

Design, Development, Implementation and
Evaluation of a Plurilingual ICALL System for
Romance Languages Aimed at
Advanced Learners

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DECLARATION

I hereby certify that this material, which I now submit for assessment on the programme of study leading to the award of Doctor of Philosophy is entirely my own work and has not been taken from the work of others save and to the extent that such work has been cited and acknowledged within the text of my work

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Thomas Koller

Design, Development, Implementation and Evaluation of a Plurilingual ICALL System for Romance Languages Aimed at Advanced Learners

Abstract

Plurilingual teaching and learning of Romance languages exploits the similarities between these languages to teach them contrastively and to raise the language awareness of the learner. Several European projects have been devoted to plurilingual teaching and learning of Romance languages. The materials developed in these projects do not involve Natural Language Processing (NLP) capabilities and almost exclusively focus on receptive skills.

The research goal of my Ph.D. dissertation was the design, development, implementation and evaluation of an interactive plurilingual ICALL (Intelligent Computer-Assisted Language Learning) software system (ESPRIT) for contrastive learning of French, Spanish and Italian aimed at advanced learners. I investigated how techniques from NLP enhance the plurilingual teaching and learning of these languages.

The ESPRIT toolset comprises dictionary tools, a concordancer, an input analysis and feedback module, custom-made animated grammar presentations and an authoring tool for animated text. Dictionary tools provide useful information on unrestricted texts. The concordancer gives extensive information about how a language term is used in different contexts. The input analysis and feedback module dynamically provides precise feedback on restricted learner input up to paragraph level. Custom-made animated grammar presentations and learning materials created with the animation authoring tool visualise contrastive grammatical properties and processes.

ESPRIT represents an interactive and flexible learning environment and is designed for autonomous learning. Formative and summative evaluation processes provided learner assessment data of different components of ESPRIT. A web-based database-driven evaluation platform developed for ESPRIT can easily be adapted to other evaluation projects.

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List of Acronyms

ADDIE	Analysis, Design, Development, Implementation, Evaluation
AI	Artificial Intelligence
AMF	Action Message Format
API	application programming interface
ASCII	American Standard Code for Information Interchange
CALL	Computer-Assisted Language Learning
CEF	Common European Framework
CL	Computational Linguistics
CSS	Cascading Style Sheets
DOM	Document Object Model
EBCDIC	Extended Binary Coded Decimals Interchange Code
EFL	English as a Foreign Language
FLT	Foreign Language Teaching
GFL	German as a Foreign language
GIF	Graphics Interchange Format
GLDT	General, Local, Differential, Targeted [requirements]
GUI	Graphical User Interface
HCI	Human Computer Interaction
HTML	Hypertext Markup Language
HTTP	Hypertext Transfer Protocol
ICALL	Intelligent Computer-Assisted Language Learning
ISO	International Organization for Standardization
ITD	Instructional Technology and Design
ITS	Intelligent Tutoring System
KWIC	Keyword In Context
LFG	Lexical Functional Grammar
NLP	Natural Language Processing
OOP	Object-Oriented Programming

PHP	PHP: Hypertext Preprocessor
POS	Part Of Speech
RBRO	Research-Based Research-Oriented
RIA	Rich Internet Application
SLA	Second Language Acquisition
TLA	Third Language Acquisition
SOAP	Simple Object Access Protocol
SQL	Standard Query Language
SVG	Scalable Vector Graphics
SWOT	Strength, Weaknesses, Opportunities and Threats
UTF	Unicode Transformation Format
XLIFF	XML Localisation Interchange File Format
XML	eXtensible Markup Language

Introduction

Research in plurilingual teaching and learning of Romance languages has shown that a combined approach to teaching Romance languages is very promising (cf. Bär, 2004; Klein, 2004). It can exploit the similarities between these languages in many ways in order to teach them contrastively and to raise the language awareness of the learner (cf. Hawkins, 1984). Within the range of this Ph.D. dissertation, it refers to the explicit knowledge about properties and processes in the languages involved and their conscious perception in language learning and language use.

To date, several European projects have been devoted to plurilingual teaching and learning of Romance languages, mainly focusing on acquiring reading competence. These projects only produced ‘static’ materials for classroom teaching or computer-based self-learning, without flexible and dynamic techniques from Natural Language Processing (NLP) or Artificial Intelligence (AI), which would support an interactive learning environment with user input and dynamically generated system feedback. To date, there exist – to the best of my knowledge – no plurilingual ICALL (Intelligent Computer-Assisted Language Learning) systems for plurilingual teaching and learning of foreign languages.

The research goal of my Ph.D. dissertation was the design, development, implementation and evaluation of a plurilingual ICALL software system ESPRIT¹ for French, Spanish and Italian, aimed at advanced learners. I investigated how techniques from NLP can enhance the plurilingual teaching and learning of these languages.

Generally the definitions and the use of the terms *multilingual* and *plurilingual* vary considerably. In the context of this Ph.D. dissertation, *plurilingual* means that grammatical and lexical properties of the languages involved are tightly linked to each other, showing a high degree of similarity in form and function. Here plurilingual relates to languages of the same language family, such as Romance languages. *Multilingual*, in

¹ESPRIT: ESPañol, fRançais, ITaliano

contrast, refers to the simple fact that language content and processing is available for different languages, for example word lists in French, Italian and Spanish based on the same topics or web sites with several language versions.

ESPRIT targets native English and German native speakers who are already at an advanced level in at least one of the Romance languages involved. These learners are expected to be familiar with general lexical and grammatical properties of this language (e.g. word classes, sentence patterns, use of prepositions).² Equivalent properties of the other languages are taught through comparison.

The research questions addressed in this Ph.D. dissertation build upon the general research findings in plurilingual teaching and learning of Romance languages, CALL (Computer-Assisted Language Learning) and ICALL, and the use of animation in language teaching.

Existing materials for plurilingual learning of Romance languages almost exclusively focus on receptive skills and lack any kind of intelligent automatic analysis of learner input as well as flexible and dynamic feedback to support interactive learning. Problems often cited for existing CALL and ICALL software are restricted input and simple feedback (Vandeventer Faltin, 2003: 27ff.). The lack of appropriate evaluation often leads to technically driven development. Limited data sources and a low degree of interactivity can hinder the learner to actively engage in a broad range of language-learning activities.

I developed a plurilingual input analysis and feedback module to provide flexible and precise feedback. I used flexible database technologies and a strict separation between storing and displaying/processing language data so that the same set of language data can easily be reused in different language learning activities. In order to dynamically present grammatical properties and processes and to support a high degree of interactivity, I created custom-made animated grammar presentations and developed an authoring tool for animated text. As much as possible I reused existing language data collection and processing resources. To avoid technically driven development, different components of ESPRIT were continually assessed by language learners.

This thesis is structured as follows:

²Existing research projects in plurilingual learning (such as EUROCOMROM and EUROM 4) are based on a similar lexical and grammatical level of knowledge of learners.

Chapter 1 provides general definitions of second language acquisition (SLA) and outlines the differences between SLA and third language acquisition (TLA). This chapter also introduces the notions of language transfer and language awareness which are central issues to the concept of plurilingual learning.

Chapter 2 describes previous and current research in the areas which are of most importance to this Ph.D. research, namely plurilingual teaching and learning, CALL and ICALL, the use of animation in language teaching and NLP-based dictionary look-up tools. In this chapter I identify a number of shortcomings in previous research projects. This helped to formulate the research questions informing my Ph.D. research.

Chapter 3 relates the design and development process of ESPRIT to two widely recognised CALL design methodologies, Hubbard's Methodological Framework (Hubbard, 1996) and Colpaert's Research-Based Research-Oriented (RBRO) design model (Colpaert, 2004). The chapter identifies the common ground between these methodologies and the design approach adopted for ESPRIT and describes special characteristics of the ESPRIT design approach.

Chapter 4 provides detailed information about the general properties and principles of ESPRIT. The chapter describes the target group and learning method of ESPRIT and gives an overview of existing language tools and resources which were successfully integrated into ESPRIT. It also examines important usability issues and software ergonomics relevant to CALL applications. The chapter describes the linguistic levels and modalities of ESPRIT and provides detailed information about the software architecture used for ESPRIT.

Chapter 5 details the components developed for ESPRIT. This includes a flexible web-based graphical user interface (GUI), different types of language tools and resources, tailor-made animated grammar presentations and an authoring tool for the creation of slide-based learning materials with animated text. Language tools developed for ESPRIT are multilingual and plurilingual dictionary tools, a multilingual concordancer, a plurilingual input analysis and feedback module, a plurilingual lexicon interface component and a multilingual verb lexicon interface

component. Language resources comprise a multilingual lexicon, full-form verb lists, a multilingual verb lexicon and a plurilingual lexicon.

Chapter 6 provides information on the testing of ESPRIT tools in a local server environment and the subsequent implementation of ESPRIT tools on a remote web server. This chapter describes a number of problems which were encountered during testing and implementation stages and the solutions to these problems.

Chapter 7 presents the results of the formative and summative evaluation processes. The chapter also provides a detailed description of a fast and reliable web-based database-driven evaluation platform which can easily be adapted to other evaluation projects.

Chapter 8 summarises this Ph.D. dissertation and outlines possible language-learning scenarios in which ESPRIT tools may be used in ways which differ from the specific context of this Ph.D. dissertation.

Background and Motivation

After having learned French in secondary school for seven years, I started to learn Spanish and Italian in the early and mid 90's, respectively. Right from the beginning, I was aware of a large number of similarities between these languages leading to positive and negative language transfer (cf. Odlin, 1989). *Positive transfer* exists if words or grammatical structures in two languages have a similar form and function (e.g. *casa* in both Spanish and Italian means *house*), whereas in *negative transfer* – often called *false friends* – there is only a similarity of form leading to the (false) conclusion that the function would be the same: *fermer* in French means *to close*, whereas *fermare* in Italian means *to stop*.

Although the similarities between Romance languages – which are for the most part due to their common (Latin) root – have been described extensively in contrastive linguistics for decades (e.g. Bodmer, 1944), a broader interest in research on plurilingual teaching and learning only emerged in the 1990s. Foreign language teaching in secondary schools and at universities, however, has been largely unaffected by this research. Language students at both levels only occasionally get the opportunity to learn similar languages simultaneously in a plurilingual setting.

Plurilingual teaching is potentially highly effective (cf. Bär, 2004), yet plurilingual teaching and learning material is quite hard to obtain. In my Ph.D. research, I aimed to design, develop, implement and evaluate software to support plurilingual teaching and learning of Romance languages which helps language learners to optimally exploit their existing knowledge in any one Romance language.

1. Second Language Acquisition

1.1. Introduction

Language acquisition refers to the process in which children become speakers of their native language (first language acquisition) or in which children or adults become speakers of a second language (second language acquisition). Only second language acquisition (SLA) will be addressed in this Ph.D. dissertation.

Section 1.2 provides general definitions of SLA and describes how the more recently established research area of Third Language Acquisition (TLA) has potentially led to a redefinition of the scope of SLA. This section also gives general information about SLA and describes differences between SLA and TLA. Central to this Ph.D. dissertation are the notions of language transfer and language awareness. Language transfer will be described in more detail in Section 1.3, whereas Section 1.4 provides information about language awareness. Section 1.5 summarises this chapter.

1.2. Second and Third Language Acquisition

The systematic study of how people acquire a second language (often referred to as L2) started in the second half of the twentieth century (Ellis, 1997:3). SLA research, however, only established itself internationally as an independent research discipline in the last 20 to 30 years by pursuing its own research topics and interests (Henrici and Riemer, 2003:38).

In most SLA definitions, 'second' refers to any language that is learned subsequent to the mother tongue, i. e. it can also refer to the learning of a third or fourth language. In the same way, the notion of a 'second' language is not intended to contrast with a 'foreign' language. As a consequence, 'L2 acquisition' can be defined as the way in which people learn a language other than their mother tongue. This acquisition process can either happen inside or outside of a classroom (Ellis, 1997:3). In the same way,

Sharwood Smith (1994: 7) states that 'second' language refers to any language other than the first language learned by a given learner or group of learners (i) irrespective of the type of learning environment and (ii) irrespective of the number of other non-native languages possessed by the learner.

Third language acquisition (TLA) makes reference to languages learned after a second one, which may imply a third, fourth or fifth language (or any further language). Specific TLA research started in the early 1990s. Before, this research was subsumed under the headings of SLA or bilingualism. TLA is related to but also different from SLA. Jessner (2006: 13) stresses the fact that TLA research in fact differs considerably from SLA research:

“For a long time linguists have treated third language acquisition as a by-product of research on second language learning and acquisition. But nowadays it is known that learning a second language differs in many respects from learning a third language.”

In the same way, Jorda (2005: 15) claims that the study of multilingualism is a neglected area within the general field of language acquisition and that investigating language learning from a perspective different from that of a second or foreign language is quite new. Multilingual acquisition is often considered to be a simple variation on bilingualism and second language acquisition.

According to these more recent TLA-centred definitions, SLA would only refer to the learning of the second language, whereas TLA investigates the acquisition of a third language, fourth language, etc.

1.2.1. Second Language Acquisition

The two main findings of SLA research of the past few decades are that (i) the stages all learners go through when acquiring the second language is highly systematic and that (ii) the rate of the learning process (the speed at which learners are learning the L2) and the outcome of the learning process (how proficient learners become) are highly variable (Myles, 2002).

This 'route' of learning stages remains largely independent of both the learner's mother tongue (L1) and the context of learning (e.g. whether instructed in a classroom

or acquired naturally by exposure). All new learners of a language progress through the same stages to acquire language. However, the length of time each student spends at a particular stage may vary greatly. Several distinct stages of second language development have generally been identified (Reed and Railsback, 2003: 15ff.):

Stage I: the Silent or Preproduction Stage: this stage often involves a “silent period” during which students may not speak but can respond using a variety of strategies such as pointing to an object or person or performing an act. Teachers should not force students to speak until they are ready to do so.

Stage II: the Early Production Stage: during this stage students can usually speak in one- or two-word phrases and can demonstrate comprehension of new material by giving short answers to simple questions.

Stage III: the Speech Emergence Stage: students begin to use dialogue, can ask simple questions and are also able to answer simple questions. Students may produce longer sentences but often with grammatical errors that can interfere with their communication.

Stage IV: the Intermediate Language Proficiency Stage: students are beginning to make complex statements and express opinions and speak at greater length.

Stage V: the Advanced Language Proficiency Stage: students have developed some specialized content-area vocabulary and can participate fully in classroom activities if given occasional extra support.

Recently, there has been a resurgence of interest in grammar pedagogy (Lightbown, 2000; Mitchell, 2000), partly because of the perceived failure of ‘natural communication’ learning methods (such as immersion and communicative language teaching) in producing learners with a consistently accurate language production. Consequently, the role of instruction and the role of the input in facilitating the L2 learning process have increasingly gained more attention (Myles, 2002).

1.2.2. Specific Properties of Third Language Acquisition

Cenoz (2000) claims that there are three main differences between SLA and TLA: (1) the order in which languages are learned, (2) sociolinguistic factors and (3) the

psycholinguistic processes involved. Hufeisen (2003) states that many factors can be enlisted to clearly distinguish SLA from the acquisition of a third (L3), fourth (L4) or fifth (L5) language, including a higher number of language transfer bases (i. e. previously learnt languages), a greater awareness with regard to languages and the proper language learning which includes language-learning strategies. Jessner (2006: 16) claims that one of the main characteristics of TLA in contrast to SLA is the greater complexity of TLA as shown in studies concentrating on the differences between SLA and TLA .

According to Jorda (2005), TLA widens the linguistic system of an individual both quantitatively and, above all, qualitatively. It cannot be viewed as the mere sum of individual language-specific linguistic systems. An additional language affects the overall linguistic system of the learner and creates new links and relationships between the new and previously learned languages. The whole language system of a learner is restructured,¹ and skills and learning techniques from the learner's previous language-learning experience come into play. The linguistic system of a third language learner is influenced by the constant change of the relationships between the learner's languages.

Jorda (2005: 13) considers language maintenance as a defining feature of third language acquisition. Language maintenance refers to the fact that "learners have to make an effort in order to maintain their proficiency level in languages known to them". The more languages an individual knows, the more effort is required for their maintenance. Language learning needs periods for refreshing language skills and linguistic knowledge.

Herdina and Jessner (2002) claim that non-linearity is one of the main characteristics of language acquisition. In their opinion, the progress made in learning a first, second or third (or further) language is non-linear in contrast to other approaches where this progress is interpreted as "an ordered sequence of individual steps suggesting a steady upward motion where one step follows on the other" (p. 89).

Jessner (1999: 207) postulates that the TLA clearly differs from SLA because "prior language learning experience changes the quality of language learning". As a result, the experienced language learner often develops clearly differing language strategies in contrast to the inexperienced language learner.

¹Jorda considers all languages known by a multilingual speaker (i. e. first, second and third languages) as a whole unit instead of separate entities that develop in isolation. Therefore a newly learned language may also influence the first language(s) of a learner.

1.3. Language Transfer

Language transfer, often used interchangeably with the term *cross-linguistic influence*, either refers to the learner's (often unconscious) attempt to apply rules and forms of the first language into a second language or to the transfer of features from one additional language to another (such as from a second to a third language). Language transfer is the "influence resulting from the similarities and differences between the target language and any other language that has been previously (and perhaps imperfectly) acquired" (Odlin, 1989: 27). According to Gass and Selinker (1983: 372), language transfer is the use of knowledge of the native language or of any other language in the acquisition of a second (or additional) language. Similar to Gass and Selinker, Sharwood Smith (1994: 198) includes non-native languages as a potential source of language transfer. He describes *cross-linguistic influence* as "the influence of the mother tongue on the learner's performance in and/or development of a given target language; by extension, it also means the influence of any 'other tongue' known to the learner on that target language".

De Angelis and Selinker (2001: 42) are quite surprised that in the last three decades most studies on language transfer have focused primarily on the influence of the native language on a second language or interlanguage and that researchers have rarely focused their attention on instances of transfer from languages other than the native language. De Angelis and Selinker reckon that the potential influence of an interlanguage on an additional interlanguage appears to be widely acknowledged in the field.

De Angelis and Selinker (2001: 44) state that current language transfer theories are highly restricted because they are based primarily only on the interaction between two systems (i. e. usually the native and one non-native system). De Angelis and Selinker, however, claim that more than two linguistic systems must be present in the speaker's mind for interlanguage transfer to occur. Therefore a minimum of three linguistic systems is required for interlanguage transfer to occur. As a result, De Angelis and Selinker (ibid.) draw the conclusion that language transfer theory cannot be comprehensive "if its principles are based on two languages only".

Meißner (2002: 129) reports on empirical research with university students in Germany who were learning a second or third Romance language. This research, which

analysed oral and written transfer processes, showed that language transfer processes show a higher success rate if a learner can make use of a suitable bridge language (i. e. a previously learned language which bridges the gap between the mother tongue and the currently learned language) and of corresponding transfer strategies. Meißner draws the conclusion that is often not the mother tongue which serves as the main basis of intercomprehension for the currently learned language.

1.4. Language Awareness

The term *language awareness* came into widespread use in the United Kingdom in the early 1980s. It was then defined as “a person’s sensitivity to and conscious awareness of the nature of language and its role in human life” (Donmall-Hicks, 1997: 21). A more recent definition states that language awareness “refers to the development in learners of an enhanced consciousness of and sensitivity to the forms and functions of language” (Carter, 2003: 64).

In the 1980s, Hawkins (1984: 4) was the first to provide a detailed description of language awareness which sought to “bridge the difficult transition from primary to secondary school language work, and especially to the start of foreign language studies [...]”. The concept of language awareness was associated with a reaction to more prescriptive approaches to language learning. These approaches generally involved atomistic analysis of language and reinforced narrowly formalistic methodologies (such as grammar translation, drills and pattern practice (Carter, 2003: 64).

Jessner (2006: 36) states that in recent years, an increase in interest of metalinguistic awareness has been stimulated by the pedagogically motivated ‘language awareness’ movement. In this context, Jessner points out that the use of the terms ‘metalinguistic awareness’ and ‘language awareness’ in literature is confusing and that none of these terms is used systematically: “metalinguistic awareness, language awareness, declarative knowledge of the rules of a language, metalinguistic ability, etc. [...] refer to the same ability” (Jessner, 2006: 40). Similarly, James (1999: 97) observed that four competing terms are used in scientific literature to describe similar concepts: language awareness, linguistic awareness, metalinguistic awareness and knowledge about language.

With the help of selective experimental data from trilingual adults (bilingual Ital-

ian/German learners of English) Jessner (1999:201) claims to provide evidence that certain processes of metalinguistic awareness take place while performing in a third language. This evidence is provided by the adults' use of certain problem-solving behaviour in think-aloud protocols during the process of academic writing. Jessner (ibid.) argues that (i) prior language knowledge should be reactivated in the language classroom and (ii) multilingual education should also focus on the similarities between languages in order to increase metalinguistic awareness in both teachers and students. As a result, "the development of competence in two or more languages can result in higher levels of metalinguistic awareness". This metalinguistic awareness, in turn, facilitates the acquisition of language by "exploiting the cognitive mechanisms underlying these processes of transfer and enhancement".

Jessner (1999:207) draws the following conclusions from her selective experimental data:

- metalinguistic awareness can be increased through teaching similarities between languages. As a consequence, multilingual education should therefore concentrate on increasing metalinguistic awareness in language students by teaching properties which are common between languages they already know.
- an increased focus on similarities could offer positive effects for multilingual education.
- the reactivation of the knowledge of other languages in the learner could guide learners in the development of a further language system.
- metalinguistic awareness plays a central and facilitating role in the acquisition of additional languages.

1.5. Summary

This chapter provided general definitions of SLA and described how the more recent research area of TLA aims to redefine the scope of SLA. The chapter outlined the differences between SLA and TLA. The notions of language transfer and language awareness, which are central to this Ph.D. dissertation, were introduced both in general and in relation to plurilingual learning.

2. State of the Art in Related Areas of Language Teaching and Learning

2.1. Introduction

This chapter describes previous and current research in the areas which are most closely linked to the research reported in this Ph.D. dissertation, namely plurilingual teaching and learning, third language acquisition, CALL and ICALL, and the use of animation in language teaching. I identify a number of shortcomings in previous and current research projects which helped to formulate the research questions for my Ph.D. research.

Section 2.2 describes several past and present European research projects in plurilingual teaching and learning of Romance languages. Section 2.3 provides an overview of general properties of existing CALL and ICALL software and highlights common shortcomings. It also gives information about the use of animation in past CALL research projects and describes the properties of existing NLP-based dictionary look-up tools. Section 2.4 details the research questions of this Ph.D. research. Finally, Section 2.5 summarises this chapter.

2.2. Plurilingual Language Teaching and Learning

In traditional language teaching, languages are taught separately. Institutional learning of a 'new' language (i.e. a language yet unknown to the learner) always starts from scratch, which implies that learners' knowledge of similar languages is usually not taken into account. The monolingual teaching method became dominant at the end of the 19th century with the introduction of the Direct Method (Richards and Rodgers, 2001: 12), which strongly favoured the intuitive assimilation of new structures and meanings in the target language (similar to the learning of the first language) and tried to avoid simple word-for-word translations. This method advocated the exclusive use of the target language in the classroom and aimed at eliminating any contrastive

teaching. In contrast to monolingual teaching, the plurilingual teaching approach exploits learners' knowledge of similar languages (Müller-Lancé, 2003). It raises language awareness by contrastively showing similar properties in several languages and aims to avoid learners' typical errors related to language transfer processes (cf. Section 1.3).

In the last two decades, a broad range of research questions has been addressed in plurilingual teaching and learning of Romance languages. Apart from investigating underlying psycholinguistic processes and describing linguistic features common among Romance languages, several plurilingual teaching materials have been developed (Blanche-Benveniste, 1997; McCann et al., 2002; Degache, 2003; EuroCom, 2007). These materials are partly 'traditional' paper-based materials, partly CALL materials.

Existing materials for plurilingual teaching focus largely on receptive skills, with a strong emphasis on reading comprehension. Additionally, if used as self-learning materials, all these materials do not perform any kind of intelligent automatic analysis of learner input, nor provide flexible and dynamic feedback. Research in plurilingual teaching of Romance languages has been conducted primarily in Denmark, Germany as well as in countries where Romance languages are spoken as mother tongues. The materials developed in these projects do not contain techniques from NLP or AI. They are mainly aimed at classroom teaching and self-learning, either with books and CD-ROMs or, more recently, via the Internet. Existing plurilingual materials contain a fixed selection of texts and exercises and do not provide dynamic feedback and analysis of language production by the learner. The main previous research projects in the area are reviewed briefly in the next sections.

Empirical evidence available for the success (or failure) of learning concepts for plurilingual learning so far only comprises test results of projects up to one semester. Evaluation projects have been conducted in secondary schools and on university level. Klein (2004) and Bär (2004: 153) report the results of plurilingual test projects in secondary schools. These projects lasted one to two weeks and were focused on reading skills. Müller-Lancé (2002) and Mahlmeister (2004) investigated the effectiveness of plurilingual courses on university level. Müller-Lancé conducted an empirical study with 21 students on listening intercomprehension, whereas Mahlmeister reports the results of an exam which tested reading comprehension. The exam was taken by 162 students.

2.2.1. Intercommunicabilité Romane

The Danish project INTERCOMMUNICABILITÉ ROMANE was based on the experiences of the Scandinavian intercomprehension (Danish, Norwegian and Swedish). It aimed at the acquisition of Romance language skills in French, Italian, Portuguese and Spanish with French as the bridge language. A *bridge language* helps language learners to ‘bridge the gap’ between the mother tongue and new languages to be learned provided that the bridge language shares many properties with those new languages and is spoken by the majority of the language learners. Schmitt Jensen (1997:96) described the aim of INTERCOMMUNICABILITÉ ROMANE as to “étudier de façon systématique les différences, d’un point de vue d’abord synchronique, pour constituer les bases d’un apprentissage contrastif”.¹ Therefore, phonetic-phonological, morphosyntactic and lexical areas of intercomprehension were transferred from diachronic into purely synchronic representations (Bär, 2004:125).

Intercomprehension either refers to the possibility of speakers to understand each other using two different languages (for example each speaker using his/her own native language) or for one learner to learn further languages with the help of previously learnt similar languages. Existing research on intercomprehension emphasises the need of precise learning targets for the acquisition of multilingual skills. Learning targets can either be confined to receptive skills (such as reading or listening comprehension) or can include oral or written language production skills (Scherfer, 2002:93).

The method of INTERCOMMUNICABILITÉ ROMANE aimed to teach students in one semester (approx. 30 hours of instruction) the skills and knowledge to understand a further Romance language. In contrast to other intercomprehension-based models, INTERCOMMUNICABILITÉ ROMANE also aimed to impart productive skills: “[...] la possibilité [...] de commencer à s’exprimer dans cette langue” (Schmitt Jensen, 1997:96). The only actual outcome of the project was the publication of a contrastive grammar “De una a cuatro lenguas” for French, Italian, Portuguese and Spanish (Schmidely et al., 2001).

¹Translation: To study in a systematic way the differences, starting from a synchronic point of view, in order to constitute the basis of contrastive learning.

2.2.2. Galatea and Galanet

GALATEA (cf. Dabène and Degache, 1996) was a multinational project with members from Argentina, Brazil, Chile, France, Italy, Portugal, Switzerland and Spain. In the first project phase (1991-1995), decoding strategies in closely related Romance languages, rules of transfer, false friends and different types of inferences between languages were researched. In the second project phase (1996-1999), CD-ROMs were developed which aimed to help native speakers of French, Spanish, Italian or Portuguese to start learning one or several of the other target languages in order to 'discover' them independently and to increase reading skills. Research in GALATEA focused on the analysis of comprehension processes and tried to raise learners' awareness of intercomprehension between languages. The materials developed aimed only at receptive skills, mainly reading comprehension. The approach taken in GALATEA allowed learners to work on one or several Romance languages at the same time.

Based on the research results from GALATEA, the project GALANET was established (Degache, 2003). In the first project phase (2001-2004), a web-based virtual learning environment was developed (Figure 2.1), using the spatial metaphor of a press agency. The press agency contains many different units either for self-study, to gather information or for interaction and discussion with other students. This includes a forum, a self-learning centre, a resource centre, user lounges, a notice board, a library, a meeting room and an editorial room. The metaphor of a press agency is used to help distinguish between the different receptive and productive activities available via this platform.

The platform aims to promote collaborative learning between native or near-native speakers of at least one of the following languages: French, Italian, Spanish and Portuguese. The target group for GALANET are students (in secondary schools, higher education or language centres) and adult learners who either learn these languages individually or via continuing education courses. Learners are encouraged to practise intercomprehension between these languages and to communicate with native or near-native speakers of the other languages involved.

The second project phase (2004-2006) has investigated how the contents of GALANET can be successfully integrated in language teaching curricula. Further research will be conducted on the processes taking place in intercomprehension between Romance languages.



Figure 2.1: Galanet – virtual learning environment

2.2.3. EuroComRom

The EUROCOMROM project (cf. Stoye, 2000) is part of the EUROCOM initiative, which aims to facilitate intercomprehension in the main European language groups, namely Romance, Germanic and Slavonic. EUROCOMROM – mainly based in Germany – uses the bridge language French in order to achieve reading comprehension in other Romance languages (currently Italian, Catalan, Portuguese, Spanish and Romanian). Reading comprehension in these languages is promoted through the explicit introduction and continuous practice of the following areas of intercomprehension: (1) lexical internationalisms, (2) pan-Romance and pan-European lexis, (3) interlingual sound correspondences, (4) the relations between spelling and pronunciation, (5) the pan-Romance syntactic structures, (6) morphosyntactic structural formulas and (7) prefixes and suffixes. Each area of intercomprehension is introduced separately and contains extensive contrastive descriptions of the corresponding topic in all seven languages (McCann et al., 2002).

The EUROCOMROM method is used in seminars at university level (mainly with students of linguistics) and can also be applied autonomously for all Romance languages involved via book, CD-ROM and Internet (EUROCOM ONLINE).

EUROCOM ONLINE (EuroCom, 2007) currently provides plurilingual online materials for Italian, Romanian and Spanish. These online materials comprise the same 36 topics in each language. Each topic consists of a text, in which each word (or multi-word unit) is linked to plurilingual information (Figure 2.2). The plurilingual information is not retrieved dynamically, but created manually by a team of editors. Currently, the only language of explanation is German. The online materials do not provide the option to work on any 'other' text (e.g. authentic text retrieved by the learner from the Internet and not provided by the EuroComRom researchers). Furthermore, the materials do not support learners to input their own sentences and to receive feedback on learner input. The learner can listen to each text paragraph by clicking on a loudspeaker icon.

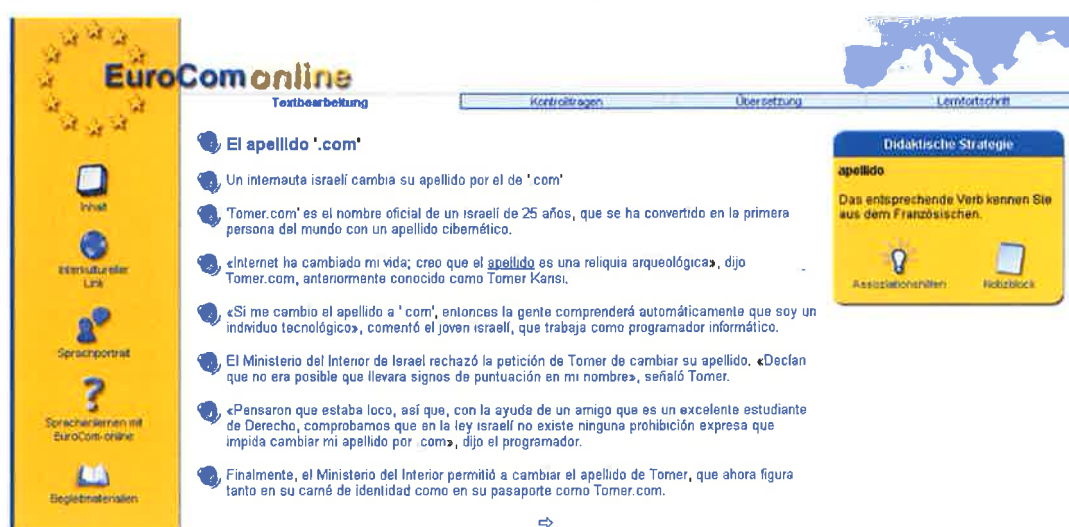


Figure 2.2: EuroCom online – text with plurilingual annotations

2.2.4. EuRom 4

The project EUROM 4 (cf. Blanche-Benveniste, 1997) started in 1990 as a cooperation between the universities of Salamanca, Aix-en-Provence, Rome and Lisbon. In seminars in Aix-en-Provence the researchers aimed to enable native speakers of one of the Romance languages involved to simultaneously acquire reading and listening comprehension in the other three languages. Instead of giving learners systematic help from the beginning (as in EUROCOMROM), the purpose of this approach instead was to provide help whenever a problem arose. The project focused on the overall comprehension of texts instead of translating every detail. In 1997, a multilingual textbook and a CD-ROM were published, which contain the methodological background, all lessons

and a contrastive grammar of Portuguese, French, Spanish and Italian.

2.3. Computer-Assisted Language Learning

CALL is the research field concerned with the use of computer technology for language teaching and learning. ICALL is a subfield of CALL. The difference between CALL and ICALL is the integration of NLP and AI techniques in the latter (Gamper and Knapp, 2001).

In the next two sections, I briefly review CALL and ICALL. Shortcomings of existing CALL and ICALL software are taken into consideration in order to identify objectives for this Ph.D. dissertation. I will also give an overview of dictionary look-up tools and the use of animation in past CALL projects.

2.3.1. CALL

Levy (1997:1) defines CALL as “the search for and study of applications of the computer in language teaching and learning”. CALL was first recognised as a research area in the 1960s. At that time CALL projects tended to involve the development of large-scale systems. Nowadays, CALL applications include web-based technologies (Internet and E-mail), CD-ROMs and hand-held devices. The great potential of new media and technologies for language learning has been recognized and explored in a large number of CALL systems. Research in CALL shows that the computer can serve a variety of uses for language teaching. CALL software can be used as a tutor which offers language drills or skill practice, as a stimulus for discussion and interaction, or as a tool for writing and research. Since the introduction of the Internet, CALL can also be a medium of global communication and a source of authentic language materials (Warschauer, 1996).

Gamper and Knapp (2001) criticise the fact that many CALL systems are focusing on single aspects of language learning and point out that many CALL systems should allow a more constructive learning process supported by the exploration of new technologies and media.

Existing CALL systems often support only very restricted learner input (if input is allowed at all), usually not exceeding one word. This input is then often analysed via simple pattern matching techniques, which then leads to a simple feedback of ‘right’ or

'wrong'. Vandeventer Faltin (2003: 27ff.) provides a detailed state-of-the-art description of syntactic error diagnosis in the context of CALL.

Most commercially available CALL software provides only limited language data sources, e. g. most systems do not support the learner to freely download authentic text and to work with that text within the CALL system. Therefore only a limited number of texts and (predefined) exercises are presented to the learner. This is also a consequence of having to pre-store all possible answers to be used by the string matching algorithm of the CALL software. That is only possible by limiting and providing all materials that can be used in the exercises.

Nandorf (2003) reports that commercial CALL software also offers a low degree of interactivity, even software developed by companies which claim to be market leaders for interactive language-learning software.

2.3.2. ICALL

ICALL systems are a type of Intelligent Tutoring System (ITS) (cf. Wenger, 1987; Burns and Capps, 1988) developed for language learning and teaching. They can generally be distinguished from more traditional CALL software by the existence of a problem-solving approach to teaching and learning, the dynamic nature of language processing, an explicit representation of a knowledge domain and the deployment of user modelling.

ICALL established itself as a research field about 15 years ago (Gamper and Knapp, 2002). Since then, NLP techniques, intelligent help systems and user models have been integrated into language-learning software in order to improve the learning process. However, ICALL systems are still not widely available due to the fact that many of the theoretical and technical issues in ICALL development are peripheral to language learning and teaching concerns (Harrington, 1996).

Nerbonne (2002: 680) lists five NLP technologies as being the main contributors to ICALL in past and present research projects and describes their main application areas. These ICALL areas are:

- **concordancing:** Nerbonne stresses the fact that concordance programs are language processing programs, although some researchers might not include them under NLP. Nerbonne claims that concordance programs "have inspired an enthusiastic group of advocates among language teaching professionals" (p. 680).

- **text alignment:** alignment programs have been applied to align bilingual texts, resulting in parallel texts which offer broad information to advanced language learners.
- **speech recognition and synthesis:** speech technology has been used to generate speech, particularly pronunciations of isolated words. It has also been applied to check (and improve) pronunciation and intonation.
- **morphological processing:** lemmatization and morphological generation have been deployed to provide drill materials, to facilitate dictionary look-up of words and to make corpus access more flexible.
- **syntactic processing:** syntactic generation has been used to create exercise material. Parsing has been employed to clarify linguistic structure and to spot and diagnose errors in learners' output.

According to Gamper and Knapp (2002), many ICALL systems just focus on single aspects of language learning and are heavily technology-driven in that many of these systems pay little attention to pedagogical issues or, even worse, ignore them. The NLP tools provided by these systems often represent “a solution in search of a problem” (Mishan and Strunz, 2003). Therefore a more integrated and comprehensive approach is needed where the language learner is at the centre of attention. Additionally, greater emphasis should be placed on teaching semantics, pragmatics, cultural knowledge and social abilities (Gamper and Knapp, 2002). The development of integrated systems and their judicious incorporation into a CALL environment is certainly very important for the acceptance and applicability of ICALL systems in language-learning labs.

Another problem often cited in research on ICALL systems is the lack of continuous evaluation (e. g. Vandeventer Faltin, 2003a; Reuer, 2004). Many ICALL systems were either never evaluated or only evaluated at the very end of the development process. In the latter case, the ICALL systems were not evaluated in real-life language learning settings, i. e. with real students learning a foreign language. The need for more evaluation is also described for CALL on the basis of a survey with language teaching practitioners (Levy, 1997: 147).

For both CALL and ICALL, it has been repeatedly stated that only little use is made of existing software modules and that new developments often do not build upon past

research results, thus 'reinventing the wheel' again and again (cf. Levy, 1997; ICT4LT, 2004).

2.3.3. Use of Animation in Language Teaching

In the context of CALL, animation has been mainly used in the form of graphical animation for pronunciation training. Sobkowiak (2005) reports that pronunciation-oriented CALL quickly adopted animation (in the same way as sound and video) to teach the phonetics of foreign languages. With the help of animation and audio, articulatory phonetics can be illustrated in transcriptions and articulatory diagrams.

Sobkowiak (ibid.) discusses and evaluates six CALL programs for pronunciation training in the context of English as a Foreign Language (EFL). He restricts this discussion to 'off-line' CALL, i. e. CD-ROM- and DVD-based CALL packages. Five of the six CALL packages use visual animated feedback for waveforms, articulation, intonation and intensity. Sobkowiak claims that "the sagittal cross-section of the vocal tract and the frontal lip view are now practically standard features of EFL (pronunciation-oriented) CALL software".

As an example of the use of animation in pronunciation training, Figure 2.3 shows a screenshot of the PHONETICS FLASH ANIMATION PROJECT (University of Iowa, 2005), which provides training materials for English, German and Spanish. This pronunciation training package, which is freely accessible, nicely integrates animation, sound and video to teach consonants and vowels of the languages involved. It uses animated articulatory diagrams, step-by-step descriptions and video and audio files of the phonetic sounds.

Devi (2005) investigated the use of animation to teach phrasal verbs. Devi's investigation focuses on how animated cartoons can be used to teach phrasal verbs to an intermediate-level learner without previous knowledge of phrasal verbs. Devi used clipart-like GIF (Graphics Interchange Format) graphics to visualise the use of verbs denoting action (like *to sit*, *to stand*, *to walk*) and abilities (like *to sing*, *to play*, *to study*) (Figure 2.4).

Devi (ibid.) states that in her study the use of animated cartoons was remarkably useful for learning phrasal verbs. However, the evaluation cannot be described as being objective from the description of the evaluation process. First, it has to be pointed out that the materials were only tested with one adult EFL learner. Second,

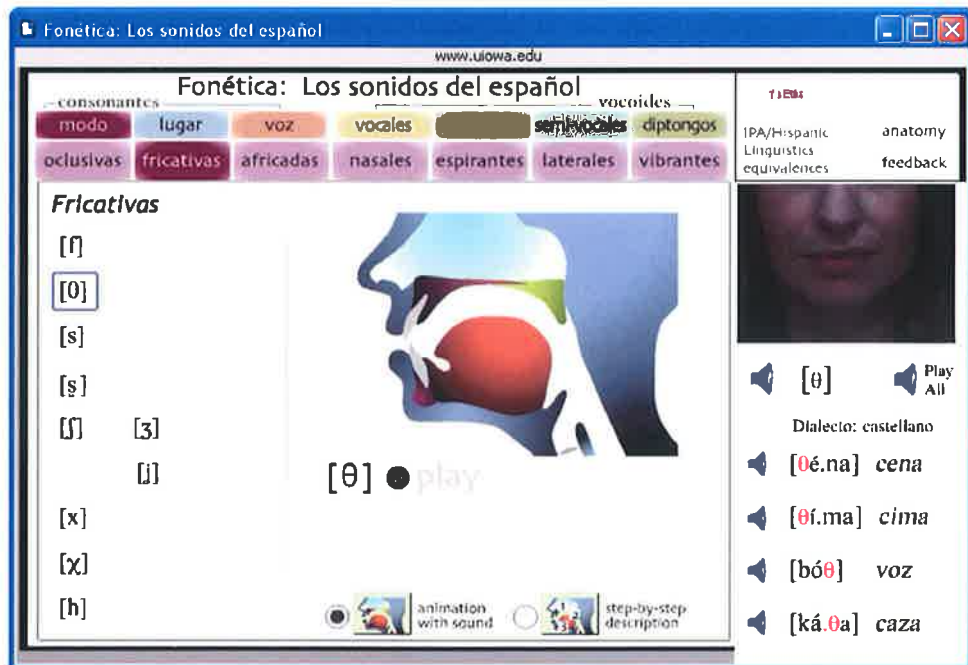


Figure 2.3: University of Iowa – graphical animation to teach phonetics



Figure 2.4: Devi – animation to teach phrasal verbs

there seemed to be continued interaction between the researcher and the participant during the evaluation process with strong guidance by the researcher. Therefore, the actual effect of the animated cartoons on the learner cannot be assessed in an objective manner.

In EUROCOM ONLINE (EuroCom, 2007), text animation was used to visualise parallel properties in all languages involved (French, Italian, Catalan, Portuguese, Romanian and Spanish). Example topics are sound correspondences and syntactic structures (Rensing and Steinmetz, 2004). The animated content materials are used as additional help modules for monolingual texts, which are annotated with plurilingual context information (cf. Section 2.2.3). The text animations of EUROCOM ONLINE offer a number of interactive controls (Figure 2.5): (1) playback buttons enable the learner to play, pause or stop the animation, to jump to the beginning or end of the animation, or to rewind or fast-forward the animation; (2) a slider provides the option to change the animation speed; (3) a progress bar can be clicked to directly jump to any playback phase.

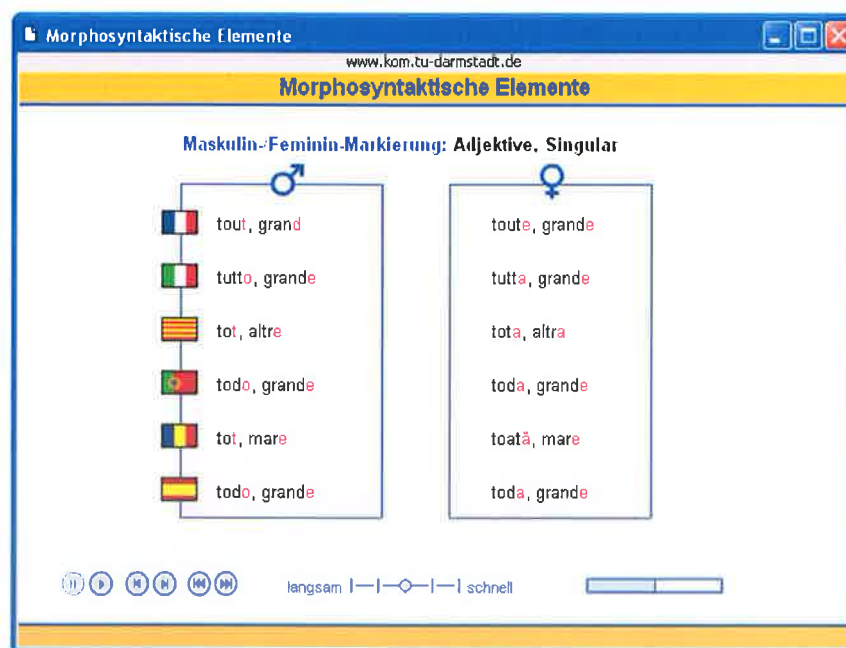


Figure 2.5: EuroCom online – text animation for plurilingual learning

Roche and Scheller (2004) developed grammar animations in the context of German as a Foreign Language (GFL), as part of the UNI-DEUTSCH.DE project. UNI-DEUTSCH.DE is an online program for the teaching of German for scholarly and profes-

sional purposes. The grammar animations illustrate those constructions of the German grammar that express some kind of movement (Figure 2.6). Nearly 100 grammar animations were developed for this project.



Figure 2.6: Uni-deutsch.de – animation for German as a Foreign Language

Roche and Scheller (2004: 50ff.) also conducted an empirical pilot study on the effectiveness² of grammar animations. Two groups, a test group and a control group, participated in the study. Both groups together comprised eleven intermediate GFL learners. The study was split into two learning stages: the first stage contained language-learning materials on prepositions and sentence structures. The second stage focused on pronouns and word formation.

The effectiveness of the instruction was measured immediately following the instruction (post test 1) and two weeks after the instruction (post test 2). Overall, the test group achieved significantly better results in terms of the retention rate than the control group on most of the tested items. Roche and Scheller reported detailed test results of the study of retention rates only for prepositions.

The control group achieved superior entrance test values. In post test 1, the scores of the control group moved noticeably towards the middle of feature distribution. In post test 2, the scores of the control group declined noticeably. By contrast, the animation group (experimental group) showed an improving tendency in post test 1. In post test 2, the performance of the group decreased slightly in comparison to post test 1.

Roche and Scheller do not consider their empirical study to be representative be-

²The authors use the term *efficiency* but *effectiveness* seems more appropriate for the contents they discuss.

cause of the small sample size, and state that it is therefore not possible to generalise the results. However, the authors claim that the success of the animations cannot be overlooked and that the use of grammar animations is successful if pedagogical considerations are taken into account.

SPOOKJES (van Breugel, 1998) was a computer-assisted grammar learning and training program for children in the higher grades of primary education and the lower grades of secondary education. It aimed to help children develop their grammar skills by building sentences. The task consists of putting different building blocks together to construct a complete sentence diagram. van Breugel designed and implemented a prototype in the form of an interactive grammar puzzle (Figure 2.7). Abstract names for grammatical concepts were replaced by visual shapes like the pieces of a puzzle.

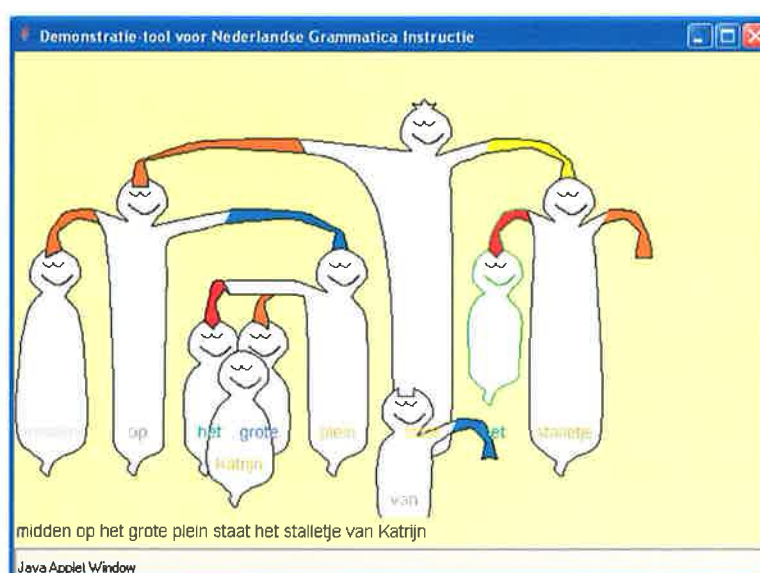


Figure 2.7: Spookjes – interactive grammar puzzle

VISL (Visual Interactive Syntax Learning) employs grammar games as part of a complexity-based teaching progression (Bick, 2004). These grammar games are part of an integrated interactive user interface for teaching grammatical analysis on the Internet. Three different types of grammar games have been developed: morphological games, syntax games and word class games (Figure 2.8). Morphological games are the most recently developed new game type. Word class games are used to support teacher-based explanations. At the syntactic level, a fundamental decision is made between word-based and constituent-based use of function categories.

Generally, language analysis in VISL focuses on surface structures and the form-

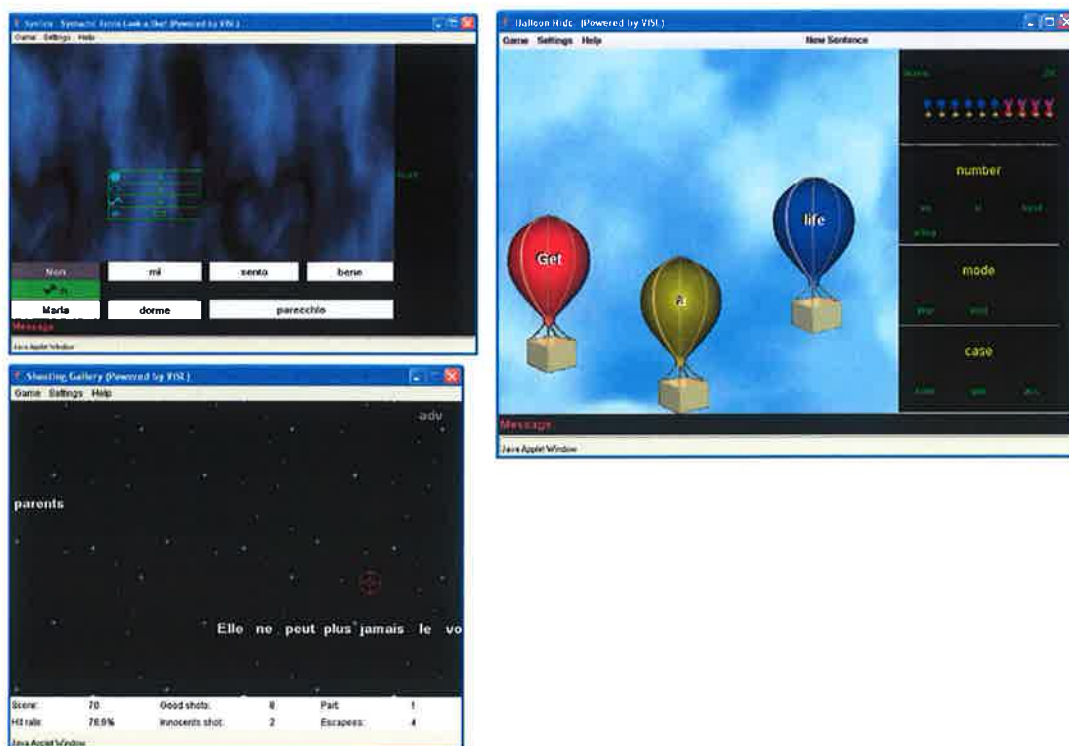


Figure 2.8: VISL – interactive grammar games

function dichotomy. The underlying lexica and grammars cover the whole language which provides the user with a wide range of lexical resources and structural unpredictability of diverse natural text. VISL systems of analysis are available for 22 different languages. The VISL project aims to be highly product- and process-oriented. Therefore, new grammar and language tools are made freely available on the Internet as soon as an operational prototype is available. Continuous feedback from learners in Danish schools and universities as well as from users worldwide helps to continually improve and update existing modules.

2.3.4. Dictionary Look-Up Tools

Several dictionary look-up tools were developed for reading texts in a foreign language. These look-up tools aimed to raise language awareness by highlighting linguistic features. GLOSSER-RUG and COMPASS deployed morphological knowledge in order to retrieve rich information from underlying lexicons for word forms of an input text.

GLOSSER-RUG (Dokter et al., 1998) aimed at facilitating the reading of French text for native Dutch speakers. An on-line dictionary, morphological analysis and examples of word use in specifically created corpora were provided to support users in the comprehension of text words. GLOSSER-RUG was part the GLOSSER framework which aimed at applying state-of-the-art linguistic technology, especially morphological processing and corpora analysis, to Computer-Assisted Language Learning. GLOSSER-WEB (Figure 2.9) was developed as an on-line demo version of GLOSSER-RUG.

