

Interpersonal Grammatical Metaphor in the Written Discourse of the Social and Natural Sciences

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Abstract

Using Michael Halliday's (1994) model of functional grammar, this paper reports on the findings from a large corpus-based study of scientific research articles all of which were published in English in 2000 and 2001. The corpus comprises the Introduction and Conclusion sections of 100 scientific research articles from 10 disciplines, five from the social sciences and five from the natural sciences. The texts have been analyzed quantitatively with respect to the realization of interpersonal grammatical metaphor, an aspect of the lexico-grammatical structure of written discourse which has not been as thoroughly investigated as have other components of the Hallidayan model. The paper will present quantitative findings regarding the realization of interpersonal grammatical metaphor in research introductions and conclusions a) within a particular research field, b) across research fields, and c) between the social and natural sciences. The analyses will show that the social sciences represent significantly more instances of interpersonal grammatical metaphor. Implications will be drawn for the Hallidayan model.

Keywords: functional grammar, interpersonal grammatical metaphor, quantitative text analysis

INTRODUCTION

Halliday (1994) has described the realization relationship between lexico-grammar and discourse semantics as 'natural'. This suggests that there is an unmarked correlation between meaning and wording – that is, as Halliday claims, all things being equal, we expect, interpersonally, that speakers/writers will realize statements as declaratives, questions as interrogatives and commands as

imperatives; or ideationally, that "participants"³ will be realized as nouns, processes as verbs, properties as adjectives and logical relations as conjunctions. Things not being equal, Halliday's model allows for tensions to arise between semantics and grammar, opening up the possibility of indirect speech acts (one mood acting as another) or nominalization (e.g. processes dressed up as nouns). Halliday refers to the realization and instantiation processes whereby meaning and wording are denaturalized along these lines as Grammatical Metaphor (GM).

Previous studies of the ontogenetic development of language in individuals show that the use of GM constitutes a significant dimension of the developing complexity in children from later childhood to adolescence (cf. Derewianka, 1995). There have also been a number of investigations into the use of GM in adult written discourse, most of which have focused on "ideational metaphor"⁴. In fact, many studies seem to associate GM with ideational metaphor, with nominalization as the most prominent instance thereof (cf. Asp, 1993; Derewianka, 1995; Goatly, 1995; Halliday, 1992, 1996, 1997, 1998; Halliday and Martin, 1993; Martin, 1992, 1995, 1997; Lemke, 1998; Matthiessen, 1995, 1998; Ravelli, 1988, etc.). These and other studies have investigated GM in different contexts, registers, genres, etc. For instance, Chen (1999) investigates the written English produced by Chinese university EFL students to see if GM constitutes a significant dimension in their English learning. The study samples 180 written texts from compositions written by science and engineering majors from three different universities in China. By analyzing the data in terms of the types of metaphor, types of process, and of lexical density (LD) and comparing these measures with those from other studies on native speakers and ESL learners, it was found

³ By "participants," Halliday means any of a clause's grammatical subjects and complements.

⁴ By "ideational metaphor," Halliday means a marked clausal structure, in which, say, an adjunct is assigned the grammatical role of a subject, and other, lexicogrammatical elements are changed as a result. For example, "The second day saw them at the mountaintop," is the ideationally metaphorical counterpart to "They arrived at the mountaintop on the second day."

that GM plays some role in construing experiences in the nominal mode of expression, and that the use of GM often involves the use of relational process and the process for realizing logical relations within the clause.

Another line of research comes from Li and Zhao (1999) who compare the metaphors used in the register of formal written language of an institutional document ("Warwick University Strategic Plan") and those used in the register of informal colloquial language in the novel *The Catcher in the Rye*. For both texts, instances of ideational and interpersonal metaphor were identified. One of the most significant differences the authors found was that both types of grammatical metaphors tend to appear in the form of lexical density in the nominal group in the institutional document, while in the informal colloquial language of the novel this is not the case, as might be expected. Another, less predictable, finding was that in the informal colloquial style, ideational metaphors were represented in many forms other than nominalizing metaphor in contrast to the institutional text. As for interpersonal metaphors, Li and Zhao conclude that objective interpersonal metaphors are used in higher proportion in the written language of the institutional document while subjective interpersonal metaphors are more often used in the informal colloquial style of the novel.

