Computer Aided Choreographic Design

CARBAJO, M.1; MEZIAT, D.1; LÓPEZ, J.1; RODRIGUEZ, I.1; CASILLAS, A.1; BOSQUE, J.L.1; CASERO, E.2

(1) Computer Engineering Department. (2) Dance Division
University of Alcalá
Spain
Proceedings of the workshop «Multimedia and
Dance Pedagogy-Developing Expertise»
University of Limerick - Ireland

1. Introduction

The new way of storing images and sounds by means of numbers (digitalization) allows computers to integrate this kind of information. This way, synthesized graphics and sounds are generated into the computer.

At the same time, the lower cost of computers, more and more powerful each time, and the technology needed as interface with the human senses, like sound and video cards, graphic adapters, etc., allows the generalized use of multimedia computers and therefore the apparition of lots of enhanced applications (see figure 1).

There are a great number of commercial programs to work in multimedia covering almost every single possible user need where the image and sound are essential.

These new possibilities of computers can make easier the job also for the study and design of Dance. We consider two main areas of software development applied to Dance. The first one is the creation of multimedia didactic units dedicated deeply to a specific dance including video, musical form, Labanotation, etc. Thus, the Bolero program was created to teach the classic Spanish dance with the same name [1].

The second area is the creation of a software tool as help for the design of a choreography by means of three-dimensional human figures [2]. These 3D multimedia applications can be created to be used in other fields like sports [3], scenic performances, phisiotherapy, etc.

With this second aim, we started to explore the market and possible solutions to define the way to work [4]. The use of commercial programs to do computer animation is a good way to get a complete design because we don't need anything more than the program and a powerful computer. However, it isn't easy for no computer's professionals to design 3D images or to manage professional software. The commercial software is expensive and has a general orientation. It may offer some facilities that are not needed and may be it doesn't have others that can be missed. Also very often, it is needed an expensive computer to use this software.

After this reflection our conclusion is that it might be better to create new Ad Hoc software and we started to study how our application should be.

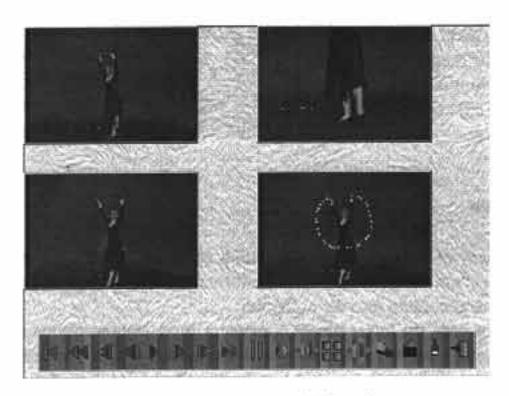


Fig. 1. An example of integration of video and computers

2. Definition phase

Our ambitious aim was to obtain a program where the choreographer could easily create a representation of a complex dance with the use of a set of human models, defining at the same time the stage, the music, the clothes, the lights, the point of view, etc.

We defined a set of features that the program had to accomplish:

- As quick and realistic as possible.
- Easy to use for Dance professionals under windows environment.
- Allowed using with simple and cheap compatible computers.

The software requires some typical program facilities:

- Ability to use and create some libraries of basic movements in order to reuse them.
- Ability to save a dance without occupying so much hard disk.

It's difficult to reach our goals everything at the same time, that's the reason why we started with a prototype, where we could do our first steps trying some important things:

- Our model of the human body (see figure 2).
- Our code design
- The user interface for a better knowledge of the choreographer requirements and to test the interaction man-machine [5].

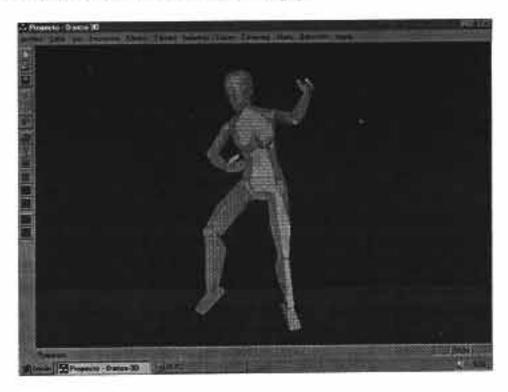


Fig. 2. Dance3D prototype

3. Description of the Prototype

The main idea of our program resides in the facility for the user to define the sequence of movements over a human model, like a puppet. To do this, the user have to define the key positions of the body, i.e. meaningful poses, and after that, the computer calculates itself the intermediate positions and show at the screen the complete movement between key positions [6].

