It is, I think, safe to assume that despite initial setbacks and some resentment by some members of the language teaching community information technology (IT) must now be regarded as an accepted and proven addition to the existing set of learning media. A large number of tools for a wide variety of applications has been developed over the past decade, and both standard hardware and software have become available not only to the privileged few but to the grass roots of language learning.

However, it still feels rather awkward to give a keynote address on the state of the art of IT, because when looking at some of the applications that have evolved even in recent years one cannot help but wonder whether art is indeed the proper ten-n to describe what has been going on. Quite often it seems that software and concepts for IT enhanced language learning are machine driven rather than methodology based. It is so very easy to be fascinated by the power and potential of the technologies on the one hand and to forget about what we have been able to find out about how to better learn and acquire foreign language skills on the other.
This is why in this paper I intend to address myself to the following issues:

- the theoretical framework of the subject at hand will be described just briefly. I do agree that we know far too little about what makes a learner’s mind tick and how best to address his or her learning and acquisition requirements. But there is some consensus concerning certain basic principles. Here, I shall argue the case not just for communicative tasks as one of the key principles in language learning and acquisition but the importance of the role of a learner as a researcher and experimenter in the language classroom.

- a software classification and some criteria concerning software development will be presented. I shall refer to the type of software and application that stimulate a learner’s cognitive processes and address his or her learning strategies as well as strategies of language processing and production rather than just facilitate the handling of a given task, a problem I shall discuss in the final part of my paper dealing with...

- ... samples of multi-media applications which in my mind represent steps in the right direction of the future shape of IT enhanced language learning.

THEORETICAL FRAMEWORK

As we all know, a general language learning theory does not yet exist and probably never will. In psycholinguistic research and in research on second language acquisition and foreign language learning, however, a number of principles and concepts have emerged which seem to be generally accepted, at least in theory. Some of these principles are being employed already in the evaluation of language learning materials and they should also be used as guidelines in developing and assessing IT-enhanced applications.

Let us first look at the various factors that are involved in the language learning process. Let us consider figure 1, which is based on ideas put forward by the proponents of a process-oriented methodology, such as Chris Candlin and Henry Widdowsen:
**Data** is best described by content, i.e. language as the subject of learning in its non-didacticized form.

**Information**, then, can be referred to as the system that is used to unlock, understand and access the data, i.e. the resources and materials that are used in language learning. This can be both authentic discourse and didacticized learning materials,

**Process** refers to the tasks that are set to engage in learning, i.e. the way learners are asked to handle and work with data and information.

All these factors are embraced by procedure, i.e. the way they are arranged and organized in a language learning situation.

The fact that we talk about processes embedded in some form of educational design, i.e. procedure, suggests that language learning is not just a set of loosely connected activities. Language learning and language acquisition are interactive and dynamic processes in the sense that “studying, learning, reviewing and recalling are not simple input - output activities any more than using language is” (Di Vesta, 1974).
Language learning and language acquisition must be considered in terms of the cognitive processes involved and the relevant strategies of language processing and production together with strategies of learning that are needed. Often hypothesis formation and hypothesis testing and verification play an important role in this context. Furthermore, the way general and linguistic knowledge appears to be organized in our minds is of great significance. This is best defined in terms of schemata, which play an important part when it comes to storing, reorganizing and retrieving both linguistic knowledge and non-linguistic knowledge and information, e.g. world knowledge (e.g. Hudson, 1982 and Kintsch and Green, 1978).

These may be some of the reasons why quite a number of language acquisition researchers believe that the cognitive model of learning offers a solid basis for explaining language acquisition processes (cf. McLaughlin, 1987). In short, this model proposes that during linguistic information processing, i.e. comprehension, a learner processes the language data via processes of abstraction and generalization and comes up with linguistic knowledge structures which are integrated into linguistic knowledge already available.

During language production but especially during comprehension a learner continuously re-examines the knowledge already acquired, and modifies it if necessary. The fact that in this process the learner also uses language in communication and transfers passive skills into active competence leads to the subsequent automization of the acquired language knowledge.

