# In Search of a General Model for the Structure of Research Article Introductions

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## Abstract

In this paper, the importance of teaching text structure in ESP and EST classes is first established, before two 'general' models for the structure of research article introductions are reviewed and evaluated. Results show that when applied in fields such as engineering and science, the models do not provide a satisfactory account of text structure, suggesting the need for more studies to be conducted in specific disciplines.

## 1. Introduction

Since the 1960's, there has been a growing preference to use English for communicating the ideas and findings of science (Baldauf & Jernudd, 1983), and the popularization of the Internet in the 1990's, with most of its resources being in the English language, is likely to accelerate this even more. Swales (1987), for example, estimates that approximately half of the millions of journal papers published annually are in English, and as early as 1981 almost 80% of all engineering journals were published in English (Swales, 1981). For the majority of the science community, who are non-native speakers of English, this obviously presents somewhat of a problem, i.e., in order to get research published in the most prestigious journals their articles have to be written in English. Clearly, there is a growing need for instruction in English for special purposes (ESP) and in particular, English for science and technology (EST).

Early studies in ESP and EST identified a number of areas that prove difficult for non-native speakers. Pearson (1983), in her summary of this work, discusses five of the more prominent of these in detail: 1) technical terminology, 2) common language words used technically, 3) strength of claim, 4) contextual paraphrase, and 5) rhetorical or text structures. The fifth category of 'text structures' has perhaps generated the most amount of interest. Differing explanations as to why this causes difficulties have been offered by James (1984) and Mohan et al. (1985), who suggest it is due to a lack of practice in writing expository writing in the L1, and Pearson (1983), who suggests deficiencies in instructional materials and classroom activities. The most widely

accepted answer is that supported by Carrell et al. (1983), Hinds (1983), Kaplan (1987), Connor (1996) and others. They argue that there are profound differences in the organization of texts between different cultures and indeed different disciplines within the same culture. A non-native speaker or even a native speaker who is unaware of the particular structure of a 'foreign' text, therefore, will experience comprehension difficulties.

In view of this, teachers in ESP and EST have begun to explicitly teach text structure, and indeed, the approach has been shown to improve both native speaker and non-native speaker skills in reading and writing of scientific English (Swales, 1984: Johns, 1986). There is, however, one important question which has yet to be considered; how far can such patterns be said to represent the 'writing of science' rather than simply the 'writing of a specific discipline within science'? In other words, is it possible to develop a general model for the structure of say, 'the research article'?

In this paper, an attempt will be made to answer the above question by critically reviewing two models that have been proposed as general models for the structure of the 'Introduction' section of a research article. Both models, it should be added, have been widely quoted in both research papers and standard texts on scientific writing. Before introducing the two models, however, it is first necessary to review one earlier model for the structure of the research article introduction section.

## 2. Basic structures and the 'Problem-solution' pattern

Early work on identifying text structures could be said to have looked at basic text structures that may appear in any piece of writing. Winter (1994) for example, extended his work on clause relations to describe two basic text structures which could be said to having matching relations between the structural elements, i.e. the 'Situation-Evaluation' structure and the 'Hypothetical-Real' structure. Hoey (1994) continuing on the foundations laid by Winter, extended work on the first structural type to identify four parts, 'Situation', 'Problem', 'Solution' or 'Response', and 'Evaluation'. He called this the 'Problem-Solution' structure. In a summary of this work he concludes that the 'Problem-Solution' structure can be applied effectively to a wide range of discourses as disparate as fairytales and interviews (Hoey, 1994: 44).

Compared with the number of studies identifying basic text structures, the number of studies identifying an overall framework for the structure of specific text types has been noticeable less extensive. One exception is the treatment of the 'Introduction' section in research articles, due perhaps to the ease in which the section can be isolated, and the important role it plays in the research article as a whole. Many native and non-native authors have also described the difficulty they have writing the 'Introduction' section, suggesting this to be a worthy area of study. (Swales, 1981: 1990)

Early attempts at analyzing the 'Introduction' section produced rather similar results. Hutchins (1977) and Hepworth (1978), for example, examined introductions in a variety of disciplines and found a structure similar to the problem-solution structure above. Zappen (1983) also looked at scientific introductions and found they could be

analyzed according to the problem-solution pattern. This would suggest that it is a good candidate for the general model being sought here. There is, however, one major drawback; that is, the problem-solution pattern is in many ways too simplistic a model to be useful in the composition classroom when teaching students how to write 'Introductions'. For example, the model provides no clues as to how 'situation' or 'problem' can be realized in a text. It would be desirable, therefore, to have a more explicit model to work from.

