Revista Alicantina de Estudios Ingleses 14 (2001): 167-176

From the Cognitive to the Pragmatic: The Scientist as Communicator

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ABSTRACT

The main contention in this paper is that the process of communicating scientific knowledge could be compared to the role of the translator as communicator (Hatim & Mason, 1997). Like the translator, the task of the scientist is to encode —or metaphorically "translate"— the conceptualizations of science into a very restricted register with particular linguistic, pragmatic, and ideological conventions. The present analysis also shows how discourse is ultimately subject to certain social restrictions established by the institutional matrix. Like the translator, the scientist should also develop awareness of the complexities of the sociology of the language when communicating specialised knowledge.

1. Introduction

Communities of practice are regarded as complex collective networks sharing common knowledge, linguistic register, and social values and conventions. Writing in English for academic purposes is a particular example of a specialist register used by a very restricted community of users —that of the members of the academy (Trimble, 1985; Swales, 1990; Bathia, 1993). In their roles of researchers, university teachers or postgraduate students, scientists use this particular variety of language use in their usual communicative events: they either speak in English in international symposia, conferences and meetings, or use its written form in specialised journals and publications, doctoral dissertations, etc., where they present their findings and experiments to the members of the scientific community.

Recent studies in English for Specialised Purposes (ESP) and more particularly in English for Academic Purposes (EAP) (Wilkinson, 1991; Swales & Feak, 1994; Alcaraz, 2000) have paid special attention to an increasing awareness of the complexity of text production in the context of scientific research. Echoing Hatim and Mason's well-known work *The Translator as Communicator* (1997), this paper regards the scientific writer as a factual translator/communicator in a metaphorical sense: when transcribing his/her thoughts into words the scientist "translates" certain mental schemata and expectations shared by his/her audience, and subsequently encodes the written message according to textual and socio-contextual parameters specific to this restricted interpretive community. By this means, the scientist acts as a "translator/communicator" and assists readers in their quest for optimal relevance or understanding.

As the present analysis shows, the process of writing in science actually involves three intricate strategic procedures with the aim of providing the audience with the most suitable interpretation of the text. First of all, the scientist-writer favours interpretation via a metadiscourse pre-revealing of structures for content organization. Both the general-specific structure (Jordan, 1984) and the problem-solving pattern (Hoey, 1983) provide a coherent arrangement and linkage of ideas and therefore improve the understanding of scientific concepts to a great extent. This first step will be hereafter defined as "cognitive translation". Secondly, scientific writing complies with certain pragmatic features which aim at simplifying both writers' implicatures and readers' inferences; this second stage in the process of communication will be further analysed as a "discourse translation". To borrow Scollon & Scollon's words (1995: 249-250), the professional communicator not only needs to decide on the appropriate arrangement of contents but rather needs to "choose the most appropriate forms of language for any particular situation so as to be as clear and effective as possible in communicating with his or her audience".

Together with both textual and discourse implications, the scientific communicator should finally "translate" into words a whole set of social and ideological conventions —rigidly established by the scientific institution itself—, conventions which inevitably affect the very textual level of the text. These are "contextually determined communication strategies [that] relate to the structure and texture of texts" (Hatim & Mason, 1997: 10). This third step in the process of communicating scientific knowledge will be considered as a "sociopragmatic translation", since what the writer does is to accept the social conventions and restrictions of the community and reflect them in the text for the sake of acceptance and recognition by the institution.

Therefore, the aim of this paper is to analyse in detail the role of the scientist as translator/communicator. This role entails "developing familiarity with and competence in the use of psychological and psycholinguistic models of memory and information processing on the one hand, and linguistic models of meaning, including meaning beyond the sentence on the other" (Bell, 1991: xvii). The translator encodes a message taking into consideration the readers' psycholinguistic mappings and further creates a contextual meaning by using the appropriate social and contextual codes of the community. In short,

the scientist "translates" the cognitive into the pragmatic, or rather, encodes individual interpretive mappings into a single collective interpretation.

As such, the whole process of scientific writing could be compared to the act of translation/communication, in which both mental schemas, discourse expectations, and socio-contextual restrictions are taken into account when producing a text. As Swales and Feak point out, academic writing is rhetorical in the sense that the scientific communicator is engaged "with thinking about [their] reader's likely expectations and reactions, with deciding on what to say —and what not to say— about our data and with organizing our texts in ways that meet local conventions and yet create a space for ourselves" (1994: 3). Only by encoding and combining both intratextual and hypertextual information will the scientist be able to aim at an optimal understanding of a written text. As a result, the process of writing scientific literature integrates the cognitive, textual and social influences on readers and writers in their respective academic discourse practices.