The screenshot displays the GLOSSER-WEB interface. At the top, there are navigation tabs for 'Morphology', 'Dictionary', and 'Exemples'. Below this, the main content area shows a French text excerpt from 'DE LA TERRE A LA LUNE' by Jules Verne, specifically the chapter 'LE GUN-CLUB'. The text describes the development of a gun club in Baltimore during the American Civil War. A word, 'instinct', is highlighted in the text. To the right of the text, a vertical panel provides a morphological analysis of the word 'instinct', showing its structure as 'instinct+Masc+SG+Noun' and providing examples of its use in various contexts, such as 'instinct de l'humour' and 'instinct de l'honneur'. The interface also includes a search bar and a list of related words or phrases.

Figure 2.9: Glosser-Web

The GLOSSER prototypes were designed to help users who know a language to some extent but cannot read it quickly or reliably. The prototypes, which worked with any text, provided further examples of words in use in large text corpora. The main technological goal of the project was to develop these prototypes and to demonstrate their usefulness, especially in assisting intermediate-level readers of foreign languages.

A user study was conducted with a group of students of French (Dokter et al., 1998: 4f.). The study aimed to evaluate GLOSSER-RUG in comparison to a traditional method of text reading and comprehension by using a hand-held dictionary. Results showed a higher average for the GLOSSER-RUG users but the difference was not significant. The users of GLOSSER-RUG, however, scored significantly better on a question concerning self-estimation.

The COMPASS project (Breidt and Feldweg, 1997) aimed at the adaption and integration of bilingual print dictionaries into an intelligent, context-sensitive dictionary

look-up system. The COMPASS project demonstrated that restrictions on conventional electronic dictionaries can be overcome by the application of existing NLP techniques. The prototype covered the English-French and German-English language pairs for translation. The information was presented to the user through a graphical user interface (Figure 2.10).

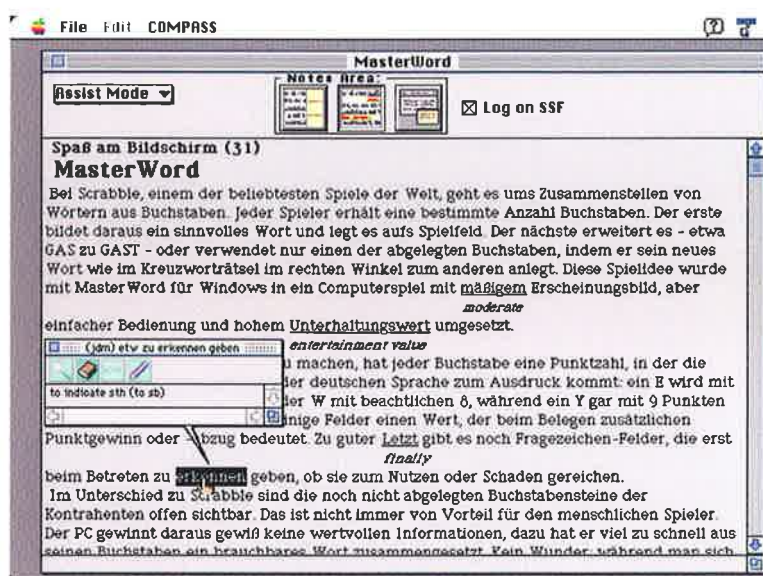


Figure 2.10: COMPASS – context-sensitive dictionary look-up system

The main language processing features of the dictionary lookup of COMPASS were morphological analysis, POS disambiguation and the recognition of multi-word expressions (MWE). The morphological analysis reduced inflected words to their base-form in order to access the corresponding dictionary entries. It also provided morphosyntactic information (such as part of speech, case, number and gender) which in subsequent analysis steps was used to select the correct meaning. A POS disambiguation component was used to resolve ambiguous syntactic information. The output of morphological analysis and the POS disambiguation information was then used to select the parts of a dictionary entry relevant to a given context. COMPASS was able to recognise MWEs and provide corresponding translation information.

The prototype's performance was evaluated through a series of user tests. The results showed that reading foreign-language texts is substantially easier with a system such as COMPASS which helps to gain a better understanding of the text. The prototype was evaluated at the Universities of Bournemouth (for German-English) and Lyon 2 (for English-French). Test users with a basic knowledge of the language were asked to

read newspaper articles (in the two source languages German and English) with the help of the COMPASS system. The success of reading comprehension was examined by comprehension questions. Test users were also asked to complete a questionnaire to assess the various COMPASS functions.

2.4. Research Questions for this Thesis

Starting from the analysis of past and present research projects in the previous sections, the following research questions were formulated to guide the research described in this Ph.D. dissertation:

(1) Existing materials for plurilingual learning of Romance languages almost exclusively focus on receptive skills, with a some emphasis on reading comprehension. Additionally, if used as self-learning materials, many existing (monolingual and plurilingual) materials do not perform an intelligent automatic analysis of learner input, nor do they provide flexible and dynamic feedback.

Research Question: How can NLP techniques be used to provide flexible plurilingual feedback on learner input?

(2) The majority of existing plurilingual learning materials are 'static', i. e. learners work on the same predefined closed set of texts and exercises as provided by a given application. Plurilingual information on text words or paragraphs has usually been added manually by content authors.

Research Question: What is involved in creating tools which provide the option to work on unrestricted, authentic learner-retrieved input (texts and single words) in a plurilingual setting?

(3) Animation has not been widely used in language learning, despite encouraging evaluation results in a small number of past research projects. In particular animated text to visualise grammatical properties and processes has rarely been used and assessed.

Research Questions: How can different types of animation (including text anima-

tion) be used in a plurilingual learning environment to visualise grammatical properties and processes? How can the creation of language learning materials with animation be facilitated?

(4) Many CALL and ICALL systems were either never evaluated or only evaluated at the very end of the development process. Similarly, very little data is available for the evaluation of plurilingual teaching and learning materials.

Research Question: How can effectiveness and user satisfaction be assessed during development stages to avoid major design and development flaws?

2.5. Summary

This chapter reviewed core research areas relevant to the research presented in this Ph.D. dissertation. Past and present research projects in plurilingual teaching and learning of Romance languages, and in CALL and ICALL were reviewed. The latter also included research projects which investigated the use of animation in language teaching and research projects in which existing NLP-based dictionary look-up tools were developed and evaluated. This research review helped to identify and formulate the research questions for this Ph.D. dissertation.

3. CALL Design Methodology

3.1. Introduction

In this chapter, I relate the design and development process of ESPRIT to two widely recognised CALL design methodologies: Hubbard's Methodological Framework (Hubbard, 1996) and Colpaert's Research-Based Research-Oriented (RBRO) design model (Colpaert, 2004). Both models provide a comprehensive framework against which the design of new CALL materials can be described methodologically. I identify the common ground between these methodologies and the design approach adopted for ESPRIT and describe the special characteristics of the ESPRIT design approach.

Section 3.2 provides a brief general introduction to CALL design. Section 3.3 reviews Hubbard's Methodological Framework, while Section 3.4 reviews Colpaert's RBRO model. In Section 3.5 I describe which of the two CALL design methodologies proved to be more appropriate for ESPRIT. In addition, the section provides information about the specifics of the analysis and design phases of ESPRIT. Finally, Section 3.6 summarises the chapter.

3.2. CALL Design

CALL is interdisciplinary in nature. It is most commonly linked to Psychology, Second Language Acquisition (SLA), Artificial Intelligence (AI), Computational Linguistics (CL), Instructional Technology and Design (ITD), Human Computer Interaction (HCI) and Foreign Language Teaching (FLT). It is important for CALL developers and researchers to be aware of the basic results and insights established in these research areas, and to be aware of recent research findings. In fact, in an ideal situation, a CALL program is developed jointly by a team of experts, including language specialists, teachers, linguists and software engineers.

Although CALL has been recognised in the academic literature for about 40 years,

it still lacks an established research and evaluation methodology. As yet, there is no universally accepted conceptual framework against which CALL researchers can measure their work. Therefore, it is even more important to take into account past work in a number of related and relevant disciplines. It is equally important that CALL development is not led purely by the latest technological innovation (Levy, 1997: 89).

3.3. Hubbard's Methodological Framework

Hubbard's Methodological Framework (Hubbard, 1996) aims to provide a comprehensive model for the creation of CALL materials. The framework builds on previous models and is neither prescriptive nor restrictive. It provides a useful checklist and guide for CALL development. According to Hubbard (Hubbard, 1996:17), the framework offers a set of underlying principles. These principles state that the framework should:

- be consistent with established frameworks for language teaching methodology;
- be method-neutral and flexible;
- explicitly link development, evaluation and implementation considerations in a consistent fashion;
- identify the relevant elements in each area (development, evaluation and implementation) and describe the interrelationships of those elements.

Hubbard identifies four different 'players' in a CALL teaching/learning scenario: the Learner, the Developer, the Evaluator and the Classroom Teacher. In Hubbard's framework, the Learner uses the CALL product in order to increase his/her language proficiency (Hubbard, 1996: 16). The Developer designs and develops courseware materials which aid teachers and learners to fulfil their learning objectives. The Developer may consider a learning situation "where the learner is his/her own 'teacher' " (ibid.). According to Hubbard (ibid.), the job of an Evaluator is to analyse the software package, describing its operation and passing professional judgment on the quality of the pedagogy and language materials. The Classroom Teacher has to decide whether to use a piece of software, and then consider when and how to deploy it in a classroom situation.

Hubbard's development framework consists of three modules: Development, Evaluation and Implementation (Figure 3.1). In Hubbard's framework (Hubbard, 1996: 20), Development necessarily precedes Evaluation and both Development and Evaluation precede Implementation. This stands in contrast, for example, to software development methodologies such as Rapid Application Development (RAD) where iterative evaluation of prototypes precedes the actual development of the final software product (cf. Martin, 1991).

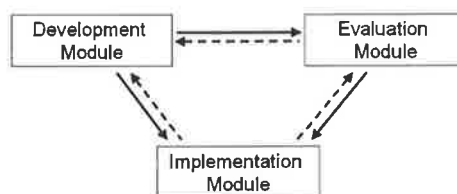


Figure 3.1: Schematic of Hubbard's Methodological Framework

The Development module of Hubbard's framework consists of three levels (Hubbard, 1996: 20ff.):

1. The *Approach* level describes appropriate theories of language structure and language learning. This level encompasses linguistic assumptions and learning assumptions which combine to determine the language teaching approach intended for a given piece of courseware. Hubbard considers learning assumptions as a set of guiding principles which he sees as related to the SLA process.
2. The *Design* level reflects the goals and objectives of the syllabus and the roles of the teacher, learner and materials. The main components of the Design section of Hubbard's development module are learner profiles and the courseware syllabus. Learner profiles point to the intended audience and consider a number of factors such as learners' proficiency level, age, native language, needs and interests and cognitive styles. The syllabus contains information about the learning objectives and the means by which they are reached.

Hubbard claims that at the level of learner profiles and courseware syllabus, design decisions have to be made with regard to language difficulty and content. CALL developers also have to take into account learning styles.

3. The *Procedure* level includes a collection of exercises, techniques and activities.

It contains the elements to be considered in the actual layout of the CALL program that presents the materials. The main factor on the Procedure level is the intended activity type and the related presentation scheme. This scheme determines how the material is presented to the learner.

In Hubbard's framework, the purpose of the Evaluation module is to determine the fit of the courseware to the needs of the learners. The Evaluation module does not propose a specific evaluation process but identifies the elements involved in evaluation. This allows teachers and reviewers to create their own evaluation forms and procedures. The Evaluation module in Hubbard's framework contains three components: teacher fit, learner fit and operational description. The focus in the Evaluation module is on pedagogical issues.

The Implementation module of Hubbard's framework mainly deals with the deployment of courseware in a classroom or language lab situation. Implementation refers to the deployment of courseware with learners, not the process of implementing (i. e. uploading and configuring) developed software components on a remote web server. It assesses factors like accessibility to computers, preparatory activities and learner use (Hubbard, 1996: 29ff.).

The central element of the Implementation module in Hubbard's framework is teacher control. Teacher control extends to many areas in the Implementation module. Control over both preparatory accompanying materials and the packages and lessons actually accessible to the students are the most important factors of teacher control.

3.4. Colpaert's RBRO Model

Colpaert's RBRO model (Colpaert, 2004) is based on the generic ADDIE software engineering model (cf. Belanger and Jordan, 2000: 89). RBRO and ADDIE share the same phases: Analysis, Design, Development, Implementation, and Evaluation. ADDIE has often been used for the design process of instructional software (ibid.). The phases of the ADDIE model can be described as follows:

- in the Analysis phase, the instructional problem is clarified, the goals and objectives are established, and the learning environment and learner characteristics are identified;

- in the Design phase, the instructional strategies are designed and media choices are made;
- in the Development phase, materials are produced according to decisions made during the design phase;
- the Implementation phase includes the testing of prototypes (with a target audience), deploying software components in production mode, and training learners and instructors on how to use the product;
- the Evaluation phase consists of two parts: formative and summative evaluation. Formative evaluation is present in each stage of the development process. Summative evaluation is done at the end of the development process and provides opportunities for user feedback on the final product.

Following ADDIE, Colpaert's RBRO model (Figure 3.2) is a systematic succession of Analysis, Design, Development, Implementation and Evaluation, where the output of each stage serves as the input of the subsequent stage. Colpaert (2004:136) claims that CALL theory is an integral part of the Analysis and Design phases. The Design phase is clearly separated from the Analysis and Development stages to prevent technology from unduly influencing the pedagogical concepts and the language-learning method adopted. The Design stage in Colpaert's RBRO model is quite comprehensive and demanding, but Colpaert (2004:145) reckons that investing in effort at the Design stage renders the development process itself much less labor intensive.

For the Analysis phase, Colpaert (2004:136f.) advises that a SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis of CALL technology in general, and of existing language courseware in particular, should be included. Colpaert proposes the use of a two-dimensional operational grid to identify system requirements (Figure 3.3). The GLDT grid includes General, Local, Differential, and Targeted requirements. General requirements refer to language courseware engineering in general, Local requirements are specific to a particular context, Differential requirements are parameters to adapt a CALL system to a particular context or to changing circumstances, and Targeted requirements are factors which can or should be improved by the CALL system under development. Each of these requirements is then described in relation

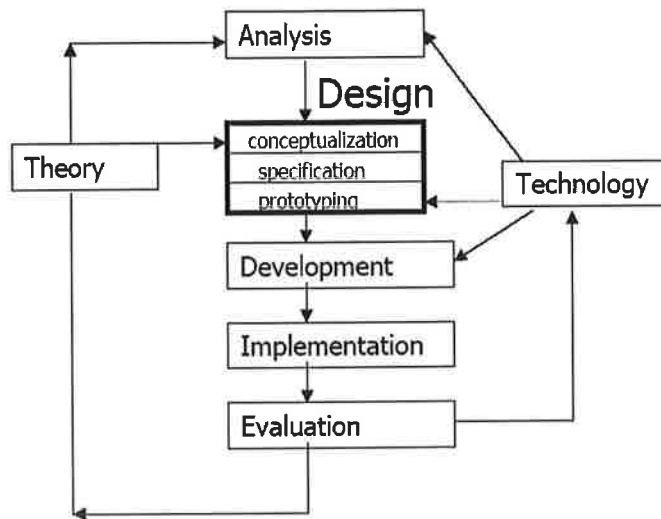


Figure 3.2: Colpaert's RBRO model – language courseware engineering loop

to the learner, the teacher, the pedagogy, the technology, the content and 'other actors' (like content providers, native speakers, or training managers). The output of the Analysis phase is used as input to the Design phase.

	General	Local	Differential	Targeted
Learner				
Teacher				
Pedagogy				
Technology				
Content				
Other actors				

Figure 3.3: Colpaert's GLDT grid

The Design phase (Colpaert, 2004: 140ff.) is divided into three stages: Conceptualization, Specification, and Prototyping. Conceptualization consists of two concurrent and iterative activities: concept development and the application of usefulness criteria (such as usability, user satisfaction and didactic efficiency). Concept development takes into account personas, practical goals, scenarios and system tasks. Specification describes the system structure in terms of components and their interaction, and details the user interface with screen design, menu systems and navigation. Prototyping serves

to estimate risks and to check the feasibility of isolated CALL software elements, such as menu systems or fill-in exercises.

The Implementation phase (Colpaert, 2004:146) is dependent on the requirements formulated in the Analysis phase and subsequently the elaboration of system properties and tasks during the Design phase. If these steps have been executed appropriately, it should be possible for the developed system to be successfully implemented into the targeted language-learning environment.

The Evaluation phase (ibid.) is clearly summative. It aims to provide a new working hypothesis for the development of future software components. Colpaert's RBRO model replaces formative evaluation phases with iterative implementation and summative evaluation cycles.

The Analysis and Design phases of Colpaert's RBRO model do not have corresponding main components in Hubbard's framework, where these phases are integrated to some extent in the Development Module. Compared to Hubbard's framework, Colpaert's RBRO model provides much more detailed information about the Analysis and Design phases.

3.5. ESPRIT Design Methodology

3.5.1. Comparing Methodologies and Assessing their Suitability for ESPRIT

In my opinion, Hubbard's framework does not represent the most suitable methodology to describe the design and development phases of ESPRIT. The following are the main differences between the ESPRIT design requirements and the main phases of Hubbard's framework:

(1) Hubbard's framework is centred around four 'players' in the teaching/learning process: the Learner, the Developer, the Evaluator and the Classroom Teacher. ESPRIT, in contrast, focuses on supporting self-learning processes. Therefore only three 'players' are identified in the ESPRIT CALL development process: the Learner, the Developer and the Evaluator.¹ In contrast to Hubbard's framework and the type of evaluation typically found in SLA, the Evaluator in ESPRIT is not an expert who passes professional judgment on the quality of the pedagogy and language materials. It

¹A classroom teacher can certainly decide to integrate learning materials of ESPRIT into his/her own language teaching but this does not represent the typical usage of ESPRIT materials.

is the Learner who assumes the role of a 'non-expert' Evaluator by providing formative and summative feedback on single components of ESPRIT.

(2) In ESPRIT, the Implementation phase differs considerably from its counterpart in Hubbard's framework. In Hubbard's framework, the Implementation phase mainly deals with the deployment of courseware in a classroom or language lab situation. It considers factors like accessibility to computers, preparatory activities and learner use (Hubbard, 1996: 29ff.). By contrast, ESPRIT was designed from the outset as a web-based language-learning environment. It can be integrated into classroom activities but it is fundamentally targeted at self-learners.

The main elements of Hubbard's Implementation Phase correspond to the following characteristics of ESPRIT:

- **accessibility:** ESPRIT does not pose any local accessibility issues. Its materials are available at any time on the Internet. The only general prerequisites for the usage of ESPRIT materials in terms of accessibility are the availability of an Internet connection, a web browser and the specific, freely available software needed to run the system, the Adobe Flash Player browser plug-in (version 7 and above).
- **preparatory activities:** several modules in ESPRIT provide screenshot-like introductory tutorials. This helps learners to become familiar with the modules and the different functionalities provided within a module. The first modules to be evaluated – several types of animated grammar presentations (Section 5.7) – only provided information via 'Help' buttons giving access to detailed help texts. However, the evaluation of several tailor-made animated grammar presentations (Section 7.3) showed that learners are often not willing to use the help function, even if the function of some parts of the CALL software has not been explained elsewhere.
- **learner use:** in ESPRIT, learners are free to explore the activities offered and to choose the activities which are of most interest to them. Direct follow-up activities are not offered in ESPRIT. However, guided tours provide information and help about which activities form a logical unit, and can be used to suggest in which sequence to work on materials.

- **teacher control:** due to its orientation towards self-learners, ESPRIT does not provide teacher control or direct intervention while students are working with ESPRIT materials.

Colpaert's RBRO design model lends itself more readily to the methodological description of the ESPRIT development process. Like Hubbard's framework, the RBRO design model makes provision for the Teacher. However, unlike in Hubbard's framework, it does not represent the central part of Colpaert's Implementation phase. Colpaert considers teachers and their interaction with the system to be an integral part of the Analysis phase. Compared to Hubbard's framework, the Implementation phase in Colpaert's model is a less-restrictive phase model. Colpaert's Implementation phase deals with the general integration of developed components into the language-learning environment.

Colpaert's RBRO design model closely reflects the design phases relevant to ESPRIT and was therefore adopted as the guiding design methodology framework. Section 3.5.2 provides detailed descriptions about the Analysis and Design phases of ESPRIT. The Development phase of ESPRIT components is described in Chapter 5. Chapter 6 provides information about the Implementation phase of ESPRIT modules. Chapter 7 details the Evaluation phase(s) of ESPRIT. However, ESPRIT's Evaluation process differs from Colpaert's Evaluation phase by incorporating formative evaluation phases. Formative evaluation phases delivered valuable information at an early stage about the acceptance and actual usage patterns of the initial versions of ESPRIT components. This helped to avoid early design and development errors.

3.5.2. Analysis and Design Phases of ESPRIT

In this section, the Analysis and Design phases of ESPRIT are described with the help of Colpaert's GLDT grid (cf. Section 3.4). Using the grid, the analysis of the properties of ESPRIT is summarised as follows:

- **learner:** language learners in this design space are adult learners with advanced knowledge in at least one of the three Romance languages involved. The intended target group of language learners are English and German native speakers who want to learn one or two of the other Romance languages.

Due to this learner profile, ESPRIT has to cater for a very heterogeneous set of adult learners. Each learner has a very different set of already learned languages and languages yet to be learned. This leads to a design space which requires a high degree of flexibility with regard to the languages and activities offered.

- **pedagogy:** the design space of ESPRIT is based on the plurilingual teaching and learning method (cf. Section 2.2). This method exploits skills and knowledge present in one or more languages to learn other similar languages more easily.

The language-learning materials in this design space must take into account that the plurilingual learning method is largely unknown to learners. Therefore, it has to provide introductory information to make learners aware about its specific plurilingual character and approach.

- **content:** existing plurilingual content is mainly available in the form of books and CD-ROMs. These materials are not usually available in general bookstores. They have to be ordered from specialist bookstores or via academic inter-library loan.

Existing plurilingual learning materials provide a fixed set of texts and exercises and only aim at receptive skills (cf. Section 2.2). By contrast, language learning materials in ESPRIT provide the option to work on unrestricted text downloaded by the learner and to obtain dynamic feedback on learner input.

The design space of ESPRIT integrates web-based materials which are accessible to anyone. These materials are integrated into a flexible self-learning environment. The majority of the ESPRIT tools are designed to support modularity and reusability: the tools can easily be used separately, for example for automatic dictionary lookup on unrestricted text.

ESPRIT provides language-learning materials for written language only. Language learners have the option to improve their receptive and productive skills with the help of various tools and activities. The activities are centred around lexical and grammatical content.

The content of ESPRIT has to cater for different levels of language skills and knowledge. Therefore, it is important to provide a wide variety of content at

different levels. The current version of ESPRIT does not contain methods for the explicit modelling of the learner and his/her level of knowledge.

- **technology:** evaluation of past research projects (cf. Section 2.3) showed that often no use was made of existing resources. This has repeatedly led to a situation of ‘reinventing the wheel’. In addition, many existing systems are technology-driven and focus on the latest technologies rather than on pedagogical considerations.

The design space of ESPRIT uses a web-based language-learning environment to display contents to the learners. This language-learning environment combines Flash, PHP, Perl, Java, XML and MySQL. It supports the integration of flexible database technologies, sophisticated language processing tools and intuitive and adaptable user interfaces into one language-learning environment. Database technologies deployed in ESPRIT lend themselves readily to diverse application programming interfaces (APIs). The design of the ESPRIT language-learning environment enforces the strict separation of storage, processing and display of language-learning content in order to achieve maximum modularity, reusability, extendability and maintainability of the resources.

The central part of Colpaert’s Design phase is Conceptualization, which consists of concurrent and iterative cycles of concept development and the application of usefulness criteria (Colpaert, 2004: 140). Within the context of ESPRIT, usefulness criteria play an important role, especially when it comes to the issues of usability and user satisfaction (Sections 4.5 and 5.1). Measuring the didactic effectiveness of ESPRIT materials brings up challenges due to the fact that the materials are web-based and targeted at self-learners. Compared with standard institutionalised testing and evaluation, such evaluation results are potentially less reliable because the test conditions of the evaluation participants cannot be controlled (if, for example, participants used grammar references or dictionaries while taking a test). In the summative evaluation phase of ESPRIT, evaluation participants were actually tested on sentence structures (Section 7.4.3). First, participants were automatically assigned to the ‘static’ or ‘animated’ test group. Evaluation participants were then either shown animated or static learning materials, depending on the test group they belonged to. The concluding test contained 13 questions to test the participants’ knowledge of sentence structures.

Little empirical evidence is available so far regarding the long-term success (or failure) of learning concepts for plurilingual learning. Past plurilingual test projects did not exceed six months (Section 2.2). Therefore, the description of personas, practical goals and scenarios for ESPRIT is experimental to some extent until a broader foundation of conceptualization ideas and experiences becomes available. Typical personas and scenarios are described earlier in this section and in Section 4.3. The practical goals of ESPRIT are summarised as:

- making learners familiar with the plurilingual teaching and learning method (as it is still largely unknown);
- giving learners confidence by showing that even parts of a totally 'new' language (unknown to the learner) can be understood, i. e. a 'new' language does not have to be learned from scratch;
- raising language awareness by contrastively showing similar/distinctive features between related languages;
- providing standalone tools to work independently on unrestricted learner-retrieved text and to input and dynamically generate feedback on learner sentences.

Colpaert (2004: 143) states that the use of metaphors is useful during conceptualization. The metaphor of a TV environment (Section 5.2) was introduced very early in the Design phase of ESPRIT. This metaphor provides the option to easily extend the language-learning environment at any time with further tools and content materials, without the need to redefine the way a learner uses the system.

3.6. Summary

In this chapter, I have briefly described the general properties of current CALL research and its links to other relevant research areas. I have presented two widely recognised CALL design methodologies, Hubbard's Methodological Framework and Colpaert's RBRO model. The development and design stages of ESPRIT share a number of properties with each of these methodologies, but also present some important differences because of ESPRIT's standalone character which is geared towards self-learners.

Furthermore ESPRIT is special in that it is not tied to a classroom or language-lab situation but freely available over the Internet.

4. General Properties of the ESPRIT Approach

4.1. Introduction

This chapter provides detailed information about the general properties and principles of ESPRIT. ESPRIT's development approach towards language-learning materials (including software components and language content) is modular and platform-independent and makes use of existing tools and language content to avoid reinventing the wheel.

Section 4.2 provides information about the Romance languages included in ESPRIT. Section 4.3 describes the target group and learning method of ESPRIT. Section 4.4 gives an overview of existing language tools and resources which were successfully integrated in ESPRIT. Section 4.5 examines important usability issues and software ergonomics relevant to CALL applications. The linguistic levels and modalities of ESPRIT are discussed in Section 4.6. Section 4.7 provides detailed information about the software architecture used for ESPRIT. Finally, Section 4.8 summarises the chapter.

Figure 4.1 gives an overview of existing resources reused for ESPRIT (Section 4.4), and resources (Section 5.3), tools and content (Sections 5.4 to 5.8) created for ESPRIT.

4.2. Languages

The reason for choosing French, Spanish and Italian as languages to be taught in ESPRIT is their importance and popularity. These languages are spoken as a first or second language by more than 500 million people in Europe, North and South America, and Africa (Frémy and Frémy, 2002).

Other Romance languages with a significant number of speakers are Catalan, Portuguese and Romanian. Catalan is spoken by about 8 million people in the Spanish provinces of Catalonia and Valencia. Portuguese is spoken by at least 170 million people in Europe, America, Africa and Asia, with 10 million speakers in Portugal and 150

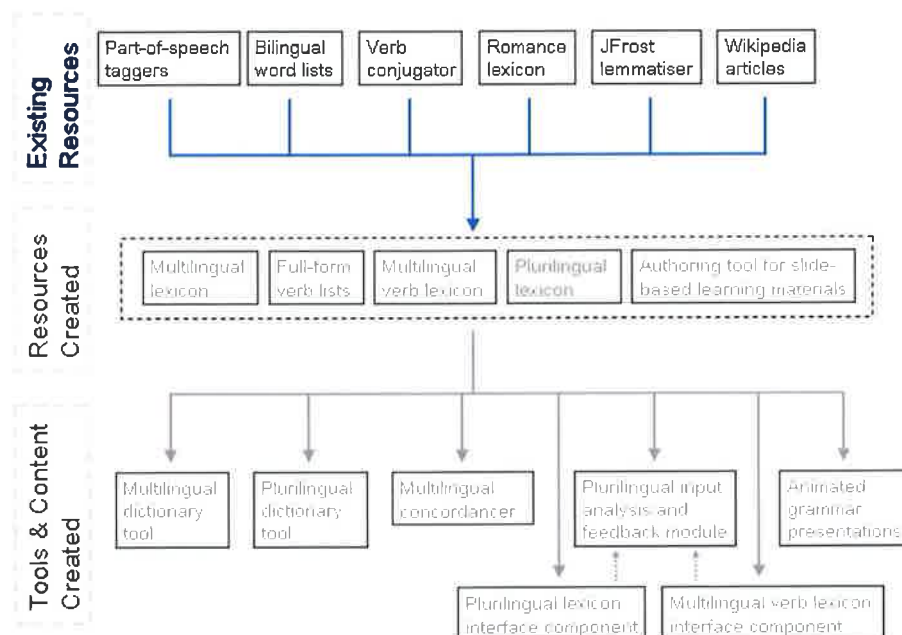


Figure 4.1: Schematic overview of language tools and resources in ESPRIT

million speakers in Brazil. Portuguese is the official language in Angola, Guinea-Bissau and Mozambique but all these countries are polyglot, with several African languages found beside Portuguese. Romanian is spoken by about 22 million people in several European countries, mainly in Romania and Moldova (cf. McCann et al., 2002). Neither Catalan, Portuguese or Romanian can be studied in secondary schools (cf. NCCA, 2003) or at university level (cf. CAO, 2007) in the Republic of Ireland. In the academic year 2002/2003, the following number of language students studied French, Spanish, Italian or Portuguese in Higher Education in the United Kingdom (CILT, 2005):

Language	Number of students
French	21,255
Spanish	11,945
Italian	5,055
Portuguese	855

Table 4.1: Students of Romance Languages in Higher Education in the UK 2002/2003

The main Spanish language area comprises Spain and 18 Latin American states. Additionally, there are over 20 million Spanish speakers in the USA (particularly in the southern states), between 2 and 3 million speakers in the Philippines and about

1/2 million speakers in Equatorial, West and North Africa. After Chinese and English, Spanish is the language with the greatest number of first or second language speakers worldwide (392 million speakers). French is spoken as a first or second language by 129 million people in Europe (France, Belgium and Switzerland, Luxembourg and Monaco), North America (mainly Canada) and South America and in 22 African states. Italian is spoken as a first or second language mainly in Europe (Italy and Switzerland). Outside Europe it is still used by several million former immigrants in some regions of the USA, as well as in Brazil and Argentina (Frémy and Frémy, 2002; McCann et al., 2002).

According to the results of a survey (Schöpfer-Grabe and Weiß, 1998) among German companies, there is a great need for French, Spanish and Italian in the German economy. French was considered important by 81.4% of the companies questioned, Spanish by 47.1% and Italian by 46.9% of all respondents.

In the Eurobarometer survey “Les jeunes Européens” (2001) in which European citizens between 15 and 24 years were questioned about their attitude towards foreign languages, 29% of the participants responded that they would like to learn Spanish, 21% had the desire to learn French and 20% would opt for Italian (in contrast, only 4% of respondents would like to learn Portuguese).

The results of the Eurobarometer survey “Europeans and Languages” (2001) showed that French is spoken by 19.2% of the EU citizens questioned, Spanish by 6.6% and Italian by 3%. 47.3% of the survey participants declared that they do not speak any foreign language, whereas only 26% speak a second foreign language, 8% a third language and just 2% a fourth language. However, 72% of the participants (and 92% of the student participants) consider foreign language skills useful or very useful (results of both Eurobarometer surveys cited in Bär (2004)).

These figures show that language skills in French, Spanish and Italian are important and useful. ICALL can help to develop these skills.

4.3. Target Learner Group and Learning Method

The learners' skills and knowledge required to work with ESPRIT tools and content can be described in detail using the Common European Framework (CEF¹) which provides

¹The CEF is ‘A common European framework for language learning, teaching and assessment’ (Council of Europe, 2006: 19).

“a common basis for the elaboration of language syllabuses, curriculum guidelines, examinations, textbooks, etc. across Europe. It describes in a comprehensive way what language learners have to learn to do in order to use a language for communication and what knowledge and skills they have to develop so as to be able to act effectively. [...] The Framework also defines levels of proficiency which allow learners’ progress to be measured at each stage of learning and on a life-long basis.” (Council of Europe, 2006: 1)

The CEF distinguishes three different user levels (Figure 4.2), both on the global scale and on more specific description levels: Basic User (sub-levels A1 and A2), Independent User (sub-levels B1 and B2), and Proficient User (sub-levels C1 and C2). With the help of these user levels, the CEF provides a detailed multi-level description of learners’ competences.

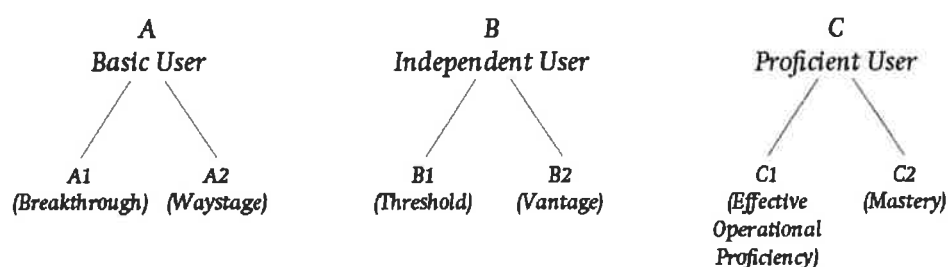


Figure 4.2: Common European Framework for Languages – user levels

The language tools and language content in ESPRIT focus mainly on lexical and grammatical topics. Therefore, the lexical and grammatical competences of this framework (Figure 4.3) are most appropriate to describe the learners’ skills and knowledge required in ESPRIT. Ideally, to use ESPRIT tools and content, the learner should have at least the competence level B2 in both lexical and grammatical competence areas in at least one of the Romance languages involved. This competence level may help to avoid that the learner does not get confused unduly by similar forms in two or more languages involved.

Lexical competence is the knowledge of, and the ability to use the vocabulary of a language. The CEF divides lexical competence into vocabulary range and vocabulary control. Vocabulary range at competence level B1 only requires that the learner has “a sufficient vocabulary to express him/herself with some circumlocutions on most topics

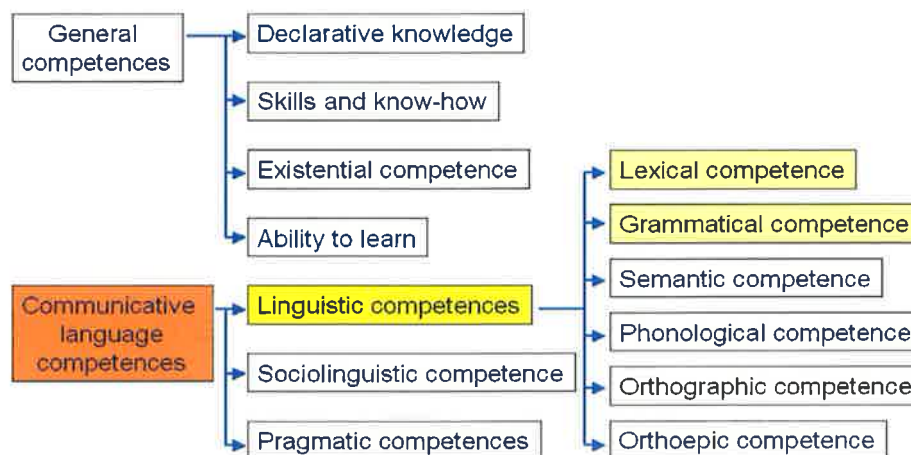


Figure 4.3: Common European Framework for Languages – learner competences

pertinent to his/her everyday life” (Council of Europe, 2006:112), whereas at level B2 the learner has “a good range of vocabulary for matters connected to his/her field and most general topics” (ibid.). For vocabulary control, level B2 requires that lexical accuracy is “generally high, though some confusion and incorrect word choice does occur without hindering communication” (ibid.). In competence level B1, the learner shows “good control of elementary vocabulary but major errors still occur when expressing more complex thoughts or handling unfamiliar topics and situations” (ibid.).

Grammatical competence is the knowledge of, and the ability to use the grammatical resources of a language. Learners using ESPRIT tools and content should have good knowledge of general grammatical properties of the language(s) they have already learned (e.g. form and use of tenses, sentence patterns, use of prepositions), because corresponding properties of the newly learnt languages are taught through comparison.

The competence level B2 in the CEF requires that a learner shows “a relatively high degree of grammatical control” and does not make “mistakes which lead to misunderstanding” (Council of Europe, 2006: 114). In contrast, learners at the competence level B1 have a more limited grammatical understanding. They use “reasonably accurately a repertoire of frequently used ‘routines’ and patterns associated with more predictable situations” (ibid.).

In summary, ESPRIT targets learners who are already at an advanced level in at least one of the three Romance languages supported by the system and who want

to learn another Romance language (no specific competence level is expected for the “other” Romance languages). Learners should also be able to explore similar languages contrastively on an abstract grammatical level (i.e. stripped from the context of a textbook text). Therefore adult learners or secondary school students at higher levels are the main targets for the use of ESPRIT tools and content.

ESPRIT targets native English and German speakers. Therefore, English and German are available as languages of instruction. Due to its modular approach, the Romance languages taught in ESPRIT could easily be included as further languages of instruction.

ESPRIT was designed to promote exploratory and learner-centred learning and to facilitate autonomous learning (i.e. learners make their own decisions about the next learning steps). The system therefore provides many options for adaptability (such as selecting different interface languages and target languages) and interactivity. Examples of interactive elements in ESPRIT are the control of animated text (Section 5.7), the option to receive dynamic flexible feedback on learners’ input (up to sentence level) (Section 5.6), and the opportunity to work on unrestricted text retrieved or created by the learner (Sections 5.4.1 and 5.4.2). ESPRIT represents a rich learning environment which is intended to enhance individual self-learning processes.

Language teaching in the 21st century is almost exclusively monolingual (Bär, 2004). Currently, in Europe there is – to the best of my knowledge – no established long-term curriculum, either for teaching several Romance languages simultaneously² or for the integration of basic techniques of plurilingual learning into existing Romance languages curricula. Therefore, the ESPRIT system is not embedded in a specific classroom situation or tied to one particular curriculum. Instead, learners (and teachers too) are invited to use the system exploratively and to pick their favourite topics. Learners have the opportunity to pursue their own pathways through the system.

The first results of the ESPRIT evaluation platform (Section 7.3) showed that the preferences of the participants in the evaluation, as well as their knowledge of French, Spanish and Italian differ considerably. Therefore, I decided at an early stage not to provide a fixed general curriculum, which would have to consist of many sub-curricula to match every possible combination of language levels. Instead, ‘guided tours’ are

²The seminars already offered at university level (Sections 2.2.3 and 2.2.4) represent short-term courses of up to one semester.

available to offer some guidance and orientation to the learner. These guided tours are based on the methods and materials elaborated and described in Blanche-Benveniste (1997), Schmidely et al. (2001) and McCann et al. (2002), and represent useful combinations of language-learning activities offered in one learning session. For detailed information on the system's user interface see Section 5.2.

4.4. Reusing Existing Software and Language Content Resources

For both CALL and ICALL, it has been repeatedly stated in the literature that only little use of existing software modules and language content resources was made. New developments often do not build upon past research results, thus 'reinventing the wheel' again and again (cf. Levy, 1997; ICT4LT, 2004). To avoid unnecessary time and effort spent on the creation of underlying software and language content resources, I examined which existing resources could prove useful for the creation of language-learning materials in ESPRIT. I identified a number of highly useful resources and tools which were adapted and reused to create materials for ESPRIT. These include lexical resources (general word lists, conjugated verb lists, a Romance lexicon, and Wikipedia articles) and linguistic tools (POS taggers, lemmatisers).

4.4.1. Bilingual Word Lists

The multilingual vocabulary learning software Win Vokabel 5.0 (STG, 1998) grants permission to export bilingual word lists for each available language pair. The exportable word lists can be copied to the clipboard and then saved as plain text files. Each word list corresponds to a word field like Culture, Medicine, Sports or Food. The source language of Win Vokabel 5.0 is German, and available target languages are English, French, Italian, Spanish and Russian. The word lists of Win Vokabel 5.0 contain the following parts of speech: verbs, nouns,³ adjectives, adverbs, interjections, conjunctions, prepositions, pronouns and articles.

I used the bilingual word lists to create multilingual lexicons for French, Italian, Spanish, English and German in XML and MySQL formats (see Section 5.3.1).

³Instead of the generic part of speech *noun*, Win Vokabel 5.0 uses the sub-classes m(asculine), n(eutral) and f(eminine), thus providing additional information on the gender of nouns.

4.4.2. Verb Conjugator

Win Vokabel 5.0 contains a verb conjugator module which is capable of generating full-form verb lists of any verb contained in the vocabulary lists of Win Vokabel 5.0. The full-form verb lists can be copied to the clipboard or directly stored as a plain text file. The verb conjugator is used inside Win Vokabel 5.0 to generate verb form exercises and to display verb conjugation tables. The verb conjugator module cannot be used, however, within other programs to provide verb lists on-the-fly.

I used the full-form verb lists to create index files of conjugated verb forms, and text files with complete conjugation information for each verb and tense (Section 5.3.2). Table 4.2 indicates the number of different verbs available for each language:

Language	Number of infinitives
French	1,520
Italian	1,600
Spanish	1,750

Table 4.2: Verb conjugator – number of infinitives

4.4.3. Romance Lexicon

Reinheimer and Tasmowski (1997) compiled a (printed) plurilingual lexicon which contains rich information about 1,800 words (around 1,000 nouns and 500 verbs) for Portuguese, Spanish, French, Italian and Romanian. This lexicon represents a basic plurilingual lexicon (“un dictionnaire roman minimal”). It contains etymological information about the origin of each word. The lexicon also indicates the Latin etymon for those words which are derived from Latin.

Extended lexical information is available for around 100 entries in the lexicon (the order in the following examples is: [Part of Speech] – *Spanish* – *French* – *Italian*)⁴:

- Change of meaning:

[v] – [*alumbrar* → ‘*éclairer*’], *encender* – *allumer* – *accendere*

This example shows that the Spanish verb *alumbrar* derives from the same etymon as the French verb *allumer* and originally had the same meaning (*to switch on*).

Over the course of time the Spanish verb *alumbrar* changed its meaning so that it

⁴For the sake of clarity all etymological information has been omitted.

now corresponds to the meaning of the French verb *éclairer* (*to illuminate*). The Spanish verb *encender* and the Italian verb *accendere* have the same meaning as the French verb *allumer*.

- Several possible word forms:

[v] – [1] *amar*, [1] *querer*, [2] *gustar* – *aimer* {1 *aimer qn.*, 2 *aimer qc.*} – [1] *amare*, [1] *voler bene*, [2] *piacere*

This example shows that the French verb *aimer* (*to like*) can be used in two different ways: *aimer qn.* (*to like someone*) and *aimer qc.* (*to like something*).⁵ The first meaning translates to *amar* and *querer* in Spanish and to *amare* and *voler bene* in Italian, the second meaning translates to *gustar* in Spanish and to *piacere* in Italian.

- Additional meaning:

[v] – *contar* [+ ‘*raconter*’] – *compter* – *contare* [+ ‘*raconter*’]

This example shows that the Spanish verb *contar* derives from the same etymon as the French verb *compter* and that both words originally had the same meaning (*to count*). Over the course of time the meaning of the French verb *raconter* (*to tell*) has been added to the Spanish verb *contar* and the Italian verb *contare*.

I used the information contained in the Romance dictionary to compile an electronic plurilingual lexicon component for French, Italian and Spanish (see Section 5.6.3). The information from the Romance dictionary represents the core of the plurilingual lexicon component. The data of the Romance dictionary was manually cleaned up and enriched with additional information to be read in and processed automatically.

4.4.4. Wikipedia Articles

Wikipedia (Wikipedia, 2007) is an Internet-based encyclopedia which anyone can edit. Wikipedia articles are available in many different languages (currently more than 200). Apart from being accessed online, Wikipedia articles can also be downloaded in one single XML file per language. As of May 14th 2006, Wikipedia contained the following number of articles:

⁵This distinction is not relevant monolingually (here in French), but it certainly plays a role in a multilingual context.

- French: 284,782 articles, file size of downloadable XML file: 255.3 MB
- Italian: 156,958 articles, file size of downloadable XML file: 124.1 MB
- Spanish: 116,516 articles, file size of downloadable XML file: 118.9 MB

Wikipedia articles are used in ESPRIT as the language database for the multilingual concordancer (Section 5.5).

4.4.5. POS Taggers

For a given input string, Part-of-Speech (POS) taggers provide the most likely POS for each word in the string. In the context of language learning, this opens up a wide range of possibilities to create language-learning activities and resources. For example, the information provided by POS taggers can be used to generate fill-in-the-blank exercises where words of a certain part of speech (for example adjectives, verbs or nouns) are blanked out automatically and have to be filled in by the language learner (cf. Metcalf and Meurers, 2006; Verlinde et al., 2003).

The quality of a tagging result has to be considered when using the tagging data in a language learning environment. POS taggers have at least a 3% error rate under good conditions; for texts from other domains than in the training corpus the error rate can even be far worse. Therefore, it is important to assess whether erroneous tagging output can be confusing for learners for a possible language learning activity. In the context of ESPRIT, this potential source of errors led to the decision not to use POS taggers to disambiguate input of the plurilingual input analysis and feedback module (Section 5.6).

Two POS taggers which are freely available cover one or more of French, Italian and Spanish: the TreeTagger (Schmid, 1994) and the SVMTool (Giménez and Márquez, 2004). One could, of course, also train one or several other free taggers on annotated corpora. Freely available trainable taggers are for example the TnT tagger (Brants, 2000) and the MBT tagger (Daelemans et al., 1996).

The TreeTagger is a tool for annotating text with POS and lemma information which has been developed at the Institute for Computational Linguistics of the University of Stuttgart. Language models for the TreeTagger are currently available for German, English, French, Italian, Spanish, Galician, Portuguese, Bulgarian and Russian. The

TreeTagger can be used on the following operating systems: Sparc-Solaris, Mac OS-X, Linux and Windows. The SVMTool toolset is based on Support Vector Machines (cf. Cristianini and Shawe-Taylor, 2000) and consists of the main components SVMTlearn (model learner), SVMTagger (tagger) and SVMTeval (evaluator). Language models are available for Catalan, English and Spanish.

In the early stages of component development for ESPRIT, TreeTagger language models were available for just French and Italian, and SVMTool language models only for Spanish (apart from models for other languages not relevant to ESPRIT). Since then, language models of Spanish have also been made available for the TreeTagger which means that all three languages can be tagged with one tagger. This saves a lot of time and effort because the ESPRIT programming code used to invoke taggers only has to be written once for all three languages. The TreeTagger and (initially) the SVMTool are being used online to tag text input provided by the learner in the plurilingual dictionary tool (see Section 5.4.2).

4.4.6. JFrost Lemmatiser

The JFrost lemmatiser is part of the IBM LanguageWare 4.0 suite which provides dictionary and linguistic tools for natural language processing.⁶ LanguageWare 4.0 tools are available for 15 different languages.

LanguageWare delivers the following functionality:

- lexical analysis
- dictionary customisation and lookup
- text correction
- phonetic spelling

JFrost recognises tokens on the basis of the LanguageWare word resources and provides the possible lemmas and parts of speech. It also gives extended morphological information (e.g. gender, person, number). JFrost, however, does not disambiguate between several possible lemmas (and corresponding parts of speech).

⁶IBM kindly granted permission to use the French, Italian and Spanish versions of the JFrost lemmatiser for this research project.

In order to assess the quality of the extended morphological information, JFrost output was examined for a sample of nineteen randomly extracted test sentences of the collection of Italian learner sentences (Section 7.4.5). The sentences contain 146 word forms. JFrost generates 229 lemmas for these word forms. Extended morphological information is available for 198 of these 229 lemmas.

JFrost indicated five lemmas which could not be verified as existing Italian lemmas by a comprehensive Italian – English dictionary with 370,000 lemmas (Garzanti, 2005). Four lemmas provided by JFrost were incorrect with regard to the input word form.⁷ The extended morphological information provided by JFrost was slightly incorrect in a further seven cases and strongly incorrect in fifteen further cases. *Slightly incorrect* here means that only a single feature of the extended morphological information is not correct: for the Italian verb form *sono* (English [*they*] *are*), JFrost provides the information *third person singular – indicative – plural – present tense*. Only the feature *singular* is not correct. *Strongly incorrect* refers to extended morphological information which is more than slightly incorrect, i. e. more than one feature is incorrect: for the word form *la* used as a pronoun (English *her*), JFrost provides the information *second person singular – plural*. The correct information for *la* would be: *third person singular – female*.

As a complete example, consider the following (correct) Italian sentence:

(1)*La* (2)*madre* (3)*parla* (4)*con* (5)*suo* (6)*figlio* (7)*di* (8)*questa* (9)*cosa*.
 The mother speaks with her son about this issue.
 ART N VFIN PREP PADJ N PREP DADJ N
 ‘The mother speaks with her son about this issue.’

For this sentence, the JFrost lemmatiser provided for each possible lemma the following extended morphological information (notation: *base form*: part of speech - morphological information):

1. *il*: Adjective⁸ - feminine singular

→ correct

io: Pronoun - second person singular, plural

→ incorrect: *la* can never be used as a personal pronoun for second person (neither

⁷For the Italian word form *va* (English [*he/she*] *goes*), JFrost provided two incorrect lemmas: *iva* (English *ground pine*) and the proper name *Eva*.

⁸In JFrost the class ‘Adjective’ includes articles.

singular or plural)

la: Noun - masculine singular

→ correct

2. *madre*: Noun - feminine singular

→ correct

3. *parlare*: Verb - third person indicative singular, present tense / second person singular imperative

→ correct

4. *con*: Adposition⁹

→ correct

5. *suo*: Adjective - masculine singular

→ correct

io: Pronoun - third person plural / third person singular

→ incorrect: 'third person plural' is wrong (cf. Garzanti, 2005; Reumuth and Winkelmann, 1996). Additionally, it is odd to provide *io* as the base form: *io* is always a personal pronoun in subject position, while *suo* is always a possessive pronoun.

6. *figliare*: Verb - first person indicative singular, present tense

figlio: Noun - masculine singular

→ correct

7. *di*: Adposition

→ correct

idi: Noun - feminine plural

→ incorrect: this information is totally unrelated. The word *idi* (English *ides*) does not have any relationship to *di* and it can never be used in the form *di*. Additionally, the extended morphological information is incomplete, because *idi* can also be masculine plural (cf. Garzanti, 2005).

8. *questo*: Adjective - feminine singular

⁹In JFrost the class 'Adposition' includes prepositions.

questo: Pronoun - feminine singular

→ correct

9. *cosa*: Pronoun - feminine singular

cosa: Noun - feminine singular

→ correct

As a result, the extended morphological information provided by JFrost did not prove to be reliable enough for automatic analysis and dynamic feedback to learner input. The basic lemma and part of speech information of JFrost, however, was used in Step 1 of the analysis in the plurilingual input analysis and feedback module (Section 5.6). The plurilingual input analysis and feedback module performs the task of disambiguating between several possible lemmas. It determines the right lemma(s) for an input word during the analysis process on the basis of the lexicon and grammar available.

4.5. Usability and Software Ergonomics

It is not sufficient to create good content to fully satisfy users. Software should also be as usable as possible to help users achieve their tasks. The usability of software helps people to use it intuitively without extended learning and training phases. However, usability is not only based on the perception of the user. Several factors influence whether a piece of software can be used without problems (Doull et al., 2002):

- Is it easy to start using?
- Is it memorable (easy to memorise)?
- Is it intuitive?
- Is it efficient?
- Are users satisfied?

For the development of ESPRIT components, I considered usability issues to be an integral and important part of interface design. The ISO 9241-10 standard (ISO-9241-10, 1996) is an international standard which describes seven principles of interface design (Hunt et al., 2004):

- suitability for the task: an interface component is suitable for a task if it helps the user to complete a task in an efficient and effective manner.
- self-descriptiveness: an interface component is self-descriptive if it provides automatic feedback for each step the user takes through a system, or if it provides explanations on user request.
- controllability: the user can have full control over the dialogue process and can influence the direction and pace of the interaction until the user goal has been met.
- conformity with user expectations: an interface component is consistent if it conforms with common conventions and the skills and knowledge of prospective users.
- error tolerance: the user can achieve intended results despite apparent errors in the input. The system only requires few or no corrections by the user.
- suitability for individualisation: an interface component can be adapted to suit users in terms of their skills, task needs or individual preferences.
- suitability for learning: the user is supported and guided by the interface component in learning to use the system.

