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Learning a Second Language with a Videogame[1]

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Abstract

In this paper, we present an experiment designed to evaluate I-Fleg, a serious game prototype for second language acquisition we implemented in our laboratory. Specifically, our experiment focuses on teaching and training French elementary vocabulary to German primary school children.

1. Introduction

Young children, when faced with learning a second language, seem to apply similar cognitive mechanisms as those underlying first language acquisition by native speakers (cf. [5]). This observation particularly apply to very young children such as pre-school and primary school children. Therefore, at this stage the exposure to the second language assume a relevant role in second language teaching and many educators [6] argue that full-immersion techniques are the most appropriate for primary school children.

Accordingly, in second language teaching classes at primary school level *natural* methods, e.i. teaching methodologies fostering interactions rather than providing instructions, are preferred to the *formal* methods that are applied in later educational stages. Hence, classroom teaching is generally based on rituals recreating real, concrete situations, that are used as a context for learning thereby providing learning through meaning communication and cultural exposure.

Another important issue in second language teaching at primary school is the playful character of the learning experience. Many authors (e.g. [9], [3] and [1]) point out that games are a central mean to convey linguistic knowledge to children as they allow to learn and use language in context and promote the communicative as well as the natural, spontaneous use of language. Further, as has been often noted [4], games might help maintain a high attention level and also promote both interest and engagement of learners.

In this paper, we present an experiment designed to evaluate the impact of I-Fleg, an interactive ITS for second language acquisition, on teaching French as a second language to German primary school children.

Second language teaching in German primary schools is not performance-oriented. Its aim is rather to convey sensitivity to the phonemic structure of the second language to young children. Therefore, in the traditional classroom listening and understanding activities (i.e. passive language learning) are privileged with respect to activities targeting the acquisition of the second language grammar rules such as spelling, orthography exercises or essay-writing activities.

In our experiment we studied how, a very difficult task for German primary school children such as learning new words and their spelling in the second language, can be facilitated by the 3D interactive, game-like environment provided by our tutorial prototype system.

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The paper is organized as follows. In section 2, we presents I-Fleg, the game-like prototype for second language acquisition we have implemented. Then in section 3, we describe the experiment we designed to study the impact of I-Fleg on primary school children learning French. Finally in section 4, we conclude discussing the results of the evaluation.

2. I-Fleg: A 3D Video Game for learning French

I-Fleg is a language learning prototype we have developed at our laboratory. It has been implemented as a 3D serious game for teaching and training French as a second language. The core of I-Fleg is implemented in Java, however for rendering the 3D graphics of the game virtual world we have integrated it with the graphical engine provided by Second Life (see [2] for more details).

The game scenario is a virtual house in which the player's avatar can freely navigate, explore the rooms and interact with their objects, by means of chatting (i.e.. text input), touch events and change of position, and by doing so they train their French. The system provides a tutorial agent, that is a window displaying guidelines for the training activity at hand or feedback on learner answer.

In the experiment, the tutorial system was adapted to interact with young children. The game consists of two phases: tutorial and a training phase. In the tutorial phase the player explores the house and learns new vocabulary by touching the objects in the rooms. The system provides both written and audio output describing the name of the object and its pronunciation. In the training phase, the system asks the player the name of the touched object. In order to score credit points, the player has to type the name of the object in the chat box. The goal of the game is to collect the highest possible number of credit points. To boost the playful aspect of the game, we use 5 blinking stars, each star starts to blink when the player has scored 3 credit points, so that the ultimate goal of the game is to get 5 stars blinking. Figure 1 shows an example scenario from the game.