To define a key position, the user must select an option of the menu, which allows him to choose a member of the human model (see figure 3) in order to place it at the desired posture.

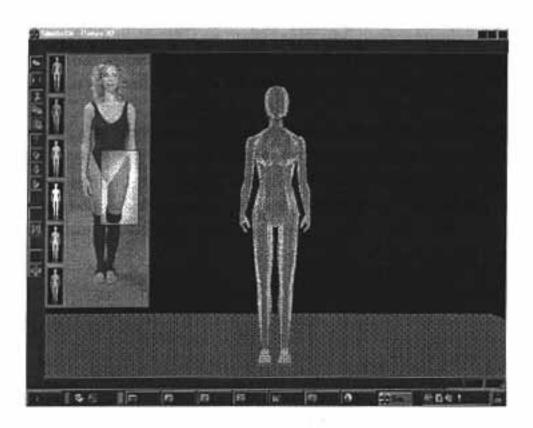


Fig. 3. Selection of a human member

We had modeled the human body divided in 16 members, and we had determined a hierarchy between them (see figure 4) to facilitate the movement of the joined members. If you try to move the arm, of course you move also the forearm and the hand. The established order and the number of body members can be observed at the next figure.

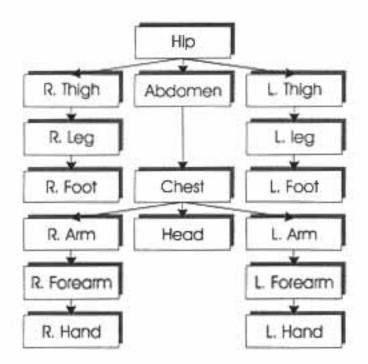


Fig. 4. Hierarchy of human members

To define a complex scene the user has to record each key position by means of an option menu adding them to the already defined movement (see figure 5).

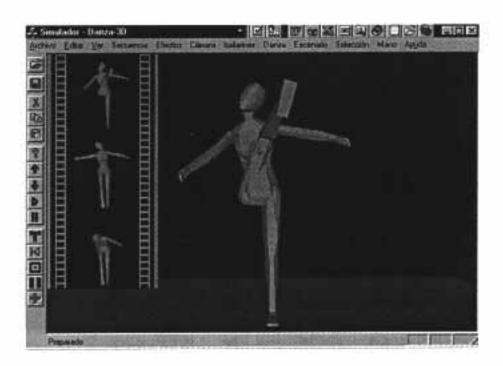


Fig. 5. Determination of key movements

One important feature of the program is the possibility to define a movements sequence and after that, to change the point of view without other movement definition. The user can select an option to modify the position, orientation and zoom of four cameras (see figure 6), and afterwards select one of them to play the sequence.

The system allows the insertion of new postures over a created sequence, to combine and change the order of existing positions, to copy and paste a sequence of movements from one dancer to the other, to create the symmetrical movements, etc. In general, there exists a series of options for the edition of dance movements.

Moreover, the user can insert a key position between two already defined positions, saving and loading a dancer sequence, get a mirror effect from a movements sequence, working at a scene trough the network, select the sound to add to the scene, and some other typical facilities.

At last, there is the possibility of obtaining a combined dance with several dancers (up to 6, right now) and to copy a movements sequence from one dancer to another, etc.

Once made this, the possibility exists of seeing the complete performance composed by all the figures in the scene (see figure 7), each one executing their defined movement's sequence.

