IMPLEMENTING WORD LEARNING STRATEGIES INTO AN INTERACTIVE LEARNING ENVIRONMENT

Andreas Röllinghoff
École Polytechnique Fédérale de Lausanne, Switzerland

ABSTRACT

The development of programming tools such as HyperCard and Authorware has had a considerable impact upon computer assisted language learning. Language teachers are now able to test new ideas through use of these tools. Unfortunately software products which differed widely both in approach and in quality, resulted. This highlights the need for a broader discussion of general guidelines for design of Computer Assisted Language Learning (CALL) products, but this contribution can not cover the whole field. Some important points which are relevant to user-program interaction are considered in the first part of this paper. The second part focuses upon vocabulary learning strategies whereas the third part gives an overview of an environment where the guidelines and strategies outlined in part one and two are implemented.

CALL PRODUCT DESIGN GUIDELINES

This first part of the paper concentrates on aspects relevant to user-program interaction.

CALL systems often lack an intuitive "feel" of well designed interfaces.

An increasing number of language students have been exposed to computers in one way or another. Working with modern word processors, desktop publishing tools, or using some of the newer electronic games like Nintendo,² they are familiar with clicking buttons and pulling down menus for rapid action. They have also acquired an understanding of generic manipulations which allow them to change rapidly over to new programs. For example, typical computer users try to hit the "Enter" key to end an
entry operation. Also, they might hope that the same key would be a short-cut for getting to the next prompt of an exercise. Confronted with classical CALL software such as the "WID)V programs, these users become frustrated with the time necessary to master the program. They are also irritated by features they judge to be inadequately implemented. That is, they cannot understand why CALL devices do not possess the same practical attributes that are common to other programs.

They are also increasingly accustomed to obtaining non-verbal clues from graphical metaphors that some programs provide. This means a pictorial interface which simulates an object or action that is known to the user. For example, instead of seeing a story represented by continuous text lines somewhere on the computer screen, the user could see a book with pages that turn in front of his eyes. In giving the user a consistent graphical metaphor, a program may greatly enhance an intuitive "feel" (sometimes called user friendliness). If the graphical metaphor is inconsistent or nonexistent, as in the case of a classical DOS screen with just a blinking pointer in the middle, this can be a source of irritation.

**CALL systems are sometimes designed to cover too many areas.**

Word processing tools are used for an enormous number of applications in daily office work. Principal strengths include integration of many different functions. Through repetition of similar actions, for example, 1) choosing a menu 2) clicking the needed parameter and 3) hitting the OK button; work procedures are streamlined and sped up a great deal. This is normal for an application that is results-oriented. Communicative language learning, however, is to a large extent process-oriented, and therefore, the way linguistic material is processed by a program is important. Students do not learn the plural of German nouns in the same way that they learn syntactical priorities. As a consequence, learning activities, exercise modules, trainers and other parts of a program should be designed according to specific linguistic features. The more linguistic areas a learning activity covers, the less specific it will be and the less motivating it might become for the learner. This limits the attractiveness of some authoring programs.
Interactivity in language teaching and learning means more than just a human touch.

Language in word processing or other office programs is used as the content and vehicle of the interaction -whereas in CALL, language itself is the aim of the program. In the same way as current communicative teaching uses classroom communication (resulting from classroom management needs) as the first real language input, student-application interaction must be considered to be an important means of contact with the target language. Therefore, when a CALL program addresses the user with prompts, questions and messages, it is not necessarily the shortest message or the fastest pictorial reaction that will be the best contact with users. In contrast to any word processing application where dialogue boxes with short texts or pictograms facilitate communication between machine and user, in CALL, interactivity has to aim at creating a target language environment. CALL products therefore should ensure that the interaction between user and application is verbalized as much as possible. Dialogue boxes should be used to expose the user to action related written and spoken messages in the target language.

Provide indicators for permanent orientation

Most programs are multi-modular and provide several working modes or procedures. Somewhere on the screen there should be a place which continuously indicates to the student "which part of program he is working at" in order to help him know "which steps are possible for him at this specific moment" (Buchholz 1991). All dialogue boxes should also include all the information a user needs at that moment. They should be specific enough to avoid ambiguity.

