

## 0:1 virtual-real duel

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**Abstract** – *In this paper we will present a complex system of new technology uses in dance and video. It is a system that allows interaction between the recorded videos and dancing with the help of two computers, four monitors, webcam, projector and Wii remote. The interaction is happening through the temporal and spatial manipulation of video outputs and real-time processing of followed movements. For realisation of this project we used the existing systems, enabling the creation of diversified forms of VJ-ing (Visual Jockey methods), especially important is the VJ-ing on several monitors at once. Dancers entrance to the video space is allowed with the interaction through Wii remote, mobile multi-monitors and through the program, which tracks dancers motion through five markers.*

**Keywords** – *dance, video, multi-monitor system, VJ (Visual Jockey), Wii remote, interactivity, motion tracking*

### 1. INTRODUCTION

This paper presents the realization of complex video-dance new media show, which was made possible by multi-monitor VJ-ing system for interactive dance purposes and with the possibility of intervention by using Wii remote and tracking of colours.

The paper is structured as follows. In the second section the conceptual design of the project is presented. Also motivation for the project is explained, different methods of interaction and the required equipment for dance are shown in the presentation. The main idea of “0:1 virtual-real duel” is presented here.

In the third section the realization of the program is presented. In this section the software tools and hardware equipment used are listed. Described are also the methods used to play videos in multi-monitor installation, start-up method with use of Wii remote and also reading of video for finding a new position of differently colour markers in the picture and the adaptation for a dance show. We will focus primarily on innovation in this part of the project.

Conclusion is given in section 4. The paper is primarily a presentation of interaction between dancer and video artist with the use of computer technology.

### 2. INTERACTIVE VIDEO-DANCE SHOW

“0:1 virtual-real duel” is a multi-media performance which by using computer technology directly links two artistic disciplines and forces on them to interdepend. By doing so it explores the limits of perception of real and virtual space. It creates a new always-changing area of movements

and images, but at the same time also requires the coexistence of both.

The performance includes four mobile monitors with on-command or on-movement shift of videos. Video on one of the monitors is in-fact sensitive to vibration and movement. The movements of the monitor are transmitted to the computer by Wii remote. The monitors present improvement in the entrance of video into a real space, they help create a more complex space, and they are the means of new motion-picture cooperation.

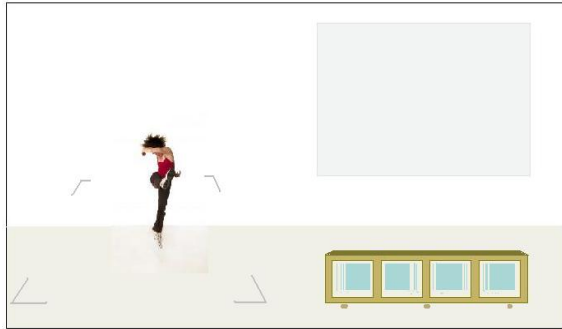
The system was designed in such a way that it allows a new type of improvisation. With the dancer and video artist interdependent, each provides the parameters for upcoming changes.

#### 2.1. Stage design and equipment

The scenography for this show is constructed with the help of already mentioned four monitors, which are placed in solid wooden boxes on wheels. It is possible to stand and walk on these boxes and move them around freely (Fig.1). This allows additional opportunities for the video manipulator to influence on dancers movement and the creation of the combined space, but also allows the dancer to return impact on the video outputs in a very direct way. The system of interaction between the video outputs to four monitors and one projector is designed so that it requires attention and sensitivity from everyone involved in the show (video artists and dancers) and brings to them a new type of always-changing space and methods of performance.

The event has two parts. First part is the result of training and testing the system with selected videos and defined choreography. In this part all the already tested ways of interaction are shown. In the second part improvisation is going on and is based on

limitations imposed by one or the other artist (dancer or video artist).



**Fig.1.** This figure shows the scenography. The dancer can move freely between four monitors and move them around and is in this way able to create always new arrangements. In the scenography another projection is added for the use of colour markers.

