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THE STRUCTURE OF ACADEMIC JOURNAL ABSTRACTS WRITTEN BY TAIWANESE PHD STUDENTS *

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ABSTRACT

Academic writing has been recognized to be embedded in wider social practices which assume participant relationships and determine how discourse should be structured and negotiated. Various discourse features of academic journal articles have been demonstrated to signal institutional and intertextual constraints (Hyland, 2000). This paper investigates structural elements of abstracts in academic journal articles relating to life science. We attempt to show how factors other than disciplinary interests and beliefs might also affect structural configurations of academic abstracts. We collected 80 instances of abstracts as the research data, including 50 samples from academic journal articles by Taiwanese PhD students of life science and the other 30 by foreign scholars of the same field. We found that the student writers tend to provide less background information in their abstracts. A substantial number of student abstracts present only a series of experimental results plus some concluding statements. The relatively less contextualization of the student abstracts might be due to factors like student writers' academic immaturity and their English proficiency. Our results might have some

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implications to the teaching of academic English in a foreign language situation.

1. Introduction

An abstract has been defined as "an abbreviated, accurate representation of the contents of a document" (Cremmins, 1982: 3). Abstracts vary in length and content in different situations. In academic journals, an abstract normally occurs immediately after the title. Academic abstracts may also be published in journals solely established for that purpose. They may also be collected in electronic information sources subjected to a key word search. Good abstracts are supposed to be "highly structured, concise, and coherent" (Cremmins, 1982: 3). They should contain four types of information elements; these refer to "purpose, methodology, result, and conclusions presented in the original document" (Creminns, 1982: 5). They are supposed to answer four questions: (i) what was the main issue? (ii) how was the experiment conducted? (ii) what were the main observations? (iv) what did the observation mean or imply? These four elements are supposed to appear in that sequence.

Academic abstracts are more broadly read than the papers themselves. They help readers in deciding whether they should consult the document in its entirety. The role of abstracts has become increasingly important in many academic fields (Berkenkotter & Huckin, 1995; Hyland, 2000). This is mainly due to time constraints which may restrict a researcher's interest in reading the whole paper. In addition, the burgeoning swell of published information does not allow academics to read every article relevant to their interests. The important role of abstracts in academic research justifies the current study.

How to write an abstract is an important topic in many handbooks for technical or scientific English. Many handbook authors have been much concerned with the definition of abstracts. An abstract is sometimes viewed as a short passage which indicates "the object and scope, and the results achieved" (Hicks, 1959:139), or simply a "short report summary" ((Morris, 1966: 138); it may be recognized as a "synopsis which gives the

findings" (Eisenberg, 1982: 162); it may also be a "digest of the report" (Bingham, 1982: 226).

Most handbook authors distinguish two main types of abstracts: (i) the indicative abstract and (ii) the informative abstract. As Rathbone (1966: 19-20) points out, indicative abstracts inform and informative abstracts describe. These are further explained, respectively, as "brief abstracts" and "detailed abstracts" (Ross, 1974: 134). The matter becomes more complicated when some authors attempt to distinguish abstracts and summaries, and such distinction sometimes leads to confusion (e.g. Tichy, 1966; Ulman & Gould, 1972; Brusaw, Alred, & Oliu, 1976; Levine, 1978; Eisenberg, 1982; Godfrey, 1983; McMurrey, 1988; Pickett & Laster, 1988). This confusion is mainly due to the different criteria used by handbook authors to make a distinction between different types of synopsis. Some authors use function or content as criteria, others base on position in the document, others on length, and still others on the information sequence in the document.

