

**“BABEȘ - BOLYAI” UNIVERSITY**

**CLUJ NAPOCA**

**FACULTY OF LETTERS**

**ENGLISH FOR SCIENCE AND TECHNOLOGY:  
THE DISCOURSE OF  
MECHANICAL ENGINEERING IN ROMANIAN  
HIGHER EDUCATION.**

**A CASE STUDY**

- **Thesis Summary -**

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**Cluj Napoca**

2011

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**Keywords:** communication, language, linguistic features, discourse analysis, discourse typology, argumentative discourse, E.S.T., E.M.E. (English for Mechanical Engineering), exposition, description, narration, argumentation, persuasion, technical vocabulary, ambiguity, metaphor, visual communication, statistics, context, knowledge content.

## **INTRODUCTION**

The discourse of engineering can be integrated into the world of technical discourse by taking into consideration its common linguistic features and the specificity given by the vocabulary in use. Our interest in this type of professional English rises from work background and experience in learning and teaching English for Engineering, as well as from observations made over the years regarding the characteristics of this type of discourse in Romania. It appears that the language of mechanical engineering is rich in foreign borrowings; it adopts mainly *English* as means of conveying information, probably due to global tendencies of communication in mainstream international languages; and it is a type of discourse that blends various contexts, language users and communication rules that are specific to the field of practice of mechanical engineers. Engineering as a profession has re-gained its sought-after status that appeared to have been lost. In the contemporary Romanian society there seems to be high demand for engineers that will contribute to the improvement of productive industries in our country. Technical education is increasing and the number of specializations offered by universities seems to demonstrate the need for specialists in engineering fields. Bearing in mind the global social and economic, as well as political context, we should take into consideration how these factors influence the production and transmission of information in this field. Whereas Romanian is official language in this country, our country's accession to the European Union has meant an increased emphasis on the acquisition and use of other foreign languages, among which English seems to be a trendsetter. From this point of view, a direction of

research that we propose to further investigate, beyond the limits of this thesis, is the extent to which Romanian language users have integrated or adapted English into their system of communication in the field of mechanical engineering.

This thesis focuses on four main aspects relating to the research topic: firstly, the reasons why the topic was selected, based on professional interest followed the scope and purpose of the thesis, the research methodology applied and finally the results arrived at, certain conclusions and further recommendations. It is divided into four chapters. They gradually take us from the definition of the discourse of mechanical engineering and its place among specialized discourses, towards a socio-linguistic and discourse analytical approach of this type of specialized language. The purpose is to demonstrate whether there is a correlation between real life and theory based characteristics as highlighted by scholars.

The thesis is a study of the discourse of engineering as a form of technical and scientific communication. Such a type of discourse is regarded as the written production and interpretation of texts that are appropriate for the targeted audience, clear and concise and whose **two main purposes** are to inform and to persuade. Articles and studies have mentioned the use of Present Tense Simple and Passive Voice, as well as Simple Sentence Structure as characteristically employed in the discourses of science and technology. The discourse of engineering can be creative and engaging and we will attempt to prove this by looking at the different types of texts that have been identified in discourse usage, by the community of language users in Romania. Moreover, we analyse fragments of discourse from the point of view of the author, audience, purpose and tasks that are specific to given contexts where engineering texts function. Do all these elements contribute to the success of discourse in the increasingly complex world of communication, defined by an interdisciplinary scope?

Furthermore, we attempt to illustrate how some phenomena that have not been the subject of extensive research are apparent in the structure of texts belonging to the field of specialized discourse, more particularly lexical occurrences and semantic phenomena. Another goal of this paper is to highlight the features that are characteristic to a mode of organizing and presenting information in written form

typical to applied sciences that are becoming increasingly popular nowadays.

Finally, we look at theories of argumentation and see how rhetoric of the discourse of engineering blends with multimodal communication strategies in order to generate meaning in the social group of engineers and scientists. In order to do this we focus on the presentation of argumentative strategies that have been identified by scholars in the field of rhetoric, linguistics, semantics and social semiotics.

We intend to highlight the features of the discourse of mechanical engineering in Romania as a type of text that incorporates modes of discourse such as exposition (in the use of sequencing features, classification, comparison and cause and effect writing) and argumentation. Moreover, a theory of argumentation must be considered when discussing matters relating to the discourse of engineering: understanding and identifying arguments and the goals of the participants, identifying the premises from which conclusions are derived and the method by which this is accomplished (producing valid and sound arguments). These statements are based on the assumption that science is an activity, typically seen as the discovery and recording of knowledge about the natural world. Scientists must convince their community of scientists that their research is based on sound scientific method. From a rhetorical point of view, scientific method involves demonstration of observational and experimental competence as a means of persuasion.

This dissertation is the result of practical observation and study of the discourse of engineering in Romania. Several questions relating to the nature of discourse and its usage are tackled. Pragmatic research has demonstrated that in order to analyse specialised discourse an integrated linguistic and semiotic approach should be applied. Considering the aforementioned, our method of investigation includes elements such as analysis of *linguistic choices* and meaning, discursive *context*, informational *content*, stylistic devices and graphic representations. The investigation has tried to highlight some specific features of the discourse of engineering, starting from the hypotheses that English is a lingua franca, understood and employed by most professionals in the field of engineering and that it is not merely the *vocabulary* but also the *purpose* of the text producers and receivers that influence the success in communication about technical matters.

