The Passive and Metaphor in Scientific Writing

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ABSTRACT

The passive is one of the most well-known features of scientific writing. If analysed as copula + complement it is an example of relational process, and as such is particularly suited to the scientific journal article. Use of the passive form is particularly significant when it combines with a modal auxiliary in mental process. This type of writing also d e s significant use of inanimate subjects with active verbs that require conscious agency. This is a form of metaphor. Mental process verbs are frequent in this type of clause. Passive forms and this type of metaphor occur in inverse distriburion, and are both involved in the same rhetorical strategy, that of creating an «impersonal» text with little reference to human agents. However, they d e different types of thematic choice which is at least one way they can be distinguished.

KEY WORDS: scientific writing, passive, metaphor, thematic structure

RESUMEN

La forma pasiva es una de la características más conocidas del discurso científico. Analizada como cópula + complemento es un ejemplo del proceso relaciona1 y como tal conviene perfectamente al artículo de una revista científica. El uso de la forma pasiva es significativo cuando se combina con un auxiliar modal en el proceso mental. Este tipo de discurso usa de modo significativo un sujeto inanimado con un verbo activo que necesita un agente consciente. Todo esto constituye una forma de metáfora. Los verbos del proceso mental abundan en este tipo de oración. Las formas pasivas y esas modalidades de metáforas están en distribución inversa y se implican en una estratagia retórica que crea un texto impersonal con pocas referencias a los agentes humanos. Sin embargo difieren las opciones en cuanto a la estructura temática, lo que es por lo menos una manera de diferenciarlas.

PALABRAS CLAVE: discurso científico, forma pasiva, metáfora, estructura temática.

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I. INTRODUCTION

In this article I hope to show that certain features of scientific writing, as exemplified in the research article, form part of an integrated pattern, and a coherent rhetorical strategy. I shall consider mainly aspects of the use of the passive form, and the use of metaphor in the form of inanimate subjects with verbs which normally require an animate subject. I shall show that these are related to the notion of the impersonality of scientific text, and suggest why these choices should be made by scientific authors.

In 1953 Theodore Savory wrote: «It is strange that no one seems to have undertaken a broad study of the language of science. Certainly no book on language omits to mention the influence of discovery on our vocabulary, but after this perfunctory reference interest wanes, and no more information is to be found» (Savory 1953, 9). In the intervening forty plus years the situation has radically changed; The start was fairly slow, for it was almost ten years after Savory's book that Barber's article «Some Measureable Characteristics of Scientific Prose» (Barber 1962), appeared. This article is considered by many to be the seminal article as far as the analysis of scientific text is concerned. Now a vast range of analytical models, with which to confront scientific writing, is available, depending on whether it is considered text, discourse, rhetoric or genre. The study of scientific language constitutes a major element in the teaching of English for specific purposes, and there are now a number of international specialist journals devoted wholly or in large part to this area. Similarly there are numerous conferences from the local to the international level where research in this area forms the staple diet.

On the other hand one does not need to be a linguist to recognise an example of scientific English. Halliday has pointed out that scientific English is a recognizable category which any speaker of English knows when he sees (1988, 162), and «whenever we interpret a text as scientific English we are responding to clusters of features...»(1988, 164).

II. THE PASSIVE

Over the years a large number of grammatical items have been studied as features of scientific writing. Barber, in the article mentioned above (1962), considered subordination, tense, modalilty and non-finite verb forms. Among other features which have been studied, nominalization is significant, and has been given particular importance in the more recent work of Halliday (Halliday 1988, Halliday & Martin 1993). Also notable among these features is the passive.

It has become a cliché to say that the passive form is a feature of scientific prose and that this is so because of the «impersonal» nature of scientific writing. The corpus which I have studied is made up of eleven research articles from the domain of oceanography, and the rate of the passive forms in this corpus, 31% (Banks 1994), confirms both the general impression and figures produced by other researchers (e.g. Barber 1962, Huddleston 1971, Dušková 1971). I have argued elsewhere (Banks 1987, 1994, 13-31) that all passives, and not just the so-called adjectival passives, should be analysed as copula plus complement. In other words passives are essentially relational processes with the past participle forming the second participant of the process. I use the term ***relational process*** in the sense in which it is used in systemic functional linguistics (cf. e.g. Berry 1975, Halliday 1985, Downing & Locke 1992, Eggins 1994), where it indicates a process of being. In other words it is a process which is static; in a sense, nothing actually happens. In systemic functional linguistics, processes are typically realized as verbs. Processes can be of three types: material process, events in the physical world; mental process, events of a cerebral nature; or relational process. More recent versions of the theory add verbal, behavioural and existential process to this list (Halliday 1985). For the purposes of this article, behavioural process is not pertinent, and I shall consider verbal process as a subcategory of mental process (Berry 1975), and existential to be assimilated to relational process. If, then, scientific enquiry is conceived of as the discovery of the nature of material reality, that is, things as thay are, rather than events taking place, then relational process would seem particularly adapted to this task (Banks 1994). I would like to show that it also enters into a larger scheme of things in relation with other features of scientific writing.

