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Motion Capture for *A Tempest*: visual analysis of human movement, digital/corporeal interaction and performance

Practice-based R&D workshop

12-19 July 2012
Findings were presented at a showing on 19 July 2012 at the Ivy Arts Centre, University of Surrey.

Funded by EPSRC (Bridging the Gaps), £3,200

This R&D workshop was a collaboration between the School of Arts / GSA (Guildford School of Acting), the CVSSP (Centre for Vision, Speech and Signal Processing), the MoVe project (Movement Visualisation for e-Cultures), Mesmer (video design & production company) and Lightwork (multimedia theatre company).

Using scenes from *The Tempest*, the workshop explored diverse modes of movement capture using specific devices and software: Kinect (used for domestic interactive games through the TV), IP 360-degree surveillance camera (Oncam Global) and 3D surround-camera animation. It examined specific qualities and adaptabilities (for a theatre setting) of the three target technologies, and sketched prospective staging treatments. Specific insights arise in relation to the three motion capture devices/systems, as indicated in B4. Taken together, they each *dimensionalise* the figure; the Kinect and the surround-camera system by enabling 3D representation on screen, the IP camera through multi-perspectival viewing from a single device. All three devices thereby trouble the distinction between stage space (three-dimensional) and screen space (two-dimensional), implicating the action from one realm in the other.

This workshop was part of a larger research project that examines the relationship between Shakespearean drama and contemporary manifestations of surveillance, space and location.

I conceived the project and directed each of its phases, working with colleagues from the Centre for Vision, Speech and Signal Processing; Movement Visualisation for e-Cultures (both University of Surrey); Lightwork (multimedia theatre company); and Mesmer (video design and production company).

The research is geared around the key question: ‘What relations obtain between space, location, movement and surveillance in i) Shakespeare’s *The Tempest*; and ii) contemporary digital culture; and how can examination of the one bear upon the other?’ It asks a subsidiary question with respect to technological application: ‘How can contemporary surveillance and movement tracking technologies (IP camera, Kinect, multi-camera motion capture) be adapted or applied to intermedial theatre production?’

The process of enquiry includes iterative practice-based research performance (Gdansk Shakespeare Festival 2009; Surrey 2013), experimental workshops, conference presentations (Chicago, Shanghai), article publication (*Studies in Theatre & Performance, Confluent*) and website dissemination.
Key insights are as follows. *The Tempest* depicts a broadly panoptic model of social observation. However, the play’s spatial and structural arrangement, along with developments in digital surveillance, enable a re-figuring of the Benthamite panopticon towards a multi-perspectival model, with mobile observation devices overseeing distributed subjects in random locations and/or motion. ‘Seeing’ is proliferated, ‘(dis)location’ is pronounced, in ways that evoke the relationships (in contemporary experience and Shakespeare’s play) between surveillance, space and corporeal disposition. The motion capture devices *dimensionalise* the human figure, eroding distinctions between 2D screen space and 3D theatrical space and implicating figures from one realm in another.

**Workshop aims, objectives and project summary**

*Aims, objectives and project summary*

**Summary**
The workshop is a collaboration between staff in the School of Arts (FAHS) and the Centre for Vision, Speech and Signal Processing at Surrey, the MoVe project (funded by EPSRC), and specialist multimedia performance practitioners. Using scenes from Shakespeare’s *The Tempest*, it explores non-marker-based methods of movement capture. The workshop develops interaction between pre-recorded and co-present (live) performers, and examines ways of capturing, playing back and aesthetically figuring the material in theatrical settings. The workshop is intended to lay the ground for further larger-scale funding application.

**Aims**
- Explore a method for tracking movement, with a view to:
  - Capturing group and individual movement without using visual markers
  - Figuring the data as an aesthetic resource in production
- Develop protocols for a system for real-time playback of data, allowing for interaction between pre-recorded and co-present (live) performers

**Summary of outcomes and findings**
The workshop explored three motion capture technologies: the Kinect (used for domestic interactive games through the TV), the IP 360-degree surveillance camera (made by the security firm Oncam Global) and 3D surround-camera animation (through CVSSP’s blue-screen studio). It developed and modeled appropriate staging configurations in relation to each, and tested these iteratively.

**Kinect**
- There is a Brechtian aspect to performance to the Kinect, enabling a double perspective through two spatial logics (an actor onstage in front of a device; and the scene presented on screen).
- The performer must remain within a ‘cone’ of readability that makes different corporeal demands from performance to a camera.
- We discovered and trialled specific effects concerning the instability of the Kinect’s field of vision, and software design/development to achieve different playback options.
IP 360° surveillance camera

- We explored and realised the following:
  - A 360-degree fisheye view figured as a circular image.
  - The same shot figured in a flat plane. This is an extremely wide shot that has the effect of showing the space as field or pattern.
  - The selection of different viewing angles from the same camera position. We found that a split-screen arrangement of four images was productive in that the eye can keep all four in inter-relation.
  - Tracking of a moving figure within a pre-defined area of capture. This particularly enhances the surveillance aspect of the device.

3D human motion reconstruction

- The actors in effect become avatars, removed from any originary location and spatial context.
- The ‘raw’ footage is manifested by way of 8 images running simultaneously. We see this as an interesting output in itself, characteristic of a saturated mode of surveillance.
- The novelty in terms of CVSSP capture technology was the capture of groups of people; capture in CVSSP’s studio is normally performed using one or occasionally two figures. Nevertheless reconstruction was shown to be possible and 3D models were created for several short (30 second) sequences shot over the space of one morning, and reconstructed in subsequent weeks of processing.

Each device or system enables a distinct form of motion capture. Taken together, however, they each dimensionalise the figure; the Kinect and the surround-camera system by enabling 3D representation on screen, the IP camera through multi-perspectival viewing from a single device. All three devices trouble the distinction between stage space (three-dimensional) and screen space (two-dimensional), implicating the action from one realm in the other.

Outputs

- The workshop concluded in a showing at the Ivy Arts Centre, University of Surrey, on 19 July 2012.
- The workshop is documented at
  
  http://moveresearch.net/A_Tempest_Web/A_Tempest.html

  and

  https://vimeo.com/47157689

- Lavender presented on the project in a paper entitled ‘Capturing The Tempest? Practice-as-research for Shakespearean dramaturgy and multimedia theatre production’ at the 3rd International Conference of Performance Studies, Shanghai Theatre Academy, China, 15 September 2012. A version of this paper was published as a journal article:
  
  Andy Lavender, ‘Capturer La Tempête? L’intervention de la recherche dans les pratiques et la production théâtrales multimedia avec l’exemple de la pièce de