These principles can be used as a yardstick to design and evaluate software components in terms of usability. In Chapter 5, I will make reference to these principles where appropriate.

4.6. Linguistic Levels and Modalities

Detailed contrastive descriptions of Romance languages, compiled in previous research projects on intercomprehension and plurilingual learning of Romance languages, provide the linguistic background of ESPRIT (Blanche-Benveniste, 1997; Schmidely et al., 2001; McCann et al., 2002). These descriptions show that modern Romance languages share a high number of similarities, especially on the morphological, syntactic, lexical and semantic levels of analysis.

4.6.1. Morphosyntax

The contrastive teaching of morphosyntactic features lends itself readily for use in ESPRIT because the distinctive and non-distinctive morphosyntactic features between Romance languages have been described extensively. Making language rules explicit is likely to raise the learner's language awareness and avoids negative transfer due to unconscious use of similar properties in related languages.

Example topics from Blanche-Benveniste (1997) and Schmidely et al. (2001) are:

- auxiliary verbs in past tenses (Fr. *avoir/être*, It. *essere/avere*, Sp. only *haber*), change of past participle (Fr. *fait* → *faite*, *faits*, *faites*, It. *fatto* → *fatta*, *fatti*, *fatte*, Sp. *hecho* → *hecho* (invariable))
- different forms of *to be* (Fr. *être*, Sp. *ser/estar*, It. *essere/stare*)
- possessive adjectives¹⁰ and pronouns: two degrees of proximity in French (*cette maison-ci*, *cette maison-là*) and Italian (*questa casa*, *quella casa*) vs. three degrees of proximity in Spanish (*esta casa*, *esa casa*, *aquella casa*); use of definite article (Fr. *sa maison*, Sp. *su casa*, It. *la sua casa*)
- formation and use of tenses in the past (perfect, preterite, pluperfect)

I developed a range of language-learning materials which give learners the option to learn morphosyntactic features of French, Italian and Spanish. The selection of topics for these learning materials were based on the type of materials of the existing plurilingual research projects EUROCOMROM, EUROM 4 and INTERCOMMUNICABILITÉ ROMANE. Electronic and printed materials of these projects are focused on language forms and contain extensive grammatical information. The morphosyntactic learning materials of ESPRIT were mainly developed with the authoring tool for learning materials (Section 5.8). Example topics are articles, negations, demonstrative adjectives and pronouns, and personal pronouns. For most of the learning materials developed with the authoring tool, two different versions with animated and static content are available. Animated and static versions of the same language content suit different

¹⁰The use of terms to describe possession (*It's my box.* vs. *It's mine.*) varies considerably across the linguistic literature. Whereas both types of possession words are sometimes named *possessive pronouns*, Reumuth and Winkelmann (1996) distinguish between *possessive adjectives* (*It's my box.*) and *possessive pronouns* (*It's mine.*).

learner types. These versions can also be used to test the suitability of animated and static content for the same language-learning topic (Section 7.4.3).

4.6.2. Syntax

Explicit demonstration and practice of syntactic structures is often neglected or even omitted in language teaching. The communicative approach (cf. Brumfit and Johnson, 1979; Nunan, 1991), for example, essentially eliminates explicit linguistic instruction and places great emphasis on learning language functions. Nunan (2005: 234), in contrast, reports that learners do not learn certain grammatical features adequately if a focus on form is entirely absent and, therefore, learners appear to end up with a kind of classroom pidgin language. *Focus on form* refers to “the practice of explicitly drawing students’ attention to linguistic features within the context of meaning-focused activities” (ibid.).

Although syntactic structures are quite similar between Romance languages, they prove to be more distinct between Romance languages on one side and Germanic languages on the other. Therefore, native speakers of a Germanic language should be made aware of the syntactic differences between Romance and Germanic languages.

In ESPRIT, language learners have the opportunity to develop and put into practice their syntactic knowledge by making use of a plurilingual input analysis and feedback module. The input analysis and feedback module is able to display detailed (error) feedback after analysing learner input. The input analysis module is also able to show differences in syntactic structures between the Romance languages involved.

4.6.3. Lexicon

The lexicon plays a vital role in plurilingual learning of Romance languages. French, Italian and Spanish (and the other Romance languages) share a large number of similarities on the lexical level. These similarities comprise the International Vocabulary and the Pan-Romance Vocabulary (Section 2.2.3). Even today, for example, there are more than 400 Pan-Romance words (i.e. words which still have the same meaning and are derived from the same Latin etymon) shared between five Romance languages (McCann et al., 2002: 218ff.).

I developed a range of language-learning materials to learn lexical properties of

French, Italian and Spanish. The learning materials cover the Pan-Romance vocabulary, sound correspondences and prefixes and suffixes. Learners can also deepen their lexical knowledge with the help of the multilingual and plurilingual dictionary tools (Sections 5.4.1 and 5.4.2).

4.6.4. Semantics

Semantic aspects of language use have been strongly neglected in existing ICALL systems (Gamper and Knapp, 2002). However, it is important to know how language is used in different situations (e.g. in a restaurant, at a box office) and how the meaning of similar terms can be distinguished (for example in English *to suppose*, *to assume*, *to presume* and *to surmise*).

A simple concordancer in ESPRIT (Section 5.5) provides the option to work on collocations which can help to improve the advanced learner's knowledge of typical word combinations and fixed phrases. A *concordancer* searches for the occurrence of particular words or structures or combination of words in a collection of electronic texts. The search results are then listed in one-line contexts. *Concordancing* as a tool for language learning reached a broader audience of language teachers when personal computers became affordable in the 1980s. The use of concordances in the language classroom has been described in great detail by Tribble and Jones (1997). Using a concordancer, the learner can see the keyword in context (KWIC). KWIC, which represents the most common format for concordance lines, provides the 'environment' of a word in sentences providing information on the neighbouring words.

4.7. Software Architecture

The client-server software architecture used for ESPRIT combines Adobe Flash (Adobe, 2007), XML (2007), MySQL (2007), Perl (2007), PHP (2007) and Java (2007) in order to integrate cutting-edge visualisation components, flexible data storage and exchange technologies and powerful programming languages into a highly flexible and modular web-based language-learning environment (Figure 4.4). This software architecture supports a platform- and browser-independent representation, and a strict separation of language content and processing algorithms. Therefore language data can easily be reused in different scenarios. A multitude of exercises and examples can be created

dynamically with a small number of templates. Language data can be processed either directly on the client-side with ActionScript (in Flash) or via server-side Perl, PHP and Java code, which provides extensive NLP capabilities.

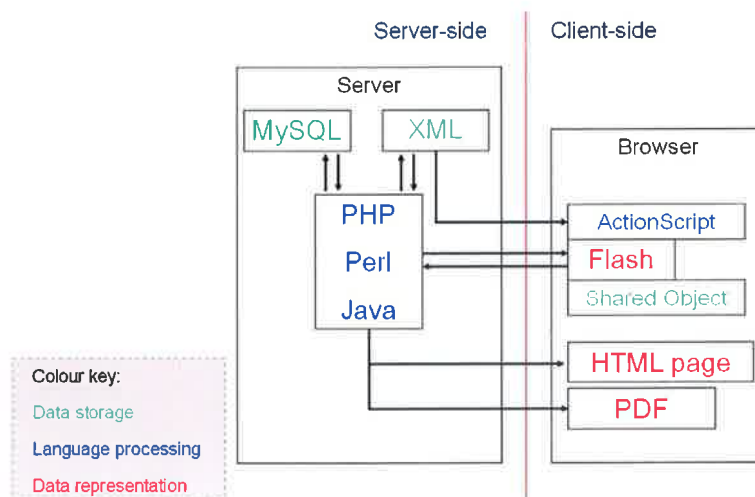


Figure 4.4: ESPRIT software architecture

The use of this software architecture also provides the option to gather learner data, for example to create a learner (error) corpus. Learner input and the output of language processing modules (e.g. a parser) can easily be recorded in Flash and stored as structured data in *SharedObjects*, a Flash property which can save large amounts of structured data (such as XML data, arrays or hashes) on a client-side computer. This data persists between user sessions. Therefore learners can easily access their own data from previous sessions. While a learner is online, the learner data can also automatically be sent to a server in order to be analysed ‘manually’ by a researcher or processed automatically at a later stage.

4.7.1. Flash

Adobe Flash was originally a pure animation software designed to create frame-based cartoon-like animations. In the meantime it has been enhanced with a fully-fledged scripting language (ActionScript) to create graphical software with a high degree of flexibility and interactivity at run-time. Flash supports the creation of Rich Internet Applications (RIA) which can easily interact with a wide range of server-side technologies.

The latest version of ActionScript, ActionScript 2.0, supports the creation of fully

object-oriented code. ActionScript 2.0 classes are – like Java classes – modular blueprints of code which can easily be instantiated in any Flash application. If code has to be reused in several applications, it can be created and stored in a central code repository. The code is only added to a Flash application at compile time if it is actually used. This approach increases the modularity in software development and decreases file sizes and download times.

Flash contains an XML parser which, since version Flash MX,¹¹ proves to be fast and reliable and provides a broad range of functions for effective processing of XML data. A third-party module is available for handling regular expressions (Jurjans, 2004). Tailor-made regular expressions were used in many ESPRIT modules to automatically recognise string patterns and or to split strings into appropriate chunks for further processing.

The Flash plug-in is freely available and of 990-1320 KB download size (depending on platform and browser). It is already installed in most browsers providing access to a broad learner audience. This represents a considerable advantage over competing plug-ins like Java or SVG (Scalable Vector Graphics) which have much bigger installation file sizes and are much less frequently installed in browsers.¹² Flash, Java and SVG can be installed at the same time in the same browser.

However, the figures for the Flash Player penetration have fallen over the last months.¹³ This is probably due to the following reasons:

- since the introduction of Service Pack 2 for Windows XP, a wide range of dynamic web content is automatically blocked to prevent local attacks.¹⁴ Therefore the user has to explicitly grant permission to dynamic web content (which includes Flash applications). Before the introduction of Service Pack 2, Flash content was immediately accessible to the user.
- Flash has attracted negative attention among Internet users who want to block commercial ads on web pages. Commercial ads created with Flash are able to bypass common popup blockers.

¹¹The latest versions are Flash MX 2004 Professional and Flash Professional 8. Flash Professional 8 was released in September 2005.

¹²Download sizes: Java for Windows: 14.5MB, SVG viewer: 2.5MB

¹³Plug-in statistics from <http://www.webhits.de/>
(20/10/2004): Flash 87.8%, Java 12.1%, SVG 1.6%.
(05/03/2006): Flash 60.7%, Java 15.0%, SVG n/a.

¹⁴More specifically all content contained in object, embed and applet tags.

These facts have to be taken into account when creating Flash content. However, the penetration figures for the Flash Player are still more favourable than those for any similar technology.

In contrast to established browser cookies, Flash provides the opportunity to save large amounts of highly structured data (for instance XML data) on the learner's computer.¹⁵ Consequently, less data has to be stored on the server and the learner has to spend less time online.

Customised context menus (accessed via the right mouse button on Windows computers) provide the option to add customised menu items. These menu items can be used to trigger any action in the Flash-based Internet application. Customised context menus can be modified at run-time or tailored to each single learner, depending on which steps the learner has taken before. Context menus can also be customised for each interface element on the screen, e. g. a submit button can have a different context menu from a menu button or an input text field.

On the graphical side, Flash supports the creation of flexible, highly interactive interface components, including animations and language games. Its visual authoring environment supports the exact (pixel-based) positioning of interface elements. Flash offers many instantly accessible high-level components for the creation of interactive multimedia applications. Flash supports the integration of audio, video and animation into one single application and provides a large number of options for customisation and learner-centred development.

The use of sophisticated multimedia and interaction capabilities in order to create intuitive web-based learning environments is strongly advocated by Handke (2003). With Flash, a large number of multimedia and interactive components can be easily integrated. The following are examples of interactive and flexible components particularly relevant to ESPRIT:

- *Tool tips* offer contextualised information to the learner when moving the cursor over a certain part of an image. With Flash the area triggering a tool tip can be of any shape (in Figure 4.5 it corresponds exactly to the tops of the colour pots).

Further actions (such as playing audio files or showing the same information

¹⁵Normal browser cookies must not exceed 4KB of storage amount and can only store simple variable-value pairs.

in other languages by pressing defined keys) can be executed simultaneously, supporting multimodal input to the learner.



Figure 4.5: Tool tips

- In Flash, *custom cursors* can be of any shape. They can be displayed instead of the commonly available cursor shapes (arrow, hand cursor, sand-glass) in order to provide the learner with additional contextual information regarding the system status or other properties of the information offered. For instance, local links can be distinguished from web links (see first example of Figure 4.6), or the learner can be notified of the successful loading of an external data device.

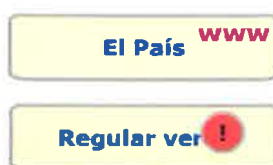


Figure 4.6: Example custom cursors (here 'www' and '!')

- Language materials which embed *drag & drop* functionality require the learner to actively engage in exercises. In the ESPRIT exercise in Figure 4.7, the learner has to drag the words in the right order. Further help is given by clicking on the flags at the top which show translations of the sentence. Drag & drop can also be used for interactive vocabulary learning.
- Animation can be used in many ways to dynamically display grammatical properties and processes (Figure 4.8) and to create language games. The animated

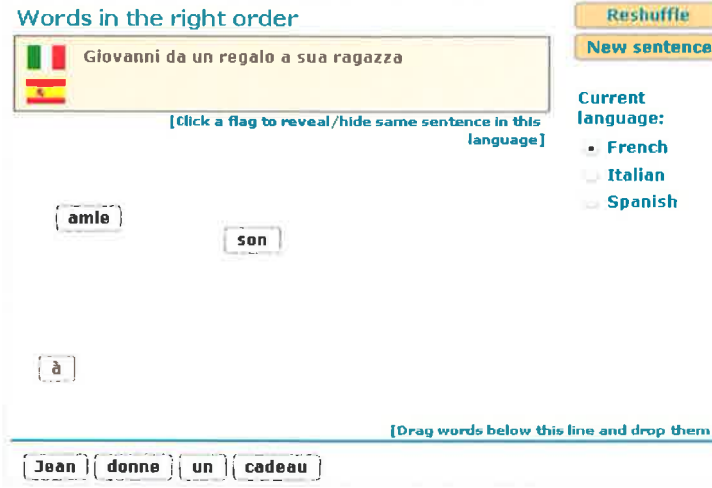


Figure 4.7: ESPRIT drag & drop exercise

content can be dynamically chosen at run-time (by the software or by the learner), which provides a high degree of flexibility. Components which provide a high level of interactivity (control buttons, draggable progress bar, etc.) can easily be included.

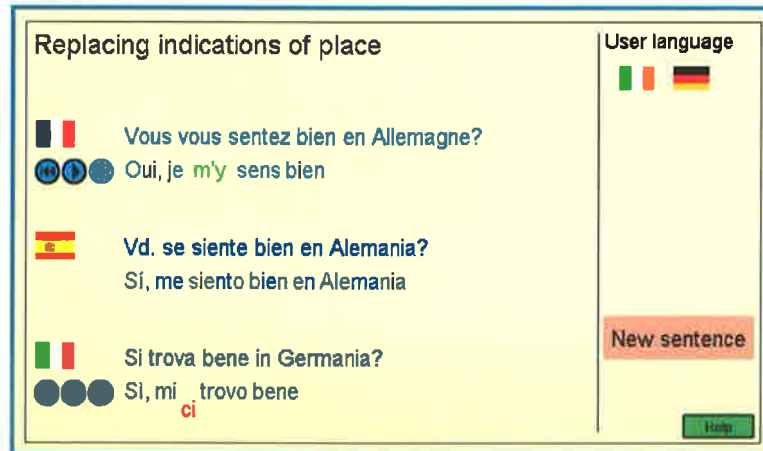


Figure 4.8: ESPRIT text animation

Flash Remoting is a technology built into the Flash player core which supports the exchange of structured data (e.g. objects, hashes, arrays) between server and client. This helps to considerably save development and data processing times because data does not have to be serialised and deserialised between server and client.

Flash Remoting uses Action Message Format (AMF) to send and receive data. AMF

is essentially a lightweight binary version of SOAP (Simple Object Access Protocol) which can be delivered over regular HTTP (HyperText Transfer Protocol). SOAP is a web standard for web services (SOAP, 2003).

4.7.2. Data Storage and Data Processing

The web-based Spanish ICALL system ESPADA (Koller, 2003) was originally developed for German students of Spanish. Therefore the only interface language of this system was German. At the beginning of my Ph.D. research, I localised the system's interface content into English so that the system could be used and evaluated in a context where English was spoken as a first language. The translation process revealed that the CALL content presented to the learner should be strictly separated from the programming code and the Flash animations. Otherwise maintaining and extending existing content and/or code is extremely cumbersome and time-consuming. For this reason my Ph.D. work provides a clear distinction between CALL content data (stored in XML files) on the one side and programming code and Flash animations on the other. This design provides the basis for the modularity of ESPRIT. An XML file which contains language or layout data can be dynamically linked to several Flash files in order to automatically generate many different exercises and language resources at run-time.

4.7.3. XML

XML has become one of the most important platform-independent data description and exchange formats. Therefore, API's are available for many programming languages. XML makes it possible to modularise language data and to easily reuse the data in different processing scenarios. Therefore a strict separation of language data content and language processing algorithms can be achieved.

XML data can be parsed stream-based or tree-based. A *stream-based* parser sends the data in a stream of 'events' as the XML is parsed. To use a stream-based module, some handler or 'callback' functions have to be written and then registered with the parser. With stream-based XML parsing, the whole XML document does not have to be parsed before XML data can be accessed. However, one cannot be sure that a document is error-free until the end of the parse which might lead to undesired results. Code written for stream-based parsing with one parser module can almost certainly

be swapped with another stream-based parser module without changing a line of code. By contrast, a *tree-based* parser parses the whole XML document and returns a data structure made up of 'nodes' representing elements, attributes, text content, etc. A tree-based module typically provides an API with functions for searching and manipulating the tree. With one method call an XML document is parsed and available for further processing. However, tree-based XML parsing is less portable: even the modules which support a DOM¹⁶ API differ enough, so that code written for one module generally has to be changed if there is a need to switch to another parser module. Furthermore, the memory required to build a tree can easily amount to 10-30 times the size of the entire source document.

In the software architecture of ESPRIT, XML data can be created, processed, modified and saved by Flash,¹⁷ Perl, PHP and Java. The Flash XML parser is a non-validating tree-based parser. Perl, PHP and Java are able to parse XML data tree-based or stream-based which provides high flexibility in data handling.

Both the data displayed to the learner in the GUI and the language resources (e.g. lexicons, corpora) are stored in XML files and strictly separated from the language processing tools (e.g. parser, generator, animation modules). This makes the maintenance of data and its reuse in different contexts much easier.

The same information units in different languages are grouped together in one place so that necessary changes of data in one language can be easily transferred to the other languages. This design also supports the addition of further languages of instruction.

Flash supports the creation of multilingual user interfaces. At authoring time Flash creates separate XML files for each language involved. The XML files comply with the XML Localisation Interchange File Format (XLIFF) standard. XLIFF (XLIFF, 2003) is an XML-based format which makes it easier to provide standardised translations of interface language data.

XPath (XPath, 1999) is a language for addressing parts of an XML document. It enables the software designer to directly access any node of an XML document if the path to this node can be determined. Since Flash MX 2004, XPath can be used directly by importing the Flash XPath class at authoring time.

¹⁶DOM = Document Object Model; the *Document Object Model* is a standard API for tree-like data structures implemented by a number of modules.

¹⁷Due to its 'sandbox' security restrictions, a Flash application is currently only able to save XML data on the client computer in local shared objects.

4.7.4. Natural Language Processing

The software architecture of ESPRIT supports natural language processing with ActionScript, Perl, PHP and Java. Therefore, a wide range of language processing capabilities is available within one single architecture. The combination of these programming languages supports the use of sophisticated string functions and regular expressions. ActionScript itself does not support regular expressions but a third-party module provides this functionality (Jurjans, 2004).

ActionScript, Perl, PHP and Java show the following differences in a web-based client-server scenario:

- Perl and PHP scripts are always executed on the server, whereas ActionScript scripts run on the client side. ActionScript scripts are always executed inside a Flash `.swf`¹⁸ file on the client side. A Flash `.swf` file is usually embedded in a web page and then executed inside the Flash Player plug-in in the client-side browser. Java scripts can be executed on the server side (as standalone applications or Java servlets) or on the client side (as applets), but in the context of this work, Java was only used on the server side.
- the software developer has to compile Java scripts to bytecode before uploading the Java application to the server, whereas Perl and PHP scripts are directly uploaded to the server. ActionScript code has to be compiled into a Flash `.swf` file at authoring time. The Flash `.swf` file is then uploaded on the server.
- cross-browser compatibility issues arise when Perl, PHP or Java scripts dynamically create HTML web pages on the server which are subsequently sent to a browser. The software developer has to be aware of the ways in which HTML, CSS and JavaScript are rendered in different browsers (for example Internet Explorer, Firefox and Opera). For ActionScript (and Flash files in general), on the other hand, it is important to know which version of the Flash Player is installed in the client-side browser.¹⁹ Freely available Flash version detection sets can be used to detect the Flash version in a client-side browser. This information is then

¹⁸ *swf* stands for Small Web Format.

¹⁹ The HTML markup generated by the Flash authoring environment to embed a Flash `.swf` file into a web page works well across all browsers.

used to display an appropriate version of a Flash file (or alternatively an error message) to the user.

- Perl, PHP and ActionScript support both procedural and object-oriented programming (OOP), whereas Java is strictly object-oriented.

4.8. Summary

In this chapter I described the general properties and principles of ESPRIT and existing language tools and resources reused for ESPRIT. I also provided information about usability issues and software ergonomics, and relevant linguistic levels and modalities. Finally, ESPRIT's software architecture was described in detail.

ESPRIT contains language materials for French, Italian and Spanish and is targeted at adult learners with advanced lexical and grammatical knowledge of at least one of the Romance languages involved. It promotes exploratory and learner-centred learning and represents a rich learning environment. For ESPRIT I reused several existing language content and software resources, such as bilingual word lists, a Romance lexicon and POS taggers. ESPRIT components aim to conform to standardised usability rules. The ISO 9241-10 rules are used as a yardstick to check developed software components for their usability. The materials developed for ESPRIT support plurilingual language learning in the linguistic areas of morphosyntax, syntax, the lexicon and semantics. The software architecture used for ESPRIT combines cutting-edge visualisation components, flexible data storage and exchange technologies, and powerful programming languages into a highly flexible and modular web-based language-learning environment. This software architecture supports a platform- and browser-independent representation and enforces a strict separation of language data and processing algorithms. Language data can be processed either directly in a client-side Flash application or via Perl, PHP and Java code on the server.

5. A Toolsuite for Plurilingual CALL Applications

5.1. Introduction

The components developed for ESPRIT fall into three groups: (i) a graphical user interface (GUI) which gives access to all available language tools (Section 5.2), (ii) different types of language tools and resources (Sections 5.3 to 5.7), and (iii) an authoring tool for the creation of slide-based learning materials with animated text (Section 5.8).

These components provide the following options to language learners:

- the tools are accessible at any time over the Internet. Learners can work with these tools independently and do not have to rely on the availability of printed learning materials;
- learners can work on unrestricted text,¹ for example on current newspaper texts or any information of personal interest downloaded from the Internet. The context (images, layout) of the original is hereby not preserved.
- learners can get detailed feedback on their own restricted input. This helps them to verify their own hypotheses about the syntactic structures of the languages they are learning.

The ISO 9241-10 standard describes seven principles of software interface design (Section 4.5). In the development process of the components for ESPRIT, I followed these guidelines as far as possible. In the description of the components, I will make reference to the ISO 9241-10 standard where appropriate, using the following notation: (→ ISO 9241-10, [name of design principle]).

Section 5.2 describes the graphical user interface (GUI) and its components. Section 5.3 gives a detailed description of the language-learning resources created for ESPRIT. These include a multilingual lexicon in XML and MySQL formats, different

¹ *Unrestricted* mainly refers to the fact that any text of interest can be used as input. The amount of input in the dictionary tools (Section 5.4) is limited for performance reasons.

types of full-form verb lists, a rich multilingual verb lexicon, and a plurilingual lexicon. The multilingual dictionary tool and the plurilingual dictionary tool are described in Section 5.4. Section 5.5 details the development of a multilingual concordancer. The plurilingual input analysis and feedback module is presented in Section 5.6. This section also contains descriptions of a plurilingual lexicon interface component and a multilingual verb lexicon interface component. Section 5.7 deals with the development of tailor-made animated grammar presentations, while Section 5.8 describes an authoring tool for slide-based learning materials with animated text. Section 5.9 summarises the development of components for ESPRIT.

Figure 5.1 gives an overview of existing resources reused for ESPRIT (Section 4.4), and resources (Section 5.3), tools and content (Sections 5.4 to 5.8) created for ESPRIT.

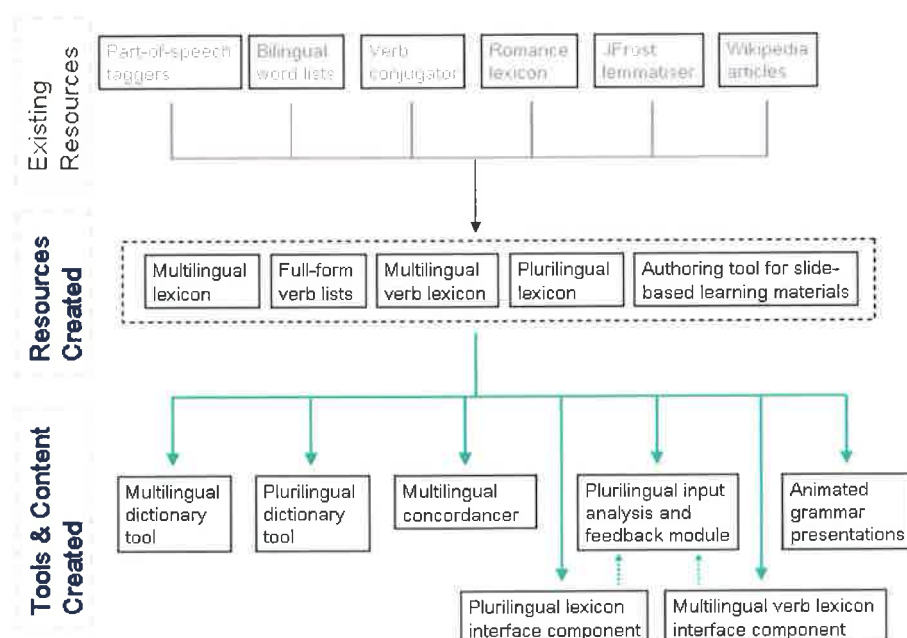


Figure 5.1: Schematic overview of language tools and resources in ESPRIT

5.2. Graphical User Interface

The GUI of ESPRIT represents a TV-like environment which consists of a TV magazine, a TV screen and a Teletext facility (Figure 5.2). Creating the GUI in a TV design can enhance the learner's acceptance of the system because learners are likely to use TVs on a (nearly) daily basis and hence are familiar with its use (→ ISO 9241-10, conformity with user expectations).

According to Lynch and Horton (2002) interface metaphors should be simple, familiar and logical. If a metaphor for information design is needed, it is useful to “choose a genre familiar to readers of documents, such as a book or a library” (ibid, p. 23). Lynch and Horton advise avoiding highly unusual navigation and home page metaphors as they are likely to fail because “they impose an unfamiliar, unpredictable interface burden on the user” (ibid, p. 23). Further examples for the use of analogies in user interface design are the desktop metaphor in modern operating systems (for example Windows or Linux) and the metaphor of a Hi-Fi system for audio and video player software. Single-function tools making use of a metaphor are a magnifying glass to search for items or a recycle bin for deleted files and folders.

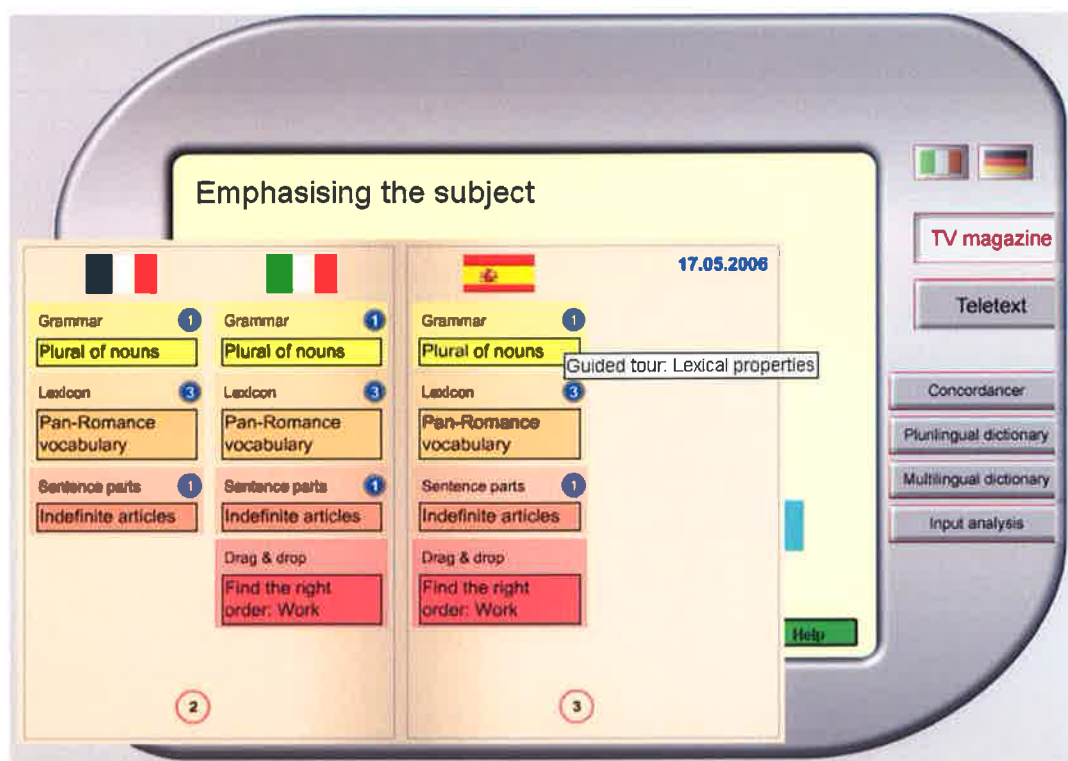


Figure 5.2: ESPRIT graphical user interface

The ESPRIT TV design supports a modular approach. Therefore the contents presented to the learner can easily be expanded at any time. The learner can freely choose the topics of interest, which facilitates exploratory learning (→ ISO 9241-10, suitability for individualisation).

For the graphical user interface, I integrated a sophisticated open-source Flash-based *pageflip* module (Macc, 2004) which serves as the TV magazine for the TV environment.

A *pageflip* module is a web-based component which simulates a book or magazine. Usually the user can turn a page by double-clicking a page corner or – as with a real book or magazine – by dragging one page with the mouse to the other side of the “document”. The analogy of a pageflip module to a book or magazine helps the user to correctly use the pageflip module from the start (→ ISO 9241-10, conformity with user expectations).

In its original version, the pageflip module only provides the option to integrate static content. This means that every content item has to be added at authoring time into the Flash authoring file. To be used flexibly in ESPRIT, I adapted the user interface to dynamically read in language and user data from XML files at run-time (Figure 5.3).

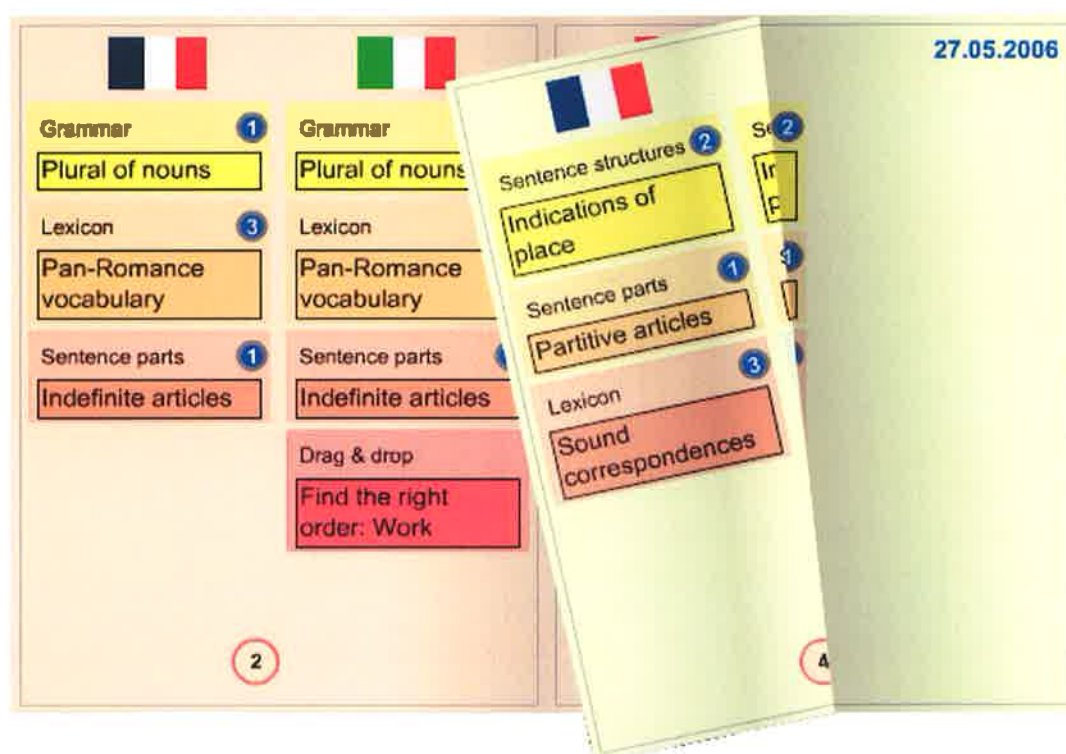


Figure 5.3: Pageflip module – dynamic version adapted for ESPRIT

The TV magazine represents the main point of information of the GUI. There is one ‘channel’ for each language. Both monolingual and plurilingual entries are available. As a result, the learner can work on exercises/information in only one language or across two or three languages. A channel’s programme for one day contains various slots which are automatically generated when the learner starts the system. Every slot contains a short name of the activity, the general type of programme (e. g. game, grammar, lexicon) and, if it is part of a guided tour (cf. Section 4.3), a link to the

corresponding Teletext information.

The selection of topics for these learning materials was based on the type of materials created in the existing plurilingual research projects EUROCOMROM, EUROM 4 and INTERCOMMUNICABILITÉ ROMANE. These materials are focused on receptive skills and mainly aim to provide knowledge of language forms.

The TV screen displays the selected contents. It provides buttons to adjust the interface language (→ ISO 9241-10, suitability for individualisation) and gives access to the Teletext facility, the TV magazine and general ESPRIT language tools (dictionary tools, concordancer, and input analysis module).

The Teletext facility gives three different kinds of information: it provides descriptions of each single learning activity; it explains how to use different parts of the GUI; and it details the contents of the guided tours ‘on offer’.

5.3. Multilingual and Plurilingual Language Resources

I re-used several existing language tools and resources (cf. Section 4.4) to create tailor-made language resources for ESPRIT. These language resources are designed to be easily reused in other research projects. These include multilingual lexicons, full-form verb lists, a multilingual verb lexicon and a plurilingual lexicon.

5.3.1. Multilingual Lexicon

The multilingual vocabulary learning software Win Vokabel 5.0 (STG, 1998) grants permission to export bilingual word lists for each available language pair (Section 4.4.1). I used these word lists to create a multilingual lexicon which comprises 43 sub-lexicons. Each sub-lexicon corresponds to a word field in Win Vokabel 5.0 (such as ‘Culture’, ‘Medicine’, ‘Sports’, or ‘Food’) and contains multilingual information in English, German, French, Italian and Spanish.² Each sub-lexicon has between 200 and 1,500 entries. For each Romance language more than 11,500 lemmas are available, ordered in levels of difficulty from 1 (easy) to 4 (hard). I created XML and MySQL versions of the multilingual lexicon (Sections 5.3.1.1 and 5.3.1.2).

Tables 5.1 and 5.2 show lemma counts and POS counts for each language:³

²Ideally each entry has translations into all languages involved. The bilingual word lists, however, cannot contain exactly the same words in all languages which leads to translation gaps.

³The lemma count of each language differs from its POS count due to the fact that a lemma can belong

Language	Lemmas
French	11,503
Italian	13,429
Spanish	14,623
English	17,604
German	5,188

Table 5.1: Multilingual lexicon – lemma count

POS	French	Italian	Spanish	English	German
Adjective	2,126	2,551	2,787	2,902	2,995
Adverb	221	349	427	395	438
Article	5	10	9	10	6
Conjunction	13	28	22	22	30
Interjection	4	11	9	21	22
Noun	7,480	8,666	9,355	11,482	3,555
Numeral	30	37	34	40	41
Preposition	20	39	47	44	57
Pronoun	33	69	92	54	73
Verb	1,645	1,906	2,121	3,493	3,134

Table 5.2: Multilingual lexicon – POS count

The multilingual lexicon proved to be very helpful as the data source for the multilingual and plurilingual dictionary tools. In the multilingual dictionary tool (Section 5.4.1), the multilingual lexicon provides word-by-word translation information which is directly displayed to the learner. In the plurilingual dictionary tool (Section 5.4.2), where the focus is on providing contrastive inference (like Pan-Romance words and profile words), the MySQL version of the multilingual lexicon is used to find possible translations into the other two Romance languages for words in the input. The possible translation words are subsequently checked for their similarity to the input word.

5.3.1.1. XML Version

I created Perl and PHP scripts to extract the bilingual word list information from Win Vokabel 5.0 for each of the supported language pairs. The scripts automatically create multilingual XML sub-lexicons and index files for each Romance language.

Each index file contains all entries for one language in alphabetical order and indicates to several parts of speech. For example the English word *house* can be a noun or a verb.

the XML sub-lexicons in which entries can be found. The use of index files helps to reduce processing times considerably because only XML sub-lexicons with relevant language information have to be processed. The index file entry for the French word *action* shows that translation information is available in the sub-lexicons Work (*Arbeit*), Law (*Recht*), Entertainment (*Unterhaltung*) and Economy (*Wirtschaft*):⁴

action – Arbeit - Recht - Unterhaltung - Wirtschaft

Each language entry has one or several possible translations plus information regarding gender (for nouns), part of speech, language level – and in some cases – information on typical collocations.

Examples from the German - English word lists are:

Anweisung {f} – *instruction* {n}; *order* {n}; *direction* [instruction] {n}

bandagieren [eine Wunde ~] {v} – *bandage* [~ a wound] {v}; *dress* [~ a wound] {v}

The following example entry from the XML sub-lexicon for the word field ‘Clothes’ contains Spanish and Italian translations of level 3 and English and French translations of level 2:

```
<entry name="Regenmantel" >
  <part_of_speech type="m" >
    <level type="3" >
      <language name="spanish" >
        <translation pos="f" >gabardina</translation>
      </language>
      <language name="italian" >
        <translation pos="m" >impermeabile</translation>
      </language>
    </level>
    <level type="2" >
```

⁴The interface language of Win Vokabel 5.0 is German. Therefore all sub-lexicon names are in German.

```

    <language name="english">
      <translation pos="n">raincoat</translation>
    </language>
    <language name="french">
      <translation pos="m">impermeable</translation>
      <translation pos="m">caban</translation>
    </language>
  </level>
</part_of_speech>
</entry>

```

5.3.1.2. MySQL Version

During the development of the multilingual dictionary tool (Section 5.4.1), performance tests showed that using multilingual XML files as the data source made the data retrieval process quite slow: on a busy server it took on average 138 seconds to retrieve the translation information for a Spanish newspaper text of 450 words. Therefore I decided to create a multilingual MySQL database to test and deploy a faster alternative. Performance test results for the XML and MySQL versions are presented in Section 5.4.1.2.⁵

The MySQL database contains one table for each of the 43 language topics. German acts as a kind of interlingua for all other languages due to the fact that the underlying bilingual word lists (cf. Section 4.4.1) always contain translations from or to German. Therefore, direct correspondences between Romance words which do not have a correspondence in German (in the bilingual word lists) do not exist in the multilingual lexicon.

Each MySQL language topic table has the following columns:

- *entry_id*: this column acts as the primary key of the table. Its numeric value is automatically incremented for each new data set.
- *german_word*: contains the German translation.
- *german_pos*: contains the part of speech of the German word.

⁵On a busy web server the MySQL version was on average 10 times faster than the XML version.

- *trans.lang*: contains the translation language with one of the following values: ‘English’, ‘French’, ‘Spanish’, ‘Italian’.
- *trans.pos*: contains the part of speech of the translation.
- *trans.word*: contains the translation of the German word.

5.3.2. Full-Form Verb Lists

Win Vokabel 5.0 contains a verb conjugator module (Section 4.4.2) which provides all inflected verb forms for all available verbs (Table 5.3).

Language	Infinitives	Tenses	Full forms
French	1,520	10	52,400
Italian	1,600	10	61,100
Spanish	1,750	11	78,300

Table 5.3: Full-form verb lists – infinitives, tenses and full forms

Win Vokabel 5.0 grants permission to export these full-form verb lists to plain text files. I transformed the full-form verb lists into two different files which can be automatically read in by ESPRIT language tools:

- an index file which contains one conjugated verb form per line along with the possible infinitives and the associated morphological information. For example the entry for the French verb form *accomplissent* provides the information that *accomplissent* can be (1) indicative present tense-third person plural, (2) subjunctive present tense-third person plural or (3) subjunctive imperfect tense-third person plural:

accomplissent

accomplir pres 3p

accomplir subj-pres 3p

accomplir subj-impf 3p

This index file is used in the multilingual dictionary tool and in the plurilingual input analysis and feedback module (Section 5.6). In both cases, the index file provides fast and reliable morphological information.

- text files which contain complete conjugation information for each verb and tense. For example the entry for the French verb *abandonner* (to abandon) provides the following conjugation information for present tense:

abandonner
1s.abandonne
2s.abandonnes
3s.abandonne
1p.abandonnons
2p.abandonnez
3p.abandonnent

This conjugation information is used in the multilingual verb lexicon interface component (Section 5.6.4) to display all conjugated forms of a verb.

5.3.3. Multilingual Verb Lexicon

With the help of available electronic dictionaries for French, Italian and Spanish (Oxford University Press, 1996; Garzanti, 2005), I created a multilingual verb lexicon for French, Italian and Spanish (Table 5.4). The general multilingual lexicon presented in Section 5.3.1 was not suitable for this task because it does not contain any sub-categorisation information. The multilingual verb lexicon, on the other hand, was not the best choice for the intended uses of the multilingual lexicon and the full-form verb lists because it contains a much smaller number of verbs and it does not contain any conjugated verb forms.

For each verb, the multilingual verb lexicon contains information about required prepositions and verb forms (infinitive, gerund, participle) and about syntactic usage types (e.g. transitive, intransitive). The verb lexicon does not contain semantic information. I manually enriched the lexicon with verb information from didactic grammars of French, Italian and Spanish (Reumuth and Winkelmann, 1993, 1994, 1996). The verb lexicon serves as a data basis for the plurilingual input analysis and feedback module (Section 5.6) and the multilingual verb lexicon component (Section 5.6.4).

The example entry for the French verb *communiquer* (to announce; to pass on) provides the following information:

communiquer

Language	Infinitives
French	400
Italian	430
Spanish	420

Table 5.4: Multilingual verb lexicon – infinitives

[à] [avec] [par] [qch à qn]

<v pron> <vt>

The verb *communiquer* can either be followed by the prepositions *à*, *avec* or *par*, or by a direct object which is a thing (*quelque chose*). In the latter case, the preposition *à* has to follow the direct object. The verb *communiquer* can be used as a pronominal verb⁶ or as a transitive verb.

5.3.4. Plurilingual Lexicon

I used the information contained in the Romance lexicon (Reinheimer and Tasmowski, 1997, cf. Section 4.4.3) to compile an electronic plurilingual lexicon for French, Italian and Spanish. The plurilingual lexicon is different from the multilingual lexicon (Section 5.3.1) in that it only contains sets of words which are derived from the same etymon (from Latin or other languages) and still roughly have the same meaning. It also contains extended lexical information about changes in meaning over time.

The data of the Romance lexicon represents the core of the plurilingual lexicon. The data was manually cleaned up and enriched with additional information so that it can be read in and processed automatically. The plurilingual lexicon contains information in a well-structured and homogeneous format so that all the lexicon information can be retrieved automatically. The plurilingual lexicon contains nouns, verbs, adjectives, adverbs and interjections (Table 5.5).

I also created monolingual lexicons for French, Italian and Spanish from the data in the plurilingual lexicon. The monolingual lexicons were augmented with entries for the following closed parts of speech: negation adverbs, numerals, prepositions, pronouns and sentence adverbs. The monolingual lexicons were enriched with morphological information (gender, number and person) from the multilingual lexicon (Section 5.3.1).

⁶A *pronominal verb* must be conjugated with a reflexive pronoun.

Part of speech	Number of entries
Nouns	1,006
Verbs	483
Adjectives	234
Adverbs	70
Interjections	2

Table 5.5: Plurilingual lexicon – POS count

The plurilingual lexicon (Section 5.3.4) represents the lexical basis for the plurilingual lexicon interface component (Section 5.6.3). The monolingual lexicons are used in Step 1 of the plurilingual input analysis and feedback module (Section 5.6) to provide monolingual morphological information for non-verbal parts of speech.

5.4. Dictionary Tools

The multilingual and the plurilingual dictionary tools in ESPRIT enable the learner to work on unrestricted text (for example texts downloaded from Internet sources). The typical coverage of words in general real world texts taken from the newspapers *Le Monde* (French), *La Repubblica* (Italian) and *El Mundo* (Spanish) showed more variation with the multilingual dictionary tool than with the plurilingual dictionary tool. The percentage of words (of such newspaper texts) recognised by the multilingual dictionary tool varied between 55% and 80%. The plurilingual dictionary tool, in contrast, had a more constant coverage of words: between 65% and 70% of newspaper text words were successfully recognised by the tool.

Both dictionary tools complement each other in their functionality and provide learners with a wide range of information and functions. The multilingual dictionary tool, for example, does not perform disambiguation of input words (unlike the plurilingual dictionary tool). Therefore, the learner can actually see to how many different parts of speech an input word can potentially be assigned to, whereas the plurilingual dictionary tool only displays plurilingual information for the most likely POS of an input word.

5.4.1. Multilingual Dictionary Tool

The multilingual dictionary tool provides word-by-word translations for unrestricted text in French, Spanish or Italian. Translations are displayed for the other two Romance languages and for English and German.⁷ The dictionary tool is able to recognise declined and conjugated word forms. For each word recognised in the input text, the tool provides information on part of speech and word field. For verbs it also indicates information on tense and person, and provides the infinitive.

The tool has several features which facilitate its use and provide the option to customise its interface:

- when using the dictionary tool for the first time, the learner is asked if s/he wants to have a short introduction (Figure 5.4). The introduction comprises three screenshot-like windows which explain the main features of the dictionary tool. This introduction can later be accessed at any time by pressing the key combination 'CTRL' + 'T' (→ ISO 9241-10, suitability for learning).

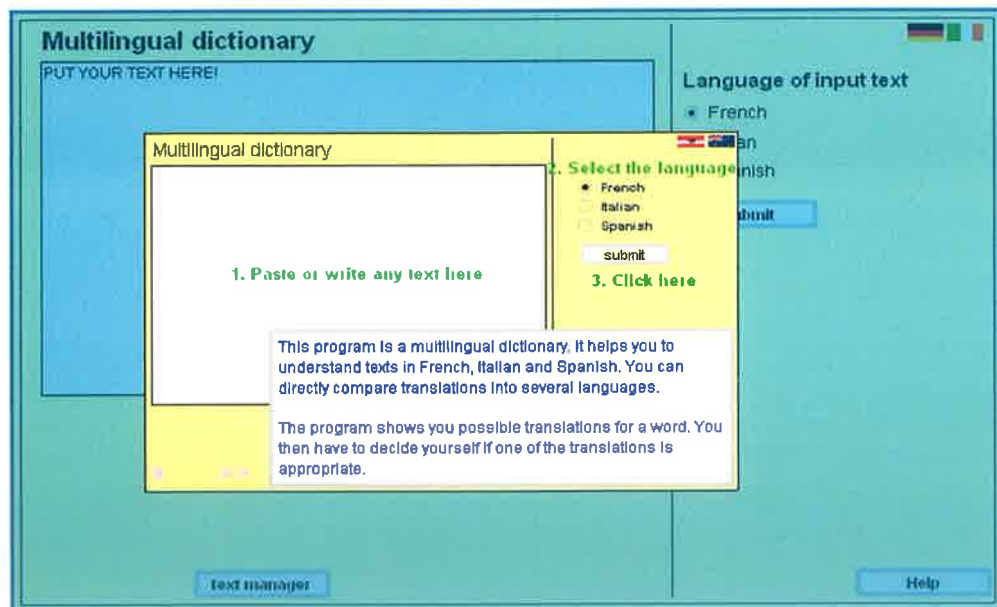


Figure 5.4: Multilingual dictionary tool – introduction

- the dictionary tool offers two interface languages: English and German. The learner can easily switch the interface language by clicking the appropriate language flag (→ ISO 9241-10, suitability for individualisation). The texts of the

⁷Translations are not always available for each language due to the fact that the underlying multilingual lexicon was created from several bilingual word lists which cannot contain exactly the same words.

interface labels are stored in an external XML file. Therefore there is no need to recompile the Flash authoring file when adding new interface label texts or modifying existing interface label texts. This approach also facilitates the addition of French, Italian and Spanish as further interface languages.

The summative evaluation of ESPRIT's main GUI (which also only offers English and German as interface languages) showed an interesting result (Section 7.4.4). Evaluation participants were asked if they would like to have French, Italian or Spanish as further interface languages. Three (out of five) evaluation participants did not want any of these languages as further interface languages. Only one participant would like to use French, Italian and Spanish as further interface languages.

- the dictionary tool contains help texts in English and German which are accessible at any time (→ ISO 9241-10, self-descriptiveness). Like the interface label texts, the help texts are stored in an external XML file.

Figure 5.5 shows the open help window. As long as the help window is open, all other interface elements are disabled (→ ISO 9241-10, suitability for the task). This is visualised by a tinted layer placed between the help window and the interface.⁸ The help window can be freely dragged across the area of the dictionary tool.

- upon first use of the dictionary tool, the learner is asked to select national flags for both interface languages. These national flags are then added to the interface as a graphical button in order to change the interface language (→ ISO 9241-10, suitability for individualisation).

Feedback from Austrian and Irish CALL colleagues⁹ showed that the option to select a specific national flag for a language can be important especially for learners of smaller countries whose mother tongue is usually represented by the national flag of a bigger country.

The same problem potentially also applies to French, Italian and Spanish. ESPRIT, however, targets English and German native speakers. Therefore, I con-

⁸The same technique to focus the learner's attention is used for the introductory tutorial.

⁹Gabriele Abermann, personal communication, EuroCALL 2004 conference / Monica Ward, personal communication, June 2004



Figure 5.5: Multilingual dictionary tool – help function

sidered it to be more important to offer a language flag choice for these languages. The option to select language flags for French, Italian and Spanish, however, could quite easily be added to the dictionary tool.

- while retrieving data from the server, the dictionary tool displays an animated pop-up window to inform the learner of the retrieval process in progress (→ ISO 9241-10, self-descriptiveness). As soon as all data is retrieved from the server, the pop-up window is removed. If the data retrieval process is interrupted due to network problems, the dictionary tool automatically halts the data retrieval process after a certain amount of time and removes the pop-up window.

5.4.1.1. Modules

The multilingual dictionary tool comprises a text manager and a web page utility which provide further options for working on the input text and corresponding word-by-word translations.

The text manager is able to store a large number of texts with corresponding translation information on the client-side computer. The data is stored in SharedObjects, a Flash property which can save large amounts of structured data on a client-side

computer. The use of the text manager can be useful for two reasons:

- learners who want to retrieve translation information for several texts from home with a slow modem connection only have to stay online for the retrieval of translation information from the server. They input each text, get the translation information and save the text and translation information onto the local computer. After retrieving the translation information for all texts, they can go off-line and work on the texts in any order.
- learners are able to store texts which are of interest to them. Therefore they do not have to rely on the availability of the same text on the same web page at a later date (for example newspaper texts or news feeds).

The web page utility was created and added to the multilingual dictionary tool to give the learner the option to create individual vocabulary lists for any input text (→ ISO 9241-10, suitability for individualisation). Its functionality is also motivated by the fact that the multilingual dictionary tool only displays the translations of one input text word at a time. Additionally, a long input text cannot be fully displayed on the main screen after retrieving the whole translation information. A printout of the main screen, therefore, would only provide limited information of the input text and the available translations.