**CHAPTER ONE** sketches an outline of the discourse of mechanical engineering as a type of discourse. Having in view that today's world is characterized by a high mobility and versatility of informational content and that technological progress is communicated worldwide using mainstream international languages, the role of English language in the exchange of information is not to be ignored. Whereas reality can be described in a variety of native tongues, English connects nations and their contributions to global progress by moving beyond borders and by creating a common environment in which communication can take place. With the increased diversification of knowledge branches we may observe the intricate and subtle relationships that occur in the interpretation and description of reality in texts that are interrelated and build specific fields of expertise. This is why the interdiscursive feature is a key characteristic of the discourse of mechanical engineering and is treated as such in Chapter One. Furthermore, the general coherence and cohesion of chunks of text needs to be considered, as the desired effect of information exchanges should be agreement and this may easily be reached when discourse displays such features as clarity of aim and purpose and a good organization of arguments. Then, we present a historical account of approaches to specialized discourse in scholarly articles, in order to place the discourse of mechanical engineering within the broad spectrum of contemporary discourses. Eventually, the chapter identifies descriptions of the characteristics mainly observed by authors in terms of their frequency in the discourses from the fields of science and technology.

The features of technical texts as named in Chapter One are put to the test in **CHAPTER TWO**. This section of the thesis deals with aspects relating to rhetorical structure and logical reasoning patterns described in the literature about the discourse of science and technology. Considering the fact that information receivers are an important part in the process of communication through language, a survey is presented that provides some information about this component: audiences. Drawing on respondents' feedback, types of text are identified as being in use most frequently by this community of users. Further, some considerations are presented regarding the representations these discourse users have about this type of discourse. A statistical research presents the correlation between scholarly evidence and practical application of the features of discourse described in the previous chapter, followed by an analysis

of a number of collected discourse samples. Issues relating to the aims of discourse, as well as what texts are used for, together with considerations on terminology are presented next.

**CHAPTER THREE** focuses on the linguistic and extralinguistic features of technical texts. A major factor in defining the discourse of mechanical engineering is the nature of its vocabulary and how linguistic patterns are organized in order to build coherent texts that can be understood by a wide range of language users. Even though knowledge content and context heavily influence understanding and interpretation of specialised information, the semantic content of technical vocabulary may also influence representations and conveyance of information about the real world.

Chapter Three investigated communicative acts in a certain **contexts** having certain social purposes. Traditionally, linguistic studies focused on single sentences or isolated speech acts. We also considered issues arising when combining the notions of syntax and discourse and we observed that language cannot be separated from its social, communicative function. We briefly evoked some theoretical considerations about presuppositions and dared to describe the discourse of mechanical engineering as **question**, based on a fundamental assumption that science questions the world in order to find out what it is like. This chapter presented some considerations about words, phrases, sentences and speech acts as well as some classifications of specialized vocabulary made in literature: technical, semi-technical and specialized terms. Then, we studied a number of examples of words and terms used in scholarly research articles to identify phenomena such as pre-modification and post-modification, the nature of syntactic phenomena and the organization of texts. We have found that in the discourse of mechanical engineering, types of relations become evident even without the use of specialised lexical items.

Pragmatics and discourse analysis serve as useful tools in the analysis of linguistic and extra-linguistic phenomena in the discourse of engineering. We have looked at a number of examples of words, phrases, sentences and speech acts, as well as noun phrases, sentences and clauses from a diverse range of technical texts. They all show the cognitive and argumentative structure of engineering texts that require users to

perform operations. The overall structure of texts displays cohesion as the number and type of connectors also illustrates. Having acquired a general view of how E.S.T. integrates into the general use of English we then have a look at methods that help in the construction of meaning, starting from word level and reaching text level in the case of a type of text, the article, according to the addressed audience, purposes and relevance.

In **CHAPTER FOUR** an analysis is made of the *article* - understood as a text published in journals aimed either at scholars or the general public. The most characteristic features of this genre are presented as well as some linguistic considerations about the structure of vocabulary and information flow in articles describing the field of mechanical engineering.

The final section of this dissertation presents some conclusions about the theoretical observations and practical aspects highlighted in the course of this research. The features of the language in use by the community of mechanical engineers are mentioned as well as some directions for further research on this topic.

The scope of this investigation is wide, as defined by the nature and focus of the subject matter itself: engineering and its branches, its multidisciplinary and interdisciplinary implications. True to content, the language of this branch of science is also broad in definition, context of use, analysis as well as the relationships that can be analysed between discursive context, content and users. It is perhaps one of the areas where context determines content, or in economic terms, it is the demand for highly specialized vocabulary that creates a specific type and range of vocabulary and linguistic choices in the user community – they are shaped and moulded according to market requirements in an increasingly global, technological society.

## **RESEARCH METHODOLOGY**

The discourse of engineering is defined by a number of argumentative strategies that serve the purpose of informing and persuading audiences ranging from lay to expert. A theory of argumentation must be considered as it is widely acknowledged that science is a rhetorical activity, a process of discovery and recording of knowledge

about the natural world. Scientists must convince their community of scientists that their research is based on sound scientific method. As we have seen in the previous chapters, in order to analyse specialised discourse an integrated linguistic and semiotic approach should be applied. Thus, our investigation includes elements such as analysis of linguistic choices and meaning, discursive context, informational content, stylistic devices and graphic representations.