## 2.2. Methods of interaction

Interaction between dance and video is made possible on several levels. Firstly the interaction is possible on a very physical level since the dancer can move the monitors around the stage making in such a way an impact on videos playing on the monitors (Fig.2). He/she can move them apart from each other, even turn them around etc. By doing this he/she poses certain limits for the video artist. Dancer can also make an impact on the video by using the monitor with Wii remote attached, by shaking it or turning it to the side [1]. More of this is explained in the continuation.

The video artist on the other hand has also many possibilities with which he/she can limit or affect the dancers performance. He/she can switch on whatever monitor at whatever time he/she feels like doing so, making in this way a totally new environment for the dancer, who has to adapt. He/she can also use the system, which follows colours to integrate the movement of the dancer on the stage into his/her video output. More about this is explained later in the paper.



**Fig.2.** This figure shows how the monitors can be moved around the stage and in this way give options

to create a more dynamic and always-changing environment.

## 3. REALIZATION

For the realization of this project special hardware was used. The computer that runs this program has to have two graphic cards with two VGA outputs or in any other way enable the use of four VGA outputs (graphic card with four outputs, dualhead2go, triplehead2go, USB to VGA adapter or similar). Also needed is a Wii remote and for that a Bluetooth connection as well. The applications were made for Windows XP.

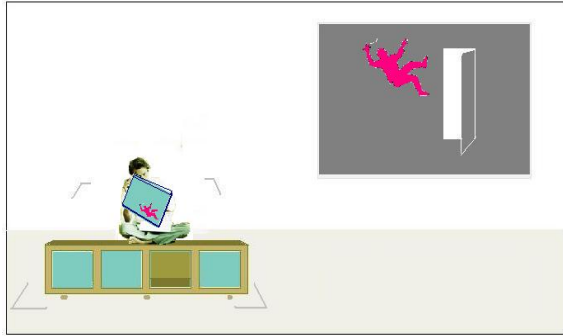
We had to build a system that would be able to quickly output videos on separate monitors but from just one computer. The options that the manipulator of videos had to have is to choose on which monitor which video is played, when and how many. It also had to include the option of playing a video on all monitors at once, which means that all four monitors had to at times be understood as one large monitor setting.

The application is made with use of several existing programs. To list all of them: vvvv for multi-monitor video output and manipulation of video through use of Wii remote; Microsoft Visual Studio 2005, Intel's open source project OpenCV (Open Computer Vision), interface between OpenCV and MS Visual Studio OpenCVDotNet; Adobe Flash CS3 for video output manipulation [2,3].

Since the quality of video processing depends a lot on the format of videos, also several programs were used to edit videos and video formats: Adobe Premier CS3, Photoshop CS3, Aftereffects CS3, Windows Movie Maker and Quicktime Player Professional. The vvvv application is able to read many different formats of video, but the chosen codec most suitable for this purpose are H264, xvid and waw9 codec [5].

### 3.1. Choosing the output monitor

Video artist is the person that chooses which monitor will play a certain video and when. This is made possible with the hardware already mentioned and the application made in vvvv program [4]. The switch between videos can be made by mouse and it includes the choice of using all four monitors together as a larger screen. This was made possible by vvvv application designed in such a way that it allows a quick and clean switch between videos and at the same time it allows to choose from a wide list of videos. Videos and complexity of application have been adapted to the hardware capabilities, since playing of videos on four monitors, processing data from Wii remote and marker processing demand a lot of CPU usage.



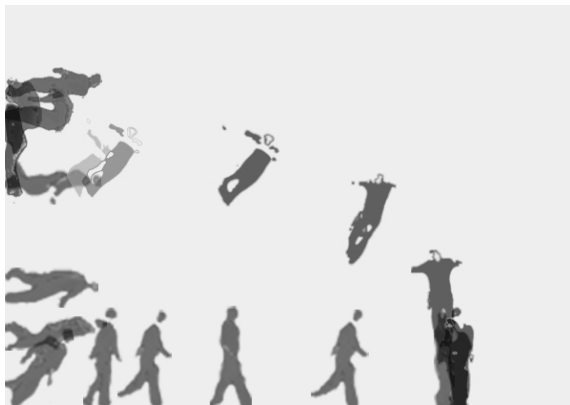
**Fig.3.** This figure shows how the monitor with Wii remote attached at the back looks like in the dance show.

