Pictorial REAP.PT

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Lisboa, October 14th, 2011

André Freire Silva
To my parents,
Lurdes and Joaquim.
Abstract

Language learning resources are constantly evolving alongside technology. One of such resources is REAP.PT, a system which aims to raise users’ proficiency in the Portuguese language in an interactive manner. Its current features include text-based exercises and a few multimedia resources, such as audio-books and captioned broadcast news. This document describes the creation of a new feature to integrate in REAP.PT aiming on locative prepositions used to describe the spatial position between objects. In this new learning resource, exercises take place in a 3D environment, and are complemented with gaming aspects to make them more appealing to students. We believe that with these gaming aspects, allied to the 3D environment, students will have increased motivation to complete exercises. A preliminary evaluation has been conducted, using real foreign students, and results show that students are receptive to this method of learning both in terms of the game itself, as well as of the learning experience.
Os recursos para aprendizagem de língua estão constantemente a evoluir ao ritmo da tecnologia. Um desses recursos é o REAP.PT, um sistema que tem como objectivo aumentar a proficiência dos seus utilizadores na língua portuguesa de uma forma interactiva. Actualmente, as suas funcionalidades incluem exercícios textuais e alguns recursos multimédia, tais como livros-áudio e noticiários televisivos legendados. Este documento descreve a criação de uma nova funcionalidade a ser integrada no REAP.PT com vista ao ensino dos verbos e proposições utilizados para descrever a posição espacial de objectos. Nesta nova ferramenta de aprendizagem, os exercícios têm lugar num cenário 3D, e são complementados com aspectos de jogo com o objectivo de os tornar mais apelativos para os alunos. Acreditamos que com estes aspectos de jogo, aliados ao cenário 3D, os alunos terão uma motivação acrescida para resolver exercícios. Já ocorreu uma avaliação preliminar, usando alunos estrangeiros reais, e os resultados mostram que os alunos estão receptivos a este método de aprendizagem tanto a nível do jogo em si, como também da experiência de aprendizagem.
Keywords
Computer Assisted Language Learning
Serious Games
Pictorial Exercises
Portuguese

Palavras Chave
Aprendizagem da Língua Assistida por Computador
Jogos Sérios
Exercícios Pictóricos
Língua Portuguesa
# Contents

1 Introduction
   1.1 Motivation ............................................................. 2
   1.2 Goals ................................................................. 2
   1.3 Contributions ....................................................... 3
   1.4 Document Structure .............................................. 4

2 Context
   2.1 Computer Assisted Language Learning ....................... 5
   2.2 REAP.PT ............................................................. 6

3 State of the Art
   3.1 Pictorial Exercises ............................................... 9
   3.2 Serious Gaming for Language Learning ....................... 12

4 Our Approach
   4.1 Integration with REAP.PT ........................................ 19
   4.2 Game Plan ......................................................... 20
   4.3 Technologies ........................................................ 23
   4.4 Architecture ....................................................... 24
   4.5 Exercise Description ........................................... 26
   4.6 Requirements Revisited ........................................ 28
List of Figures

2.1 REAP.PT’s Architecture ................................................................. 7

3.1 Digital Dialects “Fruit & Vegetables” exercise ................................. 10
3.2 Many Things animal matching exercise ........................................... 11
3.3 Polyglot Cubed screen ................................................................. 14
3.4 Mingoville world screen ............................................................... 16
3.5 Tactical Iraqi screen ................................................................. 17

4.1 One of the rooms available ............................................................ 21
4.2 Feedback provided when a wrong answer is given ............................ 23
4.3 Pictorial REAP.PT’s Architecture .................................................... 25
4.4 Exercise where the student has to move the documents to the right of the monitor 27

5.1 Methodology used for the evaluation ............................................... 32
5.2 Native language and gender distribution of the students ...................... 33
5.3 Overview of the survey’s answers .................................................... 34
5.4 Students’ opinion when comparing our application with a traditional class .................................................... 35
5.5 Answers to the Yes/No questions of the survey .................................. 36
List of Tables

3.1 The 12 elements that make video games engaging. .......................... 12

5.1 Exercise analysis .............................................................................. 37

B.1 Locative expressions intended to be learnt by the students using Pictorial REAP.PT 53
B.2 Verbs intended to be learnt by the students using Pictorial REAP.PT ........ 54
B.3 General vocabulary used in the exercises in Pictorial REAP.PT ............. 54
Nowadays, people have come to expect more from language learning tools. This document describes the development of a new language learning resource called Pictorial REAP.PT, whose idea came from looking at an existing second language tutor – REAder-specific Practice Portuguese (REAP.PT) –, and extend it to further capture the students’ interest. This extension includes the addition of a 3D environment to the tutor, which brings many possibilities both in terms of the exercises that can be made and in the ways that they can be presented to the students.

An analysis on current language learning games was made and it shows that using video games for learning can give a variety of advantages when compared to traditional exercises (Mitchell & Savill-Smith 2004). We took this into consideration and designed a game plan that details the gaming aspects surrounding our exercises in the 3D environment. In this environment, students perform exercises that focus on the verbs and prepositions used to describe the spatial relations between two objects (see Annex B). Exercises consist in asking the student – represented by an avatar on screen – to perform different actions. These actions include rearranging the position of objects so that certain spatial conditions are fulfilled, as described by the following example:

“Put object A on top of object B”

In the example above, the bolded part of the instruction is the linguistic expression we want the student to learn. In other exercises, instead of requiring the student to perform an action, the game may show an object and ask the student to provide a written description of its location. Another category of exercises requires the movement of the avatar, teaching expressions similar to “turn left” and “go down the stairs”. Some accessibility utilities are also available to the student, one of them being the possibility of clicking on a certain object to check its definition in a dictionary.
Pictorial REAP.PT has been subject to a preliminary evaluation involving foreign students that used our learning resource in a real-life scenario. Students were then surveyed on their self-perception regarding their learning experience, as well as their opinion on the gaming aspects of the application. Results so far have been promising. However, a second, more detailed evaluation is planned, which will focus on comparing the learning differences when using this application over a traditional class.

1.1 Motivation

REAP.PT — the tutor which our new resource is extending — was, at the start of this work, entirely limited to text-based exercises and a few non-interactive multimedia resources, such as audio-books and captioned broadcast news. Even though the topics of the documents that the tutor chooses for the students take into account their individual preferences, the activity of reading will hardly be one that they will find engaging. Also, even though text-based exercises may be essential for language learning, some aspects of the language are easier to acquire using a more visual-driven experience. This is exactly the case of spatial relations aimed at by this new resource. All these reasons motivated the creation of Pictorial REAP.PT.

1.2 Goals

The main goal of the work here described is to create a new learning resource that explores the advantage of the use of Serious Games for language learning, as well as of a 3D environment that the students can explore. Also, this learning resource is to be integrated with the REAP.PT Tutor in order to extend its functionalities. In the end, the developed solution should be evaluated in order to prove its usefulness in its target scenario – complementing (not replacing) a teacher.