Help and permanent orientation

As also stated by E. Buchholz (1991) "Students expect to find a "Help key. They are used to it from their work with word processors and other tools." This is especially true for those who dislike reading manuals. With modern CALL products, this help should be not only at a key's reach. In a more specific way, it should be accessible with only a click on the topic for which the user wants help (after having pressed the help key or while holding it down). Help facilities should also contain information which is more comprehensive than that related to technical options provided by the program; it should also help users understand underlying linguistic and didactic concepts.
Interaction in the target language with immediate translation

Since the success of the interaction depends on the users’ understanding the verbal material they receive, all dialogue boxes should allow users to switch momentarily over to their mother tongue.

Dialogue boxes and "help" messages should therefore not only be target language based, but they should also provide options such as a button that passes over to the mother tongue at any moment. This will help the user remain in control of the learning process.

CALL trainers are often based upon outdated psychological concepts.

As stated in numerous reviews of CALL programs, many systems do not correspond to the technical state of the art (Wazel, 1990) reached by applications in other fields and they are often based upon assumptions, in fields such as psychology, methodology and didactics, that have already been abandoned by most researchers active in these domains.

Wazel (1990) and others who criticize persistent behaviorist directions in CALL program design note the limitations imposed by these applications with respect to self guided activities. In the fields of cognitive psychology and psycholinguistics (Butzkamm, 1989) in general, there seems to exist a consensus concerning the importance of internal processing of linguistic material during learning. If programs allow users simply to dick their way through the right answers, this consensus is not addressed. Consequently, more and more reviewers are calling for more open learning environments.

Such open learning environments may include (Wazel, 1990):

- the absence of predetermined solutions;
- the need for solutions to be discovered from a choice of more than three or four alternatives;
- an evaluation or correction that should be a means of guidance, giving hints and not merely be an authority defending correct linguistic norms;
- the possibility of freely written entries of the users' own sentences;
- "deeper" processing of language material using cognitive competencies (Stevick, 1978).
CALL systems should be used not only for teaching and learning but also for research.

We know so little about what the learner does when he learns that we could profit from the administrative capacity of computers to keep track of what students do. This is valuable for providing them with feedback following work sessions; it would also enhance our capacities for judging the value of programs; and finally, it would help create data related to student behavior in specific learning situations.

Intermediate conclusions concerning learner-program-interaction

- CALL programs should provide for as many open learning moments as possible.
- Let the program take care of dull tasks but leave the tasks which demand cognitive capacities to the user.
- If the program has a metaphor, make it credible and apply it consistently throughout the interface.
- Use typical Mac dialogue boxes extensively to verbalize the user-program interaction as much as possible.
- The whole learning procedure has to be under control of the students:
  a) allow any on-going process to be interrupted,
  b) make the interaction language-flexible so that a momentary switch into the mother tongue is possible at any moment,
  c) provide possibilities for modification of important parameters, such as difficulty level and help language.
- Provide a way of tracing students achievement to
  a) organize systematic review;
  b) allow research into the way learners use the program;
  c) allow research into the way they acquire linguistic items.
WORD LEARNING AND WORD LEARNING STRATEGIES
This second part of the paper concentrates on aspects relevant to the vocabulary learning process.

Dalgish (1991) found during two studies concerning ESL that
• 19% to 25% of the errors were vocabulary or idiomatic.
• 13% to 28% of the errors involved articles.
• 12% to 18% of the errors concerned prepositions.

A survey in any language class will invariably show that the main reason for this situation can be traced to teaching practices and learning habits. A great many learners do not invest enough time and energy in the learning of important vocabulary attributes. Learners’ notebooks confirm this assumption, since most of the items which are subject to these errors cannot be found there.

More specifically, students do not
• invest enough time to clarify the meaning of a word. In general they only note down what they believe to be an equivalent word in their mother tongue;
• specify that a certain word might have several meanings. Also they rarely note the context phrase to clarify a specific use of a word;
• annotate verbs that are necessarily followed by a certain construction and/or preposition;
• note that certain words appear with typical collocations;
• identify those nouns that cannot appear in plural;
• focus on every form needed in basic use of (for example, French) verbs;
• concentrate on all the forms a noun (for example in German) may have.
Review and testing of acquired vocabulary in reasonable time intervals

As is widely accepted, memory is seen as dependent upon the quality of interaction between learners and the material they are learning. The necessity of review, that is the number of times a certain item will have to be reviewed is a function of this quality. Therefore, we should accept that the number of reviews that learners must experience depends upon individual learning situations. Review rhythms proposed by didacticians are therefore only guidelines. Whatever the review rhythm being implemented in a learning program, it should be adaptable to the needs of individual learners. The proposition, however, of 1 hour, 1 day, 1 week, 1 month and 6 months made by Tony Buzan (1974) seems to be acceptable to many students.