The learner can drag text words (where translation information is available) to the text field at the bottom of the page. After clicking the 'web page' button, a server-side script dynamically creates a web page which contains the input text and a table with translation information (Figure 5.6). The translations are displayed for the target languages currently selected in the multilingual dictionary tool. Depending on the selection of the learner, the table contains translation information either for all words with available translation information or only for those words which have been dragged to the bottom text field. The learner can also decide whether the words displayed in the table are ordered alphabetically or in the order they actually appear in the input text. The web page can either be printed or stored on the local computer.

Multilingual dictionary

Text:

La camorra ha ucciso suo marito alcuni anni fa e i suoi figli a giugno. Questo pomeriggio, tre proiettili hanno freddato Patrizia Marino, 63 anni. Un killer con il volto coperto l'ha uccisa davanti a un negozio di articolo sportivi a Volpicelli, vicino ad Arzano. Il movente è nascosto nelle trame segrete che legano i difficili equilibri tra i clan del napoletano. Dietro il duplice delitto dei figli c'era la faida del clan Di Lauro e solo qualche giorno fa, un parente della donna, collaboratore di giustizia, ha testimoniato in un processo contro la camorra.

Translations:

		English	German	French	Spanish
marito	Humans Noun	husband spouse	Gatte Ehemann	mari époux	marido esposo cónyuge
negozio	Economy Noun	shop store business	Laden	magasin	tienda
	Politics Verb		handeln verhandeln		negociar
delitto	Security Noun	crime felony	Verbrechen	crime méfait délit	delito crimen alevoso

Figure 5.6: Multilingual dictionary tool – web page function

5.4.1.2. Language Processing

The language processing in the multilingual dictionary tool is done in two steps so that after each step information can be displayed immediately on the client side (Figure 5.7).

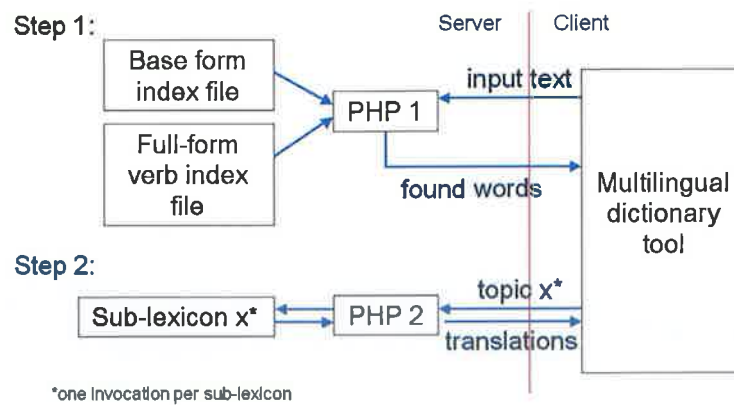


Figure 5.7: Multilingual dictionary tool – data retrieval process

In Step 1, the multilingual dictionary tool determines which text words are in the lexicon. A PHP script reads in the base form index file and the full-form verb index file for the language of the input text. Then it compares the entries of the index files to the words of the input text. Two different methods are used to identify inflected word

forms (nouns, adjectives and participles):

- for French and Spanish, I developed a basic stemming algorithm to determine the potential base form.
- for Italian, I used an existing morphological full-form list (Baroni and Zanchetta, 2004) to detect the base form for inflected word forms. List entries without translation information in the multilingual lexicon were excluded from the list to speed up the lookup process. The list eventually used for the dictionary tool contains more than 35,000 inflected word forms.

Upon completion of the lookup process, the data is sent back to the multilingual dictionary tool on the client side. This data provides information about the words found and the corresponding sub-lexicons. Words of the input text with translation information available are initially marked red in the multilingual dictionary tool to give a visual indication to the learner (→ ISO 9241-10, self-descriptiveness). This state of the retrieval process is shown in Figure 5.8.

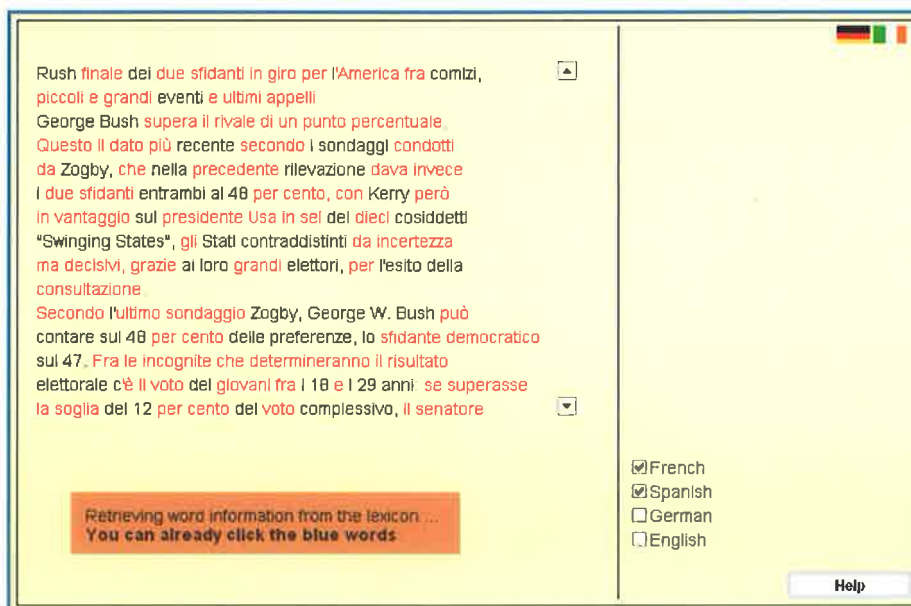


Figure 5.8: Multilingual dictionary tool – upon completion of lookup process

In Step 2, the multilingual dictionary tool sends multiple requests to the server side to retrieve the actual translation information, one request for each sub-lexicon. Through this cascaded data retrieval process, translation information for each sub-lexicon can be sent back immediately to the multilingual dictionary tool. Words for which translation

information is already available change their colour from red to blue (Figures 5.9 and 5.10).

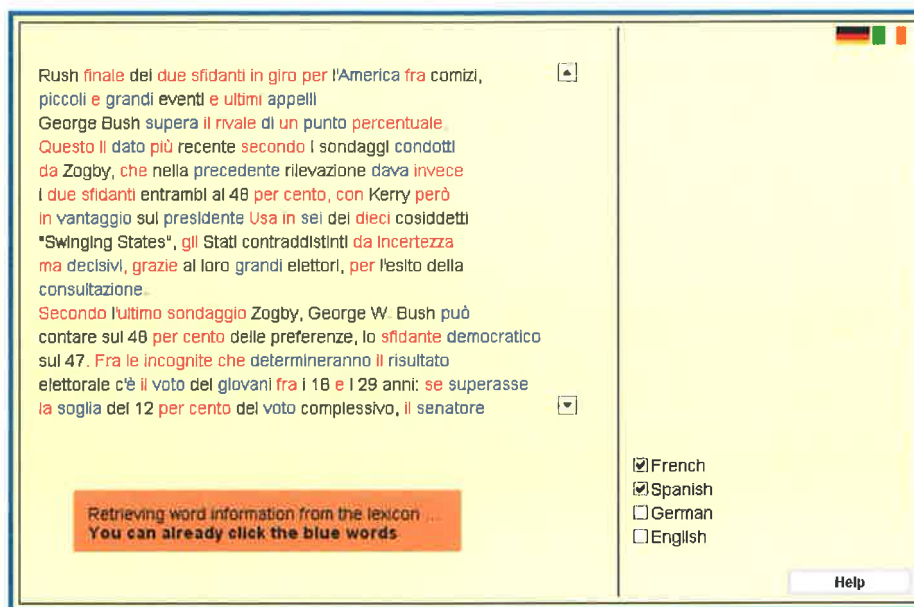


Figure 5.9: Multilingual dictionary tool – during translation retrieval process

Initially, the multilingual dictionary tool was developed for use with the XML version of the multilingual lexicon. Performance tests, however, showed that the XML-based approach was quite slow, especially when executed on a server with ‘normal’ public traffic (as opposed to a dedicated test server). In my opinion, this lack of speed can hinder the acceptance of the dictionary tool among language learners (the XML version was not actually evaluated with language learners). For a Spanish newspaper text with around 450 words and a French newspaper text with 200 words, processing times were measured to compare the XML and the alternative MySQL approaches.¹⁰ Table 5.6 shows that, especially on a busy web server (the most common deployment scenario), the average processing times vary considerably, with the MySQL version being about ten times faster for the data retrieval process of Step 2.¹¹ Due to these enormous differences in speed, only the MySQL version was actually used in the formative and summative evaluation phases. Evaluation participants did not provide any comments on the processing times of the multilingual dictionary tool.

The processing times of Step 1 do not show any significant variance between both

¹⁰The *local server* configuration was running on a Windows XP notebook computer, the *idle web server* only handles requests from members of our research group, the *busy web server* is the web server of the School of Computing at Dublin City University.

¹¹Step 1 and Step 2 in Table 5.6 correspond to Step 1 and Step 2 in Figure 5.7.

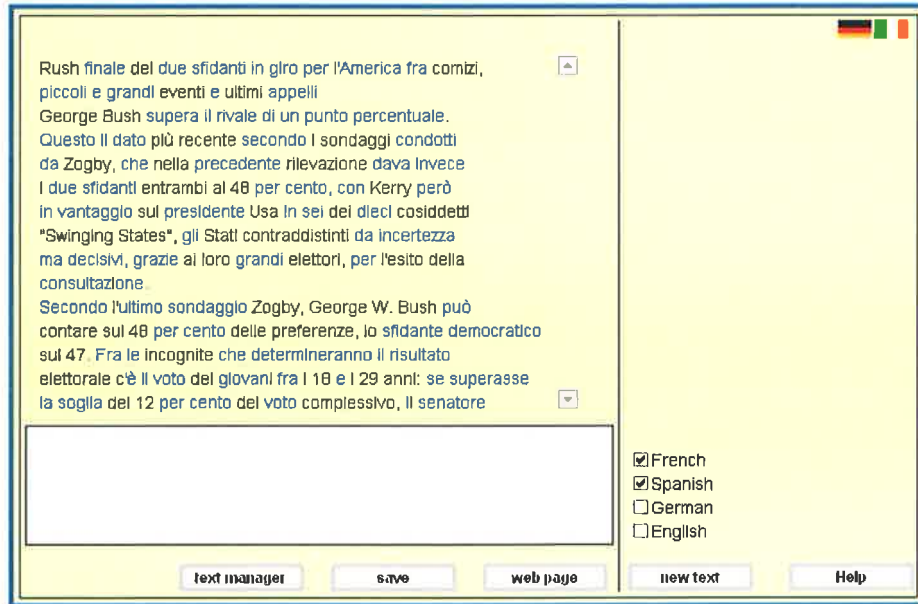


Figure 5.10: Multilingual dictionary tool – end of translation retrieval process

	Environment	Data source	Step 1 (in sec)	Step 2 (in sec)
Spanish text	Local server	XML	5.8	68.9
		MySQL	5.8	15.5
	Idle web server	XML	5.0	21.9
		MySQL	4.7	15.6
	Busy web server	XML	20.6	137.9
		MySQL	19.9	13.2
French text	Local server	XML	3.3	35.7
		MySQL	3.1	7.1
	Idle web server	XML	2.2	10.5
		MySQL	2.2	5.8
	Busy web server	XML	14.0	81.4
		MySQL	14.2	8.6

Table 5.6: Multilingual dictionary tool – performance tests

versions due to the fact that this process does not access any MySQL or XML data. An improvement to speed up the processing times would be the deployment of a Java servlet instead of a PHP file. With Java servlets, the Java Virtual Machine stays up so that data from external files are instantly accessible. Each request is handled by a lightweight Java thread instead of starting a heavyweight operating system process. With a PHP script, a new operating system process has to be started for each request.

The basic structural design of the multilingual dictionary tool is language-independent. It can, therefore, easily be adapted to other languages. It can also be deployed as a special language dictionary or as a definition dictionary. This would only require appropriate language data to be available as XML files or MySQL databases and some minor adjustments would be required in the server-side PHP scripts.

If other languages require a different character encoding, the characters of this language can easily be embedded in the Flash-based dictionary interface. This ensures that the translation information is displayed consistently in different browsers and on different platforms.

5.4.2. Plurilingual Dictionary Tool

The plurilingual dictionary tool is more closely tied to the concept of plurilingual learning of Romance languages than the multilingual dictionary tool (Section 5.4.1) by using specific plurilingual resources and techniques (of the EUROCOMROM project). The plurilingual dictionary tool aims to make learners aware of similar words and profile words between French, Italian and Spanish (cf. McCann et al., 2002: 29ff./133ff.). Similar words as recognised by the tool fall into two groups: Pan-Romance words and words which are orthographically similar and have the same meaning. These groups are not mutually disjoint. Words which belong to the second group can be Pan-Romance words at the same time (like *erreur* - *errore* - *error*, English *error*). However, they can also be part of the international vocabulary of these languages, for example derived from Germanic languages, like *jardin* - *giardino* - *jardín* (English *garden*) or *frais* - *fresco* - *fresco* (English *fresh*) (Berschlin et al., 1995: 80).

Figure 5.11 shows a screenshot of the plurilingual dictionary tool with a French source text (in the top left text field) and the same text with coloured markup for words with plurilingual translation information available (in the bottom left text field).

When clicking on any of the marked words, translation information is displayed in the bottom right text field. Two pop-up windows are opened to give a brief explanation of Pan-Romance and profile words (→ ISO 9241-10, self-descriptiveness).

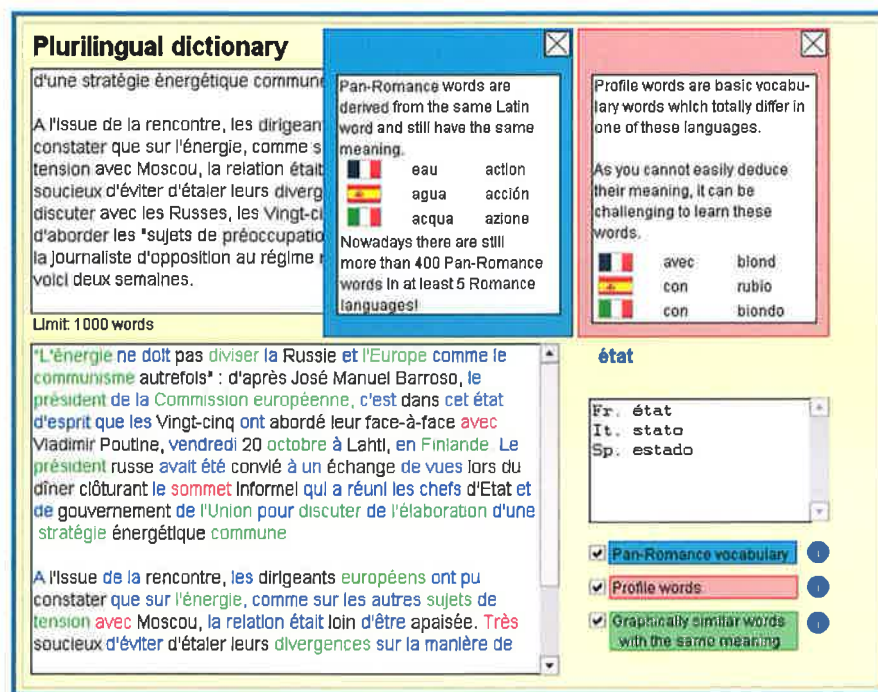


Figure 5.11: Plurilingual dictionary tool

Examples of Pan-Romance words include:

French *eau* - Italian *acqua* - Spanish *agua* (English *water*)

French *utiliser* - Italian *utilizzare* - Spanish *utilizar* (English *to utilise*)

Profile words are those words which are idiosyncratic in only one of the languages and cannot be easily deduced from their graphical form by the learner when comparing them to other Pan-Romance words or the international vocabulary of these languages (McCann et al., 2002: 133). Therefore they may represent an obstacle to the learner. Special emphasis should be put on the proper recognition of these forms to help the learner with the comprehension of a text.

Examples of profile words include:

French *avec* - Italian *con* - Spanish *con* (English *with*)

French *presque* - Italian *quasi* - Spanish *casi* (English *almost, nearly*)

The plurilingual dictionary tool builds upon existing data sources but also dynamically detects similar forms by a combination of existing tools and resources and NLP techniques. This helps to achieve a high word recognition rate¹² and to give as much information as possible to the learner. In order to accomplish this:

1. freely available Part-of-Speech (POS) taggers (Section 4.4.5) perform the task of disambiguation of the dictionary information in context. Therefore, the learner is provided with plurilingual information for the relevant POS of a word.
2. word lists are used for the proper recognition of Pan-Romance vocabulary and profile words.¹³ The Pan-Romance word list contains around 800 words per language, whereas the word list of profile words amounts to 400 words per language. These word lists contain only base forms of the words included. Fortunately, the POS taggers used for the dictionary tool not only indicate the most likely POS for each word, but also act as a lemmatiser by providing the base form for any conjugated or declined word in a text. Therefore, plurilingual translation information can also be provided for conjugated or declined words. This is achieved by looking up the base form (provided by the POS taggers) in the word lists for the Pan-Romance vocabulary and profile words to find the corresponding target language information.
3. a combination of a multilingual MySQL lexicon, sound correspondences and the Levenshtein string similarity measure (Levenshtein, 1966) is used for the dynamic detection of orthographically similar words with the same meaning. These resources are described in more detail in Section 5.4.2.1.

Figure 5.12 shows the two-step plurilingual processing of data on the server (cf. the multilingual dictionary processing in Figure 5.7). After each step, data is sent back to the dictionary tool on the client side so that the learner gets useful information as soon as possible. Words for which no information has been found in Step 1 are stored in a plain text file on the server. The Perl script in Step 2 retrieves the data from this file and tries to find further plurilingual information with the help of sound correspondences and the Levenshtein string similarity measure.

¹²In Figure 5.11 plurilingual information is available for around 67% of the text words.

¹³These word lists were kindly provided as text files by German EuroComRom researchers (cf. McCann et al., 2002: 133ff./218ff.).

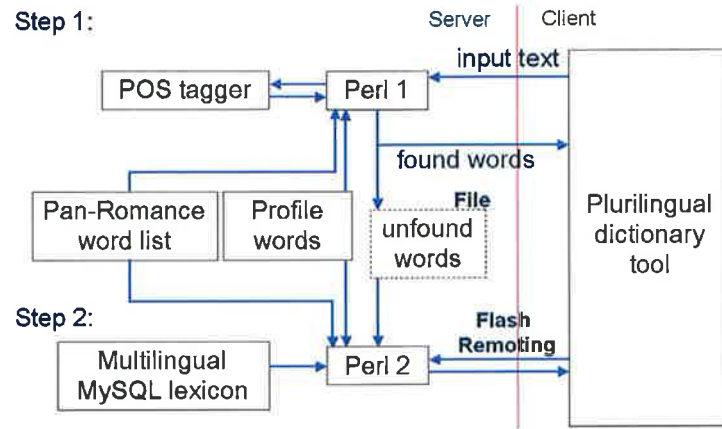


Figure 5.12: Plurilingual dictionary tool – interaction of components

5.4.2.1. Techniques and Resources for the Dynamic Detection of Similar Words

The plurilingual dictionary tool makes use of the multilingual MySQL lexicon created at an earlier development stage of ESPRIT (Section 5.3.1.2).

Following McCann et al. (2002), *sound correspondences*¹⁴ are characters or combinations of characters in one language which today correspond to characters or combinations of characters in other related languages. For example in French, Italian and Spanish the sound correspondences *gn - gn - ñ* and *n - nn - ñ* exist for a number of words:

French *seigneur* - Italian *signore* - Spanish *señor* (English *gentleman*)

French *an* - Italian *anno* - Spanish *año* (English *year*)

The *Levenshtein string similarity measure* determines for each pair of words a ‘distance’ which indicates how different these two words are. This distance corresponds to the minimal number of insertions, deletions, or substitutions of letters in the first word to match the second word.¹⁵

¹⁴McCann et al. (2002) use the term *sound correspondences* although it refers to combinations of characters in written language. They provide a detailed description of these sound correspondences for six Romance languages, including French, Italian and Spanish.

¹⁵For example the English words *kitten* and *kitchen* have a Levenshtein distance of two. Substitute the second *t* in *kitten* by *c*, then insert *h* after *c*.

5.4.2.2. Combining Sound Correspondences with the Levenshtein String Similarity Measure

In the plurilingual dictionary tool, all words of the target languages with the same meaning as the text word (as determined by the translation information provided by the multilingual lexicon) and with a Levenshtein distance of less than or equal to two (to the text word) are displayed. Firstly, the plurilingual dictionary tool automatically determines all words in the target languages which have the same meaning as an input text word by looking up the text word in the multilingual MySQL lexicon. Secondly, the tool calculates the Levenshtein distance between this text word and its possible target language words. Several restrictions were imposed to avoid unreliable results because of an evident lack of similarity: to qualify for display as a similar word, only a distance of less than or equal to two between a text word and a target language word was allowed. Additionally, both words must have a word length of five or more letters.¹⁶

Sound correspondences are used to increase the number of dynamically detected similar words. For example the Spanish word *posibilidad* and the French word *possibilité* (English *possibility*) have the same meaning but their Levenshtein distance is four, i.e. four operations of insertion, deletion or substitution are necessary to get from *posibilidad* to *possibilité*. Therefore, this pair of words would not be automatically selected for display. However, a sound correspondence between Spanish and French exists which states that Spanish nouns ending in *-dad* often correspond to French nouns ending in *-té*. With the help of this sound correspondence, the dictionary tool creates an intermediate form by replacing *-dad* in the Spanish word by *-té* which yields *possibilité*; this form is neither Spanish nor French. The intermediate form acts like an artificial etymon of *posibilidad* and *possibilité*. The dictionary tool then checks this intermediate form (*possibilité*) against the French word *possibilité*. The Levenshtein distance between these two forms is now only one which makes the pair of words, Spanish *posibilidad* - French *possibilité*, eligible for display as orthographically similar words with the same meaning.

The following test results were obtained for the dynamic detection of target language

¹⁶If for example a text word and a target language word are three letters long and have a distance of two, they barely resemble each other like *cat* and *ran* or *top* and *tea*.

words with the same meaning as an input text word and a Levenshtein distance of less than or equal to two between the input text word and a possible target language word (test corpus: 10 newspaper texts in French, Italian and Spanish; average length: 362 words): the plurilingual dictionary tool found on average 69.4 translation pairs (input text word ↔ target language word) per text without using the Pan-Romance sound correspondences. A further 8.8 translation pairs were dynamically detected per text with the help of the sound correspondences.

The process of building intermediate forms is performed automatically for all target words which have the same meaning as the source word, and with all sound correspondences which exist between these languages. However, each sound correspondence is only applied in the location where it actually occurs, i.e. the sound correspondence Spanish *dad* - French *té* is only valid at the end of words. Consequently, this sound correspondence is never used to build intermediate forms from Spanish words which start with *dad* (like *dado*) or which contain *dad* in the middle of the word (like *redada*), thus avoiding the display of erroneous results to the learner.

In my opinion, it makes sense to display the words of the Pan-Romance vocabulary and the ‘orthographically similar words with the same meaning’ in different colours (in blue and green), although in most cases displayed words have both properties:

1. some words of the Pan-Romance vocabulary have changed their graphical form considerably. Therefore it may be difficult for the learner to recognise that those words are actually related to each other. For example the Pan-Romance word pairs French *droit* – Spanish *derecho* (English *right*) and French *conseiller* – Italian *consigliare* (English *to recommend*) have Levenshtein distances of five. They would therefore not be eligible for display as ‘orthographically similar words with the same meaning’.
2. as mentioned in Section 5.4.2, ‘orthographically similar words with the same meaning’ do not automatically belong to the Pan-Romance vocabulary.

5.5. Multilingual Concordancer

A concordancer enables the learner to see how a certain word is used in different contexts. The concordancer properly aligns the search word in each displayed sentence

chunk so that the learner can directly compare which words typically occur before and after the search term (Figure 5.13). The multilingual concordancer developed for ESPRIT provides separate concordances for French, Italian and Spanish, i.e. it does not directly provide parallel concordances. The multilingual concordancer is also able to display words of the same part(s) of speech with a similar meaning in all three languages. The multilingual concordancer deliberately does not state which translation may correspond most to the search word. By subsequently retrieving the concordances for several similar words in the same language (as the search word) or any of the other two languages, the learner has the option to compare the use of these words and make his/her own assumptions about the actual usage of each word.

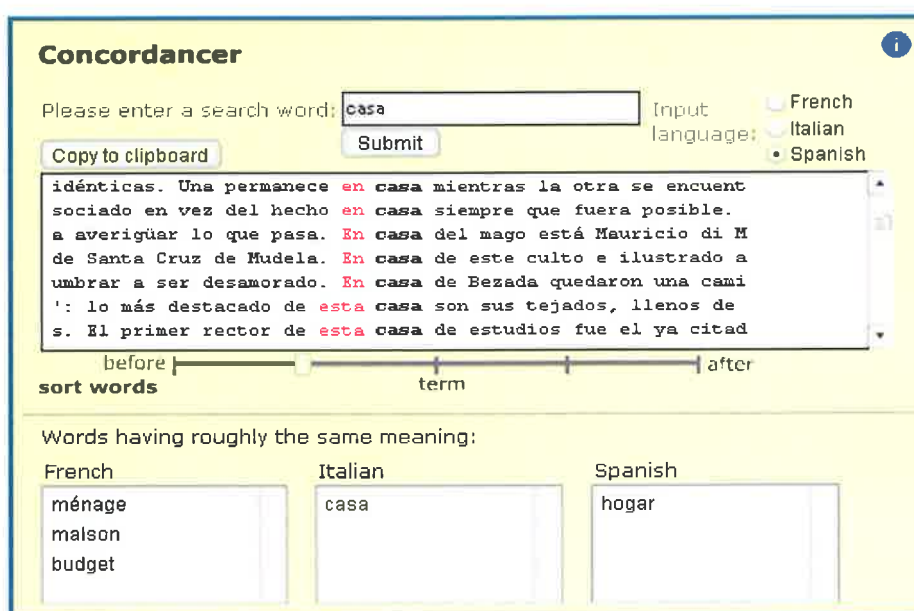


Figure 5.13: Multilingual concordancer

The language database for the multilingual concordancer in ESPRIT are Wikipedia articles (Section 4.4.4). A selection of 5,000 Wikipedia articles per language was used as a language resource for the multilingual concordancer in ESPRIT. This number was set as a tradeoff between performance (i.e. the time required to retrieve a concordance for a search word and to display it in the Flash concordancer tool) and breadth of data. To this end, I created a Perl script which extracts 5,000 articles from the XML file of each language and cleans up the Wikipedia data.¹⁷ The Perl script also created an index file which serves as a table of content for the concordancer. When the learner

¹⁷Wikipedia suggests to its authors to use a fixed set of markup elements to emphasise text elements and to create links to other articles.

submits a search word to the concordancer, the index file provides the index numbers of the articles where the search word can be found. Per search word, up to 200 article references are stored in the index file.

The concordancer provides the following functionality:

- **concordance:** the learner enters a search word and clicks the 'submit' button or presses the Enter key on the keyboard. After processing the input on the server, a concordance with sentence chunks is sent back to the Flash concordancer interface on the client side. The interface displays the concordances found line by line.
- **sort words:** the slider directly below the concordance window provides the option to sort the concordance chunks with regard to the first or second word to the left or to the right of the search word. This enables the learner to directly see which words are typical representatives on the left or on the right side of the search word.
- **copy to clipboard:** the current set of concordances can be copied to the system's clipboard and stored in a text file or printed. The concordances are always copied in the order as determined by the slider position.
- **word in context:** when the learner clicks on any chunk in the concordance output window, a pop-up window displays the whole sentence (or paragraph) of the currently selected chunk.
- **similar words:** the multilingual concordancer tool displays lists of words (in all three languages) which have a similar meaning to the search word. The component first retrieves all possible translations of the search word in German. This list of German translations is then used to find possible translations into French, Italian and Spanish. This functionality is accomplished with the MySQL version of the multilingual lexicon (Section 5.3.1.2).

The multilingual concordancer is designed in a modular and language-independent way. Therefore, it can easily be migrated to other languages or different underlying language data. The only prerequisites are a locally installed Perl interpreter to preprocess and clean up the language data, and PHP on the deployment web server.

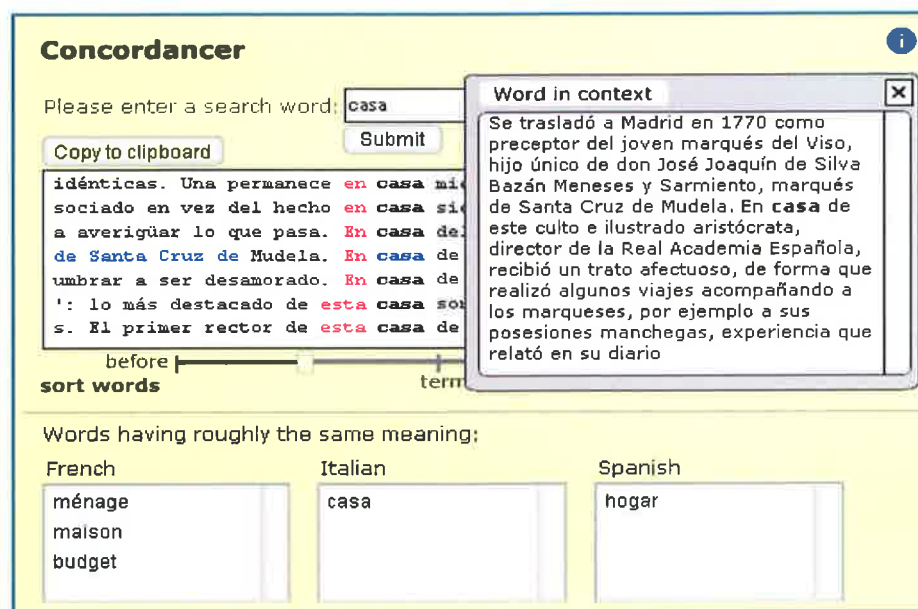


Figure 5.14: Multilingual concordancer – word in context

5.6. Plurilingual Input Analysis and Feedback Module

The plurilingual input analysis and feedback module is able to analyse and provide error feedback on learner input in French, Italian and Spanish and to indicate possible interferences between these languages. The languages are closely intertwined in the input analysis and feedback module so that diverging constructions are recognised and displayed immediately. Special emphasis was given to structures which are ill-formed in one language, but correct in the other languages, therefore often leading to transfer errors.¹⁸ The feedback generated by the plurilingual input analysis and feedback module is linked to animated grammar presentations (Section 5.7) to provide further help to the learner.

Learner input to the plurilingual input analysis and feedback module can range from single phrases (noun phrases, prepositional phrases, adjectival phrases, simple sentences) to paragraphs of simple sentences. The ability to analyse both phrases and paragraphs provides a wide range of options for language learners and for the integration of the input analysis and feedback module on different levels of language-

¹⁸Example: *His house* is translated to French and Spanish by using the appropriate possessive adjective and noun (French: *Sa maison* / Spanish: *Su casa*), whereas in Italian also the definite article has to be used: *La sua casa*.

learning activities: if a learner has just started to learn another Romance language, it may be too difficult at this stage to form a complete input sentence. With the help of the flexible approach developed here, the competence to build simple sentences can be acquired step by step, starting with sub-sentential constituents.

The plurilingual input analysis and feedback module reuses the plurilingual lexicon interface component (Section 5.6.3) and the multilingual verb lexicon interface component (Section 5.6.4) to provide the learner with extensive information about the available lexical data including subcategorisation information for each verb.

5.6.1. Language Processing

A number of technologies were integrated into the plurilingual input analysis and feedback module to support efficient language processing and quick system response times.

Figure 5.15 shows the two-step input analysis and feedback generation process.

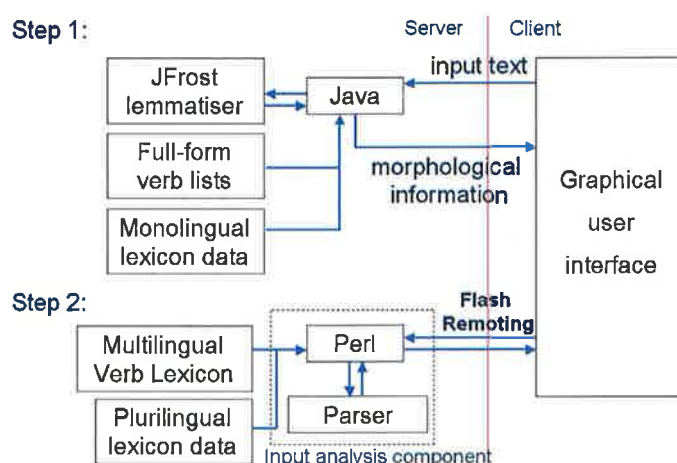


Figure 5.15: Plurilingual input analysis and feedback module – interaction of components

In Step 1, learner input is sent to the server to retrieve monolingual lexical information for all input words. Upon completion of Step 1, the data is sent back to the Flash-based application on the client side. If lexical information is unavailable for any input word after Step 1, the learner is provided with feedback as to which input words have not been found in the lexicon. The learner is asked to modify the input because the plurilingual input analysis and feedback module does not contain methods to handle out-of-vocabulary items.

In Step 2, the data returned in Step 1 is sent to the input analysis component on the

server to perform the actual input analysis.¹⁹ The input analysis component includes an error-sensitive parser. The parser implements a standard bottom-up chart parsing algorithm (cf. Gazdar and Mellish, 1989:200ff.). After parsing the learner input, the input analysis component runs a series of tests to detect learner errors in the successful parsing paths. Steps 1 and 2 are described in more detail in Sections 5.6.1.1 and 5.6.1.2.

5.6.1.1. Step 1 – Retrieving Lexical Information

The JFrost lemmatiser (Section 4.4.6), full-form verb lists (Section 5.3.2) and a monolingual lexicon (Section 5.3.4) are used in Step 1 of the language processing phase to provide monolingual lexical and morphological information for the learner input.

The JFrost lemmatiser is deployed to determine basic lemma information for each input word.²⁰ In general, JFrost is also able to provide extended morphological information for each input word, for example to give information on tense, person or gender. Tests using the currently available version of the JFrost lemmatiser showed, however, that the extended morphological information was not reliable enough to be used automatically in the context of language learning (Section 4.4.6). Therefore another approach was explored to provide reliable morphological information. Full-form verb lists and the monolingual lexicon were successfully tested and deployed to enrich the basic lemma information provided by the JFrost lemmatiser. After retrieving lexical information in Step 1 of the language processing phase (Figure 5.15), the information in Table 5.7 is available for the ungrammatical²¹ simple French sentence:

<i>Je</i>	<i>n'</i>	<i>ai</i>	<i>rien</i>	<i>donné</i>	<i>par</i>	<i>ma</i>	<i>mère</i>
I	not	have	nothing	given	by	my	mother
PRON	NEG	AUX	NEG	PPRES	PREP	PADJ	N

'I didn't give anything by my mother.'

5.6.1.2. Step 2 – Morphosyntactic Input Analysis and Error Recognition

The input analysis component on the server exploits the fact that the verbal group in simple sentences in French, Italian and Spanish has a fixed position and extension,²²

¹⁹Flash Remoting is used to send and receive data between the Flash application on the client side and the Perl script on the server side.

²⁰In ESPRIT, the JFrost lemmatiser is embedded in a Java servlet scenario which supports fast data access and processing times.

²¹The verb *donner* (English *to give*) cannot be followed by the preposition *par*.

²²Unlike for example German where the first verb can appear in second position and the second verb at the very end of the sentence: *Gestern habe ich diesen alten doch immerhin gutaussehenden Mann*

Input word	Base form	Part of speech	Morphological information
<i>Je</i>	<i>je</i>	Noun	
		Pronoun	masculine, first person singular feminine, first person singular
<i>n'</i>	<i>ne</i>	Adverb	
<i>ai</i>	<i>avoir</i>	Verb	present tense, first person singular
<i>rien</i>	<i>rien</i>	Noun	
		Pronoun	
<i>donné</i>	<i>donner</i>	Verb	participle, masculine singular
<i>par</i>	<i>par</i>	Adposition	
<i>ma</i>	<i>mon</i>	Adjective	owner: first person singular feminine possession: third person singular
<i>mère</i>	<i>mère</i>	Adjective	
		Noun	feminine, third person singular

Table 5.7: Plurilingual input analysis and feedback module – information available after Step 1

and contains only certain parts of speech, mainly verbs, adverbs and prepositions (Figure 5.16). Therefore the verbal group can be reliably identified in the parse input and checked for learner errors with simple if-then tests (for example if any finite verb or too many finite verbs are available, or if a word of a certain part of speech is allowed in the verbal group). Consequently, only the remaining parts of learner input sentences have to be parsed against the grammar (those parts are marked by ovals in Figure 5.17). Due to this reduced parsing complexity the morphosyntactic analysis is faster and less error-prone.

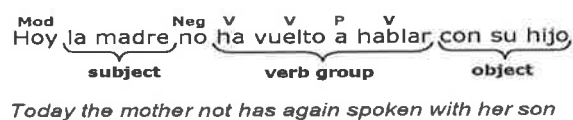


Figure 5.16: Fixed position of constituents in a simple Spanish sentence

The input analysis component recognises learner errors with a combination of error rules (cf. Schneider and McCoy, 1998), constraint relaxation (cf. Menzel, 1992) and post-parsing tests. *Error rules* are inserted into the grammar to anticipate and recognise ill-formed nominal and prepositional phrases. Error rules are flagged in a different way

in aller Frühe bei den Gleisen des alten Bahnhofs mit bedächtigem Schritt spazieren gesehen. (Bright and early yesterday morning, I saw an old yet attractive man walking with a measured step by the platforms in the old train station.)



Figure 5.17: Parse input of simple sentences in Romance languages

in the grammar so that input which was successfully parsed with an error rule can easily be detected after parsing. *Constraint relaxation* implies that a number of agreement constraints (such as gender, number, person) or subcategorisation constraints (such as prepositions required after a certain verb) are not applied during parsing. Constraint relaxation increases the probability that at least one sentence representation can be computed. However, constraint relaxation has to be applied carefully to avoid that too many parses are found. A suite of *post-parsing tests* check the parser output for morphological and syntactic errors, such as agreement within constituents and agreement between constituents which depend on each other (for example the constituents acting as subject and head verb).

The suite of if-then tests to check the verbal group for learner errors can be executed before or after the parsing process. If the tests are executed before parsing, as in the ESPADA system (Koller, 2003), the analysis process can be stopped if any errors were already detected in the verbal group. The errors are then presented to the learner who is asked to amend the input. If the tests are executed after parsing, as in the ESPRIT input analysis component, the analysis module can directly execute tests on the interaction between the verbal group and non-verbal sentence components (such as subject-verb agreement).

Upon completion of all post-parsing tests, the analysis variants with the lowest number of errors are sent back to the Flash-based application to be displayed to the learner.

The input analysis component uses a context-free grammar which does not contain any rules on the sentence level. The grammar contains rules for noun phrases (NP), prepositional phrases (PP) and adjectival phrases (AP). Plurilingual rules apply equally to all three languages, whereas language-specific rules differ for at least one of these

languages (Table 5.8).

	Core rules	Language-specific rules
NP	5	3
PP	2	0
AP	1	0

Table 5.8: Plurilingual input analysis and feedback module – number of grammar rules

The grammar rules are stored in a compact format, with brackets indicating optional constituents (n optional constituents result in 2^n alternative rule expansions):

NP \rightarrow (DET) (NUM) (ADJ) N

At startup, the input analysis component automatically generates all possible expansions of the grammar rules which yields 67 single rules for each language.

A further distinction concerns the “correctness” of grammar rules: proper rules represent valid part of speech sequences in the languages involved. Error rules, in contrast, have been inserted into the grammar to recognise part of speech sequences which are not correct in the languages involved but can occur in learner input of native speakers of Germanic languages. The grammar contains two error rules. One error rule for prepositional phrases applies equally to all three languages, while another error for noun phrases detects parse input which is erroneous in Italian and Spanish but correct in French.²³

The morphosyntactic input analysis and error recognition process comprises six phases (Figure 5.18):

- (I) identifying sentence parts: the input analysis component starts the analysis process by determining all possible verbal groups (VG) in a sentence. The verbal groups can have different extensions due to the fact that a number of words belong to two or more different parts of speech. The input analysis component then continues by performing the complementary task: for each possible verbal group (VG) it finds the sentence parts which precede (left part LP) and follow (right part RP) the verbal group. As a result, the identified sentence parts have the

²³Example: *Mister Smith* translates into French to *Monsieur Smith* and into Spanish to *el señor Smith*. An error rule on the phrasal level ensures that the literal translation *Señor Smith* can be parsed successfully.

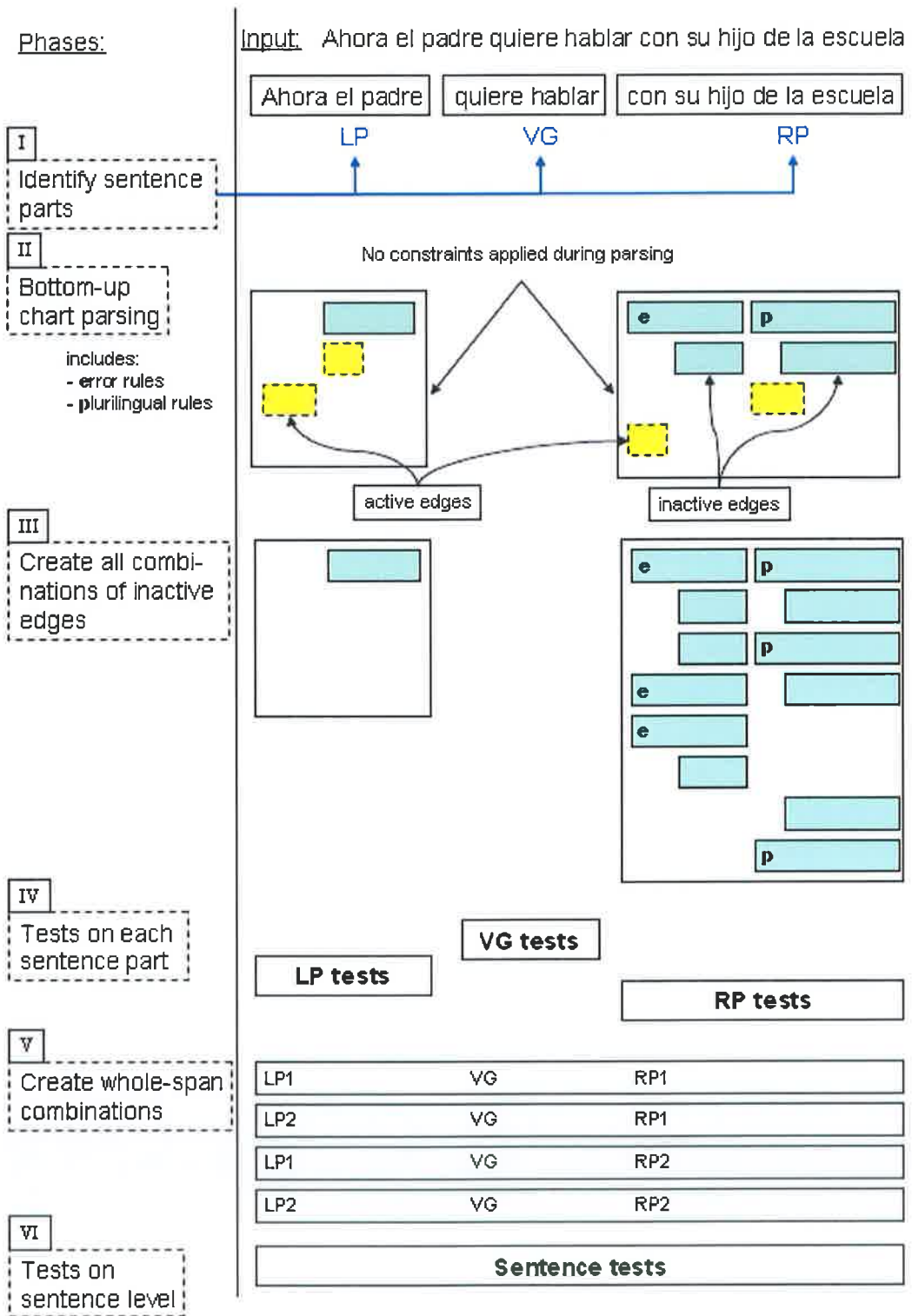


Figure 5.18: Plurilingual input analysis and feedback module – schematic of analysis process

following order: LP – VG – RP. The non-verbal sentence parts LP and RP are the only parts of the input which are actually parsed against the grammar rules.

- (II) bottom-up chart parsing (cf. Gazdar and Mellish, 1989:200ff.): the previously identified sentence parts LP and RP are now separately parsed against the grammar. The bottom-up chart parser uses both proper grammar rules and error rules (error rules are marked by *e* in Figure 5.18) to parse input. Both types of grammar rules can be plurilingual (plurilingual rules are marked by *p* in Figure 5.18) or language-specific. Table 5.9 shows the potential sentence chunks after parsing (i) the LP (*Paulo noi*) and (ii) the RP (*a casa sua per una festa*) of the following incorrect input sentence:²⁴

(0)*Paulo* (1)*noi* [(2)*ha* (3)*invitato*] (4)*a* (5)*casa* (6)*sua* (7)*per*
 Paulo we has invited to house his for
 PN PRON AUX PPRES PREP N PADJ PREP
 (8)*una* (9)*festa* (10)
 a party
 DET N
 ‘Paulo has invited we to his house for a party’

Sentence part	Part span	Chunk span	Phrase type	Part of speech sequence
LP	0..2	0..1	NP	PN
		1..2	NP	PRON
RP	4..10	4..6	PP:NP	PREP, N
		4..7	PP:NP	PREP, N, PADJ
		5..6	NP	N
		5..7	NP	N, PADJ
		7..10	PP:NP	PREP, DET, N
		8..10	NP	DET, N
		9..10	NP	N

Table 5.9: Plurilingual input analysis and feedback module – LP and RP information available after parsing

- (III) creating all combinations of inactive edges: upon completion of the parsing process, the input analysis component creates all possible combinations of non-overlapping inactive chart edges for the sentence parts LP and RP. If a combination of inactive chart edges contains gaps (i. e. if the inactive chart edges

²⁴The learner used the subject pronoun *noi* (English *we*) instead of the object pronoun *ci* (English *us*).

involved do not cover the whole sentence part LP or RP), the input analysis component performs the following steps: (1) for each 'gap word' it retrieves the list of possible parts of speech; (2) for each part of speech of this 'gap word' it creates a new combination variant.

Consider the following example:

(0)la	(1)domenica	(2)scorso	(3)
the/her	Sunday	past	
DET/PRON	N	ADJ	
'last Sunday'			

If a combination of inactive edges (in the LP or RP) only contains an inactive edge from (1) to (2) (a noun phrase which consists of the noun *domenica* – English *Sunday*), the input analysis component creates two part of speech sequences (DET N ADJ and PRON N ADJ) and marks the first and last word as non-constituents (to distinguish it from recognised inactive chart edges).

(IV) tests on each sentence part: the input analysis component runs separate tests on LP, VG and RP. The following incorrect structures and properties are detected by these tests in phase IV of the input analysis:

– verbal group (VG):

- * POS X not allowed in verbal group
- * no finite verb at the beginning of the verbal group
- * finite verb not allowed at this position of the verbal group
- * auxiliary verb can't be used as full verb
- * there is no auxiliary verb in first position (if verbal group consists of more than one verb)
- * verb X can't be directly followed by verb Y (i.e. verb X requires a preposition)
- * verb Y has the wrong verb type after verb X (e.g. infinitive instead of participle)
- * verb X can't be followed by the preposition Y
- * no finite verb available

- * too many finite verbs
- left part (LP):
 - * no isolated adjectival phrase allowed on the left side
 - * incorrect number, type²⁵ or position of pronominal noun phrases
- right part (RP):
 - * pronominal noun phrase on the right side of verbal group
- left part (LP) / right part (RP):
 - * sentence adverb in wrong position
 - * too many noun phrases available
 - * missing agreement inside noun phrase

(V) creating complete sentence combinations: in order to test properties which involve two or three sentence components, the input analysis component creates all combinations of LPs, VGs and RPs.

(VI) tests on sentence level: each LP-VG-RP combination is tested for properties which involve two or three sentence parts. The following incorrect structures and properties are detected by these tests in phase VI of the input analysis process:

- missing agreement between subject and verb
- main verb can't be followed by the preposition X
- incorrect number of noun phrases

Table 5.10 shows the processing times for Step 2, the input analysis phase, which are on average both around 0.5 seconds²⁶ for the following ungrammatical test input in (1) French and (2) Italian:

(1) French test input:

<i>Je</i>	<i>n'</i>	<i>ai</i>	<i>rien</i>	<i>donné</i>	<i>par</i>	<i>ma</i>	<i>mère</i>
I	not	have	nothing	given	by	my	mother
PRON	NEG	AUX	NEG	PPRES	PREP	PADJ	N

‘I didn’t give anything by my mother.’

²⁵Recognised types: subject, direct object, indirect object

²⁶The processing times were measured on the web server of our research group averaged over 10 runs.

(2) Italian test input:²⁷

Dobbiamo passato molto tempo in autostrada.
 [We] Must spent much time on motorway.
 VFIN PPART ADJ N PREP N
 ‘We have to spent a lot of time on the motorway.’

Adesso andare a mangiare qualcosa.
 Now go to eat something.
 ADV VINF PREP VINF ADV
 ‘Now go to eat something.’

Dopo vado a casa.
 Afterwards [I] go to house.
 ADV VFIN PREP N.
 ‘Afterwards I go home.’

	Step 1 (in sec)	Step 2 (in sec)
French example	1.168	0.468
Italian example	2.390	0.488

Table 5.10: Plurilingual input analysis and feedback module – performance tests

5.6.1.3. Related Work

Vandeventer Faltin (2003b) and Reuer (2003) presented two approaches for the recognition of errors in learner input.

Vandeventer Faltin (2003b) developed a French grammar checker for CALL applications which is able to diagnose grammar errors in free learner productions. The input analysis and feedback module of ESPRIT (Section 5.6), in contrast, only allows restricted input (i. e. up to simple sentences and paragraphs of simple sentences).

Vandeventer Faltin (2003b: 198f.) claims that the error diagnosis system of the grammar checker is competitive to commercial grammar checkers. She also believes that her French grammar checker is better suited to language learners than grammar checkers designed for native speakers because of the range of treated errors which are specifically tailored to language learners. Vandeventer Faltin’s grammar checker displays lexical

²⁷In the first sentence, *dobbiamo* is followed by a participle verb form (*passato*). If used correctly, it would have to be followed by an infinitive (here: *passare*). In the second sentence, a finite verb is missing. A finite verb would have to be used instead of *andare*. The third sentence is correct.

and syntactic information in a user-friendly format to help the users to correct their productions.

The grammar checker provides a full syntactic analysis of the sentence and an error diagnosis. It aims to detect specific error types in ungrammatical sentences while still providing full syntactic analysis whenever possible. Vandeventer Faltin used constraint relaxation and phonological reinterpretation as diagnosis techniques.

The constraint relaxation technique was implemented on a large scale system with many constraints relaxed at the same time which enabled the grammar checker to detect and diagnose errors of 14 distinct error categories which implies that a greater number of constraints are relaxed at the same time than in most other error diagnosis systems. Constraint relaxation was used in particular to detect word order errors and verb and adjective complementation errors which Vandeventer Faltin (2003b: 200) claims to be an innovative use for this kind of errors.

Phonological reinterpretation makes use of the sounds of the language. It is based on the principle that sequences that sound alike “do not necessarily share the same spelling, and that a misspelled sequence might sound identical to its correct written form” (Vandeventer Faltin, 2003b: 79). The grammar checker tries to parse a sentence with alternative words which are homophones of the analysis input words. According to Vandeventer Faltin (2003b: 200), it is a much more innovative technique than constraint relaxation.

As a first step, the written word is transformed into its phonological representation. In the second step, a lexicon indexed by phonological pronunciation information is searched for all the words which sound alike. The phonological reinterpretation technique also allows to detect tense and mode errors which cannot easily be detected with other diagnosis techniques.

Vandeventer Faltin adapted and transformed an existing syntactic parser – the Fips parser (Laenzlinger and Wehrli, 1991) – in order to obtain a grammar checker. The input analysis and feedback module of ESPRIT, in contrast, reuses only general parsing algorithms. Vandeventer Faltin (2003b: 201) reckons that the main advantage of reusing a syntactic parser is the work already being accomplished. Therefore, her grammar checker benefits from the grammar and lexicon coverage of Fips as well as from its reliability and robustness. The major drawbacks of adapting an existing parser, in

contrast, are the restrictions of the parser in terms of diagnosis techniques and the complexity of its algorithms and code. Overall, Vandeventer Faltin reckons that the advantages by far outweigh the disadvantages and that only the reuse of an existing parser allowed her to go beyond the toy prototype stage.