According to Mey (1993:181), a pragmatic view on language should not be restricted to micropragmatic issues of context, which seems to describe an unclear notion and can be understood either as extending the individual utterances making up the text, i.e. co-text; or, alternatively considering those utterances in their natural 'habitat', or the larger context in which people use language. Whetherell, Taylor and Yates (2001) offer guidelines to the study of meaning along with structures and symbols that aid in the construction of society and culture. Silverman (1993) identified two types of approaches, one being concerned with testing correlations between variables, using such concepts as social structure and social facts, while the other focusing on observation, description and generating hypotheses. Grundy (2008) and Fiske (1990) mention the major steps of such a research in pragmatics as follows: a testable hypothesis is framed as a result of some observations about the way the world appears to work; an experiment is designed, which will enable data collection from an appropriate population testing the hypothesis; data collection is made under experimental conditions; data quantification follows in order to determine whether or not the hypothesis is proved. Silverman (1993) concludes that language is similar to other social institutions that can be studied as systems of signs. Thus, technical discourse should be analysed as a system of signs functioning within given social coordinates.

Vocabulary is undoubtedly one of its most characteristic features, reflecting the specialized subject matter of scientific fields of investigation. The gap between scientific and everyday language is a large one, mainly due to the low intelligibility of highly specialized expression for lay people. But as our global societies are increasingly invaded with new scientific products, customers have become more

aware of technological processes, they understand better even complicated scientific subjects. This is largely the contribution of popular science publications. An approach to the discourse of engineering should take into account such issues as: who the language users are, what kind of language they use in their professional surroundings and how does English as one of the most powerful world languages find its place in the Romanian context.

A clear distinction must be made between the entities beyond words and what the use of language can reveal about those entities. The discourse of engineering is one that illustrates discourse modes such as exposition and argumentation and we look at some rhetorical strategies employed by the sciences. The argumentative structure of the discourse of engineering is analysed, focusing on the linguistic, as well as extra-linguistic factors that influence communicative acts. We consider elements such as reference, analogy, metaphor and the blend of image and text that contribute to the shaping of the realm of discourse of engineering. There are a number of thinking modes that have been analysed by scholars. They are: cause and effect, figurative language and analogies, classifying, induction and deduction, comparison, observation, definitions, quantifying, examples, theories and hypotheses, experiment and visual thinking. Darian (2003) studied these extensively in his book *Understanding the Language of Science*. In the materialization of scientific thinking into language, some aspects have been highlighted by Halliday: interlocking definitions, technical taxonomies, special expressions, lexical density, syntactic ambiguity, grammatical metaphor, semantic discontinuity (Halliday apud Webster 2003:163). Seen as a thinking mode that comes to life through language and language use, technical discourse is characterized by specific modes of representing reality, meaning assignment strategies and textual features.

The study of the linguistic structure of scientific texts concentrates on the structure of scientific texts rather than their vocabulary, paying attention to syntactic structures and transformations in articles; the text typology approach counts elements in a corpus of texts on different subjects and from different fields and statistically analyses them; Trimble's "rhetorical analysis" of English for Science and Technology is oriented

towards teaching, primarily intended for pedagogical purposes, with a focus on teaching procedures. Genre analysis proposes a division of texts into different types within an overall linguistic frame. Our approach focuses on the selection of a text type – the *article* – in two different registers: academic and popular science. In an attempt to analyse this type of publication, we look at a general framework of written discourse with special features as they become apparent in the discourse of engineering, considering factors such as purpose, tasks, audience and style. We explore how meaning is created in engineering texts, starting from the stage of naming entities that we perceive and analyzing how meaning is created while using figurative language in technical discourse. The second part of our analysis focuses on communication through articles in the field of engineering, with characteristics such as structure and use of visuals.

We asked ourselves what the relationship between E.S.T. and general language is. What are the specific characteristics of E.S.T.? What is textuality in E.S.T. ? These questions, open a line of thought that helps define a narrow object, one that we would like to define and describe under the term E.M.E. One of our objectives is to coin this term as an integrated concept in the general term of E.S.T.

We consider the following:

- The embodiment hypothesis, defined by Tim Rohrer in the Oxford Handbook of Cognitive Linguistics as “the claim that human physical, cognitive and social embodiment ground our conceptual and linguistic systems” (Geeraerts and Cuyckens, ed, 2007:27)
- van Dijk’s proposal of a “theoretical concept of context that can be used in theories of language, discourse, cognition, interaction, society, politics and culture”. (van Dijk, 2008: 15)
- Norman Fairclough’s view that language is an “integral element of the material social processes” ( in Wodak and Meyer 2001:122)

## APPLIED RESEARCH

Based on important theoretical considerations relating to the methods and modes of analysis used to approach discourse presented in Chapter One, definitions of discourse and a number of approaches of textual data are highlighted. The importance of lexis in communication, the role of specialized knowledge in various social practices and in specialized discourses was brought to light. An important part of Chapter One focuses on types of text described in literature and their characteristics as seen in examples from the discourse of mechanical engineering. This has the role of preparing the applied statistical research presented in Chapter Two, which is one of the most important contributions to this type of approach to the discourse of mechanical engineering:

Statistical research to highlight correlation between theory and representations in the discourse of mechanical engineering

Gross, McElholm and Reeves are among the scholars who highlighted and described some general patterns relating to how the language of science and technology is organized. The author, audience and all the components of a discursive event contribute to the shaping of science as a rhetorical activity. In order to discover how the process of communication takes place in the technical world we devised a questionnaire that helped us identify and describe features of a small user community in Romania. Its application revealed information about the functions of language in a given context as well as the nature of texts that are handled by users. Furthermore, a statistical research was carried out in order to find the correlation between theory and practice as regards the use of different types of texts and their characteristics. The results of the research show that context heavily influences the production and interpretation of texts in the field of mechanical engineering. Moreover, there seems to be a gap between theory and practice that needs further investigation.

