Exploration of the applications of multilingual generation grammar in language teaching.

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February-March 2002

Introduction

The purpose of this research is to explore the possible applications that multilingual generation grammar has to offer in the field of language teaching. It is therefore a research that belongs in the area of applied linguistics, but taking advantage of the advances produced by computational grammar in the last decades. It can thus be said that the proposed research has a double component: from the field of computational grammar, it takes the object of analysis; from applied linguistics, it takes the purpose of and approach to that analysis. Both components are treated separately in the following sections.

The computational-grammar component: establishing the object of study.

Computational grammar is a relatively recent branch of linguistics that has opened a wide range of possibilities in the field, not only concerning theoretical approaches to language, but also at a commercial level. Within computational grammar we can distinguish a number of tasks that have received major attention over the last centuries. These are parsing, machine translation and, lately, natural language generation. Parsing is, broadly speaking, the linguistic analysis of a text carried out by a computer. Machine translation is the task by which a computer, with or without human intervention, analyses an input text in a language A and subsequently produces an output text in a language B. Finally we find natural language generation (NLG). The type of task performed by NLG can be defined in these terms: "computer-internal representations of some information are used as a basis for constructing generally intelligible natural language reexpressions of that information." (Bateman 1998). Obviously the machine must contain some linguistic resources, i.e. a description of the language, in order to produce "intelligible natural language reexpressions" out of "computer-internal representations". If a generator contains the grammar of more than one language, this is referred to as multilingual generation, and can be used in a similar way to machine translation.

Generation systems can also differ significantly in complexity. Hovy (Hovy 1989) distinguishes four levels: canned-text, template, phrase-based and feature-based, and concludes that "feature-based generators are among the most sophisticated systems built." (Hovy 1989). It is then reasonable to choose a featured-based system to study the applications of NLG in language teaching, since these systems contain more developed linguistic resources and cover a greater region of the grammar of a natural language.

Recently such generators have been integrated in larger and more sophisticated programmes known as grammar development environments (GDE). GDE's can perform many more operations than generate natural language. They are usually equipped with graphic tools that enable us to explore regions of the grammar or the constituency structure of the output text. Or they can perform various constrastive

operations when dealing with more than one language. Such versatility entails more potential for applications in applied linguistics, and it is therefore these sophisticated and complex programmes, GDE's, that constitute the object of analysis of this research.

Since the emergence of NLG as a branch of computational linguistics various systems have been developed. Among the most significant in the history of this young discipline we can mention: SHRDLU, PROTEUS and BABEL in the 70's, and TEXT, PAULINE AND PENMAN in the 80's. The last one, developed at the University of Southern California, was an attempt "to construct a reusable grammar component for text generation" (Bateman & Matthiessen 1991). This grammatical component is known as the Nigel grammar and has been reused by a GDE developed presently at the University of Bremen, known as KPML.

KPML will be the programme used in this research to evaluate the applications of NLG in language teaching for different reasons. Firstly, it is a feature-based system, and such systems are the most flexible and sophisticated. Secondly, it offers more possibilities of exploitation than simple generators. And finally it not only contains an extensive grammar of English, but also the grammar of more than six languages.

The applied-linguistics component: ascertaining the potential contribution of GDE's to language teaching.

It is important to remember that GDE's are the result of an important effort to accurately describe the grammar of a language. In principle it should be possible to use this detailed grammatical information for teaching purposes, just like any ordinary grammatical description. But GDE's differ from ordinary grammars in the fact that they can perform operations that allow a degree of interaction unprecedented. Students can not only graph particular regions of the grammar they select. They can also "play" with it, observing how different selections in the grammar yield different results in the output text (cf. Wilcock 1991). To this we can add the multilingual and contrastive modes, which permit the comparison between languages. What I have presented in the previous lines is only a sample of possible applications that need further investigation. The bottom line is that GDE's are too valuable sources of knowledge to be neglected as pedagogic tools. Furthermore their characteristics invite us to think that GDE's favour ways of learning that are receiving more attention lately in the field of computer applications in language learning. Kemmis (Kemmis 1977) established four paradigms of learning, which he called "instructional", "revelatory", "conjectural" and "emancipatory". The first one is associated with deductive learning, by which rules are explicitly provided. The revelatory and conjectural paradigms are related to a kind of learning where rules must be discovered by the individual from the observation of data. As Higgins and Johns point out, "for some people it may come as something of a surprise that there are any uses of computers in language learning beyond the instructional paradigm" (Higgins & Johns 1984). Nowadays applied linguists are more interested in those applications of computers that stimulate inductive learning or acquisition (cf. Hubbard 1992, Schmied 1999). GDE's can be used for deductive learning, since they contain descriptions of grammars. But they are valid for inductive learning as well, as they provide authentic material for observation. Outside applied linguistics another point of interest is how new technologies may affect our conception of grammar in future. Matthiessen and Nesbitt define the requirements of the grammars of this century in the following terms:

"new forms of reference grammars for the 21st century will need:

a) to support a variety of readings by a variety of readers
b) to support a variety of uses
c) to support links nor just to exemplifying texts but also to flow-through corpus
d) to support arguments and alternatives by making it possible to trace through the description."