Vandeventer Faltin (2003b:207) states that her error diagnosis system can be integrated into a larger CALL software package for the diagnosis of free production exercises. The same applies to the input analysis and feedback module of ESPRIT which can easily be adapted to and integrated into other CALL software packages.

Reuer (2003) developed an anticipation-free parsing method for German which does not contain any information in the lexicon and in the grammar to identify error positions and error types. Reuer restricted error recognition to those areas where errors occur frequently in a learner corpus. Reuer (2003:2) claims that this error recognition method is able to cover main error types and proves to be more efficient for the analysis of 'real' (i. e. unrestricted) input. The input analysis and feedback module of ESPRIT, in contrast, contains anticipated information about error positions and types. This error information is encoded as error rules in the grammar.

The program developed by Reuer (2003:59) creates question-answer-dialogues which require the learner to freely form adequate answers. These dialogues comprise different situations in which the learner has to respond in 'normal' sentences. The learner, for example, has to describe an accident which has been previously been presented graphically.

Reuer's approach is tightly linked to the properties of Lexical Functional Grammar (LFG, Kaplan and Bresnan, 1982). In the constituent structure of LFG, Reuer (2003:100) used a modified Earley algorithm to integrate error hypotheses into the chart. In the feature structure, he deployed a new unification strategy which is able to store information about clashing values.

Reuer (2003:58) strongly believes that a grammar theory which is going to be used in an ICALL system to analyse erroneous input should be able to provide analysis output which can easily be transferred into easily understandable learner feedback on morphosyntactic properties. The input analysis and feedback module of ESPRIT, in contrast, is not based on any particular grammar theory.

5.6.2. Graphical User Interface

The graphical user interface of the plurilingual input analysis and feedback module was developed as a web-based Flash application, which can be easily embedded in any web page. It can also be easily adapted for integration into existing language-learning activities.

Figure 5.19 shows the main screen of the GUI. In the left part of the screen, the learner enters the phrase or sentence(s) to be analysed and selects the input language and the analysis type (phrase, sentence or paragraph). Buttons for each accented character of the input language are placed directly under the input text field. This is useful for learners who do not have the option to directly type accented characters on their keyboard (→ ISO 9241-10, suitability for the task). The plurilingual lexicon interface component and the multilingual verb lexicon interface component can be accessed via buttons in the bottom left part of the main screen. After clicking either button, the corresponding component is displayed on the right side of the main screen. In Figure 5.19 the verb lexicon interface component shows information for the French verb *donner*.

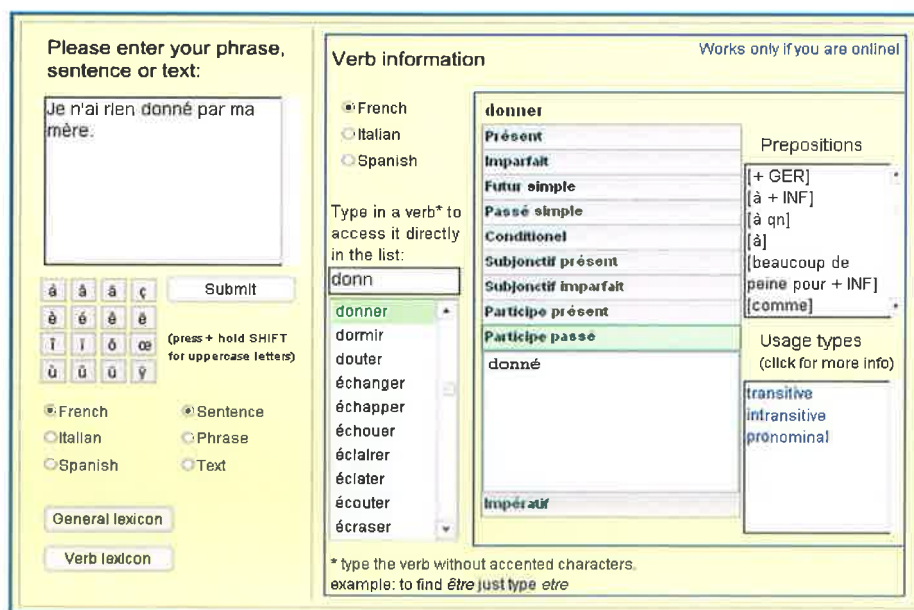


Figure 5.19: Input analysis and feedback module interface – main screen

Figure 5.20 shows the result screen after analysing the incorrect simple French sentence *Je n'ai rien donné par ma mère* (*I didn't give anything by my mother*). The input sentence is displayed in the text field at the top of the screen. Different colours are

used to visualise the syntactic parts (subject, negation adverb, verb group, object) of the input sentence as detected by the input analysis and feedback module. The learner can hide these colours by clicking the button at the bottom of the text field (→ ISO 9241-10, suitability for individualisation).

In the bottom part of the result screen, two text fields provide sentence feedback and plurilingual information. The text field for sentence feedback displays monolingual error feedback which has been detected for the analysis input. The text field for plurilingual information indicates structures which differ between the languages supported by the ESPRIT system. These differences may represent potential obstacles for the successful learning of morphosyntactic structures by means of a negative transfer between these languages.

The result screen provides a shortcut to submit a subsequent input phrase, sentence or paragraph (e.g. a correction of the previous input where the learner responds to the feedback received). If the input language and the analysis type (phrase, sentence or paragraph) remain unchanged, the learner can enter new input in the text field in the bottom left text field (labelled “Your input:”) and then click the button below the text field. If either the input language or the analysis type has to be changed before submitting a new analysis input, the learner can go back to the main screen and select appropriate settings.

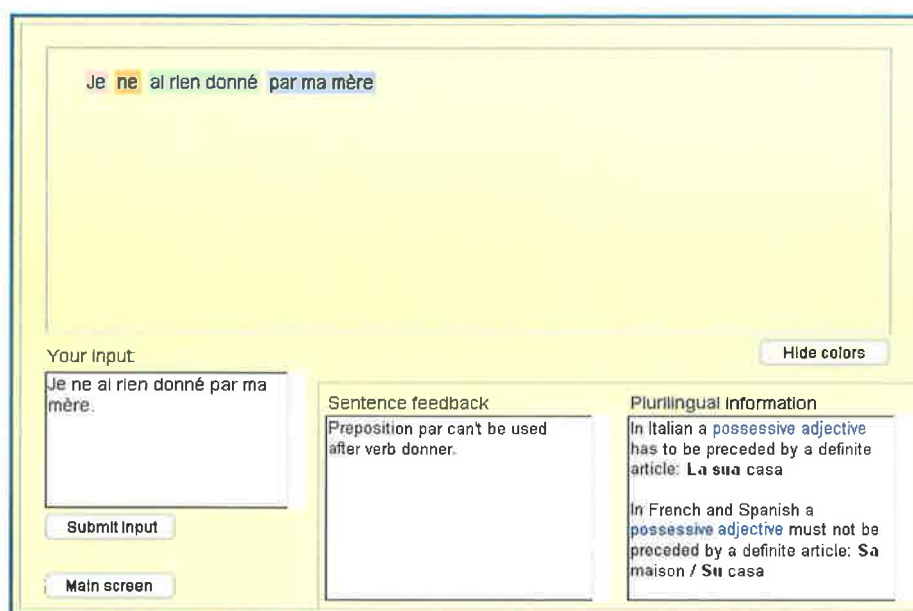


Figure 5.20: Result screen for a simple French sentence

Figure 5.21 shows the result screen after a paragraph of simple Italian sentences has been analysed. The text fields for sentence feedback and for plurilingual information always show the information for the sentence which was last clicked.

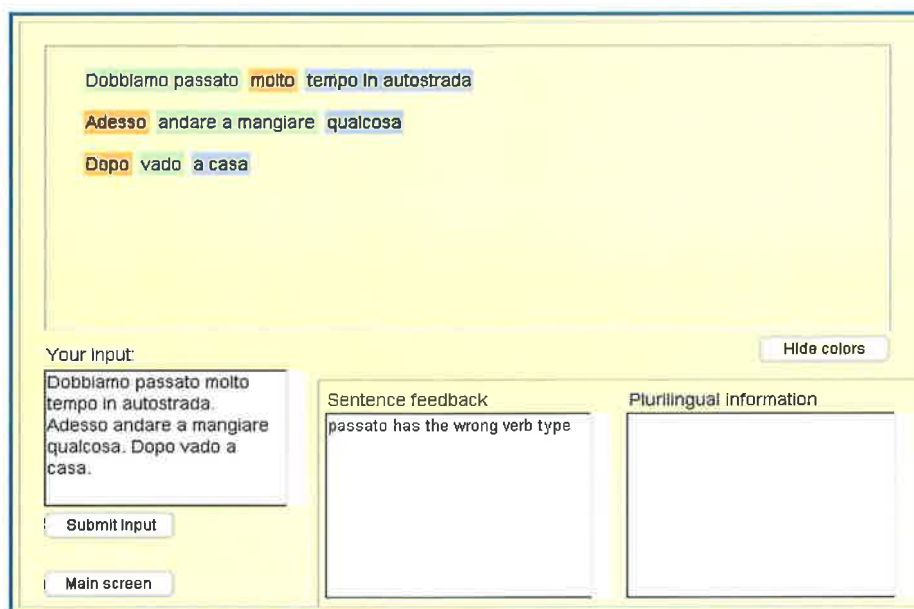


Figure 5.21: Result screen for a paragraph of simple Italian sentences

5.6.3. Plurilingual Lexicon Interface Component

The plurilingual lexicon interface component of the plurilingual input analysis and feedback module makes use of the plurilingual lexicon described in Section 5.3.4. For any French, Italian or Spanish word in the plurilingual lexicon, the lexicon interface component provides translations into the other two languages. It also displays English translations so that the learner can verify if the selected Romance language word has been chosen appropriately. All this information is displayed on the main screen of the lexicon interface component (Figure 5.22).

I integrated a Java-based approach to fully cover the extended lexical information of the plurilingual lexicon. Each lexical unit is stored in a Java object which provides object methods to store complex lexical information.

The WebORB presentation server (Midnight Coders, 2007) is used to send the Java objects directly to the client-side Flash interface via Flash Remoting. With Flash Remoting, there is no need to serialise complex data on the server and to deserialise the data on the client side. On the client side, the data is directly available as a complex

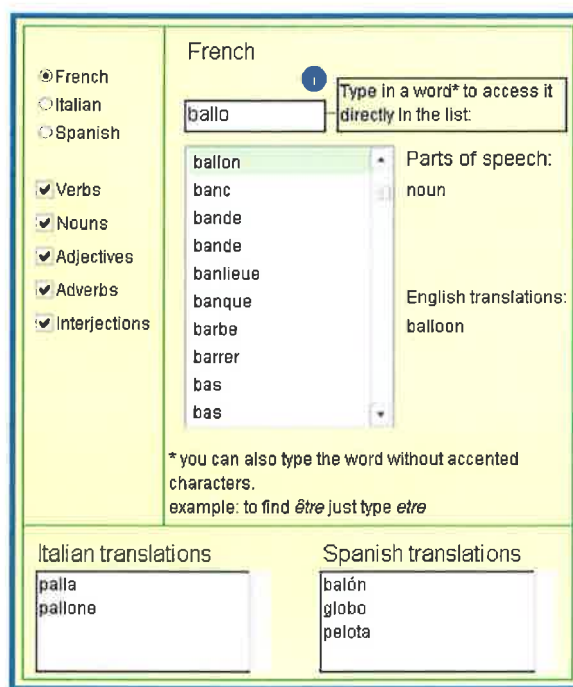


Figure 5.22: Plurilingual lexicon interface component

object, which has exactly the same structure as the Java object on the server.

5.6.4. Multilingual Verb Lexicon Interface Component

The multilingual verb lexicon interface component of the plurilingual input analysis and feedback module displays the information encoded in the multilingual verb lexicon (Section 5.3.1) to the learner. This information comprises verb conjugation tables, information on prepositions and required forms of a possible subsequent verb (like an infinitive required as subsequent verb after *have* in *I have to go*), and information about syntactic usage types (e.g. transitive and intransitive). The Flash Accordion component²⁸ was integrated into the multilingual verb lexicon interface component to display verb conjugation information in a compact format (Figure 5.23).

The multilingual verb lexicon interface component also contains a glossary for syntactic usage types. When the learner clicks on a syntactic usage entry of the selected verb, a pop-up window provides a short explanation for this verb usage type.

When used as standalone modules, the multilingual verb lexicon interface component

²⁸This component is an integral part of the Flash authoring environment since Flash MX 2004 Professional and can be added to any Flash application developed for Flash Player version 7 or above.

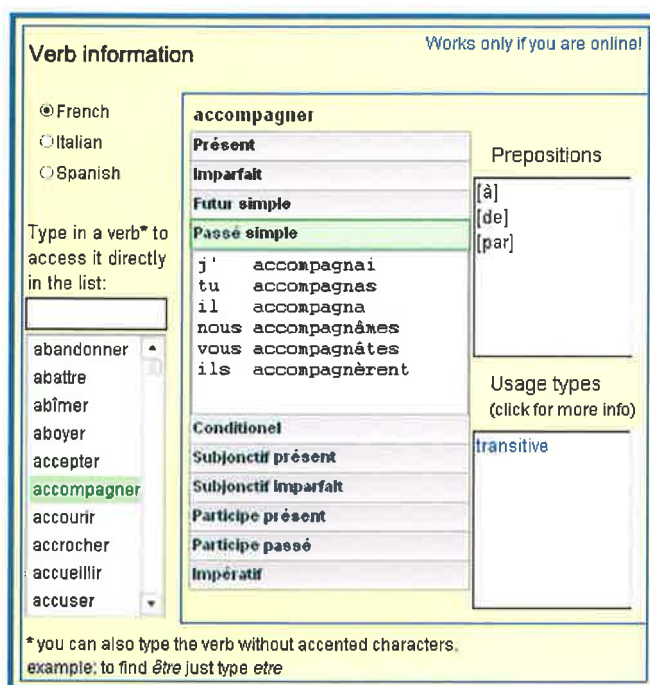


Figure 5.23: Multilingual verb lexicon interface component

and the plurilingual lexicon interface component can easily be displayed on the same web page. This enables the learner to see directly which verbs in French, Italian and Spanish correspond to each other and how each of these verbs has to be used with regard to prepositions, verb forms of following verbs and syntactic usage types.

5.7. Animated Grammar Presentations

For the Demonstration module of the Spanish ICALL system ESPADA (Koller, 2003), I developed several animated grammar presentations to dynamically display syntactic properties of simple Spanish sentences in terms of continually moving 'video' animations. These animations provided only basic control options (play, pause and stop) to the learners and a linear path through each presentation.

The ESPADA animations represented a valuable starting point for further research into the use of animated grammar presentations in ESPRIT. The use of animated grammar presentations for simultaneously teaching several Romance languages is specifically advocated by Klein (2002).²⁹ I developed different types of animated grammar presen-

²⁹Section 2.3.3 provides an overview of the use of animation in previous research projects for language teaching and learning.

tations for ESPRIT, both for monolingual and plurilingual content. These animated grammar presentations were evaluated by English and German native speakers with regard to “effectiveness” and “satisfaction” (ISO-9241-11, 1998). The evaluation results are described in detail in Section 7.3. The animated grammar presentations include different types of animation to visualise morphological and syntactic processes and properties.

On the sentence level, moving text is used to show morphosyntactic processes. The animated grammar presentation in Figure 5.24 visualises the use of adverbial pronouns in French and Italian to replace an indication of place.

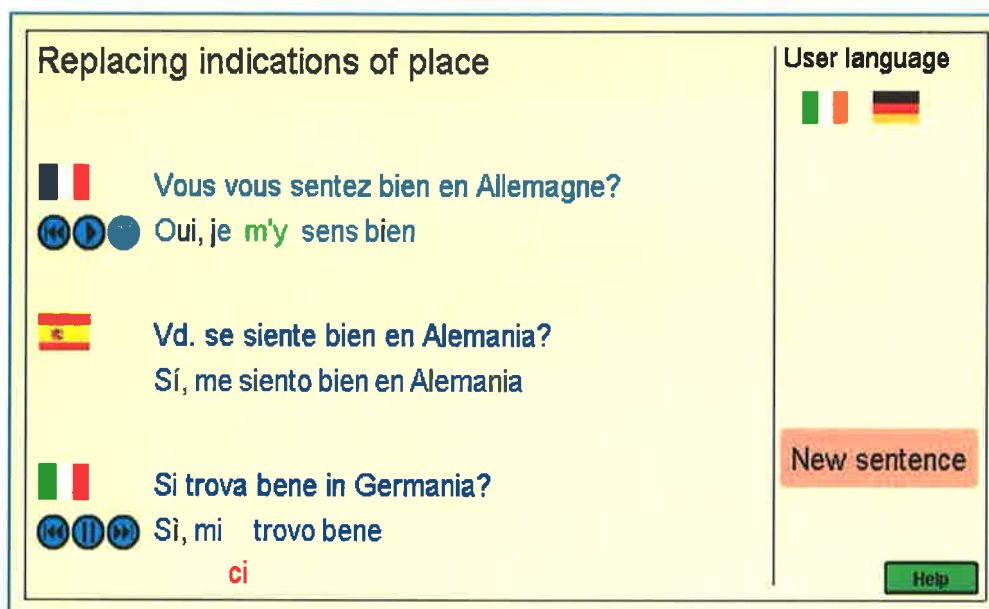


Figure 5.24: Replacing indications of place

Figure 5.25 provides a series of screenshots (stills) of the continuous animation to replace the indication of place *in Germania* (*in Germany*) in the Italian interrogative sentence *Si trova bene in Germania?* (*Are you getting on well in Germany?*) by the adverbial pronoun *ci* (*there*) in the answer.

The animated grammar presentation in Figure 5.26 shows how a subject can be topicalised in all three languages by inserting new text elements in certain positions in the sentence.

Figure 5.27 provides a series of screenshots (stills) of the continuous animation to topicalise the subject *je* (*I*) in the French sentence *Je dois finir cet article* (*I have to finish this article*). *C'est* (*This is*) and *qui* (*who*) are added before and after the subject,



Figure 5.25: Replacing indications of place – animation phases 1 - 6

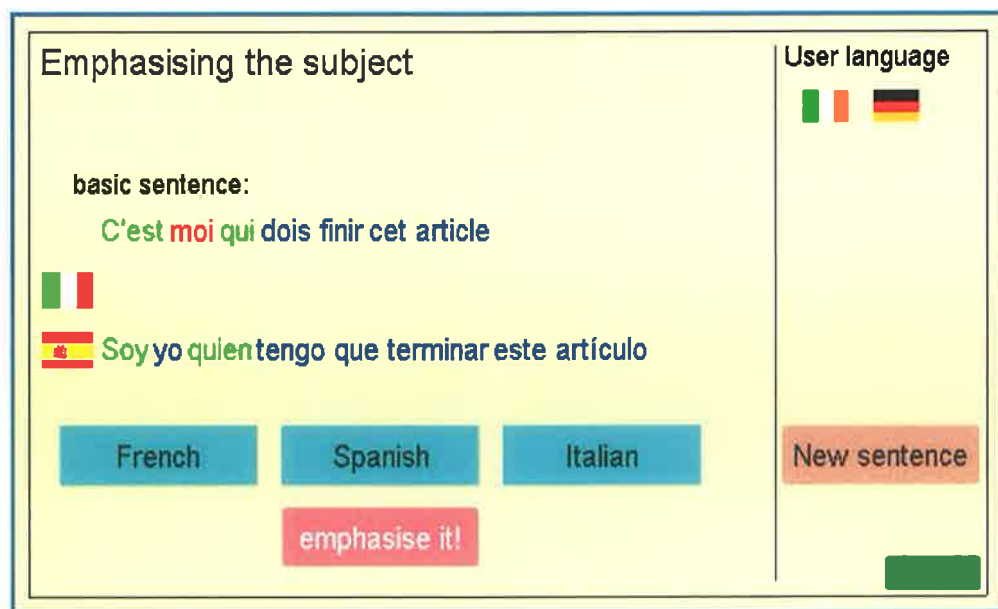


Figure 5.26: Emphasising the subject

and the unstressed subject pronoun *je* (*I*) is replaced by the stressed subject pronoun *moi* (*me*).

I	basic sentence: je dois finir cet article	IV	basic sentence: je dois finir cet article C'est qui
II	basic sentence: je dois finir cet article	V	basic sentence: C'est je qui dois finir cet article
III	basic sentence: je dois finir cet article	VI	basic sentence: C'est moi qui dois finir cet article

Figure 5.27: Emphasising the subject – animation phases 1 - 6

In Figure 5.28 the topicalised sentence is also displayed in Spanish. Clicking the Italian and Spanish language flags in this example toggles the Italian and Spanish translations.

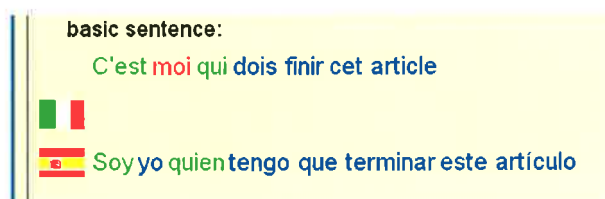


Figure 5.28: Emphasising the subject – toggling other languages

On the morphological level, animation is used to illustrate the process of conjugating, for example, irregular verb forms in the Italian tense *passato remoto* (Figure 5.29). These verb forms are difficult to learn due to the fact that there at least two different verb stems for each verb.³⁰

Figure 5.30 provides a series of screenshots (stills) of the continuous animation to conjugate the (irregular) Italian verb *godere* (*to enjoy*) in the tense *passato remoto* (simple past tense, mainly used in literary language). *godere* has two verb stems for first and third person singular and third person plural and another verb stem for second person singular and first and second person plural.



³⁰Usually one stem is used for the verb forms of first and third person singular and third person plural whereas the second stem is used with second person singular and first and second person plural.

Irregular verbs in *passato remoto*

godere

io	godetti	godei
tu	godesti	
lui/lei	godette	godé
noi	god	
voi	god	
loro	godettero	goderono

giacere
glungere
godere

User language



Verbs
 A B C D
 E F G I
 L M N O
 P R S T
 U V

Translations
 English (Ireland)
 German





 genießen
 to enjoy

Figure 5.29: Irregular verbs in *passato remoto*

I	<p>godere</p> <table border="0"> <tr><td>io</td><td>godett</td><td>god</td></tr> <tr><td>tu</td><td></td><td></td></tr> <tr><td>lui/lei</td><td>godett</td><td>god</td></tr> <tr><td>noi</td><td></td><td></td></tr> <tr><td>voi</td><td></td><td></td></tr> <tr><td>loro</td><td>godett</td><td>god</td></tr> </table>	io	godett	god	tu			lui/lei	godett	god	noi			voi			loro	godett	god	IV	<p>godere</p> <table border="0"> <tr><td>io</td><td>godetti</td><td>godei</td></tr> <tr><td>tu</td><td>god</td><td></td></tr> <tr><td>lui/lei</td><td>godette</td><td>godé</td></tr> <tr><td>noi</td><td>god</td><td></td></tr> <tr><td>voi</td><td>god</td><td></td></tr> <tr><td>loro</td><td>godettero</td><td>goderono</td></tr> </table>	io	godetti	godei	tu	god		lui/lei	godette	godé	noi	god		voi	god		loro	godettero	goderono
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lui/lei	godette	godé																																					
noi	godemmo																																						
voi	godeste																																						
loro	godettero	goderono																																					

Figure 5.30: Irregular verbs in *passato remoto* – animation phases 1 - 6

In a three-dimensional microworld, learner controlled moving coloured balls and a grey box are used to visualise the use of spatial prepositions and verbs of movement (Figure 5.31).³¹

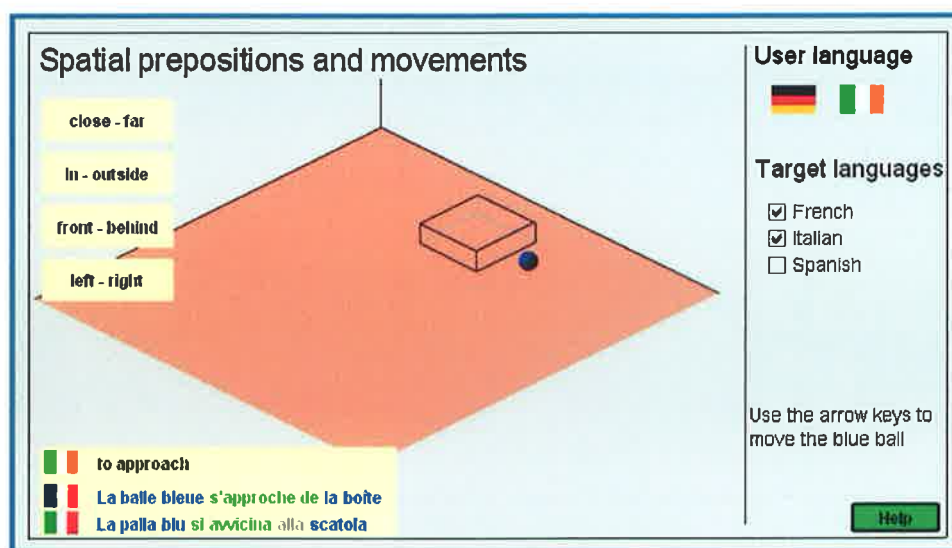


Figure 5.31: Spatial prepositions and verbs of movement

Figure 5.32 displays the French and Spanish translations of the verbs *to approach* and *to enter* when the blue ball is moved towards the grey box with the arrow keys by the learner.

Figure 5.33 displays the French and Spanish translations for the pairs of prepositions *close - far* and *in - outside*.

5.7.1. Interactive Elements

The animated grammar presentations contain a high number of interactive elements (→ ISO 9241-10, controllability). The following elements support direct control over animated content:

- a draggable progress bar in the presentation on irregular Italian verb forms (Figure 5.29) not only shows the progress of the animation but also provides a two-fold functionality to control the animation: by clicking on any point of the progress bar, the animation jumps directly to the corresponding point. If the learner drags the progress bar (while holding pressed the left mouse button), the anima-

³¹ *Spatial prepositions and verbs of movement* are used to describe positions and movements in space such as *in front of* and *move towards*.

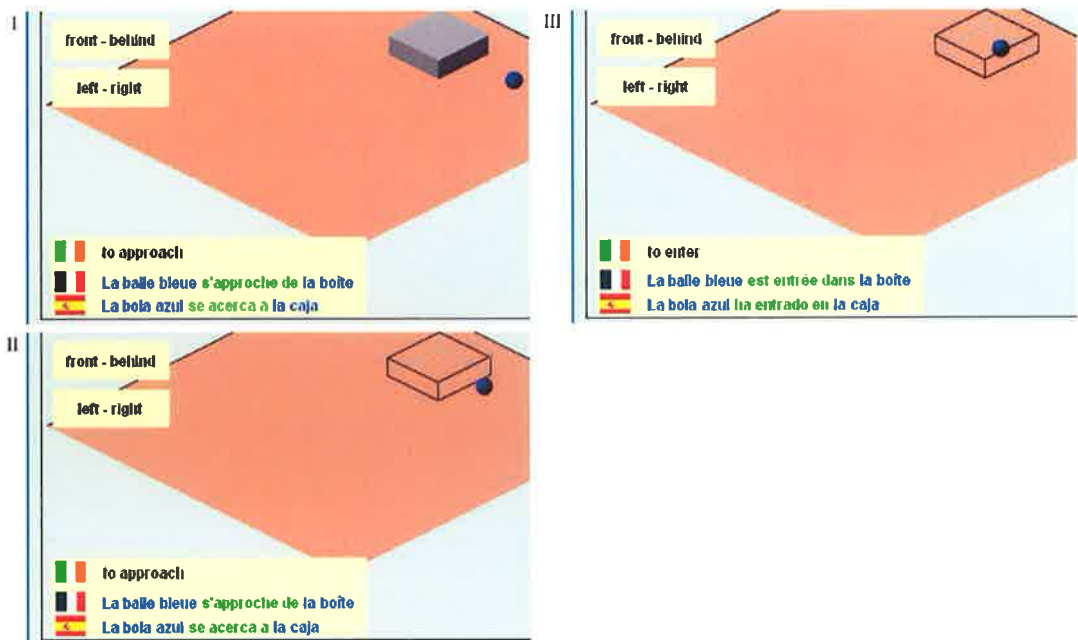


Figure 5.32: Verbs of movement – animation phases 1 - 3

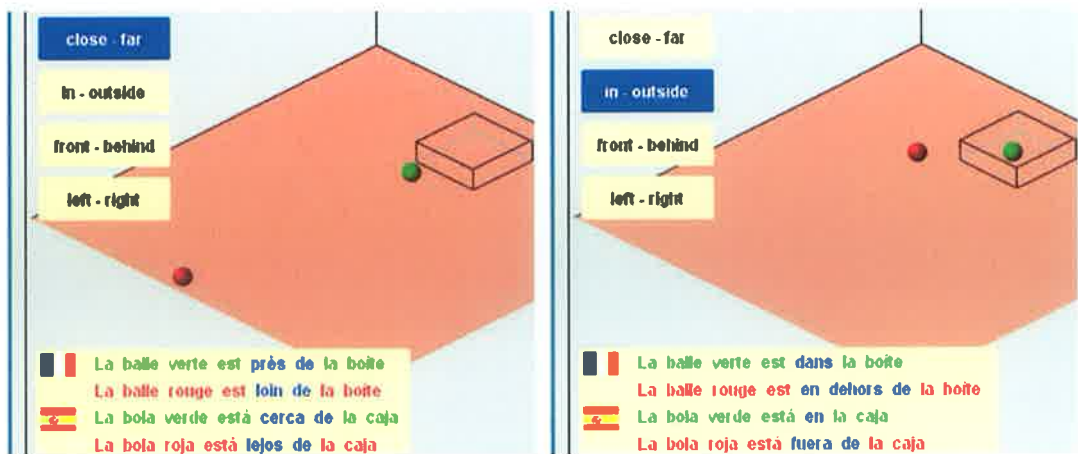


Figure 5.33: Spatial prepositions – close - far / in - outside

tion moves forward or backward, depending on the dragging direction (→ ISO 9241-10, controllability).

- buttons labelled with pairs of prepositions (like *close – far*, *left – right*) are used in the presentation on spatial prepositions in the three-dimensional microworld presentation (Figure 5.31). By clicking on one of these buttons, a green and a red ball appear on the screen. The position of these balls in relation to a grey box visualises the usage of the selected prepositions.
- in the three-dimensional microworld presentation (Figure 5.31) the arrow keys on the keyboard can be used to move around a blue ball. The movement of this ball in relation to the grey box is being tracked to display the appropriate verb of movement. When the ball is stopped, the language information for the last verb of movement remains on the screen so that the learner can read this information at their leisure.
- several types of playback buttons were developed and evaluated with language learners (for evaluation results see Section 7.3). In the presentation on the use of adverbial pronouns (Figure 5.24) four playback buttons are used: two buttons for play and pause and two skip buttons to directly get to the beginning or the end of the current example. The buttons in this presentation have a context-dependent behaviour (→ ISO 9241-10, suitability for the task). The play and pause buttons are never visible at the same time. The play button is visible when the presentation is stopped, and the pause button is visible while the presentation is running. If the action assigned to a skip button is not logical in the current situation, the skip button is dimmed and cannot be clicked.³²

In the presentation on the topicalisation of the subject (Figure 5.26) there is only one playback button. The presentation starts when the button labelled *emphasise it!* is clicked. This button becomes active after a basic sentence has been selected in one of the three languages.

In the presentation on irregular Italian verb forms (Figure 5.29), six playback buttons are active at any one time: play, pause, skip to the beginning/end, fast

³²For example the skip button which moves the presentation to the beginning cannot be used when the presentation is already at the starting point.

forward and fast rewind. Combined with the draggable progress bar described earlier, this range of buttons provides a wide range of playback control in this presentation.

5.7.2. Options for Customisation

Further elements were integrated into the animated grammar presentations to customise the interface and to support easy selection of content data:

- interface language: English and German are available in all presentations as the interface language. By clicking the appropriate language flag, all interface labels and help texts are changed immediately. Language flags for the selection of interface languages are often used on web sites (→ ISO 9241-10, conformity with user expectations).
- selecting/deselecting translation languages: in the presentation for the topicalisation of the subject (Figure 5.26), the learner can select the language for the sentence animation. After the animation has finished, the learner has the option to display the corresponding sentence in either of the other languages as a direct comparison. In the presentation on spatial prepositions (Figure 5.31), the translation languages can be selected and deselected at any time by ticking the appropriate checkboxes (→ ISO 9241-10, suitability for individualisation).
- each animated grammar presentation contains a help button to access help contents at any time (→ ISO 9241-10, self-descriptiveness). The help window can be dragged to any place of the presentation. Interactive elements which are partially or fully hidden by the help window cannot be selected.

The language content and the interface labels of all the animated grammar presentations are stored in separate XML files. Therefore new data, such as further sentence examples, can easily be added without the need to recompile the Flash-based presentation file.

5.8. Authoring Tool for Learning Materials

The development process of tailor-made animated grammar presentations described in Section 5.7 showed that their creation is very time-consuming and requires a high

level of technical and programming skills in animation-based application development. Each tailor-made animated grammar presentation required about one week of full-time development, including the creation of content data and the testing and deployment on the server. Therefore, I decided to develop an authoring tool which provides teachers (and potentially learners) with a means to quickly and easily create animated text for integration into learning materials.

The authoring tool is language- and topic-independent, i.e. it can be used to convey any information to language learners. It can be used to easily create ‘parallel materials’ with or without animated text to enable evaluation of the benefits of animated content compared to non-animated content.

5.8.1. Modules

The authoring tool has three different modules: a content manager, a topic selector and a presenter module (Figure 5.34). The content manager and the topic selector are exclusively used for the creation of learning materials, while the presenter module presents the content to the learner and displays the created content at authoring time.

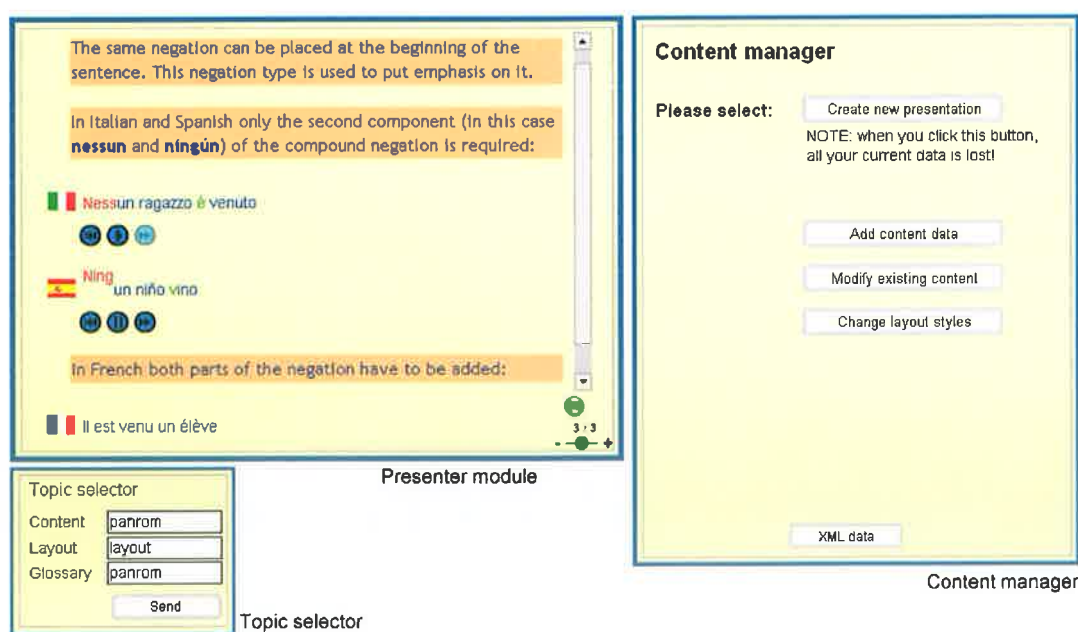


Figure 5.34: Modules of authoring tool for learning materials

The modules are created as Flash .swf files so that they can be integrated into any static or dynamic web page. Other variants which can be used to work with these modules are standalone Windows .exe files. In both cases all the accompanying data

(layout files, content files, etc.) have to reside in the same directory as the modules of the authoring tool. When embedded in a web page, the selection of XML source files is controlled by so-called *FlashVars* in the HTML source code. To select a non-default XML file for content, layout and glossary data,³³ a corresponding variable-value pair has to be added to the HTML source code. With this variable-driven approach, several instances of the presenter module can be embedded in the same web page, each instance with a different set of content, layout and glossary data. The presenter module can also be embedded in another Flash *.swf* file.

The modules communicate with each other via the Flash *LocalConnection* class. The *LocalConnection* class enables communication between Flash applications which run on the same computer but in different browsers, or as standalone applications. Using this approach, the modules of the authoring tool do not have to reside in the same Flash *.swf* file. There is, therefore, no need to develop two versions of the presenter module, one to create content and the other to present it to the learner.

The *content manager* supports adding, deleting or replacing content data and provides the option to modify layout styles. The content manager also automatically creates XML data for the content and layout of learning materials. This data has to be saved at the end of the content creation process into separate XML files so that it can be used at a later stage to present the learning content. The *topic selector* is used to easily switch between different XML input files for content, layout and glossary at authoring time. The *presenter module* is used at authoring time to display the current stage of content, layout and glossary data. At run-time it presents the learning content to the learner.

The presenter module has several options to integrate interactive elements and to emphasise information units:

- any information chunk of the content can be linked to a glossary file to provide additional information (like definitions). By clicking the created link, a pop-up window displays the additional information. The text in the pop-up window can be marked up via HTML tags.
- any static text displayed in the presenter module can be marked up via a fixed set

³³Default names are *content.xml* for content data, *layout.xml* for layout data and *glossary.xml* for glossary data.

of HTML tags or via custom element types. The CSS (Cascading Style Sheets)³⁴ definitions of these custom element types have to be stored in an external CSS file.

- animated text can be added via a very simple procedure. Only the different phases of the animated text have to be indicated. The presenter module automatically ‘calculates’ the animation and adds animation buttons.

If, for example, the following text animation is to be created:

1. initial text: *the house*
2. then *red* appears and moves between *the* and *house*
3. finally *is burning* appears and is added at the end of the text

then the (only) animation information to be entered in the authoring tool has three phases:

Phase 1: *the house*

Phase 2: *the red house*

Phase 3: *the red house is burning*

There is one important restriction when entering the different phases of animated text: from one phase to the next phase only one text block can change. For example, the following cannot be used as consecutive phases:

Phase 1: *the house*

Phase 2: *now the red house*

In this example, from one phase to the next phase, *now* and *red* have been added. However, these words do not form a block (*the* is in between them). To solve the problem, three phases have to be used altogether, one phase for *the house*, one phase to add *now* and another phase to add *red* (the last two phases in any preferred order).

From one phase to the next phase the content developer can delete a block, add a new block or replace a block with a new block. It does not matter if the block to be

³⁴Cascading Style Sheets are used to visually format element tags of an HTML or XML document.

changed coincides with word boundaries. For example the following phases do not pose any problems:

Phase 1: *my brothers don't like football*

Phase 2: *my sister doesn't like football*

The presenter module supports two different options to navigate between slides:

- the learner can click buttons to get to the previous or next slide. No navigation buttons are displayed if the current presentation has only one slide.
- the presenter module displays the current page number and the overall page number. The learner can directly access any slide of the presentation by clicking the page number display (which becomes highlighted) and then typing the desired page number on the keyboard.

The authoring tool proved to be very useful for the production of slide-based learning materials for ESPRIT, for example for the creation of user evaluation materials in Section 7.4.3. With the help of the authoring tool, the content development process required about one day's work for one single topic.

5.9. Summary

In this chapter, I have described the components developed for ESPRIT, starting with the graphical user interface which provides access to the language tools. I have presented several types of reusable multilingual and plurilingual language resources which I created from existing language resources. I have described in detail the properties of each ESPRIT language tool and indicated which options each language tool provides to the learner. Tools include a multilingual dictionary tool and plurilingual dictionary tool, a multilingual concordancer and a plurilingual input analysis and feedback module. The chapter also contains descriptions of a plurilingual lexicon interface component and a multilingual verb lexicon interface component. I have explained the development of tailor-made animated grammar presentations and presented an authoring tool for the creation of slide-based learning materials. I have shown how animated text can easily be created with the authoring tool. I have consistently made reference to the

ISO 9241-10 standard for software interface design by showing how the principles of the ISO 9241-10 usability standard apply to single components of ESPRIT.

6. Testing and Implementation

6.1. Introduction

This chapter describes the testing of ESPRIT tools in a local server environment and the subsequent implementation of ESPRIT tools on a remote web server. A number of problems which were encountered during testing and implementation stages and the solutions to overcome these problems are described.

Section 6.2 provides details about the testing of ESPRIT tools on a local server environment and the implementation of ESPRIT tools on a remote web server. Section 6.3 describes problems experienced with diacritical characters of French, Italian and Spanish. The section provides information about different character encoding systems and presents a pragmatic approach to store, transfer, process and display diacritical characters correctly across different implementation technologies. Section 6.4 details unexpected behaviour of the TreeTagger tagging software and explains the solution applied. Section 6.5 deals with a problem which occurred with Internet Explorer when AMF::Perl (Flash Remoting for Perl) was used as server-side technology for language processing. Section 6.6 summarises the testing and implementation of ESPRIT components.

6.2. Local Testing and Implementation on a Remote Web Server

Before implementing ESPRIT tools on a remote web server, I tested the tools in the *local server environment* XAMPP¹ (Apache Friends, 2007). A local server environment is a software configuration which simulates a client-server scenario equivalent to the World Wide Web. The local server environment is installed on a desktop or laptop computer. Testing in a local server environment does not require an Internet connection or the upload of web application files to a remote web server. The testing process runs

¹XAMPP stands for Apache, MySQL, PHP, Perl.

completely on the local computer,² which enables software testers to recognise and fix software failures before uploading web applications to a remote web server.

XAMPP provides an Apache-based local server environment which can be downloaded for free.³ XAMPP has proven to be very useful for the following reasons:

- it can be easily installed and uninstalled. For a standard installation it is not necessary to edit any configuration files.
- XAMPP offers a simple mechanism to switch between PHP 4 and PHP 5. This feature is very useful due to the fact that on many web servers PHP is not yet upgraded to version 5.
- a Tomcat extension can be downloaded and easily installed to run with XAMPP. The plurilingual input analysis and feedback module (Section 5.6) requires a Tomcat server for several sub-components to work properly.
- XAMPP is available for Linux, Windows, MacOS X and Solaris, and this facilitates the testing of software components on different platforms. I tested ESPRIT components in Windows and Linux local server environments.

After testing ESPRIT tools locally, I implemented each ESPRIT tool on a remote web server. Initially, all the tools were implemented on the general web server of the School of Computing at Dublin City University. However, online testing repeatedly showed slow processing times. It often took up to one minute to complete a memory-intensive request (for example operations involving the XML version of the multilingual dictionary tool) and some running processes were even cancelled after a server-internal application time limit had been reached. The unsatisfactory performance results were one of the factors which led to the decision in our research group to set up and run a dedicated server for the research group. Implementing the ESPRIT tools on the dedicated server led to a significant improvement in performance results and to constant and reliable system response behaviour.

²A normal web browser like Firefox or Internet Explorer is used to access web applications in a local server configuration. The most common URLs to access local web applications are `http://localhost` and `http://127.0.0.1`, depending on the operating system and the local server configuration.

³<http://www.apachefriends.org/en/xampp.html>

6.3. Diacritical Characters

The main implementation problem across several ESPRIT language tools and resources was the handling of diacritical characters in French, Italian and Spanish. The implementation technologies used for ESPRIT – Flash/ActionScript, Perl, PHP, Java, XML and MySQL – exhibit markedly different implementations of diacritical characters.

Diacritical characters in French, Italian and Spanish use the acute or grave accent, tilde, circumflex, dieresis, cedilla or ligature to distinguish accented characters from unaccented characters. Examples are *à* (grave accent), *é* (acute accent), *ñ* (tilde), *â* (circumflex), *ë* (dieresis), *œ* (ligature) and *ç* (cedilla). Diacritical characters do not form part of the ASCII character set. The ASCII character set represents the basic character set in Western computer systems and contains 128 different characters (including the unaccented characters *a-z* and *A-Z* and the digits *0-9*).

The ISO 8859-1 standard is an extension to the ASCII character set. The ISO 8859-1 standard defines a character repertoire which contains nearly all the diacritical characters in French, Italian and Spanish. The Windows-1252 character set is a superset of the ISO 8859-1 character set with the addition of 27 letter characters in locations where the ISO 8859-1 character set contains control codes. The main difference between Romance characters in the ISO 8859-1 and Windows-1252 character sets are the code numbers for the French characters *œ* and *Œ*, which are not included in the ISO 8859-1 character set.

Both character sets – ISO 8859-1 and Windows-1252 – can be used to encode diacritical characters in the format *ℳ#ddd;* where *d* stands for a digit (for example *à* can be encoded as *ℳ#224;*). Table 6.1 shows how the diacritical characters are represented as ISO 8859-1 character codes, Windows-1252 character codes and ISO 8859-1 HTML entity names. The latter can be used in HTML markup to represent diacritical characters.

ISO 8859-1 HTML entity names cannot be used by ESPRIT to handle diacritical characters. Most of the implementation technologies used in ESPRIT (for example Flash and PHP) do not handle named HTML entities as encoded characters, but treat them as a string which starts with an ampersand, contains a number of letters, and ends with a semicolon. ISO 8859-1 character codes and Windows-1252 character codes,

Description	Character	ISO 8859-1	Windows-1252	HTML entities
small a grave	à	224	224	à
small a circumflex	â	226	226	â
small c cedilla	ç	231	231	ç
small e acute	é	233	233	é
small e dieresis	ë	235	235	ë
small n tilde	ñ	241	241	ñ
small oe ligature	œ	339	156	œ

Table 6.1: Character encodings for some Romance diacritical characters

on the other hand, lack interoperability due to the different handling of the French characters *æ* and *œ*. Language tools are therefore not automatically portable across platforms and implementation technologies.

Unicode is often described as a comprehensive solution to the character set problem (cf. Unicode Consortium, 2007). Unicode is an industry standard which is able to encode the character sets of a wide range of written languages in a consistent way by assigning a prefix and a combination of hexadecimal characters (e.g. the character à has the Unicode code point U+00E0). Several Unicode Transformation Formats (UTF) are used to encode characters:

- UTF-8 (8-bit Unicode Transformation Format) is a character encoding for Unicode. It is able to represent any universal character in the Unicode standard. UTF-8, for example, is the preferred standard for XML files which contain diacritical characters and for data imported into Flash files.
- Java, on the other hand, uses an encoding which is called *modified UTF-8*. It uses UTF-16 for its internal text representation and supports a non-standard modification of UTF-8 for string serialization.
- further examples of UTF encodings are UTF-7, UTF-32 and UTF-EBCDIC.

Intensive testing showed that the implementation technologies used for ESPRIT do not provide a common and consistent way of handling Unicode encoded strings. The handling of strings with Unicode encoding differs considerably in Perl, PHP and Java, including how strings are matched with regular expressions. PHP, for example, does not have native support for Unicode. PHP only contains a number of functions which

allow to indicate a character set (such as UTF-8) as well as functions which are able to convert from and to UTF-8.

Further problems arose when two interacting implementation technologies did not use the same character set on their respective platforms, i. e. one technology using the ISO 8859-1 character set and the other technology using the Windows-1252 character set.

I had to check manually whether the number codes for the characters *æ* (converting 339 to 156 and vice versa) and *œ* (converting 338 to 140 and vice versa) had to be converted depending on the character sets used by the implementation technologies used for a certain ESPRIT tool. In the case of differing character sets it was necessary to include methods (or functions⁴) in the programming code to detect and convert the encoded *æ* and *œ* characters.

Eventually, I decided to use a less elegant but nonetheless effective way to solve the character encoding problem: instead of using any of the previously described encodings, I masked diacritical characters with a combination of characters which did not carry any special meaning for any of the technologies involved. I used the encoding style of the ISO 8859-1 and Windows-1252 character sets, but replaced the initial characters *æ*/*œ* by a double asterisk **, resulting in the encoding examples shown in Figure 6.2:

Character	ISO 8859-1 encoding	Windows-1252 encoding	workaround
à	à	à	**224;
â	â	â	**226;
ç	ç	ç	**231;
é	é	é	**233;
ë	ë	ë	**235;
ñ	ñ	ñ	**241;
œ	œ	œ	**156;/**339;

Table 6.2: Character encodings – workaround

Using this approach, language data was masked when it was being stored or exchanged between different implementation technologies. If language data had to be matched against regular expressions or displayed to the user, customised substitution functions transformed the masked units into the corresponding diacritical characters.

⁴In procedural programming, a *function* represents an encapsulated portion of code which can be reused easily. The naming convention in object-oriented programming uses the term *method* if it represents a function which is called on an object, either on an instance of the object or on the object itself.

6.4. Handling Inconsistent Tagger Output

The plurilingual dictionary tool (Section 5.4.2) relies on the TreeTagger (Schmid, 1994) to deliver information on the most likely POS for each input text word. Intensive testing showed that the French language version of the TreeTagger tokenised certain combinations of characters in a different way than the Italian and Spanish language versions. The French tokenisation result was non-trivial to relate to a tokenised version of the input. The tagger output and the input text, however, had to be fully matched against each other by a server-side script of the plurilingual dictionary tool to retrieve the tagger information.

Examples for this tokenisation changes were:

‘50 %’ is automatically transformed to ‘50%’

‘6 000’ is automatically transformed to ‘6000’

‘+ 1.8%’ is automatically transformed to ‘1.8%’

I inserted several customised string substitution functions into the server-side script to avoid the mismatch between tagger output and input text. To handle further as yet undetected problems, I inserted a timer into the server-side script. If the server side does not properly terminate after 45 seconds (a time span which proved to be sufficient to handle successful requests), the script is set to send an e-mail to me (containing the input text) and to terminate itself. The plurilingual dictionary tool then displays appropriate error information to the learner (Figure 6.1).

6.5. Data Communication between Server and Browser

Initially, the multilingual concordancer (Section 5.5) used the Perl-Flash Remoting implementation AMF::Perl (Ilyushchenko and Arva, 2007) to execute the language processing on the server, i. e. to look up the submitted search word in the index file, to retrieve the corresponding concordance data, and to send this data back to the client-side browser. This approach, however, caused a problem: when the concordancer tool was running in Internet Explorer on the client side, in about 50% of the cases the retrieved data did not get sent back to the Internet Explorer. This problem occurred more often when the currently submitted search term was different from the previous

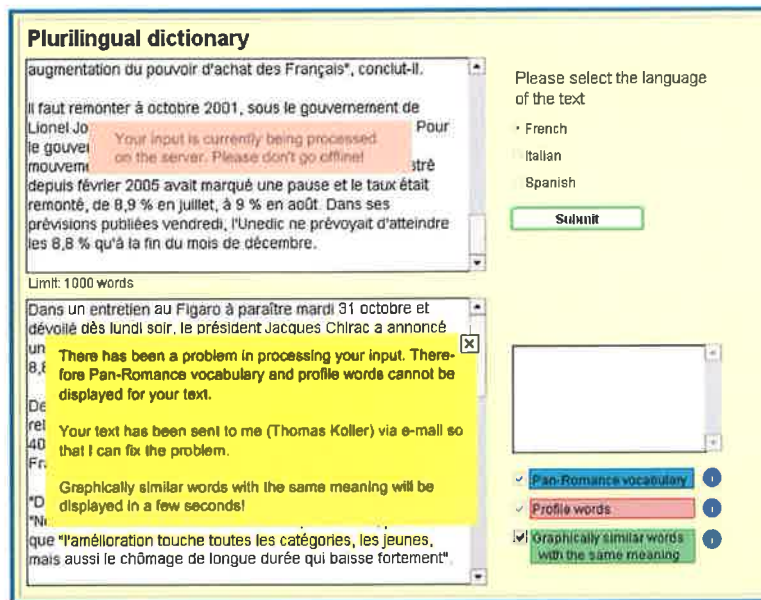


Figure 6.1: Error information after handling inconsistent tagger output

search term. With browsers other than Internet Explorer (I tested the same scenario with Mozilla Firefox and Opera browsers on Windows) this problem never happened and the response rate was always 100%.

To begin with, I tested different versions of Flash Remoting components, namely the Flash MX Remoting components and the Flash MX 2004 Remoting components, with the concordancer tool. With both versions the response rates did not show any significant change in Internet Explorer. I therefore migrated the server-side scripts from AMF::Perl to AMFPHP (AMFPHP, 2007). AMFPHP is an open-source Flash Remoting implementation for PHP. Testing with AMFPHP showed 100% response rates with Internet Explorer. I therefore chose to implement the AMFPHP approach on the server.

