

**USING AN ELECTRONIC DICTIONARY
TO UNDERSTAND FOREIGN LANGUAGE TEXTS¹**

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ABSTRACT

O trabalho resume pesquisas feitas pelo autor (Leffa, 1991; Leffa, 1992a, Leffa, 1992b) sobre o uso de um dicionário eletrônico elaborado para facilitar a compreensão de textos em língua estrangeira por alunos de nível básico e pré-intermediário. No primeiro estudo, alunos iniciantes do Curso de Letras traduziram textos autênticos da língua inglesa usando o dicionário eletrônico e um dicionário bilingüe tradicional. Os resultados desse estudo mostraram que o dicionário eletrônico proporcionou uma leitura mais rápida e melhor compreensão dos textos, tornando-os compreensíveis para sujeitos com nível de conhecimento básico da língua. No segundo estudo, alunos de graduação, matriculados em inglês Instrumental, usaram o dicionário eletrônico durante dois meses para a leitura de textos mais extensos na área da Informática. Um questionário de opinião aplicado a esses alunos mostrou uma atitude positiva em relação ao dicionário. As implicações teóricas da pesquisa para uma teoria da aquisição da língua estrangeira baseada na compreensão são apresentadas e debatidas.

INTRODUCTION

An undesirable side effect of the traditional bilingual dictionary, when used to get meaning from a reading passage, is that it can help the reader only by interfering in the reading process. The intensive exchange of information that occurs between reader and text during normal reading is momentarily suspended. The most recent data from the reading passage, stored for processing in the reader's short term memory buffer, are replaced by the dictionary data. Whereas reading should be flowing smoothly, there is now the manual turning of dictionary pages, back and forth, until the unknown term may be eventually found.

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This move from one text to another entails a change in context. The world represented by the reading passage is replaced by the dictionary, and new decisions, more or less detached from the comprehension task, have to be taken: Is the unknown word inflected or not? If inflected, what is the original form? Is the word part of an idiom? If so, which is the head word? How many entries can be found for the word? Which entry is relevant to the passage that was being read? When the reader goes back to the original text and tries to resume the reading process, there is always a longer or shorter segment of the text that has to be repeated. If the need to go to the dictionary increases, the reading experience, because of a failure to get meaning from the passage, will eventually lead to frustration.

The electronic dictionary, unlike the traditional bilingual dictionary, can automate many of those activities. The search for the unknown word is not done by the reader, but by the program itself; a keystroke and the needed information is immediately displayed on the screen. Morphological attributes such as verb and noun inflections can be automatically detected and incorporated to the translation or explanation. Help to the reader can be more sensitive to the linguistic context in which the term occurs. The reader is given a chance to construct meaning through a more direct interaction with the reading passage, which is always on the foreground, than through the electronic dictionary, which, in spite of its speed and efficiency, acts from the background, without getting in the way between the reader and the text being read.

The purpose of this paper is to report on two studies that were conducted to assess the performance of an experimental electronic dictionary, as compared to a traditional bilingual dictionary, involving beginning EFL students.

The investigation deals directly with two distinct fields of knowledge: software engineering and lexicography. Indirectly, the issue of L2 reading comprehension is also approached, mainly in terms of some underlying assumptions of reading as an interactive process between the reader and the text. These ideas are not discussed in the paper, but can be found in the literature that deals with the Schema Theory view of comprehension, from the pioneer studies of Bartlett (1931) to the recent investigations in Artificial Intelligence. For the specific issue of computer-mediated reading, the experiments conducted by Cato (1989) and Reinking (1988) should also be mentioned.

This investigation has both theoretical and practical motivations. The theoretical motivation is the need to test the impact of an electronic dictionary on reading comprehension. The practical one is the widespread use of electronically supported text: CD-ROM databases, software instructions, electronic mail, etc. The fact that many of these texts are written in English gives the electronic dictionary an immediate application for those users who are not familiar with the language.

