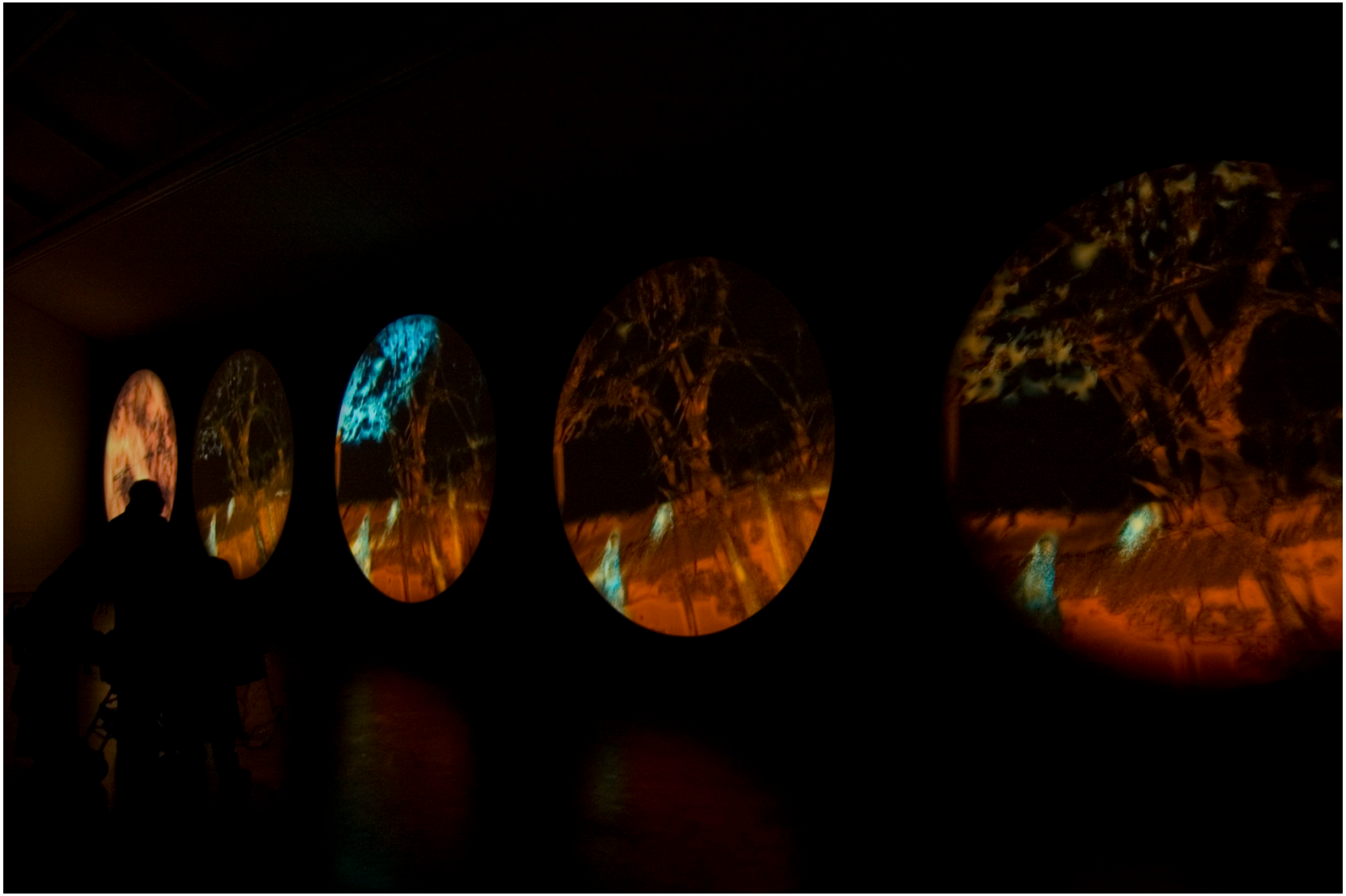
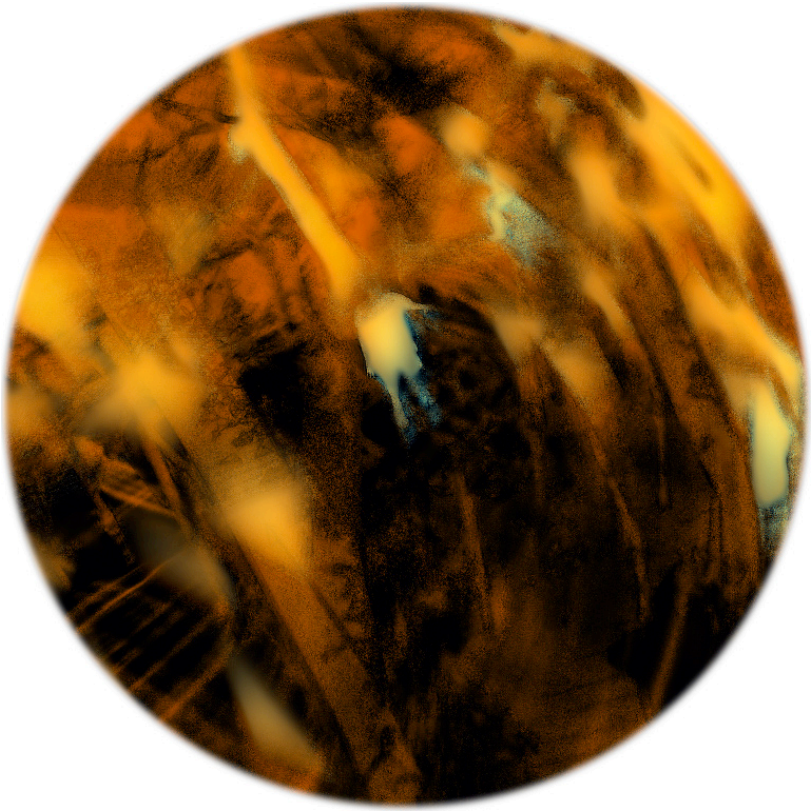