The following requirements were taken into account during the application’s planning and development. Some of them are based on the educational context of this work, others because they were already present in the system with which our application will be integrated, and still some as a request by the teachers that will make use of the application.
1.3. CONTRIBUTIONS

- **Record keeping of the student’s actions**: every action taken by the student should be stored in a database, so that it can be used as a resource to track the student’s evolution;

- **Transparency to the teacher**: teachers should have access to an useful subset of the log described above, namely the student’s performance for each exercise completed;

- **Ease of exercise creation**: taking into account that the application will not be able to generate exercises automatically, their creation has to consist in a simple process so that future content addition is a straightforward activity;

- **Automatic correction of exercises**: being an interactive experience that does not require a teacher to be present, the application must be able to check if the exercise has been finished correctly;

- **Low system requirements**: there must be an effort in optimizing the application, so that even low-end hardware does not negatively affect the experience;

- **Browser interoperability**: the application should be able to run in most commonly used web browsers;

- **Different difficulty levels for each exercise**: the student must be able to choose between easier and harder difficulty levels for the same exercise;

- **Ease-of-use**: strong emphasis should be given in terms of the application’s usability so that is does not interfere with the learning experience. This can be made in the form of an instructional introduction to its features – a tutorial.

### 1.3 Contributions

The developed application is currently being used by real students in the University of Algarve as a learning resource.

By using the TARGET Platform as a base for our architecture, this work validates its usefulness in creating Serious Games for learning.

A paper describing this work has been published and presented at the Second International Conference on Serious Games Development and Applications\(^1\), held in Lisbon, September 19-20, 2011.

\(^1\)http://groups.ist.utl.pt/sgda11/, last accessed on October 2011
CHAPTER 1. INTRODUCTION

2011.

1.4 Document Structure

This document is structured as follows: Chapter 2 gives an overview on the REAP.PT Tutor; Chapter 3 describes the state of the art regarding Pictorial Exercises and Serious Gaming for language learning; in Chapter 4, Pictorial REAP.PT is described in terms of its architecture, technologies, categories of exercises and game plan; Chapter 5 presents the evaluation conducted for this work and its results; Chapter 6 draws on the conclusions of this work and proposes a set of features that could help improve Pictorial REAP.PT even further.
In this chapter we establish the context on which this work is inserted. First, a brief description explaining in what consists Computer Assisted Language Learning is presented. After that, we make an overview of the REAP.PT system — the tutor in which our work is integrated.

2.1 Computer Assisted Language Learning

CALL had its origin in the 1960’s and has evolved quickly in the last years. It has been defined has the search for and study of applications on the computer in language teaching and learning (Levy 1997). CALL usually includes a strong interactive element and is meant to supplement a teacher in language instruction, not replace him. This interactive element contributes to one of the main advantages of CALL — motivation.

CALL’s evolution can be divided into three main stages: behaviorist CALL, communicative CALL, and integrative CALL. Each stage corresponds to a certain level of technology and certain pedagogical theories (Lee 2000). The first one, behaviorist, was the first form of computer-assisted language learning, and was simply a mechanical tutor that never grew tired. The system ran on its own special hardware. In the 1970’s, communicative CALL appeared and the mainframe was replaced with personal computers, which encouraged individual work. Finally, integrative CALL emerged, focusing on the four skills of language learning — listening, speaking, writing and reading —, and on the deeper integration of technology in language teaching.

Among the advantages of CALL, the ones that stand out the most are increased motivation for the student, individualized learning and self-paced study.
CHAPTER 2. CONTEXT

2.2 REAP.PT

REAder-specific Practice PorTuguese (REAP.PT) is a tutoring system for second language learning and is the result of porting REAP\(^1\) (Heilman & Eskenazi 2006) – the original tutor built for English – to Portuguese. REAP.PT is an example of a system which takes into account the advantages described in the previous section in order to provide the students with a more engaging and appealing learning experience. The porting effort required the integration of new linguistic tools and resources, as well as the indispensable adaptations for this topologically different language (Marujo, Lopes, Mamede, Trancoso, Pino, Eskenazi, Baptista, & Viana 2009).

The system focuses on vocabulary learning by providing the students with real documents featuring target vocabulary words in context.

Interaction with the system is done via a Web browser. When a student logs into the system for the first time, s/he is presented with a series of questions that allow the system to determine her/his proficiency level. Based on this level, the student will be assigned a word list that contains the words s/he is supposed to learn. This is where the individualized learning comes into play, since each student will have her/his own list of words to learn. The list of words is derived from the Portuguese Academic Word List (P-AWL) (Baptista, Costa, Guerra, Zampieri, Cabral, & Mamede 2010), a word list inspired in the English AWL and built specifically to be used in the REAP.PT tutoring system.

The level attributed to the student when s/he first logs in is only temporary, and will adapt itself based on the interaction with the student. Every action is logged: the time spend on reading the text, the number of times the student accessed the dictionary and the specific words words that were looked up, etc. — all of these data constitute resources that influence the evolution of the internal representation of the student’s proficiency level in the system.

Another major characteristic of the system is the use of topics of interest. The student can choose from a number of topics, such as music, sport or history, and s/he can also accord them a certain level of interest (ranging from “not interested” to “very interested”). When the system chooses which documents are to be shown to the student, priority is given to certain documents based on the manifestations of interest in those topics. After defining her/his interests, the student can start an individual reading. In the document chosen by the system, target words

\(^{1}\)http://reap.cs.cmu.edu (last accessed on October 2011).
Figure 2.1: REAP.PT’s Architecture

are highlighted in blue. The student is given a certain amount of time to read the text, during which s/he can use the dictionary or the speech synthesiser to help her/him. Having finished reading the text, the student is presented with questions focused on the target words included in the text. These questions are automatically generated by another module of the system (Correia 2010). Current developments of REAP.PT also include automatic generation of syntactic and semantic exercises, and an oral comprehension module. Finally, the student can also listen to (and follow the text of) spoken books, as well as subtitled broadcast news.

Figure 2.1 represents the architecture of REAP.PT, as described in (Marujo 2009), but taking into account developments that occurred in the meantime. As discussed above, users interact with the system through the World Wide Web with any Web browser. The component responsible for this interaction is the Web Interface, which also communicates with the DIXI Server — the oral comprehension module — and the system’s database. The former is a new feature not present in the original REAP, and includes a text-to-speech synthesizer (TTS), which
allows the student to select parts of the text and have the system generate the respective audio. This resource is also available when the student uses de dictionary. Besides the TTS, this module can also provide the student with access to other multimedia documents.

The database saves information concerning the students, namely their interests, the tracking of their actions — dictionary access’s, time spent reading, answers, etc. — and also their proficiency level and target list. Apart from this, the database also contains information about reading documents, the P-AWL, dictionary entries previously accessed and questions for every document.

The ClueWeb09\(^2\) dataset was created by the Language Technologies Institute at Carnegie Mellon University and contains over 1 billion web pages, in 10 individuals languages, collected in January and February 2009. Approximately 37.5 million of these pages are in Portuguese. This Portuguese subset was used as a Corpus for REAP.PT, and the documents that comprise this subset went through the chain of filters shown in Figure 2.1 before being accepted in the system.

