Use of three-dimensional environments in educational multimedia: new posibilities for improving learning

M. Armenteros Gallardo

Universidad CARLOS III, Dpto. Periodismo y Comunicación Audiovisual, C/Madrid, 126, Madrid, Spain

This investigation analyzes the design of didactic materials based on a model similar to games. The degree of attraction and entertainment that show the young people towards games seems to mark new line of educative hypermedia development. Several projects exist where it advances in this line of research. Nevertheless, a certain ignorance in the use of guidelines of design as pedagogical in the development of these resources is observed as much. In this research several of the resources analyze themselves multimedia that follows this line. It is divided in three sections: one, the analysis of the use of virtual scenes, from the point of view of the realism degree and its incidence on the attention generated in the subject; two, the navigation used that it makes possible to the subject to happen from a scene to another one, and the repercussions on the space interpretation; and three, the necessities of collaboration between the teaching staff and the multimedia professional to be able to transmit the pedagogical values that they require this type of didactic materials.

Keywords three dimensional environment; hypermedia language; educational technology;

1. The use of three-dimensional environments

The incorporation of the TIC to the processes of teaching offers a fan of new possibilities. The educational hypermedia veers toward models with a very next esthetics to that of the videogames. But, we will focus in those that utilize the three-dimensional virtual environments.

   The three-dimensional virtual environments permits us to access the passed, present or even future worlds; to walk for the interior of buildings that to stopped existing centuries ago, to interact with objects in an impossible way in the real world, or to study too fragile objects or of difficult access, helping in transit to its conservation. We can practice techniques of restoration on synthetic models, or to explore different theories on its construction, all it assuring us of damage not the original one. Posibilites are infinites.

   Both possible ways of acceding to a virtual three-dimensional space it can be given by means of the model of "window in the world" or "immersive".

   The model of "window in the world" can be found so much videogames of PC as consoles. The vision of the user comes to be like of a window in the world. The screen of the monitor is the window and the information on the screen provides the visual information on the world that him is presented.

Fig. 1 Apprehension of a frame of the video game Crash bandicoot 2 of Naugty Dog Inc. based on the model of "window in the world ". The agent who is handled by the user possesses a great number of movements: it allows to turn on yes same to great speed, jumps towards ahead, or even to throw itself against the soil. Copyright Naugty Dog Inc.

In the model of "Immersion", the subject feels a lot more nearby al environment, more immersed in that reality reconstructed artificially. For this type of experiences the user counts on special eyeglasses that are used to coming accompanied also of a system of sound that reproduces acoustic the virtual setting, as well as of some type of interfaces hápticas as gloves, that permit al subject to perceive sensations through the hands.

In both models is sought to obtain the maximum degree of reality. A very next artificial reality to the experienced reality in the physical world due to them advanced systems that can provide entrances controlled in the tactile, auditory, and visual systems.

The interest by knowing the behaviour of the human being in this type of environments has favoured multiples researches to discover how our perceptive system in these artificial environments acts. For example, Chance and Loomis [1], as well as R. Hegarty and Montello, [2], in one of its research on three-dimensional environments, they verified that the visual system needs to be supported in other senses as the tactile systems to determine the lineal movements or newspapers of the body.

The capacity to represent the most next and immediate reality of form they seem to be you determined by the visual field. Dixon et al. [3] have founded that the differences in the immersive possibilities came derived by the size of the visual field presented al subject, as well as of the correct height of the eye relating to the screen of projection.

Without any doubt, so much the "immersive models" as of "window in the world" they are surpassing some levels of realism that never would be able to have imagined. But ¿how they are applying these models of three-dimensional navigation in the elaboration of educational multimedia materials?

2. Of the videocassette recorder to the infografía in three dimensions

The immersive models have come being utilized for a very long time in the formation of professionals due to that permitted to create environments of very next learning to the reality that would experience. Thus, for example the flight simulators of flight have allowed that the pilots can acquire know-how and flight skills without risking in an airplane.

Little by little, and with the technological price reduction, the use of flight simulators has begun to be al reach of all the sectors. First, it introduced in the consoles, later, in the personal computers.

As a result of this evolution, the alien, educational sector to this moment in it incorporates-ción of these technologies in the process of formation, is experienced an approach al use of flight simulators and three-dimensional virtual environments based on the model "window in the world".

The infografía put in the hands of teachers the virtual reconstruction of places and actions, facilitating the student's access to information that up till then only could have access through the text or as a lot of the photography.