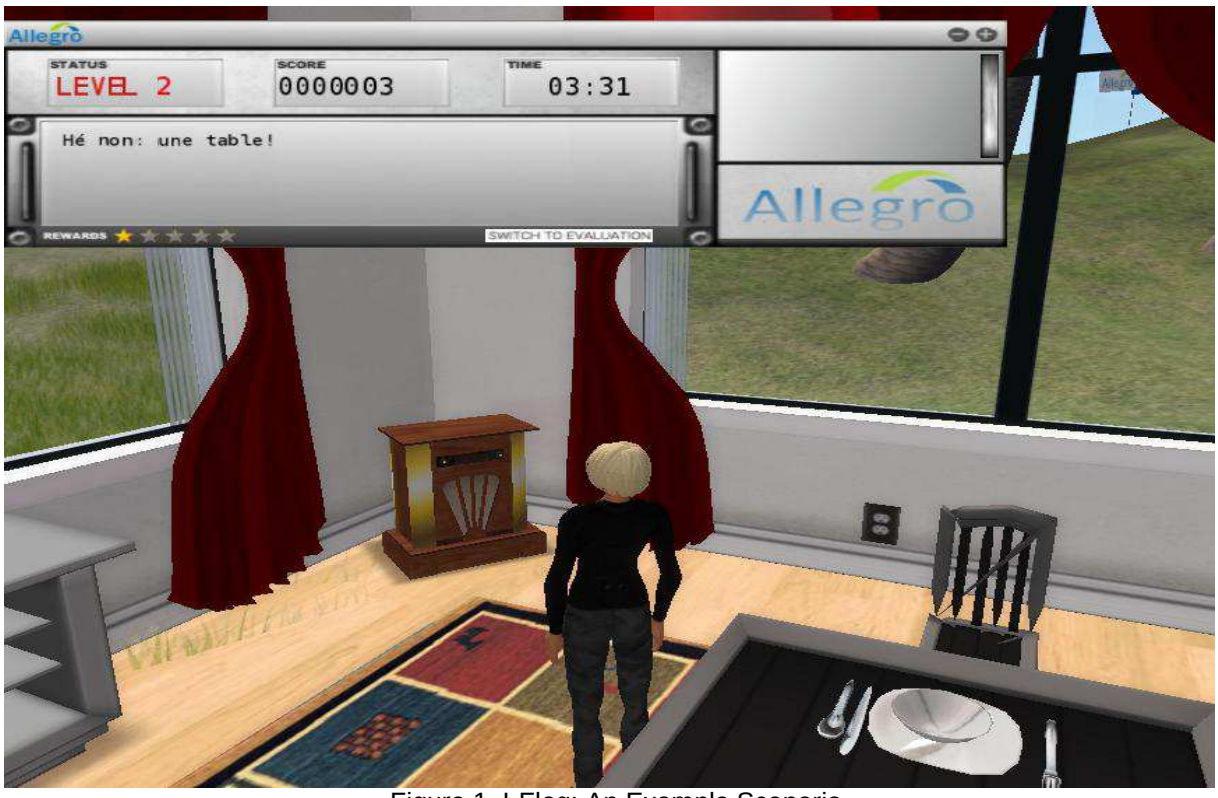

Figure 1. I-Fleg: An Example Scenario.

In order to foster children motivation and to meet the German primary school second language teaching guidelines, where the acquisition of a language feeling and of a sensitivity to the phonemic structure of the second language has a higher rank than correct word spelling, in our system we implemented a feedback strategy that also accept partially correct answers, i.e. answers that are misspelled but can still be understood.

We compared different word distance metrics and find that the Levenshtein distance best fits the kind of data at hand. The French words learned at primary school level are in fact generally very short. Thus, the system accepts an answer as correct, if its Levenshtein distance from the expected answer generated by the system is greater than a threshold value. The threshold value was defined as the mean value of Levenshtein distances computed on a set of test word pairs.

Therefore, in case of a partially correct answer, the system both increments the score of the player and displays the correct expected answer.

Expected answer: *la chaise* User Input: *la chais* Levenshtein: 0.875 System Feedback: *ok! la chaise* Score: *score+1*

Table 1: An Example of System Feedback.

3. The experiment

We now describe the experiment we performed, in order to study the impact of our 3D interactive game-like learning environment on young children acquisition of second language vocabulary skills.

3.1 Test Group

The test group was composed of 6 children (9 years old) that voluntarily accepted to participate in the experiment. All the children were in the 4th grade of German primary school and had the same background knowledge in French (i.e., 1 year school-French). Further, the experimental subjects were all German native speakers with a poor computer literacy, given the young age.