As described before, the current interface and exercises available to the student are completely text-based. Current developments include automatic generation of syntactic and semantic exercises, and an oral comprehension module. In this document we propose taking advantage of 3D interactive environments in order to further make both the interface and the exercises more appealing to the student.

\(^2\)http://boston.lti.cs.cmu.edu/Data/clueweb09 (last accessed on October 2011).
This section is divided in two parts: first, it presents a succinct description of existing systems providing pictorial exercises for language learning; and then, an overview on Serious Gaming for Language Learning.

3.1 Pictorial Exercises

While the most commonly used types of language learning exercises are simply text-based, some systems consist exclusively, or include to a certain extent, pictorial exercises. This section describes some of those systems.

Digital Dialects

Available since 2007, Digital Dialects\(^1\) is a website that features pictorial exercises for more than 60 languages. The focus of the exercises is mainly on vocabulary learning, although some are about verb conjugation. Most exercises start with an introduction where the words are shown both in English and in the language being practised, and only after that does the exercise begin. As an example, the exercises that focus on the “Fruits & Vegetables” theme show a bowl filled with fruit and the student has to pick each fruit he is asked to. See Figure 3.1 for an image of that exercise. These exercises were made with Adobe Flash.

\(^1\)http://www.digitaldialects.com (last accessed on October 2011).
Korean Pictorial Exercises

The Faculty of Arts of the Monash University\(^2\) provides some resources for Korean Studies\(^3\). Among these resources are some pictorial exercises.

Mostly, the exercises available include pictures and text descriptions that have to be mapped together, either by dragging and dropping or choosing the correct description from several provided, depending on the exercise. When the student finishes, s/he can click on a button to check the correctness of his/her answers. These exercises were made with Javascript and PHP.

Many Things

Many Things\(^4\) is a website with exercises for English as a Second Language (ESL) students. Most of these exercises are text-based, although there are some exceptions, mainly consisting of simple matching exercises, including one for two players. As an example, one of those matching exercises shows a list of animal names in one side of the screen and pictures of those animals on

\(^2\)http://www.monash.edu (last accessed on October 2011).
\(^3\)http://arts.monash.edu/korean/klec (last accessed on October 2011).
\(^4\)http://www.manythings.org (last accessed on October 2011).
3.1. PICTORIAL EXERCISES

3.1.1. Many Things animal matching exercise

Students have to map the names with the pictures correctly. See Figure 3.2 for an image of that exercise. These exercises were made in Javascript.

Rosetta Stone

Rosetta Stone is a language learning software available in more than 30 languages. It was first released in the year 2000 and has had various versions since then, each introducing more features. Among the exercises available are some pictorial exercises. These include:

- A version of the memory game, i.e., an exercise where many cards are turned down, some containing a picture and others a text-based description; the user can only turn up two cards at the same time, turning them back down if one of them is not a text-based description of the other and keeping them up if it is. The exercise ends when all the cards are turned up;

- In another exercise, pictures are shown, as well as a phrase. The user as to select the

---

Figure 3.2: Many Things animal matching exercise

http://www.rosettastone.com (last accessed on October 2011).
### Table 3.1: The 12 elements that make video games engaging.

<table>
<thead>
<tr>
<th>Characteristic of the game</th>
<th>Characteristic contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fun</td>
<td>Enjoyment and pleasure</td>
</tr>
<tr>
<td>Play</td>
<td>Intense and passionate involvement</td>
</tr>
<tr>
<td>Rules</td>
<td>Structure</td>
</tr>
<tr>
<td>Goals</td>
<td>Motivation</td>
</tr>
<tr>
<td>Interactive</td>
<td>Doing</td>
</tr>
<tr>
<td>Adaptive</td>
<td>Flow</td>
</tr>
<tr>
<td>Outcomes and feedback</td>
<td>Learning</td>
</tr>
<tr>
<td>Win states</td>
<td>Ego gratification</td>
</tr>
<tr>
<td>Conflict/Competition/Challenge/Opposition</td>
<td>Adrenaline</td>
</tr>
<tr>
<td>Interaction</td>
<td>Social group</td>
</tr>
<tr>
<td>Representation and story</td>
<td>Emotion</td>
</tr>
</tbody>
</table>

picture that is best described by the phrase:

- (For two players) A game where each player sees an image and must describe it to the other. Both images are similar, but there’s a difference, and the goal of the exercise is to find this difference between the images.

### 3.2 Serious Gaming for Language Learning

Video games have an intrinsically motivation appeal (Kirriemuir & Mcfarlane 2004) (Malone & Lepper 1987) (Gee 2003). (Prensky 2004) has identified a combination of 12 elements that make video games so engaging. These are summarised in Table 3.1.

Serious Games emerged as digital games and equipment with an agenda of educational design and beyond entertainment (Srensen & Meyer 2007). As Kurt Squire said, “e-Learning designers struggle to compel users who have paid thousands of dollars to complete an online course. Yet, game players routinely spend dozens, if not hundreds and thousands of hours mastering complex skills in digital worlds that are time-consuming, challenging, and difficult to master” (Squire 2005). Video games also allow players to be placed in rich environments, otherwise not accessible, that make for a great learning context.

Studies show that a combination of both interactivity and media-richness results in an in-
crease in knowledge acquisition, sustainability and topic interest (Wong, Shen, Nocera, Carriazo, Tang, Bugga, Narayanan, Wang, & Ritterfeld 2007), making video games a valid environment for learning.

Although Serious Games can have a broad range of purposes and areas of application – such as healthcare, military and education (Michael & Chen 2005) – we will focus on language learning. Recent projects show that most of the time, Serious Games are used to learn specific parts of a language, or to prepare someone for a certain situation, be it a person in a vacation trip or a soldier going to war. This section describes some of the Serious Games recently developed for language learning.

**Rainbow Rummy**

Rainbow Rummy (Yoshimoto, Mcgraw, & Seneff 2009) is a flash card web-based game created by the MIT Computer Science and Artificial Intelligence Laboratory to help English and Chinese language learners in vocabulary learning. There was an effort in making the game engaging in order to invite persistent replay. The game can be played either by one or more students against each other or with AI controlled partners, although some complex board manipulations are out of the AI planner’s reach.

Rainbow Rummy is turn-based, and for each turn the game layout shows the player’s hand and the board configuration. All the cards are identified by their color and vocabulary described. The player’s objective is to be the first to get rid of all his cards by moving them to slots in the board. These slots must always contain at least 3 cards with the same color or with the same vocabulary item. The turn ends only when the player makes a valid move, and in the case of his/her hand not allowing this, the player must draw cards until s/he gets one that can be moved into one of the slots in the board.

As stated above, the game’s main resource are the flash cards. These can be chosen from pre-defined categories, such as animals and clothing, but can also be personalized by the player.

One of the main characteristics of the game is its speech interface. In order to play, the student must give spoken instructions to the computer. In the computer’s turn, its actions

\footnote{http://www.csail.mit.edu (last accessed on October 2011).}
are given verbally with synthesized speech, and the student has to recreate those actions by manipulating the cards in the board.

Rainbow Rummy was made in Java.

Polyglot Cubed

Polyglot Cubed\textsuperscript{7} is an educational game designed to aid in foreign language learning (Grace 2009). Its purpose it not to provide all the resources required to learn a language fully, but instead to assist in particular situations, like a trip to a foreign country, where a few common vocabulary words will be useful.