Installation photograph – Centre for Contemprary Art, Glasgow – December 2007

Forest

a live digital artwork by the OpenEnded Group



The Artwork

Forest is a visual enactment of outdoor games played in childhood. In this five-screen live installation, virtual children wander through a forested parkland playing hide-and-seek among the tree-trunks. They swing dizzily on monkey bars, then clamber up among the branches overhead. They lose themselves in revery and then re-encounter each other in the forest. The children's movements are uncannily life-like, for they are drawn from an extensive library of motion-capture data created specifically for *Forest*.

It's not just the children playing in this fashion — for the imagery itself plays similar games across the five circular projections.

Each of its portholes looks out on the same forest scene, but these views are in dynamic disequilibrium with each other. One porthole may decide to jump to a different camera angle, for example, and the adjacent views will then struggle to catch up with that new angle. Another porthole may choose to switch its color relations, and again the others may try to shift theirs in the same direction.

The circular frame of each projection plays odd tricks with perception, gently undermining the viewer's sense of gravity, especially when the camera angle rolls slightly. The rich ambiguity of visual perception is intensified by the "visual physics" embedded in our custom 3D renderer. For example, our system conjures up the moving image out of the propagation of its own grain.

We describe this more fully in the following section. What's important here is the full aesthetic effect — for all this gives rise to a strikingly filmic and uncannily live expression of subjective space, the likes of which have never been seen before.

Visual Physics

In addition to controlling camera position, movement, angle, zoom, and the flow of time, the custom *Forest* renderer manipulates lighting and shadow and all the elements of its visual physics, such as:

Movement-directed grain – image grain responds either to the movement of a figure or object within the scene *or* that of the virtual camera – or both.

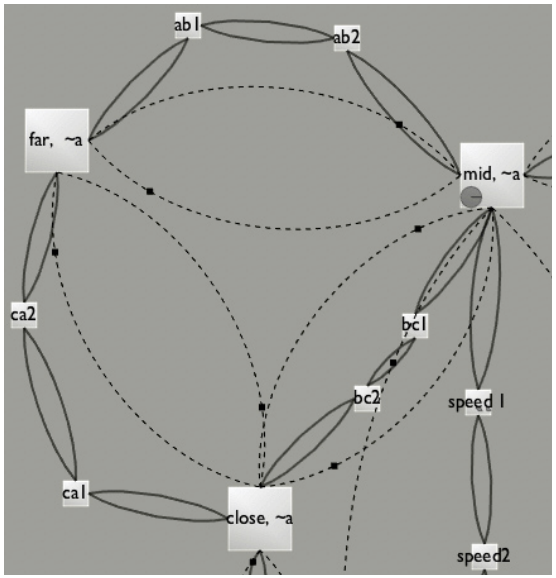
Paint dynamics – Occluded objects are made visible in depth and motion layers, creating uncanny superimpositions as background objects "paint" ones in the foreground — an unreal but psychologically true way of rendering depth.

