IntegraGame: a real-life inspired serious game for social and professional training of people with intellectual disability.

[Extended Abstract]

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ABSTRACT

This paper describes IntegraGame a game for professional training and social empowerment of persons with intellectual disabilities. The game was designed based on a real case of professional integration, the InOut hostel near Barcelona, in which 90% of the personal has a disability. Integragame reproduces in 3D as realistically as possible the real hostel and presents several tasks to train cleaning procedures, vocabulary and social behavior. The game is adapted to a wide range of intellectual disability: it provides automatic navigation, uses verbal instructions and different types of visual assistance and feedback. It has been designed in narrow collaboration with educators and managers. It has been tested by users throughout its development and evaluated with a group of students with ID. The results are positive showing that students could use the game, had fun with it and learned from it.

Categories and Subject Descriptors

H.1.2 [**User/Machine Systems**]: Software Psychology; I.3.8 [**Computer Graphics**]: Three-dimensional Graphics and RealismApplications; K.4.3 [**Computers and society**]: Social IssuesAssistive technologies for persons with disabilities

Keywords

Serious game, Intellectual disability, social empowerment, professional training

1. INTRODUCTION

There is a number of evidences that training on the community skills of individuals with intellectual disabilities (ID) can improve their cognitive performance and social behavior and increase their functional independence [4]. However, the amount of resources needed for the personal accompaniment of this type of instruction is often unsustainable, yielding to an under-stimulation of many of these persons that results in a lower leisure and employment participation of this collective [13].

Computerized simulations and games may be able to provide ID persons with more effective and efficient simulated instructional activities [6]. In particular, serious games bring an opportunity to practice and train in an adaptive, personalized and engaging way [11]. Several successful experiences have been carried out to train ID individuals mathematics skills [2] and general cognitive skills [9] in the classroom. Other studies focus at improving behavior in daily life situations [5] in particular money management [8] and public transportation [7] [3]. However, there is a only limited number of games addressing professional training for persons with ID. For instance "My first day at work" [12] is a 2D game oriented at training e-mailing and usage of office equipment for non-severely disabled persons. According to an analysis of the Spanish organization of persons with disabilities ONCE [10], hostelry is one of the economic sectors that could offer better professional opportunities to persons with ID. However, up to our knowledge, no training game for this sector exist currently.

We describe IntegraGame a 3D game devoted at training persons with ID as room attendants. The novelty of our approach aside from the economic sector that it addresses, is that the game, inspired on a real use-case, presents a realistic 3D environment providing a strong immersion feeling. We describe the game, the technology used to make it accessible and we evaluate its results with the aim of analyzing the potential of a serious game as a professional training tool.

2. THE CASE STUDY

IntegraGame is based on a real case: the hostel InOut [1], located near Barcelona, that belongs to a non-lucrative organization, Icaria, devoted at promoting laboral integration

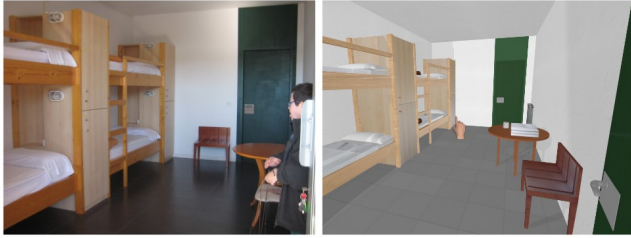**Figure 1: The scenarios of the virtual world**

Figure 2: A real room and the virtual corresponding model at right

of persons with disabilities. Up to 90% of the InOut workers have a disability.

Room attendants at InOut must perform routine duties in cleaning and servicing guest rooms and baths. Moreover, they must be able to face non-usual situations and give a discrete but positive and pleasant image to their guests. To make easier the training and daily tasks of their workers, educators and managers of the hostel have established very precise routines, and they supervise them continuously.

The challenge of the game was to provide an immersive training that could complement the in-situ education. For this, we decided to design a 3D environment, as similar as possible as the real one, and to focus at the skills that educators believed to be the most important and the most difficult to acquire. The game has a first-person perspective with users controlling the virtual camera position and orientation. The pedagogical approach is error-free: only correct actions are available at each moment of the game. The style is friendly and encouraging with positive messages also in case of failure.

