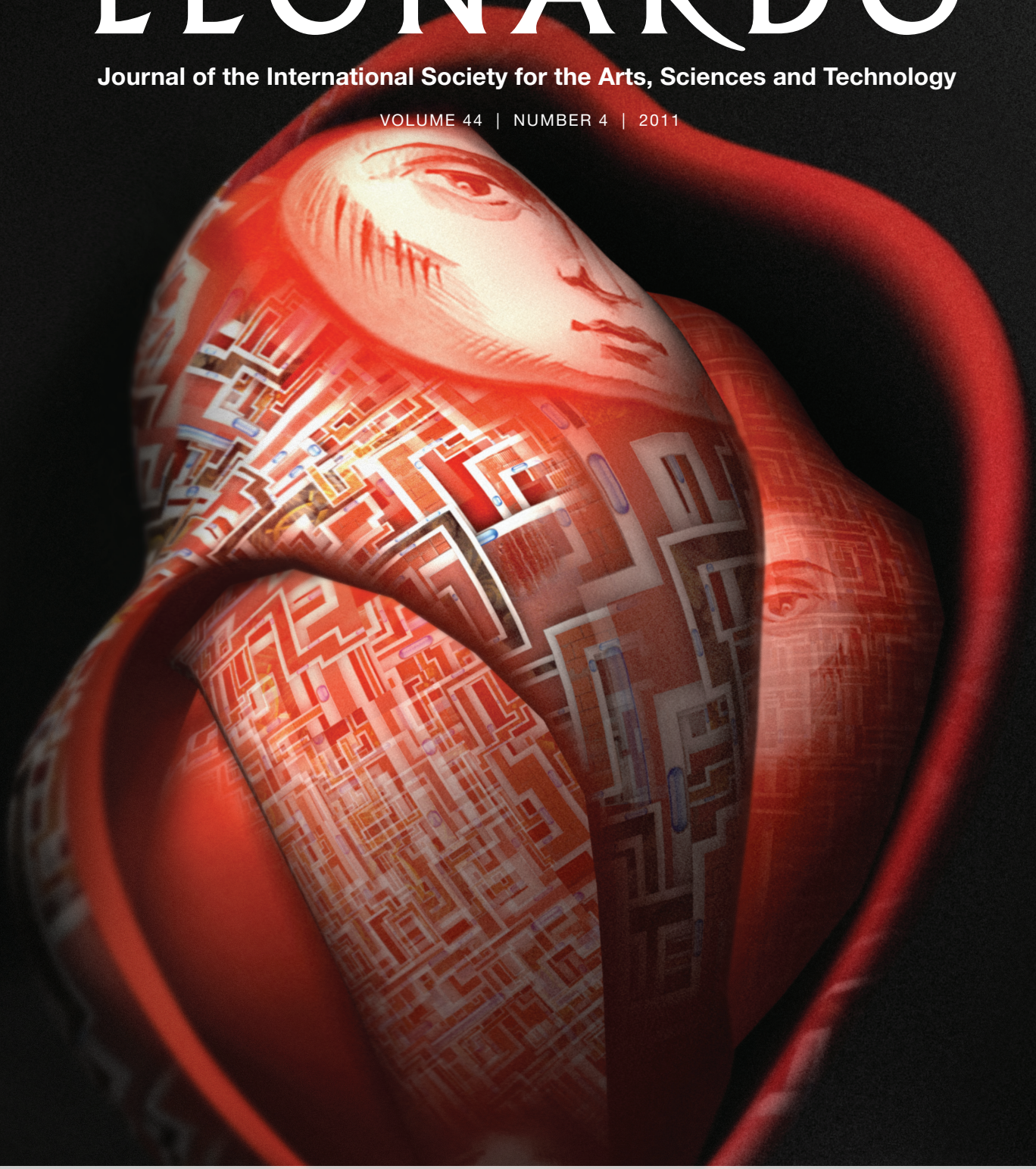


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Concordia University
Duke University
University of Texas-Dallas
University of Michigan, School of Art & Design
Level 10 Interactive

