

## **PREDICTIVE STRUCTURING IN SCIENTIFIC RESEARCH ARTICLES**

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### **ABSTRACT**

This paper reports on a generic analysis of scientific research articles from the perspective of reader-writer interactivity in texts through predictive structuring (Tadros, 1981). The role of the Question - Answer pair was examined and the results indicate that it plays a significant part in organising both short stretches of text in addition to having a larger function in accounting for relationships between texts spanning sections of the article. The Q-A pair seems to be a generalisable feature which is likely to be part of the generic schematic knowledge possessed by experienced readers of scientific research articles. The study also indicated certain similarities as well as disciplinary variations between scientific journal article discourse and the discourse of economics textbooks.

### **Introduction**

An adequate understanding of the nature of reading and writing is an important prerequisite for effective teaching so that pedagogic decisions and curricula are informed by insights from analyses of written communication. Many ELT courses have a restricted focus in that they are concerned mainly with processing local features of texts at a discrete level. They are often centred around activities which focus on the particular texts facing the learner as self-contained and independent entities rather seeing them as exemplars of a whole class of texts or even of written texts in general. It is doubtful whether such an approach will necessarily lead to the development, in the learner, of generally applicable comprehension skills and strategies which are internalised and, therefore, transferable to reading in the real-world outside the classroom and which enable the learner to cope independent of the teacher.

As opposed to the approach to texts as isolated and autonomous units, it seems important to develop in learners a familiarity with appropriate schemata about the generic text-types s/he will eventually have to comprehend and produce. Schemata, in this context, refers to the mental store of expectations and prior knowledge derived from our previous experiences with texts which help us to interpret and make sense of new texts. There are content schemata and formal or rhetorical schemata (Carrell 1983) about the rhetorical patterns and structures in texts. This highlights the need for ELT courses to aim at developing, in learners, schematic knowledge for processing texts.

Research has shown that written texts have some features in common, and that a schematic knowledge of these will facilitate comprehension and production. However, it is increasingly clear that there are genres and text types which are distinguished on the basis of particular communicative purposes (Swales 1990).

Just as there are some features common to all types of written communication, there are also characteristic rhetorical and organisational features and linguistic options that distinguish different text types. The academic journal article is one such genre, and courses in English for Academic Purposes often aim at creating in their learners an awareness of the schemata appropriate for processing such articles.

This paper looks at the discourse of the journal article with a view to describing generalisable features which are likely to be part of the formal schemata that an experienced reader brings to bear upon the texts she is faced with.

### **The Study and its Background**

The present study was motivated by the need to investigate a key feature of the scientific journal article which might be relevant in helping learner-readers become familiar with the organisational structures and patternings of research articles. The journal article is considered an important genre in the academic world and students in tertiary institutions will invariably be required to master it in order to advance in their fields of study. Often, problems arise because the research article has features quite different from those of the textbooks students are familiar with. Thus, it appears that we need to create in students of EAP an awareness of the schemata appropriate for processing journal articles. The corpus for the analysis was 10 articles from the scientific journal "Animal Behaviour".

### **Theoretical Orientation and Relevant Previous Research**

This study takes as given the idea that written discourse is inherently interactive and shows evidence of writers' attempts to anticipate and meet readers' potential needs. Readers, by the same token, are seen as active participants of the text-interpretation process, who exploit the text in terms of their own purposes for reading. The text manifests signals of this kind of interactive co-operation between reader and writer.

An important means by which writers adopt an interactive stance towards their readers is by structuring their language in predictable patterns. Hoey (1983) describes a number of such patterns of discourse organisation in written texts and shows how readers make use of a variety of interactive features to predict and recognise these typical ways of presenting information.

Another study applying an 'interaction and negotiation' of meaning approach to discourse is Tadros (1981). She examines a key feature of interactivity, Prediction, which is a device used by writers to explicitly indicate the intended course of action in the subsequent part of the text. This then obligates the writer to actually do what was signaled as intended. These predictive devices are particular linguistic signals that predict the occurrence of "linguistic events" and commit the writer to fulfillment of the prediction set up. They enable the reader to see the likely direction of the text,

where the writer is leading her/him. According to the model of analysis, there is a clear relationship between the item that predicts and the item that is predicted. Together they form the "pair". Tadros has identified six categories of prediction for a corpus of Economics texts. They are Enumeration, Reporting, Hypotheticality, Questioning, Advance Labeling and Recapitulation. These categories are said to be "pervasive" and to account to a large extent for the organisation of texts.

The aim of this paper is to investigate the extent to which one of these predictive categories, Questioning, is a general organisational feature of written texts from a field quite different from the Economics textbook corpus it was originally applied to. Apart from the fact that the disciplines were different, another factor which might be of significance for the findings was the status of these articles and the ideas expressed.