Polyglot Cubed is a matching game that consists of 6 rooms, each with many floating cubes. In these cubes there are pictorial representations of words. The cubes are clustered in a way to encourage context-based recognition and aid visual memory. The player ears a word being spoken and has to click on the corresponding cube. When this is done correctly, the cube clicked becomes part of an unfinished picture, which is completed when the player makes enough matches. This can be seen in Figure 3.3.

The game is designed for touch interfaces and does not require any prior knowledge of the

\textsuperscript{7}http://www.polyglotgame.com (last accessed on October 2011).
language being learned.

Currently, only Mandarin Chinese and Cape Verdean Creole are available, but the game was made with extensibility in mind, and even users can add new languages manually.

Polyglot Cubed was implemented using Microsoft’s DirectX\(^8\) API.

Global Conflicts

Global Conflicts\(^9\) is a series of educational games used for teaching history, citizenship, geography and media courses. These games are designed for secondary school students between the age of 13 and 20.

As an example, in one of these games the user takes the place of a freelancing journalist that has to write an article about the Palestinian Conflict, on site, by gaining the confidence of locals — NPC’s (Non-playable Characters) — and have them provide him with quotes.

While not directly developed to teach a second language, it can be used as such, even if for an advanced level.

A research project in two Danish high schools with 51 students using a playable prototype showed that 57,8% felt they had learned more from the game course than from normal history courses, and 33,3% of the students felt they had learned as much as they usually do from a normal course (Buch & Egenfeldt-Nielsen 2006).

These games were made using Unity 3D\(^10\).

Mingoville

Mingoville\(^11\) is an online learning environment featuring English lessons for kids. It has currently more than one million users. Users are represented on screen by a Flamingo (hence

\(^9\)http://www.globalconflicts.eu (last accessed on October 2011).
\(^10\)http://unity3d.com (last accessed on October 2011).
\(^11\)http://www.mingoville.com (last accessed on October 2011).
the name, Fla - mingo Ville), and can move freely in a world populated by other user’s Flamingos (see Figure 3.4), with whom they can speak to through text — being corrected when orthographic mistakes are made. Various games and learning activities are scattered throughout the world; these include exercises in spelling, speaking, reading and writing, sing-along karaoke songs and missions for vocabulary learning, each featuring a theme with a list of words that the user must learn. The game also features an illustrated dictionary with translations for 32 languages. This game was made using Adobe Flex.

**Tactical Language & Culture Training Systems**

Tactical Language & Culture Training Systems\(^{12}\) (TLTS) are courses that use virtual-world simulations to help people acquire communicative skills in foreign languages and cultures. Several titles have already been developed. Tactical Iraqi, Tactical Pashto, and Tactical French are in widespread use by U.S. marines and soldiers, and increasingly by military service members in other countries (Johnson & Valente 2008).

3.2. SERIOUS GAMING FOR LANGUAGE LEARNING

Heavy emphasis is given to spoken vocabulary and pronunciation, while grammar and written language is covered only when required. Also with significance in these courses is the cultural education. Users can learn norms of politeness and etiquette, as well as non-verbal gestures that are critical for successful communication.

In terms of its architecture, TLTS has two main components that interact with the user (Johnson, Marsella, Mote, Vilhjalmsson, Narayanan, & Choi 2004). One of them is the Mission Skill Builder (MSB), which provides learning resources in the form of lessons. Another, the Mission Practice Environment (MPE), consists in the 3D simulations of social situations, as seen in Figure 3.5. Both of these components share and use a pool of resources of a common set of services and databases. These include a Language Model, that has the Natural Language Parser and the Speech Recognizer. The MPE has two modules: The Mission Engine and the Unreal World. The former controls what happens and uses Thespian (Si, Marsella, & Pynadath 2005), which deals with the open-ended interaction by using autonomous agents to control the various characters, giving them unique personalities and allowing them to have goals of their own. The latter uses the Unreal Tournament 2003 game engine to render the action and user interface.

In short, the use of Serious Games for language learning has been increasing in recent years, and there are already some successful systems in widespread use. Thus, these systems served as inspiration for some of the aspects of our approach.
As described in Section 1.2, the goal of this work is to extend the REAP.PT Tutor with a new learning resource. In this new resource, students are placed in a 3D environment where exercises are presented in a different, more interactive manner.

The creation of a new exercise module so unlike what already existed in the REAP.PT system was not a straightforward process. Decisions were made regarding which technology to chose in order to provide a 3D environment, as well as which type of exercises would best suit the students’ needs. Another major decision point was on how to surround these exercises with a gaming environment, so that all the advantages of the systems discussed in Section 3.2 could be explored.

This section will provide an insight on those decisions, starting with how the integration with REAP.PT was achieved, followed by the game plan of the application, as well as an in-depth description of the exercises available, the technologies chosen for development, and finally, its architecture.

### 4.1 Integration with REAP.PT

The work developed is quite different from the remaining learning resources in the REAP.PT tutor. Even so, with some effort most of the infrastructure used for progress tracking in REAP.PT could be adapted to allow for the integration of this new learning module. This integration occurs mostly at the database level.

REAP.PT’s databases are used to retrieve information on the student using the application and also for storing his/her results and progress. Using the same databases enables the teachers to check their students’ progress in real-time, much like they already did for the previous exercises in REAP.PT.
Apart from database sharing, taking into account that REAP.PT already has a web service capable of communicating with the Infopédia dictionary, that web service was also used to provide the same functionality.

4.2 Game Plan

We believe that a 3D environment alone is not enough to increase students' motivation and interest in the tutor. Therefore, and after seeing some successful approaches to Serious Games use for language learning, it was decided that we would envelop the exercises in a gaming experience. This section describes the creation of the game plan responsible for defining that experience.

Much care has to be taken when developing a game in order for it to be successful regarding the user’s enjoyment. Even more so when that game is intended for learning purposes. (Malone 1980) discusses some heuristics that make things fun to learn, in particular when applied to instructional games. Those heuristics, along with the Serious Games reviewed, were used as a base during the creation of this game plan and helped define many of its aspects, such as the importance of goals and progression in keeping the user engaged; the need for a challenge in order to maintain the student in an high concentration state; the role of appropriate performance and informative feedback to instruct the student; among others that are discussed in detail throughout this section.

Tutorial

When first starting the game, the player is encouraged to complete a tutorial. This tutorial was created to minimize the difficulty in learning how to play the game. Instructions are shown and practical exercises are given to the student so that s/he can get acquainted with both the controls and the rules of the game. This tutorial takes little more than 5 minutes and is available in Portuguese and in English.
Goals and Progression

Goals are very important. This is because setting goals makes the student feel like s/he is progressing towards something, increasing his motivation to solve more exercises. The game’s main scenario is an office. In this office there are various rooms that the player can explore, and in every room different exercises are available. When starting a new game, only a single room is available (See Figure 4.1 for an example of one of the available rooms). For each correctly finished exercise, the student is awarded some points, and when enough points have been earned, another area of the office is unlocked for exploration, where more exercises are also available. This structure of progression was chosen in order to keep the student curious about what is coming next, giving him the motivation to finish the exercises.