With regard to another type of formal writing, Halliday (1985; 1994; 1998) has shown the importance of grammatical metaphor in scientific writing in English, notably processes encoded in nominal form. It seems, however, that the use of grammatical metaphor in scientific writing has progressed at different rates within different disciplines, depending on whether the discipline was dominated by a more descriptive genre or one which presented experimental findings. In particular, Banks (1996) has found that the biological sciences, having remained descriptive long after the physical sciences had become experimental, began using more grammatical metaphors at a much later date. Banks (1999) also has compared the incidence of grammatical metaphor in the biological and physical sciences within

particular periods in the history of science to see whether any notable differences remain today.

The present study also analyzes the formal genre of research articles but within the social and natural sciences. More specifically, the present study addresses the following question: Is there any significant difference between social and natural sciences, across subfields within each, as well as between introductions and conclusions regarding the realization of interpersonal grammatical metaphor?

Unlike previous studies, however, the corpus analyzed is large, both with respect to the number of fields and the number of texts within each field. Through quantitative analysis of this corpus, it will be shown that, overall, interpersonal metaphors are more characteristic of social science research writing, but that significant differences exist within particular disciplines and particular sub-sections of research articles.

Halliday's theory of interpersonal grammatical metaphor

In rhetorical theory, the term *metaphor* is defined as a word which is "used for something resembling that which it usually refers to; for example *oozes* in *He oozes geniality [displays all over]*" (Halliday, 1994, p. 340). Most instances of metaphor involve transfer from a concrete to an abstract sense. According to Halliday (1994, p. 341), however, "there is a strong grammatical element in rhetorical transference; ... there is such a thing as grammatical metaphor, where variation is essentially in the grammatical form although often entailing some lexical variation as well".

Halliday assumes two main types of grammatical metaphor in the clause: metaphors of mood (including modality) and metaphors of transitivity. In metaphors of modality, the speaker's opinion regarding the probability that his observation is valid is coded not as a modal element, but as a separate, projecting clause in a hypotactic⁵ clause

⁵ A hypotactic clause complex is a complex clause in which there is one dependent clause and one independent clause, as in: *If it rains, I won't go*, in contrast to a paratactic clause complex in which both clauses are of equal status, as in *John ran away, and Fred stayed behind*.

complex. For example, *It probably is so*, which is the congruent⁶ form, corresponds to *I think it is so*, the metaphorical variant.

Halliday discusses the modality system with respect to its orientation and manifestation, its value, and its type: the terms *orientation* and *manifestation* refer to the way in which speakers formulate 'indicative' and 'imperative' speech act as negotiable propositions and proposals. At issue here is the rhetoric whereby modality and the source of the modal assessment (i.e. the speaker) are structured into or around the Subject and Finite MOOD functions. The system of *value* focuses attention on the strength of a modal assessment. Modalities of probability, usuality, inclination and obligation can all be scaled according to whether their value is low, median, or high. The system of *type*, on the other hand, distinguishes between the system of modalization, which opens up degrees of polarity for propositions, and modulation, which opens up degrees of polarity for proposals. Halliday (1994, p. 358) presents the following table in which he combines all the features of modality.

In Table 1, the modality orientations most relevant to interpersonal grammatical metaphor are the subjectively explicit and the objectively explicit forms. As Halliday puts it, "the explicitly subjective and the explicitly objective forms of modality are all strictly speaking metaphorical, since all of them represent the modality as being the substantive proposition" (p. 362). It is the features of these two orientations that make up the criteria to locate instances of interpersonal metaphor in the corpus of the study.

Table 1: Modality (examples of type and orientation)

Orientation Type	Subjective: Explicit	Subjective: Implicit	Objective: Implicit	Objective: Explicit
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⁶ By congruent it means the unmarked or non-metaphorical way of expressing the meaning of a clause.

Modalization: Probability	I think [in my Opinion] Mary knows	Mary'll know	Mary probably Knows [in all Probability]	It's likely that Mary knows [Mary is likely to]
Modalization: Usuality		Fred'll sit quite Quiet	Fred usually sits: Quite quiet	It's usual for Fred to sit quite Quiet
Modulation: Obligation	I want John to go	John should go	John's supposed to go	It's expected That John goes
Modulation: Inclination		Jane'll help	Jane's keen to Help	

METHOD

Corpus

The corpus of the study consists of the introduction and conclusion sections of 100 scientific research articles⁷, 50 from five randomly selected social science disciplines (psychology, sociology, philosophy, economics, linguistics) and 50 from five randomly selected natural science disciplines (physics, chemistry, botany, biology, and electronics).