Hunt, a cognitive scientist, refers to this process as "... linkage of new material to previously known material" (Hunt, 1982, p. 29). Linkage, however, covers only part of this process, as existing knowledge organized in the appropriate schemata is not just passively added to. Quite the contrary, the "activation" of existing knowledge in this process and its active participation and interaction with the new information to be digested is of utmost importance for the successful outcome of this process.

In simple terms, such processes could be described as processes of information gathering, information processing and reorganization as well as internalization and automation. Consequently, one of the basic laws of language learning is the principle that "language learning is language use" (Ellis, 1985).
However, when designing IT resources to facilitate language learning and language acquisition processes it is also important to keep in mind that during this process learners make use of various types of competence: factual linguistic knowledge and world knowledge (declarative knowledge) on the one hand and strategies of language processing and production (procedural knowledge) on the other (cf. Rüschoff and Wolff, 1991).

As far as the strategies are concerned, Anita Wenden defines these as follows: "Strategies are problem oriented. Learners utilize them to respond to a learning need, or to use ... cognitive psychology [terminology], to facilitate the acquisition, storage, retrieval or use of information" (Wenden, 1987). She even refers to such strategies as being part of our I/ mental software."

Wode points out time and again, "... daß sich Lerner die Zielsprache als dem sprachlichen Input, den sic registrieren, 'kreativ' erschließen; ... und daß die Vorgänge, die sich während des Lernvorganges im Gedächtnis abspielen, 'nicht bewußt' gesteuert bzw. steuerbar sind" (Wode, 1988, p. 15). It seems then that language learners not only need ample opportunity to engage in communicative activities but must also be exposed to as much linguistic discourse (sometimes referred to as input) as possible and be given enough freedom to creatively interact with it in order to build on their mental knowledge base.

Therefore, I would like to argue that in modern language teaching theory it is possible to distinguish between the importance of language use in communicative activities on the one hand, and of language use in activities of experimentation and research on the other. Allowing learners to experiment with and explore language to which they are exposed in spoken, written or audio-visual discourse is of the utmost importance for developing competence in a foreign language.

It is my belief that the language learner’s role as an experimenter and researcher in the classroom should not be underestimated: actively and often consciously exploring language and communication should constitute an important activity in the language classroom. Providing the appropriate data, organized into suitable units of information and supported by relevant processes must be the foremost task of educational design of any kind of language learning and teaching resource in order to contribute to the success of any learning situation, i.e. procedure.
SOFTWARE CRITERIA AND CLASSIFICATION

Taking into consideration the theoretical framework which within the context of this paper could only briefly be touched upon, let us now reflect upon its implications for the design of IT enhanced learning materials. Obviously, traditional concepts of drill and exercise as well as standard exercise formats are not able to provide learners with opportunities for learning and acquisition as described above. Consequently, new concepts for the design of such materials are required, concepts that result in software and applications that are compatible with the learners' previously mentioned mental software.

Amongst these we consider the following to be essential:

(a) Looking at what has been said about linguistic information processing, such software must permit learners to "interact" with language data in order to modify acquired linguistic knowledge on the basis of analysis and testing.

(b) Consequently, such software should not put the learner into the role of testee, but rather facilitate their role as an experimenter and researcher.

(c) Furthermore, control over what the software does or what one wants to do with the software has to be left to the learner to a much higher degree than in most examples to date.

(d) With regard to language processing, most traditional CALL exercises so far focus too much on the linguistic aspect of declarative knowledge. In allowing the learner to work with learning materials in different modes, such software should consider procedural knowledge and non-linguistic aspects of declarative knowledge to a much higher degree.

While these principles for software design listed here are far from being a complete inventory of requirements they do reflect some of the aspects of the theoretical framework discussed above.
The figure 2 above, classifies some of the existing materials into a selection of utility software. Such software, in my opinion, must provide learners with a set of tools addressed to their learning needs, which are to a large extent determined by the concepts specified above. Software that forces learners into a predesigned straight-jacket of what is sometimes referred to as instructional design does certainly not answer these needs. Only by providing learners and teachers with learning utilities and tools will it be possible to make the language learning community aware of the potential IT has to offer to language learning.

Starting with materials of a somewhat traditional kind, exploratory programs can be regarded as a first step into the direction of learning tools. Such software does not insist that learners enter any one correct answer but encourages them to explore the whole range of potentially acceptable variations within a given linguistic framework. In addition, a program such as WIDA Software’s TESTMASTIER enables the creation of exercises with full phrasal input rather than simple one-word gap-filling.