Points earned for completing the exercises serve two purposes. The first is to unlock new areas. The second is to compare scores with other players. For each room, students are able to check how they graded against other students, both in terms of points and speed. This second aspect of the scoring system contributes as a second-layer goal. If there was no higher score to
achieve, students would have no desire to repeat exercises, yet repetition can play an important role in language learning. It also provides the student with a sense of accomplishment, which, once again, keeps him motivated. Point attribution takes into consideration the exercise base point value, the number of errors made during its execution and the time taken to finish it.

Challenge

Each division has a fixed number of exercises, and these become increasingly more difficult as new areas are unlocked. Even so, it is not required that the student finishes all exercises before s/he is given access to a new room. Since points are dependent on the student’s performance, students that score higher need to complete fewer exercises in order to get to the next level. This is important because if a student is receiving good scores, we can assume that the difficulty of the exercises s/he is currently solving is below her/his level. If that student does not progress to a level with harder exercises quickly, s/he will start losing interest. On the other hand, students that score lower must complete almost every exercise in a room before progressing to another. Low scoring students can proceed without completing all the exercises so that frustration does not build up from being unable to finish an exercise, causing her/him to quit. Hints are also available, which can help in a number of ways. One of them is in finding objects whose name the student still has not learned during a certain exercise.

One of the essential characteristics of a good game, as discussed by (Malone 1980), is the existence of a challenge. Winning can not be a certainty. Otherwise, the student would have less reason to give her/his full attention to the exercise. Because of this, it was decided that when an exercise is failed the student loses some of his score and may have to repeat a previous exercise.

Feedback

Feedback plays an important role in any game. (Malone 1980) identified feedback as being necessary to both keep the player engaged and to instruct her/him. Keeping the player engaged can be accomplished by always providing feedback on how close s/he is to her/his goal. Applied to this game plan, the feedback is provided at different levels; the first one consists in giving the player information about how many points s/he still has to obtain in order to unlock the next
division; the second one, inside exercises, is achieved by showing the student whether s/he is moving towards the exercise goal or away from it. Perhaps s/he picked the incorrect object or took the wrong turn. The student should be informed of this.

Instructing the player is done by giving constructive feedback when the exercise is not finished correctly. Instead of displaying a message such as “You have failed the exercise”, it is many times more helpful to display something like “You did [A] and were supposed to do [B]”. With the latter approach, students actually learn from their errors, and it was thus adopted when informing the player of her/his results. See Figure 4.2 for a screen showing this type of feedback in the game.

4.3 Technologies

This section provides a description of the technologies used in the development of this module. The chosen framework was the Transformative, Adaptive, Responsive and enGaging EnvironmenT (TARGET) Platform (Ribeiro, Jepp, Pereira, & Fradinho 2010). This serves
as support for the TARGET Project\(^1\), whose objective is to research, analyse and develop a new genre of Technology Enhanced Learning environment. In this environment, the learner goes through complex situations in the form of game scenarios. By completing these scenarios, knowledge is gradually acquired by the player.

The selection of the technology for the TARGET Platform was made iteratively, during which two prototypes were developed in two different engines before going back to the analysis phase and finally choosing Unity 3D\(^2\) game engine. This engine is one of the few that allows for the deployment of a web-based application – a crucial requirement in any REAP.PT module.

The TARGET Platform was chosen based not only on its capabilities, but also on the similarities between the requirements of the work described in this paper and those in the TARGET Project. Also, (Ribeiro, Jepp, Pereira, & Fradinho 2010) state that real development is necessary in order to be able to choose an appropriate platform. Since this was the case during TARGET's selection of technology, one can be confident in its capabilities based on the requirements of the project.

### 4.4 Architecture

Our system follows the TARGET Platform’s architecture, which is based on managers. It deploys a client-server application, and requires that the code running in both the client and the server side be the same. Because of this, these managers can be instantiated in both a client version and a server version. However, considering that multiplayer interaction will be approached only in future work, we decided to disable the server side of the platform. This means that there will be no need for a server to be running for each player that uses the application. Our architecture – which can be seen on Figure 4.3 – makes use of some of the managers available in the TARGET platform, but adds new ones as well. All of them are are detailed below.

**Game Manager** is the main manager. It is responsible for loading the remaining managers. It also maintains the game state, and was adapted by us to deal with the progression aspect of

\(^1\)http://www.reachyourtarget.org/ (last accessed on October 2011).
\(^2\)http://unity3d.com (last accessed on October 2011).
4.4. ARCHITECTURE

Figure 4.3: Pictorial REAP.PT’s Architecture

the game — keeping track of the player points and unlocking further exercises and divisions as necessary — and to check if the player has logged in successfully.

**World Manager** was already available in the TARGET Platform and is responsible for defining the avatar’s spawn point and moving it between different scenarios.

**HUD Manager.** The Heads-Up-Display Manager was completely overhauled according to our needs. It is used to provide most of the feedback given to the player, which includes information about the currently available and already completed exercises, and the player’s current score and level. When the player is solving an exercise, the HUD Manager provides the exercise’s instruction, a timer, and visual feedback on how many wrong answers the player can still give before failing the exercise. Other feedback elements include notifications when the player levels up, information on the awarded points after completing an exercise and instructive criticism when an incorrect answer is given. This manager gives the option to choose from different languages for the interface. Currently both Portuguese and English are available. This manager also provides the menus used to navigate and configure the application.
Network and Session Managers are required to aid the communication between the client and the server application. Currently, they are not being used, but remain available if needed in the future.

Sound Manager. Sound is also important to provide feedback. This is achieved with a Sound Manager, which allows different sounds to be played depending on the situation.

Exercise Manager. The Exercise Manager was created from scratch and contains the exercises in the application. It defines the room in which they appear as well as which hints can be used on each of them. The manager is also responsible for keeping track of the exercises’ status. Every exercise has associated how any points it is worth, and an average time for completion.

Accessibility Manager is a new manager that provides access to the dictionary and the TTS functionality already in use on the REAP.PT Tutor.

Data Manager This new manager is responsible for interacting with the REAP.PT Databases. It gets information on the student using the application and stores her/his results. For every exercise, this manager saves every answer, correct or incorrect, as well as the time of completion of the exercise and the number of points awarded. By keeping the progress of the student updated, s/he can continue a previously started game at any time. The tracking of the student’s progression is done in real-time, and this is very useful for teachers that want to have access to the student’s performance as soon as possible, in order to know who needs help.

Character Manager is one of the managers provided by the TARGET Platform. It defines the player’s avatar and handles its movement in the scenario, its animations and the camera position.

4.5 Exercise Description

Each exercise can be presented in two ways: (i) by asking the student to perform some sort of action; (ii) in a “describe the action” alternative, where the action is shown to the student,
and s/he is asked to describe that particular action. This description can be provided either by choosing one of various options or by writing it. Apart from the differences between categories, each exercise also features different difficulty levels. Two categories of exercises are already implemented and described below. One more is planned to be developed in the near future.