The development of IntegraGame was done in close collaboration with the educators who validated continuously its pedagogical contents. The game was tested periodically with current room attendants at InOut. As part of the its projects, Icaria has also a special education school (Taiga). The validation experiment was performed in this school.

3. THE GAME

3.1 The virtual environment

The first stage of the game development was to reproduce the real environment. We visited several times the hostel, accompanied the workers in their duties, took pictures and videos and created the environment as a replica of the real one. Figure 1 shows a panoramic view of the environment: the corridor, the rooms and baths and a service room where the cleaning supplies are stored. Figure 2 shows a comparison between a real and a virtual room.

3.2 The tasks

The whole cleaning process has been broken down into small independent tasks that can be played one after the other or separately. In addition, there is an introductory task aimed at training users in the use of the software. In this task, users learn how to navigate in the environment and how to interact with objects. In every task, all user interactions are recorded to provide data for analysis. Currently, there are six tasks:

- **T1:** Prepare the cleaning cart. In the service room, users should open the closet containing the products and fill the cart (see Figure 3). The cart is located nearby the closet so that navigation is not needed. Users simply rotate the camera to look in one or the other direction. The task requires attention and memory skills. Its pedagogical goal is to identify products visually and by their name and to know which ones are necessary.

- **T2:** Knock at the door. In the corridor, users should knock at the door before entering in a room to clean it. Various situations can happen: empty room, room occupied by a client that leaves the room or that stays inside. In each case, users must learn to wait or act. The pedagogical focus of the task is put on the social interaction of the worker with clients, fostering education and patience.

- **T3:** Find valuable objects. In the room, before cleaning, users should check if there are valuable objects. If so, they must call the supervisor with a virtual phone. They will need to confirm which objects they have seen, first in a 2D panel and next in the 3D room. The first pedagogical goal is to be able to discern if an object is or not valuable. The second goal is to get used to notifying precisely what happens in a unusual situation. Thus, the task requires attention on one side and ability to take decisions on the other.

- **T4:** Clean the room. Users must tidy up and then clean the room, step by step. The task requires memory, attention, executive functions to correctly concatenate activities, and spatial orientation to move in the environment. The main pedagogical goal is to be able to follow a routine procedure, with a focus on side details such as opening and closing the window and turning off lights at the end (see Figure 4).

- **T5:** Make the beds. Users must change bed linens and make one of the beds of the room. This task is also to aimed at learning to follow a strict procedure.

- **T6:** Tidy up everywhere. Users are told to pick an object in the cart at the end of the corridor. In their way to the cart, they must collect all the garbage. The goal of the task is to make them understand they should care of cleanliness and order wherever in the hostel, even if their programmed task is to clean a specific

Figure 3: The *Prepare the cart* task

Figure 4: The *clean the room* task

space. This task is aimed at fostering a global understanding of their role and promoting engagement during all their work-time.

3.3 Accessibility

One challenge of the game was to be accessible for all potential users. For that, we integrate the following features:

- One click/touch interaction: the game can be played with a mouse, based on one-button click and mouse movement or on a touch screen. Clicks or single touches are interpreted as selections. Camera rotation is handled either with mouse movements or with touches in a navigation widget that frames the scenario. Actions are generally launched with a single click or a mouse or finger movement.

- Targeted selection: only objects related with the next correct action are selectable at each moment of the game in order to provide an error-free play.

- Simplified navigation. Camera rotation is restricted to small angles. Navigation is disabled when it is not necessary, as for instance in Task 1 and Task 2. In the other tasks, navigation is automatic: a simple click on an object yields a camera movement towards it. If the path towards the object is short, when reaching it, the corresponding action is done automatically. Otherwise, a second click to confirm the action is needed.

- Instructions are provided always verbally, with a simple and clear style optionally complemented with a

written message to reinforce reading skills of users that have them. In addition, in Task 1, iconic images of the objects to be collected are shown at a side of the screen to reinforce the verbal and written messages.

- Feedback mechanisms are available like highlighting and blinking the objects involved in the next action.

