,' a *that*-complement clause, and a verb phrase with the modal verb '*can*.'

Reiteration is signified with the sequence-marking conjunctive adverb '*in addition*.' The rhetorical function of the following clause is unclear at first glance

because the lexical verb '*introduced*' does not carry much meaning in this regard and in this particular context. However, it later becomes clear that the clause serves as M2, stating the other, although secondary in status, objective of the research. The reason for this interpretation is what follows is M5, discussion of the advantages of the proposed approach.

Emerging rhetorical patterns:

After the moves in the two corpora were classified and the move sequences in all the abstracts were determined, a third round of analysis was conducted in order to identify whether there were any emerging rhetorical patterns. Presented below are two examples of a novel type of organization spotted in the data.

> *Energy efficiency and bandwidth efficiency are two* ***paramount important*** *performance metrics for device-to-device communications [M1]. **In this work**, we **investigate** how mobility impacts EE and BE in a general framework of an LTEAdvanced network [M2]. **First**, we **deploy** a simple but practical mobility model to capture the track of the mobile devices. In particular, unlike previous works focusing on mobility velocity, which is difficult to obtain in practical mobile D2D systems, we **deploy** the parameter of device density to describe the device mobility [M3]. **Next**, we **investigate** the relationship between EE and BE in a mobile environment, and **propose** an EE-BE-aware scheduling scheme with a dynamic relay selection strategy that is flexible enough for making the transmission decision, including relay selection, rate allocation, and routing [M2]. **Subsequently**, **through rigorous theoretical analysis** [M3], we derive a precise EE-BE trade-off curve for any device density and **achieve** the condition to attain the optimal EE and BE simultaneously. **Finally**, numerical simulation **results are provided** [4] to **validate the efficiency** of the proposed scheduling scheme and the correctness of our analysis [M5].* [CE10]

> ***In this paper**, we **propose** and demonstrate an effective methodology for implementing the generalized extension principle to solve Advanced Computing with Words (ACWW) problems [M2]. Such problems involve implicit assignments of linguistic truth, probability, and possibility [M1]. **To begin**, we **establish** the vocabularies of the words involved in the problems, and **then collect** data from subjects about the words after which fuzzy set models for the words **are obtained** by using the Interval Approach (IA) or the Enhanced Interval Approach (EIA). **Next**, the solutions of the ACWW problems, which involve the fuzzy set models of the words, **are formulated** using the Generalized*

Extension Principle [M3]. ***Because*** *the solutions to those problems involve complicated functional optimization problems that cannot be solved analytically [M1], we* ***then*** *develop a numerical method for their solution.* ***Finally****, the resulting fuzzy set solutions* ***are decoded*** *into natural language words using Jaccard's similarity measure [M3]. We* ***explain*** *how ACWW problems* ***can solve*** *some potential prototype engineering problems and* ***connect the methodology*** *of this paper with Perceptual Computing [M5]*. [EE19]

A careful examination of the data revealed a unique move structure that has not been pointed out elsewhere, except in Ren & Li (2011)[3] and Samraj (2005). As shown in the extracts, CE10 was characterized by a distinct move structure M1-M2-M3-M2-M3-M4-M5. Likewise, the move sequence of EE19 was anything but a generic one, constructed with M2-M1-M3-M1-M3-M5. In addition to such idiosyncrasies, the two abstracts shared another important commonality. That is, both seem to involve presentation of the organization of the accompanying article, closer to the optional Move 3D (indicating the structure of the research) of the research introduction in Swales and Feak (2004, 2009). CE10 employed the use of the sequence-marking conjunctive adverbs '*first*,' '*next*,' '*subsequently*,' and '*finally*' to convey how the paper was structured. A similar rhetorical strategy was also at work in EE19, in which conjunctive adverbs were amply exploited to guide the audience through the organization of the article. Even more profound was that the conventional five-move structure of the abstract and the last optional move of the research paper was aptly interwoven, resulting in two subtly coherent layers of rhetorical structure. Such a pattern emerged in twelve CE abstracts and four EE abstracts—a small, yet meaningful figure.

Discussion

Throughout its rich history, genre analysis has provided valuable insights to EAP and ESP practitioners in terms of textual structures in various genres and the peculiarities inherent in each. It is the latter, however, that keep the momentum moving, deepening the current understanding of the intricate relationships between discourse communities

[3] The relevant part of their corpora, however, is different from those in this article. More details will be provided later in the discussion section.

and texts, and paving the way for further research. In this study, several eccentricities are revealed.

