I-Fleg a 3D-Game for Learning French

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ABSTRACT

In this paper, we present I-FLEG, a serious language game designed for interactively learning French as a second language. The game is integrated in Second Life and exploits the 3D virtual reality environment provided by this platform to implement immersive, *learn-by-doing* techniques that have proved to be among the most effective learning strategies in second language acquisition. Furthermore, the integration of the game in Second Life permits to fulfill many important desiderata of computer-aided learning technology. It allows ubiquitous, long distance learning as well as universal access. In addition, these characteristics by facilitating the collection of big amounts of test data over the web render our game an ideal device for both monitoring learner performance in dependence on situational context factors and for comparing different teaching methodologies.

Keywords: Virtual Learning Environments, Computer Assisted Learning, Intelligent Tutoring Systems, Immersive Learning

1. INTRODUCTION

In the last few years, due to the increased quality of web and 3D virtual reality technology and to the large availability of fast personal computers and cheap connections to the internet, there has been a flourishing of web-based learning platforms which range from simple web applications to high quality game products that reproduce a reality-like learning experience.

And indeed, in many disciplines the attention of e-learning research is focusing on simulations and serious games for situated immersive learning. The reasons for this is that web technologies provide large, universal access to learning resources, allow synchronous as well as asynchronous learning and they are cheap. In many technical fields, expensive laboratory experiments can be replaced with cheaper simulations (e.g. flight, emergency situation simulators etc.). However, the interest of e-learning in game technology has also a theoretical reason.

In his theory of the *flow* or focused motivation, Csikszentmihalyi [1] describes the principles which govern human handling, performing and learning. He comes out with a list of requirements that a learning experience should fullfill so to facilitate humans acquiring new knowledge.

An optimal learning environment is one that causes learners a positive experience thereby maintaining their focused motivation high and corresponds to an *immersive* experience which meets the following constraints:

- the goals or learning tasks are clear and well defined,
- the difficulty of the task matches the ability of the learner, i.e. the task is neither too easy nor too difficult,
- the learner has a feeling of control over the situation, he can make decisions and interact with the environment,
- the learner receives direct and immediate feedback.

In this context, serious games and simulations seem to be ideal candidates as learning environments, as they show the same characteristics of optimal real-life learning experiences (indeed, learners can move in the virtual game world and physically interact with objects), without having their shortcomings, such as for instance the injury risk.

Second language acquisition has been one of the first fields to acknowledge the importance of immersive environments for facilitating learning foreign languages. Krashen [2], for instance, noticed that adult learners acquire a second language more easily and their knowledge is more anchored, (i) if they are exposed during learning to real-life-like situations, like those that the children experience by acquiring the first language and (ii) if they are forced to active communication (*communicative language learning approach* see [3]). Other authors such as Rutherford [4] pointed out that teaching a second language consists in raising the awareness of the learner on the phenomena of the target language in context, i.e. by noticing or highlighting them in a particular situation.

Recently, pedagogical approaches such as constructivism (e.g. see [5]) and cognitivism (e.g. see [6]) have emphasized both the role of '*learn-by-doing*' techniques in second language acquisition and the importance of learner awareness of the acquired language skills during the learning process. In this context, an optimal learning environment is one promoting independent learning and

providing learners enough freedom to explore learning contents and to organize the learning process meeting the own individual needs.

A 3D language game based on virtual reality technology might supply an ideal learning platform for second language acquisition as it allows situated language learning, active communication, social learning, and personalization of the learning process.

In this paper, we present I-FLEG, a language game designed for interactively learning French as a second language. The game is integrated in Second Life and exploits the 3D virtual reality environment provided by this platform to implement immersive, *'learn-by-doing'* techniques for second language acquisition. The integration of the game in Second Life permits to fulfill many important desiderata of computer-aided learning technology. It permits personalization of the learning process and enhance learner awareness of the acquired learning skills. In addition, it allows ubiquitous, long distance learning as well as universal access, characteristics that facilitate the collection of big amounts of test data over the web and make our game ideal as a device for both monitoring learner performance in dependence of cognitive context factors and for comparing different teaching methodologies.

This paper is structured as follows. Section 2 presents an overview of related work on computer-aided software for teaching a second language. Section 3 describes the architecture of the language game I-FLEG. Section 4 and 5 illustrate the learning activities that are implemented in the game. Section 6 concludes with some final remarks.