THE SOFTWARE ISSUE

Dictionaries for specific purposes are already used by many programs that run on IBM-compatible microcomputers. A typical word processor, for example, usually incorporates a spelling checker and a thesaurus. These dictionaries not only access a reasonably large numbers of entries, but also resolve many problems caused by word inflections and suffixes. Typically, they can find the root form for words such as "homeless" (subtracting "less"), "happier" (changing "ier" into "y") or "formatting" (solving the consonant duplication problem and finding "format").

These dictionaries usually adopt what may be referred to as the hypertext technique. A word displayed on the screen is connected to a hidden word behind it, which, on command, may be brought to the foreground, displaying a segment of a different text. Depending on the sophistication of the program, the second word may be connected to a third word, which, in turn, may be connected to a fourth, and so on, until different layers, in different degrees of depth, are displayed for the reader. The immediate consequence of the process is that reading is no longer linear, from left to right, but cross-sectional, from one document to another.

A survey of hypertext packages available on the market showed that some of them could be used to write small bilingual glossaries. None of them, however, met all the criteria we regarded as important for a functional electronic dictionary, which included the ability to: (1) store and access a relatively large number of entries, (2) display text and dictionary entry simultaneously, (3) solve the problem of morphological attributes and (4) analyze segments of text beyond the word, searching for idioms and stock phrases. The technique of opening windows over the passage being read, used by many programs, produced a pleasant visual effect, but beat the purpose of the dictionary; by highlighting information that was accessory to reading, the technique moved to the background what should always be on the foreground, that is, the text being read by the student.

The first step was then to write a program to write the dictionary, which was done using the author's experience with programming languages. The program allows for any text file to be read on the screen, using a previously prepared dictionary. Any word or phrase can be defined, explained or translated as fast as the cursor is moved over the text. The program is able to detect whether the text is written in English, in which case the item is analyzed in terms of its morphological attributes, so that additional information is offered, in one of six languages chosen by the reader: English, German, Spanish, French, Portuguese and Italian. Search speed and word analysis for any dictionary item are, in terms of reading purposes, instantaneous, allowing the reader to construct the meaning of the text practically as the cursor - and eyes - move over the text.

THE LEXICOGRAPHIC ISSUE

Lexicographically, the purpose of the study was to develop a system that would include in the entry not only lexical but grammatical information as well. Ideally, the program should work both as a dictionary and a grammar, offering the reader not only the meaning of the original term but also the meaning added by the presence of any morphological attribute.

The idea of incorporating grammar data in the definition is not new. A typical example are the EFL learning dictionaries, where, besides the usual definition of the term, we can also find information about its use in different contexts, including regular and irregular inflections.

The problem is that a lexicon-grammar needs much more printed space than a dictionary and a grammar put together. Basically, every entry would have to be duplicated for any morphological attribute it might have, turning the lexicon-grammar unmanageably large in printed form. In fact, the lexicon-grammar is only viable electronically, through a computer. Information duplication would be replaced by processing, which would involve morphological rules linking the attributes to the original words in real time, thus saving space. Whereas traditionally we would first concatenate the inflections to the base form and then store the combinations, producing almost endless duplications, we can, through a modern microcomputer, produce the concatenations at the moment they are used, and present them to the reader without any noticeable delay. The investigations of Gross (1989), with the French language, and Subirats-Rüggeber (1989), in Spanish, show how the computer can also deal effectively with highly inflected languages.

THE COVERAGE ISSUE

Although medium-sized bilingual dictionaries feature about 40,000 entries, the computer program used in this study allowed for only 8,000 items. This capacity, however, was not totally used, since the final list amounted to 4,700 entries. The criteria for item selection were (1) frequency of occurrence in written English, and (2) contrastiveness with the corresponding term in the Portuguese language. The second criterion was based on the assumption that words which were very similar in meaning and form, between English and Portuguese, would be easily recognized by the reader and needed not be included in the list.