The selection procedure for the texts was in part affected by the availability of research journals in the libraries of the University of Tehran, Iran and the nearby University for Instructor Education, which have the richest academic journal holdings in the nation's capital. For each field, two journals with high reputational prestige within the field were chosen (see appendix for the title of the journals). From each journal, five articles published in the years 2000-2001 were selected, for a total of 10 articles per field. The criterion for selecting an article was that it had specific subsections entitled "Introduction" and "Conclusion". This resulted in a total of 100 introduction sections and 100 conclusion sections.

Design and Procedure

The present study is a text analysis performed within the framework of Halliday's functional grammar. The first step in conducting the

⁷ A complete list of all articles analyzed is available upon request.

current research was the collection of the corpus to be analyzed (see section 3.1). The unit of analysis within the texts was 'clause' defined as a grammatical entity which needs at least a subject and a predicator (the subject may be missing through ellipsis). For example, in the following sentence, "*He shouted, laughed, cried, and finally fell down the stairs,*" there are four clauses: (1) he shouted, (2) he laughed, (3) he cried, (4) and finally he fell down the stairs.

To decide whether or not each clause was metaphorical or congruent in its expression of meaning, the criterion presented in Table 1 was employed. As a reminder, the criterion says the explicitly objective and the explicitly subjective forms of modality are strictly speaking metaphorical. Once all the instances of interpersonal metaphor were located across all the 200 texts (i.e. across 100 introductions and 100 conclusions), the data were put into statistical analysis. Tables 2 and 3 demonstrate the frequency of occurrence of interpersonal metaphor across the social and natural science corpus, respectively.

Here is what the shorthand headings stand for: #C/I for the total number of clauses in introductions, #C/C for the total number of clauses in conclusions, #IGM/I for the total number of interpersonal grammatical metaphor in introductions, and #IGM/C for the total number of interpersonal grammatical metaphor in conclusions.

Table 2: *The frequency count of interpersonal grammatical metaphor in the social science corpus*

Discipline	#C/I	#C/C	#IGM/I	#IGM/C	Total
Sociology	204	216	10	8	18
Psychology	114	122	10	16	26
Philosophy	168	96	18	16	34
Linguistics	166	118	2	4	6
Economics	202	114	2	4	6
Total	854	666	42	48	90

Table 3: *The frequency count of interpersonal grammatical metaphor in the natural science corpus*

Discipline	#C/I	#C/C	#IGM/I	#IGM/C	Total
Chemistry	206	130	0	2	2
Electronics	198	114	0	0	0
Botany	126	58	0	0	0
Physics	164	92	0	0	0
Biology	154	82	0	0	0
Total	848	476	0	2	2

RESULTS

As Table 3 demonstrates, there are no instances of interpersonal metaphor in the natural science corpus, except for chemistry with only two cases in the conclusion sections. Obviously, there is no significant difference across the natural science disciplines nor between introduction and conclusion sections regarding the frequency of interpersonal metaphor.

The social sciences, as Table 2 shows, contain considerably more instances of interpersonal metaphor compared to the natural sciences. So there is a difference between these two domains with respect to this variable, no matter this difference is statistically significant or not. (Notice that we cannot run any statistical procedure to find out if the difference is significant, simply because the natural sciences have almost zero cases of the variable under study.) It should be mentioned that although the corpus in the two domains does not consist of the same number of clauses, it seems that the length of the corpus is not a determining factor in the frequency of interpersonal metaphor; in other words, there is no correlation between the number of clauses and the number of interpersonal metaphor. If length were a significant factor, we would expect that, for instance, chemistry introductions have the highest number of interpersonal metaphors, while this is not the case.

Across the social sciences, on the other hand, philosophy has the highest number of interpersonal metaphors, psychology and sociology take the second and third positions, and linguistics and economics have the least number of this variable. In order to see if these disciplines significantly differ among themselves with respect to the frequency of interpersonal grammatical metaphor, Kruskal-Wallis test was conducted:

Table 4: Kruskal-Wallis test for the disciplines in the social sciences

Ranks			
	grouping	N	Mean Rank
Disciplines	1.00	10	22.70
	2.00	10	33.30
	3.00	10	42.70
	4.00	10	15.10
	5.00	10	13.70
	Total	50	

Test Statistics

	Disciplines
Chi-Square	31.130
df	4
Asymp. Sig.	.000

The observed value of Chi-Square is more than its critical value, so there is a significant difference across the social science disciplines regarding the frequency of interpersonal metaphor. To locate the source(s) of difference, the Ryan procedure was performed. The Ryan exact test divided the disciplines into three groups: Group 1 including linguistics, economics and sociology, Group 2 including sociology and psychology, and Group 3 including psychology and philosophy.