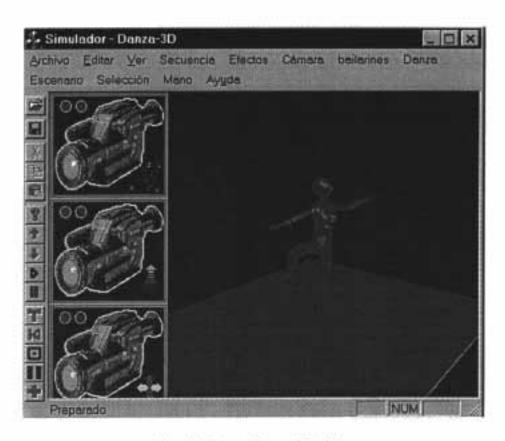


Fig. 6. Point of view definition

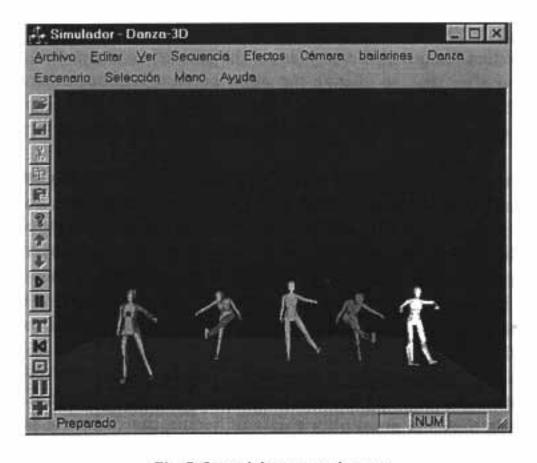


Fig. 7. Several dancers on the stage

COMPUTER AIDED CHOREOGRAPHIC DESIGN

Finally, the user can save the dance, of one figure or all, in a file for afterwards being able to retrieve, edit, or transfer them to other professionals.

We can emphasize that this first prototype will allow a first contact with Dance professionals, which will determine what aspects can be improved.

4. Conclusions and Future improvements

A user interface to design multimedia animations has been developed to facilitate the creation of 3D human figures in movement.

The actual prototype is a first step to create the basis of a multimedia application to the professional choreographic design. This has served fundamentally to determine the structure of the program code, which will be subsequently improved in different phases.

Firstly, it has been fixed the type of data used in the source code, defining the objects to represent each member of the human model considered in our design. It has been specified for each one of them the co-ordinates of the triangles that compose the surface of a member. Also the code to specify every operation over them has been designed. The established hierarchicalization of the members allows rapid calculations of the movements that are produced in some members due to the effect of movement of the others.

With the current prototype the users first contact with the environment is being established, allowing the users to suggest improvements and/or amplifications. At this moment, the user can really design choreographies with the current model and its environment.

We have reached our first goal but there is more to do. For instance, we have to add some menu options to create and modify the stage distribution and scenery, wardrobe design, music synchronization, etc.

Finally, one last mention to the possibility of working at real time by means of two ways. First, it requires the improvement of the software to use more effectively the graphical and computational computer resources. Second, the continuous down trend for the price of the computers and the up trend at the capacity suggest us that the objective is each day nearer.

Abstract

Este artículo trata sobre un sistema de simulación de movimiento humano en figuras virtuales 3D a través de programas informáticos creado para diseñar coreografías por ordenador. Para conseguir este objetivo, la aplicación multimedia nos permite trabajar con varias figuras tridimensionales al mismo tiempo y con diferentes secuencias de movimientos. El programa para PC está diseñado de tal forma que ofrezca un fácil manejo para los profesionales o estudiantes de Danza, de tal forma que se convierta en una herramienta más de trabajo del profesional en un futuro próximo.

5. References

- [1] Casillas, A. et al. "Estudio y Análisis de El Bolero, una aplicación multimedia" Revista internacional de Ciencias de la danza, Cairón. pp 65-70, 1996.
- [2] Colomé, Delfín. "El ordenador como instrumento coreográfico". Introducción conceptual al taller práctico del Profesor Peter Rajka, sobre el mismo tema, en el Congreso "La memoria de la Danza", Barcelona.
- [3] Hodgins, J. K."Animating Human Atletics". SIGGRAPH 95.
- [4] Preston, M.and Hewitt, T. "Integrating Computer Animation and Multimedia". EUROGRAPHICS 96.
- [5] Bryson, S. et al. "Strategic Directions in Human Computer Interaction". ACM Computing Surveys, 1996.
- [6] Rodríguez, I. et al. "Entorno Visual para el Diseño Interactivo de Animaciones de Figuras Humanas Tridimensionales". III Jornadas de Informática, 1997.