The 4,700-word list was tested in terms of coverage. A survey was first conducted in ten different areas of knowledge, encompassing the most popular courses in Brazilian universities: Business Administration, Law, Ecology, Physics, Geography, History, Languages, Mathematics, Medicine and Chemistry. For each of these areas, 6 passages, 500 words each, were randomly selected from different academic journals, producing a corpus of 30,000 words. This corpus was then scanned with the electronic

dictionary. The results showed that different areas were differently covered by the 4,700 word list. In decreasing order, the percentages for the 10 areas were the following: Chemistry (99.9%), Mathematics (99.5%), Geography (99.4%), Physics (99.3%), Medicine (99.2%), Ecology (99%), Law (98.1%), Business Administration (97.9%), Languages (97.7%), History (97.1%).

In a second survey, using only news items published in English newspapers, covering a corpus of 60,000 words, we found that 99.1% of these words were either found in the 4,700 list or classified as easily recognizable cognates. This percentage, above 99%, suggested that the selected list of words could offer the reader a reasonable level of comprehension, assuming, of course, that other important factors were present: topic familiarity, basic reading strategies, ability of activate the adequate schemata, etc.

Comprehension, of course, can only be measured with real readers interacting with real texts. The electronic dictionary described here has been used with more than 300 university students over three semesters, both in self-access computer labs and in controlled testing conditions.

HYPOTHESES

The main hypothesis in this investigation is that the electronic dictionary, in the terms described here, can make the authentic foreign language text comprehensible for the reader who is not proficient in the language.

There are two secondary hypotheses: The first is that, all other things being equal, readers with a pre-intermediate knowledge of English would understand an authentic English passage better using the electronic dictionary than using a traditional bilingual dictionary. The second hypothesis is that pre-intermediate students of English would read an English text faster with an electronic dictionary than with a traditional bilingual dictionary.

METHODOLOGY

The investigation that was conducted to evaluate the efficiency of the electronic dictionary in the reading of authentic texts tried to answer three questions: (1) What percentage of the text beginning foreign language students would be able to understand with the help of the electronic dictionary? (2) How would the dictionary improve reading speed? (3) How would students react to the electronic dictionary? Forty-three undergraduate students enrolled in the first semester of English were selected for the study. A language proficiency test (vocabulary and syntax) was administered to these students, which classified them into two levels: pre-intermediate and intermediate. Only those subjects classified as pre-intermediate were used in the study. In terms of linguistic proficiency, this group ranged from false beginners to

pre-intermediate (knowledge of the basic structures of the language in a vocabulary range of about 500 words). The original group of 43 students, after this further classification, was reduced to 20.

A reading comprehension test was prepared to measure the subject's ability to extract meaning from a text. This test, in five different versions, was based on typical news items, published by a Cambridge newspaper. These news items included the following topics: the death of a television soap star, a power blackout in Cambridge, a car accident, a case of food poisoning, and the arresting of three shoplifters. It was assumed that no specific previous knowledge about the topics would be necessary to understand the passages. Although there were references to local people and institutions that were unknown to the subjects, the structuring of the information followed the same rules of the newspapers published in the students' community and should offer no special difficulty. The passages were all authentic and, although restricted to the first paragraphs, could be read as a complete text.

The comprehension test was administered in two modes: one using a traditional dictionary and the other using the electronic dictionary. Each subject did both of them, using different passages. To account for the problem of test wiseness, half the subjects did first the traditional dictionary mode, while the other half did first the electronic dictionary mode. All the passages were equally distributed between the two modes.

The subjects were asked to translate the passages into Portuguese, using either the bilingual dictionary or the electronic dictionary, if they found it necessary. Time was controlled by asking the subjects to write it down when they started the test and when they finished it. The tests were administered at the beginning of the semester. The subjects were told that the tests were part of a research project and that the results would not affect their grades. They were assured, however, that they would benefit by doing their best, because the results would be used to plan the activities for the semester. All the subjects seemed to be equally motivated to complete the test in either the traditional dictionary or the electronic dictionary mode.

The test using the traditional dictionary was administered in the classroom. The dictionaries used were all bilingual and included both desk and pocket dictionaries. Since most dictionaries were brought by the students themselves, it is assumed that most students were familiar with the dictionaries they used in the test. The others used dictionaries borrowed from the University library.