Here we can answer the research question: there is in fact a difference between the social and natural sciences with respect to the frequency of interpersonal metaphor; the introduction and conclusion sections in any of these two domains, however, do not differ significantly regarding this variable. Moreover, in the case of the natural sciences, there is no difference across the disciplines under study with respect to the frequency of interpersonal metaphor simply because there are almost no cases of this variable across this part of the corpus. The social sciences, on the other hand, significantly differ

among themselves and are divided into three groups in this regard, as described above.

DISCUSSION, CONCLUSION AND IMPLICATIONS

The present study investigated 100 scientific research articles in the social and natural sciences to find out if there was a significant difference between these two domains, across sub-fields within each, and between introductions and conclusions regarding the realization of interpersonal grammatical metaphor. The results of the data analyses show that while across the natural sciences and across the social sciences no significant differences emerge as to the realization of interpersonal grammatical metaphor, these two domains do in fact differ (significantly) in this regard. But could there be an explanation as to why the social sciences, in general, demonstrate more instances of interpersonal metaphor compared to the natural sciences?

Several areas might provide explanations for the results that were achieved among which I limit myself to Hallidayan register theory, modality system, and the nature of knowledge making in different disciplines:

Under the concept of register, issues of mode, tenor, and field are studied (Halliday and Martin, 1993; Ghadessey, 1999; Martin, 2002). Simply put, mode refers to the channel of communication (i.e. speech vs. writing), tenor to the relationship between the interlocutors in the act of communication, and field to the context in which the communication takes place. Of these three, I think mode and tenor have a higher potential for answering the question just asked. As to the mode factor, one of the factors which differentiates speech from writing is lexical density (LD) defined as the proportion of the total number of lexical items in a text to the total number of (non-embedded) clauses (Ravelli, 1988). Writing tends to be lexically more dense than speech (here I am concerned with formal writing as in academic papers). If it can be shown that the papers in the natural sciences have significantly lower LD than those in the social sciences, then it would be possible to suggest that the natural science writing is closer to the speech end of the mode continuum and therefore the close-to-zero instances of interpersonal metaphor in the natural

sciences would be justifiable -- It should be notified that various studies demonstrate that grammatical metaphor is more characteristic of written than spoken language. I calculated the LD for all the 200 texts (i.e. 100 introductions and 100 conclusions), but there was no statistically significant difference between the social sciences and the natural sciences in this regard. The mode part of register theory, therefore, did not provide us with the answer to the question why the social sciences contain significantly more instances of interpersonal grammatical metaphor.

The second aspect of the register theory, i.e. the tenor, might sound more promising in providing a reasonable answer to the same question. Under tenor, the issues of power and authority, and who's who in the act of communication are given rise to. A relevant question one may ask him/herself is: what does interpersonal metaphor add to the meaning of the clause, and if we transform a metaphorical clause into a congruent one, what information do we lose? Let us consider the following examples to see if we can come up with some answers:

1. *I believe that Mary already knows the solution to the problem.*
2. *It is likely that Mary already knows the solution to the problem.*
3. *Mary probably already knows the solution to the problem.*

Sentences 1 and 2 are metaphorical and sentence 3 is congruent in their expression of meaning. In the first two sentences, it is the probability of the event that is emphasized (and the main proposition has been dressed up as an embedded clause); in sentence 3, however, there is no way to know that there is an emphasis unless we highlight or underline the word *probably* to get the reader to read it with some emphasis. Moreover, in sentence 1, it is I, and not John for instance, who thinks that Mary already knows the solution to the problem, but in sentence 2 the speaker avoids to undertake any responsibility, so to speak, and makes the statement look as if it is an agreed-upon fact or that it is a generally-held idea. (At any case, we should not forget about the "context" of situation. It may be that the context and contextual factors require the speaker/writer to use any of the available options. In other words, I may be "forced" into selecting one way of expressing meaning rather than another. In this study,

however, I will not discuss the issue of context. It will be taken up in future work. I refer the interested reader to Ghadessy, 1999.) It appears that the tenor factor does explain, to some extent, why there are more instances of interpersonal grammatical metaphor in the social science texts than in the natural sciences texts. However, to understand how tenor does this, the following discussion on modality seems pertinent.