## 3. Swales' Four-Move Model (1981)

In 1981, in the most extensive study of article introductions of the time, John Swales analyzed 48 article introductions from 14 separate journals, 16 in the fields of physics, electronics and chemical engineering, 16 in bio-medicine, and 16 in the social sciences. Conducting the study, Swales noticed that far from being objective, reasoned descriptions of the research, as was depicted in the 'Problem-Solution' description, the introductions in his study were performing a major role of persuasion. In other words, they were attempts to persuade the reader to accept the research as non-trivial contributions to an important area of study. Swales explains,

> "On the surface they may indeed be instances of problem solution text types, but beneath the surface they are pleas for acceptance, and designed accordingly." (Swales, 1984: 82)

This view led Swales to develop a completely new description of the 'Introduction' in which the author of the research article makes four steps or 'moves' in order to persuade the reader to accept the importance of the research itself (see Figure 1). From Figure 1, it can also be seen that the model is far more complex than the problem-solution structure, offering three options for establishing both the field and the present research within that field.

Move 1:    **Establishing the Field**
A) Showing centrality
B) Stating current knowledge
C) Ascribing key characteristics

Move 2:    **Summarizing Previous Research**
A) Strong author-orientations
B) Weak author-orientations
C) Subject orientations

Move 3:    **Preparing for Present Research**
A) Indicating a gap
B) Question-raising
C) Extending a finding

Move 4:    **Introducing Present Research**
A) Giving the purpose
B) Describing present research

Fig. 1    Swales' (1981) Four-Move Model for Article Introductions

After the four-move model was proposed, many began quoting it as part of their own research or in their own accounts of scientific writing, e.g. Bhatia (1993) and Huckin and Olsen (1991), and others have clearly been influenced heavily by it, e.g. Weissberg (1990). Being based on a large corpus of articles from varying disciplines in both science and engineering, the model gained acceptance as being a 'general' model, encapsulating the main features of *all* research article introductions. It was only in the mid-1980's, due to the work of researchers such as Crookes and Cooper, that the problems of trying to develop such a 'general' model begin to be realized.

## 4. Reactions to Swales' Four-Move Model

### 4. 1   Crookes (1986)

The first major reaction to Swales' model was that of Crookes (1984), the results of which were summarized in 1986. The first problem he identified was the choice of the corpus used in Swales' work, described as having introductions with a Move 2 (summarizing previous research) occurring as "a priori" (Swales, 1981: 19). Not surprisingly perhaps, Swales (1981: 33) subsequently found that Move 2 was "in many cases the most extensive section of the introductions". This would clearly effect the generalizability of the conclusions made.

This problem was compounded when Crookes' own study, using 96 article introductions from the same fields as those used by Swales, showed that previous work was often summarized throughout the introduction. This made the distinction between moves, in particular Move 1 and 2, almost impossible to make. Another problem that emerged was that moves were often 'embedded' within each other, a possibility only briefly mentioned by Swales. Finally, and most important here, Crookes found introductions could have from two to five moves, depending on the discipline being studied. Research articles in the social sciences, for example, were found to have a new Move 5, with the function of "presenting general, non-referenced theoretical background" (Crookes, 1986: 67).

### 4. 2   Cooper (1985)

Like Crookes, Cooper (1985) also applied Swales' model but this time to 15 article introductions in the narrower field of engineering. Cooper (1985) found, as did Crookes, that Swales' (1981) model as it stood could not adequately describe her corpus. In particular, she observed similar problems in identifying Move 2 in over half the sample, and again, data which could not fit into any of the defined moves. Unlike Crookes, however, rather than suggesting only minor changes Cooper proposed a completely new scheme. In the new model, two different types of step were distinguished; the first being sequenced and having surface features which signal its onset. Included here was the possibility for explicit results to be given in the introduction, and for the introduction to end with a section by section summary of the remaining paper. Steps of the second type were also not included in the Four-Move model, and were said to be justificatory in nature, having less rigidity in sequencing and only sometimes having signaling of their onset. See Figure 2.