In one of the investigations on the utilization of three-dimensional environments for the basketball referees formation [4] is observed that the application of three-dimensional environments is very useful to create played model that permitted to show the referees situations that themselves had not been produced in the reality. For example, in the establishment of the third referee in basketball, different points of view have been utilized to show the spaces without cover when is arbitrated with two referees. Las posibilidades infografícas han pasado de la recreación de animaciones en dos dimensiones a la recreación en tres dimensiones. Estas animaciones, a diferencia de la imagen proporcionada por los gráficos estáticos, aportan una nueva dimensión espacio-temporal: el movimiento.

As it can be observed in the figure 2, these forms to present the information permits to situate al referee in an environment it more nearby al than will experience in the court. In the investigation carried out on the process of arbitration formation making use of the three-dimensional environments, is observed that the use of the 3D is more efficient than the representation 2D in those situations where is desired to rival next points of view al that utilizes the referee in the court.
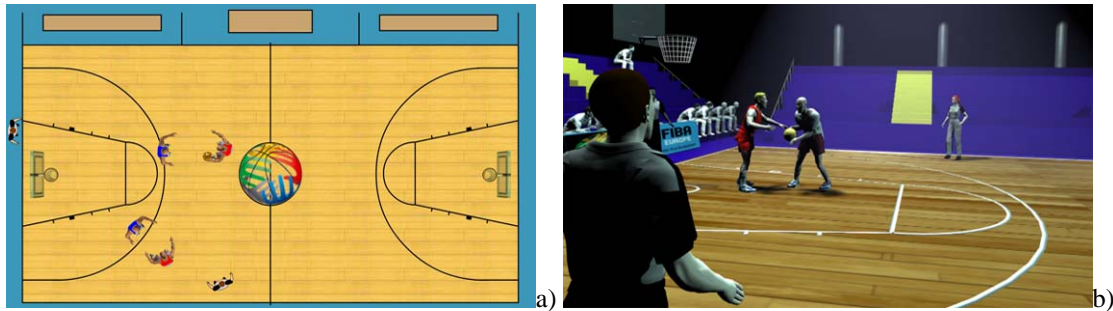
The capacity by rivaling the reality, permitting to adopt so much the height, the inclination and even the space of optimum vision, just as occurs in the human vision is what endows al three-dimensional virtual space of the capacities for the learning. In the research, opted for utilizing angles of camera that oscillated among the 45º and 50º that comes to coincide with the field of clear vision of the human being, in spite of the fact that the angle of vision reaches the 180º. For that reason, when was decided to reproduce the virtual vision of the referee, resorted to situate in the camera lenses with that angulations, obtaining that the angle of vision of the camera correspond with the angle of optimum vision of the referee. When the first animations were tested, all the subjects affirmed that a great analogy with the perception existed that was obtained on the court.

2.1. Other applications of the three-dimensional virtual environments

The capacities to rival the reality of the three-dimensional virtual environments are being object of study in different universities and since different disciplines as the psychology, Sociology, Communication, etc. The formative possibilities of application go since the application to people with disability to the formation of the army.

The University of Southern California, for example, has several lines of investigation: The Institute for Creative Technologies develops various projects of investigation in environments and virtual agents: the project "Emotional Modeling" analyzes the creation of synthetic personages that generate an emotional answer and a specific behavior in function of the emotional state; the "Socially Situated Planning" whose object of study is centered in trying that the virtual agents behave as social beings inside a group or an organization; the "Mission Rehearsal Exercise", that examines the creation of training camps with a high degree of reality, so that a high degree of similarity between these three-dimensional spaces exist and the real environments; finally, the project of investigation "Command Force" is centered in the Development of agents with those competences that are desires-bles in a soldier.

The University of Nottingham, through its department of Virtual Reality, has also participated in the based immersion programs development on three-dimensional virtual environments as ACE Interactive and Virtual Life Skill, both directed children with special educational needs. Contribu-ye to the viewing of phenomena and to endow them of a "realism" al that are accustomed our students.

Different projects educational hypermedia coordinated by the Department of Education and Science also they begin to utilize three-dimensional models, like sample the image of the figure 3, where appears

Fig. 3. Capture of a frame of a still of the resource multimedia educational Mos, which develop the education of the Music for Secondary and Bachillerato. In the picture, Mos is visiting the High Middle Ages to know its dark monasteries as well as it slow but hard life. Copyright MEC.

Mos, an agent that navigates the different historic phases of the music, permitting, thanks to the technology 3D, to have access to already vanished places.

Besides the capacity of immersion, the three-dimensional environments possess an enormous capacity to call the attention. The attention plays a determinant role in the process of learning and, therefore, fundamental at the moment of to articulate the speech hypermedia. The attention serves so that our brain us east toward somewhat concrete, or, on the contrary, we filter the information and him do not we pay attention. If once called the attention, the interest continues, so the subject will put all its senses, giving rise to a decode information.