Halliday, in a study of scientific writing from Newton onwards (Halliday 1988) claims that there has been an evolution towards increasing nominalization. He suggests (1988, 175) that the two following schematic representations show the pattern of change which has taken place over time:

a happens; so x happens
because a happens, x happens
that a happens causes x to happen
happening a causes happening x
happening a is the cause of happening x

a happens; so we know x happens
because a happens, we know x happens
that a happens proves x to happen
happening a proves happening x
happening a is the proof of happening x

What is interesting here from my point of view is that each of the endpoints reached in these two schemata are expressions in the form of relational processes. To the extent that Halliday is correct, my argument that the passive form is essentially expressing what would, with different speaker choices, have been material, or even mental processes, as relational ones, is going in the same direction. Scientific endeavour is an attempt to discover «what is what», so that the format of nominal groups linked by verbs of relational process seems a natural way of expressing scientific research.

In my corpus, I discovered that while the overall rate of passive verbs was 31%, when verb forms containing a modal auxiliary were considered, 41% were passive (Banks 1991, 1994). However, simply talking about the passive can be deceptive. The rate of passive verbs in a text depends to some extent on the incidence of passivizable verbs in the text. Not all verbs can be passivized, so the rate of passives should perhaps be related more to the number of verbs which have a passive form, rather than the total number of verbs in a text. Applying this idea to the modal verbs brings out the fact that of those verbs which are passivizable, and which appear in the text with a modal auxiliary, 59% are in the passive form. Moreover, if we are thinking about the notion of impersonality, mental processes would seem to be particularly important. A mental process of its very nature demands a conscious subject in the active form, a senser (Halliday 1985, Eggins 1994) or experiencer (Downing & Locke 1992) in systemic terms. If we now consider passivizable mental process verbs which appear with a modal auxiliary, then 69% were in the passive form.

(1) ... possible similarities can be detected between the oceanic and coastal measurements ...

(2) The computerized data ... must therefore be considered rather qualitative ...

(3) ... juvenile ... growth may be acceptably modelled by a growth increment.

It would seem that we here have an interlocking set of features that are all going in the same direction. If it is true that scientific writing has a tendency to thematize elements of the scientific process by bringing them into sentence initial or subject position, relegating the scientist himself to a prepositional adjunct or, more frequently, not mentioning him at all, then it would seem natural that clauses expressing mental process, and in particular mental process verbs with modal auxiliaries should reflect this tendency to a greeater extent than other verb forms.. Modal forms, while not exclusively linked to human action, do have a close connection with it, and mental process requires a conscious senser, so clauses which combine these two features are obviously prime candidates for passivization.

III. METAPHOR

I would now like to consider another way of avoiding reference to human agents.

(4) Figure 1a shows depths ...

(5) A redetermination of the slope ... would cast light on these problems ...

(6) The linearization used here ... employs a friction coefficient ...

In each of these cases we have a process which requires a hurnan agent, and the verbs appear in the active form. We might then reasonably expect the subjects to correspond to the agent, but this is not the case. A figure, of itself, cannot show anything. What is happening is that the scientist is using a figure to show something to his readers. Similarly, the act of redetermination does not cast light on anything, rather the scientist casts light on the problem by carrying out a redetermination of the slope, and linearization does not employ anything, the scientist employs a friction coefficient in his linearization. Thus the expected anirnacy of the subject has been inverted: the nature of the verb leads us to expect an animate subject, and the text in fact provides an inanimate one. Berry (1975) labels cases of mismatch of this type *untypical animacy*.

Master (1991) has considered the question of active verbs with inanimate subjects in scientific writing, but his discussion cannot isolate the question of subject-verb mismatch since many active verbs can quite legitimately be found with inanimate subjects.

(7) As the current approaches the cyclonic tum off Tavemier, it also presumably speeds up so that the current banks more steeply to the right ...

In (7) the current is associated with three active verbs, *approach, speed up,* and *bank,* but none of these demand a conscious subject, so there is no mismatch between subject and verb in this case despite the active nature of the verbs. For this purpose it is necessary to isolate oniy those verbs which normally require conscious subjects. In my corpus 250 verbs, representing 10% of all clauses, were verbs of this type, which in fact appeared with inanimate subjects. Of these inanimate subjects, the majority, 81%, were abstract (e.g. (5) and (6) above), 15% were physical,

(8) ... the catches again indicated much lower densities ...

and oniy a small number (4%) were cases of sentential anaphora:

(9) The modelled region is larger than that for which results are presented ... this avoids the possible spurious circulation at the open boundary ...

The physical cases were either items of equipment (10%) or objects of study (5%). Where items of equipment occur as subject it is evident that these are instrumental, with the unmentioned scientist as conceptual agent. In the case of objects of study, this is still arguably the case: in (8) the researcher is telling us (indicating) that there are lower densities, according to the information he has gleaned from the catches. Among the abstract cases are a number of nominalized verbs:

(10) A comparison of the computed depth averaged residual currents with observations shows qualitative similarities ...