6.6. Summary

This chapter presented testing and implementation issues of ESPRIT. The most frequent implementation problem, namely encoding diacritical characters, was solved by a pragmatic workaround which masks diacritical characters when these characters are stored or transferred between implementation technologies. Diacritical characters are

only unmasked to compare them via regular expressions, or to display them to the learner. The TreeTagger showed an unexpected behaviour when used with the plurilingual dictionary tool, as the tagger automatically modified certain combinations of characters. Detected modification patterns were fixed, and potential future inconsistencies will trigger the automatic mailing function on the server to notify me of failed language processing interactions. A problem occurred when the concordancer tool was used in Internet Explorer. Testing different approaches led to the use of the AMFPHP implementation (Flash Remoting for PHP) instead of the AMF::Perl implementation (Flash Remoting for Perl) for language processing on the server.

7. Evaluation

7.1. Introduction

ESPRIT components were evaluated by adult language learners during development stages (formative evaluation) and at the end of the development process (summative evaluation). *Formative evaluation* is a technique which is used to obtain feedback at different development stages. This feedback is then used to implement improvements and to avoid design and development flaws at later stages. *Summative evaluation* is a method to assess components at the end of software development activities. It provides comprehensive feedback on the whole system and the interaction of components which were developed at different stages.

Section 7.2 describes the properties of the evaluation platforms created for ESPRIT. This includes a detailed description of a fast and reliable PHP/MySQL-based evaluation platform which can easily be adapted to other evaluation projects. Section 7.3 shows the results of the formative evaluation stages. The results of the summative evaluation are presented in Section 7.4. Section 7.5 summarises the evaluation phases of the research reported in this dissertation.

7.2. Evaluation Platforms

I created two evaluation platforms to facilitate formative and summative evaluation of ESPRIT components. The first evaluation platform was based on a combination of Perl and XML, using the XML::Simple, XML::DOM, and XML::XPath Perl modules to access and modify data stored in XML files. The deployment of the first evaluation platform turned out to be slow and unreliable with regard to data storage and processing. I therefore decided to develop a new evaluation platform for the summative evaluation using a different approach to store and display data. The second platform proved to be much faster and less error-prone than the first evaluation platform. It

used a combination of MySQL databases, PHP, Flash and Flash Remoting to create and display evaluation questions and to store evaluation results. Stored data could then be easily retrieved in a flexible way via SQL (Standard Query Language) commands.

The first evaluation platform was used in the formative evaluation to ask participants general questions about their language-learning experience and to get specific feedback on animated grammar presentations and on the multilingual dictionary tool (Section 7.3).

The second evaluation platform was used for the summative evaluation of the research reported in this dissertation. Evaluation participants were asked for general feedback on their language learning and for specific feedback on slide-based learning materials,¹ on dictionary tools and the concordancer, and on the graphical user interface (Section 7.4).

The plurilingual input analysis and feedback module (Section 5.6) was evaluated on a random selection of sentences from a collection of essays from students of Italian at the University of Nottingham (Section 7.4.5).

The MySQL/PHP/Flash evaluation platform was designed and developed in a modular way (Figure 7.1) and can be easily adapted to other evaluation projects. It has the following properties:

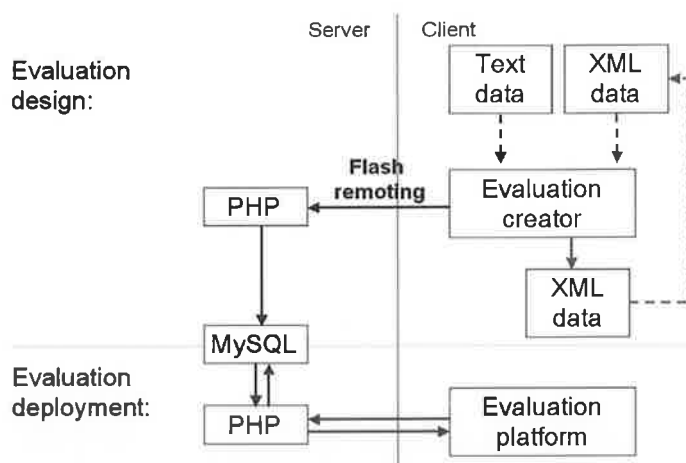


Figure 7.1: Evaluation – design and deployment

- evaluation participants can give feedback in any order and have the option to modify their feedback at any time. Therefore, evaluation participants do not have to answer all evaluation questions at once.

¹These materials were created to provide plurilingual content on lexical properties and on sentence structures.

- the platform offers the following information and feedback types:
 - headers and comments to structure the evaluation and to provide information to the participant;
 - text fields and text areas to receive feedback on open questions;
 - check boxes and radio buttons for multiple-choice and single-choice decisions.

Both feedback types can be displayed horizontally or vertically.
- the evaluation platform provides the option to access several MySQL databases simultaneously, which is useful if parallel versions of the same content are to be evaluated. This feature was deployed for the summative evaluation of this Ph.D. dissertation to offer static grammar presentations to one half of the evaluation participants and animated grammar presentations to the other half. When a new participant registers with the platform, the platform automatically checks the number of existing participants in each linked database. If the number of participants is equal across all linked databases, the new participant is assigned to a database by a random number generator. If the linked databases do not have equal numbers of participants, the new participant is registered with a database containing fewer participants. This procedure ensures that the databases are always filled up equally and by a random selection.
- language tests can be included at any time. The data for a language test is stored in an external XML file and can be modified with a simple text editor or XML editor. Each test question can have up to three answers. The evaluation author has the option to provide further feedback, which is displayed to the evaluation participant upon (successful or unsuccessful) completion of a language test question (Figure 7.2). Each answer is automatically sent to the server and stored in the corresponding MySQL database.
- I created a Flash-based ‘evaluation creator’ which facilitates the creation of new evaluation platform instances or the modification of existing evaluation platform instances. Existing evaluation question data can be imported as plain text data or XML data. The Flash-based interface then displays all data in a tree structure. Evaluation chapters are represented by top-level nodes in the tree, and evaluation

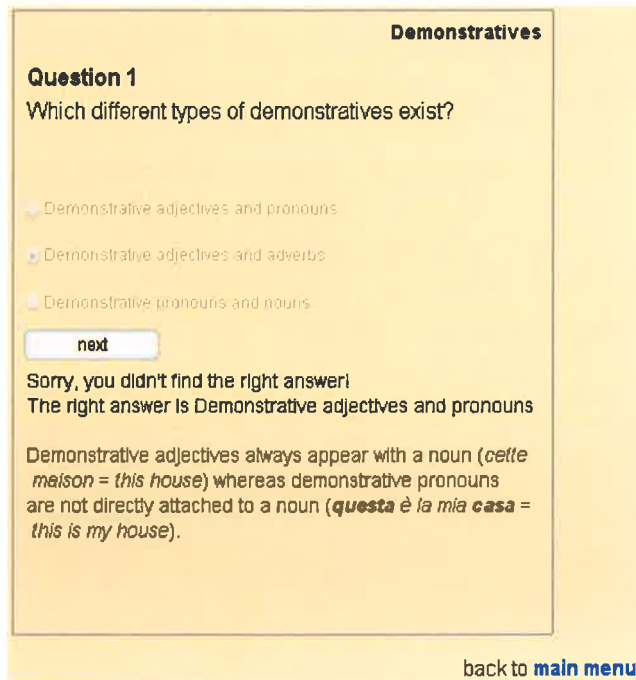


Figure 7.2: Language test – further feedback

questions as leaves on the next lower level. Chapters and questions can be added or deleted via the context-menu in the tree. The Flash-based interface was used to create and modify the evaluation platform for the summative evaluation of the research reported in this dissertation.

The process of creating, modifying and storing evaluation items is straightforward. In Figure 7.3, plain text data is imported. Plain text data has to be marked up to be properly recognised: (1) each chapter or question has to go on a separate line; (2) the question type, question text, feedback type, and further settings have to be separated by a delimiter. In Figure 7.4, imported data is modified in the evaluation creator: the evaluation author selects a chapter or a question in the tree on the left-hand side and then adds or modifies the corresponding details on the right-hand side. In Figure 7.5, evaluation data is exported to XML data which can be copied with a mouse click to the system's clipboard and then stored as a local XML file. The XML data can be reimported at a later stage to make further modifications. By clicking the 'Create DB on server' button, all the tables are created in the evaluation database on the server. Existing database tables are

not erased automatically; the evaluation author is asked whether to keep existing tables or to overwrite them with the newer version.

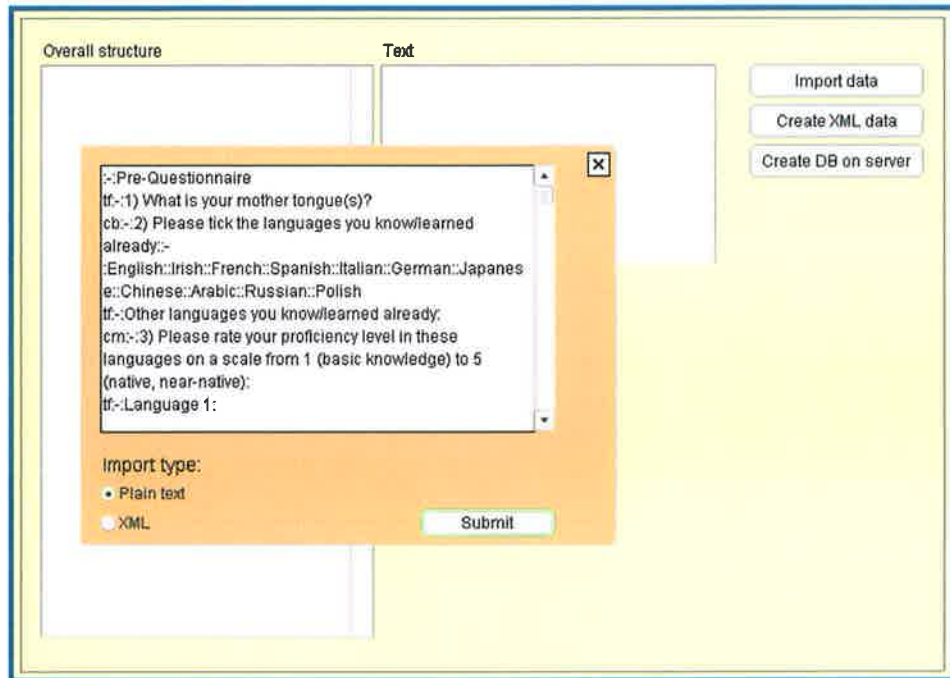


Figure 7.3: Evaluation design – importing data

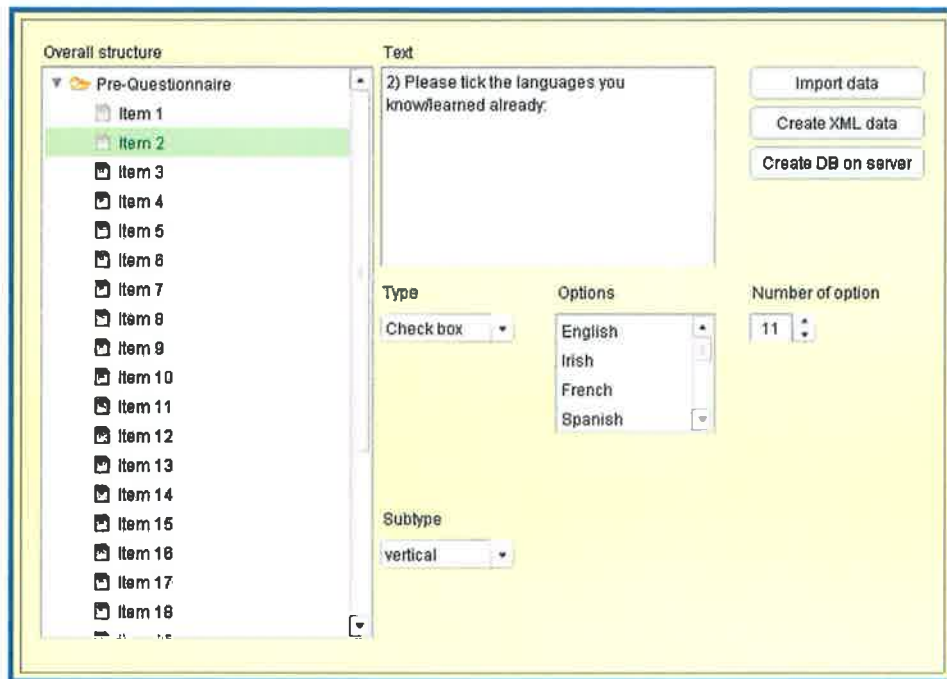


Figure 7.4: Evaluation design – modifying data

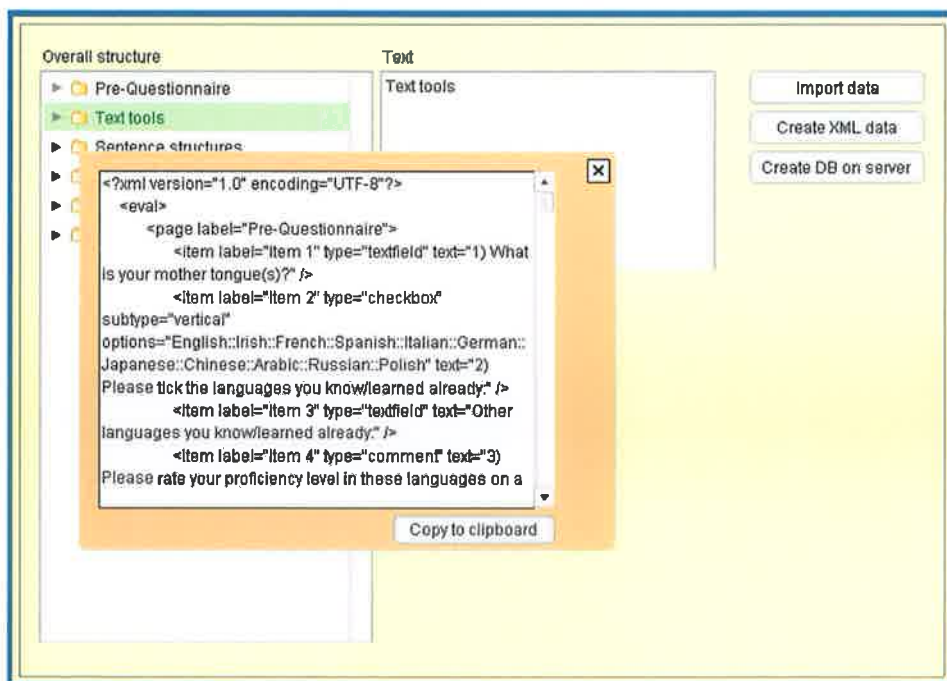


Figure 7.5: Evaluation design – exporting data

7.3. Formative Evaluation

The formative evaluation process mainly contained questions about the usability and user satisfaction of developed software tools (Section 3.5.2). The formative evaluation covered five different sections. Three sections were related to the evaluation participants themselves, while two sections contained questions about tools developed in this Ph.D. research, namely animated grammar presentations (Section 5.7) and the multilingual dictionary tool (Section 5.4.1). The formative evaluation process extended over a period of more than one year. Due to this extended period of time not all participants answered the questions in all sections. Participants were mainly recruited in 2004 from students of Modern Languages and of Computational Linguistics at Dublin City University and at the Justus-Liebig-University of Gießen (Germany). Additionally, visitors on the start page of my university web site were kindly asked to participate in the evaluation. Overall, 44 participants gave feedback in the formative evaluation process.² The evaluation process was conducted anonymously. Each participant freely chose an arbitrary combination of login and password.

The summarised feedback for each section is detailed in the following sub-sections (the complete feedback is available in Appendix B.1). The title of each sub-section reflects the name of the evaluation section. The following number of participants gave feedback in each section:

Your languages: 38 participants

Plurilingual learning: 34 participants

Language-learning software: 38 participants

Animated grammar presentations: 28 participants

Multilingual dictionary tool: 14 participants

7.3.1. Your Languages

In this evaluation section, participants were mainly asked about the languages they had already learned and the languages they would like to learn (Figure 7.6). Out of 38

²The response rate cannot be calculated because of the open recruitment process.

participants in this part of the evaluation, more than 70% were German native speakers and 24% were English native speakers (exact figures see Appendix B.1.1).

The form is titled "Your languages" and contains the following questions and options:

- What is your mother tongue? (Text input field)
- Which other languages have you learned? (List input field)
- Do you want to learn any other Romance language(s) (Spanish, Italian, etc.)? (Radio buttons for yes, no, don't know)
- If yes, which Romance languages would you like to learn? (Checkboxes for Spanish, French, Italian, Portuguese)
- Comments: (Text input field)

Figure 7.6: Formative evaluation – your languages

The question on languages learned by the evaluation participants shows a wide distribution of languages. Three participants had learned five languages, five participants had learned four languages, fourteen participants had learned three languages, thirteen participants had learned two languages and just three participants had learned only one language.

Evaluation participants had a strong background in Romance languages: twenty participants had learned one modern Romance language (three of these participants had also learned Latin), ten participants had learned two modern Romance languages (three of these participants had also learned Latin), three participants had learned three or more modern Romance languages (one of these participants had also learned Latin).

Almost two thirds (63%) of evaluation participants stated that they would like to learn another Romance language. Spanish was the most popular language participants wanted to learn (20 participants), followed by Italian (14 participants), French (5 participants) and Portuguese (2 participants).

7.3.2. Plurilingual Learning

This evaluation section contained questions about the language-learning experience of the evaluation participants. The objective of the section was to find out whether par-

Participants experienced positive or negative interference when learning foreign languages (Figure 7.7). Participants were also asked to indicate language pairs for which they had noticed positive or negative interference and to give examples.

Plurilingual learning

While learning a language, have you ever noticed a positive or negative influence from previously learned languages? yes no

If yes, please indicate for each language pair if the influence positive and/or negative?

Language pair 1: positive
 negative

Comments:

Language pair 2: positive
 negative

Comments:

Language pair 3: positive
 negative

Comments:

Do you think that comparing a language you already know with a new language would be helpful? yes no

Comments:

Figure 7.7: Formative evaluation – plurilingual learning

Almost 90% of evaluation participants (30 out of 34) had noticed a positive or negative influence from previously learned languages while learning a new language. More than 90% of evaluation participants thought that comparing a new language with a language they already knew would be helpful. However, several evaluation participants pointed out that it depends on the languages or language families, and that transfer can also be negative.

Asked about language pairs with a positive and/or negative influence, the evaluation participants cited 32 pairs of Romance languages (with French, Latin and Spanish being the most frequent previously learned languages). In three cases this influence

was described as negative. Germanic languages (English and German) were cited in 17 cases as having an influence on subsequently learned languages, and in 10 of these cases, this influenced the learning of Romance languages (positively in 70% of these combinations).

7.3.3. Language-Learning Software

In the last section about general language-learning experiences, evaluation participants reflected upon their experiences with language-learning software (Figure 7.8). Around 40% of evaluation participants (15 out of 38) had used language-learning software before. Evaluation participants who had already used language-learning software liked the fact that it enabled self-directed learning at their own pace and also enabled autonomous learning. Some participants stressed the fact that language-learning software offered interactive and multimodal exercises and that it provided the option for intensive drill. On the other hand, evaluation participants perceived language-learning software to be too inflexible and not customisable enough. Further criticism concerned the lack of communication when working with language-learning software and the simplicity of texts and exercises.

Evaluation participants considered language-learning software to be useful, especially for vocabulary training (37 out of 38 participants), dialogues (34 out of 38) and grammar exercises (32 out of 38). Although computer-based vocabulary and grammar exercises are often called ‘drill-kill’ and ‘grammar-hammer’ exercises, they seem to show the biggest potential for language learners.

7.3.4. Animated Grammar Presentations

This evaluation section contained questions about the tailor-made animated grammar presentations presented in Section 5.7. It should be pointed out that these animated grammar presentations did not contain any introductory information about the objective of the corresponding animated grammar presentation or about the functions of the control elements. However, comprehensive help contents were available at any time via a clearly visible help button. This decision was taken intentionally, in order to see how evaluation participants coped with a minimum of directly given information.

Evaluation participants were asked if it was easy to familiarise themselves with all of

Language learning software

Have you ever used language learning software? yes no

If you have used already language learning software:

What did you like?

What didn't you like?

Even if you have not used language learning software before, please answer the following questions:

In your opinion, which tasks would be useful in language learning software?

- Dialogues
- Language games
- Grammar exercises
- Cultural information
- Vocabulary training

Comments:

Which language learning topics would you be interested in?

- Politics
- Food
- Sports
- Fashion
- Music
- Economy

Comments:

Comments:

Figure 7.8: Formative evaluation = language-learning software

Animated grammar presentations

Please go to the [animations page](#) (opens in new browser window) and try out the animations (**Flash** required)!

Some questions (numbers in brackets refer to the corresponding animations):

Was it easy to familiarise yourself with all of the control elements and to use them effectively?

In your opinion, which control buttons should be part of the control panel? [1, 3]

Pause
 To the beginning
 Rewind
 Forward
 Play/Continue
 To the end

How would you rate the progress bar? (5 = very useful, 1 = not useful) [3]

	5	4	3	2	1	no opinion
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Would you like to be able to enter your own sentences as examples?

	yes	no
	<input type="radio"/>	<input type="radio"/>

Is it useful for you to see the same information in several Romance languages at the same time?

Are the help texts helpful for you?

Please rate the use of animation in each example (5 = very useful, 1 = not useful):

[1] Replacing indications of place

	5	4	3	2	1	no opinion
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[2] Emphasizing the subject

	5	4	3	2	1	no opinion
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[3] Irregular verbs in *passato remoto*

	5	4	3	2	1	no opinion
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[4] Spatial prepositions and movements

	5	4	3	2	1	no opinion
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Overall, how do you rate the use of animation in language learning?

	5	4	3	2	1	no opinion
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Comments:

Figure 7.9: Formative evaluation – animated grammar presentations

the control elements and to use them effectively. The majority of participants (17 out of 28) did not have any problems with the control elements of the animated grammar presentations. Either the participants knew right away how to use the control elements, or they accessed the help function to get appropriate help. Four participants had some problems with the control elements. Another four participants did not like the fact that they did not receive any direct instructions and therefore had to access the help contents. Two participants made the point that in their opinion it would be useful to have greater separation between the control elements and the content.

Evaluation participants were asked which control buttons should be part of the control panel. The answers show that apart from the essential play button (26 out of 26)³, the other buttons were considered to be useful in 58% to 69% of cases:

- Pause: 16
- To the beginning: 18
- Rewind: 15
- Forward: 15
- Play/Continue: 26
- To the end: 15

These results led to the decision to provide only a selection of control buttons for animated text in the authoring tool for learning materials (Section 5.8). The authoring tool provides altogether four buttons: a play/continue button, a pause button and two buttons to jump to the beginning or to the end of the presentation. Additionally, the availability of the control buttons is context-dependent: if a button's function is not necessary in a certain animation phase, then the button is either not visible or not clickable (visualised by a greyed-out effect).

The progress bar in the animated grammar presentation on irregular verbs in the Italian tense *passato remoto* received the following ratings in the evaluation platform (5 = very useful, 1 = not useful):

³Overall 28 participants gave feedback on the evaluation of animated grammar presentations. However two participants did not indicate any control button which should be part of the control panel. Therefore the assumption is that these two participants did not answer this question.

Rating	5	4	3	2	1	no opinion	average
Participants	5	7	3	4	5	4	3.13

Table 7.1: Evaluation results – progress bar

Evaluation participants were asked if they would like to be able to enter their own sentences as demonstration examples. Interestingly, only about half of the evaluation participants (13 out of 27) would have liked to have this option. Evaluation participants were asked if it was useful for them to see the same information in several Romance languages at the same time. Almost half of the participants (13 out of 28) said that this option was useful, though two participants disagreed. Most of the other participants considered this option to be positive, given that each language could be switched on and off at any time, or that the option is only useful if their language skills are strong enough in the languages involved.

Evaluation participants were asked if the provided help texts were helpful for the use of the animated grammar presentations. Sixteen participants found them useful but two participants criticised the fact that the use of the help texts should not be a prerequisite to fully understanding the usage of the animated grammar presentations. Two participants actually had to make a lot of use of the help texts to understand how to work their way through the animated grammar presentations. Five participants did not use the help texts at all because the design of the animated grammar presentations seemed to be straightforward enough.

Evaluation participants rated the use of animation in each animated grammar presentation as follows (5 = very useful, 1 = not useful):

Rating	5	4	3	2	1	no opinion	average
Replacing indications of place	13	11	3				4.37
Emphasizing the subject	9	9	9				4.00
Irregular verbs in <i>passato remoto</i>	6	7	8	2	1	3	3.63
Spatial prepositions and movements	14	6	6	1			4.22
Overall	14	9	2	1		1	4.38

Table 7.2: Evaluation results – animated grammar presentations

Two evaluation participants made the general comment that the speed of the animations should be controllable and that it should be possible to completely switch off the

animation. These suggestions were implemented in the authoring tool for slide-based learning materials (Section 5.8) in the following ways:

- the presenter module of the authoring tool automatically detects if the current learning content contains any items of animated text. In this case, the presenter module displays a slider with which the learner can increase or decrease the animation speed.
- the author of learning content can decide at authoring time if a piece of content will be presented in static or animated form. The author has only to modify the corresponding chunk in the underlying XML content file. As an alternative, the learning content author can provide both animated and static versions of the same content. This approach was used for the creation of different versions of learning content for the summative evaluation of this Ph.D. dissertation (Section 7.4).

7.3.5. Multilingual Dictionary Tool

This evaluation section contained questions on the multilingual dictionary tool (Section 5.4.1). In this evaluation phase, the multilingual dictionary tool was evaluated as an isolated application (Figure 7.10). In the summative evaluation, on the other hand, the multilingual dictionary tool was embedded in a learning module on lexical properties of Romance languages, along with the plurilingual dictionary tool (Section 5.4.2) and the multilingual concordancer (Section 5.5).

In the previous evaluation section, I showed that a number of evaluation participants were not satisfied with the amount of direct information when starting to work with the animated grammar presentations. As a consequence, I created an introductory screenshot-like tutorial which provided information about the main components of the multilingual dictionary tool (Figure 5.4).

Evaluation participants were asked if the short introduction helped them to use the multilingual dictionary tool (5 = very useful, 1 = not useful):

Rating	5	4	3	2	1	no opinion	average
Participants	3	4	6	1			3.64

Table 7.3: Evaluation results – short introduction

Evaluation participants were asked if it was easy to familiarise themselves with all

Multilingual dictionary tool

Please go to the **dictionary** (opens in new browser window) and try it out with different texts (**Flash** required)

Some questions:

If you used the short introduction: How much did it help you? (5 = very useful, 1 = not useful)

	5	4	3	2	1	no opinion
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Was it easy to familiarise yourself with all of the control elements and to use them effectively?

How useful is the "web page" function for you?

How much do the translations help you?

Please rate the usefulness of the further translation information (5 = very useful, 1 = not useful):

Part of speech ('noun', 'adjective' ...)

	5	4	3	2	1	no opinion
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Topic ('sports', 'politics' ...)

	5	4	3	2	1	no opinion
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Time and person (for verbs)

	5	4	3	2	1	no opinion
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

What other functions would you like to see in the program?

Overall, how did you get on with the program?

Overall, how do you rate the usefulness of the program for you? (5 = very useful, 1 = not useful)

	5	4	3	2	1	no opinion
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Comments:

Figure 7.10: Formative evaluation – multilingual dictionary tool

of the control elements and to use them effectively. Nine participants did not have problems using the control elements, but two participants found it difficult to use them effectively. For four evaluation participants, it was not clear from the beginning which languages could be used as input languages. After this evaluation phase, I added a text label to the language selection radio buttons to make their function clearer.

Evaluation participants were asked if the ‘web page’ function was useful for them. Nine participants found the web page function useful, while five participants did not see a benefit to themselves.

Evaluation participants were asked about how much the translations helped them. Eight participants found the translations helpful, whereas four participants criticised the fact that not all possible translations of an input text word were displayed and that phrases which consisted of several words were not translated.

Evaluation participants were asked to rate the usefulness of the lexical and grammatical information (5 = very useful, 1 = not useful):

Rating	5	4	3	2	1	no opinion	average
Part of speech (‘noun’, ‘adjective’ ...)	5	5	2	2			3.93
Topic (‘sports’, ‘politics’ ...)	1	5	2	3		3	3.36
Time and person (for verbs)	8	3	2	1			4.29

Table 7.4: Evaluation results – lexical and grammatical information

I had included topic information so that the learner could see if a displayed translation belonged to the ‘correct’ topic area in the context of the input text. Interestingly, evaluation participants seemed to rate grammatical information (part of speech, time and person of verbs) considerably higher than lexical information (topic).

Evaluation participants were asked about what other functions they would like to see in the program. Apart from general suggestions to include further languages, or to support German and English texts as input text, there were a couple of interesting suggestions:

- linking the multilingual dictionary tool to a grammar reference
- words which are dragged into the box at the bottom of the tool should also be directly shown in other example sentences to ensure that the learner understands their proper use. The multilingual concordancer (Section 5.5) actually does pro-

vide a similar functionality, apart from the fact that the learner has to input and submit each key word manually in the concordancer.

- send text words directly to Google to get further information on their usage in web texts. Technically this would be quite easy to accomplish as Google offers an API to access its services automatically from any server script. However, it is questionable if this would really be useful to a language learner. Search results from Google are somewhat unpredictable with regard to content and linguistic quality. Each Wikipedia article, in contrast, is usually checked by several Wikipedia authors.⁴
- possibility to listen to text-to-speech output of single words

Evaluation participants were asked how they coped with the program overall. Eleven participants did not experience any problems with the tool, while one participant needed some help and exploration to use it effectively.

Evaluation participants were asked how they personally rated the usefulness of the program overall (5 = very useful, 1 = not useful):

Rating	5	4	3	2	1	no opinion	average
Participants	2	8	3	1			3.79

Table 7.5: Evaluation results – usefulness of Multilingual dictionary tool

In this evaluation phase, several participants pointed out that the translation information offered by the multilingual dictionary tool was sometimes misleading and did not provide the most appropriate translation for some input text words. However, it has to be taken into account that the multilingual dictionary tool does not perform any semantic or syntactic analysis of the input text. Therefore this tool is not able to select the most likely translation of a word in a certain context.

7.4. Summative Evaluation

The summative evaluation process contained questions about the usability and user satisfaction (Section 3.5.2) of the software tools developed. The summative evaluation covered four different sections. One section was related to the evaluation participants

⁴Wikipedia articles are used as the database for the multilingual concordancer.

themselves, while three sections contained questions about tools developed in this Ph.D. research, namely text tools, learning materials about sentence structures (including multiple-choice questions), and the graphical user interface of ESPRIT (Section 5.2). Text tools include the multilingual and plurilingual dictionary tools (Sections 5.4.1 and 5.4.2), and the multilingual concordancer (Section 5.5).

The summative evaluation was performed in winter/spring 2006. Overall, 24 participants gave feedback in the summative evaluation process. Participants were mainly recruited from adult language learners in Dublin, Gießen (Germany) and Nottingham (United Kingdom). The evaluation process was conducted anonymously. Each participant freely chose an arbitrary combination of login and password.

The summarised feedback of each section is detailed in the following sub-sections (the complete feedback is available in Appendix B.2). The title of each sub-section reflects the name of the evaluation section. The following number of participants gave feedback in each section:

- Pre-Questionnaire: 24 participants
- Text tools: 15 participants
- Sentence structures: 11 participants
- Graphical user interface: 5 participants

7.4.1. Pre-Questionnaire

In this evaluation section, participants were mainly asked about the languages they had already learned, the languages they would like to learn, and their experience with language-learning software (Figure 7.11).

Out of 24 participants in this part of the evaluation, around 70% were German native speakers and more than 20% were English native speakers.

The evaluation question on languages learned/known by the evaluation participants showed that 17 participants knew/had learned at least three languages which in my opinion represents a huge potential for plurilingual learning (Table 7.6). All participants had learned/knew English. Twenty participants had learned French, eleven participants had learned Spanish and six participants had learned Italian.

1) What is your mother tongue(s)?	<input type="text"/>										
2) Please tick the languages you know/learned already:	<input type="checkbox"/> English <input type="checkbox"/> Japanese <input type="checkbox"/> Irish <input type="checkbox"/> Chinese <input type="checkbox"/> French <input type="checkbox"/> Arabic <input type="checkbox"/> Spanish <input type="checkbox"/> Russian <input type="checkbox"/> Italian <input type="checkbox"/> Polish <input type="checkbox"/> German										
Other languages you know/learned already:	<input type="text"/>										
3) Please rate your proficiency level in these languages on a scale from 1 (basic knowledge) to 5 (native, near-native):											
Language 1:	<input type="text"/> <table style="width: 100%; text-align: center;"> <tr> <td>1 (basic knowledge)</td> <td>2 (intermediate knowledge)</td> <td>3 (advanced knowledge)</td> <td>4 (fluent)</td> <td>5 (native, near-native)</td> </tr> <tr> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> </tr> </table>	1 (basic knowledge)	2 (intermediate knowledge)	3 (advanced knowledge)	4 (fluent)	5 (native, near-native)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1 (basic knowledge)	2 (intermediate knowledge)	3 (advanced knowledge)	4 (fluent)	5 (native, near-native)							
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
Language 2:	<input type="text"/> <table style="width: 100%; text-align: center;"> <tr> <td>1 (basic knowledge)</td> <td>2 (intermediate knowledge)</td> <td>3 (advanced knowledge)</td> <td>4 (fluent)</td> <td>5 (native, near-native)</td> </tr> <tr> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> </tr> </table>	1 (basic knowledge)	2 (intermediate knowledge)	3 (advanced knowledge)	4 (fluent)	5 (native, near-native)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1 (basic knowledge)	2 (intermediate knowledge)	3 (advanced knowledge)	4 (fluent)	5 (native, near-native)							
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
Language 3:	<input type="text"/> <table style="width: 100%; text-align: center;"> <tr> <td>1 (basic knowledge)</td> <td>2 (intermediate knowledge)</td> <td>3 (advanced knowledge)</td> <td>4 (fluent)</td> <td>5 (native, near-native)</td> </tr> <tr> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> </tr> </table>	1 (basic knowledge)	2 (intermediate knowledge)	3 (advanced knowledge)	4 (fluent)	5 (native, near-native)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1 (basic knowledge)	2 (intermediate knowledge)	3 (advanced knowledge)	4 (fluent)	5 (native, near-native)							
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
Language 4:	<input type="text"/> <table style="width: 100%; text-align: center;"> <tr> <td>1 (basic knowledge)</td> <td>2 (intermediate knowledge)</td> <td>3 (advanced knowledge)</td> <td>4 (fluent)</td> <td>5 (native, near-native)</td> </tr> <tr> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> </tr> </table>	1 (basic knowledge)	2 (intermediate knowledge)	3 (advanced knowledge)	4 (fluent)	5 (native, near-native)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1 (basic knowledge)	2 (intermediate knowledge)	3 (advanced knowledge)	4 (fluent)	5 (native, near-native)							
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
Language 5:	<input type="text"/> <table style="width: 100%; text-align: center;"> <tr> <td>1 (basic knowledge)</td> <td>2 (intermediate knowledge)</td> <td>3 (advanced knowledge)</td> <td>4 (fluent)</td> <td>5 (native, near-native)</td> </tr> <tr> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> </tr> </table>	1 (basic knowledge)	2 (intermediate knowledge)	3 (advanced knowledge)	4 (fluent)	5 (native, near-native)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1 (basic knowledge)	2 (intermediate knowledge)	3 (advanced knowledge)	4 (fluent)	5 (native, near-native)							
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
4) Which Romance languages would you like to learn for the first time? Romance languages include French, Spanish, Italian, Portuguese and Catalan (all Romance languages are derived from Latin).	<input type="checkbox"/> French <input type="checkbox"/> Italian <input type="checkbox"/> Spanish <input type="checkbox"/> Portuguese <input type="checkbox"/> Catalan										
5) While learning a new language, have you ever experienced an effect from previously learned languages?	<input type="radio"/> Negative <input type="radio"/> Positive <input type="radio"/> Never <input type="radio"/> Don't know										
If you experienced any effect, can you give one or two examples?	<input type="text"/>										
6) While learning a language, which topics are you interested in? (fashion, music, sports, food, politics, economy, etc.)	<input type="text"/>										
7) Have you ever used language learning software?	yes no <input type="radio"/> <input type="radio"/>										
If you have used language learning software:											
a) What did you like about it?	<input type="text"/>										
b) What did you not like about it?	<input type="text"/>										

Figure 7.11: Summative evaluation – pre-questionnaire

Languages known/learned	6	5	4	3	2
Number of participants	1	2	10	6	5

Table 7.6: Evaluation results – number of evaluation participants per number of languages

More than 90% of evaluation participants stated that they would like to learn another Romance language. Italian (12 participants) and Spanish (11 participants) were the most popular languages participants wanted to learn, followed by Portuguese (3 participants) and French (2 participants).

While learning a new language, more than 90% of evaluation participants had experienced a positive effect from previously learned languages.

7.4.2. Text Tools

In this evaluation section, participants were mainly asked about the multilingual and plurilingual dictionary tools and the multilingual concordancer (Figure 7.12). This evaluation section also contained learning materials on lexical properties of Romance languages.

Thirteen participants used the multilingual dictionary tool. Twelve participants gave feedback on the question whether the “web page” function in the multilingual dictionary tool was useful for them: four participants found it ‘very useful’, five participants considered it to be ‘useful’ and three participants stated that it was ‘not useful’ for them.

Evaluation participants mainly used English or German as translation languages in the multilingual dictionary tool. German was used by five participants, English was used by four participants (two participants used both languages), and French was used by three participants.

Thirteen participants used the plurilingual dictionary tool. Evaluation participants were asked whether the grouping of words in Pan-Romance vocabulary, Profile words and Orthographically⁵ similar words was helpful for them. Eleven participants found it helpful, one participant did not find it useful because “with basic language knowledge you know from where some words have been derived from [sic]”.

Nine out of ten evaluation participants thought that the plurilingual dictionary tool would be useful or very useful for their language learning, and the same number of participants claimed that they would really use the tool.

Evaluation participants were asked if they found the buttons and layout of the multilingual dictionary tool and plurilingual dictionary tool to be intuitive and effective.

⁵The questionnaire used the looser term ‘graphically’ instead of the scientifically correct ‘orthographically’ to avoid confusing participants with terminology they might not be familiar with.

Dictionary tools	
Please go to the learning materials and read the provided information. Then please try out the (multilingual and plurilingual) dictionary tools with texts which are of interest to you and test the concordancer (previous links open in new browser window).	
1) Did you use the Multilingual dictionary tool?	yes no <input type="radio"/> <input type="radio"/>
1a) How useful was the "web page" function in the Multilingual dictionary tool for you?	1 2 3 (not useful) (useful) (very useful) <input type="radio"/> <input type="radio"/> <input type="radio"/>
1b) Which translation language did you mainly use when looking up words in the Multilingual Dictionary Tool?	<input type="text"/>
2) Did you use the Plurilingual dictionary tool?	yes no <input type="radio"/> <input type="radio"/>
2a) Did you find the grouping of words in Pan-Romance vocabulary, Profile words and Graphically similar words to be helpful?	<input type="text"/>
2b) Do you think that this tool would be useful for language learning?	1 2 3 (not useful) (useful) (very useful) <input type="radio"/> <input type="radio"/> <input type="radio"/>
2c) Would you really use it?	yes no <input type="radio"/> <input type="radio"/>
3) If you used at least one of the dictionary tools:	
3a) Did you find the buttons and layout of the Multilingual dictionary tool and Plurilingual dictionary tool to be	
- intuitive?	yes no <input type="radio"/> <input type="radio"/>
- effective?	yes no <input type="radio"/> <input type="radio"/>
3b) Do you think that the dictionary tools were easy to use with the information provided?	1 2 3 4 (difficult) (quite difficult) (quite easy) (easy) <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
3c) Which dictionary tool did you find more useful?	<input type="radio"/> Multilingual dictionary tool <input type="radio"/> Plurilingual dictionary tool
Concordancer	
1) How useful did you find the concordancer?	1 2 3 (not useful) (useful) (very useful) <input type="radio"/> <input type="radio"/> <input type="radio"/>
2) Did the information about "Words having roughly the same meaning" help you?	<input type="text"/>
Slide-based learning materials	
How useful were the slide-based learning materials (for Pan-Romance vocabulary, Sound Correspondences and Prefixes and Suffixes) for you?	1 2 3 (not useful) (useful) (very useful) <input type="radio"/> <input type="radio"/> <input type="radio"/>
Text tools overall	
What other functions or what other kind of information would you like to see in these tools?	<input type="text"/>
Comments:	<input type="text"/>

Figure 7.12: Summative evaluation – text tools

Around 70% of participants found the buttons and layout of these tools to be intuitive. More than 90% considered the buttons and layout of the dictionary tools to be effective. Two participants found that the dictionary tools were ‘easy’ to use with the information provided, while almost 80% of participants considered it to be ‘quite easy’.

Nine evaluation participants considered the plurilingual dictionary tool to be more useful than the multilingual dictionary tool, whereas five participants preferred working with the multilingual dictionary tool.

The multilingual concordancer was considered to be ‘very useful’ by seven evaluation participants. Five participants found it ‘useful’, and two participants stated that it was ‘not useful’ for them. The multilingual concordancer contains a list element which shows words with roughly the same meaning in all three languages. This feature was rated positively by ten evaluation participants, whereas two evaluation participants did not find it useful.

Two evaluation participants rated the slide-based learning materials (for Pan-Romance vocabulary, Sound Correspondences and Prefixes and Suffixes) as being ‘very useful’, while eight evaluation participants considered them to be ‘useful’ and one evaluation participant found it ‘not useful’.

7.4.3. Sentence Structures

This part of the evaluation mainly dealt with similar grammatical properties on the sentence level. The authoring tool for slide-based learning materials (Section 5.8) was used to create learning materials on sentence components such as negations, demonstrative pronouns and adjectives, and personal pronouns. These learning materials were created as static and animated versions, so that the effect of animated text could be tested in comparison to static text. Evaluation participants were automatically assigned to the ‘static’ or ‘animated’ test group when they registered with the evaluation platform. In this evaluation section, evaluation participants were either shown animated or static learning materials, depending on the test group they belonged to. The evaluation section on sentence structures concluded with a test of 13 questions to test the participants’ knowledge of sentence structures.

Evaluation participants were asked to rate the content of learning materials (Table 7.7) and the language style of the explanations (Table 7.8).

Please go to the **learning materials** and work your way through the provided information.

How do you rate the content of learning materials?	<input type="radio"/> Too easy <input type="radio"/> Quite my learning level <input type="radio"/> A bit difficult but still manageable <input type="radio"/> Too difficult
How do you rate the language style of the explanations?	<input type="radio"/> I could easily follow <input type="radio"/> Quite easy but did not understand a few things <input type="radio"/> Quite difficult <input type="radio"/> Very difficult
Comments:	<input type="text"/>

Now please go to the **language test** page. Please don't go back to the learning materials while doing the language test! It's important for the evaluation to see what you actually know.
IMPORTANT: Don't forget to save your feedback before starting the test!

Figure 7.13: Summative evaluation – sentence structures - static version

Please go to the **learning materials** and work your way through the provided information.

How do you rate the content of learning materials?	<input type="radio"/> Too easy <input type="radio"/> Quite my learning level <input type="radio"/> A bit difficult but still manageable <input type="radio"/> Too difficult
How do you rate the language style of the explanations?	<input type="radio"/> I could easily follow <input type="radio"/> Quite easy but did not understand a few things <input type="radio"/> Quite difficult <input type="radio"/> Very difficult
How useful do you find the use of animation in these language materials?	<input type="radio"/> Just gimmicks! <input type="radio"/> Helped me in some cases <input type="radio"/> Quite good <input type="radio"/> Very useful
Comments:	<input type="text"/>

Now please go to the **language test** page. Please don't go back to the learning materials while doing the language test! It's important for the evaluation to see what you actually know.
IMPORTANT: Don't forget to save your feedback before starting the test!

Figure 7.14: Summative evaluation – sentence structures - animated version

Rating item	Number of participants
Too easy	1
Quite my learning level	8
A bit difficult but still manageable	2
Too difficult	0

Table 7.7: Evaluation results – degree of difficulty of learning materials for sentence structures

Rating item	Number of participants
I could easily follow	8
Quite easy but did not understand a few	2
Quite difficult	1
Very difficult	0

Table 7.8: Evaluation results – language style of the explanations

Evaluation participants of the ‘animated’ test group were asked to rate the use of animation in the language-learning materials on sentence structures (Table 7.9). Only four participants of the ‘animated’ test group provided feedback on this evaluation question.

Rating item	Number of participants
Just gimmicks!	0
Helped me in some cases	2
Quite good	1
Very useful	1

Table 7.9: Evaluation results – use of animation in learning materials

Nine evaluation participants completed the test on sentence structures. The test contained 13 multiple-choice questions on sentence components such as negations, demonstrative pronouns and adjectives, and personal pronouns. For each test question there were three possible answers with only one correct answer. Each participant received two points for a correct answer at the first attempt and one point for a correct answer at the second attempt. Consequently, each participant could achieve a maximum of 26 points.

Six evaluation participants belonged to the ‘static’ test group, while three participants were part of the ‘animated’ test group. The participants in the ‘static’ test group had learnt on average 1.8 Romance languages, whereas the participants in the ‘animated’ test group had learnt on average 2.3 Romance languages (data from Section 7.4.1). Overall, the participants in the ‘static’ test group achieved higher results (Table 7.10).

In the ‘static’ test group two participants achieved the maximum amount of points (26), with two participants achieving 20 points and two others 18 points. In the ‘animated’ test group one participant achieved 23 points, one participant achieved 18 points and one participant achieved 17 points.

	Average points per participant (maximum 26 points)
'Static' test group	21.3
'Animated' test group	19.3

Table 7.10: Evaluation results – test on sentence structures

Table 7.11 shows the correlation (across both groups) between the test results and the number of Romance languages the evaluation participants had learnt.⁶

Number of languages	Number of participants	Average points per participant (maximum 26 points)
Three Romance languages	2	24.5
Two Romance languages	5	19.8
One Romance language	2	19

Table 7.11: Evaluation results – test result compared to Romance languages learnt

Unfortunately, the number of participants in the 'static' and 'animated' sentence structure experiment is too small to generalise the results. In further work I hope to be able to run experiments with a larger, more representative number of participants.

7.4.4. Graphical User Interface

In this part of the evaluation, participants were asked to assess the graphical user interface of ESPRIT and its components.

Two evaluation participants found it 'very easy' to use ESPRIT right from the start, for two evaluation participants it was 'easy', and one participant rated it as being 'regular' to use.

Evaluation participants were asked if they would like to have French, Italian or Spanish as further interface languages. Three evaluation participants did not want any of these languages as further languages. One participant would like to have Italian, while another participant would like to use French, Italian and Spanish as further interface languages.

All the participants in this evaluation section used the 'guided tours'. However, the benefit of the guided tours was very different among the evaluation participants, from

⁶Previously learnt Romance languages: French, Italian, Spanish, Catalan and Latin.

Figure 7.15: Summative evaluation – graphical user interface

<p>Please go to the ESPRIT graphical user interface and play around with the materials offered.</p>	
<p>Please note: normally, you would have to log in several times on different days to see many different language learning materials in the TV magazine. For evaluation purposes, I created an example user who currently accesses the ESPRIT graphical user interface for the fourth time. As a consequence, you will see three past days in the TV magazine and today's entries.</p>	
<p>How easy was it for you to use ESPRIT right from the start?</p> <p>1 (very difficult) (difficult) (regular) (easy) (very easy) 2 3 4 5</p>	<p>Would you like to have French, Italian or Spanish as further interface languages? The interface language is displayed in which all the information is displayed, currently English or German.</p> <p><input type="checkbox"/> French <input type="checkbox"/> Italian <input type="checkbox"/> Spanish <input type="checkbox"/> none of them</p>
<p>Did you use the 'guided tours'?</p> <p><input type="radio"/> yes <input type="radio"/> no</p>	<p>If yes, how much did they help you?</p>
<p>How much instruction do you generally prefer with language learning materials?</p> <p><input type="radio"/> I always want to be told what to do next <input type="radio"/> I want to make a few decisions but most of the time I am just fine with the program's suggestions <input type="radio"/> I can be very active and very passive, just depends <input type="radio"/> Suggestions are helpful but at the end it's me who decides what to do <input type="radio"/> I actually want to decide freely when to do what</p>	<p>How do you find the idea to use the TV metaphor (TV screen, TV magazine and Teletext) for language learning?</p> <p><input type="checkbox"/> It helped me a lot to use the system right from the start <input type="checkbox"/> I don't see the point watching TV is passive, whereas language learning is active <input type="checkbox"/> I would prefer a topic-based approach (e.g. Lesson 1 - Informal conversation, Lesson 2 - Getting information ...)</p>
<p>Do you have any suggestions to improve or extend the ESPRIT learning environment?</p>	<p>Comments:</p>

helping “very much” to “not very”.

Evaluation participants were asked how much instruction they generally prefer with language-learning materials. Three participants selected the option that they ‘can be very active and very passive, just depends’. Two participants thought that ‘suggestions are helpful but at the end it’s them who decide what to do’.

Evaluation participants were asked how they found the idea to use the TV metaphor (TV screen, TV magazine and Teletext) for language learning. Four participants selected the pre-set answer that it ‘helped them a lot to use the system right from the start’. One participant selected the pre-set answer ‘I don’t see the point: watching TV is passive, whereas language learning is active’. No evaluation participant would have preferred a topic-based approach.

7.4.5. Plurilingual Input Analysis and Feedback Module

The plurilingual input analysis and feedback module (Section 5.6) was tested with a collection of essays from students of Italian at the Language Centre of the University of Nottingham. The students were at Stage 1.⁷ By the time of writing the essays the students had completed about 50 hours of study. The corrections made by Marisa Marmo⁸ were used as the gold-standard for the evaluation of the plurilingual input analysis and feedback module.

From the essays I randomly extracted 50 sentences containing errors (simple and complex sentences). Each sentence contained one or more errors. From each sentence I manually isolated one or several sentence chunks. Each sentence chunk is a simple sentence and contains exactly one error. The chunking process yielded 67 sentence chunks. A total of 32 sentence chunks can potentially be analysed with the plurilingual input analysis and feedback module (Section 7.4.5.1), while another 35 sentence chunks contain errors or syntactic constructions which are beyond the current capabilities of the plurilingual input analysis and feedback module (Section 7.4.5.2).

⁷Stage 1 is for absolute beginners studying the language *ab initio*. A Stage 1 course aims to enable learners to cope with everyday situations in the target language, to practise the basic grammatical structures underlying the target language, to write short letters and accounts and to have some appreciation of the culture of the countries concerned. The language centre offers language courses up to Stage 6.

⁸The essays were kindly provided by Marisa Marmo, Italian language teacher at the Language Centre of the University of Nottingham.

7.4.5.1. Analysable Learner Input

The input analysis component of the plurilingual input analysis and feedback module performed a complete analysis of all 32 analysable sentence chunks. For each of these sentence chunks, the plurilingual input analysis and feedback module provided between 1 and 5 possible error analyses as feedback to the learner (on average 1.59 error analyses per sentence chunk). All these error analyses contain the same number of flagged potential errors.⁹

The input analysis component correctly recognised 29 of the 32 known errors, which yields a recall of 0.91. The precision for the analysable sentence chunks is 0.66 (45 correct guesses, 68 guesses altogether).¹⁰ The sentence chunk errors which can be analysed by the input analysis component fall into ten different categories (ordered from most frequent to less frequent):

- missing auxiliary verb (9 occurrences): in several sentences students did not provide an auxiliary verb along with the past participle form of the main verb like in *Sabato visitato il castello* ([On] Saturday visited the castle). This was reliably detected by the input analysis component through if-then tests of the verbal group. These tests check whether any finite verb is available in the sentence and whether the verbal group starts with a finite verb.
- missing noun phrase agreement (9 occurrences): generally the input analysis component detected missing noun phrase agreement reliably. However, it failed to detect the missing noun phrase agreement in the learner sentence *Ho avuto tutti il giorno studiare*. (*I had to learn the whole day long*). The noun phrase *tutti il giorno*¹¹ (*the whole day long*) which acts as an adverbial complement was (incorrectly) placed by the learner between the verbs *avuto* and *studiare*. As a consequence, the input analysis component treats the noun phrase as a part of the verbal group. Noun phrases within verbal groups, however, are not checked by the input analysis component because noun phrases normally cannot be part of a verbal group in the context of ESPRIT's input analysis and feedback module.

⁹Recall that only the error analyses with the lowest number of errors are displayed to the learner. In case of ties, multiple error analyses with the same (minimal) number of errors are generated as feedback.