In some handbooks published in recent years, the main concern has shifted to the internal structure of abstracts (e.g. Cremmins, 1982; Day, 1983; Weissberg & Buker, 1990; Kuo, 1993; Moriarty, 1997). Cremmins' (1982) demonstrates, on the basis of two sample articles, how the four information elements (i.e., purpose/scope, methods, results, and conclusions) can be recognized by means of what he calls "critical reading and rules". Equally impressive is his demonstration of how writing purposes may affect the formal construction of abstracts (Cremmins, 1982: 84-92). Another useful handbook is Weissberg & Buker (1990), which devotes a chapter to report abstracts. Their main concerns relate to linguistic realizations and to the information structure of abstracts in different academic fields. As discussed later on, their concept of "reduced abstracts" is particularly relevant to the interpretation of our findings. Kuo (1993: 234-235) regards an abstract as "a miniature of the research paper, suggesting that "the common structure for an abstract is problem-approach-results-conclusion". Moriarty (1997) also devotes a chapter to the instruction on the layout of abstracts. In addition to the distinction

between two types of abstracts (i.e., indicative abstracts and informative abstracts), her main contribution is how three kinds of "codes" (i.e., scientific criteria) may affect the information structure of abstracts in scientific discourse (Moriarty, 1997: 63-66).

Indeed, quite a few practical suggestions have been made regarding academic abstracts by handbooks for technical or scientific English. However, most suggestions are often very general, subjective or implicit in nature, and their usefulness to novice learners may thus be restricted. Such issues have inspired some researchers to investigate academic abstracts from the perspectives of genre analysis. An abstract has been suggested as an independent discourse (Van Dijk, 1980), a representation (Bazerman, 1984: 58), a distillation (Swales, 1990: 179), a crystallization (Salager-Mayer, 1990: 367), or a summary (Kaplan et al., 1994: 405) of an associated article. Bhatia (1993) observes that an abstract describes or presents a factual summary of a much longer report. The summary function of abstracts is further emphasized in other observations, echoing certain suggestions from handbook writers just mentioned. The conclusion of such previous research is best generalized in Salager-Mayer (1990: 370), arguing that abstracts should reproduce the construction of a full report, reflecting fundamental procedures in scientific enquiry and patterns of thoughts relating to particular disciplines. Hyland (2000) proposes that academic abstracts may be analyzed in terms of five structural elements: Introduction, Purpose, Method, Product, and Conclusion. Based on this analytical model, Hyland (2000) argues that the abstract structure is mainly determined by contextual factors such as communicative purposes, rhetorical considerations, and persuasive intentions of writers of various disciplines. This paper attempts to investigate whether the writer's academic maturity and language background may affect the actual realization of structural elements in academic journal abstracts.

2. Methodology

This discussion is mainly based on an interpretative analysis

plus some fundamental calculation. Our method was to carry out a move analysis and to search for structural features of academic journal abstracts which might provide some pedagogical implications for the teaching of English for academic purposes in a foreign language situation. The following are relevant information.

2.1 The corpora

Our data consisted of 80 abstracts taken from academic journal articles on life science. These included 50 samples written by Taiwanese PhD students doing research on life science in National Tsing Hua University and the other 30 was by foreign scholars in the same field.[1] The selection of articles was based on recommendations from a fifth year PhD student of life science, who was employed as a research assistant on this project. One of his tasks was to select articles published in the last 10 years and by different researchers and to ensure that the articles were from leading journals in the field. The details of the two corpora are summarized in the following table.

Table 1: Total numbers of sentences and units in the two corpora

Corpora	Sentences(Average)	Units[2] (Average)
PHDTXT (50 abstracts)	434 (8.7 per abs)	546 (10.9 per abs)
FRSTXT (30 abstracts)	306 (10.2 per abs)	369 (12.3 per abs)

Notes: PHDTXT = PhD student texts
FRSTXT = Foreign scholar texts

2.2 Analytical units

Our calculation of move distributions was mainly conducted in terms of analytical units made up of ranking clauses.[3] Some

[1] The selections were mainly based on speculation, from the authors' names and the affiliated academic institutions mentioned under the authors' names.
[2] The term 'units' refers to analytical units, to be explained in the next subsection.
[3] Halliday (1994) distinguishes between ranking clauses and embedded clauses. The

move boundaries might occur within the sentence. For example, each of the following sentences contains two analytical units.