### 3.2. Choosing video by Wii remote

There is also another way of choosing the video and that is by Wii remote. This can though be done only on one monitor. Videos are played depending on how the monitor (and by that Wii remote) is moved or rather shaken (Fig.3.).

By shaking the monitor one or several videos are played, which represent a stylized figure shaking. By turning the monitor over to one side another video is played representing a person falling to that side of the monitor (Fig.4.).

This application was also made with the use of vvvv program.



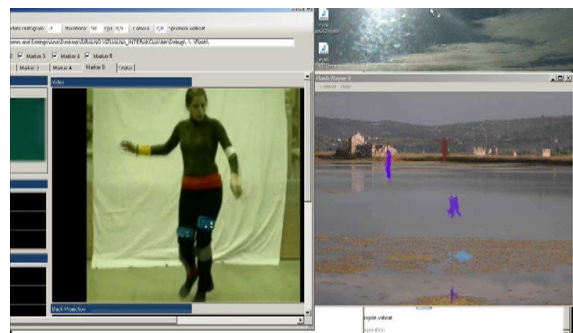
**Fig.4.** This figure shows an example of how the video frames are structured to be played as video when the monitor (and with that the Wii remote) is turned for 90 degrees.

### 3.3. Interaction with the use of five markers of different colours

“0:1 virtual-real duel” multi-media dance show includes in its performance another computer as well, which is used to process the dancers movements through a webcam. This part of the computer-based interaction enables the video maker to capture movement from the dancer through five differently coloured markers.

Dancers place different markers on their bodies. These can also be the clothes they are wearing. The dance is recorded by the camera, which sends the video to computer in real-time.

The application is developed in Microsoft Visual Studio 2005 and is based on Intel's open source project OpenCV (Open Computer Vision), an interface between OpenCV and MS Visual Studio OpenCVDotNet and Adobe Flash CS3. A C# application receives the video from the camera, processes pictures and tracks markers. This application calls OpenCV functions through OpenCVDotNet. The program returns the  $(x,y)$  coordinates of the marker, which are written to a XML file. The file is then sequentially read by the user interface and visualisation module, which is developed in Flash CS3.



**Fig.5.** This figure shows how the connection between movement and virtual representation on the output video can be seen.

The video artist interactively chooses the representation of a marker in the virtual video dance. The virtual dance is produced as a consequence of real dance. The user defines the virtual space while the dancers dance, so he/she manipulates the virtual dance and its presentation. The application produces a movement of the virtual representations that is in correlation with the markers on the dancer's body (Fig.5.,6.). The representation can be a picture or an animated two dimensional sequence, e.g. a movie clip of the dancer representing a pre-recorded movement. The user can also choose the background of the virtual dance and can change the size and the colour of virtual markers. New pictures and videos for markers and background can be simply added by updating XML files. This application is made for showing virtual world and virtual dance to the public. For more details see article “A system for interactive virtual dance performance” in Proceedings Elmar-2008, Volume 2 of 2, pages from 475 to 478.



**Fig. 6.** This figure shows the video output that is in the show projected by a projector. Video artist has chosen the background, icons for the markers and selected their sizes and colours.

### 3.4. New adaptations for dance show

The part of the dance show given in the section 3.3. was already presented last year but now it has been transformed to enable the use of the program for a dance show. All the functions of choices that were made in Flash CS3 and could originally be made by using the mouse were transported to the selection by keyboard so that there is no unnecessary cursor movement and buttons blocking the view of the output video. Some other actions were also added to the main Flash file and of course new videos were made for the purpose of the dance show.

## 4. CONCLUSION

In this paper we presented many connections and between dance, video and technology. We also presented a method for interesting use of monitors and Wii remote.

Obviously, we can use the program not only in the described fashion, but also in many other ways. The interactions can be discovered through use and all of the used programs have many possibilities of upgrades and adaptation for other dance shows or other artistic or non-artistic uses.

## ACKNOWLEDGEMENT

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