ACM

2 Penn Plaza, Suite 701
New York, New York 10121-0701 USA
800.342.6626 (US/Canada)
+1.212.626.0500
Fax: +1.212.944.1318
www.acm.org

Leonardo

www.leonardo.info

Main Editorial Office

Leonardo
211 Sutter Street, Suite 501
San Francisco, California 94108
USA
Fax: 415.391.2385
isast@leonardo.info
www.leonardo.info

Collaborating Society

Association Leonardo
8 rue Émile Dunois
92100 Boulogne Billancourt, France
Fax: 33.1.46.04.43.28
www.olats.org

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Leonardo
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55 Hayward Street
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Front Cover

Anyia Belkina's *MOSTON*, a 12-foot-tall suspended inflatable sculpture, conjures a technology-driven amalgamation of Moscow and Boston with its three-dimensional form of mutated Russian nesting dolls and two-dimensional surface design of printed artwork and documentary footage projection. © 2011 Anyia Belkina.

Back Cover

David Bowen's *tele-present wind* consists of a field of x/y tilting devices connected to thin, dried plant stalks installed in the gallery and a dried plant stalk connected to an accelerometer installed outdoors. When the wind blows it causes the stalk outside to sway. The accelerometer detects this movement, transmitting it in real time to the grouping of devices in the gallery. Therefore, the stalks in the gallery space move in real time in unison based on the movement of the wind outside. © 2011 David Bowen. Photo © 2011 Shannon Di.

Guest Editorial

Joanna Berzowska

It is with great pride that we bring you this third special issue, the result of an ongoing collaboration between Leonardo/ISAST, an organization that has fostered the exchange of ideas between practitioners in art, science, and technology since 1968, and ACM SIGGRAPH, a venue that has been bringing together scientists, engineers, and artists since 1947. Through this issue, SIGGRAPH 2011 extends its commitment to and recognition of the community of artists, designers, and scholars who work at the intersection of art, design, computer graphics, and interactive technologies.

In her introduction, Mona Kasra presents the juried SIGGRAPH 2011 Tracing Home Art Gallery, which includes digital and technologically mediated artworks exploring the concept of home in our highly networked age. We also recognize the accomplishments of our 2011 recipient of the ACM SIGGRAPH Lifetime Achievement Award in Digital Art, Charles Csurí, who inspired generations to embrace the aesthetic potential of computer imaging. Finally, we are happy to publish, for the third time, a new set of Art Papers; this program aims to feature not only artists and artwork, but also the processes and theoretical frameworks for making art and contextualizing its place in society.

What is an Art Paper?

Having served on the Art Papers jury, as juror and chair, since its inception three years ago, I have come to realize that writing an Art Paper is a very ambitious undertaking. It necessitates a seamless integration of creative practice, visionary thought, technical innovation, conceptual complexity, and theoretical rigor.

An Art Paper can take many forms. It can be a project description, a position paper, a thematic survey, a technical paper, or a monograph. This breadth and freedom can sound very liberating until we consider that an Art Paper must also fulfill a complex set of needs. In addition to providing a well-articulated description of a compelling artwork, the Art Paper must present the historical and theoretical framework for the piece, argue that the work is technologically innovative, as well as provide a conceptual and contextual narrative that inspires and provokes.

Artists traditionally do not write about their own work. SIGGRAPH artists, however, have to wear many hats. Their work usually includes computing and interactive technologies and is often done in an academic context. They need to find funding for their work, produce it in a collaborative setting, document the work, and write about it. Publication and dissemination encompasses a variety of venues, including those devoted to technological innovation and those devoted to artistic expression. The work needs to be personal, but not too personal; technical, but not too technical; controversial, but not too controversial. SIGGRAPH Art Papers are a complex and multifaceted endeavor. They need to showcase simultaneously artwork, novel technologies, and innovative ways of working in computation and interaction.