(1) There is only one HpaII site located in the promoter region of rat PCNA gene and this HpaII site was found to be demethylated in both normal and regenerating livers. (Taken from Liu, et al., 1993)
(2) Neural disconnection of the CA from the brain mimicked the effect of mating, suggesting that enhanced cell proliferation is permitted by the removal of inhibitory signals from cerebral neurosecretory cells. (Taken from Chiang, et al., 1996)

In (1), the first clause realizes a Background move, whereas the second clause realizes a Result move. In (2), the primary clause (i.e., the main clause) realizes a Result move, but the secondary clause starting with *suggesting that* obviously realizes a Conclusion move. These examples suffice to argue that the notion of sentence is not adequate as an analytical unit in our current research. When ranking clauses become our analytical units, we are able to identify distinctive move categories within a sentence boundary. At the same time, there is no harm to those moves whose realization goes beyond the clause boundary because there are no upper limitations imposed on the possible range of a move category. A move may thus be realized by as many as ten ranking clauses as well as by a single one.

2.3 The analytical model

As noted above, Hyland (2000) analyzes academic abstracts in terms of five moves (or structural elements): Introduction, Purpose, Method, Product, and Conclusion. Our analytical model uses the category 'Result' to substitute for 'Product', to better suit the nature of our data. This is because the new category seems to represent more closely the consequence of an experiment which characterizes our corpus. This analytical model may be summarized in the following examples. All the examples in this

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former often function as hypotactic clauses; the latter are downranked to serve as modifiers in noun phrases.

section were taken from a PhD student's text, Lin & Markhart III, (1996).

Background (BAC). This move may be defined as a semantic unit in which the writer uses one or more clauses to state relevant information that is thought to be necessary for the understanding of what follows in the text. For example, the following two sentences are calculated as two Background moves in the text.

(3) Field observations suggest that *Phaseolus acutifolius* A. Gray is more heat and drought tolerant than *P. vulgaris* L. Since high temperature stress and water stress are difficult to separate in field experiments, we do not know if *P. acutifolius* is more high temperature tolerant than *P. vulgarism.*

Purpose (PUR). This move may be defined as a semantic unit in which the writer uses one or more clauses to specify the purpose or objectives of a research. For example,

(4) The goal of our research was to determine whether *P. acutifolius* is more heat tolerant than *P. vulgaris* in the absence of water stress.

Method (MET). This move may be defined as a semantic unit in which the writer uses one or more clauses to briefly describe materials used and/or procedures followed. For example,

(5) Plants grown at 25^0 C *for* 13 d in controlled environment chambers were separated into two groups; one group was maintained at 25^0 C for 8 d and the other at 32^0 C for 8 d. Air vapor pressure deficit at the two temperatures was maintained at 1.1 *kPa.*

Result (RES). This move may be defined as a semantic unit in which the writer uses one or more clauses to state or generalize what has been observed in an experiment. For example,

(6) *Phaseolus vulgaris* growth was significantly decreased at 32^0 C compared with growth at 25^0 C. The decrease included total leaf area, total dry weight, root weight, and net assimilation rate. [9] *Phaseolus acutifolius grew* similarly at both

temperatures. ...

Conclusion (CON). This move may be defined as a semantic unit in which the writer uses one or more clauses to state an implication or inference deduced from certain experimental results. For example,

(7) Our results indicate that at the tissue level *P. acutifolius* is more heat tolerant than *P. vulgarism*

2.4 Procedures

Since my analysis of texts involved longer stretches of discourse than individual sentences, all the work was done manually. First, I and my informant assistant examined each abstract in the corpus several times to gain some impression of the overall organization of the abstracts and to identify recurrent structural patterns. Next, we marked move categories, based on the analytical model just mentioned. To attain a high level of consistency in the assignment of certain problematic move categories, I and my informant assistant met numerous times, discussing irregularities and problems encountered. Then, the assistant helped with the calculation of move categories. Finally, I performed the interpretation of the data, with frequent consultation with the informant assistant.

3. Results and discussion

It was generally assumed that academic journal abstracts would be composed of five move categories: Background, Purpose, Method, Result, and Conclusion. According to suggestions in handbooks for technical English (e.g. Creminns, 1982; Day, 1983; Weissberg & Buker, 1990; Moriarty, 1997), all these elements are proposed as dominant in the data; they all contribute to the completeness of a text. And these elements would also occur in the same sequence, starting from the initial Background to the final Conclusion. Our findings partially support what has often been suggested in such handbooks. Considerable percentage of writers of the corpora go through five stages (i.e., moves) in their attempt to achieve the main goal of

writing a journal abstract: presenting the main points of the whole article. Our results may be summarized in the following table.