As there it will be been able to observe the reader, the utilization of three-dimensional virtual environments is one of the expressive elements more and better used in videogames. Estallo [5] presents various appointment studies that show the positive effects of the videogames as the selective attention [6], the best ocular-manual coordination [7] and a better comprehension of the implicit mechanisms in the process of the information and knowledge of the motor abilities [8].

This interest by the use of three-dimensional environments has reached the Internet. The Virtual one Reality Modeling Language supposes a great leap on the traditional conception of navigation and all aims at that the great network goes to become middle that each time seems less to the reading of newspapers and more to the real life.

3. Toward the development of educational hypermedia based on three-dimensional environments

And development of creation of any multimedia project based on three-dimensional virtual environments carries prepared a great one unfold of resources, so much human like the technicians. Nevertheless, as opposed to the hypermedia destined al entertainment, the educational hypermedia seems that has not found the formula to manage to call the attention as the videogames do it.

Among the variables that may be influencing in this phenomenon I want to emphasize:

1. The educational hypermedia counts on a smaller budget that the hypermedia of entertainment.

2. As immediate consequence of the previous variable, not the degree of specialization in the development exists, what involves that a same person participate in different tasks (for example, design and programming) something, totally incongruent, if we leave that the educational hypermedia projects development or of entertainment requires to know each one of the expressive substances utilized. The execution of a video is very different to the preparation of a photographic session, like the voice in one is it or various languages can involve each project. On the other hand, the hypermedia projects involve a great dose of programming and related to the interactivity and the navigation. To it, one must add the knowledge on the technology involved in the processes of virtual creation, what evidently requires a high degree of specialization

3. Non-existence of a model educational hypermedia that the attention of the user manage to catch the attention of users at the same times that the pedagogical objectives of the resource be obtained. Extremadura or Madrid communities have introduced among the measures adopted as priorities in education, the guidelines and orientation in the development of contents, though what more worries in these moments is the infrastructure and the technological backup.

One of the most difficult objectives to obtain in the educational hypermedia is its pedagogical character. If difficult it is the control of each one of the processes involved in a hypermedia, is not less important to obtain the user learn. For it, it is fundamental to know what wants to be transmitted and to utilize the most appropriate expressive substance to explain that concept.
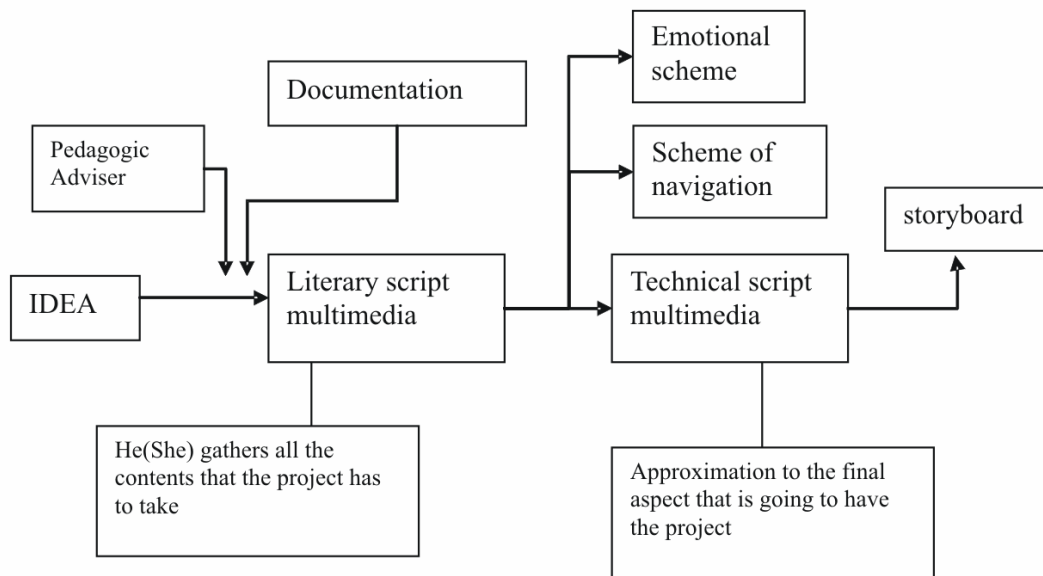
Fig. 4. Process involved in an educational hypermedia storyboard. Own production.

4. The role of the teaher

As it can be observed in the figure 4, the difficulty that leads to the development of these processes, and that has remained declared in the previous paragraphs, requires of professionals in each one of the different media used. And the teacher, like the expert in teaching and in the contents of the subject, is able and should participate in the approach of the pedagogical objectives that is pursued in the project, even participate in the elaboration of the literary script of the hypermedia. Nevertheless, it has no reason to know which is the most suitable expressive substance to transmit one or another concept. That will be decided by the multimedia developer who knows the characteristics and limitations of each media.

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