Software dealing with what might be described as text-based discovery, such as concordances, are probably the best example of data-processing utilities. Such tools open completely new ways for learners to explore linguistic data with the aim of discovering linguistic concepts for themselves. Tim Johns, one of the pioneers of the application of concordances in language learning, refers to such software as a "... research tool for investigating the company that words keep..." (Johns, 1986).
Without doubt, such materials tie in very well with the need for learners to explore and research as part of the process of acquisition and learning. Furthermore, concordances can be used by a teacher to create a whole range of newly styled worksheets for classroom activities quite different from the traditional handouts being used to date.

As far as information gathering and processing are concerned, any kind of HYPERTEXT application and hypermedia fits into this category of utility software. However, as I shall discuss in the final part of my paper, the problem of the possibility of getting lost in hyperspace is a danger not to be underestimated. Both content and the predesigned modes of interaction of such systems have to thought out very carefully.

Men it comes to software supporting the conceptual needs of learning through communication, games and simulations as well as any kind of telecommunications applications can be referred to as examples.

MULTI-MEDIA APPLICATIONS

During her plenary presentation at the CALICO international symposium "Bridges" at Maastricht (August 1992) Nina Garrett discussed some deliberations concerning the potential and limitations of powerful hypertext and multi-media learning systems that reflect some of the thinking behind my own work in this field. She referred to the danger of systems that pretend to have everything available and at the learner's disposal at the click of a button.

Quite often, she rightly warned, it seems to be unclear why and how multi-media enhanced help options are presented to the learner and to what effect. I do agree that Help options and feedback that simply make it easier to solve a task rather than lead to learning do not necessarily correspond to the theoretical framework discussed above. A recent article on the future of IT dealing in part with learning and the potential of what was referred to as information repository systems stated quite dearly that "the value and function of these systems is largely determined by the content and organization of the database rather than by the structure of the predesigned interactions" (Benjamin and Blunt, 1992, p. 12).

When designing hypertext and multi-media resources it is extremely important to think carefully about what buttons we provide the learners with and what kind of help and information can be accessed through them. Above all, help must lead to strategy
building and be cognition oriented rather than just geared towards task solving. Considering what has been said about language learning and acquisition and the importance of cognitive processes and strategies I agree with Pressley and Associates, who propose that "strategies should not be taught as a separate topic in the curriculum. Rather, they should be taught throughout the curriculum as part of the actual academic tasks that students encounter" (Pressley and Assoc., 1990, p. 16). This statement is relevant to the educational design of IT resources as much as it should be the basic guideline for curricular development.

Let me now briefly describe a few examples of multimedia resources that attempt to translate the concepts discussed above into usable software. One example is VOICECART, an interactive audio-enhanced authoring system I have developed. Apart from trying to convert the concepts mentioned, VOICECART as a listening comprehension tool has been developed on the assumption that comprehension skills are vital in the context of foreign language learning and acquisition. However, listening comprehension is not a passive skill; it has to do with processing information. As Anderson and Lynch (1988) point out, a successful listener is almost always actively involved in this process and needs to acquire adequate strategies of processing and interpreting, but also intervening in what they are listening to.

I shall not discuss all features of the package in great detail (see Rüschoff and Wolff 1991 for complete description). However, one of the options available to the learners is AUDIO HELP. This option offers a set of audio-enhanced help options via three additional audio channels, e.g., a spoken summary of the original dialogue or additional listening materials, such as change of speaker or speed of presentation or any other kind of listening material suitable to facilitate a learner's comprehension of the original.

The materials offered through this part of the program are, however, not simply intended to present easier versions of a listening task. It is here, for example, that a learner can start to experiment with strategies of interaction and intervention, provided the audio channels have been filled with appropriate variations. These should demonstrate in an authentic way how to signal comprehension problems in real-life communicative situations, thus enabling the learner to experiment with and experience the effectiveness of such strategies.
If the original text, for example, is spoken very quickly in a rather colloquial language or if a particularly difficult register or accent is used, one of the variations could represent a version with the same speaker trying to take into consideration that they are talking to a non-native speaker. If the original listening task is a conversation amongst a group of people, a situation in which a less advanced learner is faced with a particularly difficult listening problem, the option of listening to a summary of the conversation might serve to make the student aware of the fact that it can be quite useful to turn to someone and ask for similar help when faced with such a comprehension problem.