2. On cognitive "translation"

Starting from the premise that "[c]ognition is governed by the search for maximal relevance" (Wilson & Sperber, 1998: 9), the scientist's first task as a specialist communicator is to bear in mind all the cognitive effects and processing effort of the readers, and see how the text sticks to a context of existing assumptions.

The act of writing in science is done with a particular reader in mind, knowing who the reader is, his/her background knowledge, his/her contexts and expectations. "[M]any faculty[1] believe that there is a general academic English as well as a general set of critical thinking skills and strategies for approaching texts" (Johns, 1997: 56). These strategies for reading, writing and, generally speaking, interpreting are shared by all the members of the community and evolve as the academic register does with the sign of the times.

As rhetorical handbooks on academic rhetoric dictate (Barras, 1978; Hamp-Lyons & Heasley, 1987; Weissberg & Buker, 1990, among others), the scientific writer should know how specialised contents have to be structured and how complex conceptualizations ought to be explained. Appealing to the cognitive domain, the scientist must take into consideration the fact that pattern recognition of scientific texts is traced down by prior knowledge and experience of classical genres in the academic context. As Gutt explains (in Navarro ed., 1998: 153), "accessibility to the right contextual information plays a key role in inferring the communicator's intended meaning".

Prior texts are regarded as belonging to the reader's mental schemata. As part of a closed register, both textual and contextual features of academic genres conform to certain rules for content organization. The classical example of textual typologies is the research paper —perhaps the academic genre *par excellence*—, whose contents are systematically encapsulated in what is known among the community as the IMRAD (Introduction-Methods-Results-Discussion) structure. Contextual models of scientific writing —that is to say, that "minor literature" related to the process of writing in the academic milieu— also

follow rigidly stereotyped formats and style conventions: letters for applications, reprint requests, grant proposals or e-mail correspondence are instances of minor written genres which are closely linked to academic situations such as submitting a paper, requesting reprints, applying for a position, raising funds for research, etc.

"Cognitive translation" involves the writer in the task of appealing to the reader's cognitive schemas or established routines in search for inferential understanding. In this first stage of "translation" the scientist facilitates the construction of a suitable context or background knowledge of assumptions to the audience. Simultaneously, the reader's effort when processing information greatly depends on the form in which it is presented: a considerable syntactic complexity, well-defined recurrent structures for content organization and, obviously, a highly specialised terminology and vocabulary. The result is a text which conforms to the well known Gricean cooperative principle and its four maxims for successful communication: quality, quantity, manner and relevance.

Closely related to the process of "translating" scientific contents into written words is the notion of intertextuality. Every scientific text integrates information from previous researchers. Campbell, for instance, remarks that "[e]ven the most original academic paper integrates facts, ideas, concepts, and theories from other sources by means of quotations, paraphrases, summaries and brief references" (in Kroll ed., 1993: 211). The main function of intertextuality is to support the writer's ideas with studies which have already been accepted by the community. Also, intertextual citations represent an important rhetorical element in academic prose since it is believed that the more authorial references in a text, the deeper and the more relevant the written text looks.

To sum up, in this first stage of "cognitive translation" the scientist encodes —"translates"— the audience's prior conceptual and mental knowledge into complex textual practices and adjusts the textual contents to the proper academic style, the "C-B-S style" (Scollon & Scollon, op. cit.: 98), standing for clarity —by being as accurate and precise as possible—, brevity —by using the exact information— and sincerity —by showing objectivity and reliability in the exposition of facts and events. Cognitive domains help once again to "provide the basis for linguistic meaning, including the previous discourse and the linguistic interaction itself" (Langacker, in Nuyts & Pederson eds., 1997: 235). An adequate "translation" of cognitive schemata seems therefore necessary as a first step towards successful communication.

3. On discourse "translation"

Once contents have been selected and organized, a second step in the process of writing scientific texts should focus on how to "translate" into words another contextual criterion —the intentionality of the scientific communicator. Whether s/he wants to persuade with an argument, to convince with a new theory, method or procedure or, simply, to inform about an experiment or an analysis is all a matter of the intentionality of the text. Like the

translator, the scientist-writer transmits contents with a particular purpose in mind and, consequently, provides them with a suitable rhetorical framework.

Studies on discourse pragmatics (Gumperz, 1982; Brown & Yule, 1983; Mey, 1993) put forward that "[s]uccessful reference means that an intention was recognized, via inference, indicating a shared knowledge and hence social connection" (Yule, 1996: 24). According to its functionality, the rhetorical architecture of scientific literature is grounded in two main modalities of text: the informative and the argumentative. Informative texts impart knowledge about a specific subject or topic; argumentative ones on the other hand form reasons, draw conclusions, and apply them to a case or subject under discussion.