Table 2: Distribution of moves in two corpora

Corpora	Dominant moves calculated (% of the total)				
	Background	Purpose	Method	Result	Conclusion
PHDTXT (50)	24 (48%)	26(52%)	15 (30%)	50(100%)	47 (94%)
FRSTXT (30)	24 (80%)	27(90%)	18 (60%)	30(100%)	30 (100%)

Notes: PHDTXT = PhD student texts
FRSTXT = Foreign scholar texts

Overall, a very high percentage of abstracts by foreign scholars contain the assumed five move categories, with the exception of Method. These findings are largely consistent with most previous research results (e.g. Swales, 1990: 181), though not quite supportive of Hyland's (2000: 70) observation. In Hyland's corpus, about 14% of the texts do not form meaningful patterns and are thus left undifferentiated. Among the rest 86% of the total, only 46% of the biology abstracts contain Introduction, 90% have Purpose, 58% have Methods, 100% contain Results, and 65% have Conclusion. While the real causes of these discrepancies are not clear, one possibility is that Hyland's corpus comes from biology journal articles, whereas our current corpora are related to life science research.

Our results show that the student abstracts do not contain all the five moves as originally assumed. Among the 50 texts, only 24 texts have Background moves, among which 16 texts indicate topical significance (data not shown).[4] In other words, nearly

[4] Background moves sometimes contain lexical items which indicate topical significance. Consider the phrases printed in bold in the following three examples:
(i) Glucose is **one of the primary energy sources** for animal cells. (Taken from Wang & Wang, 1993)
(ii) Taxol, a microtubule stabilizing agent, **has been extensively investigated** for its

70% of the 24 abstracts use Background moves mainly for topical orientation.[5] Among the other 8 of the 24 texts, 5 of these texts (data not shown) use their Background moves for explanation purposes.[6] The other 3 abstracts contain the main features of "problematization" (to be discussed below). Therefore, most of the Background moves orientate the reader towards the topic of the research, with some Background moves providing common knowledge for local explanations.

While 27 of the 30 foreign scholar texts (90% of the total) contain a Purpose move, 26 out of 50 abstracts (about 52%) in the student corpus have this Purpose Move. Among these, 17 abstracts occur at the very beginning. In other words, these 17 abstracts mainly rely on the Purpose as a means of topical orientation. When a Purpose move is preceded by a Background move, the topical orientation is thus reinforced.

Next in the sequence come Method moves. While 18 of 30 of the scholar texts (about 60%) contain this move, only 15 instances out of the 50 abstracts (30%) were observed in the student texts. In both corpora, this move shows the least occurrence rate among the five categories. Although exact reasons are not clear, the frequent merging with other move realizations might have affected our final calculation (cf. Hyland, 2000: 73). Also, the strict word limit set for an abstract might have prompted authors to save space for other move categories. Moreover, there might be comparatively more difficulty in generalizing in one or two sentences the Materials and Methods used.

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antitumor activity. (Taken from Chu, et a., 1998)
Each of the bold-printed sections indicates that the topic in question is important and thus worth a thorough investigation. The significance of this feature in journal abstracts is further explored when we discuss Tables 3 and 4 below.

[5] When Background moves occur at the very beginning of an abstract, it has an orientation function in the discourse. This means that the background information somehow 'prepares the ground' or 'provides a standpoint/perspective' for readers to comprehend what is to be introduced.

[6] In the student corpus, some Background moves may occur somewhere in the middle or even near the end of an abstract. When this happens, the author attempts to explain the relevance of a certain finding or to provide extra information to facilitate a subsequent conclusion or deduction.

All the texts in both corpora have Result moves. This presence is understandable because results are, after all, what each article mainly intends to present. If the main task of researchers is to investigate their subject matters by reasoning and argument, then in empirically-oriented research fields such as life science, the raw evidence for reasoning and argument is supposed to be their experimental results. According to our interview survey, all of the ten Taiwanese professors affiliated with the Department of Life Science agreed that presenting results must be obligatory in writing an academic journal abstract. This comment has been empirically supported by our calculation of the students' abstracts as well as from that of the foreign scholars' corpus. All the 80 abstracts in the two corpora contain the Results move.