2. PREVIOUS WORK ON COMPUTER-AIDED LANGUAGE TEACHING

Since the 1990's, there have appeared a lot of products on the market providing second language learning software of different type and quality which generally reflect the availability of new technologies.

The first experiments produced computer-aided learning software on CD-ROM. Among these, there are language games of great quality such as *Escape From Planet Arizona*[1] and *Who is Oscar Lake*[2], both adventure games for learning English as a second language.

In *Escape From Planet Arizona*, the user plays the role of an alien who has crash-landed in the Arizona desert. The task is to find a certain number of objects necessary to repair the spaceship. In order to do that, the learner needs to master different situations such as to withdraw money from the bank, to make a phone call, to look for a job, etc. This game uses quicktime movies and 3D graphics.

1. Escape from Planet Arizona: An EF Multimedia Language Game. [Software]. (1995). Stockholm, Sweden: EF Education.

2. Who is Oscar Lake: A Language Learning Adventure Game. (1995). Jersey COW Software.

In *Who is Oscar Lake*, a diamond has been stolen from a New York museum, and the police believes the well-known international jewel thief Oscar Lake to be guilty of the crime. The user is believed to be the thief Oscar Lake and has to prove his innocence.

The innovation proposed by these two language games was that of inserting traditional learning content (i.e. vocabulary and grammar explanatory tools or activities such as grammar exercises and preset dialogues) in a situational context (an adventure story), thus producing in the learner an impression of immersive experience, which makes learning more pleasant and effective.

After the advent of the internet, numerous web-based learning interfaces have appeared providing classical learning content and activities online that allow learners to train the second language when and where they want. However, these tools are generally based on HTML technology and thus do not provide immersive learning in the sense that neither learning content nor training activities are linked with a context with which the learner can interact. A further point that is worth stressng is that these interfaces generally do no allow personalization and monitoring of learner language proficiency, as they do not permit storage of information about previous system-learner interactions.

In the last decade, the interest of second language acquisition research has focused on using 3D virtual reality environments, such as Second Life, for teaching languages. This type of environments indeed provide immersive learning and facilitate distance learning. And further promote learning as a social experience allowing learners to practice active communication over the web by means of chatting, emails etc. And indeed there are many examples of web platforms providing social learning environments such as online classrooms where learners can virtually meet the teachers and/or talk and exchange ideas with other learners and even with native speakers.

Segond and Parmentier [7], [8], for instance, describe Thethis, a web application providing a learning software for the situational language training of hotel receptionists. The learner is exposed to similar situations as if he were in the reception of an hotel. He can interact both with virtual agents simulating telephone calls, hotel guests arriving and others by means of preset dialogues or with a human tutor or other learners by means of chatting. Further, the system allows synchronous as well as asynchronous learning. The main innovative aspect of Thethis is the social, communicative aspect of the learning platform which allows learners to share the learning experience with fellow students and the tutors.

And recently, there have appeared some interesting work on automatic generation of learning content and learning activities. Indeed, teachers very often lament the high expense on time to produce different learning

activities. Bick [9], for instance, describes VISL, a visual interactive syntax learning tool accessible though the internet for learning the syntax of different languages. Amaral and Meurers [10] propose TAGARELLA, an intelligent web-based workbook for learning Portuguese as a second language and more recently WERTI [3], a prototype of a system for the automatic generating of exercises [11] based on arbitrary web content selected by the learner.

Summarizing, the research on computer-aided second language acquisition has been carried out into two main directions. On the one hand, there are approaches that focus on situated language learning and provide learning content in contexts recreating reality-like situations. On the other hand, attempts have been made to automatize the process of generating both learning content and learning activities.

I-FLEG, the language game we present in this paper, integrates both these research approaches and provides a situated language learning environment together with automatic, context-aware generation of learning activities. Further, I-FLEG allows personalization and monitoring of the learning process and provides an experimental platform to test different teaching strategies.

3. I-FLEG

In this section, we describe the prototype of I-FLEG (Interactive French Language Learning Game) an interactive 3D game for learning French that implements an immersive and interactive paradigm for distance and ubiquitous learning. The game has been realized within the virtual reality environment provided by Second Life[4].