¹⁰In the case of multiple error analyses, the same error is flagged correctly (or incorrectly) more than once.

¹¹Missing agreement: *tutti* is plural, *giorno* is singular.

- missing preposition (3 occurrences): the input analysis component checks after parsing if the main verb of the input requires certain prepositions. This type of mistake was properly recognised in two learner sentences. In the learner sentence *Abbiamo telefonata la taxi compagnia.* ([We] have phoned the taxi company.), however, it failed to indicate the required preposition *a* because the verb lexicon used by the input analysis component indicates that the verb *telefonare* (to call, to phone) can be used as both a transitive (hence without a preposition) and as an intransitive verb.
- spelling mistakes (3 occurrences): the plurilingual input analysis and feedback module provided the feedback that some verb forms had not been found in the lexicon. The learner input can be fully analysed as soon as the learner modifies the input, for example by replacing *devuto* by *dovuto* (past participle of *dovere* (must)).
- wrong auxiliary verb (2 occurrences): the verb lexicon of the plurilingual input analysis and feedback module contains auxiliary verb information only for the most common verbs. Therefore the wrong auxiliary verb *essere* (word form *siamo*) was not properly recognised in the learner sentence *Venerdì sera siamo preparate la cena con gli amici.* (Friday evening [we] are prepared the dinner with the friends.)
- missing accent (1 occurrence): in the learner sentence *Paulo va all'universita nel centro.* (Paulo goes to the university in the [city] centre.) the word form *universita* lacked a grave accent on the last character. The correct word form would be *università* (university). The plurilingual input analysis and feedback module provided the feedback that the word form *universita* had not been found in the lexicon. The learner input can be fully analysed as soon as the learner modifies the input by replacing *universita* by *università*.
- direct object pronoun instead of indirect object pronoun (1 occurrence): in the learner sentence *Li sono molto piaciuti gli spaghetti.*¹² the direct object pronoun *li* had to be replaced by the indirect object pronoun *gli*. The input analysis

¹²Not directly translatable into English because the English language uses a different syntactic construction to express the concept of *They much liked ...*

component successfully detected this error by checking the subcategorisation information of the verb *piacere* (*to like*) against the object pronoun in the learner sentence.

- missing indirect object pronoun (1 occurrence): the verb *piacere* (*to like, to be fond of*) either requires an indirect object pronoun or an indirect object (= a prepositional phrase with the preposition *a*) to denote the person who likes something. In the learner sentence *Piaciuta il film.* (*Liked the film*) neither sentence part is available. This was recognised by the input analysis component and displayed as feedback.
- a subject pronoun was used instead of a direct object pronoun (1 occurrence): in the learner sentence *Paulo noi ha invitato a casa sua per una festa.* (*Paulo we has invited to his house for a party*) the subject pronoun *noi* (*we*) had to be replaced by the direct object pronoun *ci* (*us*). This was properly recognised by the input analysis component as it is able to distinguish between subject pronouns and (direct and indirect) object pronouns. Therefore the input analysis component found two potential subjects: *Paulo* and *noi*.
- false infinite verb form (1 occurrence): in the learner sentence *Sabato sera abbiamo fare una festa.* (*Saturday evening [we] have make a party.*) the infinitive *fare* (*to make*) is not the correct verb form (a past participle must be used instead). This was properly recognised by the input analysis component because the verb lexicon provides information about the allowed infinite verb forms (infinitive, participle, gerund) of a verb which follows another verb.

7.4.5.2. Unanalysable Learner Input

The errors of the 35 sentence chunks which cannot be analysed by the input analysis component of the plurilingual input analysis and feedback module fall into eleven different categories (ordered from most frequent to less frequent):

- wrong idiomatic use of a verb (13 occurrences): the learner sentence was grammatically correct but a different construction had to be used in the context of the essay. In the learner sentence *Sono andato per il treno* (*I went for the train*)

the article *il* (*the*) had to be dropped and the preposition *per* (*for*) had to be replaced by the preposition *in* (here: *by*) to get the intended sentence *Sono andato in treno* (*I went by train*). Another example is the omission of the definite article in the sentence *Sono uscita della casa alle nove* (*I left [from] the house at nine [o'clock]*) where the idiomatic use of the verb *uscire* (*to leave*) in conjunction with a place required the definite article to be dropped: *Sono uscita di casa alle nove* (*I left [from] house at nine [o'clock]*).

- wrong adverbial (6 occurrences): the learner sentence contained an incorrect adverbial construction as in the sentence *Domenica sera scorsa ho dovuto studiare* (*Last Sunday evening I had to study*). The correct sentence is *La sera di domenica scorsa ho dovuto studiare* (*The evening of last Sunday I had to study*).
- unknown word (5 occurrences): the learner sentence contained one or more words which are not in the lexicon of the plurilingual input analysis and feedback module, such as *pranzare* (*to have dinner*) and *stipato* (*crammed, packed*).
- wrong non-verbal word (3 occurrences): the learner had chosen a wrong word (noun or preposition) such as *conferenze* (*lectures*) instead of *lezioni* (*lessons*) in the sentence *Non ho avuto delle conferenze* (*I did not have any lectures/lessons*).
- false preposition used with city names (2 occurrences): in Italian, in conjunction with city names, the preposition *a* has to be used. Some learners, however, used the preposition *in*. In Italian the preposition used in conjunction with city names does not change when used with a verb of direction or a verb of location: *Vado a Roma in macchina*. (*I go to Rome by car.*) / *Sono a Roma per vacanze*. (*I am in Rome for holidays.*). For Italian these errors could potentially be spotted with post-parsing tests. However, it is not possible to apply similar simple tests to French and Spanish. In these languages the use of prepositions in conjunction with city names depends on the verb type (direction or location), as for example in Spanish: *Voy a Barcelona en coche*. (*I go to Barcelona by car.*) / *Estoy en Barcelona de vacaciones*. (*I am in Barcelona for holidays.*). This cannot be tested with the information currently available in the multilingual verb lexicon (Section 5.3.3).

- wrong verb (1 occurrence): the main verb of the learner sentence was incorrect. In the learner sentence *La sera siamo usciti a vedere un bel film* (*In the evening we went out to see a good film*) the use of the verb *uscire* (*to go out*) is not correct. In this context the verb *andare* (*to go*) had to be used: *La sera siamo andati a vedere un bel film* (*In the evening we went to see a good film*).
- missing *ci* particle (1 occurrence): the learner sentence *C'era il compleanno del mio ragazzo*. (*There was the birthday of my boy-friend.*) contains the adverb *ci* (*there*) which in the context provided had to be dropped. The correct sentence was *Era il compleanno del mio ragazzo*. (*It was the birthday of my boy-friend.*). This semantic subtlety cannot be checked with the current input analysis component.
- missing agreement between subject and predicative complement (1 occurrence): in the learner sentence *così siamo tornate all'albergo stanchissima* (*so we returned to the hotel [being] very tired*) the (implicit) subject *we* (feminine) did not agree in number with the adjectival phrase *stanchissima* (*very tired*) which in this sentence had the function of a predicative complement. The correct Italian sentence would be *così siamo tornate all'albergo stanchissime*.
- coordinating conjunction (1 occurrence): the learner sentence *La sera sono uscita con i miei amici e il mio ragazzo per divertirci*.¹³ (*to enjoy ourselves*) (*[In] the evening I went out with my friends and my boy-friend to enjoy ourselves.*) contained the coordinating conjunction *e* (*and*). The current input analysis component is not able to analyse learner sentences with coordinating conjunctions.
- multi-word expressions (1 occurrence): the learner sentence *Non ho fatto molti fino alle due* (*I did not make many until two [o'clock]*) contained the preposition *fino a* (*until*). The current input analysis component is not able to properly recognise and process multi-word expressions.
- wrong part of speech (1 occurrence): the learner sentence *Non ho fatto molti* (*I didn't do many*) contained the word form *molti* which is the masculine plural form of the adjective *molto* (*much/many*) and the pronoun *molto* (*much/many*). In the context of the essay the adverb *molto* had to be used.

¹³The actual error in this sentence is the incorrect word form *diverstirci*. The correct form is *divertirci*.

The evaluation of the plurilingual input analysis and feedback module with the Italian test sentences identified a number of shortcomings which can be used as a starting point for future improvements to the input analysis and feedback module:

- sentence constituents and adverbial complements: the current input analysis component is not able to distinguish between prepositional phrases which act as an obligatory sentence constituent (direct or indirect object) or as an adverbial complement, such as *per tre giorni* (*for three days*).
- the current input analysis component is not able to recognise and process multi-word units. Therefore it cannot handle common terms such as *fino a* (*until*) or *fine settimana* (*weekend*).
- currently the input analysis component does not assign weights to different kinds of errors. The input analysis component automatically selects the input analysis variants with the lowest number of errors for display to the learner.

7.5. Summary

This chapter has provided extensive information about the evaluation results of ESPRIT components. ESPRIT components were evaluated by adult language learners during development stages and at the end of the development process. I described the properties of the evaluation platforms used for the formative and summative evaluation stages. The evaluation platform used for the summative evaluation is a fast and reliable PHP/MySQL-based evaluation platform which can easily be adapted to other evaluation projects.

8. Conclusions and Further Work

This thesis described the design, development, implementation and evaluation of the web-based toolset ESPRIT which contains a series of (I)CALL tools and resources for the plurilingual learning of French, Italian and Spanish. ESPRIT represents the first plurilingual ICALL system which deploys NLP tools and techniques to enhance the plurilingual teaching and learning of these languages. ESPRIT provides the learner with the option to work on unrestricted texts and to receive dynamic feedback on restricted input. The toolset comprises an input analysis and feedback module, animated grammar presentations, dictionary tools and a concordancer. The input analysis and feedback module dynamically provides precise feedback on restricted learner input up to paragraph level. Animated grammar presentations visualise contrastive grammatical properties and processes. Dictionary tools provide useful lexical and grammatical information on unrestricted texts. The multilingual concordancer gives extensive information about how a term is used in different contexts.

An authoring tool for slide-based learning materials provides teachers (and learners) with a means to quickly and easily create animated text for integration into learning materials. The authoring tool is language- and topic-independent, i. e. it can be used for any information to be conveyed to language learners. The authoring tool can be used to easily create 'parallel materials' with or without animated text to evaluate the benefits of animated content compared to non-animated content.

ESPRIT tools make use of three of the five NLP technologies Nerbonne (2002: 680) listed as being the main contributors of NLP to ICALL in past and present research projects (Section 2.3.2): concordancing, morphological processing and syntactic processing.¹ Concordancing facilities are provided by the multilingual concordancer. Morphological processing is used in the dictionary tools to facilitate automatic dictionary look-up of words. Morphological processing is also used in the input analysis and feed-

¹Not included in ESPRIT are text alignment and speech recognition and synthesis.

back module to provide extended morphological information. Syntactic processing has been employed in the input analysis and feedback module to spot and diagnose errors in learners' output.

I examined which existing resources could prove useful for the creation of language-learning materials in ESPRIT, and I identified a number of linguistic tools (POS taggers and lemmatisers) and lexical resources (general word lists and conjugated verb lists) which were adapted and reused to create language materials for ESPRIT.

The graphical user interface developed for ESPRIT represents a TV-like environment which consists of a TV magazine, a TV screen and a Teletext facility. The TV design supports a modular approach. Therefore the contents presented to the learner can easily be expanded at any time. The learner can freely choose the topics of interest, which facilitates exploratory learning. The results of the summative evaluation process showed that evaluation participants did not seem to have acceptance and usability problems regarding the TV-like environment (Section 7.4.4).

The client-server software architecture used for ESPRIT combines Flash, XML, MySQL, Perl, PHP and Java in order to integrate cutting-edge visualisation components, flexible data storage and exchange technologies, and powerful programming languages into a highly flexible and modular web-based language-learning environment. This software architecture supports a platform- and browser-independent representation and a strict separation of language data and processing algorithms. Language data can be processed either directly with ActionScript (in Flash) or via server-side Perl, PHP and Java code, which provides extensive NLP capabilities.

ESPRIT components were evaluated by adult language learners during development stages (formative evaluation) and at the end of the development process (summative evaluation). The feedback of the formative evaluation was used to implement improvements and to avoid design and development flaws at later stages. A fast and reliable web-based database-driven evaluation platform was developed for the summative evaluation of ESPRIT tools. This evaluation platform can easily be adapted to other evaluation projects.

Four research questions were initially formulated to guide the research described in this Ph.D. dissertation (Section 2.4). The research questions have been addressed in

the following way:

(1) Existing materials for plurilingual learning of Romance languages almost exclusively focus on receptive skills, with a some emphasis on reading comprehension. Additionally, if used as self-learning materials, many existing (monolingual and plurilingual) materials do not perform an intelligent automatic analysis of learner input, nor do they provide flexible and dynamic feedback.

Research Question: How can NLP techniques be used to provide flexible plurilingual feedback on learner input?

In order to address this research problem, I developed a plurilingual input analysis and feedback module (Section 5.6) for French, Italian and Spanish. The plurilingual input analysis and feedback module is able to parse ill-formed input (simple sentences or sub-sentential constituents of a 'controlled' language fragment) in order to provide the learner with flexible dynamically generated feedback. This feedback includes plurilingual information about morphosyntactic structures which differ between the Romance languages involved.

(2) The majority of existing plurilingual learning materials are 'static', i. e. learners work on the same predefined closed set of texts and exercises as provided by a given application. Plurilingual information on text words or paragraphs has usually been added manually by content authors.

Research Question: What is involved in creating tools which provide the option to work on unrestricted, authentic learner-retrieved input (texts and single words) in a plurilingual setting?

The development of multilingual and plurilingual dictionary tools (Sections 5.4.1 and 5.4.2) and a multilingual concordancer (Section 5.5) enables the learner to obtain useful information on single search terms and unrestricted learner-retrieved text.

(3) Animation has not been widely used in language learning, despite encouraging evaluation results in a small number of past research projects. In particular animated text to visualise grammatical properties and processes has rarely been used and assessed.

Research Questions: How can different types of animation (including text anima-

tion) be used in a plurilingual learning environment to visualise grammatical properties and processes? How can the creation of language learning materials with animation be facilitated?

I designed and implemented animated grammar presentations to provide dynamic presentations of grammatical properties and processes, with animation playback being fully controlled by the learner. I also created an authoring tool for the creation of slide-based learning materials with animated text. Animated grammar presentations were presented in Section 5.7, and the authoring tool was detailed in Section 5.8.

(4) Many CALL and ICALL systems were either never evaluated or only evaluated at the very end of the development process. Similarly, very little data is available for the evaluation of plurilingual teaching and learning materials.

Research Question: How can effectiveness and user satisfaction be assessed during development stages to avoid major design and development flaws?

I created web-based evaluation platforms to enable continuous assessment of different components of ESPRIT (during both development and deployment cycles). The interim evaluation results were used to modify relevant parts of the Ph.D. work. The evaluation platforms were presented in Section 7.2, while Sections 7.3 and 7.4 provided information about the formative and summative evaluation stages.

The ESPRIT tools were developed in a modular way, which provides the option to deploy them as standalone tools, or to integrate them in comprehensive learning environments. In the following sections, I outline potential language-learning scenarios in which the tools may be used in ways which differ from the context of this Ph.D. dissertation.

8.1. Migrating ESPRIT Tools to Other Languages

Many of the tools developed for ESPRIT are language-independent and can therefore be adapted to other languages. If appropriate language resources are available, the following tools would be especially easy to modify and adapt:

- the multilingual dictionary tool (Section 5.4.1) can be adapted to other combinations of languages. It can also be used to provide monolingual definitions instead

of multilingual translations, or it can be deployed with a special language vocabulary. The fact that fully working versions for XML and MySQL data have been developed provides even greater flexibility when adapting the multilingual dictionary tool to different scenarios.

- the basic concept of the plurilingual dictionary tool (Section 5.4.2) is to look up possible translations of an input text word in a lexicon, and to then check the input text word and its possible translations for graphical similarity. This method can also be applied to other language families (such as Germanic or Slavic languages), if contrastive descriptions of the language family in question are available.
- the concordancer (Section 5.5) is language-independent (an English version has already been created), and can be easily adapted to other languages. Wikipedia articles, which serve as the data basis for the concordancer in the context of this work, are currently available in more than 200 languages. To date, 'Less Commonly Taught Languages' in particular have attracted little attention in the area of CALL. The concordancer may be helpful in providing a data-driven, easy-to-use, web-based learning resource for these languages.
- the authoring tool for slide-based learning materials (Section 5.8) is language- and topic-independent. Any text-based content can be created and then embedded in web pages or standalone Flash applications.

8.2. Migration to Mobile Devices

The technology Flash Lite enables the development of language-learning content for mobile devices. The Flash authoring environment provides customised templates for the development of materials for a series of PDAs and mobile phones. The Flash Player can be downloaded and installed on these devices to properly display Flash-based content.² Flash Lite applications can be tested in the Flash authoring environment before actually being deployed (Figure 8.1). The testing mode simulates the functionality of the mobile phone where all phone key actions can be simulated (in this example the '1' key is pressed).

²In contrast to the web-based Flash Player, the Flash Lite Player is not available for free.

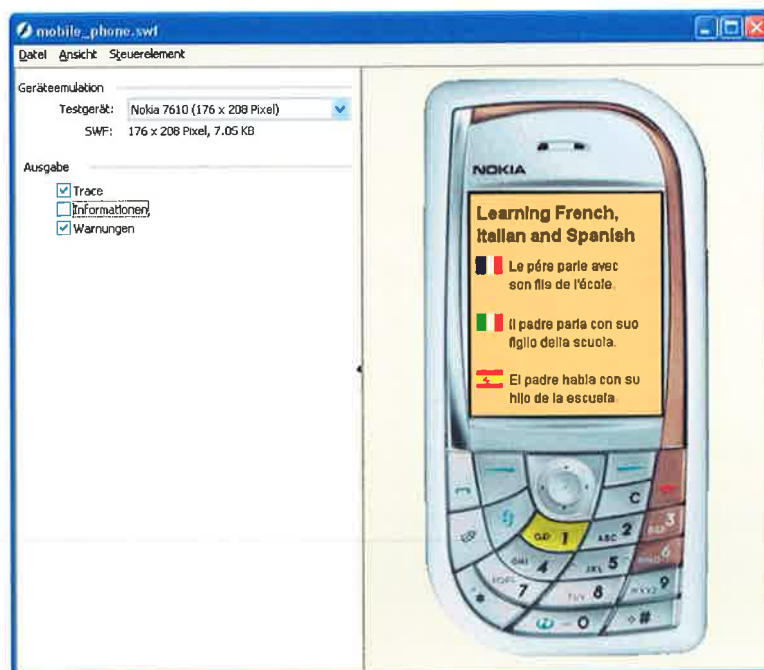


Figure 8.1: Testing Flash Lite applications

According to a survey conducted at the University of Nottingham³ among undergraduate students of Modern Foreign Languages, 47% of students (81 participants out of 171) would like to use electronic language-learning materials on mobile devices (mobile phones, PDAs or hand-helds). Dictionaries, verb conjugation tables, vocabulary exercises or grammar references were indicated as possible application examples to the students.

8.3. Creating Browser Extensions

Several ESPRIT tools can also be adapted and provided as Firefox browser plug-ins. Mozilla Firefox (Mozilla Corporation, 2007) is a free, open-source web browser currently available for Windows, MacOS and Linux operating systems. The functionality of Firefox can be extended by Firefox 'extensions' (i.e. browser plug-ins). These extensions provide the option to add a wide variety of new features to Firefox. The extensions can be developed by anyone and then uploaded to central extension repositories to be made available to others.

³This survey was conducted in May 2006. Its results have not been published yet. The University of Nottingham kindly agreed to make these results available for this Ph.D. dissertation.

As a Firefox extension, an ESPRIT tool would be instantly accessible from any other web page (for example for dictionary look-up). The dictionary tools (Sections 5.4.1 and 5.4.2), the lexicon interface components (Sections 5.6.3 and 5.6.4), and the multilingual concordancer (Section 5.5) could be adapted as Firefox extensions to provide a wide range of plug-in resources for plurilingual learning of Romance or other languages.

A. URLs

The Adobe Flash Player plug-in (version 7 and above) is required to access the following software modules. The latest version of the Flash Player plug-in can be freely downloaded from <http://www.adobe.com/go/getflashplayer>

Integrated learning environment (Sections 5.2 and 7.4.4)

<http://icall-group.computing.dcu.ie/esprit/interface.php>

This is the setup of an example learner who is using the learning environment for the fourth time.

Multilingual dictionary tool (Sections 5.4.1, 7.3.5 and 7.4.2)

<http://icall-group.computing.dcu.ie/dict/dict.php>

Plurilingual dictionary tool (Sections 5.4.2 and 7.4.2)

<http://icall-group.computing.dcu.ie/pluri/dict.php>

Multilingual concordancer (Sections 5.5 and 7.4.2)

<http://icall-group.computing.dcu.ie/esprit/concord.php>

Plurilingual input analysis and feedback module (Section 5.6)

<http://icall-group.computing.dcu.ie/parser/analysis.php>

Plurilingual general lexicon interface component (Section 5.6.3)

<http://icall-group.computing.dcu.ie/parser/lexicon.php>

Multilingual verb lexicon interface component (Section 5.6.4)

<http://icall-group.computing.dcu.ie/parser/verbs.php>

Animated grammar presentations (Sections 5.7 and 7.3.4)

Replacing indications of place:

http://www.computing.dcu.ie/~tkoller/animated.php?topic=pron_adv

Emphasising the subject:

<http://www.computing.dcu.ie/~tkoller/animated.php?topic=topicalization>

Irregular verbs in *passato remoto*:

http://www.computing.dcu.ie/~tkoller/animated.php?topic=passato_remoto

Spatial prepositions and movements:

<http://www.computing.dcu.ie/~tkoller/animated.php?topic=prepositions>

Authoring tool for slide-based learning materials with animated text (Section 5.8)

http://www.computing.dcu.ie/~tkoller/phd/animation/anim_template.php

Learning materials for lexical properties (Section 7.4.2)

<http://icall-group.computing.dcu.ie/eval/part1/intro1.php>

Learning materials for syntactic properties, animated version (Section 7.4.3)

<http://icall-group.computing.dcu.ie/eval/part2/intro2-an.php>

Learning materials for syntactic properties, static version (Section 7.4.3)

<http://icall-group.computing.dcu.ie/eval/part2/intro2-st.php>

B. Evaluation

In the following sections of this appendix chapter, the complete feedback of the formative and summative evaluation phases is displayed. Feedback on open questions (including comments) which was given in German are translated into English with the German version attached in brackets. The English translations are printed in *slanted* form. Original comments were only corrected with regard to orthography and capitalization of words. The evaluation questions and pre-set answers are printed in **boldface**.

B.1. Formative Evaluation

B.1.1. Your Languages

What is your mother tongue?

German: 24 participants, English: 8 part., Danish, Hungarian, Persian, German/French, Spanish, Basque/Spanish (each 1 part.)

Which other languages have you learned?

- * 3 participants: English, French
- * 2 participants: English / English, French, Italian / English, Latin, French / French, English
- * 1 participant: English, Catalan / English, French, Italian, Latin, Spanish / English, French, Portuguese, Spanish, Italian / English, French, Russian / English, French, Spanish / English, German, French / English, Italian, Latin / English, Latin / English, Latin, French, Spanish / English, Latin, French, Italian / French / French, German / French, Irish / French, German, Spanish / French, Spanish, Latin, German / German, English, French / German, English, Russian, Spanish / Irish, French / Irish, German / Irish, French, German / Irish, French, Italian / Latin, French / Latin, English, French / Latin, English, French, Portuguese,

Dutch / Russian, English / Spanish, English, French / Spanish, English, Italian,
Catalan

Comments:

- * *French perhaps a bit better* (Französisch vielleicht ein bißchen besser :-))
- * *actually grew up bilingual (German/Spanish)* (eigentlich bilingual aufgewachsen (Deutsch / Spanisch))
- * I think like most people, I'd like to, but probably never will !
- * *brushing up French* (Französisch: auffrischen)
- * *I hardly speak French any more, I learned Spanish while I lived and worked in Spain* (Französisch spreche ich fast gar nicht mehr, Spanisch habe ich im Land gelernt beim Arbeiten und Leben)
- * I only have very basic Spanish and would like to continue it
- * I'd also like to revise my Spanish

B.1.2. Plurilingual Learning

If yes, please indicate for each language pair if the influence positive and/or negative?

- * Catalan - Italian: positive 1 participant(s), negative 0 participant(s)
- * English - Catalan: positive 0, negative 1
- * English - Dutch: positive 0, negative 1
- * English - French: positive 6, negative 1
- * English - German: positive 2, negative 0
- * English - Spanish: positive 0, negative 1
- * French - Catalan: positive 1, negative 0
- * French - German: positive 1, negative 0
- * French - Italian: positive 4, negative 0
- * French - Old English: positive 1, negative 0
- * French - Portuguese: positive 1, negative 0
- * French - Romanian: positive 1, negative 0

- * French - Spanish: positive 5, negative 1
- * German - English: positive 3, negative 0
- * German - Latin: positive 1, negative 0
- * German - Russian: positive 1, negative 0
- * Italian - French: positive 1, negative 0
- * Italian - Spanish: positive 0, negative 1
- * Latin - English: positive 0, negative 1
- * Latin - French: positive 4, negative 0
- * Latin - German: positive 1, negative 0
- * Latin - Italian: positive 2, negative 0
- * Latin - Portuguese: positive 1, negative 0
- * Latin - Spanish: positive 1, negative 0
- * Portuguese - Spanish: positive 1, negative 0
- * Spanish - English: positive 1, negative 1
- * Spanish - French: positive 2, negative 0
- * Spanish - Italian: positive 2, negative 1
- * Spanish - Portuguese: positive 1, negative 0

Comments:

- * *as far as the roots of the words are concerned* (von den Wortstämmen her)
- * having studied French I found Spanish vocabulary quite easy to pick, a lot of words are very similar
- * *in England I bought a dictionary for English-Spanish because I always remembered the Spanish words in England and sometimes the other way round (although English is not a Romance language). With the help of the dictionary both languages were present for me.* (Ich kaufte mir in England ein dictionary English - Spanish, weil mir in England immer die spanischen Wörter einfielen, manchmal auch andersrum (obwohl Englisch keine romanische Sprache ist). Mit Hilfe des Wörterbuchs hatte ich beide Sprachen gegenwärtig.)

- * *As French is my mother tongue, there is no mix up with new words, but new words are easier to learn/understand/use. (Da FR Muttersprache ist, besteht keine Verwechslung mit den neuen Vokabeln, die aber einfacher zu lernen/verstehen/einsetzen sind.)*
- * *French was helpful for learning Portuguese but not the other way round (Fr. war hilfreich für Port. aber nicht umgekehrt!)*
- * *Latin + English = Spanish (in many ways) (Latein + Englisch = Spanisch (in weiten Teilen))*
- * many French verbs are very similar to old (often now unused) English verbs.
- * English contains many cognates and French expressions.
- * *Italian is in some sense a very modern form of Latin (Italienisch ist ja irgendwie eine sehr moderne Form des Lateins)*
- * *every time I started to learned a new language I "was not able" to speak the old language any more - that is every time I wanted to say something in English, Catalan words came to my mind. However, this gets better by knowing the new language. (ab dem Moment, wo ich eine neue Fremdsprache gelernt habe, konnte ich die alte Fremdsprache "nicht mehr" - zumindest kamen immer katalanische Wörter wenn ich etwas auf Englisch sagen wollte. Dies wird aber mit der Beherrschung der neuen Fremdsprache besser.)*
- * *positive AND negative interferences (positive UND negative Interferenzen)*
- * *see above, if someone speaks Spanish s/he will learn Portuguese faster, but this is not so much the case as the other way round. (siehe oben, wer Spanisch kann, lernt zwar auch schneller Portugiesisch, aber es hilft nicht so enorm wie umgekehrt)*
- * many similar verbs stems. Similar sentence construction.
- * *partly useful, partly a hindrance (teilweise hilfreich, teilweise hinderlich)*
- * English contains many cognates and some German expressions.
- * *naturally not so useful as with Spanish-French (natürlich nicht so hilfreich wie bei Spanisch-Französisch)*
- * *often similar grammar... recognition of Latin terms in German (häufig ähnliche/gleiche Grammatik.... Wiedererkennungswert von lateinischen Begriffen im Deutschen)*

- * *only in Grammar because of the cases and determinants in comparison to Hungarian (nur grammatikalisch wegen Fällen und Determinanten im Vergleich zum Ungarischen)*
- * Syntactic and other structural clues from French were useful in learning how to formulate German sentences.

Comments:

- * It depends on the languages.
- * *maybe not exclusively (vielleicht nicht ausschließlich)*
- * Sometimes
- * Mostly in terms of already having vocabulary due to similarities between words, rather than grammatical structures
- * *conscious transfer from language A to language B (bewußter Transfer von Sprache A zu Sprache B)*
- * *often mistakes occur because of that... e.g. you notice if someone speaks Portuguese s/he often uses 'mas' instead of 'pero' in Spanish (Oft schleichen sich dadurch Fehler ein..... z.B. merkt man wenn jemand Portugiesisch kann, dass er im Spanischen oft 'mas' anstatt 'pero' verwendet)*
- * Certainly, if they were similar enough, which I'm guessing romance languages are.
- * This applies in particular to language that share similar origins. For example, Irish and Italian, are not hugely similar!
- * Constantly comparing 'unknown' elements at morphological, syntactic, grammatical levels when encountering foreign words, phrases in text or in audiovisual formats. Don't forget that gestures tell a lot about the meaning of the message.

B.1.3. Language Learning Software

If you have used already language-learning software:

What did you like?

- * *Phonetics, lexicon and grammar are bundled together on the user interface and do not require a swap between cassette recorder and books as with classic media. I also liked that the exercises are being analysed right away and that I do not*

need to look up the answers in the solution key of the book. (Dass Phonetik, Lexik und Grammatik gemeinsam auf einer Oberfläche sind und nicht wie bei klassischen Medien den Wechsel zwischen Kassettenrecorder und Buch brauchen. Gefallen hat mir auch, dass die Übungsaufgaben sofort ausgewertet werden und ich nicht wie beim Lernen mit Buch erst mühsam im Lösungsschlüssel blättern muss.)

- * *the piece of software was multimodal and addressed different senses, well two senses (listening and seeing)...* (Die Software war multimedial und hat verschiedene Sinne, naja 2 Sinne (Hören und Sehen) angesprochen...)
- * *interactive and diverse exercises* (interaktive und verschiedenartige Aufgaben)
- * *unknown words were repeated until they were spelled correctly for a couple of times.* (Worte, die nicht gewußt wurden, wurden so lange wiederholt, bis sie mehrfach in Folge korrekt geschrieben wurden.)
- * *intensive drill possible* (intensiver Drill möglich)
- * *Work at own pace, new way information is presented (vs. books)*
- * *listening exercises, concordance exercises quizzes*
- * *Efficient GUI elements that reduce mouse clicks to see outcomes. Easy "return" paths to previous states/screens/menus.*
- * *modular design, interactivity, stimulation to self-directed learning, individual pace of learning* (modularer Aufbau, Interaktivität, Anregung zum selbstgesteuerten Lernen, individuelles Lerntempo)
- * *autonomous work, looking up systematically* (Selbständiges Arbeiten, Gezieltes Nachschlagen)
- * *help for autonomous learning, pronunciation coaching, vocabulary coaching* (Selbstlernplanungshilfen, Aussprachtrainer, Vokabeltrainer)
- * *variety* (Abwechslung)

What didn't you like?

- * *... that my pronunciation was not analysed or improved.* (Dass meine Aussprache nicht bewertet oder verbessert wird.)
- * *It would have been even better if there were more possibilities to work individually... maybe via different intermediate buttons and links.* (Ich hätte es

toll gefunden, wenn es noch mehr Möglichkeiten gegeben hätte individuell zu arbeiten...vielleicht u.a. über Zwischenschaltflächen und Links)

- * *you have to create a list of new vocabulary by yourself, it would be nice if you could print a list of the words you learned.* (man muss nebenbei noch eine Vokabelliste führen - es wäre schön, die Vokabeln, die man gelernt hat, nochmal als Liste ausdrucken zu können.)
- * *to be in front of the PC for such a long time* (Das lange Sitzen vor dem PC)
- * *less communicative, at higher levels not sufficient, too easy* (wenig kommunikativ, auf höheren Niveaus nicht ausreichend, zu 'einfach')
- * *not enough focus on grammar and abstract connections between the language families. The texts are often too easy. The goal should not be to understand everything at 100% but to understand the content semantically.* (Zu wenig Wert auf Grammatik und abstrakte Zusammenhänge innerhalb der Sprachfamilien. Die Texte sind häufig nicht sehr anspruchsvoll. Ziel sollte nicht sein, beim ersten Durchlesen alles 100%-tig kennen zu müssen, sondern den Inhalt semantisch verstanden zu haben.)
- * games
- * Poor GUI design, poor navigational paths or directions.
- * *existing knowledge is not being used, that is why learning is getting boring* (bestehende Kenntnisse werden nicht genutzt, dadurch wird Lernen langweilig)
- * *sometimes unclear feedback, little interaction* (Zum Teil ungenaue Rückmeldungen, wenig Interaktion)
- * *the exercises are in parts very simple and also their content repeats constantly* (die Übungen sind z.T sehr simpel und wiederholen sich auch inhaltlich ständig)
- * *little flexibility* (wenig Flexibilität)

Comments:

- * *language [should be as] authentic as possible, so no media quotations or constructs from textbooks.* (Möglichst authentische Sprache, also keine Zitate aus Medien und keine Konstrukte von Lehrwerkautoren.)

- * *like this it would be perfect, but it has to have a good structure and has to be explained well.* (so wäre sie dann perfekt, aber es müsste dann gut strukturiert und erklärt sein)
- * *Of course, I like to learn more about the country of which language I learn.* (Klar, ich will ja mehr über das Land lernen, von dem ich die Sprache lerne)
- * *it is important that you can listen to the correct pronunciation, e.g. via sound. That's very important.* (die korrekte Aussprache sollte irgendwie rüberkommen, z.B. per Sound. Das ist super wichtig.)
- * *evolution of language, connections with other languages of the same family.* (Sprachentwicklung, Zusammenhänge mit anderen Verwandten der jeweiligen Sprache)
- * All of the above and several tasks containing a mixture of the above to encourage a more 'real' adoption and learning environment.
- * Include audio-visual elements of authentic language when possible.
- * In particular, dialogues and vocabulary are very important for comparing languages
- * *Links to interesting web sites in the language one is learning.* (Links zu interessanten Internetseiten in der zu lernenden Sprache)

Comments:

- * *interpersonal stuff* (Zwischenmenschliches)
- * *making reference to the country language of which I learn* (auf das Land bezogen welche Sprache ich lerne)
- * *indications of place, shopping and finding a room are essential.* (Ortsangaben sind essentiell, einkaufen gehen ist essentiell, Zimmer finden ist essentiell)
- * *cultural events: how do they celebrate things like Christmas and Easter or events like Christmas, Easter time, birthdays, weddings, christenings in that country.* (kulturelle Ereignisse: wie werden die bei uns üblichen Feste (Weihnachten, Ostern, ...) oder Ereignisse (Geburtstag, Hochzeit, Taufe) in dem Land gefeiert.)
- * *dialogue-games: at the railway station, in the hotel, in a restaurant, doing shopping.* (Dialogspiele: -am Bahnhof -im Hotel -im Restaurant -beim Einkaufen)
- * *tourism, contents specific to culture and mentality.* (Tourismus, kultur- und mentalitätsspezifische Inhalte)

- * When I learn a language, firstly I just want to be able to communicate in everyday situations, such as in a shop or looking for directions. These would be more important to me than any of the above.
- * Many of the above are specialised areas. The most useful topics to learners, I believe, is topics they can use almost straight away - phrases that books rarely teach, such as “what’s happened?”, “what’s wrong?” or “Thanks fine, thank you”. There are other phrases such as these that all of us use many times a day in daily conversation, but books do not teach them, often as late as intermediate level.
- * literature culture, e.g. theatre education
- * perhaps you can find a useful way to incorporate the “natural voices” from AT&T in synthesized spoken feedback or other messages intended for the student:
<http://elvis.naturalvoices.com/demos/>
- * Small talk, Shopping, Flirt
- * *culture / art / literature* (Kultur / Kunst / Literatur)
- * *People, art* (Menschen, Kunst)

Comments:

- * I see business people, who are likely to travel with laptops, frequently abroad, as people likely to be interested in this kind of software, so politics and economy are probably quite suitable...
- * Thanks for working on this project.

B.1.4. Animated Grammar Presentations

Was it easy to familiarise yourself with all of the control elements and to use them effectively?

- * *1 and 2 yes, 3 and 4 not so much.* (1 und 2 ja, 3 und 4 weniger)
- * *In my opinion you should not be forced to click first before you see the help contents because it is essential for the understanding of the exercise and in danger to be overlooked in which case the whole animation would not makes sense.* (Inhalt der Hilfetexte sollte meiner Meinung nach nicht erst extra angeklickt werden)

müssen, da es für den Sinn der Übung entscheidend ist und evtl. übersehen wird und damit die gesamte Animation unverständlich wirkt.)

- * *Yes, but the selectable language flag for English is wrong which is confusing. The control buttons are missing in window 1. In window 3 the language cannot be selected or how should I select the language in which the irregular verbs are presented?* (Ja, aber Flagge bei Sprachauswahl Englisch falsch, daher verwirrend. Bei Fenster 1 fehlen die Kontrollbuttons. Bei Fenster 3 fehlt die Sprachauswahl, oder wie wählt man die Sprache in der irreguläre Verben angezeigt werden sollen?)
- * *Not with everything. I think you should separate more the control elements from the content.* (Nicht bei allen. Ich denke Du solltest Bedienelemente und Content optisch und räumlich weiter voneinander trennen.)
- * *Relatively easy, perhaps some basic instructions would be useful, even just one sentence.*
- * *Relatively easy. The interface, although completely functional is somewhat terse. We are simply told to try out the animations. Details such as purpose, objectives and goals after completing the lessons are not indicated. However the animations are excellent and very effective teaching mechanism.*
- * *So, So. In the first box my expectation towards the buttons were different. Because I knew them from media players I thought that a sound or film would appear. But eventually only letters or words start to move. A button with the label "reorganise" or "first sentence" would have been less confusing. In the other 3 boxes I didn't know which buttons I should press first. More narration would have been helpful. Maybe it would be easier to separate the control elements (buttons and all user options to click or modify something) from the output area (effects of manipulation). It would probably be easier for me to use the system if for example all control elements are on the right side along with a sequence of manipulation steps and some further explanation. I don't want to devaluate your animation. At the moment I familiarise myself with the control elements in a explorative manner, which isn't bad at all.* (Teils, teils. In der ersten Box hatte ich eine andere Erwartung an die Funktion der Buttons. Da ich sie aus Medienplayern kenne, hatte ich vermutet, dass gesprochene Sprache oder ein Film erscheint. Letzlich bewegen sich ja nur die Buchstaben bzw. Wörter. Daher wäre ein But-

ton mit der Beschriftung "Umstellen", "Ausgangssatz" o.ä. für mich weniger verwirrend. Bei den anderen drei Boxen wusste ich anfangs nicht, welche Buttons ich zuerst drücken muss. Etwas mehr Narration hätte mir hier evtl. geholfen. Evtl. wäre es auch leichter, die Funktionsbereiche Manipulation (Buttons bzw. alle Anklick- und Änderungsmöglichkeiten durch den Benutzer) räumlich von dem Ergebnisbereich (Auswirkungen der Manipulation) zu trennen. Wenn es geht, dass z.B. alle Bedienelemente (Manipulatoren) auf der rechten Seite wären und dort eine Sequenz der Manipulation deutlich wird und auch noch ein Satz zur Erklärung abgegeben wird, wäre es für mich wahrscheinlich einfacher, das System zu verstehen. Ich will damit Deine Animationen keineswegs abwerten. Im Moment erschließt mir die Bedienung eher explorativ, was ja auch nicht schlecht sein muss.)

- * *Most of it, if you know how to do it it's not a problem. I tried everything first.* (Weitgehend, aber wenn man es mal verstanden hat, ist es kein Problem. Ich habe eh erst mal alles ausprobiert.)
- * Yes, I found them very straight forward.
- * Yes, the help files were really good any time I needed to use them.
- * *I found them quite comfortable and easy* (fand ich ziemlich angenehm und einfach)
- * *yes they have become 'everyday usage' and because of that easy to use right away.* (ja, sie sind mittlerweile 'alltäglich' und daher sofort richtig verwendbar)
- * *yes, most of them* (ja, die meisten)
- * *yes (ja) [11 participants]*
- * the help button was a great help. I would prefer a stop button, a start button, a pause button and a replay button.

Is it useful for you to see the same information in several Romance languages at the same time?

- * Yes [9 participants]
- * *if I can deactivate this function it makes a lot of sense.* (sofern diese Funktion ausschaltbar ist finde ich sie sinnvoll)

- * *Not really, I don't know any Italian and only a little bit Spanish but it is interesting.* (Nicht so wirklich, ich kann überhaupt kein Italienisch und nur bruchstückhaftes Spanisch, aber interessant ist es schon)
- * Limited use as I am familiar only with French
- * *If I could speak any of the other languages sure, but as I don't it is more confusing because I only want to learn one language.* (wenn ich davon welche sprechen würde sicherlich, tue ich aber nicht und somit ist es eher verwirrend, da ich ja nur eine Sprache lernen möchte.)
- * *I prefer the possibility to choose the comparison languages myself.* (Ich bevorzuge die Möglichkeit, selbst die evtl. zu vergleichenden Sprachen auswählen zu können.)
- * *Only if I could speak one language very well.* (nur, wenn ich die eine Sprache sehr gut beherrsche)
- * *yes, very good.* (ja, sehr gut.)
- * *yes, but only if you can activate it when you like. If all languages are presented all the time or selectable it might be confusing. E.g. if you like to exercise Spanish but you think oh, I like to learn this in Portuguese ... you loose control over learning.* (ja, aber nur mit der Option diese zuzuschalten, wenn es gewünscht ist. Sind alle Sprachen immer angezeigt oder zur Auswahl, kann dies ablenken oder verwirren. Z.B. will man in Spanisch üben, denkt aber ah! das will ich auch in Portugiesisch wissen..... das führt zu unkontrolliertem Üben/Lernen)
- * *Yes, as long as the number of languages and the kind of languages is configurable.* (Solange die Anzahl und die Art der Sprachen konfigurierbar ist, ja.)
- * *I find it interesting to see how similar they are, but think I might find it distracting if I was only learning one of them...*
- * *Yes, I also like how you can turn off whatever language(s) you're not interested in at the time.*
- * *Yes, very useful.*
- * *no (nein)*
- * *yes, by all means. Existing knowledge is being connected easier with new knowledge, success in learning is achieved faster, a sense of achievement is motivation for further learning.* (ja, durchaus. Bestehendes Wissen wird leichter mit neuem

verknüpft, der Lernerfolg stellt sich schneller ein; Erfolgserlebnisse sind Motivatoren für weiteres Lernen)

- * *Not so much, sometimes it is interesting, but my knowledge of languages is not so good to appreciate it... maybe English as a "standard" comparison would be good, because most people speak English.* (Eher nicht, das ist zwar manchmal interessant, aber da meine Sprachkenntnisse nicht ausreichen, um das zu würdigen ... Vielleicht wäre Englisch als "Standard"-Vergleich ganz gut, weil das die meisten Menschen können.)
- * *Depends on the objective. Not if I want to learn only one language. But if I am interested in language learning in general it would be useful.* (Kommt auf das Ziel an. Wenn ich nur eine Sprache gezielt lernen will, dann nicht unbedingt. Wenn ich eher global an Sprachenlernen interessiert bin, fände ich es eher nützlich.)

Are the help texts helpful for you?

- * Yes [6 participants]
- * *Yes ... but I didn't really need them ... but if someone wants to learn something new with this piece of software the grammatical background is important.* (Ja...aber ich habe sie nicht wirklich gebraucht...aber wer anhand dieser Software Neues lernen möchte ist der grammatische Background auf jeden Fall wichtig)
- * Very much so, yes
- * so, so
- * *very useful* (sehr nützlich)
- * *to be honest I don't need them. But they are useful for less proficient users.* (ehrlich gesagt brauche ich die nicht. Sind für weniger geübte Leute aber sicher sinnvoll.)
- * *yes. Unfortunately I needed them almost all of the time.* (Ja. Ich habe sie leider fast immer gebraucht.)
- * *I didn't use them.* (ich habe sie nicht aufgemacht)
- * *no, I don't need them.* (nein, brauche ich nicht)
- * Yes, more than enough.
- * Yes, everything that you could have a problem with is in there.

- * Yes, quite informative.
- * *Yes, because they are necessary to make sense.* (Ja, da sie Sinn erklärend sind!)
- * *yes, most of all they only include information that is needed in a particular place, no unnecessary extra info.* (ja, sie beinhalten vor allem nur Information, die an der jeweiligen Stelle erforderlich ist, keine unnötigen Zusatzinformationen)
- * *I didn't need them - I think I understood the tasks without them. Sorry: I didn't find out myself that one should move the blue ball.* (habe ich nicht gebraucht - ich glaube ich habe die Aufgaben auch so verstanden :-) Pardon: Ps - aber ich hatte nicht rausgefunden, daß man den blauen Ball bewegen sollte ...)
- * *Often not necessary, because most functions are self-explanatory.* (Oft nicht nötig, da die meisten Funktionen selbsterklärend sind.)
- * *Yes, but they shouldn't be a prerequisite to understand the controls.* (Ja, sie sollten nur nicht Voraussetzung zur Erschließung der Bedienung sein)
- * *yes, but they should only be used as an emergency, or for dummies. Things like the blue ball should be explained without accessing the help function.* (ja, aber sie sollten nur als Notfall benutzt werden (oder nur für ganz Blöde). Dinge wie z.B. der blaue Ball sollte erklärt werden, ohne in die Hilfe zu schauen.)

Comments:

- * The choice of colours is a bit perplexing. I expect red to be wrong and green to be right. I'm not sure that "emphasising the subject" is the right heading.
- * *I would have liked the opportunity to try the task myself before the animation started ... or even after.* (Ich hätte gerne bevor die Animation gestartet wird die Möglichkeit gehabt, die Aufgabe selbst auszuprobieren....oder auch danach)
- * *Looks really good!!* (Sieht richtig gut aus!!)
- * Overall a very useful idea for learning a language. Perhaps better for beginners than more advanced users??
- * *I have little experience yet with animation and language learning via computers.* (ich habe noch wenig Erfahrung mit Animation, Sprachenlernen mit Hilfe des Computers)

- * *Animations should move faster and one should be able to switch them off. (Animationen sollten schneller ablaufen und optional sollten Animationen abschaltbar sein.)*
- * *Generally I would simplify the animations. Only horizontal movements and fade in and out are sufficient for showing connections. I think animation 3 does not work properly with Safari. Animation 4 is only understandable with the help. Maybe you should implement arrows for the blue ball right away. (Ich würde die Animationen generell vereinfachen. Nur horizontale Bewegungen und ein- bzw. ausblenden reichen zur Verdeutlichung von Zusammenhängen. Die Animation [3] funktioniert nicht so richtig (glaube ich, zumindest unter Safari). Die Animation [4] erschließt sich nur mit dem Hilfemenu. Vielleicht solltest Du gleich rechts-links-oben-unten-Pfeile für den blauen Ball einbauen.)*
- * *The animations are very nice but they take time. (Die Animationen sind sehr nett gemacht, verschlingen allerdings auch Zeit.)*
- * *the advantage of animation 3 is out of proportion for the time it takes. The difference in colour is sufficient - good design, but I would only use 3 colours, stem 2 colours, ending 1 colour. (bei 3 stehen Vorteil und Zeitaufwand nicht im Verhältnis. Eine farbliche Unterscheidung (Stammwort in einer Farbe) reicht aus (Darstellung gut - nur würde ich nur 3 Farben verwenden - Stamm 2 Farben, Endungen 1 Farbe)*
- * *The animations are too slow for me. (Mir sind die Animationen zu langsam)*
- * *I think perhaps it might be nice to have translations, such as those in 3, available in the other 3 animations. Possibly a simple (translate) button would suffice, rather than having to take up space writing the translation all the time.*
- * *Animations make it much easier to see the traditional rules you learn for grammar at play.*
- * *Good Work, well done! :)*
- * *As long as the animation is better for showing the important things as only charts with colour, animation is useful. (Solange die Animationen besser in der Lage sind, das Wichtige besser zu verdeutlichen als reine farbliche Darstellungen ohne Animationen, solange sind sie sinnvoll.)*

- * *Animation not absolute necessary, a chart would be ok too. Apart from Animation 3, there it is a useful help for learning. (Animationen sind nicht unbedingt nötig, hier würden es Abbildungen vollständig tun. Außer bei 3., da das eine gute Lernhilfe darstellt.)*
- * *Progress bar: first I thought it would indicate the loading of the animation. The progress bar would be useful with animation that take longer to show that it is not finished yet and how much time remains. Animation: They are useful for me if they show a process where a spatiotemporal component is an important factor, e.g. animation 4 or changing of words in a sentence in animation 1. (Zum Fortschrittsbalken: Ich dachte zuerst, das wäre der Ladebalken für die Animation. Nützlich finde ich ihn dann, wenn er bei einer längeren Animation, bei der auch schon mal ein oder zwei Sekunden nichts passiert, signalisiert, dass es noch weiter geht und wie lange es noch dauern wird. Animationen: Diese sind für mich dann nützlich, wenn Sie einen Prozess abilden, bei dem die räumliche und zeitliche Komponente ein wesentlicher Faktor ist. Also z.B. bei Animation 4 aber auch bei Verschiebung von Wörtern innerhalb eines Satzes (Animation 1).)*

B.1.5. Multilingual Dictionary Tool

Was it easy to familiarise yourself with all of the control elements and to use them effectively?

- * I would like a "go back" button, for when I make a mistake
- * *Basically yes, I just asked myself if there is a possibility to translate a German text. (Eigentlich schon...ich habe mich nur gefragt, ob es auch die Möglichkeit gibt, einen deutschen Text übersetzen zu lassen)*
- * Yes (Ja.)
- * *yes, but it is not absolutely clear which language is translated into which. (ja, aber es ist nicht ganz klar, welche Sprache in welche übersetzt wird.)*
- * It took a few attempts to learn all the aspects of the dictionary, I had to look at the 'help' option a couple of times
- * *yes, actually (eigentlich ja)*

- * yes, although i think that the difference between the red and blue text is not initially obvious.
- * Yes.
- * *Not right away but fast enough.* (Nicht sofort, aber ziemlich schnell.)
- * *because of the short introduction, otherwise probably not.* (aufgrund der Kurzeinführung ja, sonst wahrscheinlich eher nicht)
- * *In the beginning I was confused because of the blue circle with the V, I should have read the introduction properly ...* (Was mich am Anfang ein bißchen verwirrt hat, war der blaue Kreis mit dem V - wahrscheinlich hätte ich die Kurzeinführung aufmerksamer lesen sollen ...)
- * *No, but a little exporation helps fast.* (Nein, allerdings hilft ein wenig Herumprobieren recht gut und schnell.)
- * *No, unfortunately not. I had to explore first or use the help function. At the guided tour I found it hard to distinguish the green coded tips from the actual control elements. Only later I understood that you can only enter a French, Italian or Spanish text. Maybe you can clarify by writing "Enter your French, Italian or Spanish text" instead of "Enter your text here". I also didn't understand why I had to choose between English and German at the beginning.* (Nein, leider nicht. Ich musste erst explorieren, bzw. die Hilfe verwenden. Bei der Guided Tour fand ich verwirrend, die Hinweise (obwohl sie farblich mit grün codiert waren) von den Bedienhinweisen zu differenzieren. Im Programm selber ist mir erst später klar geworden, dass ich nur Französisch, Spanisch oder Italienisch eingeben kann. Vielleicht kann man dies verdeutlichen durch Ersatz des Textes "Gib hier Deinen Text ein!" in der Textbox durch "Gib hier deinen französischen, italienischen oder spanischen Text ein". Wieso ich mich anfangs für die deutschen und englischen Regionen entscheiden musste, blieb mir auch verborgen...)
- * *yes, after the introduction.* (nach der Einführung ja)

How useful is the 'web page' function for you?