Different discourse communities are made of different groups of people using the same language or sometimes separate languages. Reference points such as class,

region and ethnicity signal a type of social identity, according to which language use can vary. Language use also varies according to the situation in which we find ourselves. Montgomery stated that “the sensitivity of language to its context of situation is so strong that we can often recover features of the context from the very small – almost trivial examples” (1995:105). Furthermore, van Dijk wrote about language users and context, defining language users as *members* of social categories, who take on cultural *roles* and *identities* (van Dijk 2000:3) The discourse of science and engineering falls into the category of a sociological-rhetorical tradition, where texts establish scientific facts. These texts can be analysed to obtain a view of the relationship between text, social group and society.

Having carried out the survey and statistical research activities mentioned previously, the data collected there indicated the article as one of the most frequently used modes of expression in the community of engineers in Mures county. For this reason, Chapter Four focused on an:

Analysis of linguistic expressions of cognitive processes in the form of analogies and metaphors and how they are reflected in publications such as scientific reports (research articles) and popular science articles.

In the way they are organized articles make no exception from the general rules of organizing information in technical documentation. This standardized organization helps readers find information quickly. As regards register, there is a clear difference between scholarly articles and popular science articles. Their purposes differ, as well as the methods of accomplishing those purposes. Not only are we dealing with questions of register and style but also with audiences and audience expectations. It has been implied that a technical documents function well when they address a broad audience from less technical to expert. Due to the high degree of diversification of science and technology research areas, this issue has become a complex one while fields have become narrow and interdisciplinary, and at the same time very specific.

While audience structure varies, we should keep in mind what Wodak called the ‘myth of the collective knowledge’ one of the myths on which institutions rely to

cover up and hide internal contradictions. This myth might present a specialist engineer or researcher as someone who is the holder of all knowledge in the field of his practice, while the rapid pace at which science and technology are evolving leads us to think that there is little likelihood of this being true. Scientific facts are numerous and there is a constant challenge by the community of researchers and working professionals interested in progress that leads to a certain pressure regarding what Gunnarsson calls the “social construction of scientific facts” (Gunnarsson, 1997).

According to the medium of the information exchange, articles published in scholarly journals and popular science articles face two types of pressure: peer-pressure, for scholarly journal publications, where only the informed opinion matters, whereas lay audiences apply an additional pressure having expectations for which they are willing to pay the price of the magazine. Scholarly articles may be intended to inform and to persuade fellow researchers to consider and value the results published, while lay audiences impose a quick pace by their consumer thirst for much information that takes up little time to digest.

The visual component which is present in both types of articles should not be ignored. They help readers identify and understand specific pieces of information. Whereas scholarly articles do not directly address the readers’ emotions, peers may find the content very helpful. On the other hand, popular science magazines contain colourful representations of scientific findings and they attract readers’ attention to the accompanying text that usually employs everyday language to clarify the message. It is clear that with this type of discourse, about science and technology topics, style and register as well as informational content and the way it is made explicit render the discourse of engineering as expressive and emotional, appealing to readers’ minds in order to create attitudes and beliefs.

It may be argued that articles of research serve as the basic level of understanding matter and entities from our physical world. The language of science and technology may appear impossible to access for lay audiences but it is the role of popular science

articles to make the transition from the factually very specific to the generally understandable level, accessible to an educated middle class audience. The inspired addition of images and colour contribute to the creation of a more accessible type of information.

According to Gee (2005), “these two different ways of writing do different things and display different identities”. Scholarly articles focus on the methodology of science and particular theoretical perspectives, while trying to deal with the unknown or yet unexplored that needs to be managed. On the other hand, popular science magazine articles convey the message that the world is knowable.

## **CONCLUSIONS**

Engineering as a profession has re-gained its sought-after status that appeared to have been lost. There seems to be high demand for engineers that will contribute to the improvement of productive industries in our country. Bearing in mind the global social and economic, as well as political context, we should take into consideration how these factors influence the production and transmission of information in this field. It has been said that technical and scientific discourse has a reputation for being dull. In this thesis we have shown that the discourse of engineering can be creative and engaging. Furthermore, we have illustrated how some phenomena that have not been the subject of extensive research are apparent in the structure of texts belonging to the field of specialized discourse, more particularly lexical occurrences and semantic phenomena. Last but not least, we have looked at theories of argumentation and seen how rhetoric of the discourse of engineering blends with multimodal communication strategies in order to generate meaning.

Together with other types of E.S.P. that we mentioned in this dissertation, English for Mechanical Engineering is an integral part of English as a language used for international communication. We have tackled the issues of construction and

coherence of sentences and types of texts, according to their functionality: argumentative, narrative, descriptive, expository and instructive. Technical communication and technical writing have been approached as forms of written communication, having the purpose of informing and persuading people to perform some professional tasks. We have underlined the nearly equal importance of four elements in the creation of technical discourse: purpose and aim, audience, knowledge structure and argumentation strategies employed.