Multiple focus – focus can be shifted anywhere in the depth of the scene; likewise, any moving object can "paint" itself in blurred or sharp focus.

High-range dynamic lighting – the renderer addresses color values beyond the old 0 to 255 range, which allows us to blow out light sources to simulate overexposure and to cast shadows of focus.

Geometric depth-cues – the ground of a scene is constructed from tessellated geometry, which inevitably have seams between them (due to rounding errors). We sharpen these contours so that they become a series of lines receding from the camera – a "mistake" that paradoxically accentuates the illusion of depth.

These effects are best seen in moving clips, which we provide on the HTML/QUICKTIME mini-site on the accompanying disc.



autonomous camera controls for Forest *(detail of screenshot)*

Field – open-source software

The *Forest* installation generates itself algorithmically in real-time, so that no frame of its continuous animation ever quite repeats.

Since the imagery it generates is resolution-independent, its projected resolution and frame-rate are limited only by hardware — as graphic cards improve, so will *Forest*'s image resolution.

The *Forest* renderer is part of our Field software system, which is also what runs it in realtime. More than an authoring system, Field is in fact a system for creating authoring systems (a "meta authoring system," if you like). It allows us as artists to fashion our own authoring environment for any given artwork we wish to create; and as we work we can continue to adjust and even to recast this environments as the need arises.

Field underpins many other artworks of a completely different nature — *Enlightenment* (2006), the AI exploration of Mozart's final symphony we made for Lincoln Center; *Loops* (2001-8), our abstract portrait of Merce Cunningham; and *how long does the subject linger on the edge of the volume...* (2005), in which our projected imagery responds intelligently in real-time to the motion-captured live performance of the Trisha Brown Dance Company.

We are now releasing Field as open-source software, as our way of giving back to the field of digital art. Meanwhile, *Forest* represents one radical expression of the software's potential.

Technical Specifications

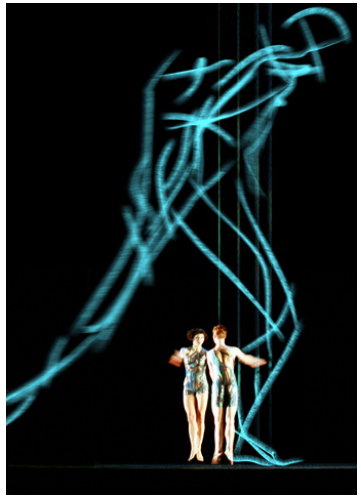
3 Macintosh Pros, each with 2 GB RAM

5 ATI X 1900 graphics cards, or better

5 projectors at 1024 x 768 resolution,
minimum brightness: 4,000 lumens,
contrast ratio: 1,000:1 or better

assorted ethernet cables

PEDESTRIAN — ROCKEFELLER CENTER



BIPED — LINCOLN CENTER STATE THEATER

RECOVERED LIGHT — YORK MINSTERR

The OpenEnded Group

The OpenEnded Group consists of three digital artists — Marc Downie, Shelley Eshkar, and Paul Kaiser — who create works for stage, screen, gallery, page, and public space. (Individual bios are given on the following pages.)

The group's artworks include several in the field of dance — *BIPED* (with Merce Cunningham, 1999), *Ghostcatching* (with Bill T. Jones, 1999), and *how long...* (with Trisha Brown, 2005).

Public artworks include *Pedestrian* (2002), *Enlightenment* (2006), *Recovered Light* (2007), and *Breath* (2007).

Gallery installations include *Musical Creatures* (2000-3), *Trace* (2001), *Arrival* (2003-4), and *Point A → B* (2007).