3.1. Game Scenario

I-FLEG is a sort of an adventure game. Its goal is to teach vocabulary (on some specific topics such as *house*, *colors*, *furniture*, *food*) and some grammar features (e.g. prepositions, adjective morphology) to learners of French as a second language. The current implementation is addressed to a target audience including learners of A1-A2 levels, i.e. beginners and medium level learners.

The game scenario is a house containing different rooms such as living room, kitchen, library, bathroom, etc. This is the house of a crazy linguist that has invented the *Universal Language Machine* and is disappeared. The *Universal Language Machine* is a machine able to understand and speak all languages of the world.

The user (the learner) is represented as an avatar and can navigate freely and interact with the virtual world by touching, moving or taking objects or by sitting on them. In order to win the game, he has to reconstruct the language machine, by finding out where the different gears which made up the universal machine are hidden in the house.

Each gear activates some learning activities, for instance the vocabulary gear activates a vocabulary test, the adjective morphology gear activates an activity for training adjective morphology, etc.

3.2. Game Features

The language game presented in this paper has the following features.

Immersive and Context-aware Learning

The use of the 3D environment provided by the Second Life platform allows I-FLEG to provide immersive learning, i.e. in the game the context in which the user is immersed, in which he navigates corresponds to the learning context. Further, in the game the flow of the learning process is triggered by the user, and namely by his position and by the actions he performs (e.g. which object he touches) in the game world.

Automatic Generation of Training Activities

I-FLEG provides automatic context-aware generation of training activities. The generation of such activities is parametrized for context factors and learning goals. Context factors are responsible for the content expressed in the generated exercise. For instance, it the user touches a table, the content of the generated exercise will contain some references to this object, e.g. will mention some of its physical properties such as size or color.
The learning goal is responsible for the syntactic complexity of the generated exercise. For instance, if the teaching goal are pronouns, the generated activity will be one that forces the user to use pronouns.

Personalization

In I-FLEG, the learning process is adapted to user needs and language proficiency. In each game session, the user decides the content (by navigating into specific rooms or by touching specific objects) and the type of activity (by activating some specific activity-triggering object) he prefers to train. After each game session, the interactions of the user with the system are stored in a database. The content of the database is retrieved each time the same user log in the game. Before a new game starts, the results of the previous game are evaluated so that the level and type of new interactions depend on the evaluation of precedent results.

Scoring

I-FLEG supports scoring. Scoring is used for two reasons. First, to enhance the game aspect. Scoring helps to ”keep”

3. http://prospero.ling.ohio-state.edu/WERTi/
4. http://secondlife.com/

the learner playing (learning a foreign language requires a large amount of practice time). Second, the scoring of the different learning activities is used to create the learner model and to determine the proficiency level of the learner in further interactions.

Evaluation Data

The game has been realized within the virtual reality environment provided by Second Life. The reason for choosing the Second Life environment is twofold. First, it offers very high level 3D graphical tools thus facilitating the design of virtual worlds and second, being accessible by everyone over the Internet, Second Life allows gathering large amounts of test data for evaluation.

I-FLEG provides teaching activities as well as learning activities. In the prototype, we have implemented, a tutorial session and two exercise sessions. The next sections describe these issues in detail.

4. TEACHING ACTIVITIES

In the tutorial session, the learner learns new vocabulary on some particular topic, e.g. the *house*, by interacting with the context. The system teaches the learner basic knowledge about the world. This happens at two levels:

1) When the learner enters a room, the system indicates to the user the name of the place in which he is in. The player can move freely in the different rooms of the house, each room gives the user information about itself.

   (1)
   Vous êtes dans la bibliothèque.
   You are in the library.

Fig. 1. An example of tutorial interaction: the user enters a new room (the library) and the system describes it.
System: *Vous êtes dans la bibliothèque.*

2) When the learner touches objects in the room, the system tells the user their name. The user can touch whatever object he wants thereby obtaining information on the object.

   (2)
   C'est une table.
   This is a table.

Fig. 2. An example of tutorial interaction: the user touches an object (the table) and the system describes it.
System: *C'est une table.*

Figures 1 and 2 illustrate this behaviour.

Teaching is a context-aware process, depending on where the user is and which objects he touches the teaching content and the learning flow will be different. For instance, the learner can decide to start learning vocabulary on the *food* topic by going in the kitchen, however if he wants to train vocabulary on the *cloths* topic he will go in the bedroom.