The test using the electronic dictionary was done in a computer laboratory, using nine IBM-compatible machines. The program was previously loaded and each subject was briefly introduced on how to move the cursor with the arrow keys, which was all they had to do in the computer if they wanted and out the translation for a given word in the text. This was done in a two-minute session for each subject before the test.

Each subject had been randomly assigned to two of the five passages that had been prepared. When they did their first translation task, either in the laboratory or in the classroom, they received two test sheets, signing both and returning the one not

related to the test being taken at the moment. The first sheet was then used for the first test, leaving the other for the other mode. The procedure allowed full control with both the different texts and the two modes, so that all passages were equally distributed between the traditional and the electronic dictionary.

For correcting the tests, each of the five passages was divided into idea units and then given to two scorers. The instruction was to grade the translations along the idea units. There was a maximum of points for each idea, but the scorer was free to decide on how to penalize the mistakes inside each idea unit. The test sheets were totally shuffled and the scorers had no information about the subjects' identity or mode of testing (traditional or electronic dictionary). The inter-judge reliability was .89. The score for each test was the mean between the two scores.

RESULTS

The scores were statistically analyzed in terms of difference between means, considering both performance in the two modes (traditional dictionary versus electronic dictionary) and the time taken for doing the test. Table 1 summarizes the results in terms of performance.

TABLE 1 - Performance in the comprehension test, using a traditional bilingual dictionary and the electronic dictionary

	Traditional	Electronic	Difference
Mean	62.70	86.10	23.40
SD	26.85	12.10	

$N = 20$ $t = 3.55$ $DF = 38$ $p = 0.0005$

These results show that while the subjects were able to retrieve 86.10% of the idea units in the electronic mode, their performance dropped to 62.70 in the traditional dictionary mode, a difference that is statistically significant at the 0.0005 level. The subjects, on the average, understood 38% more of the text in the electronic mode than in the traditional one. Even with only 4,700 entries, and thus covering a smaller area of the text to be read, the electronic dictionary was significantly more efficient in helping the reader.

The results also indicate that the electronic dictionary not only brought up the scores but also reduced dispersion between subjects; the standard deviation difference between traditional and electronic is significant to the .00002 level ($F=3.60$). In other

words, weaker students, who needed more help, seemed to have profited most from the electronic dictionary.

Table 2 summarizes the results in terms of time. On the average, the students spent 17.34 minutes doing the traditional dictionary mode. In the electronic dictionary mode, time was reduced to 12.5 minutes. The 4.83 difference is statistically significant beyond the .0001 level (Table 3).

TABLE 2 - Time taken for the comprehension test, using a traditional bilingual dictionary and the electronic dictionary

	Traditional	Electronic	Difference
Mean	17.34	12.50	4.83
SD	4.39	3.76	

Considering that part of the time, in the comprehension test, was taken up for the writing of the translation, it can be argued that the mean difference would be even higher if the subjects were using the electronic dictionary in real-life situations, where they would not have to supply written evidence of their comprehension.

DATA ABOUT ATTITUDE

A second more informal study was also conducted in an attempt to measure the attitude of the subjects toward the electronic dictionary. For this study, the subjects were undergraduate students from the Mathematics Department enrolled in two ESP courses. The activities with the Electronic Glossary were part of the curriculum proposed for the students, allowing more extensive use of the Glossary.

Each student was given a floppy disk with the program and five texts of about 2,000 words each to be read in the computer with the help of the Electronic Glossary. The activity was conducted individually, when and where would be convenient for the student. The only control was a worksheet with comprehension questions that should be answered by the students after reading each one of the texts. The worksheets were collected weekly by the teacher.

On the sixth week, after the last worksheet was collected, 51 of the 55 students who took part in the activities answered an opinion questionnaire. The responses were very positive and could be summarized as follows:

Forty-two of the 51 subjects answered that the activities with the electronic dictionary should be repeated in the following semester, 49 described the activity as interesting and 41 thought that the electronic dictionary was more helpful than the traditional one. When asked to write a positive and a negative aspect, the students

produced 54 positive and 30 negative. Among the main positive aspects they emphasized the speed and ease with which they could get the meaning of words, freedom to choose the time to do the activity and a chance to use the computer. The following comment can be used as a typical sample:

(A positive aspect is) the speed with which we can retrieve information, that is, translation. Everything is fast, there is not the waste of time that often makes the student lose track of what is being read.