We have demonstrated that the knowledge content of what engineering represents, as a branch of the applied sciences, is moulded according to interdisciplinary correlations between facts and processes belonging to the listed subject matters. As regards the ideology of science, we feel that Fiske's assumption that science is "socially neutral" should be reconsidered. We cannot ignore that science and technology are closely linked with the economic organization of a society. Community practices provide the structure, motivation, and modes of communication required to sustain scientific discourse.

Among the patterns or organization we have listed the features that have been considered as typical for technical documents. As we have seen from the classification of types of texts found in the field of engineering, a technical document is supposed to contain an argument, a definition (definitions), descriptions, classifications/divisions and comparisons/contrasts. Logical reasoning becomes obvious by linguistic choice, as illustrated in the examples from various engineering texts. Technical and scientific texts are part of argumentative discourse, an activity that shifts an existing state of affairs into a new dimension, under the influence of an author, an audience and persuasive strategies that build arguments.

The study of the linguistic structure of scientific texts has focused on the structure of scientific texts and their vocabulary, paying attention to syntactic structures and transformations in articles. We have selected a text type – the article – in two different registers: academic and popular science, taking into consideration the embodiment hypothesis, the concept of context and the claims that link language and social activity

in an attempt to analyse technical discourse as a form of social and semiotic enterprise.

Further, we studied the use of figurative language, more specifically the use of metaphor, synecdoche and metonymy as linguistic and rhetorical figures that are characteristic of technical communication. Moreover, we have looked at the informational content of articles. Then, we looked at the aspect of communicating through visuals and visual rhetoric. As a general rule, we have concluded that in the way they are organized articles make no exception from the general rules of organizing information in technical documentation. This standardized organization helps readers find information quickly. As regards register, there is a clear difference between scholarly articles and popular science articles. Their purposes differ, as well as the methods of accomplishing those purposes. Not only are we dealing with questions of register and style but also with audiences and audience expectations. It has been implied that a technical documents function well when they address a broad audience from less technical to expert. Due to the high degree of diversification of science and technology research areas, this issue has become a complex one while fields have become narrow and interdisciplinary, and at the same time very specific.

It may be argued that articles of research serve as the basic level of understanding matter and entities from our physical world. The language of science and technology may appear impossible to access for lay audiences but it is the role of popular science articles to make the transition from the factually very specific to the generally understandable level, accessible to an educated middle class audience. The inspired addition of images and colour contribute to the creation of a more accessible type of information.

The discourse of engineering as a form of discourse involves an exchange of information intended to inform and persuade readers about facts of science and its practical applications, as well as the usefulness of research findings in people's everyday lives. The knowledge that this type of discourse contains and conveys is made up of various types of contents and meanings used by the historical community

that interprets and shapes the surrounding reality. Taking into account both qualitative and quantitative analyses we have attempted to highlight the kind and form of argumentation involved in the discourse of engineering, the composition of certain texts from the field of mechanical engineering, sources of knowledge, symbols and metaphors both in language and in graphic contexts, vocabulary and style. Linguistic features have been considered starting from the lexical structure and composition of sentences and phrases, as well as the cohesive devices that hold together E.S.T. texts.

The language of technical and professional communication is perhaps one of its most distinguishing features. Technical communication uses language that consists of simple, everyday words mainly nouns and verbs; and descriptive adjectives as well as imagery in metaphors, similes, and symbols. It was stated that such stylistic features seem to be scarce, but as the examples show, they are found in most engineering text, except perhaps the highly technical and specialized research articles aimed only at specialists in the given fields. As presupposed, numbers are frequently used and text structure contains a very straightforward syntax. Most sentences are short, though for a more technically-advanced audience, they appear to be more complex. Figurative meaning also plays an important part in the construction of technical discourse, with simple words that gain metaphorical dimension in use, especially in less formal texts.

Having in view the language used and the audience addressed there are a number of features that distinguish scholarly articles from popular science magazines. The audience to which scholarly articles address consists of professionals, professors, graduate students, whereas popular science addresses lay people without degrees in the subjects described. Scholarly journals display field-specific language (jargon), a fact that requires readers to be in touch with other research in the field. Popular magazines usually convey information in everyday language that is accessible to any generally knowledgeable reader.

As a general rule, it could be concluded that in the way they are organized articles make no exception from the general rules of organizing information in technical documentation. This standardized organization helps readers find information quickly.

The concept of engineering has existed since ancient times. As discourse blends social practice with knowledge and realities of the mind, it may be argued that the discourse of engineering integrates into the general concept of discourse, with certain specific features. They are reflected in the nature and types of practices of the sciences and practical applications where engineers are active. In this thesis, we have attempted to make an analysis of the discourse of engineering, focusing on the linguistic phenomena that can be observed in the structure of engineering texts, as well as the contexts in which such texts function. In this sense, we asked a number of questions and tried to find an answer.

E.S.T. is a phrase that clearly involves two dimensions:

1. English, the language that contains all the phonological, lexical and semantic units is the tool that constructs and reveals

2. the knowledge content of science and technology. The approach that can be the most productive is a sociolinguistic and cognitive one. An integrated approach that blends syntax, semantics, social research, examples of linguistic production in context, statistical analysis, all contribute to the shaping of a realm of what the language of science and technology is like. Language as a tool used in communication can be analysed best in real life situations, which show how use influences grammatical structure and other theories dealing with linguistic phenomena.