Further, teaching can be parametrized. The system can output for the objects touched by the user descriptions of different complexity. The complexity of the description depends on the level of language proficiency of the learner and on the teaching goal. For instance, after the user has touched the table, the system outputs (3.a) if the user is a beginner. However if the learner is more advanced and the teaching goal is to teach pronouns the system outputs (3.b).

(3) a. *C'est une table.*
   This is a table.
   b. *C'est une petite table blanche.*
   This is a small white table.
   c. *C'est une petite table. Elle est blanche.*
   This is a small table. It is white.

5. LEARNING ACTIVITIES

After the tutorial session, all types of training activities can be activated. To activate a specific activity, the learner has to find out the correspondent gear and touch it. Gears have different colors that signalize the type of learning activity they trigger. For instance, geen gears trigger vocabulary exercises and red gears morphology exercises.

The learning activities proposed to the user are personalized and tailored on the user language proficiency, that is determined after evaluation of the results of the previous interaction, and on the learning goal. That is, in a successive interaction the system might propose the same kind of exercise but focusing on items which the learner often mistook in the previous interaction or might propose training items of greater syntactical complexity.

In the I-FLEG prototype, we have focused specifically on two types of learning activities:

- vocabulary training,
- fill in the blank exercises focusing on adjective morphology.

Both type of activities are generated automatically depending on the context in which they are activated.

5.1. Vocabulary Exercise

In this kind of exercise, the learner can train his vocabulary on a given topic (e.g. *house*, *food*, *clothes*, etc..) interactively. The system monitors the position of the learner and generates a vocabulary exercise which depends on the context the player is in.

In this exercise the system shows the user pictures of peaces of furniture and the user should provide the name of the object. Depending on the room in which the learner is, the vocabulary exercise will propose a different set of training items. For instance, if the learner is in the kitchen when he activates the vocabulary test object, he will train vocabulary on the kitchen forniture, e.g. *le frigidaire*, *la table*, etc. or on the *food* topic depending on his level of language proficiency. However, if the user is in the living room he will train vocabulary on living room furniture, etc.

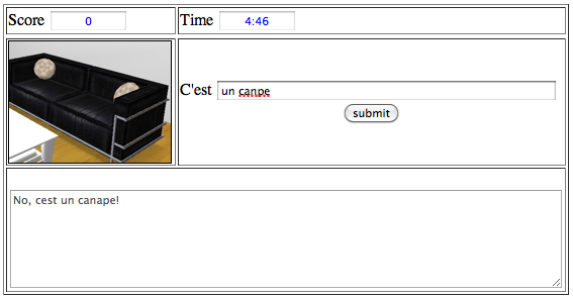

Fig. 3. An example of vocabulary training activity.

5.2. Morphology Exercise

Our framework further provides automatic generation of adjectival morphology exercises.

After activating the morphology gear, the learning activity starts. Now, when the learner touches an object the system generates a fill in the blank exercise the content of which is triggered by the properties of the touched object. For instance, if the user touches a chair, I-FLEG generates the output in (4), i.e. a sentence describing some properties of the chair that can be expressed as an adjective and also provides the noninflected form of the adjective. The learner should provide the inflected variant of the proposed adjective.

(4)
System: *La chaise est ... (blanc).*
The chair is white (not inflected).
Learner: *La chaise est blanche.*
The chair is white (inflected).

(5)
System: *La table est ... (petit).*
The table is small (not inflected).
Learner: *La table est petite).*
The table is small (inflected).

The generation module is based on the surface realizer GenI [12], [13], a surface realizer for tree adjoining grammar and generates training items which are parametrized for teaching goal, thereby allowing to set the syntactic complexity of the output.

6. CONCLUSIONS

In this paper, we presented the prototype of I-FLEG an interactive 3D language game for learning French.

Our game makes use of virtual reality technology as provided by Second Life and allows immersive, situated language learning and context-aware automatic generation of learning activities. Further, as it permits to gather big amounts of test data over the internet, it represents an ideal evaluation tool for teaching methodologies.

In future work, we want to improve I-FLEG by taking into account more complex language phenomena. We further plan to formalize the process of evaluation of the learner output, and to define more efficient ways to present feedback to learners.

We also plan to use the system to test the efficiency of different teaching methodology such as free vs. prescriptive learning flow.

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