- * Quite useful.
- * *I would like it if I could go online at home.* (Wenn ich zu Hause Internet hätte fänd ich sie nicht schlecht)

- * *I find it quite useful, because you can print the text with the translation in a neatly arranged format. (Ich finde sie recht nützlich, denn so kann man sich den Text mit den Übersetzungen in übersichtlicher Form ausdrucken.)*
- * *not very useful (eher wenig nützlich)*
- * *Useful for getting a translation of all the words together*
- * *It is quite good, but you get more than one answer in the language you learn and if you don't know the article of this word you might choose the wrong one. (Es ist ganz gut, allerdings man bekommt mehrfache Antworten in der jeweiligen Sprache und wenn man gerade den Artikel des gesuchten Wortes nicht kennt, dann kann man die falsche Wahl treffen.)*
- * *I think it's a good way to save data, as it can be printed... printing Flash it a lot harder.*
- * *For me personally, not much. However, to a regular user of this system, I'm sure it is advantageous.*
- * *Can be useful to print specific word lists, but it is not essential. (Kann nützlich sein um spezielle Wortlisten auszudrucken. Finde sie aber nicht unbedingt notwendig.)*
- * *seems useful to me (scheint mir recht nützlich zu sein)*
- * *ok, I find the other functions more handy (geht so - die anderen Funktionen finde ich praktischer)*
- * *Not very useful. (Nicht sehr nützlich.)*
- * *Very useful as I noticed what it is for. Instead of 'Website' (technical definition) I would use a more content oriented definition, such as 'printed version' as the button label. Maybe you can make the function of the box at the bottom clearer if you move the 'website' function closer [to the text] and move the other functions further apart. (Sehr nützlich, als ich merkte, wofür sie ist ;-). Statt 'Website' (technische Definition) würde ich eher eine inhaltliche Definition (z.B. Druckversion) als Buttonbezeichner wählen...Vielleicht könnte man die Funktion der unteren Box noch klarer herausstellen, indem man die Nähe der Webseiten bzw. Druckfunktion erhöht und die anderen Funktionen weiter weg stellt...)*
- * *very useful (sehr nützlich)*

How much do the translations help you?

- * Not very much. I don't know the languages well enough.
- * *At the first try it seems useful to me, but I don't know how it is with an actual text that you can not translate word by word.* (Beim ersten Ausprobieren erscheinen sie mir schon hilfreich...ich weiss nicht, wie es an einem konkreten Text aussieht, der vielleicht nicht 1 zu 1 übersetzbar ist)
- * *Very much, you can read and understand articles much faster without losing time with looking words up in a dictionary. At the same time I could see the English words. But I noticed from a short article about the upcoming football match Barcelona - Celtic Glasgow that not all translations are given, e.g. for 'partido' it did not provide the translation '(football) match'.* (Sehr, man kann z.B. Zeitungsartikel leichter und schneller lesen und verstehen, ohne sehr viel Zeit damit zu "verlieren", selbst im Wörterbuch nachzusehen. Gleichzeitig konnte ich die englischen Vokabeln sehen. Allerdings habe ich bereits bei einem kurzen "Testbericht" über die anstehende Partie Barcelona - Celtic Glasgow gemerkt, daß nicht immer alle Übersetzungen angegeben wurden; z.B. für partido nicht Partie (Fussballpartie; Fussballspiel).)
- * *difficult, for me English-German would be better.* (schwierig, hilfreicher für mich wäre Englisch-Deutsch)
- * Very useful and comprehensive dictionary, enabled me to better comprehend the details of newspaper articles for example. There seemed to be a problem with words with accents as I mentioned to you by e-mail
- * I think they would help more if they understood phrases, and not just single words, as often, two single words mean a totally different thing when combined.
- * Very useful.
- * *Unfortunately not all possible translations are shown, e.g. for the French negation "ne...pas" only "pas" was translated with "step", which can be correct but not in this context! But this is maybe just the beginning of this tool. Otherwise I like it that apart from the Romance translations you get the English and German translations, too.* (Leider werden oft nicht alle möglichen Übersetzungen angezeigt, z.B. wurde mir bei der französischen Verneinung "ne...pas" nur das Wort "pas" angezeigt und zwar mit der Übersetzung "Schritt", was ja auch richtig sein kann, aber leider nicht in diesem Fall! Aber das ist evtl. noch in der Auf-

bauphase... Ansonsten finde ich es praktisch, dass man neben den romanischen Sprachen auch noch Englisch und Deutsch zuschalten kann.)

- * *the comparison with the other languages is quite informative, I didn't expect that much.* (der Vergleich mit den anderen Sprachen ist recht aufschlußreich - hätte man so nicht immer erwartet)
- * *Very much! Because my French is not perfect, I can look up the words I don't know.* (Sehr! Vor allem, weil mein Französisch nicht so perfekt ist - dann kann man sich die fehlenden Wörter kurz anzeigen lassen)
- * *I thought that the dictionary behind is a bit thin so that the translations weren't very rich.* (Hatte den Eindruck, dass die hinterlegte Datenbank noch etwas dünn ist. Daher waren die Übersetzungen nicht sehr ergiebig.)
- * *Very useful.* (Sehr hilfreich)
- * *very much* (sehr)

What other functions would you like to see in the program?

- * I would say 'tense and person' for verbs. A translation function would be useful.
- * *Maybe a link to grammar, but via the web site you have that opportunity a bit.* (Vielleicht ein Link zu einer Grammatikübersicht...aber durch die Website ist das ja ein bisschen gegeben)
- * *I don't know any.* (Mir sind keine eingefallen.)
- * *more languages* (noch weitere Sprachen)
- * A print function would be useful on the 'web page' function
- * *the article for nouns* (bei den Substantiven der Artikel)
- * perhaps words dragged into the box, and shown on the web page, could be shown in other example sentences, to ensure that the user understands its proper use
- * 1. A progress bar while it is checking the words in the lexicon. 2. When the scroll bar is required in the right hand plane, it should be clearly visible to the user.
- * [...] *maybe a function like "search this word via google". Because you don't give all the information in your dictionary tool (connotations are missing), maybe this is a suggestion for the learner to get involved with the pragmatic use of the language.* (vielleicht ist das eine blöde Idee: Nachdem ich den Tipp, den

praktischen Gebrauch von Worten über Google im Internet zu explorieren bei meiner spanischen Übersetzungsarbeit oft hilfreich umsetzen konnte, fände ich eine Funktion wie "dieses Wort über Google suchen" ganz interessant. Da Du in Deinem Wörterbuch nicht alle Informationen angeben kannst (insbesondere Konnotationen), die zu einem Wort vorstellbar wären, ist dies eventuell auch eine Anregung für Lerner, sich mit der Pragmatik der Sprache zu beschäftigen.)

- * *That you can listen to some of the words* (Daß man sich manche Wörter auch noch anhören kann)
- * *mail to an expert* (Mail an einen Experten)
- * *Functions are all good. Translation from English and German into the other languages would be great.* (Funktionen sind wunderbar. Übersetzung von Englisch und Deutsch in die jeweils anderen Sprachen wäre schön)
- * *Saving and loading of texts already worked with* (Speichern und Laden schon bearbeiteter Texte)

Overall, how did you get on with the program?

- * OK
- * *good!* (gut!)
- * *Actually I did not have any problems* (Ich hatte eigentlich keine Probleme.)
- * *relatively easy to use, but the processing time of the program is long* (relativ leicht zu bedienen, aber Bearbeitungszeit des Programms ist sehr lang)
- * *Yes, quickly learned how to use it and found it useful. Very comprehensive, very few words for which a translation was not provided*
- * Very Good.
- * *I managed fine.* (Bin gut mit dem Programm zurecht gekommen.)
- * *very good!* (prima!)
- * *Very good, easy and clear* (Sehr gut, einfach, klar und übersichtlich)
- * *Good* (Gut)
- * *See above... after some exploration and use of the help it worked...* (Siehe oben...Nach etwas Exploration und Hilfe-Verwendung ging es dann...)
- * *got on well* (gut zurechtgekommen)

Comments:

- * I like the comparative feature, but I'd like more info about each language.
- * *I used the program with Internet Explorer. Some letters were not readable especially in German, but in Spanish too.* (Ich habe das Programm mit dem Internet Explorer benutzt. Einige Buchstaben scheint er nicht herzustellen, vor allem im Deutschen. Dadurch sind einige Worte stark verkürzt und nicht lesbar. Aber auch im Spanischen.)
- * User friendly and useful, and other comments as above
- * *I have entered the Italian text: 'la donna è mobile'. In 3 languages I only got the translation 'furniture' for 'mobile', although in this text it can't be furniture.* (Ich habe den it. Text: 'la donna è mobile' eingegeben. Für 'mobile' habe ich bei 3 Sprachen immer nur die Übersetzung 'Möbel' bekommen, obwohl in diesem Text auf keinem Fall Möbel gemeint ist.)
- * I found it useful. I translated French, but found that the English translation sometimes confused as well as helped. I guess this is a fundamental problem, in that if the system doesn't translate perfectly, it could actually harm learning, rather than help it... that's why i think seeing the same word/phrase in a different sentence would be useful. if you were unsure of the translations accuracy, you could say, "well lets see that word used in a different sentence, and see if it still makes sense" ...
- * While learning a language and wanting to understand sentence construction, it is very useful.
- * *very nice, keep up the good work! I am already looking forward to the next development step.* (echt schön! Weiter so! Freue mich schon auf den nächsten Entwicklungsschritt!)
- * *Why doesn't a message appear if a word is not translated in some languages? I found that confusing, e.g. I entered a French text in which 'vivres' was only translated into German... pity!* (warum kommt keine Meldung, wenn ein Wort in manche Sprachen nicht übersetzt wird ? Das finde ich irritierend z.B. hatte ich einen französischen Text, in dem vivres nur auf Deutsch übersetzt wurde ... schade!)

* *Very good program, comments see above...* (Klasse Programm, Anmerkungen siehe oben...)

B.2. Summative Evaluation

B.2.1. Pre-Questionnaire

What is your mother tongue(s)?

German: 16 participants, English: 5 part., Turkish: 1 part., Russian: 1 part., German/Spanish: 1 part.

Please tick the languages you know/learned already:

English: 24 participants, French 20 part., Spanish 11 part., Italian 6 part., Russian 3 part., German 15 part., Japanese 1 part.

Other languages you know/learned already:

Latin: 6 participants, Romanian 2 part., Dutch 2 part., Ancient Greek, Catalan, Danish, Galician, Portuguese, Scots Gaelic, Swedish, Turkish: each 1 part.

Languages known/learned already, added together:

- * 4 participants: English, French
- * 3 participants: English, French, Spanish, German
- * 2 participants: English, French, Italian, German / English, French, German / English, French, Spanish
- * 1 participant: English, French, Italian, German, Japanese / English, French, Spanish, German, Russian / English, French, Spanish, Italian / English, French, German, Russian / English, French, Russian / English, German / English, Spanish, German, Russian / English, Spanish, German / English, Spanish, Italian, German / English, French, Italian, Scots Gaelic / English, French, Spanish, German, Romanian, Dutch

Which Romance languages would you like to learn for the first time? (multiple selection)

Italian: 12 participants, **Spanish:** 11 part., **Portuguese:** 3 part., **French:** 2 part., **Catalan:** 1 part.

While learning a new language, have you ever experienced an effect from previously learned languages?

Positive: 22 participants, **Don't know:** 1 part., **Never:** 1 part.

If you experienced any effect, can you give one or two examples?

- * *1. In German the past tense is mostly formed by an auxiliary verb and the main verb. This is the case in Spanish as well as English. (1. Im Deutschen besteht die Vergangenheitsform meistens aus einem Hilfsverb und dem Hauptverb. Dies ist sowohl im Spanischen als auch im Englischen der Fall.) 2. Ski fahren = esquiar = to ski*
- * - words look similar or are identical (e.g. madre/mère, parce que/por que, jardin/jardin) - structure of grammar is similar (je m'appelle/yo me llamo) - words sound similar
- * Sometimes similarities in words and structure can be found.
- * similar grammatical structure similar vocabulary
- * The wrong language surfaces I get stuck in "neutral" for a second and cannot say anything in any language. The new language pushes the older ones lower down on the ready access totem-pole.
- * You can derive a lot from Latin. In my Italian lessons I often noticed the similarity between i.e. Italian and French...which can as well sometimes be confusing.
- * *I could derive some English and French words because of my knowledge of Latin. Regarding grammar I also had an advantage in English and French because of my knowledge in Latin (durch meine Lateinkenntnisse konnte ich mir viele englische und französische Vokabeln erschließen; auch in Bezug auf die Grammatik hatte ich durch meine Lateinkenntnisse in Englisch und Französisch einen Vorsprung*
- * Latin grammar helped understanding French and even German (native) grammar. Similar vocabulary in roman languages.
- * *Some words in Spanish and French are similar, at least they sound the same (Einige Wörter im Spanischen und Französischen sind ähnlich, zumindest vom Klang)*

- * *grave = difficult (French, Latin)* (grave = schwer (Französisch, Latein))
- * Mostly positive help, but sometimes I get a 'billboard' in my head with the same word listed in all the languages I know, except for the one I need to remember. It can be rather annoying.
- * Comprehension of words can be guessed if the words are alike to the known language (ex. chanter in French - canter in Spanish); the structures of sentences are sometimes the same to the known language
- * French and Spanish: often similar words
- * grammar: subjuntivo -> subjunctif sequence of tenses voc: nouns: a lot of nouns are nearly the same verbs: roots of the verbs are the same
- * If the languages come from the same family, meaning can sometimes be deduced
- * The wrong language surfaces first.
- * Understanding more words than I already learned
- * Sometimes I get lists in my head of more than one language, but often when I am trying to think of a word, it only appears (in my mind) in the languages which I don't need at the moment. This can be a bit annoying.
- * There's a lot of 'crossover' between French and Italian, particularly in vocabulary and verb structures (such as reflexive verb formation and conjugation), and that was useful when learning Italian to give me a 'hook' into Italian.

While learning a language, which topics are you interested in? (fashion, music, sports, food, politics, economy, etc.)

- * *biographies, short stories, economy, health issues, fashion.* (Biographien, Kurzgeschichten, Wirtschaft, Gesundheit, Mode)
- * - travelling - daily life (food, shopping, etc.) - news (political but also yellow press) - culture, history
- * Politics, economy, society, but also music, sports and culture.
- * art culture politics
- * Any current or professional interest does fine
- * Education, music, politics, personal/philosophical topics
- * reading books in original language

- * *I don't have any special interests. My interest in learning languages is that I can make myself understandable in everyday life as soon as possible.* (ich habe keine speziellen Themen; mich interessiert beim Lernen einer Sprache im wesentlichen, dass ich mich schnellstmöglich im täglichen Gebrauch durch sie verständigen kann)
- * everyday life (politics, food, news...)
- * basic learning: all day experiences like shopping, ordering at restaurant, small talk about hobbies. advanced learning: politics, economy, expressing feelings (talking about relationships, problems,...)
- * culture of the country food history economy politics
- * *travelling, sightseeing, culture, traditions, festivals, holidays, food (restaurants)* (Reisen, Sightseeing, landesübliche Bräuche, Traditionen, Feste, Feiertage, Essen (Restaurant))
- * Economics, society
- * everyday human life, food, culture, landscape
- * it doesn't matter, I usually concentrate on the language, not on the topic
- * politics, economy
- * all topics
- * politics, cultural issues, music, news etc
- * culture, music, literature
- * First I think it start with something common like entertainment and news. I've learned the best and easiest way to work on language learning is watching TV or videos in the languages you wanna learn
- * children's comics
- * culture, everyday use, country
- * no special preference, just less sports or politics
- * At the beginner stage any topic is fine, later current affairs and politics are of interest, not least because events in the news

Have you ever used language-learning software?

yes: 10 participants, **no:** 14 part.

If you have used language-learning software:

a) What did you like about it?

- * *The possibility by pressing the “repeat”-button to determine myself the order of the task and the focus (Die Möglichkeit - die Reihenfolge der Aufgaben selbst zu bestimmen und somit Schwerpunkte nach Bedarf zu verändern; - auf die Wiederhol“taste” zu klicken)*
- * *- interactive features like games, quizzes - visualizations of grammatical peculiarities - immediate and individual feedback - individualizability of lessons (i.e. being able to learn what I want; creating ones own schedule)*
- * *You were told what to do...so you can be lazy in some way. I liked the interactive parts...*
- * *I haven't used any piece of software (ich habe keine Software genutzt)*
- * *Easier than books (motivation)*
- * *Not used it to any great extent. Mostly did illustrations for this type of software.*
- * *I can decide how to structure my learning time*
- * *Ease of access and availability multimedia resources in one place*
- * *Really nothing ... They were all very boring and mostly they dealt with tourist phrases and check in and check out in hotels etc.*
- * *Didactic CALL can be useful as an adjunct to a face-to-face course, to reinforce and extend knowledge. Drill and practice exercises, though boring, are useful for particular topics (e.g. imperfect subjunctive in Italian which is quite awkward). Reference software is very useful, particularly online dictionaries with usage examples.*
- * *I have only used this software, since I learned my foreign languages long ago. The plurilingual tool was very helpful, and in such a short time I was able to improve my quiz results from getting only half right to missing only 3 questions.*

b) What did you not like about it?

- * *expensive, no value for money and I missed the interaction. (teuer und wenig und fehlende Interaktion.)*

- * - the inherent anonymity of learning software - technical problems - overloaded and confusing design (too many colours, too many visual details, confusing menu, etc.) - no cross-referencing to other languages - most learning software does hardly make a diagnosis of my actual knowledge
- * Sometimes it was a bit inflexible and monotonous ...
- * *I haven't used any piece of software* (ich habe keine Software genutzt)
- * In most cases not as effective as learning with teacher in school.
- * no negative feelings yet, unless the software has really annoying design elements.
- * it needs a lot of discipline to go on when it gets harder, its often easier to learn in groups
- * Lack of constructive feedback, boredom factor setting in after a while
- * Really nothing ... They were all very boring and mostly they dealt with tourist phrases and check in and check out in hotels etc.
- * Most of the didactic software I didn't like as it didn't even approach face-to-face learning, and the claims it made were far too overblown - "Learn to speak XXX in 10 days!". There's also very little for non-beginners, and the topics in the beginners packages were often the same old same old - restaurant, hotel, taxi, airport.
- * most language software needs visual improvement

B.2.2. Text Tools

Did you use the Multilingual dictionary tool?

yes: 13 participants, no: 2 part.

How useful was the "web page" function in the Multilingual dictionary tool for you?

not useful: 3 participants, useful: 5 part., very useful: 4 part.

Which translation language did you mainly use when looking up words in the Multilingual Dictionary Tool?

French: 3 participants, German 3 part., English 2 part., German / English 2 part., Italian 1 part., one answer: 'depends on purpose'

Did you use the Plurilingual dictionary tool?

yes: 13 participants, no: 1 part.

Did you find the grouping of words in Pan-Romance vocabulary, Profile words and Graphically similar words to be helpful?

- * yes [5 participants]
- * useful, when I learned at least two languages and the third language is to be learned
- * yes, very interesting: 2 participants
- * I found it surprisingly helpful for learning new words in the Romance languages in which I am less strong
- * Yes, it was useful to split words into those 3 categories, particularly the language-specific (Profile) words as these can't be derived from one tongue into another.
- * Yes, because this tells me something about the probability of finding a similar word in other languages.
- * No not really, because with basic language knowledge you know from where some words have been derived from ...
- * not primarily helpful, but interesting

Do you think that this tool would be useful for language learning?

not useful: 1 participant, very useful: 5 part., useful: 7 part.

Would you really use it?

yes: 12 participants, no: 1 part.

If you used at least one of the dictionary tools:

Did you find the buttons and layout of the Multilingual dictionary tool and Plurilingual dictionary tool to be intuitive?

yes: 10 participants, no: 4 part.

Did you find the buttons and layout of the Multilingual dictionary tool and Plurilingual dictionary tool to be effective?

yes: 13 participants, no: 1 part.

Do you think that the dictionary tools were easy to use with the information provided?

difficult: 0 participants, quite difficult: 1 part., quite easy: 11 part., easy: 2 part.

Which dictionary tool did you find more useful?

Multilingual dictionary tool: 5 participants, Plurilingual dictionary tool: 9 part.

How useful did you find the concordancer?

not useful: 2 participants, useful: 5 part., very useful: 7 part.

Did the information about “Words having roughly the same meaning” help you?

- * yes [7 participants]
- * yes, it is useful to see words interrelated
- * I don't work with the concordancer.
- * No. I typed in “para” and got “encima de”. A relation between these two is no closer than that between “for” and “on top of”.
- * not tremendously
- * Yes, this is a great tool
- * Yes, especially when combined with the plurilingual dictionary. You get an idea of the contexts in which different pan-romance words are used.

How useful were the slide-based learning materials (for Pan-Romance vocabulary, Sound Correspondences and Prefixes and Suffixes) for you?

not useful: 1 participant, useful: 8 part., very useful: 2 part.

What other functions or what other kind of information would you like to see in these tools?

- * Maybe some exercises would be useful. People improve language proficiency by practicing the target language. Providing exercises and direct feedback would probably further increase the usefulness of your tools.
- * *I didn't miss anything so far* (soweit ich es ausprobiert habe, hat mir nichts gefehlt)
- * *phrases and idioms, e.g. by entering "andare in giro" it only showed the meaning of "andare", "in" and "giro", not the meaning of the phrase: to take a walk.* (Redewendungen, feststehende Ausdrücke (z.B. bei der Eingabe von "andare in giro" wird nur angezeigt was "andare", "in" und "giro" bedeutet, nicht aber dass das Verb auch "spaziergehen" heißt.)
- * I would like to see the same buttons in the plurilingual tool as in the multilingual: save, web page...
- * I would like to see a combination between the multilingual and the plurilingual dictionaries.
- * Audio clips to help with pronunciation.

Comments:

- * - the multilingual dictionary tool didn't work in MSIE and in Mozilla - in the tools a help function within the tools would be helpful (not only at the beginning)
- * *I think it is a pity that the multilingual dictionary tool isn't connected to the concordancer.* (ich finde es schade, dass das multilinguale Wörterbuch nicht mit der Concordancer Funktion verbunden ist.)
- * Well done so far! ;-)
- * *very interesting* (sehr interessant!)
- * I wasn't clear on the use of the web page function in the multilingual dictionary, or I would have tried it. When people are trying these dictionaries out, you should provide sample text in French, Spanish and Italian, in order for people to get an idea first of how they work, otherwise we must hunt the internet for a sample of text just to be able to see how the dictionaries work.

B.2.3. Sentence Structures

How do you rate the content of learning materials?

- * **Too easy:** 1 participant
- * **Quite my learning level:** 8 part.
- * **A bit difficult but still manageable:** 2 part.
- * **Too difficult:** 0 part.

How do you rate the language style of the explanations?

- * **I could easily follow:** 8 participants
- * **Quite easy but did not understand a few things:** 2 part.
- * **Quite difficult:** 1 part.
- * **Very difficult:** 0 part.

How useful do you find the use of animation in these language materials?

- * **Just gimmicks!:** 0 participants
- * **Helped me in some cases:** 2 part.
- * **Quite good:** 1 part.
- * **Very useful:** 1 part.

Comments:

- * The animations help me to form a representation of a stepwise procedure (first do this, than do that, etc.) for different linguistic cases: Very useful visualizations!
- * *it would make sense to have a list at the end of a unit with articles, demonstratives, etc. to see again the differences between the languages. The example sentences should be shown with m/f singular and plural. Demonstrative adjectives: LA voiture, therefore cette voiture-ci, explanations should be checked for correctness. (es wäre sinnvoll eine Übersichtstabelle am Ende einer Lerneinheit (Artikel, Demonstrativa, etc.) zu haben, um noch mal rekapitulieren zu können wo genau die Unterschiede der Sprachen liegen. Die Beispielsätze sollten der immer für m/w singular und plural aufgeführt werden. Bei Demonstrativadjektiven: es heisst LA voiture, folglich auch cette voiture-ci, Erklärungen sollten auf ihre Richtigkeit hin geprüft werden)*
- * *Very clear and easy to understand!* (Sehr übersichtlich und leicht verständlich!)

- * it is easy to understand
- * very interesting info!
- * it is mostly like reading in a book
- * the animations were too slow, but interesting, and seemed to add to the understanding. Perhaps you could put in a control for nervous types like me so I could speed up the animations.
- * Other than the animations, I don't see any advantage in having such textual materials online compared to textbooks, and think that there are many disadvantages. I certainly would prefer to read a good textbook to learn this kind of material.

B.2.4. Graphical User Interface

How easy was it for you to use ESPRIT right from the start?

very difficult: 0 participants, difficult: 0 part., regular: 1 part., easy: 2 part., very easy: 2 part.

Would you like to have French, Italian or Spanish as further interface languages? The interface language is the language in which all the information is displayed, currently English or German. (multiple selection)

French, Italian and Spanish: 1 participant, Italian: 1 part., none of them: 3 part.

Did you use the 'guided tours'?

yes: 5 participants, no: 0 part.

If yes, how much did they help you?

- * It helped me, when I got stuck using the system correctly.
- * very much, they are helpful to understand why there are so many similarities between Roman languages and they explain how the learner can transfer knowledge from one language to the other
- * a little bit

- * Mostly helpful, but interface was intuitive enough not to really need them
- * Not very - I'd have preferred a simple 'Help' button with help pages, as that's what I've come to expect as a long-time computer user. I got the hang of the 'teletext' eventually, but the metaphor threw me at first.

How much instruction do you generally prefer with language-learning materials?

- * I always want to be told what to do next: 0 participants
- * I want to make a few decisions but most of the time I am just fine with the program's suggestions: 0 part.
- * I can be very active and very passive, just depends: 3 part.
- * Suggestions are helpful but at the end it's me who decides what to do: 2 part.
- * I actually want to decide freely when to do what: 0 part.

How do you find the idea to use the TV metaphor (TV screen, TV magazine and Teletext) for language learning? (multiple selection)

- * It helped me a lot to use the system right from the start: 4 participants
- * I don't see the point: watching TV is passive, whereas language learning is active: 1 part.
- * I would prefer a topic-based approach (e.g. Lesson 1 - Informal conversation, Lesson 2 - Getting information ...): 0 part.

Do you have any suggestions to improve or extend the ESPRIT learning environment?

- * guided tour in the tv-metaphor
- * (un)fortunately not ;-)
- * I can imagine it becoming a huge suite of language learning activities, but in that case there should be an appendix with grammar rules for each language. Not everyone can remember what demonstrative pronouns even means after having learned a language so long ago.

* In the interface, I do think the user needs a bit more guidance as to what to do next. I looked at the indefinite articles lesson, the content of which was good, and the 1-3 buttons were quite clear, but the small green button on a line didn't seem to do anything, and the + sign was mystifying. After finishing the lesson, it wasn't clear to me where I should go or that the lesson was finished.

I think some context-sensitive help might be useful. There's some such help already, in the form of 'tooltips' in various places, and this is useful.

The addition of pronunciation could be a big help, although that would probably require a major extension of the environment. Spanish pronunciation is particularly awkward for English native speakers, and if you want to move onto Portuguese that can be difficult as well.

Comments:

* Well done! Great tool!

* Your language tool has great potential.

* I was slightly bewildered when the interface loaded, after the choice of flags, as 'pages' were scrolling past in front of me finally stopping on 8-9. It wasn't then clear where I should start and what to do: should I go back to page 1 of the 'magazine', or try a few other buttons to explore the application? I did the latter and [?]

Bibliography

ADOBE (2007): Flash MX 2004 Professional and Flash Professional 8.

<http://www.adobe.com/products/flash/>[checked:14.01.2007]

AMFPHP (2007): Open-source Flash Remoting gateway.

<http://www.amfphp.org/>[checked:14.01.2007]

APACHE FRIENDS (2007): XAMPP for Windows.

<http://www.apachefriends.org/en/xampp-windows.html>[checked:14.01.2007]

BARONI, MARCO AND ZANCHETTA, EROS (2004): Morph-it! A free morphological lexicon for the Italian Language.

<http://sslmitdev-online.sslmit.unibo.it/linguistics/morph-it.php>[checked:14.01.2007]

BELANGER, FRANCE AND JORDAN, DIANE H. (2000): *Evaluation and implementation of distance learning: Technologies, tools, and techniques*. Hershey, PA.: Idea Group.

BERSCHIN, HELMUT; FERNÁNDEZ-SEVILLA, JULIO AND FELIXBERGER, JOSEF (1995): *Die spanische Sprache: Verbreitung, Geschichte, Struktur*. Ismaning, Germany: Hueber, second edition.

BICK, ECKHARD (2004): "Grammar for Fun: IT-based Grammar Learning with VISL". In: *CALL for the Nordic Languages - tools and methods for Computer Assisted Language Learning*, HENRIKSEN, PETER JUEL (ed.), Copenhagen, Denmark: Samfundslitteratur (Copenhagen Studies in Language), 49-64.

BLANCHE-BENVENISTE, CLAIRE (ed.) (1997): *EuRom 4: Metodo de ensino simultâneo das línguas românicas - Metodo para la enseñanza simultánea de las lenguas románicas - Metodo di insegnamento simultaneo delle lingue romanze - Méthode*

- d'enseignement simultané des langues romanes*. Florence, Italy: La Nuova Italia Editrice.
- BODMER, FREDERICK (1944): *The Loom of Language*. London, UK: Allen and Unwin.
- BÄR, MARKUS (2004): *Europäische Mehrsprachigkeit durch rezeptive Kompetenzen: Konsequenzen für Sprach- und Bildungspolitik*, volume 18 of *Editiones EuroCom*. Aachen, Germany: Shaker.
- BRANTS, THORSTEN (2000): "TnT - A Statistical Part-of-Speech Tagger". In: *Proceedings of the Sixth Applied Natural Language Processing Conference ANLP-2000*. Seattle, WA., 224-231.
<http://www.coli.uni-saarland.de/~thorsten/tnt/> [checked:14.01.2007]
- BREIDT, ELISABETH AND FELDWEG, HELMUT (1997): "Accessing Foreign Languages with Compass". *Machine Translation* 12 (1-2): 153-174.
- BRUMFIT, CHRISTOPHER J. AND JOHNSON, KEITH (eds.) (1979): *The communicative approach to language teaching*. Oxford, UK: Oxford University Press.
- BURNS, HUGH L. AND CAPPS, CHARLES G. (1988): "Foundations of Intelligent Tutoring Systems: An Introduction". In: *Foundations of Intelligent Tutoring Systems*, POLSON, MARTHA C.; RICHARDSON, J. JEFFREY AND SOLOWAY, ELLIOT (eds.), Mahwah, NJ.: Erlbaum, 1-18.
- CAO (2007): Central Applications Office - course search.
<http://websr3.cao.ie/courses.php> [checked:14.01.2007]
- CARTER, RONALD (2003): "Language awareness". *ELT Journal* 57 (1): 64-65.
- CENOS, JASONE (2000): "Research on multilingual acquisition". In: *English in Europe. The Acquisition of a Third Language*, CENOS, JASONE AND JESSNER, ULRIKE (eds.), Clevedon, UK: Multilingual Matters, 39-53.
- CILT (2005): Languages in education.
<http://www.cilt.org.uk/research/statistics/education/index.htm> [checked:14.01.2007]

- COLPAERT, JOZEF (2004): *Design of Online Interactive Language Courseware: Conceptualization, Specification and Prototyping. Research into the impact of linguistic-didactic functionality on software architecture*. Ph.D. dissertation, University of Antwerp, Belgium.
- COUNCIL OF EUROPE (2007): *A Common European Framework of Reference for Languages: Learning, Teaching, Assessment*.
http://www.coe.int/t/dg4/linguistic/Source/Framework_EN.pdf [checked: 14.01.2007]
- CRISTIANINI, NELLO AND SHAWE-TAYLOR, JOHN (2000): *An Introduction to Support Vector Machines and other kernel-based learning methods*. Cambridge, UK: Cambridge University Press.
- DABÈNE, LOUISE AND DEGACHE, CHRISTIAN (eds.) (1996): *Comprendre les langues voisines*. Number 104 in *Etudes de Linguistique Appliquée*. Paris, France: Didier érudition.
- DAELEMANS, WALTER; ZAVREL, JAKUB; BERCK, PETER AND GILLIS, STEVEN (1996): "MBT: A Memory-Based Part of Speech Tagger-Generator". In: *Proceedings of the Fourth Workshop on Very Large Corpora*, EJERHED, EVA AND DAGAN, IDO (eds.). Copenhagen, Denmark, 14–27.
<http://ilk.uvt.nl/~zavrel/tagtest.html> [checked: 14.01.2007]
- DE ANGELIS, GESSICA AND SELINKER, LARRY (2001): "Interlanguage Transfer and Competing Linguistic Systems in the Multilingual Mind". In: *Cross-Linguistic Influence in Third Language Acquisition: Psycholinguistic Perspectives*, CENOZ, JASONE (ed.), Clevedon, UK: Multilingual Matters, chapter 3, 42–58.
- DEGACHE, CHRISTIAN (ed.) (2003): *Intercompréhension en langues romanes. Du développement des compétences de compréhension aux interactions plurilingues, de Galatea à Galanet*, volume 28. Grenoble, France: LIDILEM, Université Stendhal Grenoble 3.
- DEVI, V. ANITHA (2005): "Using animation for teaching phrasal verbs - A brief Indian experiment". *Language in India* 5: [no page numbers].

<http://www.languageinindia.com/aug2005/animationanitha1.html> [checked: 14.01.2007]

- DOKTER, DUCO; NERBONNE, JOHN; SCHURCKS-GROZEVA, LILY AND SMIT, PETRA (1998): "Glosser-RuG: a User Study". In: *Language Teaching and Language Technology*, JAGER, SAKE; NERBONNE, JOHN AND VAN ESSEN, ARTHUR (eds.), Lisse, Netherlands: Swets and Zeitlinger, 167–176.
- DONMALL-HICKS, B. GILLIAN (1997): "The History of Language Awareness in the UK". In: *Knowledge about Language. Encyclopaedia of Language and Education*, VAN LIER, LEO AND CORSON, DAVID (eds.), Dordrecht: Kluwer, volume 6, 21–31.
- DOULL, DAVID; KIRKPATRICK, ANDREW; MCGREGOR, CHRIS; PINCH, PETER; REGAN, BOB AND WATERS, CRYSTAL (2002): *The Macromedia Flash Usability Guide. Interacting with Flash MX*. Berkeley, CA.: Apress.
- ELLIS, ROD (1997): *Second Language Acquisition*. Oxford, UK: Oxford University Press.
- EUROCOM (2007): EuroCom online - Romanische Sprachen sofort lesen können - Be able to read romance languages immediately.
<http://eurocom.httc.de/> [checked:14.01.2007]
- FRÉMY, DOMINIQUE AND FRÉMY, MICHÈLE (2002): *Quid*. Paris, France: Éditions Robert Laffont.
- GAMPER, JOHANN AND KNAPP, JUDITH (2001): "A Review of CALL Systems in Foreign Language Instruction". In: *Proceedings of the 10th International Conference on Artificial Intelligence in Education (AI-ED 2001)*. Amsterdam, Netherlands: IOS Press, 377–388.
- GAMPER, JOHANN AND KNAPP, JUDITH (2002): "A Review of ICALL systems". *Computer Assisted Language Learning (CALL)* 15 (4): 329–342.
- GARZANTI (2005): *Dizionario Garzanti Hazon di Inglese 2005*. CD-ROM. Milano, Italy.
- GASS, SUSAN M. AND SELINKER, LARRY (eds.) (1983): *Language Transfer in Language Learning*. Rowley, MA.: Newbury House.

- GAZDAR, GERALD AND MELLISH, CHRIS (1989): *Natural Language Processing in Prolog*. Reading, UK: Addison Wesley.
- GIMÉNEZ, JESÚS AND MÁRQUEZ, LLUÍS (2004): "SVMTool: A general POS tagger generator based on Support Vector Machines". In: *Proceedings of the 4th International Conference on Language Resources and Evaluation (LREC'04)*. Lisbon, Portugal, 43–46.
- HANDKE, JÜRGEN (2003): *Multimedia im Internet*. München, Germany: Oldenbourg.
- HARRINGTON, MICHAEL (1996): "Intelligent Computer-Assisted Language Learning". *ON-CALL* 10 (3): 2–9.
- HAWKINS, ERIC (1984): *Awareness of Language. An Introduction*. Cambridge, UK: Cambridge University Press.
- HENRICI, GERT AND RIEMER, CLAUDIA (2003): "Zweitsprachenerwerbsforschung". In: *Handbuch Fremdsprachenunterricht*, BAUSCH, KARL-RICHARD; CHRIST, HERBERT AND KRUMM, HANS-JÜRGEN (eds.), Tübingen, Germany; Basel, Switzerland: Francke, 38–43.
- HERDINA, PHILIP AND JESSNER, ULRIKE (2002): *A Dynamic Model of Multilingualism: Perspectives of Change in Psycholinguistics*. Clevedon, UK: Multilingual Matters.
- HUBBARD, PHILIP L. (1996): "Elements of CALL Methodology: Development, Evaluation, and Implementation". In: *The Power of CALL*, PENNINGTON, MARTHA C. (ed.), Houston, TX.: Athelstan, 15–32.
- HUFEISEN, BRITTA (2003): "L1, L2, L3, L4, Lx - alle gleich? Linguistische, lernerinterne und lernerexterne Faktoren in Modellen zum multiplen Spracherwerb". *Zeitschrift für Interkulturellen Fremdsprachenunterricht* 8 (2/3): 1–13.
- HUNT, BRIAN; BURVALL, PATRIK AND IVERGARD, TONI (2004): "Interactive media for learning (IML): assuring usability in terms of a learning context". *Education + Training* 46 (6/7): 361–369.
- ICT4LT (2004): Information and Communications Technology for Language Teachers. <http://www.ict4lt.org/> [checked: 14.01.2007]

- ILYUSHCHENKO, SIMON AND ARVA, ADRIAN (2007): AMF::Perl - Flash Remoting in Perl and Python.
<http://www.simonf.com/flap/> [checked:14.01.2007]
- ISO-9241-10 (1996): "Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 10: Dialogue Principles". Technical report, International Organization for Standardization, Geneva, Switzerland.
- ISO-9241-11 (1998): "Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 11: Guidance on usability". Technical report, International Organization for Standardization, Geneva, Switzerland.
- JAMES, CARL (1999): "Language Awareness: Implications for the Language Curriculum". *Language, Culture and Curriculum* 12 (1.): 96-116.
- JAVA (2007): .
<http://java.sun.com/> [checked:14.01.2007]
- JESSNER, ULRIKE (1999): "Metalinguistic awareness in multilinguals. Cognitive aspects of third language learning". *Language Awareness* 8 (3&4): 201-209.
- JESSNER, ULRIKE (2006): *Linguistic Awareness in Multilinguals*. Edinburgh, UK: Edinburgh University Press.
- JORDA, MARIA PILAR SAFONT (2005): *Third Language Learners : Pragmatic Production and Awareness*. Clevedon, UK: Multilingual Matters.
- JURJANS, PAVILS (2004): RegExp class for Flash 5 / Flash MX.
<http://www.jurjans.lv/flash/RegExp.html> [checked:14.01.2007]
- KAPLAN, RONALD M. AND BRESNAN, JOAN (1982): "Lexical-Functional Grammar: A Formal System for Grammatical Representation". In: *The Mental Representation of Grammatical Relations*, BRESNAN, JOAN (ed.), Cambridge, MA.: MIT Press, chapter 4, 173-281.
- KLEIN, HORST G. (2002): "Entwicklungsstand der Eurocomprehensionsforschung". In: *EuroCom - Mehrsprachiges Europa durch Interkomprehension in Sprachfamilien*, KISCHEL, GERHARD (ed.), Aachen, Germany: Shaker, 35-58.

- KLEIN, SILVIA H. (2004): *Mehrsprachigkeitsunterricht an der Schule. Protokoll einer 25-stündigen EuroComRom-Unterrichtsreihe an der Heinrich Böll-Schule (Hattersheim)*., volume 22 of *Editiones EuroCom*. Aachen, Germany: Shaker.
- KOLLER, THOMAS (2003): "Knowledge-based intelligent error feedback in a Spanish ICALL system". In: *Proceedings of The 14th Irish Conference on Artificial Intelligence & Cognitive Science*. Dublin, Ireland, 117–121.
http://www.computing.dcu.ie/~tkoller/AICS_paper_Thomas_Koller.pdf [checked:14.01.2007]
- LAENZLINGER, CHRISTOPHER AND WEHRLI, ERIC (1991): "Fips, un analyseur interactif pour le français". *TA informations* 32 (2): 35–49.
- LEVENSHTAIN, VLADIMIR I. (1966): "Binary codes capable of correcting deletions, insertions, and reversals". *Soviet Physics Doklady* 10 (8): 707–710.
- LEVY, MICHAEL (1997): *Computer-Assisted Language Learning: Context and Conzeptualization*. Oxford, UK: Clarendon Press.
- LIGHTBOWN, PATSY M. (2000): "Classroom SLA Research and Second Language Teaching". *Applied Linguistics* 21 (4): 431–62.
- LYNCH, PATRICK J. AND HORTON, SARAH (2002): *Web Style Guide: Basic Design Principles for Creating Web Sites*. New Haven, CT.: Yale University Press.
<http://www.webstyleguide.com/> [checked:14.01.2007]
- MACC (2004): pageFlip version 2.02.
<http://www.iparigrafika.hu/pageflip/> [checked:14.01.2007]
- MAHLMEISTER, SABINE (2004): "Empirische Untersuchung zum Erfolg eines EuroComRom-Kurses". In: *Neuere Forschungen zur Europäischen Interkomprehension*, KLEIN, HORST G. AND RUTKE, DOROTHEA (eds.), Aachen, Germany: Shaker, volume 21 of *Editiones EuroCom*, 155–164.
- MARTIN, JAMES (1991): *Rapid application development*. Indianapolis, IN.: Macmillan.
- MCCANN, WILLIAM J.; KLEIN, HORST G. AND STEGMANN, TILBERT D. (2002): *EuroComRom - The Seven Sieves*, volume 5 of *Editiones EuroCom*. Aachen, Germany: Shaker.

- MEISSNER, FRANZ-JOSEPH (2002): "Transfer aus der Sicht der Mehrsprachigkeitsdidaktik". In: *Europäisches Jahr der Sprachen: Mehrsprachigkeit in Europa*, WOLFF, ARMIN AND LANGE, MARTIN (eds.), Regensburg, Germany: Fachverband Deutsch als Fremdsprache, Materialien Deutsch als Fremdsprache 65, 128–142.
- MENZEL, WOLFGANG (1992): *Modellbasierte Fehlerdiagnose in Sprachlehrensystemen*. Tübingen, Germany: Niemeyer.
- METCALF, VANESSA AND MEURERS, DETMAR (2006): Generating Web-based English Preposition Exercises from Real-World Texts. Paper presentation at EUROCALL 2006, Granada, Spain.
- MIDNIGHT CODERS (2007): WebORB presentation server.
<http://www.themidnightcoders.com/weborb/aboutWeborb.htm> [checked: 14.01.2007]
- MISHAN, FRED AND STRUNZ, BOB (2003): "An application of XML to the creation of an interactive resource for authentic language learning tasks". *ReCALL* 15 (2): 237–250.
- MITCHELL, ROSAMOND (2000): "Applied Linguistics and Evidence-based Classroom Practice: The Case for Foreign Language Grammar Pedagogy". *Applied Linguistics* 21 (3): 281–303.
- MÜLLER-LANCÉ, JOHANNES (2002): "Aural Intercomprehension of Multilinguals: an Empirical Study". In: *Proceedings of the 2nd International Conference on Third Language Acquisition and Trilingualism*, YTSMA, JEANNES (ed.). Leeuwarden: Fryske Akademy.
- MÜLLER-LANCÉ, JOHANNES (2003): *Der Wortschatz romanischer Sprachen im Tertiärsprachenerwerb*. Tübingen, Germany: Stauffenburg.
- MOZILLA CORPORATION (2007): Firefox 2.0.
<http://www.mozilla.com/> [checked: 14.01.2007]
- MYLES, FLORENCE (2002): Second language acquisition (SLA) research: its significance for learning and teaching issues. Online document.

<http://www.llas.ac.uk/resources/goodpractice.aspx?resourceid=421> [checked:14.01.2007]

MYSQL (2007): .

<http://www.mysql.com/> [checked:14.01.2007]

NANDORF, KATJA (2003): "Interaktivität in multimedialer Englisch-Lernsoftware für erwachsene Selbstlerner". In: *Fremdsprachenlernen mit digitalen Medien*, LEGUTKE, MICHAEL AND RÖSLER, DIETMAR (eds.), Tübingen, Germany: Narr, Giessener Beiträge zur Fremdsprachendidaktik, 35–63.

NCCA (2003): Languages in the post-primary curriculum: a discussion paper.

<http://www.ncca.ie/uploadedfiles/Publications/LanguagesPaper.pdf> [checked:14.01.2007]

NERBONNE, JOHN (2002): "Computer-Assisted Language Learning and Natural Language Processing". In: *Handbook of Computational Linguistics*, MITKOV, RUSLAN (ed.), Oxford, UK: Oxford University Press, 670–698.

NUNAN, DAVID (1991): "Communicative tasks and the language curriculum". *TESOL Quarterly* 25 (2): 279–295.

NUNAN, DAVID (2005): "Classroom Research". In: *Handbook of Research in Second Language Teaching and Learning*, HINKEL, ELI (ed.), Mahwah, NJ.: Erlbaum, chapter 13, 225–240.

ODLIN, TERENCE (1989): *Language Transfer: Cross-Linguistic Influence in Language Learning*. Cambridge, UK: Cambridge University Press.

OXFORD UNIVERSITY PRESS (1996): Oxford Superlex. CD-ROM.

PERL (2007): Practical Extraction and Report Language.

<http://www.perl.org/> [checked:14.01.2007]

PHP (2007): PHP: Hypertext Preprocessor.

<http://www.php.net/> [checked:14.01.2007]

REED, BRACKEN AND RAILSBACK, JENNIFER (2003): "Strategies and Resources for Mainstream Teachers of English Language Learners". Portland, OR.: Northwest

Regional Educational Laboratory.

<http://www.nwrel.org/request/2003may/ell.pdf> [checked: 14.01.2007]

REINHEIMER, SANDRA AND TASMOWSKI, LILIANE (1997): *Pratique des langues romanes: espagnol, francais, italien, portugais, roumain*. Paris, France: L'Harmattan.

RENSING, CHRISTOPH AND STEINMETZ, RALF (2004): "Multimedia- und Hypermedia Einsatz in Sprachlernprogrammen am Beispiel EuroCom Online". In: *Mehrsprachigkeit und ihre Didaktik: Multimediale Perspektiven für Europa*, RUTKE, DOROTHEA AND WEBER, PETER J. (eds.), St. Augustin, Germany: Asgard, 3–12.

REUER, VEIT (2003): *PromisD - Ein Analyseverfahren zur antizipationsfreien Erkennung und Erklärung von grammatischen Fehlern in Sprachlehrensystemen*. Ph.D. thesis, Philosophische Fakultät II, Humboldt-Universität zu Berlin, Germany.

<http://edoc.hu-berlin.de/dissertationen/reuer-veit-2003-06-26/PDF%/Reuer.pdf> [checked: 14.01.2007]

REUER, VEIT (2004): *MiLCA (Medienintensive Lehrmodule in der Computerlinguistik-Ausbildung) - Language Processing and Intelligent Computer-Assisted Language Learning (online resource)*. University of Osnabrück, Osnabrück, Germany.

<http://www.cogsci.uni-osnabrueck.de/~vreuer/milca/> [checked: 14.01.2007]

REUMUTH, WOLFGANG AND WINKELMANN, OTTO (1993): *Praktische Grammatik der spanischen Sprache*. Wilhelmsfeld, Germany: Egert.

REUMUTH, WOLFGANG AND WINKELMANN, OTTO (1994): *Praktische Grammatik der französischen Sprache*. Wilhelmsfeld, Germany: Egert.

REUMUTH, WOLFGANG AND WINKELMANN, OTTO (1996): *Praktische Grammatik der italienischen Sprache*. Wilhelmsfeld, Germany: Egert.

RICHARDS, JACK C. AND RODGERS, THEODORE S. (2001): *Approaches and Methods in Language Teaching*. Cambridge, UK: Cambridge University Press, second edition.

ROCHE, JÖRG AND SCHELLER, JULJA (2004): "On the Efficiency of Grammar Animations in CALL". *TEL & CAL Zeitschrift für neue Lernkulturen* 04: 50–55.

- SCHERFER, PETER (2002): "Was ist und wie erlernt man Interkomprehension?" In: *EuroCom - Mehrsprachiges Europa durch Interkomprehension in Sprachfamilien*, KISCHEL, GERHARD (ed.), Aachen, Germany: Shaker, 82–96.
- SCHMID, HELMUT (1994): "Probabilistic part-of-speech tagging using decision trees". In: *Proceedings of International Conference on New Methods in Language Processing*. Manchester, UK, 44–49.
- SCHMIDELY, JACK; ALVAR EZQUERRA, MANUEL AND HERNÁNDEZ GONZÁLEZ, CARMEN (2001): *De una a cuatro lenguas. Intercomprensión románica: del español al portugués, al italiano y al francés*. Madrid, Spain: Arco Libros.
- SCHMITT JENSEN, JØRGEN (1997): "L'expérience danoise et les langues romanes". In: *L'Intercompréhension: le cas des langues romanes. Le français dans le monde*, BLANCHE-BENVENISTE, CLAIRE AND VALLI, ANDRÉ (eds.), Paris, France: Hachette/EDICEF, Le Français dans le Monde. Recherches et applications, 95–108.
- SCHNEIDER, DAVID AND MCCOY, KATHLEEN F. (1998): "Recognizing Syntactic Errors in the Writing of Second Language Learners". In: *COLING-ACL*. Montreal, Canada, 1198–1204.
- SCHÖPPER-GRABE, SIGRID AND WEISS, REINHOLD (1998): *Vorsprung durch Fremdsprachentraining. Ergebnisse einer Unternehmensumfrage*. Köln, Germany: Deutscher Instituts-Verlag.
- SHARWOOD SMITH, MICHAEL (1994): *Second Language Learning. Theoretical Foundations*. London, UK: Longman.
- SOAP (2003): SOAP Version 1.2 Part 0: Primer. W3C Recommendation 24 June 2003.
<http://www.w3.org/TR/2003/REC-soap12-part0-20030624/> [checked: 14.01.2007]
- SOBKOWIAK, WŁODZIMIERZ (2005): "Pronunciation in EFL CALL". *Teaching English with Technology: A Journal for Teachers of English* 5 (1): [no page numbers].
http://www.iatefl.org.pl/call/j_article20.htm [checked: 14.01.2007]
- STG (1998): Win Vokabel 5.0. CD-ROM. Software-Team Gievers.

- STOYE, SABINE (2000): *Eurocomprehension: Der romanistische Beitrag für eine europäische Mehrsprachigkeit*, Aachen, Germany: Shaker, volume 2 of *Editiones EuroCom*, 183–193.
- TRIBBLE, CHRIS AND JONES, GLYN (1997): *Concordances in the Classroom: a resource book for teachers*. Houston, TX.: Athelstan.
- UNICODE CONSORTIUM (2007): What is Unicode?
<http://www.unicode.org/standard/WhatIsUnicode.html> [checked:14.01.2007]
- UNIVERSITY OF IOWA (2005): Phonetics Flash Animation Project.
<http://www.uiowa.edu/~acadtech/phonetics/> [checked:14.01.2007]
- VAN BREUGEL, CAMIEL (1998): *A Visual Method for Teaching Grammatical Concepts to Primary and Secondary Schoolers: An Interactive Sentence Assembly Tool on the Internet*. master thesis, Department of Computer Science, Leiden University, Leiden, Netherlands.
- VANDEVENTER FALTIN, ANNE (2003a): *Grammar Checking for CALL*. Presentation at EuroCALL conference 2003, Limerick, Ireland.
- VANDEVENTER FALTIN, ANNE (2003b): *Syntactic Error Diagnosis in the context of Computer Assisted Language Learning*. Ph.D. thesis, Faculté des lettres, Université de Genève, Switzerland.
<http://www.unige.ch/cyberdocuments/theses2003/VandeventerA/meta.html> [checked:14.01.2007]
- VERLINDE, SERGE; SELVA, THIERRY AND BINON, JEAN (2003): “Alfalex: un environnement d’apprentissage du vocabulaire français en ligne, interactif et automatisé”. *Romanesque* 28 (1): 4262.
- WARSCHAUER, MARK (1996): “Computer-assisted language learning: An introduction”. In: *Multimedia language teaching*, FOTOS, S. (ed.), Tokyo, Japan: Logos International, 3–20.
- WENGER, ETIENNE (1987): *Artificial Intelligence and Tutoring Systems: Computa-*

tional and Cognitive Approaches to the Communication of Knowledge. Los Altos, CA.: Morgan Kaufmann.

WIKIPEDIA (2007): Wikipedia - the free encyclopedia that anyone can edit.

<http://www.wikipedia.org/>,<http://download.wikimedia.org/>[checked: 14.01.2007]

XLIFF (2003): XLIFF 1.1 Specification.

<http://www.oasis-open.org/committees/xliff/documents/xliff-specification.htm>[checked:14.01.2007]

XML (2007): Extensible Markup Language.

<http://www.w3.org/XML/>[checked:14.01.2007]

XPATH (1999): XML Path Language (XPath) Version 1.0. W3C Recommendation 16 November 1999.

<http://www.w3.org/TR/xpath>[checked:14.01.2007]