## **The Analysis**

The analysis of the ten articles for the categories of Prediction showed that the categories feature in the texts. However, some of the categories were more typical than others. Enumeration, Advance Labeling, Questioning and Reporting occurred frequently enough to warrant attention, whereas there were practically no instances of Recapitulation or Hypotheticality. The rest of this paper will examine Questioning or the Question-Answer sequence, an important predictive device which has a role in the organisation of the research articles.

## **Question-Answer**

According to this category of Prediction, a writer detaches him/herself from the text by asking a Question and "this detachment predicts that he will be involved at some point in the forthcoming text by declaring his/her state of knowledge as regards the question" (Tadros 1981).

This device demonstrates the interactional relationship of the discourse - the explicit introduction into the text of a reader's potential questions and the writer's provision of information to answer the question.

For her Economics data, Tadros identified two distinct types of Questions which predict an Answer. These are distinguished on the basis of their position in the text - one type acting as heading/subheading for a section, while the other does not. The analysis of the articles revealed that the Question-Answer sequences characteristic of the genre were not of the former type, i.e. those acting as heading/subheading of a section. The second, non-heading, type of Question-Answer pair had a textual role though not frequent enough as to be considered a typical feature of research articles. This will be discussed below before we proceed to describe another type of Q-A pair.

- i. In the first type of Q-A, the writer poses a Question which is the predicting element in that it sets up an expectation in the reader that the writer will then go on to provide an Answer. An example of this is given below.

### *Example 1*

Does this merely reflect dynamic differences, say in terms of synaptic activity or does it involve structural differences, say in terms of synaptic connectivity?

*(Predicted Answer)*

Based on admittedly circumstantial and involved evidence, I'm inclined to think that structural differences must be seriously considered.

This is a Yes/No Question in which two alternatives are presented - **dynamic differences or structural differences**. The reader can recognise the predicted Answer easily enough in the way the writer picks up one of the alternatives, i.e. structural differences. Here the writer provides the Answer to his Question without any intervening text which creates a delay to the Answer. It might be revealing, at this point, to consider the function of such Q-A pairs in their contexts. In the example above, the writer need not have posed a Question to provide the information in the Answer. After the sentence preceding the Question (effectively, fearful animals appear to have a more widely distributed neural fear system than tame ones) he could have gone on to provide the information

Based on admittedly ....I'm inclined to think that structural differences must be seriously considered.

The writer has used this technique of asking a question and then provided the answer himself, because he is, in a sense, putting himself in the reader's place and trying to anticipate the kind of questions a reader might ask at that point, if he had a chance. In written discourse, the writer is in control and s/he makes the decisions as to what s/he thinks a reader might ask. This suggests that a high degree of reader-writer interactivity is a feature of these texts and that the writer is not merely presenting a series of propositions for the reader, regardless of whether s/he has prepared her/him adequately for reception and comprehension of the ideas in the way s/he intends.

However, it might be argued that some of the questions are fairly sophisticated and such that they would require someone who was well informed to be able to even formulate them. In the example above, the reader would already have to know that there are two such alternatives before s/he could ask a question. However, it must be borne in mind that the intended readership of these research articles are specialists, colleagues and fellow-researchers of the writer in the same discipline. Given that the intended audience can be assumed to have a sophisticated level of knowledge and would be familiar with the issues the writer is raising, it is plausible that the writer is anticipating a question that might possibly be asked by such readers.

Part of the rhetorical motivation for the Q-A sequence is that this device serves to highlight important information. In a number of the examples, the stretches of texts making up the Answer element were really dealing with key points and issues. The writer, who does not wish to take the chance that this information may be glossed over or overlooked in the mass of details around, may use the Q-A pattern to set it off from what has preceded. By thus drawing attention to the information to be presented, the writer ensures that its importance is signaled to the reader.

We can demonstrate the changed effect that results when a Q-A pair is reworded by removing the Question element.

*Example 2*

But the question remains why do these grasshoppers expose themselves to any risk however reduced, by roosting in such open positions high in the bushes? Perhaps the key advantage derived from high roosting is lowered vulnerability to nocturnal predators.

The Question element can be removed and the information presented as Answer can be simply stated as:

The grasshoppers roost high in the bushes because of the advantage of lowered vulnerability to nocturnal predators.

However, this almost has the effect of treating it as incidental information, although the subsequent development of the point in its context does help to mark its importance.

The Q-A sequence, in the context of the research article, has an important text organising role. A whole section of the article might be organised on such a basis with the relationships between parts of the text created by the Q-A pair sequence. An example of this is given below.

### *Example 3*

In addition to this .... two questions are of interest. First, is the distribution of displays consistent from animal to animal? Second, are there any reliable differences that appear between the free and impaled conditions?

The appearance of these Questions gets up a prediction that the writer will be obliged to answer the Questions he has raised. This expectation structures the text to follow and, in the whole of the remaining section, the writer then proceeds to take up each of the Questions in turn and discusses the issues raised and presents them systematically, in the form of Answers to the Questions.

