

Eye-Balls: Juggling with the virtual

ABSTRACT

The authors will introduce and demonstrate a novel computer vision based system for augmented performance. Unlike previous systems, which have primarily focused on ‘high art’ forms such as modern dance, this system is designed for use during a juggling performance. The system allows a juggler to interact with a computer through their movements, and the movements of the balls, to create audio and visual projections which respond to their performance.

This system has been designed in an iterative process involving amateur and professional performers, in order to create a system which is truly accessible. In particular, this project takes inspiration from mass market interactive entertainment and has been developed to only use commodity hardware and to be easily distributable, in order to allow it to be used within the small, self funded groups common in the circus arts community.

Keywords

Interactive art, performance, juggling, computer vision

THE SYSTEM

The Eye-Balls system uses a camera attached to a computer to detect the position of the head and arms of a juggling performer, and multiple balls that are being juggled. The positions and velocities are then input into a script based display system, which creates interesting audio and visual output which may be controlled based on the movement of the performer or balls. This output is projected onto a large screen on stage with the performer, and output through speakers, in order to create an ‘augmented’ performance which is entirely controlled by the juggling performer. This is in contrast to most current performances, where the juggler is ‘slaved’ to their music and visual effects, and must perform exactly in time to them, with reduced scope for improvisation and audience interaction.

Eye-Balls is designed to use only commodity equipment: a laptop, a camera, a video projector and speakers. The laptop, camera and projector are all set-up in front of the

performer, with a projection screen next to the performer. The laptop displays the video output so that the performer can see and interact with the output, rather than the output being purely accompaniment to the juggling performance.

Output from the System

The simplest output from the system is a projected display of trails showing the patterns that the balls are moving in, as shown in Figure 1. The flexibility of our script based system means that scripts can do many more complex things from mixing multiple channels of music together, to complex systems such as the juggling space invaders game shown in Figure 2. This is interesting from a performance point of view, as it allows long and varied performances to be created, in contrast to many existing systems, which are based upon a single fixed augmentation of the performance.

DESIGN PROCESS

The aim of this system is to take interactive vision technology and use it within juggling performances. This is a particular challenge, as much juggling performance is done in front of paying audiences with little knowledge of the art form and there is significantly less tolerance of more conceptual work than in dance, theatre and conceptual art, where most similar work has been situated (eg.[1, 2]). Secondly, the venues and performance groups are generally small, and self-funded, so they do not have large technology budgets. This makes it impossible to use expensive custom built equipment as other similar systems do

As a result, this system is being developed using a collaborative design process, with performer workshops, and public performances an important part of the iterative design process. Two workshops were run with local juggling groups, these were hobbyists, whose experience ranged from purely juggling for their own enjoyment, to experience of large scale public performances. We also spent some time with a professional performer, which gave

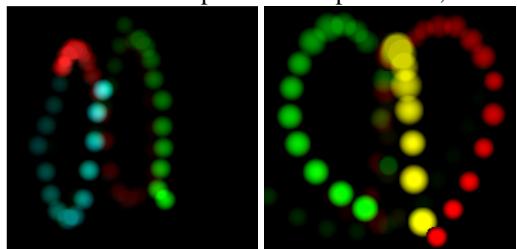


Figure 1 Display of ball patterns as trails

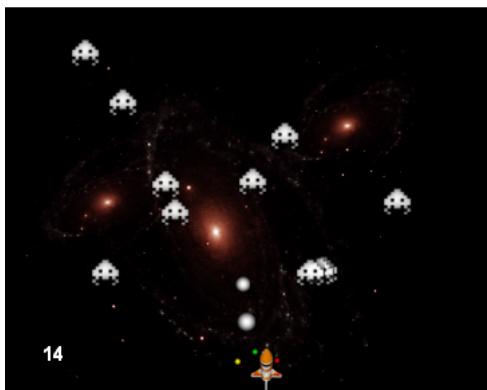


Figure 2 The juggling space invaders game

us a much greater insight into the needs of a full-time performer, and was inspirational in terms of performance development.

As well as this the system was recently used for a public performance at a local cabaret. This was a science fiction themed evening, and the performance was designed to fit that. It told the story of a man flying into space, meeting aliens, and his disillusionment upon returning to Earth. The performance was inspired by the song *First Man In Space*, by the band *All Seeing I*, and used loops and vocals sampled from the song as a narrative device, along with various visual elements which responded both to the juggling and to audio triggered by juggling (See Figure 3).