**Object Manipulation**

This type of exercise consists in asking the students to change the position of various objects in the scene in order to comply with a specific spatial restriction. As an example, the player can be asked to put a document folder to the right of a computer monitor (see Figure 4.4). In order to correctly finish this exercise the student would have to find the document folder and move it to the right of a computer monitor. The exercise is broken down in two steps, so that feedback can be given for each action. Initially, the student has to find and click the document. With this, we are certain that the student has found the right object, and can then fixate the camera in a new position where it will be possible to move the object. After that, the student has to pick and move the object around. S/he does this by click and holding on the object and then
moving the mouse until the object is placed in the intended position. To drop the object, s/he must stop holding the mouse button. The object will fall and the result will be displayed. If the answer is correct, a message appears giving information on the time taken to complete the exercise, the number of errors committed and the number of points awarded. If, however, the answer is incorrect, a message appears informing the student of the position where s/he dropped the object, so that s/he can learn with that mistake.

Avatar Movement

In this category, the avatar is able of walking freely in the environment. The goal of each exercise involves performing movements with the avatar and go from one place to another. Directions appear on screen, such as “turn right”, or “go down the stairs to the left”, which the student must follow in order to reach her/his destination and complete the exercise. Similar attention to feedback has been given in this category, and the student is informed of errors with constructive messages.

Both these categories of exercises are presented in a gaming context (See Section 4.2), where the student is challenged to keep up with the increasing difficulty of the exercises, while, at the same time being rewarded with points for correctly finishing them. For this reason it is expected that the students will enjoy solving the exercises and become more motivated throughout the whole learning experience.

4.6 Requirements Revisited

In Section 1.2, we discussed important requirements that should be taken into account during the planning and development of this application. In this section, we revisit those requirements, and assess which of them have been met.

- **Record keeping of the student’s actions**: A log of interaction is kept for every student that uses the application;

- **Transparency to the teacher**: Teachers are able to access a special interface where they can check their students’ performance in real-time;
4.6. REQUIREMENTS REVISITED

- **Ease of exercise creation**: The developed Exercise Manager helps in the creation of new exercises and makes this process straightforward;

- **Automatic correction of exercises**: Answers are validated and both informative and constructive feedback is given without the need of a teacher’s interaction;

- **Low system requirements**: The engine used for development (Unity 3D) has low system requirements;

- **Browser interoperability**: Unity 3D allows for the application to be deployed not only for a web-browser, but also as an executable for desktops, smartphones and consoles;

- **Different difficulty levels for each exercise**: Instead of a difficulty setting, a progression system was developed where exercises are easy in the beginning but get increasingly more difficult as the student completes them;

- **Ease-of-use**: A tutorial was created in order to aid in the learning of the application’s functionalities. Our evaluation shows that 62.5% of the students found this tutorial helpful (See Section 5).
Concerning the evaluation, it was decided that the most appropriate way to do it would consist in having real students interacting with the system. Although this is a very time and resource-consuming method for evaluation, it provides the most accurate measure of quality, making it possible to see how the application will be used in its real target scenario.

Aspects evaluated should include not only the knowledge acquired by the students, but also knowledge retention – a major importance in language learning. The students’ opinion about the application – ease of use, interest, self-reported learning, etc. – should also be taken into account during evaluation.

This chapter presents the methodology followed in the evaluation of Pictorial REAP.PT, its application with real students and the results.

5.1 Methodology

Initially, students are to be divided in two groups, A and B, in a way that guarantees balance in terms of their gender, language knowledge and proficiency with games. This will provide a strong guaranty that the differences found when comparing results from both groups will be caused solely by the application. Following the division, the two groups are then subject to a pre-evaluation (or placement test), in order to establish a baseline knowledge. After that, group A has a session using the application, during which their actions will be monitored for analysis. At the same time, group B has a normal class with text-based and oral exercises. In the end, both groups are subject to a post-evaluation in order to analyse the knowledge gained by the students. A week after the evaluation, both groups have, once again, to complete an evaluation test, this time to analyse knowledge loss. See Figure 5.1 for a graphical representation of this methodology.

Apart from this, students that use the application also answer a questionnaire that provides
insight on their opinion of the system, their self-reported learning, and general suggestions and criticisms to the application. This is useful not only to evaluate the current system, but also to acquire essential information for future work.

5.2 Preliminary Evaluation

Since real students are the most essential resource in our proposed evaluation, the schedule available is very limited. The subjects envisioned were foreign students attending the University of Algarve. There, foreign students can take Portuguese Courses. One of those courses is the Portuguese Foreign Language (PFL) Summer Course that takes place in August. There is also a 3-week 45-hour Intensive Course that starts in September and a 60-hour Normal Course that starts in October and ends in January and functions on a weekly basis. Because the development of the application finished after the September Intensive Course, we were unable to follow the methodology proposed above (Section 5.1). However, we were still able to have the students use the application after their final (written and oral) evaluation in the Intensive Course and have them answer our questionnaire (See Appendix A). This section details this evaluation.
5.2. PRELIMINARY EVALUATION

A total of 14 students participated in this evaluation, six of which only used the application, while the remaining also answered our questionnaire. It is on these remaining eight students that we will focus. All of them are foreign students that attended the 2011’s PFL Intensive Course at the University of Algarve. Their age averages at 27 years old and ranges from 23 to 29 years old. Their time learning Portuguese averages at six months and goes from zero knowledge (no contact with Portuguese prior to the Intensive Course) to one year of contact time. Figure 5.2 shows a graphical representation of the native language distribution of the students, from which Spanish is the predominant one. Figure 5.2 also shows the gender distribution of the students.

Students’ Description

The evaluation took place in a quiet classroom, with teachers at the disposal of the students. After starting the game, the students were encouraged to complete a brief tutorial that explained the various mechanics of the game, including how to control the avatar, start exercises and interact with objects. When this tutorial was finished or skipped, the first level unlocked and the students were on their own.

In this evaluation there were a total of 32 exercises scattered throughout five different rooms. The maximum level that a student could reach was six. Each level unlocked a new room, except the last, which unlocked new exercises in every room. When the student finished playing, we
presented our questionnaire.

This survey was divided in three parts; first, a section concerning personal information; then, a section with focus on the interaction with the application and its interface; and finally, questions regarding the student’s learning experience (See Appendix A).

Figure 5.3 provides a graphical representation of the answers to the main questions of this survey.

**Game Analysis**

The students were asked how helpful they found the initial tutorial. 62,5% of them said the tutorial was helpful, and only 12,5% did not find it helpful. It came to our attention that some students did not notice the option to change the interface to English, and this may have impacted negatively in their opinion on the tutorial, seeing as it was text-heavy. Still, as it is, this shows the importance of the initial tutorial in order to explain the instructions and objectives of the game.
5.2. PRELIMINARY EVALUATION

In terms of the control of the avatar and of objects, students’ opinion of each was similar. Figure 5.3 shows the answers given when asked about the difficulty of controlling the avatar and moving objects. Those who had more difficulty moving the objects also had more trouble controlling the avatar. And those who found it very easy to move objects also had less trouble controlling the avatar. Either way, most students found it neither easy nor difficult to control the avatar and move objects around. Future work should focus on polishing these controls in order to improve the results.

