How to interest Seniors with Serious Games ?

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***Abstract*— Serious Game is considered currently as a new non-medicated measure to the advantage of seniors, allowing to maintain good health in the playful conditions by doing cognitive and physical exercises. However, user's motivation is still a problem that needs to be studied more precisely. Indeed, most of them previously have neither game culture nor knowledge of new technologies (camera, computer). We propose in this paper a system which is able to initiate older people into Serious Games. Consisted of a recognition module and of a communicative interface with an animated avatar, the système accompanies the player in his game experience. 19 participants are recruited during their memory consultation and are tested the functioning of this system. Only 3, having an impaired mobility for the one and the disorders of understanding for 2 others, did not manage to interact with the system. We propose an improvement to bring more advice when the player faces difficulties in the course of the game session.**

Keywords — Serious Game; older people; motivation; interactive system.

I. INTRODUCTION

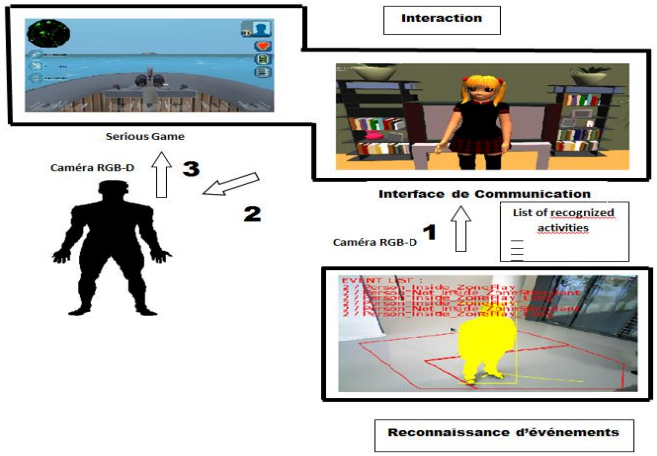

Fig. 1. Framework of interactive system

Cited among new technologies of gerontechnology, Serious Games (SE) are more and more adopted in the health projects for older people. Some games [3] suggest to the user working their memory, stimulating their cognitive function or training their physical condition : for example, **X-Torp**, allowing the patients suffering from the Alzheimer's disease to train their cognitive capacities by realizing the exercises in the form of missions integrated into the game.

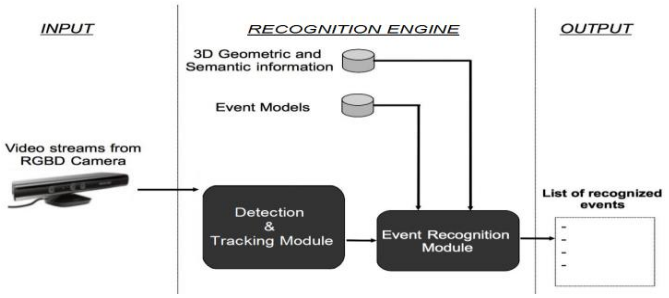

Fig. 2. The sequence of data processing of ERM

However, efficiency and use of this tool for this fragile population still remain to be a big question. Indeed, these particular users could resist the use of SG [12]. It asks them beforehand an effort of familiarization with the new technologies, while they do not have, for the majority, certain knowledges or habits in this domain. So, how to interest, even to seduce, older people with SG ?

The main idea is to establish a regular interaction between user and game to maintain an usual relation growing up over time. Then, how and at which moment it is necessary to interact ?

Wafa [5] grouped several factors (position, speed and distance between the person and his assistance robot, acoustic factors and facial information) at the same time to increase the precision of the engagement detection. In the case of the older people suffering from Alzheimer's disease, Adriana [7] learn his robot to adapt the level of interaction (easy, normal, difficult) with player by focusing on his response time during a series of game session in the conception of intelligent cognitive therapies.

We propose a system that can decide a favorable moment in order to invite the person to use SG by basing itself on the his movement and his position in the global environment. The system was tested with the older people to measure its interactivity. In the next sections, we explain the structure of the system, then the experiment. To conclude, we discuss a proposal allowing to improve the system.

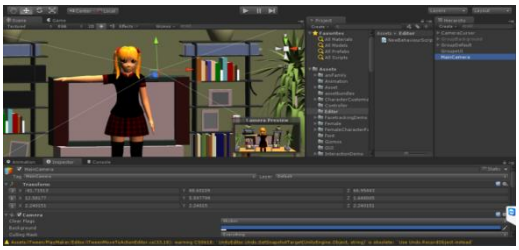

Fig. 3. The avatar and the interface of Unity3D

II. Approach

To encourage the person to play the game, the system has to observe, firstly, his physical characteristics in the global environment (movements, position, posture, etc..). This vision allows to constitute a perception of the state of the person, that is an essential factor to determine the favorable moment. Secondly, when the last one is decided, the system has to interact with the person according to scenarios pre-established via an user interface.