Vocabulary learning is a rich cognitive process.

Vocabulary and word meaning in general seem to be stored in the human brain in the form of a network. This means that a single word is composed of different aspects which go far beyond pronunciation, spelling and meaning. These aspects are linked to context, and this in tight be expressed as sentences as well as personal experience and feelings. They are also linked to use, such as formal, standard, vulgar, slang, familiar, archaic, law etc. Recent research confirms that they are also linked to cognitive categories, i.e. "cow" is linked to "animal" (Hilts, 1992). Other organizational principles have been well described for language teachers by J. Rohrer (1978).

He gives a list of word relations, where a word A might be

**Example**

- a part of B the trunk of an elephant
- made of B beer from barley
- found in B islands in the sea
- produced from B milk from cows
- symbolic of B a rose for beauty
Since the aspects mentioned above are expressed with words, one is tempted to conclude that words are mainly linked to many other words. Therefore, an important word learning strategy would link a new word to many other words already stored in memory.

**Intermediate conclusions related to vocabulary learning**

Make sure that the foreign language learner
- learns all the attributes that a mother tongue speaker knows of a word (Richards 1976; Röllinghoff 1983);
- takes time to find out what a word means;
- pays attention to context;
- links any new word to relevant cognitive categories;
- is given a review rhythm, that he or she can modify.

**LEXI-PROGRAMS: AN OVERVIEW**

The third part of this paper concentrates on a program which implements the guidelines and strategies mentioned above. In creating a program for word learning we had aimed to lead users systematically with the vocabulary and to provide assistance with the complexity of the task. It was understood from the start that our project could not cover all acquisition phases which constitute word learning. We did not feel competent to integrate semantic disclosure of word meaning (semantization phase) nor the communicative use of words. Although both of these phases are constitutive to word learning, they must be accommodated elsewhere. This means that the vocabulary trainer was designed as a program for assisting existing learning and teaching structures. Success, therefore, depends on the collaboration of an expert in the target language.

A system corresponding to these guidelines has been developed over three years. Since it has been adapted to several languages, there is a "LexiFiche" for French, a "LexiFile" for English, a "LexiKartei" for German, and a "LexiFichero" for learning Spanish vocabulary. For practical reasons they will be collectively referred to as Lexi-programs. We chose HyperCard on the Macintosh since it is easily accessible to non-programmers and since it allows a rapid adaptation to modifications during development.
With the goal of adhering to a consistent metaphor, we chose to simulate a card index (Figure 1). The card index or "file" metaphor seemed more apt to represent the active side of the Lexi-programs than the dictionary metaphor.

In each language version, two main modes of activity are available: the introduction of new words and the review mode called "Quiz."

For each Word signification, a card-like file is created (Figure 2). There, users introduce all the information they know about that word. The number of cards is limited only by disk space. This means that a Lexi-program may accompany a learner throughout the time it will take him or her to learn the language.

**Word introduction**

Imagine that a learner discovers the sentence: "After that argument, the director offered no further resistance to their plans" and decides to learn the English word *resistance*, that is, to enter it into his LexiFile — the English version of the Lexi-programs. The button <New word> is activated and a number of dialogue boxes with questions for filling the file are presented. The first dialogue box requests entry of the sentence (context), where the word was found (Figure 3). The entry is then automatically introduced into the corresponding field of the new file. Another dialogue box appears, thereby allowing the choice of the word in the context *schoner* in this case (Figure 4).
Figure 2

Figure 3

Figure 4
Another dialogue box then inquires if *joyeux* (resistance) is the base form of that word (Figure 5). If this is not the case, the base form can be introduced. Finally an explanation of the word *joyeux* is requested.

The sentences produced here are used later during the revision phase in order to evoke the word, that is, to assist recall. This implies that the explanation has to be formulated so that it can later be used as a riddle sentence during the Quiz (discussed later in this section). E.g. for *joyeux*: ‘*X*’ is an action or argument you put up against someone or something. Especially one does not agree with an act one is supposed to support. Then there is the possibility of entering a translation for the context. At the end, the learner is prompted to create a multi-sensory inner representation of the new word (Figure 6) and the new file as created is presented to the learner (Figure 7). In the field "card of:’ the day’s date and an indication *uncorrected* is given. This indicates — obviously — that this card has not been corrected. N.B.: files with the status *uncorrected* are not accepted for revision in the ‘Quiz.’