In the example above and in other similar cases, the scope of the Question is not very extensive. For example, a Question may be asked about a further aspect of the phenomenon under study, a set of data relating to it is presented and the relevant conclusions (the Answer) are all presented within one section.

A variation of this discourse organising principle was the use of Questions which had a larger function in the text so that their scope cut across sectional divisions. This type of Question occurred in the data in order to justify or introduce an experiment or field study or even the whole research. The example below illustrates this:

### *Example 4*

The fact that both threat displays and fighting behaviours can be elicited by a variety of opponents raises the question of whether there is any particular visual stimulus which is critical in eliciting the display

The writer then proceeds to cite previous research which partially answers the Question asked, but the final resolution is to be provided by the writer himself, through an experimental study:

Experiment 4 was designed to keep colour, brightness, patterning orientation and movement constant while testing the effects of shape.

The writer could, in a sense, have come up with the Answer to the Question immediately after the Question, i.e. presented the results directly. However, this would not be acceptable according to the conventions of scientific writing. Thus, he makes it clear that, as required by the discipline, the reader will be taken through the whole process the researcher himself went through in arriving at the Answer; thus the required Answer to the Question spans the Methods and Results sections to the

Discussion where the necessary generalisations based on the results are to be found. The recognition signals in such instances are often not very obvious and fairly heavy demands may be put on the reader to see that a particular statement provides the information required by the Question. There are, however, signals of the semantic relation between Question and Answer, such as Repetition and Paraphrase of elements of the Questions:

Is there any particular visual stimulus...?

This enables us to identify the sentence:

Thus no particular elements such as the fins, tail or gill covers could be singled out as being crucial for initiating threat displays. However, the main point is that shape alone did not have a differential effect.

Other examples are worked in fairly similar ways to organise the discourse. Sometimes the scope of the Question is larger as when the aim of the whole paper is stated as an attempt to answer two or three Questions and all the experiments or field studies are arranged so that they will lead to the required Answers.

#### *Example 5*

It was to investigate questions of this sort that the present research was initiated. The first section asks, what are the colour changes.... the second section examines questions of simple discrimination learning and ask whether....

This suggests that there is a generic difference between the discourse of economics textbooks and that of scientific research articles in the way in which the predictive Question-Answer structure is used. While both text types use the Question-Answer pair to organise short stretches of text by setting up an expectation for an Answer to follow immediately after the Question, the corpus of research articles analysed suggests that this predictive device had a particularly important role in organising large stretches of text. This is the kind of schematic knowledge that is specific to the genre and which an efficient reader will already be familiar with.

### **Conclusion and Pedagogical Implications**

This study has investigated the relevance and applicability of one aspect of the notion of text interaction, Predictive structuring, to the genre of research articles and with particular reference to scientific experimental research articles. It isolates one predictive device, Question-Answer, and examines its role in the corpus. The analysis showed that there is disciplinary variation in the way it operates in research articles as opposed to textbook discourse. The results of the study seem to confirm the important text organisational purpose served by such predictive devices.

The kind of predictive structuring in these texts has pedagogic significance for learner-readers and writers who may lack sufficient familiarity with genre-specific conventions. Tadros's perspective, that the writer maintains an explicitly marked interaction with the reader by Prediction and her identification of a number of such predictive devices is insightful and carries pedagogic relevance for ESP and EAP programmes.

The analysis of the corpus for the way the Question -Answer sequence operates suggests that this is an important textual signal which reveals to the reader what s/he will be doing in the next part of the text. The occurrence of these signals commits the writer to provide an Answer with specific information pertinent to the Question. The reader realises that the writer has committed him/herself to a certain course of action-giving an answer with particular information-only because of the presence of the signals, i.e. the Question. If a learner-reader can be alerted to such signals and its implications for the kind of information to follow, s/he learns to process information more rapidly. With clues to help predict the organisation and presentation of subsequent information, the learner can proceed to read more fluently and with greater comprehension than if s/he had no basis for predicting what come next in the text.

The Question-Answer device is easily accessible to readers for revealing the kind of information that will follow. It demonstrates the interactional nature of the discourse when the writer introduces potential questions from the reader into the text and then structures the text so that the anticipated information follows. And, since the Question - Answer pair often deals with key points and issues in the argumentation, this seems a worthwhile area to develop pedagogically. Furthermore, a consideration of the functions served by the Question - Answer parts in this corpus indicates the important organisational role they have. They create relationships between parts of texts which often operate across section boundaries. In this way, the structure of large portions of the text are revealed to the reader, who is thus enabled to find his/her way through it better than if the Q-A relationship had not been set up. The Question serves as the focal point to which the rest of the section relates.

Where the Answers to such Questions span large parts of the text, the learner-reader is likely to need help to recognise and focus on the important generalisations which draw together all the details and serve to summarise the answer.

Since the recognition signals are not always very obvious, explicit instruction can help develop skills of recognising clues as to the generalisations which answer the questions. This might include means such as Repetition and Paraphrase of elements of the Question in the general statements which serve as the Answer.

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