In terms of the status of moves as obligatory, conventional, or optional, the present findings deviate from most of those previously reported (e.g. Ayers, 2008; Kanoksilapatham, 2009, 2013; Ren & Li, 2011; Saeeaw & Tangkiengsirisin, 2014; Santos, 1996; Suntara & Usaha, 2013). For example, M1 was either conventional or optional in most of the works cited, whereas it played a mainly conventional role in CE in this study. The same applies to M2, which surfaced in approximately 80% of those studies but are instantiated in almost 100% here. On the other hand, M4, the supposedly conventional, if not obligatory, move appears in only 78%-88% of the CE and EE abstracts analyzed. This contradicts the results of previous research, most of which indicated the occurrence of M4 at around 90%. A comparison with only studies dealing with science disciplines, i.e. civil engineering in Kanoksilapatham (2013), natural science in Oneplee (2008), and environmental science in Saeeaw & Tangkiengsirisin (2014), also makes clear that counter arguments on the grounds of interdisciplinary variations does not rule out such marked differences.

A logical question following from the foregoing discussion is to what factors those distinct dissimilarities can be attributed. Take M1 in CE as an example. A partial answer can be found in Orr (1999), who contends that unlike the traditional branches of engineering, computer engineering is a new field that is in the process of expanding and evolving. Shaw (2003, 726) also subscribes to this view, adding that for new fields with relatively little 'well-established research paradigms,' there is a need to establish the scope of a particular study, which is often not available even to the research community. These are probably some of the underlying mechanisms leading to the conventional status of M1 in this study, at least for CE. The question remains to be answered, however, as to why such standing of M1 is not also realized in a comparatively novel discipline like electrical engineering.

Another surprising result is that M4 is present in only 78% of the CE abstracts and 87% of the EE abstracts despite its significant role in many disciplines. The data alone suggest that the authors might have chosen to delay the presentation of the findings, perhaps to attract the audience to flip through the pages to that piece of

information. Alternatively, prominence given to different types of information may be a factor determining the degree to which M4 is substantiated in these two engineering sub-disciplines (Saeeaw & Tangkiengsirisin, 2014).

As regards move sequences, the results reported depart markedly from those of previous research. Kanoksilapatham (2009), for instance, investigated moves in the abstracts of articles in software engineering, a discipline closely related to computer engineering. She found that M3-M4-M5 was a likely sequence. Although the same canonical structure, i.e. M1-M2-[M3-M4-M5], is partly identified in both the CE and the EE abstracts, noticeable variations are also recognizable in at least two aspects. First, the traditional move sequence does not seem to be followed in this study with the total number of abstracts containing unconventional sequences greatly surpassing those structured in a conventional way. Similar findings were reported only in Ayers (2008), who found the prescribed five-move pattern in as little as 18% of his data.

Second, in Kanoksilapatham (2009) and others, the rhetorical sequence of the abstracts examined were comprised of two to five moves, contradicted by the six-, seven-, and eight-move sequences identified in the present study. On a superficial level, such a phenomenon seems to be inexplicable, but it is likely that rhetorical structures are varied for a reason that will be explicated below.

Turning now to move cycling, the present findings go along with those of a number of previous studies. Kanoksilapatham (2013) discovered in her examination of sixty civil engineering abstracts that M3, M4, M5, and M2 were cyclical in ten, eight, three, and two abstracts, respectively. Pho (2008) similarly found a few instances of move reiteration in thirty linguistics and applied linguistics abstracts in her data. Likewise, Saeeaw and Tangkiengsiri (2014) mentioned having located move cycling, although exclusively in environmental science abstracts. What distinguishes the results reported here from those in the works cited is the relatively high degree at which the cycling of moves is evident, nine times for M1, 38 times for M2, 58 times for M3, 46 times for M4, and five times for M5.