At any time, but especially at the end of a work session, the learner may choose the sub-menu "Print uncorrected card" in the print menu. This produces a hard copy of the newly introduced files with all relevant information. This then must be corrected by a teacher or any expert of the target language. Having received the corrected print-out the learner then transfers these corrections into his Lexi-program. Then the learner chooses the sub-menu "Indicate correction" and the indication "uncorrected" in the field "card of:" changes to "corrected." Files with this indication are then incorporated in the review of the Quiz.
Figure 6

Now close your eyes for twenty seconds and concentrate on the word or the entire sentence. See it, hear it, feel it, taste it. Create an intensive representation of this word.

Figure 7

Wort: schö

Worterklärung: Mit X meint man eine Qualität. Zum Beispiel Liz Taylor oder Cleopatra waren sehr X.

Kontext: Ein "X" Mann ist selten treu.
Difficulty level

With the exception of the "LexiFile," the menu "Level" of an the other Lexi-programs contains five sub-menus corresponding to five difficulty levels (Figure 8). An increasing number of questions with increasing difficulty are asked. This is equally valid for entering a new word as well as forgoing through the revision in the Quiz.

The procedure of word entry described above corresponds to Level 1. Only the context, the new word and a word explanation need be introduced. The translation is optional.

At Level 2 other questions are added to those of Level 1. In the "LexiFile" — which has only three difficulty levels — there is a possibility of indicating particularities such as false friends, reflexive, plural only, etc. as well as a register for word quality such as slang, vulgar, standard etc. Then, the part of speech has to be indicated and the following questions will reflect the choice made here. If the new word is a verb, the next question concerns the "past tense" and the "past participle." If it is a noun or an adjective, the query is related to antonyms (field: contrary).
At Level 3, questions concerning prepositions, constructions, synonyms and associated words are added. Only fields employed for a certain part of speech on a certain level are displayed. (Figure 9 represents a verb file on Level 5.)

![Figure 9](image)

The importance of gender, plural and comparative forms in German, gender dependent adjective forms, and the abundance of verb forms in French and Spanish necessitated a higher number of difficulty levels that are spread over a total of five degrees within LexiFiche, LexiFichero, and LexiKartei, reflecting thus the greater number of grammatical attributes needed in these languages.

**The Quiz**

When learners have entered several words - resulting in the creation of an equivalent number of files — and if these files have been corrected, then the review mode may be activated by clicking the <Quiz> button. When the Quiz starts, most of the file fields will be hidden so that only the field indicating the part of speech and the context field will be visible. This means that the Lexi-programs make a random choice among the files which are due for revision. Learners are presented with one of the contexts (Figure 10) that they have formulated previously. In this context sentence, the new word that they want to learn is asked for at this point, and is then replaced by an 'X.' Thus, the context gives clues to remember or guess the word. If the guess is successful, the
program signals this by playing a short melody while the word file is dropped momentarily from the Quiz. This refers to Level 1. Under a higher level there are more questions asked before such music is played.

If learners fail to indicate the required word correctly in the first go, they are given another chance. First the Lexi-program will present the evaluation of the wrong entry (Figure 11). It will then add the word explanation field to the already visible context field.

In the word explanation field, the required word has also been replaced by an “X” (Figure 12). With the help of this extra information, if learners manage to come up with the correct word, they will be rewarded at this point with the brief melody while the word file is dropped momentarily from the Quiz. Again, this refers to Level 1. Under a higher level, users have to answer more questions before the music is played. If learners fail a second time to provide the required word, the Quiz procedure is interrupted and the complete file is shown.
As stated above, it is no longer acceptable to base CALL products on a dosed design. On the other hand, as long as there are no parsers, free formulated language entries, which the Lexi-programs allow, will require outside correction. Users of Lexi-Programs therefore need access to an expert in the target language who is able and willing to correct the entries in their files. For this purpose, several print out menus and one export menu are provided by the program. Also several other menu functions help the learner introduce corrections into the fields.

When users introduce new words, new contexts, and word explanations, it is important to emphasize that the Lexi-programs are not capable of correcting their input. However, during the Quiz, an evaluation on the basis of the corrected material in the files is possible. Therefore only corrected files are accepted for use during the Quiz.