The Conclusion move is another popular category in both corpora, with a slightly smaller rate in the student texts (94% of the total). This is certainly a very crucial component in the genre under investigation. Its importance is due to the fact that the Conclusion serves as a logical end point in a chain of reasoning, a tentative explanation for the data in question. Generally speaking, our calculation of move categories in the foreign scholar texts largely supports most other previous research (e.g. Swales, 1990), and our results also appear to be consistent with what has often been suggested in writing handbooks for science and technology. The variation of the student texts deserves more discussion, which constitutes the focus of the subsequent discussion.

Our preliminary observation shows that the identification of the dominant moves in a text may also shed light on how structural elements may reflect the function of an academic genre. If an abstract can be divided into five moves (i.e., Background, Purpose, Method, Result, Conclusion), each of these categories is supposed to represent one whole section of an academic journal article. Background and Purpose moves condense the key points of the Introduction, the Method move represents the salient points of the Materials and Methods, the Result condenses the observations specified in the Result section, and the Conclusion move condenses the important points of the Discussion section. Such an abstract can function as a microcosm of an academic

journal article.

Abstracts are generally strict in their word limit, but good abstracts are also supposed to "explain to the general reader why the research was undertaken and why the results should be viewed as important" (quoted from *Science* by Moriarty, 1997: 63). This requirement is generally reflected in the scholar corpus. As Moriarty argues, there are three scientific criteria for journal authors to show the significance of their research. First, the authors can emphasize the recency of their research to show the importance of their work. Second, the authors can show how their work makes an innovation to the field. Third, the authors can indicate that there is a problem which may be solved or partially solved or possibly solved by their findings. As demonstrated below, such a requirement is perhaps most conveniently realized through Background moves, and implicitly or indirectly through Purpose or Method moves in an abstract. The interrelationship among the move categories can be appreciated in the analysis of a student text displayed in Table 3 below.

Table 3: The move structure of Text 1 (Taken from Tzang, et al., 1999)

Units[7]	Moves calculated	Phrasal signals printed in bold
1	Background	The ... gene p53 **plays an important** …
2	Background	the gene ... of p53 **functions as** ...
3	Background	the status of p53 ... **remains** an ...
4	Purpose	CHO.KI cells **were investigated**.
5	Result	P53 proteins **was elevated** ...
6	Result	and the proteins **formed** specific ...
7	Result	Its activities ... **were inducible** ...
8	Result	the mutation ... **had no effect** ...
9	Result	The CHO.KI cells **failed to** ...
10	Conclusion	**indicating that** the failure was not …
11	Conclusion	**This result** is consistent with ...

[7] As exemplified in Tables 3, 4, and 5, analytical units can be finite or nonfinite clauses.

Analysis of Text 1 shows that it contains the following move categories: Background, Purpose, Result, and Conclusion. Obviously, the structure does not fully correspond to the five-move structure as originally hypothesized. As mentioned earlier, none of the text in the student corpus has the hypothesized structure. Nevertheless, the four semantic blocks as represented by the four moves correspond fairly well to the four basic elements of expository texts: Situation, Problem, Response and Evaluation (Hoey, 1983; Jordan, 1984; Winter, 1992). The Background block contains the features of Situation and Problem; the Purpose and the Result blocks possess the Response features, and the Conclusion block has Evaluation features. In academic discourse, the ability to show problems in the current knowledge state paves the way for researchers to show their distinction among their colleagues (Barton, 1993). In other words, experienced authors may not merely present what have been observed; they may also argue that their results help to solve certain problems unsettled. Accordingly, the student authors of Text 1 had obviously learned the ability to show their contribution by means of what we may call the "problematization" process.