This type accounts for 19%. These are obviously cases with putative human agents. However the largest group consists of subjects which, although they are not nominalized verbs, still presuppose the presence of a human agent; 43% are of this type.

(11) The photographic technique will produce underestimates of abundance ...

This leaves 19% which do not presupppose a human subject and can perhaps thus be thought of as being closer to more traditional forms of metaphor.

(12) ... the associated strong tidal currents ensure that the water column is virtually homogeneous.

Thus, at least 72% of these cases of metaphor, or over 7% of all clauses, are cases where the use of metaphor results in the human agent being unmentioned. Indeed the precise nature of the metaphor is that an act which is an essentially human act has been attributed to some inanimate entity, usually a thing or process that has an instrumental function.

When one looks at the verbs concerned in this type of metaphor, it becomes evident that they are to a large extent verbs of mental process. Three verbs of mental process occur with particular frequency. These are *show, suggest,* and *indicate.* Together they account for 38% of the cases of metaphor: *show,* 18%, and *suggest* and *indicate,* 10% each. There is also strong collocation between certain subjects and verbs. For example, *figure* as subject, as in (4) above, occurs exclusively with the verb *show* in this corpus.

IV. THE RELATIONSHIP BETWEEN PASSIVES AND METAPHOR

So far I have considered use of the passive form and use of metaphor as ways of avoiding mention of the human agent. However, closer study of these two features indicates that the link between them is of a somewhat closer nature. Their use is in a sense integrated, for in the majority of articles in my corpus they are in a distribution which is inversely related. By this I mean that when the incidence of passives and metaphorical clauses in each article is considered in relation to the average for the corpus as a whole, it emerges that for most authors, when more then the average percentage of passives is used, then it is combined with a lower than average percentage of cases of metaphor, and vice versa. This is the case in seven of the eleven articles in the corpus. In three cases the percentage of both types of clause is higher than the average, although in one of these the incidence of passive clauses is greater than the average by only 0.1%. In one article the incidence of both types was less than the average.

Taken together, passive and metaphorical clauses account for 41% of the corpus, ranging from 32% to 51% in individual articles. If the two extremes are excluded, the range narrows to 38% to 46%. I take it then that there is a stable and significant relationship between these two features.

V. THEMATIC STRUCTURE

So far, I have considered both of these phenomena as methods of avoiding mention of the human agent. It is now worthwhile considenng what it is that distinguishes them, for it is evident that there must be something which leads a scientific author to choose one formulation rather than the other. It seems to me that the main element involved is that of information structure, that is, what the author selects as theme, his starting point, and what he presents as rhematic material, what he wants to say about the theme. In systemic functional grammar, it is considered that in English, thematic material always occupies clause initial position. Thus in the case of a passive with a material process verb, the goal (Halliday 1985, Eggins 1994), usually the complement in the active clause, is selected as theme and thus occupies subject position.

(13) ... the sedirnent samples were soaked ..

Here, *the sediment samples* constitutes the goal and has been selected as theme; the process, *were soaked,* is the rheme. Similarly, in the case of a passive with a mental process verb, the phenomenon (Halliday 1985, Downing & Locke 1992, Eggins 1994) is selected as theme.

(14) ... mean densities were calculated ...

Here, *mean densities* consitutes the phenomenon, the conceptual object of the mental process, and is selected as theme, while *were calculated* encodes the process and is rhematic.

The case of metaphor is rather more complicated, since metaphor, of its very nature, can be analysed in two ways.

(15) This analysis shows that the effects of friction and the Earth's rotation ... are comparable ...

In (15) *shows* is a mental process verb, of the verbal process subtype. Here, *this analysis* has an intrumental role, but is presented metaphorically as the sayer, normally subject in an active verbal process clause. It is thus selected as theme, with *shows that the effects of...* as rheme. This strategy enables the writer to transfer features of human action to an element which initially has an instrumental role. There is a further difference between the use of passives and the use of metaphor. In the case of passives, the option of mentioning the agent

in a prepositional phrase is still grammatically open, though this option is taken in less than 20% of cases (Huddleston 1971, Dušková 1971, Banks 1990, 1994). In the case of metaphor, since the human features have been transferred to something inanimate, mention of the human agent is no longer even theoretically possible.

I do not wish to suggest that these three exarnples cover all of the possibillities, nor that other factors are not involved. What I would claim is that these examples are typical, and that the aspects discussed here are central to the question.

VI. CONCLUSION

In this article I have discussed the use of passives and the use of one type of metaphor in the scientific journal article. I hope to have shown that these features are not simply features in isolation, but that they form part of a integrated and coherent whole. In particular, they are both related to the avoidance of reference to human agents, they are distributed in an inverse relation, and their selection depends on thematic choices.

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