What, then, may account for this pervasive influence of cyclical patterning? According to Kanoksilapatham (2013), engineering, particularly civil engineering, is featured by series of experimental procedures generating different sets of output,

possibly resulting in a second or third mention of certain moves. This explains the somewhat frequent reiteration of M3 in this article. Also, the argument put forth by Orr (1999) and Shaw (2003) that computer engineering is a young discipline suggests that its rhetorical pattern may not be at a fully-fledged stage, displaying more variations than conformity and hence more frequent recycled moves. The last and perhaps more solid reason giving rise to move cycling lies in interface between syntax and semantics. Excerpts from the CE10 and the EE19 abstracts above are reproduced as an example.

> *... In this work, we investigate how mobility impacts EE and BE in a general framework of an LTEAdvanced network [M2]. First, we deploy a simple but practical mobility model to capture the track of the mobile devices. In particular, unlike previous works focusing on mobility velocity, which is difficult to obtain in practical mobile D2D systems, we deploy the parameter of device density to describe the device mobility [M3]. Next, we investigate the relationship between EE and BE in a mobile environment, and propose an EE-BE-aware scheduling scheme with a dynamic relay selection strategy that is flexible enough for making the transmission decision, including relay selection, rate allocation, and routing [M2]. Subsequently,* ***through rigorous theoretical analysis [M3]****, we derive a precise EE-BE trade-off curve for any device density and achieve the condition to attain the optimal EE and BE simultaneously. Finally, numerical simulation results are provided [4] to validate the efficiency of the proposed scheduling scheme and the correctness of our analysis [M5].* [CE10]

> *... Such problems involve implicit assignments of linguistic truth, probability, and possibility [M1]. To begin, we establish the vocabularies of the words involved in the problems, and then collect data from subjects about the words after which fuzzy set models for the words are obtained by using the Interval Approach (IA) or the Enhanced Interval Approach (EIA). Next, the solutions of the ACWW problems, which involve the fuzzy set models of the words, are formulated using the Generalized Extension Principle [M3].* ***Because the solutions to those problems involve complicated functional optimization problems that cannot be solved analytically [M1]****, we then develop a numerical method for their solution. Finally, the resulting fuzzy set solutions are decoded into natural language words using Jaccard's similarity measure [M3]. We explain how ACWW problems can solve some potential prototype engineering problems and connect the methodology of this paper with Perceptual Computing [M5].* [EE19]

In CE10, M3 is syntactically integrated into M4 to derive a more encompassing meaning indicating how the results are achieved, leading to the recycling of M3. Likewise, in EE19, the conflation of M1 through a syntactic means highlights the importance of the implementation of M3, resulting in M1 being cyclical. Hypothetically, an incorporated move may be the cause of cycling itself, or may contribute to the cycling of another move, or both. Furthermore, although the examples above depict the merging of moves realized by dependent syntactic constructions, the insertion of independent ones is also possible (Pho, 2008; Saeeaw & Tangkiengsirisin, 2014). Whichever the case, such semantico-syntactic strategies interrupt the conventional single progression from M1 to M5, bringing about the peculiar and highly varied move sequences discussed earlier. Pho (2008) reported comparable findings, indicating that M3 was likely to be embedded in M2 or M4 due to its flexible syntactic realizations as a participial phrase or a noun phrase that can be adjoined to M2, M4, or even M5. This kind of move embedding (cf. Swales, 1990; Pho, 2008) and its complex interactions with move sequences and the overall rhetorical pattern of the abstract is an understudied area of investigation deserving more attention.

The last focus of this research is the emergence of a new rhetorical pattern. As pointed out in the previous section, sixteen abstracts, i.e. twelve in CE and four in EE, appear to amalgamate both the conventional moves of the abstract and the last optional move of RA introductions, 3D: indicating the structure of the research (Swales & Feak, 2004). This finding is relatively new and hence partially corroborated by only a few studies in the far-reaching evolution of abstract analysis, namely Ren & Li (2011) and Samraj (2005). The abstracts examined in Ren & Li (2011) were found to infuse what they referred to as the ‘structure’ move (p. 165). It should be noted, however, that the portion of their data exhibiting such a novel move differs sharply from that in the present article, involving thesis abstracts rather than RA ones. In regard to this, Dudley-Evans (1997) and Swales (1990, 2004) posit that in comparison with RA abstracts, thesis abstracts are characteristically longer and entail more structural complexities, an assertion that can account for the structure presentation in Ren & Li (2011) but not that in this study.