The negative aspects were mainly mentioned for reasons that were not related to the experience. Thus, from the 30 negative aspects cited by the students, 14 referred to the difficulty of getting access to a computer (there was a strike involving the computer lab assistants at the time of the experiment). Some students complained that the passages were too long, sometimes too difficult and not interesting. Others complained that some words were not found.

In general, in spite of the real problems found by the students, the questionnaire reflected a very positive attitude towards the use of the Electronic Dictionary. The students found the experience interesting, they would have liked to use the dictionary more than they did, and felt motivated to read more in English.

DISCUSSION

During the test procedure, special care was taken to produce data as reliable as possible. Five different passages were used, each equally distributed between the two modes (traditional dictionary versus electronic), to avoid any possible linkage between one mode and an easier passage. Order in doing the tests was also controlled by having one half of the subjects taking first the traditional dictionary mode and vice-versa, so that test-wiseness from one mode to another was balanced.

During the scoring procedure, care was taken to hide the identity of the subjects and the mode under which each test was taken. The scorers knew they were grading tests translated with either a traditional dictionary or an electronic dictionary, but they had no way of knowing which test sheet belonged to which. Considering that grading translations is rather subjective, two scorers were used, each receiving the test sheet without any remarks from the other.

In transcribing the raw data everything was carefully double checked. After the data had been typed in, the final print produced by the statistical package was compared with the original grades provided by the scorers, the time used in the test, and the mode under which it was taken. A checksum procedure -- adding the data for each variable first from the test sheets, then from the computer printout, and finally comparing the totals -- was also used. In every step of the study, care was taken to produce results as reliable as possible.

The findings unmistakably favor the electronic dictionary as more useful to help the student comprehend an authentic text. All other things being equal, pre-intermediate students of English get more meaning from a text, and get it faster, if they use an electronic dictionary that exploits the speed and context-sensitive search allowed by computers.

An informal protocol conducted with a beginner who scored 3 points in the traditional dictionary test, after working on it for 23 minutes, and 86 points in the electronic dictionary, in 11 minutes, also supports the conclusion advanced by the statistical analysis:

I got lost with the [traditional] dictionary. When I managed to find the meaning of one word I had forgotten the meaning of the one I had looked up before. In the computer I could go back and forth, and see the meanings of the words. I could understand the passage [translated from the Portuguese].

The fact that these results were obtained with a general purpose electronic dictionary indicate that better results would probably be obtained with specific glossaries. These glossaries, geared to a specific area, group of texts, or even individual passages, could be used to produce comprehensible output for early intermediate students using authentic passages. One possibility is a collection of reading passages with a specific glossary. This kind of electronic textbook, compared to a traditional reader, is cheaper, easily customized to the students needs, and relatively easy to produce, test and improve.

CONCLUSION

The purpose of this paper was to describe some theoretical and practical aspects involved in the preparation and use of an electronic dictionary with undergraduate ESP students. It seems that electronic glossaries have a potential not only for retrieving information from text printed on the screen but also for learning the language.

The experiment, designed to test the performance of the electronic dictionary as compared to traditional bilingual dictionaries, showed that the electronic dictionary was superior, both in the number of idea units it allowed the subjects to retrieve from the text, and in time it demanded for the comprehension. Using the electronic dictionary, the subjects read the passages faster and got more meaning from it. The difference was greatest with subjects whose language proficiency was lowest.

One of the current basic assumptions about language development is that we acquire a language by interacting with comprehensible input. Providing comprehensible input for early intermediate students, using authentic material, is sometimes very difficult for the classroom teacher. An electronic dictionary, as proposed here, may be an

interesting way of transforming certain texts, which are otherwise out of the reach of the students, into comprehensible passages, and thus enabling, with practice, acquisition of the language.

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