EYE-BALLS: CHEAP AND CHEERFUL INTERACTIVE PERFORMANCE

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Most interactive performance systems to date have been expensive, large scale setups, targeted at genres where funding is typically available, such as modern dance and experimental music. With the Eye-Balls project, I attempt to create interactive performance which is accessible. This means minimizing both financial and technological requirements on the performer, and also choosing a style of performance which is accessible to a wide audience.

I chose juggling as a focus for this work. Juggling was a natural choice for multiple reasons. Firstly, I am a skilled juggler with performance experience, and wished to make something that I could perform with. Juggling is arguably inherently cheap and cheerful, characterized by the taking of simple and relatively cheap items and creating engaging performance through skillful manipulation of these objects. It is also a genre of performance characterized by individual artists and small groups, who are typically independent and self funded. Because of this, with one notable (expensive large scale) exception [1], juggling and other circus arts have mostly been ignored by developers of new performance technologies.

**Fig. 1. A simple Eye-Balls output (©Joe Marshall)**

Cheap

The Eye-Balls system uses a video camera, plugged into a computer, running software that visually tracks the position of a set of balls, and the head and hands of a performer who is juggling these balls. This information is then passed to a set of user written scripts, which create video projections and audio output based on the performer's movements and juggling. A very simple example of an output is shown in Fig. 1. (Technical details of the tracking algorithms and scripts are available in [2,3]).

I designed Eye-Balls to only use commodity equipment, so that it could be used with a performer's existing equipment. It requires a laptop computer, a video camera, and whatever output devices are being used, typically a video projector and a set of speakers. During development of the system, all performers I met during development including amateur groups, had access to a laptop and video camera suitable for running the system.

The laptop is placed in front of the performer, displaying what is output on the projection screen, so that they can get feedback and respond to the projections. Having this level of feedback allows the performer to create performances that respond to their juggling, allowing improvisation and flexibility in timing. This is in contrast to current ways of accompanying performance such as pre-recorded soundtracks and visuals, which are typically non-responsive and fixed in time, so require the performer to react to them. This in turn limits the possibilities for interaction with the audience at points when the music is on or the visuals are playing. In Eye-Balls there is freedom to improvise, with the ability to work with other audio/visual elements. Eye-Balls has been used for several performances, including public cabaret, academic conferences, small group demonstrations and digital art events. Audience sizes have been anything from 20 people up to a large theatre with 500 people. A recent performance I have worked on is entitled "Juggling Like a Bicycle". This was designed as an attempt to move away from an abstract computer-generated style of performance and explore the use of the system in a more classical comedy juggling performance. The next section presents an illustrated script, as an example of a performance in Eye-Balls (all pictures ©Joe Marshall).

Cheerful
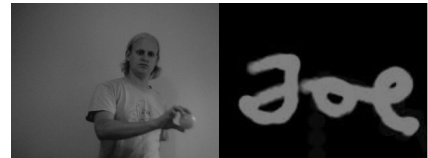
Hi, my name's Joe and I'm a juggler.
I move a ball in the shape of the word "Joe", which causes it to be written on the screen above me. *Ooh isn't that clever!* I jump into a victory pose (shown below), arms raised, and the screen changes to a picture of a bike.

I have a dream... No not that one. This is more odd (at this point I talk all about my bike and how much I love it)

Anyway, I had a dream about my bicycle and that it was juggling. It was performing intricate patterns. I'm juggling, balls are shown circling above the bike. *And I woke up, thinking how on earth can a bike juggle?*

I yawn, arms above head, triggering another change, to show an engine on screen. *I know how a car would juggle* Juggling in a 'pistons' pattern where balls move in columns, engine moves and makes engine noises *High Gear* Juggling faster, engine moves faster. Victory pose, causing the display to show a factory.

I had a thought, what if jugglers were mass produced, and came out of a factory. Juggling in a 'machine' pattern, as multiple video images of me juggling come out the factory.
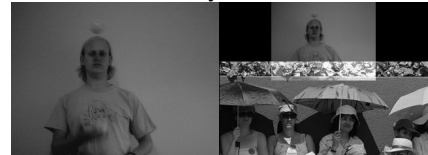
Like a tennis match. Juggling in a 'tennis' pattern, with one ball going from side to side over a 'net' of two other balls, on screen a tennis audience turns their heads from side to side to follow

the ball, tennis sounds come from the speakers.