Exhibit and performance venues have included Lincoln Center, Barbican Centre, the Whitney Museum, ZKM, SIGGRAPH, Ars Electronica, the Center for Contemporary Art (Glasgow), Massachusetts Museum of Contemporary Art (MASS MOCA), the ICA (London), the Wexner Center for the Arts, the MIT Media Lab, the Brooklyn Academy of Music, the Kitchen, the New York Film Festival, the Berlin Film Festival, the Fondacio Antonio Tapies (Barcelona), the Yerba Buena Center for the Arts (San Francisco), the York Minster, the Nabi Museum (Seoul), the ICC (Tokyo), the Monaco Dance Festival, Théâtre de la Ville (Paris), the Grand Theater (Hong Kong), the Chicago Museum of Contemporary Art, the Jerwood Space (London), and many others.

Reviews have appeared in The New York Times, the New Yorker, Wired, the Village Voice, the Guardian, the London Times, Newsweek, Time, Computer Graphics World, the Wall Street Journal, the Financial Times, Le Monde, Die Welt, ABC-News, National Public Radio, and many others.

For complete information, please see www.openendedgroup.com.

Marc Downie

Marc Downie is an artist and artificial intelligence researcher. Born in Aberdeen, UK, he has an MA in natural science and a MSci in physics from the University of Cambridge, graduating at the head of his class with the Mott Prize in the Natural Sciences. In 2005 he obtained a PhD from MIT's Media Lab, writing a thesis entitled "Choreographing the Extended Agent."

Downie's complex algorithmic systems are inspired by natural systems and a critique of prevalent digital tools and techniques. His interactive installations, compositions, and projections have presented advances in the fields of interactive music, machine learning, and computer graphics.

While he was at the MIT Media Lab, he collaborated extensively with colleagues there, playing key roles in projects such as as *AlphaWolf* (A Prix Ars Electronica honorable mention in 2002), *Dobie* (SIGGRAPH 2002), and (*void* *) (SIGGRAPH 2000), and *Jeux Deux* (2006).

Downie's solo works include the series *Musical Creatures* (2000-3), which have been exhibited internationally.

Downie continues to develop the authoring system FIELD for our artwork creation and for open source.

Shelley Eshkar

Shelley Eshkar is a digital artist whose research explores drawing, computer graphics, and human motion. He received his B.F.A. from the Cooper Union in 1993.

One of his primary tools is motion capture, a technology that digitally captures the movement, but not the physical likeness, of human motion. Eshkar creates new digital bodies and spaces to host these motions. The motions are radically recomposed and altered, creating a work of performance that could exist only in virtual form.

Eshkar has received awards from the New York Station Foundation for the Arts (2001), New York State Council for the Arts (2001), the Bessie Awards (2000), Foundation for Contemporary Performance Arts (1998), and Ars Electronica (1999 and 2004).

Eshkar was a Lubalin Fellow at Cooper Union in 1997, and has had artist-in-residencies at MASS MoCA in 1999, at UC-Irvine in 2001, at Arizona State University (2003-5), and at Le Fresnoy (current).

Paul Kaiser

Paul Kaiser is a digital artist and writer. He earned his bachelor's degree in film and art history from Wesleyan University (1978; summa cum laude), and his M.Ed. in special education from American University.

Kaiser's early art (1975-81) was in experimental filmmaking and writing for recorded voice. He then spent ten years teaching students with severe learning disabilities, with whom he collaborated on making multimedia depictions of their own minds. From this work, he derived two key ideas - *mental space* and *drawing as performance* - which became the points of departure for the solo and collaborative digital artworks he has been making since the mid-90s.

Kaiser's solo artworks include a pair of abstract films (*Flicker-Track / Verge*, 1999); an interactive exhibit at The Exploratorium in San Francisco (*Inkblot Projections*, 2002); and a multimedia installation at the Brooklyn Academy of Music (*Trace*, 2002).

Kaiser has taught at Wesleyan, Harvard, Columbia, and San Francisco State, with artist's residencies at Cooper Union, UC-Irvine, Harvard, Ohio State University, The Exploratorium, Arizona State University, and Le Fresnoy. He has written and lectured extensively about digital art, filmmaking, dance, and education.

In 1995, Kaiser was the first digital artist to receive a Guggenheim Fellowship. He also received a ComputerWorld/Smithsonian Award (1992) for his multimedia work with children. Most recently, in 2008, he was given the John Cage Award by the Foundation for Contemporary Arts for lifetime achievement in the performing arts.