For the current set of Art Papers published in this special issue of *Leonardo*, we have accepted five papers from a pool of 64 submitted manuscripts (ratio 1:13). Jurors were seeking papers that provide context (historical and theoretical), present practical considerations within a solid conceptual/theoretical framework, provide critical reflections and analysis, and describe the significance and the unique contributions of the work under consideration.

The Art Papers would not have been possible without the dedicated involvement of the Art Papers committee, over 30 reviewers, the advisory board, SIGGRAPH contractors, our colleagues at Leonardo, and the authors themselves. I sincerely thank all of these contributors for their hard work, inspiration, and expertise.

Joanna Berzowska

DESIGN AND COMPUTATION ARTS

CONCORDIA UNIVERSITY



ACM SIGGRAPH Lifetime Achievement Award in Digital Art

Charles Csuri

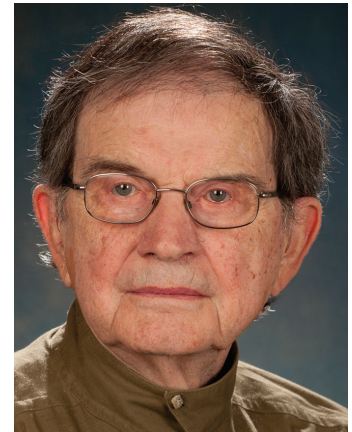
The 2011 ACM SIGGRAPH Lifetime Achievement Award in Digital Art honors Charles Csuri, for his visionary and creative blending of art and technology.

In the 1960s, Charles Csuri envisioned the intertwining of art and computer science that gave rise not only to his own expansive body of work, but inspired generations to embrace computer imaging as a serious form of artistic investigation. As a painter, he was immersed in the passionate discussions of his time, when abstract expressionists challenged everything from the purpose of art to the functions of abstract compositional elements. Through his personal network of colleagues, he was also aware of parallel discourses among scientists who debated the role of computers in society. His profound understanding of these “two cultures” put him in a unique position to merge aesthetics and computing, long before either group recognized the potential synergies.

Combining the two fields at that time was a bold move. As an artist, Csuri had the vision to approach the National Science Foundation, and he succeeded in securing funding to establish a leading center of computer graphics at The Ohio State University. Through his teaching, his research, and his own artistic output he exemplified his convictions not only that the fundamental aesthetic concepts that make conventional media so dynamic could form the basis of computer-generated art, but also that entirely new aesthetic ideals could arise from the incalculable possibilities of computer imaging.

An Ohio native, Csuri attended The Ohio State University, where he studied fine art and also excelled at football, proving that the creative mind can move through any number of obstacles. He received BFA and MA degrees from OSU, was appointed to the faculty in 1949, and in 1971 established the Computer Graphics Research Group that later, as ACCAD, emerged as one of the leading centers for research on the use and integration of emerging arts technologies. Csuri’s work is housed in the collections of the Museum of Modern Art, the Zagreb Museum of Contemporary Art, the Victoria and Albert Museum, the ZKM Center for Art and Media, and numerous other important collections. SIGGRAPH attendees know his work from many SIGGRAPH art shows and a special retrospective at SIGGRAPH 2006.

ACM SIGGRAPH is honored to recognize Charles Csuri. He is a true visionary who decades ago embraced the aesthetic potential of early computer imaging, and since then has unfailingly advanced the field as both educator and creator, keeping us growing, discussing, and moving forward.



Charles Csuri.
Photograph courtesy of
Charles Csuri.

Mouna Andraos

Working in new media for almost a decade, Mouna Andraos reinvents everyday electronic experiences to trigger our imagination and stimulate conversations about the roles they play in our lives. She holds a master's degree from NYU's Interactive Telecommunication Program and is an alumna of Eyebeam Center for Art and Technology in New York City. She has shown work and led workshops in various locations, including the 2008 YAP installation at PS1/MoMA in New York, Beirut's Olympiades culturelles, the Société des Arts Technologiques (Montréal), the San José Biennale, and the Nagoya Design Center. Her work for the Montréal-based interactive agency Bluesponge has won prizes from Communication Arts, the Webbies, Best of Show at the SXSW Festival, and a CyberLion in Cannes. Mouna was recently awarded the Philly's Lambert design award for her work with designer Melissa Mongiat.