Most students did not think that learning how to play the game interfered with their experience. When asked this question, only 10% said it had interfered at all.

In general, students were satisfied with the game, as shown in Figure 5.3.

Learning Experience Analysis

With this section of the survey, we wanted to know the students’ perception of how much they had learned, the difficulty level of the exercises and their general satisfaction with the knowledge provided by the game.

When asked to compare what they had learned with the game and what they usually learn in a traditional class (See Figure 5.4), 25% answered that they thought they had learned more with the game, while everyone else thought they had learned the same. No one thought they had learned less with the game, which is good.

In terms of the exercises’ difficulty level, every student considered the difficulty to be at their own level, neither being too high nor too low. This is also very good. Furthermore, when asked if they noticed an increase in difficulty as they progressed, Figure 5.5 show that 62.5%
CHAPTER 5. EVALUATION

Figure 5.5: Answers to the Yes/No questions of the survey

Students were satisfied with their learning experience, as shown in Figure 5.3.

In the general comments question of the survey, some students said they had trouble knowing what to do after completing all the exercises in the first level. The feeling of exploration we were hoping the students would feel was, apparently, nowhere to be seen. Instead, they seem to prefer knowing exactly where to go and what exercise to do next. Some of them also wished to exit the office and explore different scenarios. This is certainly something to be done as future work.

Apart from the survey, our analysis also used logs of interaction to extract more information. These logs allowed us to create Table 5.1, which compares, for every exercise, its expected time for completion with the average time taken in the evaluation, and the maximum points obtainable with the average points awarded. This table also shows the average number of errors committed.

The expected time was set according to the exercises’ difficulty level. Three levels of difficulty were defined, and for the easiest level 60 seconds were set as the expected time. For the next two difficulty levels, 90 and 120 seconds were set, respectively. Comparing the expected time with the average time we can see that students took less time than expected in 94% of the exercises. At first it might seem that this expectation should be lowered. That is not the case because the average hides the information that while some students’ time was greatly below the expected
## 5.2. PRELIMINARY EVALUATION

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Expected Time</th>
<th>Avg. Time</th>
<th>Avg. Number of Errors</th>
<th>Points Worth</th>
<th>Avg. Points Obtained</th>
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<td>488</td>
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<td>882</td>
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<td>840</td>
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</tr>
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</tr>
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</tr>
<tr>
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</tr>
<tr>
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</tr>
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</table>

Table 5.1: Exercise analysis
– bringing the average down–, others were above. That is the reason why in exercises marked with B the average is even lower – according to our logs, students who took more time were the ones who completed less exercises and seeing as the B exercises only appeared after reaching the last level, those students did not even try to solve them.

Also as a result from analysing our logs of interaction, we reach the conclusion that the forfeit rate of the exercises is very close to zero. There was only a single case in which a student tried the same exercise 3 times unsuccessfully and then decided to move to another exercise without returning. Every other failure resulted in the student trying again – either right away of after solving other exercises in between – and then finishing correctly. This is exactly what we had hoped for during development and in particular when we decided to provide constructive feedback for wrong answers.

Although the points awarded are a reflection of the students’ performance – time and error-wise –, Table 5.1 shows that a higher average of errors does not always mean a lower average of points awarded. The reason for this is that, after making 3 errors, failing the exercise, and receiving a penalty, the student may then retry the exercise with a clean record, that is to say s/he can still be awarded the maximum points if her/his performance is good that second time. This is also why there is an exercise where the average number of errors is above 3. This means some students had to try that exercise two or three times before completing it successfully.

An information that can not be inferred from this table but is shown in our logs is that students that take longer to answer are prone to commit more errors than the quicker ones. This is not what we expected. When designing our scoring system we decided that the students would be able to complete an exercise either by not making errors or by being quick. This means that the student can be quick and effective – best case scenario, typically when an exercise is below the student’s level–, slow but effective – the student takes her/his time in thinking what the answer is, but does not fail when finally giving it –, or fast and prone to errors – a trial and error approach, making use of the constructive feedback. Unfortunately, our logs show that students taking a lot of time do so because they do not know the answer and are probably afraid of failing. We will try to improve this situation by encouraging the students to answer more quickly when they are not sure of the answer so that they can use the constructive feedback, otherwise they will be penalized in their score twice – for being slow and for committing errors. A possible approach is to replace the timer with a countdown so that students answer more
According to our analysis, this first evaluation shows that the learning resource developed during this work has the potential to be well received by the students. Even though we have not yet been able to follow our proposed methodology for evaluation and, with that, validate and compare the knowledge obtained by the students that use the application with the ones that attend a traditional class, this preliminary evaluation shows that students’ self-reported learning after using our learning resource is already at the same level than that of a traditional classes. In fact, for 25% of the cases, students’ self-reported learning has already surpassed that level. We believe that with more work in order to polish the controls and with an increased variety of exercises as well as other additional features, this learning resource will be a useful addition to the REAP.PT Tutor.

5.3 Second Evaluation

As mentioned, another Portuguese Course is starting at the time of this document’s writing. There are already 160 students enrolled in this course. This time, we will be able to follow the methodology proposed in Section 5.1 and with that conduct a better, more detailed evaluation of the application developed in this work.
The work here described represents an extension of REAP.PT towards a new direction, introducing exercises that use gaming aspects in order to further capture the students’ interest. These are also the first non-text-based exercises, taking place in a 3D virtual environment. However, more features can and should be added to the version described in this document in order to adapt this learning resource to the results observed in our evaluation.

To enrich the game, more categories of exercises are planned. “Object Interaction” is a new category involving interacting with objects. These exercises consist in asking the student to interact with the various objects that compose the scene independently. For instance, the student can be asked to call an elevator in order to go to a certain floor, or to pick up a book from the correct shelf. The integration with the text-to-speech synthesiser already in use in the remaining REAP.PT resources will allow the student to hear the exercises’ instructions, as well as any words s/he selects. Furthermore, the inclusion of speech recognition is also planned for future work. Another feature that can be added is a multiplayer component, which gives students a way to share their environment with other students. This would allow for the exercises to be taken in a competitive or cooperative manner, opening a variety of new ways to present the same exercises. The current game features an office as the main scenario; however, it would be interesting to provide the student with more varied locations, not only to make it more fun, but also because it would allow for different expressions to be taught. Possible new locations are a mall, a street, a school or a farm.

We believe that this new approach can offer satisfying results in language learning. Although we can not validate such claim before a complete testing, we expect that it will be ascertained by the second evaluation, considering how promising were the results from the first field test. If this is proved to be the case, our architecture will allow for an easier creation of future learning resources that will feature similar requirements and that will enrich the learning experience of those using the REAP.PT Tutor.
Bibliography


report, NESTA Futurelab.


Evaluation Questionnaire

Pictorial REAP.PT

Obrigado por utilizar o Pictorial REAP.PT
Este curto inquérito permitirá perceber quais os pontos fortes e fracos do jogo e consequentemente melhorá-lo.
Nas perguntas de resposta aberta pode responder em inglês se preferir.

Thank you for using Pictorial REAP.PT
With this short survey we will be able to discover both the strong and the weak aspects of this serious game, and with that, to improve it.
In open-answer questions, feel free to answer in English if you prefer.