Let us take a closer look at this procedure. During the Quiz, learners try to come up with words that are replaced by an 'X' in the random context sentence they are presented. Learners try to remember the word and the word meaning they originally recorded with this context sentence. N.B. This concerns the word belonging to just this context sentence, which means that only one correct answer is possible: the original word. Synonyms are excluded. This simplifies the evaluation a great deal. The evaluation is designed to give hints, not the results. Thus, learners are presented with feedback that indicates which letters of their entries were correct, which letters were too many and which were too few.
In the dialogue box during evaluation (Figure 11):
• "wrong" letters are indicated with “?”
• missing letters with “-“
• and unnecessary characters with “+“

For example: when the student entry is reed and the required word is read, the feedback will look like this:
   re?d
When the student entry is useful and the required word is usefulness, the feedback will look like this:
   useful?---
When the student entry is procreate and the required word is create, the evaluation will look like this:
   + + +create

Lexi-programs thus indicate how near a learner has come to the right word. It is regrettable that a more detailed analysis is not yet possible. Neither the comparison of syllables nor a word root analysis is implemented. For example, if the learner entry was drinker and the required word is drunkard, the program will respond with this message: This is not the word you originally entered into the corresponding field. In a later version of the evaluation module, there should be more assistance for situations where users have come near to the root of the word and where they have indicated part of the right word, for example in German if a student misses the mutated vowel or forgets to capitalize, the question mark is insufficient help.

**Organization of the review and control of the learning success**

As stated above and as proposed by Buzan (1974), Lexi-Programs present the words in a preset rhythm of decreasing frequency in their Quiz; this is after one day, one week, one month and 6 months. Thus the Lexi-programs guarantee a temporal organization and a review structure that assists the learners and teachers in reviewing vocabulary.

For a Lexi-program with several hundred words, learner might find about 20 words at the beginning of a work session in the Quiz. These words are found to be due for review by the review module upon start-up of the Lexi-program. Some might have been introduced the day before, while others might have been repeated already several
times. They indicate their review status in the second line of the field “back the:” ("revint le," "zurück am" etc.). This field shows in its first line, the date when this specific file will show up again in the Quiz. Each time a word has been correctly reviewed, this review status is updated and the relevant file is dropped form the Quiz until it is due again.

After all the words contained in the <Quiz> at a given time have been reviewed correctly, the Lexi-program announces success, which means for the learner that his "homework" for that day has been done. N.B. If a word has been reviewed correctly after 6 months — that is under review level 4 — it is taken out of the Quiz completely. The status of words that are not reviewed correctly in the first go are downgraded with the effect that they reappear more rapidly in the Quiz.

A special menu “Review file the ...” gives the user the possibility of changing the review status of a word, thus adapting the review rhythm (within certain limits) to personal needs.

In addition, the Lexi-programs provide a record named "Statistics" (Figure 13) that includes the new words introduced and the words that have not been reviewed correctly. With the hard copy of these statistics learners have the possibility of continuing their work without the computer.

![Figure 13](image-url)
Other functions

In the menu bar with "Action," "Show field," "Print," etc., many sub-menus can be found. Sub-menus allow access to functions such as
- consultation of an index of all the words introduced;
- reaching the card of any indexed word;
- printing words that have not yet been corrected;
- creation of a "word only" document with all the words that have not yet been corrected; this might then be opened by the teacher with any text editing program for correction;
- re-integration of any file that no longer appears in the Quiz, for example after a successful 6 month review period;
- entry of correction into fields that are normally protected against involuntary change;
- deactivation of the success melody in order not to disturb other persons;
- adaptation of the rhythm of revision.

Immediate translation

The interface of the Lexi-programs is organized in the target language. Us learners continuously learn and work in a target language environment. Each dialogue box addressing learners uses the target language. However in each of these dialogue boxes there is a button called "translation," "Übersetzung," "traduction," etc. (Figure 6). A click on this button presents learners with the same question or message in the help language (Figure 14). They can choose among English, French, Italian, Spanish or German. This provides learners with a psychological safety net. In any situation, they may momentarily switch over to a mother tongue version without disturbing current activities.
Additionally, there are explanations for every field button or menu in one of the help languages. Upon clicking a topic while holding down the option key, learners receive explanations for the selected subjects (Figure 15).

![Figure 15](image)

**Research facilities**

In a hidden field, out of the reach of teachers and users, the Lexi-programs record:
- the number of times a card has been consulted
- corrections and the replaced version
- numbers and dates of reviews
- errors committed during the review.

After every 250 new words, a dialogue box invites users to send a copy of their Lexi-program to our institute.