Tad Hirsch

Tad Hirsch is an artist and designer currently employed as Senior Research Scientist with Intel's Social Insights Lab, where his work focuses on the uses of technology for advocacy, civic engagement, and environmental sustainability. He is also a founding member of the Institute for Applied Autonomy new media arts collective. Hirsch's works have been exhibited at ISEA, ZKM, Ars Electronica, The New Museum, the Centre Georges Pompidou, and the New Millennium Museum. Hirsch has been the recipient of several prestigious awards and commissions, including an Award of Distinction at Prix Ars Electronica 2000 and Rhizome Net Art Commissions in 2002 and 2006. He has taught art and design at the Rhode Island School of Design, the University of Oregon, and Carnegie Mellon University. Hirsch holds a PhD in media arts and sciences from MIT's Media Lab, and an MDes in interaction design from Carnegie Mellon University.

Craig S. Kaplan

Craig S. Kaplan is an associate professor in the David R. Cheriton School of Computer Science at the University of Waterloo. He is interested in computer graphics applications in art, architecture, and design, and makes occasional forays into human-computer interaction and computational geometry. A native of Montréal, Craig has a bachelor's degree in pure mathematics and computer science from the University of Waterloo and a PhD in computer science from the University of Washington. He is a member of the board of the Bridges organization, which organizes the annual Bridges conference on art and mathematics, and an associate editor of the *Journal of Mathematics and the Arts*. Several of Kaplan's Islamic star patterns were displayed in the 2008 Design & Computation art exhibition at SIGGRAPH.

Jason Edward Lewis

Jason Edward Lewis is a digital media artist, poet, and software designer. He founded Obx Laboratory for Experimental Media, where he directs research/creation projects devising new means of creating and reading digital texts, developing systems for creative use of mobile technology, and using virtual environments to assist Aboriginal communities in preserving, interpreting, and communicating cultural histories. He co-founded the Aboriginal Territories in Cyberspace research network investigating how

Native people can shape our digital media future. Lewis is deeply committed to working on conceptual, creative, and technical levels simultaneously. His creative work has been featured at the Ars Electronica Center, ISEA, SIGGRAPH, Urban Screens, and Mobilefest; his writing about new media has been presented at conferences and festivals on four continents; and his projects have won awards at the Ars Electronica and imagineNative festivals. He is currently an associate professor of computation arts at Concordia University (Montréal).

Mine Ozkar

Mine Ozkar, an architect by training, holds a master of science degree in architectural studies and a PhD in design and computation from the Massachusetts Institute of Technology. Her current research is on shape studies with regard to computation in design, visual computation, and implementation of shape algebras. She has also published on the history, theory and practice of foundational design education, and on curriculum changes in architectural education. She is an associate professor at Istanbul Technical University.

Despina Papadopoulos

Despina Papadopoulos is a design strategist with extensive experience in systems design, prototyping interfaces, and production development. A graduate of NYU's Interactive Telecommunications Program and with an MA in philosophy, she has led and directed research and development teams at IBM and NCR and has consulted for the private sector, government, and non-profits. Her work has appeared at the Victoria & Albert, the Tate, the Holon Museum, and in art galleries around the world.