It is also interesting to discuss further other variations in the student corpus. The information structure of Text 2 below can be accounted for in terms of three move categories: Background, Result and Conclusion. This sample does not possess the four move categories as exemplified in the first sample; nevertheless, this text also contains the features of the problematization process. Note that the Situation and the Problem are briefly mentioned in the Background move, the Response is implied in the Result move, and the Evaluation is condensed in the Conclusion move. Although this sample does not contain explicit Purpose and Method moves, their meanings can be inferred from the initial three sentences.

Table 4: The move structure of Text 2 (Taken from Huang, et al., 1998)

Units	Moves calculated	Phrasal signals printed in bold
1	Background	Antimony compounds **are widely used** in …
2	Background	Previously, it **has been shown** that…
3	Background	However, only…**are available** so far.
4	Result[8]	The present **results demonstrate** that…
5	Result	The order of…**is**…, with LD50 values …
6	Result	…**was not found** in cells immediately…
7	Result	…**was detected** in CHO-K1 cells after…
8	Result	The delayed apoplosis **was also observed** …
9	Result	In addition, an increase in…**appeared**…
10	Conclusion	The present **results provide important** ...

Background information in academic abstracts allows writers to create an effective persuasive context. As noted earlier, one main function of abstract is to help readers to decide whether to read the whole article. An important consideration is whether the writer has the credibility to deliver on the topic. An experienced writer knows the importance of using credibility appeal, and constructs him-/herself to be an informed colleague, able to speak with authority on the subject. Background moves identified in the two samples above allow the writers to project an insider ethos. They not only secure readers' interest, but also display the writer's credentials as an informed member of the field. Consider the

[8] These two results were realized as generalizations in Sentences 4 and 5.

following two examples.[9]

(8) The tumor suppressor gene p53 **plays an important role** in guarding genomic integrity.
(9) Antimony compounds **are widely used** in various manufacturing and semiconducting industries.

Certain linguistic features in the above examples signal the writers' disciplinary competence. The definiteness of the subjects, indicating specificity of the topic; the present tense of the verbal expressions, indicating 'current' truth of the phenomena; the evaluation realized by *important* and *widely*, indicating a professional judgment. All such features imply the researchers' familiarity with the discipline's previous research and awareness of the topics currently considered urgent, and worth addressing.

Indicating a gap in the past research represents a further step in demonstrating one's insider status in the community. In this case, writers mention some problem which is unknown or unresolved by other colleagues of the field. The following are two typical examples.

(10) In contrast, the status of p53 in Chinese hamster ovary (CHO) cells, commonly used as a model system for various studies including those involving the cell cycle and transformation, **remains an enigma**.
(11) Previously, it has been shown that antimony trichloride ($SbCl_3$) elevates sister chromatid exchange (SCE) rates in V79 cells after a 28-h incubation. [3] However, **only limited data** on its genotoxic effects are available so far.

Indeed, having the ability to identify such information gap in certain areas of research is a critical step in projecting an insider ethos, enabling writers to signal their right to be heard as competent members of the field. There are, of course, other means which allow writers to show intimacy with implicit

[9] Note that all the examples used in the subsequent discussion are taken from Tzang, et al., (1999) and from Huang, et al., 1998).

cultural knowledge of an associated discipline. The ubiquity of acronyms, technical terms, citations as well as Purpose and Method moves in journal abstracts can also be regarded as markers of disciplinary identity, constructing writers as community-situated participants in the discourse. In this section, we have shown how our student writers can use particular move structures to demonstrate their insider status to promote themselves and their research claims. Student writers knowing how to make good use of such resources are inevitably in a better position to succeed.

Showing how a piece of research challenges or readdresses certain issues is not the only way for abstract authors to orientate readers towards the goal of their reporting. As mentioned above, Background moves occurring in one third of the texts simply state or imply the current state of knowledge, thus demonstrating the topical significance and signaling writers' professional ethos. Such an intention may, of course, be realized by categories other than Background moves alone. Sometimes, Purpose and Method moves or either one may suffice to make clear the topical significance and to demonstrate insider credibility. Sometimes, Method moves merge with Purpose moves, and either may merge with a Result move. In brief, some of the student writers have already learned a range of structural patterns that allow the student writers to construct a suitable context for an abstract.