Samraj (2005), on the other hand, explored moves in environmental science abstracts of articles published in Conservation Biology and Wildlife Behavior, applying an innovative approach integrating both Swales' (1990) and Bhatia's (1993) frameworks in her analysis. She found that the abstracts in the two leading journals could be characterized by the centrality claim and the gap moves in Swales (1990). Specifically, centrality claims surfaced in seven abstracts in the former and one in the latter, while gaps were employed in six Conservation Biology abstracts and two Wildlife Behavior abstracts. It is worth noting that although her findings reflect the use of centrality claims and gaps, it should not be uncommon to find such constituents of RA introductions integrated in the abstract. A possible reason is that one function of the abstract is to enthuse the audience for readership of the accompanying article, and indicating the centrality of a study along with identifying a gap in the discipline is likely to serve that purpose. The driving force behind the incorporation of article structures found in the present data is perhaps a different one.

The data being considered alone, it may be postulated that presenting the structure of an article is a means to several ends. To begin with, as Kanoksilapatham (2013) notes, one discernible characteristic of engineering research is that it involves several cycles of experiments and results. Thus, structure presentation in the CE and EE abstracts may be deemed as an appropriate strategy to provide an overview of the whole article to help the audience decide its relevance. Alternatively, including such a constituent is likely regarded as a cognitive aid, easing getting through what would otherwise be a complicated reading task.

A last possibility is that the abstract with such a textual feature may be a constellation of individual variation or deliberate manipulation of the target genre. As Bhatia (2004) argues, genericity is not to be mistaken for universality; that is, although rhetorical structures are somehow governed by conventions, they are also subject to room for innovation. Similarly, Hyland (2012) contends that disciplinary practices are not shallowly followed but tactically interacted on, negotiated, co-constructed, and individualized by discourse members. Such a view is accentuated in Dressen-Hammouda (2008), who propounds that one goal for language learners is to be able to "use the conventions to develop their individual expression and make their own impact on the

discipline" (p. 155). Thus, the incorporation of article structures in or the flouting of the canonical structure of the abstract discussed earlier does not seem to take place out of all recognition but for a legitimate reason. Regardless of which interpretation is the case, if any, it remains clear that yet another pattern is emerging—outlining the structure of an article early in the abstract.

Conclusion

The discipline of genre analysis, especially that relating to a study of the textual patterns of RAs and related publications, has advanced dramatically since the 1980s, bringing to light fluid interrelationships between discourse communities, texts, and individuals. This study aims to reveal new findings concerning the status of different moves in the abstract, move sequences and move cycling, and the emergence of novel rhetorical organizations. The results seem to provide concrete evidence that variations figure prominently not only *across* but also *within* disciplines or even between closely-related sub-disciplines. In addition, the eccentric move sequences and the great number of move combinations found seem to underline the fact that conformity to the traditional five-move structure of the abstract is probably fading away into obscurity, at least in CE and EE, thereby rendering ascribing firmly to a particular organizational convention obsolete. Furthermore, move cycling appears to be abundant in the present data, a manifestation of both the effort to accomplish communicative purposes and the indistinguishable relationships between studies in genre and syntax. Finally, it seems that a new type of rhetorical make-up is surfacing in which the abstract embraces presentation of the structure of the accompanying article.

To conclude, genre knowledge is not a panacea solving scholarly writing problems once and for all (Flowerdew, 2000; Kay & Dudley-Evans, 1998). Clinging to the belief that it is can lead to undesirable over-prescriptivism (Dudley-Evans, 1997). Thus, in spite of its pedagogical applications for novice writers, the conventional pattern should not be given as much emphasis (Dudley-Evans, 1997, 2000; Hyland, 2006) as how genre analysis can provide insights that help students to maintain a balance between observing discourse community conventions and expressing their own voices to secure

standing in their respective discipline (Bhatia, 1997; Dudley-Evans, 1997; Hyland, 2015).

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Biodata

Rananda Rungnaphawet qualified with a B.B.A. in General Management from Assumption University in 1998. He earned an M.A. in Communications Studies from the University of Leeds, U.K., in 2001 and a Ph.D. in English as an International Language (English Linguistics) from Chulalongkorn University, Thailand, in 2008. He is currently a full-time English teacher at Chulalongkorn University Language Institute (CULI). His areas of interest include second language acquisition and interlanguage syntax, discourse analysis, genre analysis, and pragmatics.