- Actions are implemented at different levels of detail. If the focus of the exercise is on the order of the actions and not on how they are done, a single click or touch is sufficient to do them. For instance, a single click on the shoes, tidies them up under the bed. However, if the focus is put on how to do the action, then the action is broken into a sequence of steps, each one launched through a new interaction. For instance, in Task 4, it was important to teach that scrubbing a surface must be done carefully until the surface is clean. This action was implemented with texture painting. It required users to move back and forth the virtual cloth on the surface until covering it all.

- A familiarization task is set up to train selection and navigation in the same environment.

4. EVALUATION

4.1 Method

The game was installed in the school Taiga and a group of 10 students selected by the teachers with ID played with it during school hours. We couldn't use the touch screen used during the tests previous to the game, so they played with the mouse version. There were 4 women and 6 men aged between 15 to 18 with different degree of ID. One of them had in addition a 80% of visual impairment. Teachers supervised them mostly for the familiarization task and less in the other tasks. They played 4 times through a period of 1 month. The results were automatically stored. After the test, we discussed with the teachers that gave us their impressions.

4.2 Results

Based on teachers observations and comments, we conclude that all students could play the game, they all understood the environment, the interaction rules and the aim of the game. They didn't report having difficulties in using the mouse for navigation although, in the validation tests held during the development of the project, it was clear that the touch device was easier for them. The feeling of immersion was strong, some students answering to the character inside the room or knocking directly on the screen at the virtual door in Task 2. All students felt attracted by the game and wanted to play. They were concentrated while playing. The major flaw that teachers found was that in the version of the game tested, all feedback and help mechanisms were enabled from the beginning. They recommended us to deactivate them progressively according to the users results. Their global feeling was that IntegraGame was a useful tool that could complement effectively their work.

The numerical results are shown in Figure 5: for each task, average of time, errors and traveled distance in the four repetitions of the game and a reference value computed for a first-time play of a person without ID. The numerical results of the class training confirm the teachers impressions:
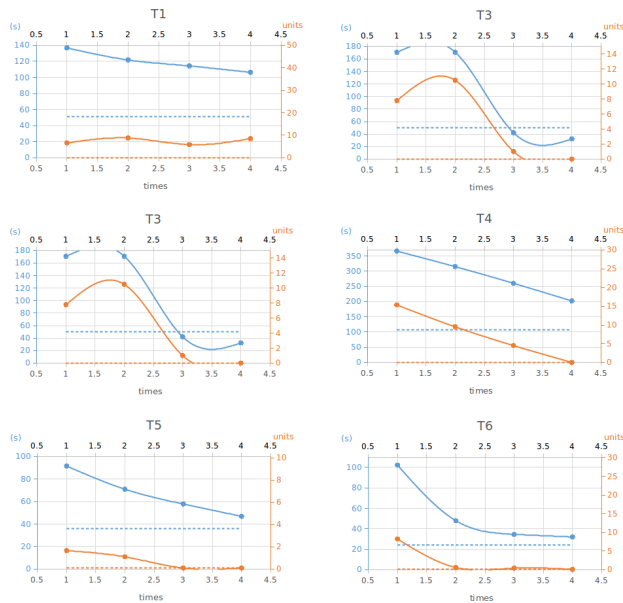
Figure 5: Results of the training stage for the six tasks (T1 to T6). The figures show the average results of the users. In the horizontal axis each trial of the game. In the vertical axis, in blue, times in seconds and in orange, distances in meters with real world scale.

the tasks are feasible, and students clearly improve their score through practice diminishing significantly the difference with the reference value for the first play and even enhancing it (Task 3).

5. CONCLUSIONS

Serious games can constitute a complementary mechanism for professional training of persons with ID. The IntegraGame experience has shown us that youngsters with ID are attracted to computers and gaming just like any other person. The cliché that 3D environments are too difficult for them has shown to be wrong: with suitable accessibility mechanisms, they are able to manage them and experiment a strong feeling of immersion. Moreover, they understand the tasks, are able to complete them and learn. The next step of our work is to implement levels of difficulty in the game, increase the number of situations and add rewards. We plan to analyze the transfer of virtual skills to real skills, by performing a real-life exercise similar to the game.

6. ACKNOWLEDGMENTS

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