3.2 Experiment Setting

The children played with a simplified version of the I-Fleg game. Each children played 2 game sessions. A game session has a duration of 20 minutes and includes a tutorial and a training phase. During the tutorial phase (5 min.), the children were exposed to both audio output and visual output, i.e. they heard the pronunciation of the name of the objects they have touched, and further could read the correct spelling of these words in the tutorial window.

During the training phase (15 min.), when touching an object the children only received audio output from the system and had to write down the spelling of the name of the objects in the chat box. A spelling was counted correct if its Levenstein distance to the correct answer was below the set threshold (in practice, this usually corresponds to cases where the correct answer can be guessed from the given answer). In case of a wrong answer, the system also displays the expected correct answer. After playing, the children were asked to name the objects they had seen in the game and if they had enjoyed playing.

3.3 Evaluation Metrics

For the experiment, we chose a set *W* of 40 simple French words for the children to learn, 15 providing audio as well as written output and 25 only providing written output. These words all correspond to objects of the game virtual house that were selected after a pre-test among the words the children did not yet know. Thus, we divided this set of words into two groups, the set S of objects that provides written as well as audio output and a second group W of words that only provides written output.

We then used the following metrics to study the impact of I-Fleg on children learning vocabulary skills in French and in particular to answer the question whether there is a correlation between the different types of system output and vocabulary learning.

1) Ss, the number of words in S the children could right-spell during the game,
2) Ws, the number of words in W the children could right-spell during the game,
3) Sr, the number of words in S that the children could remember after the game,
4) Wr, the number of words in W that the children could remember after the game.

3.4 Results

As the results of the experiments show (see Table 2), the children could remember more easily the words linked to audio output and this result remains consistent in both game sessions, i.e. the values of Ss and Sr are always greater than those of Ws and Wr. These results are consistent with the theories on school-age children learning techniques. It was difficult for these children to focus their attention on the written output. Children were indeed more interested in exploring the game world, however they heard the audio output with interest. The results of the question whether they have enjoyed the game also shows that the game setting was challenging and motivating for the children, they all want to play again.

Player	**Session 1**					**Session 2**				
	Game		Game after			Game		Game after		
	Ss	Ws	Sr	Wr	Enjoy	Ss	Ws	Sr	Wr	Enjoy
P1	3	0	3	0	yes	5	0	6	0	yes
P2	1	1	2	1	yes	2	1	2	1	yes
P3	5	0	6	0	yes	7	2	9	4	yes
P4	4	0	6	0	yes	6	1	7	1	yes
P5	6	1	3	1	yes	8	1	9	1	yes
P6	6	2	5	2	yes	7	2	8	2	yes

Table 2. Experimental Results.

Finally a comparison of the results for the two sessions shows that I-Fleg game environment helps young children to improve vocabulary skills in second language. Most children performed better in the second game attempt. The mean number of words the children could remember after the second game session is 8.3. Children in the successive school grades (5th 6th) generally have to learn 20 words in a 45 min lecture. Thus, the achieved results are very encouraging. The different performance in the two sessions is also due to the fact that children in session 1 had to deal with technical problems such as learn how to navigate and interact with the virtual game world, find out where the letters are positioned on the keyboard and further understand the logic of the game.

4. Concluding Remarks

In this paper, we have described an experiment for studying the impact of I-Fleg, an intelligent tutorial system we have implemented for second language acquisition, on primary school children learning French as a second language. I-Fleg is designed as a 3D video game-like interactive learning application. The system version used for the experiment reported in this paper provides written as well as audio output and is targeted to young learners who want to train French vocabulary. The experiment is limited in scope and needs to be carried out on a larger scale for the results to be reliable. Nonetheless, it suggests that two features of I-FLEG are particularly important for language learning by children. First, audio input is of particular relevance for this target group. We observed that objects without audio output were largely ignored by children and as the numbers show, they were also less well learned.

Second, the situated environment provided by the game was also very relevant, stimulating the children in their learning. The children enjoyed a playful learning experience avoiding to concentrate on word reading and spelling, which is still a difficult task for primary school children. The preliminary evaluation that we performed with a small group of children show that the children were motivated by the playful game setting and that the one-to-one feedback they received from the system enhanced their learning performance. In future, we plan to evaluate a linguistically more complex version of the system with adults learners.

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