Teri Rueb

Teri Rueb is professor of media study at the University at Buffalo (SUNY), where she is founder and director of the Open Air Institute, a platform for connecting field-based learning and collaborative partnerships at the intersection of landscape, technology, media art, and design. She served as founding faculty and later department head of the graduate Digital + Media Department at the Rhode Island School of Design from 2004 to 2009. She earned her doctorate at the Harvard University Graduate School of Design, where her dissertation addressed constructions of wilderness and subjectivity in what she calls "network landscapes." She has created GPS-based interactive sound, land, and environmental art since 1996 and has been funded by the Banff Center, Edith Russ Site, Klangpol, LEF Foundation, Turbulence.org, and Artslink. She presented work in the SIGGRAPH Art Gallery in 2002. Her project *Core Sample* received a Prix Ars Electronica Award of Distinction in 2008.

Karan Singh

Karan Singh is an associate professor of computer science at the University of Toronto, where he co-directs the graphics and human computer interaction lab, DGP. His research interests lie in artist-driven interactive graphics, spanning geometric shape design, character animation, and artistic rendering. He has been a lead architect on various commercial software systems, including Maya, and his interactive tools have been used on a number of film projects, including the 2005 Oscar-winning animated short *Ryan*.

Conserving Digital Art for Deep Time

Francis T. Marchese

Educator, Gallery Director
Pace University
Computer Science Department
New York, New York 10038
USA
fmarchese@pace.edu

Francis T. Marchese

ABSTRACT

Displaying digital art in the late twentieth and early twenty-first centuries is already proving to be a challenge. Exhibiting this same art in the distant future will depend upon new thinking and practices developed today by artists, conservators, and curators. Established software engineering methods for dealing with aging systems can provide a new model for the conservation of digital art, and a foundation for the enhancement of art-historical scholarship. Artists with an interest in a more refined approach to the programming that underpins their work will also be interested in software engineering concepts.

Introduction

Consider the following scenario. It is the year 2511, and a museum curator of 21st century digital art plans an exhibition encompassing the first decade of the 21st century. This decade was a heady time for digital art. Relentless innovations in computer hardware and software, and nearly limitless access to information afforded by the World Wide Web, provided artists with the means to create singular and collaborative artworks. Works ranged from the purely ephemeral, such as performance, to those fixed to a specific physical substrate, such as an immersive installation. Independent web sites, such as Rhizome.org and Turbulence.org, commissioned and hosted digital art, complemented by online museum galleries, such as the Whitney Museum's AirPort. New York's Museum of Modern Art (MoMA) and the Tate Modern in London increased their rate of acquisition of digital art through the 21st century's first decade, although these entities were far outpaced by Ars Electronica, which by 2010 had amassed over 30,000 digital artworks [1].

By 2010 it had already been recognized that digital art would pose many challenges for museums, particularly in terms of maintaining its longevity. General approaches to digital preservation had been focused primarily at the institutional level, which considered an organization's goals, priorities, available resources, and management policies [2]. A digital object within this context became a discrete entity with well defined attributes that could be managed throughout its lifetime. The goal of the digital preservation community had been to create standards and develop best practices for the conversion of digital material into "archival" formats that could be manipulated and shared.

Digital art conservators had taken a two-pronged approach to preserving digital art as explicit digital artifacts: technology preservation and document compilation. Technology preservation encompassed both physical and digital artifacts. In the former case, computer technology is stockpiled to support the artwork in the inevitable case that a component fails (e.g., CPU, hard drive, etc.). In the latter, digital artifacts such as computer programs or digital videos must be archived to durable media. Because any digital storage medium (e.g., tape, CD, DVD) ultimately either decays or becomes obsolete, all digital artifacts must be routinely refreshed to a new storage medium. In document compilation, an extended set of documentation is assembled to help define and contextualize the artwork with the express purpose of making the artwork

displayable at some future date. Artist interviews, questionnaires [3], artist-conservator-curator collaborative discussions, conservation workshops [4], and outright documentation of a program's source code were all approaches that had been taken. Yet these procedures remained experimental in nature, and had not been integrated into the formal scientific activity of art conservation [5].