The modality system is the key to the interpersonal grammatical metaphor, as Table 1 demonstrates. I compared the social and natural sciences with respect to the frequency of the Modal Adjuncts⁸. It happened that there was significantly less use of these Adjuncts in the natural science texts. I think we can relate this to the issue of tenor. In other words, the way the author posits himself with respect to the audience, the way he presents his findings, as well as how certain he feels in presenting those findings can be understood through the use of the Modal Adjuncts. The lesser use of modality in the natural sciences (here I am concerned with the modalization system, the system of probability and usuality, as I am dealing with academic texts whose purpose is the exchange of information)⁹ may be a sign that the author is more certain of the findings. This relatively more certainty may be due to the nature of the natural sciences which are more experimental compared to the more descriptive nature of the social sciences. (This, however, does not mean that one is superior or inferior to the other.) In the natural sciences, there is a tendency to look at non-human objects in contrast to the social sciences which not only primarily deal with human beings but they also have a high degree of complexity and variability that cannot be precisely measured. More specifically, in the natural sciences, there is a high tendency to quantify and, as a result, to simplify data which in turn causes the loss of some information. In the social sciences, there is less room for quantification. It should be acknowledged that there are, of course, experimental/quantitative

⁸ For a complete list of Modal Adjuncts see Halliday, 1994.

⁹ Halliday (1994) discusses the modality system in terms of modalization (probability and usuality) and modulation (inclination and obligation). For further information see ch. 4.

social science research; as a matter of face, a number of the social science papers analyzed in this study were quantitative, but, interestingly, they were different from the natural sciences in the frequency of interpersonal metaphor and the modal Adjuncts.

A very relevant issue to that of "author's certainty" and modality in general is what MacDonald (1994) refers to as "compact and diffuse disciplinary problems" (p.22) or the nature of knowledge making. She maintains that "disciplinary fields may be ranged roughly on a continuum from compact to diffuse in the ways they define, present, and attempt to solve problems" (p.22). The natural sciences are, according to MacDonald, compact in the sense that there is more "consensus" (Kuhn, 1970) as to how to define, present, and attempt to solve problems of the fields. There is less of this consensus in the social sciences and humanities.

Together, then, these three areas, i.e. the register theory, the modality system, and the nature of knowledge-making in various disciplines, provide a reasonably sound explanation for why the natural sciences represent significantly less instances of interpersonal metaphor in comparison to the social sciences. In short, the compact nature of knowledge making in the natural sciences would require less use of the modality power tool which in turn conveys the fact that the author feels more certain in getting his/her message across.

The present study has implications for Swales' genre theory and for Halliday's theory of grammatical metaphor. As to the genre theory, it seems that the genre of Research Article in itself includes sub-genres of social science and natural science articles. I admit that the corpus of the study might not be large enough to make a rigorous claim; moreover, in this study only the introductions and conclusions were analyzed. The picture might have changed if all sections of the papers were analyzed. With respect to Halliday's theory of grammatical metaphor, it seems to me that those studies which claim that grammatical metaphor is mostly characteristic of written than spoken language should rethink their claim. It is true that various studies on ideational metaphor support this claim, but the results of the present study show that in the case of interpersonal metaphor the picture is

somehow different. Strictly speaking, interpersonal grammatical metaphor is not a feature of scientific writing in the discourse of the natural sciences.

This study is a contribution to the research within the domain of Systemic Functional Linguistics in that few studies have so far been done on the issue of interpersonal grammatical metaphor in the context of scientific writing and also, as Lazaraton (2002) states, there is a shortage of quantitative discourse analytic studies. This study, hopefully, has shed some light on both issues.

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Appendix

The Journals which made up the sources of articles analyzed in this study are as follows:

1. The Economic and Social Review, 2000 (Economics)
2. Empirical Economics, 2000 (Economics)
3. System, 2000 (Linguistics)
4. Linguistics, 2001 (Linguistics)
5. Journal of Applied Philosophy, 2000 (Philosophy)
6. NOUS, 2000 (Philosophy)
7. Cognition, 2001 (Psychology)
8. Councelling Psychology Quarterly, 2000 (Psychology)
9. Sociology, 2001 (Sociology)
10. Critical Social Policy, 2000 (Sociology)
11. NMR Biomedicine, 2000 (Biology)
12. Journal of Industrial Microbiology and Biotechnology, 2000 (Biology)

13. Journal of Applied Physics, 2001 (Physics)
14. Review of Modern Physics, 2001 (Physics)
15. Plant cell, Tissue and Organ Culture, 2000 (Botany)
16. In Vitro Cell. Dev. Biology, 2001 (Botany)
17. Vehicle System Dynamics, 2000 (Electronics)
18. Electric Machines and Power Systems, 2000 (Electronics)
19. Analytica Chimica Acta, 2001 (Chemistry)
20. Journal of American Chemical Society, 2001 (Chemistry).