The structure of the system is presented in the Fig. 1, which is the connection of two modules : Event Recognition (ERM) and Interaction (IM).

A. Events Recognition Module

The Fig. 2 explains the sequence of data processing of ERM, by starting from video stream (input, to the left), until the list of detected events (output, to the right). This sequence divides mainly in two under-modules :

- ✓ the vision module : that manage the sequence of detection and tracking of person.
- ✓ the event recognition module : from the data supplied by the vision module, the event models and the contextual information of the scene (zones, objects), the module will define and render a list of recognized events.

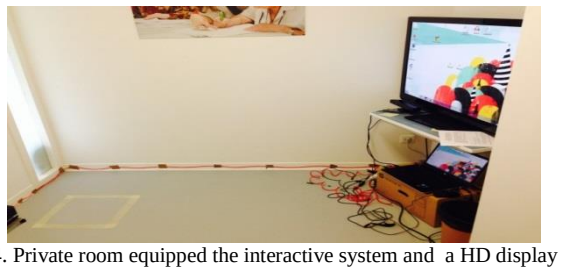

Fig. 4. Private room equipped the interactive system and a HD display

Thanks to this list, we can imagine several scenarios that could decide a right time to interact with the person. The event models are described by using a descriptive language allowing to define the spatial-temporal constraints between different states and events. Here is an example of the definition of an event :

CompositeEvent (Sitting_in_couch,
PhysicalObjects ((p1 : Person), (z1 : Zone))
Components ((c1 : Person_sitting (p1))
(c2 : Person_inside_zone_couch (p1, z1)))
Constraints ((c1 and c2))
Alarm (URGENT)
)

We note that :

- ✓ *Sitting_in_couch* : name of event,
- ✓ *PhysicalObjects* : the objects involved in the modelized event recognition (e.g., person or zone),
- ✓ *Components* : other events that need to be recognized before the current event,
- ✓ *Constraints* : conditions that need to be satisfied by the Components and/or the PhysicalObjects,
- ✓ *Alarm* : priority level.

B. Interaction Module

The module plays the role of an interlocutor between the game and the person. From the recognized events, received from the ER, it determines a corresponding interaction and execute this one using an interface composed of a scene and an animated 3D virtual avatar (Fig. 3,4). The interest of the avatar were prouved in the literature. Indeed, it can bring to the person a feeling of company [2], increase his attention and his sympathy [4] and more importantly, improve the interaction between the person and the machine [6].

The user interface is designed by the game engine Unity 3D. This engine is chosen due to its intuitive editor of integration of objects and scripts (Fig. 5). Unity 3D can import numerous 3D formats (Maya, FBX, etc..) or varied resources (audio, video). It simplifies the development and allows a quick initialization. Another advanted of this tool is that support lastest devices like the Microsoft Kinect camera which allows the vocal or gestural interactions.

III. Experiment

In order to validate the functionalities of the system, we evaluate the interactivity by analyzing the interaction time of users. We recruit voluntary participants, recommended by their doctor to perform a therapeutic training in the form of video game. We select two mini-game using the Kinect camera. A private room is reserved and equipped to realize the experiment and protect intimacy.

In this section, we present at first the protocol of experiment then the adaptation of system to an guided scenario of interaction and finally the result.

Protocol

- ✓ The doctor recommends to the person for participating in a therapeutic training in video game.
- ✓ If the person accepts, he is led into the private room, equipped with the system and the game (Fig.4, 5), in the presence of a therapist.
- ✓ The therapist observes, evaluates the progress of scenario and intervenes only in case of emergency.

- ✓ The participant follows the scenario of interaction through indications posted on the screen and information supplied by avatar.
- ✓ At the end of the training, the therapist fills a questionnaire in order to collect several information concerning the result of the interaction and the characteristics of avatar.
- ✓ No private information of the participant is saved.

Adaptation of system

We decompose the scene of interaction into two zones : *play zone* and *stimulation zone* (Fig. 5). We are particularly interested in three important events :

- ✓ *Person_Inside_Zone_Stimulant_Long (i.e the person stays in the stimulation zone more than 3 seconds.)*
- ✓ *Person_Inside_Zone_Play_Long (i.e the person stays in the game zone more than 3 seconds.)*
- ✓ *Person_Outside_Long (i.e the person is out of these two zones more than 3 seconds.)*

When one of these three events is recognized, it is sent immediately to the IM so that the last one could determine the interaction with the user.