**Some problems**

With the help of the level menu, the Lexi-programs adapt to learners, so no prerequisites are requested. Since entries of complete sentences are required for the context and the word explanations, some training in syntax, including the use of subordinate clauses, is helpful.
Word explanations might be too demanding on the low level and too simple on a high level. A word like "chair" can be explained, for example, as "I sit on it, wooden, not comfortable." It is not the precision and elegance of the word explanation that is important, but the fact that the learner devotes a certain effort to explaining it. Such effort of cognitive reflection helps to construct multiple associations and assures, by its depths of processing, better recall of the new word.

Concerning mistakes, autonomous learning always implies the risk of acquiring mistakes. The Lexi-programs therefore contain a special barrier in the review mode. Only files that are declared "corrected" are admitted to the review with the Quiz. The learner uses the print menu to submit his work to an expert of the target language and later transfers corrections onto the files of his personal program which are then declared corrected. This procedure will continue to be necessary as long as no suitable parser is available.

Another problem is related to dictionaries and grammars which learners need to consult during work with Lexi-programs. Although hard copy dictionaries for English as a Foreign language are in general of very high standard, the same quality is not guaranteed for all other languages nor for electronic dictionaries. Some do not indicate all the grammatical attributes needed. Very few give collocations and all are deficient concerning limitations in usage.

Another problem is that some learners strongly dislike computers and prefer writing. Such personal views have to be respected. Some, nevertheless, accept using a computer as part of collaborative work where communication is a dominant aspect of their work.

Finally, there are those learners that have achieved good results in word and language learning and do not see any reason to change their methods. Confronted with the learning success of classmates that use a Lexi-program, occasionally some of them reconsider their strategy.

CONCLUSION REGARDING LEXI-PROGRAMS

The Quiz pleases most of the learners and motivates them to undertake the cumbersome procedure of word entry with all the different grammatical attributes. It is precisely this entry phase that is especially effective for the memorization and later retrieval of words. Confronted with different entry questions, learners are motivated to
take a good look at the words. If they work in a group, this often leads to very lively
discussion. They also consult their manual, dictionary and teacher with renewed
interest.

In many notebooks, one finds correct and wrong annotations side by side, as well as
clearly written mistakes in ink, subsequently corrected by pencil. In contrast to this
unsatisfactory situation, Lexi-programs always provide a dear picture.

Work with a Lexi-program generally leads to greater learner autonomy. Learners
decide themselves which word they want to work on and they can also freely decide
when they want to do so. This freedom, together with immediate feedback of mistakes
or success in review, leads to increased self-confidence, thereby helping to construct
positive inner attitudes which are so important to overall learning success.

A Lexi-program — once accepted — offers an attractive model that allows learners to
take control of most of their word learning requirements. The overall time that they
invest in word learning increases, and systematic review in decreasing intervals (1 day,
1 week, 1 month, 6 months) produces rapid results in the language production of the
learner. Finally, learners develop a consciousness of word complexity and adapt their
learning strategies to accommodate this.

FURTHER DEVELOPMENTS

In order to improve the current implementation of our CALL design for word learning,
the following developments are necessary:
- The open structure has to be supported by a parser as well as evaluation modules
  which are capable of coaching a user intelligently.
- User-program interaction should include a spoken component.
- Libraries of pictures, films and sounds should be assessed by the program.

ACKNOWLEDGMENTS

I do not claim to be the originator of many ideas expressed in this paper. Our work is
influenced by programs for the PC such as Wordstore\(^4\) (Chris Jones) and Autodico\(^5\)
(Paul Mairesse). We are also indebted to LCC Logics in Lausanne and especially to the
generosity of its director, Serge Rochat.
NOTES

1 This point came also up repeatedly in discussions during the CALICO '92 International Symposium “Bridges.”
2 Student control is a demand being voiced by many software critics, e.g. Josy McGinn during her presentation at 'Bridges.'
3 The Figures show related examples in the different languages available.
4 Edited by WIDA Software.
5 Unreleased experiment at Eurocentre Zürich.

REFERENCES


Hilts, Philip J. "Clues to Brains Data System." Herald Tribune, September 17, 1992. [Relates a recent finding at the John Hopkins Medical Center.]


**AUTHOR'S BIODATA**

Andreas Röllinghoff is responsible for computers and German teaching at the Language Center of the Swiss Federal Institute of Technology, Lausanne.

**AUTHOR'S ADDRESS**

École Polytechnique Fédéral de Lausanne  
Centre de Langues  
Swiss Federal Institute of Technology  
CH - 1015 Lausanne  
Switzerland

Phone: + 41 21 693 2289  
Fax: + 41 21 693 7050

E-mail: andreas.rollinghoff@cl.adm.epfl.ch