(Type 1) **PLACING STEPS**

    Which are orientational or, as it were, topographical in function. They place the reader by providing

(a)  in STEP ONE, content background (by giving explanations and/or descriptions of work with which the reader is assumed to be unfamiliar)

(b)  in STEP TWO, context background (by giving an explanation and/or description of current work and its citation)

(c)  in STEP THREE, an article summary

(Type 2) **JUSTIFICATORY STEPS**

    Which provide the reader with reason for the work undertaken by

(a)  STEP A, justification by demonstration of use or application

(b)  STEP B, justification by contrast; namely, a contrast of present intention and previous failures or limitations

(c)  STEP C, justification by demonstration of the consequences of the work

Fig. 2   Cooper's (1985) Model for Article Introductions

## 4.3   Taylor et al. (1991)

A more recent study is that of Taylor et al. (1991) who applied Swales' four-move model to 31 Anglo-American and Chinese scientific texts, in the fields of geophysics, metallurgy and mineral processing, materials science, and materials engineering. Here, a close agreement was found with the four-move structure with 16 of the papers in the corpus following it exactly. Variations similar to those of Crookes and Cooper, however, were also found with five showing embedding of moves and a further 11 showing a deletion of a move. Interestingly, in eight of these the deleted move was Move 2.

Although Taylor et al. (1991) did a cross-cultural study, one important result was the considerable differences they found in writing between disciplines. In fact, they found the overall move structure of articles to be affected *more* by the discipline than the cultural background of the writer. They concluded the work by stating,

> "*[A] great deal more attention needs to be paid to the rhetoric of individual disciplines. Generalizing about 'scientific writing' (much less 'academic writing') is plainly insufficient." (Taylor et al., 1991: 332)*

## 5. A New Model for Article Introductions-Swales' CARS Model (1990)

In view of the criticisms of the four-move model described above, Swales offered a revised model in 1990, which he called the 'Create a Research Space' or CARS model. (Figure 3). As the labeling of the different moves shows, Swales (1990: 141) still maintained that the introduction is performing a persuasive role and argued that the new model,

> "*adequately captures a number of characteristics of research articles: the need to re-establish in the eyes of the discourse community the significance of the research field itself; the need to 'situate' the actual research in terms of that significance; and the need to show how this niche in the wider ecosystem will be occupied and*
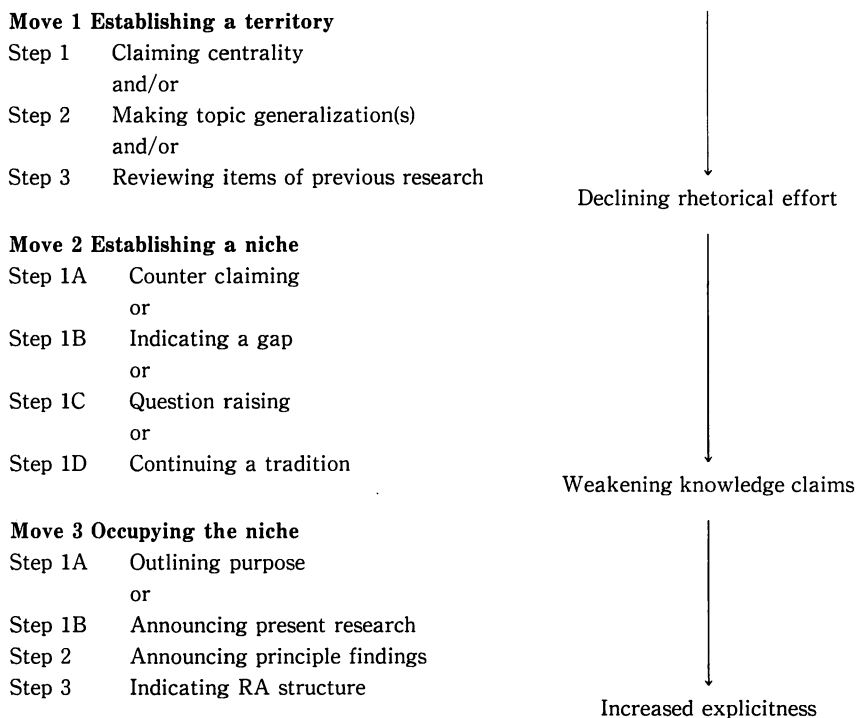
**Move 1 Establishing a territory**
Step 1     Claiming centrality
           and/or
Step 2     Making topic generalization(s)
           and/or
Step 3     Reviewing items of previous research

                                                    Declining rhetorical effort

**Move 2 Establishing a niche**
Step 1A    Counter claiming
           or
Step 1B    Indicating a gap
           or
Step 1C    Question raising
           or
Step 1D    Continuing a tradition