… (various other dubiously stretched visual analogies follow)

Then I was banging my head against the wall (bangs head on onscreen wall, with comedy crashing noises) *but then suddenly it came to me, I knew how to juggle like a bicycle. But unfortunately, it required* throws hands up in horror) *THE HARDEST TRICK IN THE WORLD*

The finale is a big and obviously difficult trick, which ends up in a position that looks like riding a bicycle and juggling.

This performance is entirely controlled by the juggler's actions, with the victory poses in between each 'scene' serving a dual purpose of giving the audience time to clap the trick, and telling the system to move on through the performance. Stylistically, it has a lot in common with classic street performance acts, it is a comedy build up to a single big impressive trick.

Having the system allows for visualizations which react interestingly to what I am doing, and do not require careful synchronization. It also gives the freedom to extend or shorten the accompanying patter depending on how the audience is responding. It does add another thing to think about, controlling the system; in this performance the victory pose works relatively automatically, however this is not the case in performances with a more complex structure.

Interaction System Design

The script processor which creates the output uses a JavaScript interpreter, in order to allow many kinds of interaction with the system. This can be basic operations such as displaying visual trails based on the ball positions, to video processing effects that respond to the

ball movements, to entire interactive systems, such as a juggling controlled space invaders game, an interactive juggling teaching system, and a real time music mixing application controlled by ball gestures.

The flexibility allows for the creation of performances which develop through a large number of different styles and different types of output, in contrast to most other performance systems which do not support this kind of movement. The system is designed so that the control of the performance can be done by the juggler, for example by performing particular juggling gestures to alter the speed of an effect, or to move through a range of different effects by using stage movement, or body positions.

In order to design a system with this wide a range of flexibility, and to envision the possibilities of such a system, it was vital to have input from the wider juggling and circus performance community. Because of this, I have used a collaborative design process, with several workshops with local juggling groups, plus also spending time with two professional performers. The people in these sessions covered a range of experience levels, from world class performers to hobbyists.

The workshops provided valuable inspiration in the early design stages, as to what the sensing and pattern recognition should be able to do, and in terms of designing the output system. However, the point at which they were most useful was later in the design process, when the system was relatively stable, and I was creating actual performances within the system. In particular, talking to performers who use existing non-interactive technology, such as programmable color changing juggling balls, video projections and music was a big help. A major part of this was in the discussion of issues they had using technology during performance, including practical problems such as setup time and synchronization, and more performance related ones, such as the division of audience attention between the performer and the clever visual elements they are using, and the fear of just using technology because it is there, rather than for any artistic purpose.

I also got the chance to talk to Joel Salom [4], an Australian professional juggler, who uses a home-made set of sensing pads attached to his arms and hands. These trigger sound and lighting effects when balls are bounced off them,

allowing him to create music entirely triggered by his juggling. His show has been developed over several years and is probably the only professional circus show using technology purely controlled by the performer. A major issue that was brought up in this conversation is that of audience understanding. He found that at times, despite him explaining the system in advance, audience members would sometimes compliment him afterwards on how well he juggled to the rhythm. In an early public performance with the Eye-Balls system at a local cabaret, I also experienced this; several of the audience members I spoke to said that they were initially confused as to what the link between the pictures and the juggling was, with a lot of variation as to which point in the performance they understood that there was a link. In future performances, I worked hard to start with a very simple example in which it is obvious that the projections and audio are responding to ball movement, which reduces this confusion.

The Future

The Eye-Balls system has proven its potential as a cheap and cheerful interactive performance tool. The relatively simple setup of the system lends itself well to real world situations, it takes 5 minutes to set up, and other than projection equipment (generally venue provided), can be transported in a single laptop bag. It has proven to be possible to create engaging short performances using the system and I have found it easy to integrate the system into my performances. The future development of this work will involve the exploration of longer performances within the system.

The success of this system has also inspired me to begin the creation of further 'cheap and cheerful' performances and interactive artworks.

References

1. Matthew Reynolds, Bernd Schoner, Joey Richards, Kelly Dobson, and Neil Gershenfeld, "An immersive, multi-user, musical stage environment." in *Proceedings ACM SIGGRAPH 2001*, (ACM Press, NY, 2001) pp 553-560

2. Joe Marshall, Steve Mills, Steve Benford "Using Object Interactions to Improve Particle Filter Performance" in *Proceedings British Machine Vision Conference 2006*

3. Joe Marshall "Eye-Balls: Computer Vision in the Circus" in *Proceedings Creativity and Cognition 2007* extended version at <http://www.mrl.nott.ac.uk/~jqm/juggling/> accessed 02 October 2007.

4. Joel Salom <http://www.joelsalom.com> accessed 02 October 2007.