Matthiessen and Nesbitt (1996)

Some of these characteristics raised here as a possibility are in fact present in KPML, so we could say that a further goal of this research is to empirically test theoretical issues about the new way of writing grammars making using of modern technologies.

Specific Goals of the research

The general purpose of this research is to look into the matter of possible applications of multilingual generation grammars in language teaching. More specific goals can be formulated as a number of questions to which I intend to find a conclusive answer. These goals or questions are:

a) GDE's are machines primarily built for the task of generating. But could they also be useful for the language teaching?
b) In case GDE's are useful for language teaching, what types of language teaching can benefit most from GDE's?
c) What group of learners is more likely to find advantages in the use of GDE's for teaching purposes?
d) What part/tool/operation/characteristic of GDE's is particularly useful for language teaching? Why? Is there a difference in the answer to this question motivated by variation in the characteristics of the learners or the type of language teaching?
e) What are the disadvantages of GDE's for language teaching? Can they be removed?
f) Are there any changes that could be introduced in GDE's to make them more suitable to learners needs?

Methodology

This research is essentially an evaluation of the applications of multilingual generation in language teaching. Roughly speaking, the objective is to obtain information from language learners about their interaction with a GDE. So there are two elements to be taken into account: the GDE that is going to be tested by learners and the way the information is going to be obtained from the learners.
The GDE used for evaluation in this research will be, as I mentioned above, KPML. This choice has been motivated mainly by the technical characteristics of the programme, since it is equipped not only with a good variety of multilingual operations, but also with specific operations for contrastive purposes, which makes it particularly suitable for teaching. Besides KPML has a wide range of resources from different languages available now.
The subjects that will test KPML will be taken from a group of learners of a foreign language, mainly English, but also German and Spanish. The selection will be based

on significant factors for the research such as academic level, purpose of learning a foreign language or age. Since the purpose of this research is precisely to determine which tools may have an application in language teaching, it is inevitable that the first step will be a personal judgement on which tools lend themselves to pedagogical uses and in which way. These applications will be studied together with teaching experts. The design of activities for the tests will also require the selection of a region of the grammar with some interest from a pedagogical point of view. The activities and exercises designed at this point will be presented to the learners. They will work in groups of two or three and their opinions will be obtained through an individual interview afterwards. The questions have four aims: to know if the activities were perceived as interesting and useful by the learners; to find out what the learners' attitude towards computers is; to know if the teachers found the activities not only relevant and useful but also easy to handle; to find out to what extent teachers and learners think they are able to design their own activities.
With the results obtained from these interviews new activities can be designed and some of the activities tested will be refined. A second round of sessions with the new activities will follow, with the corresponding interviews. These final results will be analysed, interpreted and presented in relevant graphic tools, drawing conclusions from them.

Computers in language teaching: The state of the art

The discipline that aims at the integration of computers in the process of teaching is usually referred to as CAT (Computer Assisted Teaching) and its origins are to be found in the United States in the 70's. At that time some American universities began to consider the idea of using computers in their classroom in the hope that the new technology would constitute an advance in the learning process. They began to develop educational software for a central computer that the students could access from a terminal. This project, developed at the University of Illinois, was known as PLATO (Programmed Logic for Automatic Teaching Operations) and is regarded as the initiator of Computer Assisted Teaching. It was just a matter of time before this new discipline gave way to more specialised branches of computer assisted teaching, and so shortly after PLATO we witness the development of projects which tried to integrate the computer in the learning of languages, mainly foreign ones. This branch of CAT received the name CALL (Computer Assisted Language Learning) and very soon it gained the favour of teachers. However its main disadvantage derived from the technical limitations: the first computers were very expensive and bulky, which means they were not particularly accessible.
It is with the appearance of microprocessors (much cheaper and smaller) that the interest in CALL spread to other countries. In some places the introduction of computers in education was even sponsored by the government. In the late 70's and early 80's a great effort was made in Great Britain to encourage the use of computers in primary and secondary classrooms. Higgins and Davies (1985) list five projects in progress at British universities and colleges of higher education. In Germany the development of CALL was slower until the arrival of the project "Mikrocomputer in der Spracharbeit" at the Goethe Institut, which gave way to a series of programmes that include guessing games, a travel quiz, authoring programs for multiple-choice and other tests and for a cloze-type exercise, etc (Berger 1985:112-113).
Nowadays computers are not only cheaper and faster. Multimedia machines combine the capabilities of video and tape recorders but adding a higher degree of interaction

on the part of the learner. This development ensures that the new technologies will still play an important role in the education systems of nations as well as in private institutions, and the interest in investigating the applications of computers in teaching is constantly growing, as shown by the volume of literature on the matter that appears every year.