The problem of context creation is not solely the responsibility of the reader or hearer, as they are partially responsible for acting in a situation that will be defined as context. In terms of form, E.S.T. sentences are quite the same, as any other sentences understood as grammatical units. The problem of interpretation of the meaning is never one of minimal or maximal effort, but rather a question of situational analysis. As van Dijk observed, “there are few grammatical features that exclusively and directly have contextual functions”. (van Dijk 2008:171)

The language of E.S.T. then refers to objects and processes in the field of science and engineering. The concepts in this field are manipulated in operations at the cognitive

level and these operations are dependant on the purposes and methodology employed by the respective science or branch of engineering. Thus, rhetoric proves to be vital in analysing the structure of texts. Whereas scholarly articles display a clear and simple structure determined by standardized academic requirements, popular science articles contain colourful illustrations accompanying texts. While the former address a community of users with specialized knowledge, using formulae and specific explanations, the latter can be read and understood by a wide range of readers from general lay readers to managers and decision makers in various fields of industry.

The discourse of engineering should be considered as a distinct variety of English, which overlaps General English. It reflects a set of phenomena in particular linguistic and extra-linguistic contexts. What is typical of E.S.T. texts is the nature of arguments and cognitive operations involved that are primary in certain areas of E.S.T. The texts analysed come from a wide range of text types, from manuals, patents and articles, to technical specifications. We tried to focus on popular science texts in comparison with scholarly articles. This dissertation is only a starting point in the investigation about the structure of articles as the means of disseminating information in the 21<sup>st</sup> century are becoming more versatile.

Further research is needed to better describe particularities of each type of text mentioned in this dissertation. Special attention should be given to such issues as figurative language and the aims of technical texts. Beyond lexical specialization, articles have their characteristic structure and function and play an increasing role in the dissemination of knowledge regarding matters of science and technology, as they are becoming more and more important in the contemporary world.

#### **SELECTED BIBLIOGRAPHY**

Aitchison, J. (1994). *Words in the mind: An introduction to the mental lexicon* (2nd).

Oxford: Blackwell

Allen, G., (2000) *Intertextuality*. London: Routledge.

Antaki, C., Billig, M., Edwards, D., Potter, J., (2003) Discourse Analysis Means Doing Analysis: A Critique Of Six Analytic Shortcomings, in *Discourse Analysis Online*, vol.1, no.1.

Ariel, M., (2008) *Pragmatics and Grammar*. Cambridge: Cambridge University Press.

Austin, J.L. (1962) *How to Do Things with Words*. New York: Oxford University Press.

Baker, A., (1995) *A Complete Guide to Tools and Materials*. London: Magna Books.

Bell, C.D.S., (2004) *Lexical inference from specialized texts* in IATEFL ESP SIG Newsletter 25: 13-23

Bordwell, David (1989): *Making Meaning: Inference and Rhetoric in the Interpretation of Cinema*. Cambridge, MA: Harvard University Press.

Brabie, Gh., (1998) *The effects of torsion and their technical applications*. Iasi: Junimea Publishing House.

Brooks, Cleanth & Robert Penn Warren (1972) *Modern Rhetoric* (Shorter 3rd Edn.). New York: Harcourt Brace Jovanovich.

Brown, G., Yule, G., (1983) *Discourse Analysis*. Cambridge: Cambridge University Press.

[Charaudeau](#) & [Maingueneau](#) (2002) *Dictionnaire d'analyse du discours* Seuil; Sciences H.C. edition

Chomsky, N. (1957) *Syntactic Structures*. Berlin: De Gruyter.

Chomsky, N. (1984) in McEnery, T., Wilson, A. (2001) *Corpus Linguistics*. Edinburgh: Edinburgh University Press.

Cook, G. (1989) *Discourse*. Oxford: Oxford University Press.

Comfort, J., Hick, S., Savage A., (1982) *Basic Technical English*. Oxford: Oxford University Press.

Crowther, D. Green, M. (2004) *Organisational theory*. London: CIPD.

Darian, S. (2003) *Understanding the Language of Science*. Austin: University of Texas Press

Edwards, D., Potter, J., (2001) Discursive Psychology in McHoul, A.W. and Rapley, M. (eds) *How to Analyze Talk in Institutionalized Settings: A Casebook of Methods* London: Continuum International

Eggs, E. (2000) Vertextungsmuster Argumentation: Logische Grundlagen. In Brinker, K, ed. *Text und Gesprächslinguistik. Ein internationales Handbuch*