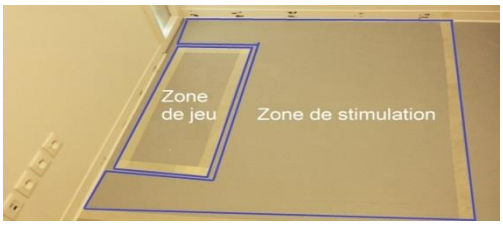

Fig. 5. Scene of interaction

In term of interface, we choose the avatar representing a little in a living room to bring softness and sympathy in a playful ambience. We add to the avatar the animations and the recorded voice that can help it to express many emotions, in order to emphasize its realistic side and to ensure a communication more effective.

Interaction scenarios

- ✓ The screen displays a message asking the user to place in the specified zone (*stimulation zone in the Fig. 5*) for starting the conversation.
- ✓ The user set up correctly in the required place. The avatar appears and ask him to move on the reserved place (*game zone in the Fig.* 5) for starting the game if he wants to play.
- ✓ The user set up correctly in the required place. The avatar asks him to wait then launches a covering video of gameplay. At the end of this demonstration, the game is started. The user is informed that he can stop playing at anytime by only leaving the reserved place.
- ✓ During the interaction of game or before the end of the game, the avatar invites the user to continue the training by proposing him another game. If he agrees to continue, he has to follow the same instructions as previous game. Otherwise, he completely leaves the space and the training ends.

Results

For two weeks, we tested the system with 19 older people. Among them, 16 made a successful interaction. It means that they were able to follow the instructions of the avatar from the beginning until the launch of the game. These results in Tab. 1 are such encouraging, taking into account of the participant's inexperience. Indeed, only 4 participants already tried the games on Ipad and non tested the RGB-D camera. More interesting, 14 agrees to play the second game suggested by the avatar.

TABLEAU I. RESULTS OF INTERACTION

Participants	**Average age**	**Successful Interaction**	**Pursuit to 2nd game**
19	75	84%	87,5%

In order to understand better the influence of the interface on their interaction with the system, we proposed a questionnaire on different characteristics of the avatar as its appearence, its gestures, its voice as well as the content of its communication (Tab. 2). Once again, the results confirm favorably our proposed solution. The avatar established a relation of collaboration and accompanied the participant throughout the interaction.

TABLEAU II. QUESTIONNAIRE

Question	**Positive Response**
Is the appearance of the avatar lovely ?	87.5%
Are the gestures of the avatar natural?	75%
Is the voice of the avatar audible, crisp and clear ?	100%
Is the communication understandable?	100%

IV. DISCUSSION AND PERSPECTIVES

We presented a solution allowing to enhance the interest of older people in the SG. The results posted in the Tab. 1 describe the efficiency of the interaction of participants with the proposed system. Only 3 persons did not know how to follow the indication of the avatar, the first one meeting difficulties to move and two others having important cognitive disorders. Theses particular cases did not reduce the quality of the system because their difficulties are independent from the system but due to the advanced state of their pathology.

We noticed that the proposed system gives to older people a good experience of cognitive training vie the SG. It facilitates the interactions by recognizing directly gestures and user's position facing the screen, using the specified zones defined on the ground. Indeed, the support of the avatar and the video allows the participants not to need any classical devices like a mouse or keyboard, and to interact with the system from the beginning until the launching of the game.

Moreover, the presence of the avatar contributes, largely in this success, as we can record in the Tab. 2.

However, the proposed system still requires improvements. We remarked that some participants forgot from time to time, the controls, even the goals of the game and began to lose the game line. This awkward situation can prevent the user from practicing regularly. In order to improve, the system have to able to anticipate the moment when the user could be lost and to propose the remedial indications, as proposed by [11]. This proposition would reduce an impression of a complicated process to control towards the game, then would boost the user's motivation and invite them to choose it as a tool of therapeutic training. The more the user plays regularly without interruption, the more he will benefit the advantages brought by the game to his health.

Suggestions from the user's experience allow us to explore many recherche direction. Three persons having already played the game on touchscreen devices, consider that the avatar's movements are still artificial and his animations need to be more natural. Two women want to add music during game session. They want to play games in a pleasant ambiance. Indeed, other factors, besides the interaction mode and the avatar's assistants integrated in the system, could act considerably on the user's motivation. Of course, a man could better train and play longer with a « male » game (combat, sport). An avatar in the form of a doctor also has a big chance to encourage the person to user the SG. Therefore, we have to realize more experiments to collect information in order to answer the question : what are the essential characteristics allowing the user to have an successful interaction and supported trainings with SG ?

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