Equally interesting is the evolution of the kind of contribution made by computers to the process of learning. Their first applications in language teaching were restricted to certain grammatical exercises of the type question-answer. Their only advantage was that they offered an immediate correction, but in the long run they were repetitive and boring (Higgins and Johns 1984). It was just a matter of time that new exercises, more stimulating and specific, were devised. New activities covering most areas of grammar and skills became available with different degrees of participation by the student. It was possible to find exercises on the morphology of the verb, cloze, text reconstruction, interactive audio and video drills, reading, vocabulary, letter writing and grammar drills in general (Ruiperez 1995:35-50). In addition, the appearance of authoring systems such as PILOT or CALIS endowed CALL programmes with great flexibility, since they permitted the teacher to create and feed into the computer new and customised exercises.

It is significant that much of the discussion has been centred on the role of the computer in the learning process. Linguists have tried to show that the role assigned to computers in the first years of CALL is too restricted and more flexible and imaginative models are possible. As Stevens puts it "This watershed development (...) heralds the emergence of CALL as a versatile tool, as an aid to learning, and as an informant on language rather than a preceptor, task-master, or programmed instructor." (Stevens 1991)

Another issue that has received a considerable amount of attention has been the exploration of the possibilities offered by computer programmes not intended for language teaching, with the main advantage that they provide authentic material. In the last years a considerable number of articles have been dedicated to the potential for pedagogical purposes of tools or components such as word processors, games, the e-mail and the Internet (cf Higgins and Johns 1984, Jung 1988).

The present work intends to continue both lines of research in computational linguistics. Firstly natural language generators are not designed for teaching purposes, so they provide authentic material and linguistic resources whose utility in language teaching deserves careful study. Secondly the role of the computer in the learning process when using generators is not restricted to that of an "instructor", but rather it plays the role of informant that encourages inductive learning .

Previous work on the area of the proposed research.

To date I have acquired some experience in the areas related to this research which will certainly be of utility. In the field of natural language generation I have taken part in various post-graduate courses at Universidad Complutense de Madrid, Spain, which provided me with a substantial knowledge on GDE's such as Penman and KPML, as well as the computational grammar Nigel. Other post-graduate courses relevant for the present research dealt with systemic-functional grammar and rhetorical structure theory, both of which play a fundamental role in Nigel, Penman and KPML. In the last two years I have also been involved in the creation of different parts of a Spanish grammar for KPML, which include the regions of aspect, tense,

polarity, nuclear-transitivity and theme. The process of creation of these regions gave me a good knowledge of KPML and so puts in a privileged position to explore and become familiar with multilingual operations in a short period of time.
In the field of applied linguistics I have taken two courses at Universidad Nacional de Educación a Distancia (UNED), Spain, on the subject of Computer Assisted Language Learning (CALL). Through these courses and the papers I had to write I became acquainted with the methods of computer-assisted teaching and the most important projects carried out in the education system of various countries. Since this area of research is relatively unexplored, these projects will constitute valuable reference points to set the lines of investigation and methods of the present study, as well as an interesting precedent for comparison of results and conclusions.

Basic bibliography.

As a preparation for this research I have consulted the following books, which I consider basic as a starting-point for further investigations. I have classified them according to the areas of linguistics which constitute the base of the dissertation.
On systemic-functional linguistics:

Butler, C.S. (1985) *Systemic Linguistics: theory and applications*, London: Batsford.
Downing, A. and Locke, P. (1992) *A University Course in English Grammar*. London: Prentice Hall.
Eggins, Suzanne (1993) *An Introduction to Systemic Functional Linguistics*. Lodon: Pinter Publishers.
Halliday, M.A.K. (1985) *An Introduction to Functional Grammar*. London: Edward Arnold.
Martin, J.R., (1992) *English Text: system and structure*, Amsterdam: Benjamins.
Matthiessen, C. (1995) *Lexicogrammatical Cartography: English Systems*. Tokyo: International Language Sciences Publishers.

On natural language generation:

Gazdar, G. & Mellish, K. (1989) *Natural Language Processing in LISP*. Reading, MA: Addison-Wesley.
Matthiessen, C. & Bateman, J. (1991) *Text Generation and Systemic-Functional Linguistics. Experiences from English and Japanase*. London: Pinter Publishers.

On applied linguistics and computers and teaching:

Boswood, T (ed.) (1997) *New Ways of Using Computers in Language Teaching*. Washington: TESOL.
Corder, S.P. (1973) *Introducing Applied Linguistics*. London: Penguin.
Crook, C. (1994) *Computers and the Collaborative Experience of Learning*. London: Routledge.