In both modalities the most outstanding features of academic writing are those of objectivity and simplicity in the exposition of arguments. Objectivity is easily achieved by using the passive voice, thus giving prominence to the object of the study rather than to the subject itself. As Myers pointed out (1989: 4), the use of the passive blurs the identity of the author and foregrounds the universality of science leaving aside individual landmarks. Other syntactic features that also contribute to an objective prose are the use of ergative verbs and personifications. In the scientific register "tables show", "results prove", or "analyses confirm", are the formulas used in preference to others such as "the authors show ... in this table", "according to these results, the authors prove ....", or "the researchers confirm with these analyses that ...".

In seeking simplicity, scientific prose follows certain recurrent syntactic patterns which help to avoid ambiguity and obscurity. An example of simplifying syntactic structures in the academic register is the ample use of reduced relative and temporal clauses. "The trials carried out [that were carried out] showed that ...", "After being used [after the device has been used] it is disconnected from the mains", etc. are instances of these two types of structures which omit part(s) of the subordinate clauses for the sake of linguistic brevity.

Other syntactic structures employed by the scientific writer are conditional statements and cause-effect relationships. The former are used to express hypotheticality in the experimental method ("[T]he obtained mixture will have X qualities if the amount of solution is the correct one"), or to express criticism about former studies ("[R]esults would have been more accurate if the authors had considered X variation"). The latter have lately become useful linguistic tools to provide sound explanations and, generally speaking, support intricate scientific procedures. For instance, sentences of the type "[A]s a result of these findings, several conclusions can be drawn about ...", or "[T]he tests were performed several times because further details were about the experimental sample under study were necessary" are often found in scientific texts.

Together with syntactic simplification, specialised terminology plays a vital role for an accurate development of contents. At first sight, it may seem that vocabulary in the scientific register adds more difficulty at a textual level. Apparently, the higher the lexicality of the text the more difficult it is to infer the proper meaning. However, both readers and writers who are specialists in the field widely use this kind of terminology. Then the role of the scientific communicator focuses not on the use of this kind of terms, but on the "translation" of complex scientific issues into recurrent lexical patterns adopted by the

network of users. In particular, the procedure of nominal compounding aims at simplifying long lists of nouns and their modifiers in a single chain of noun compounds. If instead of "an engine works with petrol and is driven by means of a pump", the scientist rather refers to a "pump-driven petrol engine", the language is simplified to a great extent. The longer the noun compound, the more difficult it is for a non-expert to interpret it correctly. It is the task of the scientist-writer to use such lexical structures keeping in mind the audience's background knowledge and expectations.

From a discourse perspective, the linkage of scientific concepts within a coherent and cohesive text is achieved through the use of discourse markers. In their role of communicators, scientists should provide mappings for the readers throughout the texts making it easier to understand the relationship between topics and argumentative tactics. Echoing the process of translation from one language to another, reformulation works as a rhetorical tool to express the same thought in different words, facilitating in this way inferential meanings. When dealing with very restricted registers, a specialised language such as the academic one is very suitable for clear formulations. As Salkie (1995: 75) explains, discourse markers can work as pre-revealing features of the writer's intentions: the enumeration of stages in a process, the exemplification of facts, reporting what others have said to introduce the topic under discussion, references to visual or non-linguistic elements (charts, graphs, tables, etc.), or the recapitulation of previously mentioned ideas, to name but a few discourse functions. With the help of discourse connectors the scientist guides his/her readers along the text favouring understanding.

When building up scientific discourse deductive rhetorical strategies become a useful way to interpret and understand "how linguistic representations reveal and constrain conceptual representations and how conceptual representations are mapped into linguistic representations" (Tomlin, in Nuyts and Pederson eds., 1997: 162). This is precisely the way the cognitive and the linguistic domains converge in a common interface.

4. On social-pragmatic "translation"

When people communicate they use language "to define their relationship to each other, to identify themselves as part of a social group" (Fasold, 1990: 1). Like the translator, the scientist should also be familiar with the cultural and ideological contexts —or "orders of discourse", as Michel Foucault (1970) calls them— in which texts are produced. As a specialised register, scientific literature acts as a highly restrictive code; it expresses identity, detachment from the rest of the society, and institutional power —mainly with respect to publications, journals, referees, funds, etc. Despite the classical premises of objectivity and clarity claimed for what is considered as "good" scientific writing, texts are ultimately understood in accordance with socially accepted norms, patterns and expectations shared by all the members of the community. As Chambers concludes, "[T]he codification of linguistic norms and their imposition is culturally determined" (1999: 213).

Having adapted specialised contents to textual and discourse requirements, the third stage in the process of scientific writing focuses on how to reflect —"translate"— in written words the relationship between the writer and his/her interpretive community. In this stage both the cognitive and the linguistic are thus shaped in response to the ideological and social nature of language.