We have earlier mentioned the concept of schematic knowledge and pointed to the fact that gaps in non-linguistic schemata, such as world knowledge, often lead to difficulties or even a complete breakdown in comprehension. The AUDIO HELP option can be used to make learners aware of this by using one of the audio channels to fill some of the potential gaps as far as background information on the real world related to the content of the listening task is concerned. In an exercise presenting an extract from a news broadcast one of the audio channels contains an interview with a person commenting on and explaining the wider implications and reasons for what was reported in the news.

In the same way the TEXT HELP integrated in the system is not simply intended to facilitate the understanding of the listening material by being allowed to read the script. In our example of the exercise dealing with a news broadcast, one of the text help options provides the learner with a selection of headlines and short newspaper articles on the same or related news items. In addition to being able to find out a bit more about the background of certain news stories, this way of using text help in a listening comprehension exercise makes learners aware of the fact that the real world offers the same help, e.g. that one can always look things up in a newspaper before listening to the news again an hour later.

In summary, both the TEXT HELP and the AUDIO HELP options are intended to present learners with data and information which they may use to seek help in processing the information contained in the original listening material. That is to say, the material contained in the additional audio and text channel can be seen as a kind of back-up to the inferencing processes needed to enable a listener to understand the text. Furthermore, the way learners are presented with and can work with these options can be used to help them develop an understanding for the kind of declarative and procedural knowledge necessary for successful listening in a foreign language.
A similar example is a project dealing with an interactive video system that has been developed by Ulrike Hanna Meinhof in the UK. Her system is intended to function as a cognitive support tool for comprehending news programs. In it “television provides the resource ... I and]... the computer provides the tool for interacting with the programs in a highly flexible way which allows both, a whole range of guided paths ... as well as open frames ... for annotating and analyzing the programs” (Meinhof, 1989, p. 252).

CONCLUSION

Obviously a full description in greater detail of all features of the examples mentioned here would be beyond the scope of this paper. Furthermore, the intention of the presentation is to show how the principles of a theoretical framework of language learning based on psycholinguistic research and on research into second language acquisition and foreign language learning can be translated into guidelines for software design and actual IT enhanced learning materials.

As far as multi-media resources and IT enhanced learning systems are concerned, these must be firmly based on an “informatique pedagogique utilitaire” as proposed in 1986 (Pelfrène, 1986, p. 140). An important feature of such software is the fact that it does not simply confront learners with traditional drill and kill exercises and comprehension tests but rather with a tool to prepare for and handle difficulties in language processing and production.

If such systems are well designed in the sense discussed above they can provide learners with a powerful utility to handle more effectively learning materials: effective not in the sense of simply solving a given task but in the sense of drawing new knowledge from linguistic input thus improving linguistic competence. As far as a hypermedia approach to IT-enhanced language learning is concerned “transformation of knowledge ... is the litmus test we should use in judging both exploratory and constructive hypertexts.” Such tools must engage “... learners in looking at material in new ways ...” (Jackson, 1988, p. 12), thus drawing on and hopefully restructuring and adding to their mental knowledge base.

It is in this context that I see the potential of the hopefully not too brave new world of IT enhanced language learning: powerful tools that are available not just to facilitate task handling but to facilitate the application and acquisition of strategies of language processing and ultimately language production.
Further research is needed to see how working with such programs both fits with and affects individual learning strategies. Such research should draw on the principles and general findings of psycholinguistics in order to enable us to better understand why and how certain features of resources of the kind discussed in this paper are utilized and, above all, to what effect. As far as our own VOICECART system is concerned, it is also hoped that observing and analyzing the @ay learners work with listening materials of this type may lead to further deductions as to listening comprehension in the context of foreign language learning and second language acquisition. We intend to report on the results in due course.

N.B.: A tribute is owed to my colleagues in the "Wuppertal CALL team" at our university's Dept. of Language and Literature, without whose cooperation none of my work would have been possible.

REFERENCES


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