What has been observed in the previous two sample texts does not occur in all the student abstracts. Some students tend to demonstrate their contribution in less sophisticated manners. There are occasions where the student writers simply report their experimental results plus an optional conclusion or recommendation. As demonstrated earlier, the internal structure of an abstract may be accounted for in terms of what move categories can be identified and in what order they actually occur in the text. Text 3 below has been analyzed to contain the following two move categories: Result and Conclusion. This sample is nonetheless well-structured, representing another common discourse pattern in our data.

Table 5: The move structure of Text 3 (Taken from Chen, et al., 1996)

Units	Move scalculated	Phrasal signals printed in bold
1	Result[10]	We **have demonstrated** that…can…
2	Result	**as well as alter** the kinetics of stress …
3	Result	cells ... **exhibited enhanced** induction …
4	Result	the induction peaks **was also delayed** in ...
5	Result	The above treatment **also resulted in** ...
6	Result	which expression **remained constant** in ...
7	Result	Enhanced ... **were also observed** in cells …
8	Result	protein ... **did not differ from** those ...
9	Conclusion	**we concluded that** there is a critical link …
10	Conclusion	the rapid ... **offered a novel avenue** for ...

The authors of this abstract announce their finding at the very beginning, which is then immediately elaborated by a series of observations. The results are then generalized as a conclusion in the last two units. Regardless of certain ambiguities due to awkward expressions, the authors have been quite successful in reporting their findings. The process does not involve any obvious challenging or revealing inadequacy concerning the current state of knowledge. The vast majority of the student abstracts are more or less similar to this third sample text. As mentioned earlier, all the 50 abstracts (i.e., 100%) contain Result moves, and 47 of them (i.e., 94%) have Conclusion moves. These two move categories constitute over 76% of all the move items calculated. In other words, our student authors employ most of their space available in the abstract section to spell out their

[10] These two results were realized as generalizations in Sentences 1 and 2.

findings and conclusions.[11] Our student authors rely most heavily on this structural pattern to demonstrate their contribution to their academic field. The popularity of this structural pattern in the student corpus might reflect their academic immaturity and English proficiency, but such issues deserve more investigation.[12]

Although all the texts in our corpus have been published in international journals, we still encountered various types of problems which might be related to their English proficiency. As far as information structure was concerned, their biggest problem appeared to be the vagueness of certain move status in a text. Two moves were sometimes inextricably intertwined, so that more than one move category may be assigned to a single sentence or an analytical unit. Consider the following example.

(12) The cutting sites specificity of topoisomerase II from porcine spleen were determined by a modified Sanger's DNA sequencing method. (Taken from Huang, et al, 1992)

It seems quite difficult to decide whether this sentence or analytical unit was intended to realize a Purpose move or a Method move. It could be a Purpose move because this can be rewritten as (13) below.

(13) Our goal was to determine the cutting sites specificity of topoisomerase II from porcine spleen by a modified Sanger's DNA sequencing method.

Alternatively, the same sentence could be interpreted as a Method move because it can be rewritten as (14) below.

(14) We determined the cutting sites specificity of topoisomerase II from porcine spleen by a modified Sanger's DNA

[11] Note that the information flow from experimental results to some conclusion can itself be a logical process.

[12] Note that the Result block in this abstract is initiated by a generalized Result move (i.e., [1]-[2]), and such a generalization actually functions as "topic sentence" for the rest of the text.

sequencing method.

Since (12) originally occurs at the very beginning of an abstract, both the rewritten versions can perfectly substitute the original one in the context it was taken from. Our purpose is to show that the original sentence is ambiguous in its move status in that abstract. One possible solution is to rewrite (12) as (15) below.

(15) Our goal was to determine the cutting sites specificity of topoisomerase II from porcine spleen. We employed a modified Sanger's DNA sequencing method.

The version as in (15) uses 23 words, with only four words more than the original version. The gain in clarity of information is clear. Note that the abstract from which (12) was taken contains only 4 sentences or 6 analytical units, with 104 words in total. This is much shorter than the average for the data, which contains 8.7 sentences or 10.9 units, with 209 words in length. In other words, the authors of (12) could have used more space to express more clearly and precisely the necessary information of their abstract. This is not an accidental incidence; there are numerous similar examples in our data. The following are two typical cases.