- zeitgenoessischer Forschung*. Berlin:De Gruyter, pp. 397-414.
- Fairclough, N. (1995) *Media Discourse*. London: Hodder Education.
- Fairclough, N. (1995) *Critical Discourse Analysis*, Boston: Addison Wesley.
- Fairclough, N. (1989) *Language and Power*, London: Longman.
- Fairclough, N. (1992) *Discourse and Social Change*. Cambridge: Polity Press.
- Fauconnier, G. and Turner, M (2002) *The Way We Think. Conceptual Blending and the Mind's Hidden Complexities*. New York: Basic Books.
- Fiske, J. (1990) *Introduction to Communication Studies*. New York: Routledge
- Firbas, J. (1992) *Functional Sentence Perspective in Written and Spoken Communication*, Cambridge: Cambridge University Press
- Fowler, A. (1989) Genre. In Erik Barnouw (Ed.): *International Encyclopedia of Communications*, Vol. 2. New York: Oxford University Press, pp. 215-7.
- Fowler, R., Hodge, R. Kress, G. Trew, T. (1979) *Language and Control*. London: Routledge and Kegan.
- Gee, J.P. (2005) *An Introduction to Discourse Analysis: Theory and Method* (2<sup>nd</sup> edition). UK: Routledge
- Geeraerts, D and Cuyckens, H. (eds) (2007) *The Oxford Handbook of Cognitive Linguistics*. New York: Oxford University Press.
- Gläser, R., (1990). *Fachtextsorten im Englischen*, Tübingen: Narr.
- Gopnik, M. (1972) *Linguistic Structures in Scientific Texts*. The Hague: Mouton.
- Gotti, M., Giannoni, D.S., (2006) *New Trends in Specialized Discourse Analysis* on [www.peterlang.com](http://www.peterlang.com)
- Graddol, D., Boyd-Barrett, O. (1994) *Media Texts: Authors and Readers*. Clevedon: Multilingual Matters LTD.
- Grice, H.P. (1975) Logic and Conversation in Cole, P. and Morgan, J. *Syntax and Semantics 3: Speech Acts*. New York: Academic Press.
- Groenendijk, J., Stokhof, M. (1984) Studies on the Semantics of Questions and the Pragmatics of Answers, Department of Philosophy, University of Amsterdam: Doctoral Dissertation. <http://dare.uva.nl/document/23983> and <http://dare.uva.nl/document/23984>
- Gross, A. (1996) *The Rhetoric of Science*. Harvard: Harvard University Press
- Grundy, P. (2008) *Doing Pragmatics*. London: Hodder Education.
- Haegeman, L. and Guéron J., (1999). *English Grammar: A generative perspective*. Oxford: Blackwell.

- Halliday, M.A.K (1978) *Language as social semiotic: the social interpretation of language and meaning*. Baltimore: University Park Press.
- Halliday, M. A. K. and Hassan, R (1976) *Cohesion in English*. London: Longman.
- Halliday, M.A.K. (1994) *An Introduction to Functional Grammar*. London: Edward Arnold.
- Hannah, J and Stephens R C., (1984) *Mechanics of Machines*. London: Edward Arnold
- Hodge, R. Kress, G. (1988) *Social Semiotics*. Cambridge: Polity.
- Hutchinson, T., Waters, A. (1987) *English for Specific Purposes* (Cambridge Language Teaching Library). Cambridge: Cambridge University Press.
- Johnstone, B. (2002) *Discourse Analysis*. Oxford: Blackwell Publishing.
- Karttunen, L. (1977) Syntax and semantics of questions. *Linguistics and Philosophy*1:3-44
- Kinneavy, James L. (1971) *A theory of discourse; the aims of discourse*. Englewood Cliffs, N.J: Prentice-Hall.
- Kövecses, Z. (2010) *Metaphor*. New York: Oxford University Press.
- Kramsch, C. (1998) *Language and culture*. New York: Oxford University Press.
- Kress, G., van Leeuwen, Th. (2001) *Reading Images: The Grammar of Visual Design*. London: Routledge.
- Lackstrom, D., Selinker, J., Trimble, L., (1973) *Technical Rhetorical Principles and Grammatical Choice*, published in electronic format on [www.jstor.org](http://www.jstor.org)
- Lakoff, G., Johnson, M. (1980) *Metaphors we live by*. Chicago:University of Chicago Press.
- Langacker, R.W., (2001) Discourse in Cognitive Grammar in *Cognitive Linguistics* 12/2.
- Levinson, Stephen C. (1983) *Pragmatics*. Cambridge: Cambridge University Press.
- Levinson, Stephen C. (1992) *Activity types and language*. In P.Drew and J. Heritage (eds), 66-100.
- Leech, G. (1974) *Semantics*. Harmondsworth: Penguin.
- Leech, G. (1983) *Principles of Pragmatics*. London: Longman.
- Lyons, J. (1977) *Semantics I*, Cambridge University Press.
- Lyons, J. (1981) *Language and Linguistics*, Cambridge University Press.
- Mackay, R. & Mountford, A. (Eds.). (1978). *English for Specific Purposes*. London:

Longman

Man, William C., Thomson, Sandra, A. (eds) (1992) *Discourse Description. Diverse linguistic analyses of a fund-raising text*. Amsterdam/Philadelphia: John Benjamins Publishing Company.

Martin, J.R., Rose, D. (2007) *Working with Discourse. Meaning beyond the Clause*. London: Continuum.

McElholm, D. (2002) *Text and Argumentation in English for Science and Technology*. Frankfurt am Main: Peter Lang.

McHoul and Rapley (eds.) (2001) *How to Analyse Talk in Institutional*, London: Continuum International.

Mey, J. (1993) *Pragmatics*. Oxford: Blackwell Publishing.

Mih V and Bozdog C, (2002), *Text comprehension and representation* in *Cognition, Brain, Behaviour*, Volume VI, No. 2, 155-174

Mih V and Bozdog C, (2003), *Inferential processings in text reading* in *Cognition, Brain, Behaviour*, Volume VII, No. 4, 359-382

Miller, C. (1984) Genre as social action in *Quarterly Journal of Speech*. 70 (1984): 151-67

Montgomery, M. (1986) *An Introduction to Language and Society*, London: Routledge

*New Scientist Magazine*, 2009 January – December editions, 2010 January – June editions (American Edition)

Oltean, Șt. (2006) *Introducere în semantica referențială*. Cluj: Presa Universitară Clujeană.

Osgood, C. (1967) *The Measurement of Meaning*. Illinois: University of Illinois Press

Pauley, Steven E., Riordan, Daniel G. (1985) *Technical Report Writing Today*. Boston: Houghton Mifflin Company.