                                                    Weakening knowledge claims

**Move 3 Occupying the niche**
Step 1A    Outlining purpose
           or
Step 1B    Announcing present research
Step 2     Announcing principle findings
Step 3     Indicating RA structure

                                                    Increased explicitness

Fig. 3    Swales' (1990) CARS Model for Article Introductions

*defended."*

The first major revision was the merging of Move 2 (the review of literature), into Move 1, although he still contended that it is the obligatory step in Move 1, but with one exception, that of introductions in the field of engineering. This reflected the results of Cooper (1985) described above. Move 3 was also extended to include the options identified by Cooper, i.e., to include a summary of findings and to detail the structure of later sections in the article. Again, however, he commented that these options may be discipline-dependent, Step 2 appearing only 7% of the time in educational psychology, but 45% of the time in physics.

Finally, in the new model, Swales accepted the possibility of Move 1/Step 3 and Move 2 cycles, and suggested that this feature is likely to appear in longer introductions and that again it may be discipline-dependent. Interestingly, he proposed that 'branching' fields such as social sciences are more likely to show cycles than introductions in engineering that will be characteristically brief and linear.

It can be seen, therefore, that the claims made for the CARS model are far more tentative than those made for its predecessor, the Four-Move model. In essence, however, the CARS model is still being offered as a 'general' description of research article introductions.

## 6. Comments on the CARS model

The CARS model, despite its rigorousness and obvious pedagogic attractiveness, presents the teacher of an ESP or EST class with a dilemma; if the CARS model is to be used in the classroom, should it be presented 'as is', or should it be seen only as a guide for students when forming their own models for the structure of introductions in a specific discipline. Since the model was first proposed, it has been quoted frequently in other studies on writing, e.g. Thompson (1994) and Nwogu (1997), but as yet has seen little exposure in textbooks on technical writing, the one exception being Swales & Feak's (1994). Although this book makes efforts to encourage the student to make conscious decisions about when and how to apply the model, it is anticipated that a large number of students with little or no experience of technical writing even in there own discipline will use it 'as is'. Many teachers of technical writing classes, coming from a background often unrelated to the discipline in which they teach, will also be unable to provide the specialist knowledge required to correctly interpret the model and so are also likely to present it 'as is'. This is common in Japan, for example, where teachers with an English literature background are asked to teach technical writing courses to engineers and scientists. One other problem is how teachers and students will deal with texts that do not fit the prescribed model. In Swales & Feak's book, students rarely get an opportunity to deal with such 'problem' cases, so if at some point they are encountered they will probably then be treated as simply 'exceptions' to the rule.

Of course, the many exceptions to the CARS model 'rule' may in fact be following the standard structuring of a specific discipline. Research articles in English, for example, rarely if ever exhibit the Move 3, Step 3 of the CARS model, giving a summary of the rest of the paper. To suggest the CARS model is the norm to students of this discipline is obviously giving a misleading picture. In the Swales and Feak's textbook (1994), the decision whether or not to include such a section is said to be related to whether or not the research papers follows a standard pattern, or if the research field is new. From personal communications with both scientists and engineers, however, it appears that the section will be included simply as a matter of course in certain disciplines regardless of how closely the rest of the paper follows a standard format.

## 7. Conclusions

This paper opened with the question, is it possible to develop a general model for the structure of 'the research article'? Unfortunately, as it is hoped this paper has shown, the answer is a difficult. Of course, general models can be developed, but as they become more explicit they also begin to generate an increasing number of exceptions. The 'Problem-Solution' pattern, for example, fits the test data well but its simplicity limits its effectiveness as a pedagogic tool. The two models proposed by Swales, on the other hand, are far more detailed but the exceptions they generate weaken their generalizability. If the unique features of writing in the target discipline are known,

this in not a problem; a general model can then be treated simply as a foundation on which to build a more precise description. A large number of teachers with courses in technical writing, however, are unfamiliar with the target discipline. In such cases, the adjustments necessary to a model such as Swales' CARS model cannot be made, resulting in the content of a course doing perhaps more damage to the students' writing advancement than good.

As Taylor et al. (1991) stated in the quote earlier in this paper, there clearly needs to be more research done on the writing of specific disciplines before any general model can be offered with confidence. It is to this area of research that this author is now engaged, and it is hoped that others will also strive for a deeper understanding of writing in the discipline that they teach.

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