(16) The capability of Cr(III) to induce DNA lesions generated by oxidative damage was investigated in this study by examining the formation of 8- hydroxydeoxyguanosine (8-OHdG) in calf thymus DNA by $CrCl_3$ and/or H_2O_2 in 10 mM phosphate buffer. (Taken from Tsou, et al. 1996)

(17) The signal transduction mechanism of protein kinase FA/GSK-3α by tyrosine phosphorylation in A431 cells was investigated using calphostin C as an inhibitor for protein kinase C (PKC). (Taken from Lee, & Yang, 1996)

Note that these two sentences also occur at the very beginning of the abstracts from which they were taken. The vagueness of these two sentences could be improved if they are, respectively,

rewritten as follows.

(18) The purpose of this study was to investigate the capability of Cr(III) to induce DNA lesions generated by oxidative damage. We examined the formation of 8-hydroxydeoxyguanosine (8-OHdG) in calf thymus DNA by $CrCl_3$ and/or H_2O_2 in 10 mM phosphate buffer.

(19) Our research attempted to investigate the signal transduction mechanism of protein kinase FA/GSK-3α by tyrosine phosphorylation in A431 cells. We used calphostin C as an inhibitor for protein kinase C (PKC).

Thus, the meanings of the two sentences have been clarified and their function in the abstracts becomes evident. Note that our revised versions use only four more words than the original, but the quality of both the abstracts has been much improved.

There are certainly other types of problems relating to information structure of a text. But our examples suffice to show that the English ability of our graduate students needs to be improved, especially in using their English for their academic purposes. The above examples also demonstrate that as English teachers, we can do something helpful to assist our students to enhance the presentation of their research.

4. Conclusion

We might argue that the disciplinary culture of the field (i.e., life science) might expect experimental findings to be desirably contextualized when presented to their audience (Hyland, 2000).The comparison of move distributions in the two corpora allows us to conclude that the five-move framework is useful to show structural features of academic journal abstracts. The vast majority of the foreign scholar texts observed bear evidence for the co-occurrence of the five move categories in an abstract. In contrast, a much lower percentage of the student texts contain all the five moves in a single abstract. There might be three reasons for the authors not to employ Background or other moves to

orientate their readers. First, the academic immaturity of the PhD students might not have enabled them to show their contribution sufficiently by problematization. They were not yet able to draw the audience's attention to the weakness of the current state of research. Second, the student might have been linguistically inadequate in providing contextual information for their main findings. Third, the word limit set for an abstract might have prompted them to provide less rather than more background information in their abstracts. Moreover, problematization was shown to be an important means to orientate readers towards the goal of research. However, only a small number of student abstracts actually employ this persuasive strategy. This might also be due to the three reasons just mentioned. All such issues are worth further investigation.

Based on the above analysis, we might suggest that most instructional manuals for science and technology provide only partial information about how to write abstracts for their academic journal articles. The four types of information suggested in Cremmins(1982) and Day (1983), for instance, are certainly too vague to be practically useful in the classroom. Among the handbooks available in Taiwan, the one by Weissberg & Buker (1990) is worth our recommendation. Their prescriptions on writing abstracts provided in this book can be useful to our graduate students. The concept of "reduced abstracts" helps students to decide what are obligatory elements in an academic journal abstract. Kuo's (1993) opinions about features of good and poor abstracts are also relevant. In addition, the concept of "scientific criteria for significance" discussed in Moriarty (1997) can also be heuristic to graduate students as well.

However, none of the handbooks available include adequate information about the merits and demerits of different structural patterns in reporting one's academic contribution to the field. None of them attempt to provide suggestions specific to a particular field. It is thus suggested that our graduate students should be familiar with various structural patterns, so that when situations permit, they can have the resources to demonstrate their research contribution in one way or another. The structural

patterns demonstrated in this paper can be useful to the teaching of academic English to graduate students majoring in life science. Indirectly, our generalizations might also be relevant to graduate students who want to observe conventions of abstract writing relating to their own fields.

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Appendix: The sources of the texts exemplified in the paper.

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