Informação Pessoal / Personal Information

Nome / Name *

Idade / Age *

Língua materna / Native language *

Anos de aprendizagem do Português / Years learning Portuguese *
Responda com [0, 1, 2, 3, ...] / Answer with numbers [0, 1, 2, 3, ...]

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### Pictorial REAP.PT

*Required*

### O Jogo / The Game

Esta seção apresenta questões relacionadas com a interface do jogo (menus, instruções, etc.) e formas de interação (controlos, interação com objectos, etc.).

This section presents questions related to the game interface (menus, instructions, etc.) and interaction (controls, interaction with objects, etc.).

-O Tutorial inicial foi útil? -
"The initial Tutorial was helpful"

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discordo Completamente / Completely Disagree</td>
<td></td>
<td></td>
<td></td>
<td>Concorro Completamente / Completely Agree</td>
</tr>
</tbody>
</table>

-Controlear a personagem foi fácil? -
"Controlling the avatar was easy"

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<thead>
<tr>
<th>1</th>
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<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discordo Completamente / Completely Disagree</td>
<td></td>
<td></td>
<td></td>
<td>Concorro Completamente / Completely Agree</td>
</tr>
</tbody>
</table>

-Mover os objectos foi fácil? -
"Moving objects was easy"

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<tr>
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<th>4</th>
<th>5</th>
</tr>
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<tbody>
<tr>
<td>Discordo Completamente / Completely Disagree</td>
<td></td>
<td></td>
<td></td>
<td>Concorro Completamente / Completely Agree</td>
</tr>
</tbody>
</table>

-Aprender a utilizar o jogo interferiu com a minha aprendizagem? -
"Learning how to play did not interfere with my learning experience"

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<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
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<tr>
<td>Discordo Completamente / Completely Disagree</td>
<td></td>
<td></td>
<td></td>
<td>Concorro Completamente / Completely Agree</td>
</tr>
</tbody>
</table>
"Estou satisfeito/a com o jogo" 
"I am satisfied with the game"

1 2 3 4 5

<table>
<thead>
<tr>
<th>Discordo Completamente / Completely Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

Houve algo que esperava ser possível fazer dentro do jogo e que não conseguiu?
Was there anything you expected to be possible to do in the game which wasn't?

Qual foi a sua maior dificuldade no que diz respeito aos controles e interface do jogo?
What was your main difficulty when it comes to the controls and game interface?

Sugestões relativas à interface e controles:
Sugestions concerning the interface and controls:

« Back  Continue »
Pictorial REAP.PT

* Required

A Aprendizagem / The Learning Experience
Esta seção apresenta questões relacionadas com a aprendizagem ao utilizar o jogo.
This section presents questions related to your learning experience using the game.

Comparando este jogo com aulas tradicionais, acha que: *
Comparing with traditional lessons, you feel:
- **Aprendeu menos com este jogo / You learned less with this game**
- **Aprendeu tanto com este jogo como com aulas tradicionais / You learned as much with this game as with traditional lessons**
- **Aprendeu mais com este jogo / You learned more with this game**

**No geral, considera que a dificuldade dos exercícios apresentados esteve:** *
In general, you feel that the difficulty of the presented exercises was:
- **Abaixo do seu nível / Below your level**
- **Ao seu nível / At your level**
- **Acima do seu nível / Above your level**

**Notou um aumento da dificuldade dos exercícios com o avançar do jogo? ** *
Did you notice an increase in the difficulty level as the game progressed?
- **Sim / Yes**
- **Não / No**

**Completou todos os exercícios? ** *
Did you complete every exercise?
- **Sim / Yes**
- **Não / No**

Se não completou todos os exercícios, indique por quê:
If you didn’t complete every exercise, why was that?
- **Os exercícios eram demasiado difíceis**
- **Os exercícios eram fáceis demais**
- **Os exercícios eram pouco interessantes**
- **Other:**
“Estou satisfeito com a aprendizagem que fiz”
“I am satisfied with my learning experience”

1 2 3 4 5

Disordo Completamente / Completely Disagree
Conordo Completamente / Completely Agree

Indique as principais dificuldades que encontrou na aprendizagem:
Tell us your main difficulties that you found during your learning:

Use o campo abaixo para nos fazer críticas e sugestões para melhorarmos este jogo.
Use the field below to make critics and sugestions to make our game better:

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| à altura de                  | à beira de                   | à boca de                  | à cabeça de                  |
| à direita de                | a dois passos de             | a par de                  | a poucos passos de           |
| a jusante de                | a montante de                | abaixo de                 | acima de                    |
| à volta de                  | à volta de                  | além de                   | ao de cima de               |
| adiante de                  | além de                     | ao longo de               | ao nível de                 |
| ao lado de                  | ao largo de                 | às portas de              | até a                       |
| ao pé de                    | ao redor de                 | cerca de                  | de cima de                  |
| atrás de                    | através de                  | de fora de                | de frente de                |
| de dentro de                | de diante de                | debaixo de                | de frente de                |
| de frente para              | de trás de                  | detrás de                 | defronte a                  |
| defronte de                 | dentro de                   | em cima de                | diante de                   |
| do alto de                  | em baixo de                 | em frente de              | em face a                   |
| em frente de                | em frente a                 | fora de                   | em redor de                 |
| em torno de                 | face a                      | longe de                  | frente a                     |
| junto a                      |          | nas costas de             | na frente de                |
| na rectaguarda de           |                | no meio de                | no exterior de              |
| no interior de              |            | para ao pé de             | para a frente de            |
| para além de                |              | para diante de            | para cima de                |
| para dentro de              |            | perto de                  | para trás de                |
| pela frente de              |            | por detrás de             | por cima de                 |
| por dentro de               |            | por fora de               | por entre                   |
| por falta de                |            | por trás de               | por volta de                |

Table B.1: Locative expressions intended to be learnt by the students using Pictorial REAP.PT
### Table B.2: Verbs intended to be learnt by the students using Pictorial REAP.PT

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<thead>
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<th>Colocar</th>
<th>Descer</th>
<th>Esconder</th>
<th>Guardar</th>
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<tr>
<td>Inserir</td>
<td>Introduzir</td>
<td>Mover</td>
<td>Pendurar</td>
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<tr>
<td>Poisar</td>
<td>Pôr</td>
<td>Posicionar</td>
<td>Pousar</td>
</tr>
<tr>
<td>Recolocar</td>
<td>Repor</td>
<td>Reposicionar</td>
<td>Retirar</td>
</tr>
<tr>
<td>Subir</td>
<td>Tirar</td>
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<td></td>
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</tbody>
</table>

### Table B.3: General vocabulary used in the exercises in Pictorial REAP.PT

<table>
<thead>
<tr>
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<th>Almofada</th>
<th>Arquivo</th>
<th>Cadeira</th>
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</thead>
<tbody>
<tr>
<td>Caixote do lixo</td>
<td>Chávena</td>
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<td>Mesa</td>
<td>Microfone</td>
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<td>Prateleira</td>
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<td>Telemóvel</td>
<td>Tira-agrafas</td>
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</table>

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