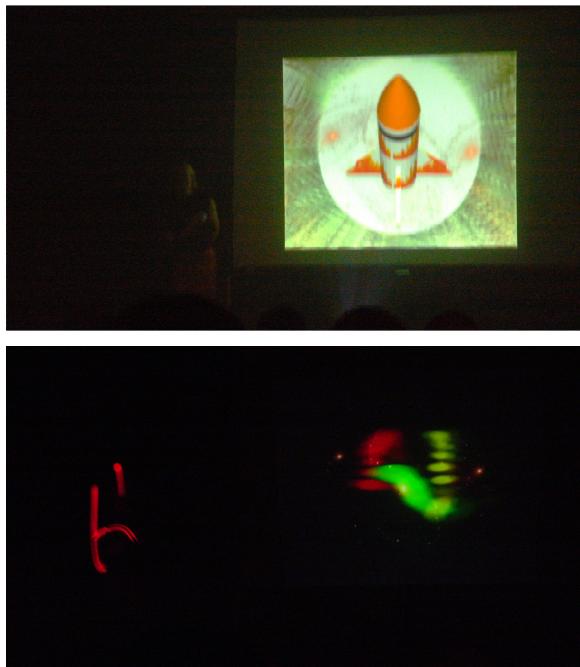


Figure 3 The system in use for live performance – the juggler is using glowing red juggling balls which can be seen on the left hand side of the second picture.

THREE PRINCIPLES INFORMING THIS WORK

This system has been designed to encourage performers to engage with the system, and extend their performance vocabulary, with the help of the following rough principles.

Design for Narrative

Typical juggling performances whilst they undoubtedly have a structure, and are performed in character, generally have limited if any narrative. Some more experimental performers have worked with narratives, for example ‘Stop Breaking my Balls’ by Gandini Juggling[3] uses a combination of juggling and dance to address the real life relationship of the two performers involved.

Visual accompaniments in particular allow an extra range of expression for exploring narratives. Combining these narrative elements with skill based performance creates some interesting challenges, particularly in terms of how the changes in the different audio visual elements are orchestrated within a performance and integrated with the juggling, without forcing the performer into a rigid set of timed actions.

Design for Play

An important part of the design process was making the system fun to play with. Games such as ‘Gladiators’, where jugglers attempt to make other players drop, whilst continually juggling themselves, are well established as a way for jugglers to improve their skills. For many jugglers, the act of juggling itself is seen as a game, playfulness is extremely important to the art form.

As well as working on performance scripts for the system, several games involving hitting targets on the screen with balls, and also the juggling controlled space invaders game shown in Figure 2 were created. During the second workshop with the local jugglers, it was interesting to see how compelling the very simple games that we created were. When developing the recent performance, an explicit focus on play was used within the design process.

Design for Inspiration

The workshops were most interesting when, having played with the system for a time, the jugglers started altering their performance to be informed by the system. As an example the heart shaped juggling pattern shown in Figure 1 is produced by a stilted looking pattern of ball throws, which only become beautiful when combined with the system.

BIBLIOGRAPHY

1. Rokeby, D., *Very Nervous System*. 1986
2. Sparacino, F., G. Davenport, and A. Pentland, *Media in performance: Interactive spaces for dance, theater, circus, and museum exhibits*. IBM Systems Journal, 2000. **39**(3 + 4).
3. Gandini Juggling. [cited 2006 Dec]; Available from: <http://www.gandinijuggling.com>.

Eye-Ball: Juggling with the Virtual:Technical Specifications

SITUATION

The Eye-Ball system will work in several possible situations.

Dark Large Scale Situation

This is best for a theatre / lecture hall demonstration, and is easiest to set up.

Juggling will be done in the dark using brightly glowing juggling balls.

Setup time: Approx 2 minutes.

Requirements

- Room with a projector plus projection screen.
- Lights that can be turned off, no natural light.
- An area at least 3 metres x 3 metres facing the audience. If this is directly in front of the projection screen, the screen must be at least 6 foot from the ground below.
- The VGA Cable for the projector, **must** be able to reach to the front of the 3 metre space.

Light Large Scale Situation

Juggling will be done in the light using standard juggling balls

Setup time: 5-10 minutes – may require some fiddling with lights, cameras, black-cloths etc. This may be done in advance, once the setup is known, 2 minutes or less should be needed to setup.

Requirements

- Well lit room with projector & screen
- An area at least 3 metres x 3 metres facing the audience. If this is directly in front of the projection screen, the screen must be at least 6 foot from the ground below.
- The VGA Cable for the projector, **must** be able to reach to the front of the 3 metre space.

Small Scale Demo

This is best for a small scale ‘kiosk’ style demonstration. Juggling will be done using standard juggling balls.

Setup Time: 5-10 minutes – may require some fiddling with lights, cameras, black-cloths etc.

Requirements:

- Projector with VGA input – we can bring this, but it is much easier if we don’t have to.
- Well lit room
- Area at least 3 metres x 3 metres, against a wall so a black-cloth may be attached.
- Projection screen, either to one side of the 3 metre area, or above – if the projector is bright, a white wall may do.

Ultra Small Scale Demo

This is what we use for impromptu demonstrations of the system, using standard juggling balls.

No projector is used, so this is only suitable for a small number of viewers at a time.

Setup Time: 2 minutes

Requirements:

- Well lit room.
- Area at least 3 metres x 3 metres, against a wall so a black-cloth may be attached.

PERFORMANCES

For performances, lengths are flexible, from approx 5 minutes to 15.

Alternatively, a non-structured technology demonstration can be performed.