Partee, B. (2009) Formal Semantics, Lecture 11, MGU May 22, 2009, docs.google.com

*Physical Review* (1992) published by The American Physical Society through the American Institute of Physics, Volumes 45 and 46.

*Popular Science Magazine*, 2010 January – June editions

Quirk, R. et al. (1972) *A Grammar of Contemporary English*, London: Longman

Radford, A. (1988) *Transformational Grammar. A First Course*, Cambridge: Cambridge University Press.

Richardson, John. E. (2007) *Analysing Newspapers: An Approach from Critical*

- Discourse Analysis*. New York: Palgrave MacMillan.
- Ricoeur, P. (2006) *The Rule of Metaphor*. London and New York: Routledge.
- Romaine, S. (1994) *Language in Society. An Introduction to Sociolinguistics*, New York: Oxford University Press.
- Romanian Journal of Technical Sciences, Tome 47, Special Number (2002) *Proceedings of the International Conference on Manufacturing Systems ICMaS 2002*. București: Editura Academiei Romane.
- Reeves, C. (2005) *The Language of Science*. London: Routledge.
- Roberts, C. (2004) Context in dynamic interpretation. In *Handbook of Contemporary Pragmatic Theory*, Horn, L.R. and Ward, G. (eds) 197-220. Oxford: Blackwell
- Rosenberg, Barry J. (2005) *Technical Writing for Engineers and Scientists*. Pearson Education, Inc.
- Rovența Frumușani, D. (2005) *Analiza discursului. Ipoteze și ipostaze*. București: Ed. Tritonic.
- Salkie, R. (2001) *Text and Discourse Analysis*. New York: Routledge.
- Sanborn Pfeiffer, W. (2003) *Technical Communication: A practical approach*. Ohio: Pearson Prentice Hall.
- Saussure, Ferdinand de., (1977) "Curs de lingvistică generală" (traducere în limba română de Ion Coja) în Lucia Wald (redactor responsabil), "Antologie de texte de lingvistică structurală", Universitatea din București.
- Searle, J.R., *Indirect Speech Acts* in Searle, J.R. (2000) *The Philosophy of Language*. (fourth edition), USA: Oxford University Press.
- Scientific American Magazine*, 2008 January - December editions, 2009 January-December editions, 2010 January – June editions.
- Shepherd, V. (1994) *Literature about language*. London: Routledge.
- Silverman, D. (1993) . *Interpreting qualitative data: Methods for analysing talk, text and interaction*. London: Sage.
- Slembrouck, S. (2001). Explanation, Interpretation and Critique in the Analysis of Discourse. *Critique of Anthropology*, 21: 33-57.
- Smith, .D.B. (1986) *Axioms for English in a Technical Age* on [www.jstor.org](http://www.jstor.org)
- Sperber, D., Wilson, D. (2002) Pragmatics in *The Oxford Handbook of Contemporary Philosophy* (2005). Oxford: Oxford University Press.
- Stubbs, M. (1983) *Discourse Analysis*. Chicago: Basil Blackwell Publisher Ltd.
- Swales, John M. (1990) *Genre Analysis*. Cambridge: Cambridge University Press

- Tannen, D. (1990) *That's Not What I Meant*. New York:Ballentine Books.
- The Oxford Companion to the English Language* (1992) Oxford: Oxford University Press
- Thomson Industries Inc (1993) *Linear motion technology guide*, Thomson Industries Inc.
- Timings, R.L. (1984) *Workshop Processes and Materials*. London: Longman.
- Toulmin, S. E. (2003) *The Uses of Argument*. Cambridge: Cambridge University Press.
- Trimble, L. (1985) *English for Science and Technology. A discourse approach*, (Cambridge Language Teaching Library), Cambridge: Cambridge University Press.
- Van Dijk, Teun A. (2008) *Discourse and Context. A Sociocognitive Approach*, Cambridge: Cambridge University Press.
- Van Dijk, Teun A. (ed) (2000) *Discourse as Social Interaction*. London: SAGE Publications.
- Van Leeuwen, Th. (2005) *Introducing social semiotics*. London: Routledge.
- Van Rooy, R., (2003) Questioning to resolve decision problems in *Linguistics and Philosophy* 26: 727-763
- Van Valin, Robert D. Jr. LaPolla. Randy J. (1997) *Syntax. Structure, meaning and function*. Cambridge: Cambridge University Press.
- Webster, J. (ed). (2004) *The Collected Works of M.A.K. Halliday, Volume 5. The Language of Science*. London and New York: Continuum
- Werlich, E. (1976) *A Text Grammar of English*. Heidelberg: Quelle & Meyer.
- Wetherell, M. Taylor, S. Yates, S. (2001) *Discourse as data: a guide for analysis*. London: The Open University.
- Widdowson, H. (1996) Reply to Fairclough: Discourse and Interpretation: Conjectures and Refutations. In *Language & Literature* 5(1): 57-69.
- Willard, Ch. A. (1988) *A Theory of Argumentation*. University of Alabama Press.
- Wodak, R. Meyer, M. (2007) *Methods of Critical Discourse Analysis*. London: SAGE Publications
- Wunenburger, Jean-Jacques (1988) *Viața imaginilor*. Cluj Napoca: Ed. Cartimpex.
- Yankee, H.W. (1985) *Engineering Graphics*, Boston: PWS Engineering.