Particularly interesting in this respect is the sociology of the scientific knowledge (SSK), a branch of social pragmatics which studies the way a specialist language such as that of science is closely tied to institutional power and social restrictions. As literature reflects (Pinch, in Battalio ed. 1998; Button ed., 1991), the institution often becomes the wider matrix for academic discourse practices. On the one hand, this self-contained institutional network impinges detachment and a strong sense of identity with respect to the other linguistic communities. On the other hand, and within the community itself, scientists publish to achieve reputation, social acceptability and, on frequent occasions, to raise funds for further research.

As a general rule, scientific prose shows a priori constraints regarding social acceptability. The institution validates a scientific experiment if it can be replicated, if both theory and practice are related, and if the scientists involved in the research have prestige. Conversely, the scientific community rejects failure in the experimental methods, impropriety, or a categorical exposition of facts. For instance, a research paper is accepted or not according to the standards of readability; consequently, the scientist-writer should be concerned with his/her status in the social structure and therefore select the most appropriate style for the particular audience and the specific context of situation in which communication takes place: a prestigious journal of the field, an international forum or symposium, etc.

Rules of politeness are grounded in the recognition of power and well differentiated social status within the institutional framework. Politeness strategies symbolize identity and membership among members of the discourse community. One of the most recurrent communicative strategies in specialist networks such as the scientific one is the use of hedges (Salager-Meyer, 1994). Hedges avoid giving a direct or definite statement; "it may seem that ...", "it appears that ...", "apparently", "approximately", "it is likely that ...", etc., are common expressions which often appear in scientific publications for the purpose of showing detachment on the part of the author with respect to the finding or study.

From a pragmatic perspective, hedging reduces the level of certainty, facts are no longer imposed but suggested to the scientific community. Yule explains that hedges are used "to show that the speaker is conscious of the quality maxim" (op. cit.: 38). By hedging the discourse the writer shifts from a straightforward exposition to a more persuasive and subtle style.

Despite the apparent objectivity in the presentation of facts that characterizes academic writing, the task of the scientific writer is to encode —or metaphorically "translate"— strictly scientific matters into what Alcaraz (2000: 143) calls a "tentative language". By this means, the scientist shows modesty, respect for the institution and and acceptance of the

provisionality of the research, thus leaving space for further studies, counterargumentations and, at times, even controversy and debate.

As stated earlier, in academic discourse the authority of the scientist is replaced by the authority of the text for the sake of science itself; in other words, what is important is not the researcher involved but the scientific ideas. In this sense, a "sociopragmatic translation" of scientific concepts into a suitable rhetorical frame is also required to carefully articulate an apparently aseptic language with the purpose of persuading the audience and convincing them of the validity of the research. To put it simply, the aim of the writer is, ultimately, to search for credibility and acceptance on the part of the institutional network.

In the light of this complex process of communication —that is, the "translation" of the cognitive, the discoursive and the sociopragmatic—, scientific discourse in particular could likewise be regarded "as a text whose contexts (including cognitive, social and linguistic contexts) allow the interpretation of speaker meaning in utterances" (Schiffrin, 1994: 227).

5. Conclusions

"[T]he process of translating is a special case of the more general phenomenon of human information processing" (Bell, 1991: 229). The purpose of the present analysis has been to motivate a reflection on the process of writing in science taking into account the readability and acceptability of academic literature as the two main pillars for institutional acceptance. The analysis has also attempted to portray the scientists' "metacognitive awareness" —in Ann Johns's words (1997: 13)— of the process of academic writing, a process which becomes a search for a cohesive texture, a coherent text and a suitable genre format.

Academic English, as used in the scientific domain of knowledge, represents an instance of how cognitive, linguistic and discourse features characterize particular social arrangements, and an example of how language in general is "a social practice determined by social structures" (Fairclough, 1989: 17). The scientific communicator needs to be aware of the social influences of the context on discourse and reflect —or "translate"— them in written words.

It then seems that scientific discourse practices should be described with reference to the cognitive, interactional, pragmatic and ideological use of the language. First of all, the scientist should pay attention to psychological concepts such as background knowledge, beliefs and expectations, since "a communicator, by means of her communicative behaviour, is deliberately and overtly helping her addresee to infer the content of the mental representation she wants him to adopt" (Wardhaugh, 1998: 157). Then, the scientific communicator should particularly focus his/her attention on the appropriate discourse conventions in order to provide the text with both cohesion and coherence. And finally, s/he should put into words a set of social and cultural rules to make the whole piece of writing acceptable by the institutional community.

The task of the scientist-writer is as complex as that of the translator: to find the adequate interaction between conceptual meaning and sociological assumptions for a desired

interpretation. In this respect, scientific writing reifies, metaphorically, the "continuum" —intertextually echoing the famous scientist Albert Einstein— between cognitivism and pragmatics.

Notes

1. The term "faculty" should be understood here as a professional discourse community identified with a college or university, as well as its language and values. For further details see Johns, op. cit. pp. 54-64.

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