Holmberg, B. “Enseñanza a distancia y autoaprendizaje de lenguas modernas: el uso de las nuevas tecnologías” (“Distance teaching and self-learning of modern languages: the use of new technologies”). In Ruipérez, G. (1995) *Enseñanza de lenguas y traducción con ordenadores*. Madrid:Ediciones Pedagógicas.
Jung, U.”Evaluating Microcomputer Software: The State of the Art.” In Legenhausen & Wolff (eds.) (1987) *Computer Assisted Learning and Innovative EFL Methodology*. Augsburg.
Pennington, M.C.(ed.) (1995) *The power of CALL*, Houston: Athelstan.
Powell, B. “Las lenguas y las nuevas tecnologías en la universidad británica” (“Languages and new technologies in the British university”). In Ruipérez, G. (1995) *Enseñanza de lenguas y traducción con ordenadores*. Madrid:Ediciones Pedagógicas.
Wolf, W. “Computerunterstützter Unterricht im Goethe-Institut. Erfahrungen und Perspecktiven.” In *Spracharbeit*, 2, 1988.
Zettersten, A. (1985) *New technologies in language learning*. Oxford.

Division of the research into sub-tasks and time estimation for each of them.

The first task will be an in-depth exploration of all the operations and capabilities of KPML, accompanied by an initial evaluation of their possible application in language teaching. This task should not take longer than **4 months**.
After the first evaluation, I will begin with the preliminaries of the interviews with students. These preliminaries include activities such as determining groups of learners that might benefit from the use of multilingual GDE’s and classifying them according to relevant factors. The delimitation of these factors is also part of the preliminaries. The time I expect to spend with this second task is **8 months**.
Another important part of the preliminaries will be the preparation of materials and tasks that will be used in the interviews. These include examples sets, activities that involve generation and interaction with the grammar, the graph of specific regions and contrastive exercises. The preparation of the material will take up another **6 months**
Most of the three-year period estimated for this research will be consumed by the different phases of the interviews. The first phase will be an initial contact with learners. The results obtained from these first interviews will be useful because they will provide important information about the adequacy of the materials employed. After a refinement of the materials, a second round of interviews will be conducted and the results will be contrasted with those obtained in the first interviews. At least **10 months** will be required for the completion of the whole process.
The last task will be the interpretation of the data, which includes their organisation, their presentation in statistical or graphic modes (if pertinent), and the drawing of conclusions from the information they provide. The amount of time allocated to this task is **8 months**.

References

Bateman, J. (1998) Automated Discourse Generation, in Kent, A. (ed.) *Encycolpedia of Library and Information Science*. Volume 62, Supplement 25. New York: Marcel Dekker, Inc.

Bateman, J.A. y Matthiessen, C.M.I.M (1991) *Text Generation and Systemic-Functional Linguistics. Experiences from English and Japanese*. London: Pinter Publishers.

Berger, R. (1985) Mikrocomputer im Lehren und Lernen einer Fremdsprache. In Langenscheidt Redaktion (ed.) *Computergestützter Fremdsprachenunterricht: Ein Handbuch*, Berlin: Langenscheidt.

Higgins, J. & Johns, T. (1984) *Computers in Language Learning*. London: Collins ELT.

Higgins, J. and Davies, G. (1985) *Using Computers in Language Learning: A Teacher's Guide*. London: CILT.

Hovy, E. (1989) New possibilities in machine translation. Technical report, USC/Information Sciences Institute, Marina del Rey, CA.

Hubbard, P. (1992) A Methodological Framework for CALL Courseware Development. In Pennington, M and Stevens, V. *Computers in Applied Linguistics*. Clevedon: Multilingual Matters Ltd.

Jung, U. (ed.) (1988) *Computers in Applied Linguistics and Language Teaching. A CALL Handbook*. Frankfurt a. M.

Kemmis, S (1977) How do students learn. Technical report, University of East Anglia.

Ruiperez, G. (1995) El ordenador en la enseñanza de lenguas". In Ruiperez, G. (ed.) *Enseñanza de lenguas y traducción con ordenadores*. Madrid: Ediciones Pedagogicas.

Schmied, J. (1999) Applying Contrastive Corpora in Modern Contrastive Grammars: The Chemnitz Internet Grammar of English. In Hasselgard & Oksefjell (ed.) *Out of Corpora. Studies in Honour of Stig Johansson*. Amsterdam: Atlanta.

Stevens, V (1991) Humanism and CALL: A Coming of Age. In Pennington, M and Stevens, V. *Computers in Applied Linguistics*. Clevedon: Multilingual Matters Ltd.

Wilcock, G. (1991) An experimental Japanese interface to a systemic grammar for generation of English auxiliary verbs. Information System R&D Center, Sharp Corporation 492 Minosho-cho, Yamatokoriyama, Nara 639-11, Japan.