Meanwhile, computer technology continued to advance, with older technology fading into obsolescence. Concomitantly, the variety of computer languages and software employed by digital artists expanded. In 2010 alone, languages such as C/C++, Java, JavaScript, Flash, HTML, XML, Processing, Perl, and Max/MSP were in use with widespread exploitation of development libraries and environments for such things as mobile application development, sound composition, virtual worlds, and computer games. Operating systems evolved, database formats changed, and globally accessible data disappeared or became redistributed. Hence, given the assured evolution or transience in even the simplest of digital entities (e.g., video file formats), it would be difficult to predict that a computer-based artwork created in 2010 would survive intact so it could be exhibited, as originally constructed, in the year 2060 – certainly not in the year 2511!

Digital Art Conservation

Artworks collected by museums possess a particular magisterial quality. Because museums are the *de facto* keepers of cultural heritage, any work acquired by a museum is expected to become part of the canon. Preservation is an essential part of museum practice. Once an institution has decided to acquire an artwork, its evaluation and care is entrusted to the museum's conservators.

The practice of art conservation is a formal scientific activity, defined in the following way by the International Council of Museums Committee for Conservation:

The activity of the conservator-restorer (conservation) consists of technical examination, preservation, and conservation-restoration of cultural property: Examination is the preliminary procedure taken to determine the documentary significance of an artifact; original structure and materials; the extent of its deterioration, alteration, and loss; and the documentation of these findings. Preservation is action taken to retard or prevent deterioration of or damage to cultural properties by control of their environment and/or treatment of their structure in order to maintain them as nearly as possible in an unchanging state. Restoration is action taken to make a deteriorated or damaged artifact understandable, with minimal sacrifice of aesthetic and historic integrity. [6]

Traditional conservation practice thus focuses on an artwork as an integrated physical whole, the integrity of which must be preserved. Change is defined as a process that will deleteriously affect the stability of an artwork, moving it away from its original reference state and altering its identity.

Time-based digital artwork does not fit this definition because change is an intrinsic part of its nature. Museum conservators in charge of maintaining time-based media, that is, artwork whose aesthetic experience evolves over time, realize this and are attempting to expand the conservation paradigm to accommodate digital art. Pip Laurenson, Head of Time-based Media Conservation at the Tate Museum, has proposed a redefinition of conservation practice to accommodate time-based media, so that conservation becomes the means by which an artwork's essential properties are documented, understood, and maintained. Its aim is the preservation of the artwork's *identity*, so that it may be displayed in the future as different possible authentic installations [7]. For Laurenson, the *identity* of a digital work should be considered as a

collection of properties which include: the artist's instructions, approved installations intended to act as models, an understanding of the context in which the art was made, and the degree to which the artist specifications reflect his or her practice at the time the art was created. For a 26th century conservator this means that if the standard methods of digital art conservation (e.g., migration and emulation) eventually fail, then the preservation strategy of reinterpretation, that is, the process of recreating part or all of the artwork utilizing this extended documentation, can be invoked.

This expanded notion of an artwork's identity as a collection of concepts and artifacts may be used as a starting point for formal identification and documentation of an artwork employing the principles and practices from the field of software engineering. Software engineering is the process of applying a systematic, disciplined, quantifiable approach to problem analysis, system and software design, its development, operation, and maintenance [8]. Software engineering methodologies focus on both the software product and the process used to create and maintain it. In the latter case, the software life-cycle is an extension of the business life-cycle and is defined by the business process management model (BPM) [9]. As such, its tools and techniques may be integrated into a museum's conservation practice. In the former, software engineering artifacts may be adapted to the representation of a digital artwork. Software engineering as a process may engage all stakeholders who comprise an art museum's business practice, including artists, curators, conservators, installers, maintainers, museum directors, art historians, and viewers; and can reflect and integrate this process into a museum's current best practices. Finally, software engineering practices may be adapted to all digital conservation strategies, including refreshing, migration, emulation, and recreation.

Documentation and Conservation

When a museum acquires a digital artwork, it is usually assumed that the work will be in a form that will allow it to be exhibited as is, with no further developments, enhancements, or adaptations expected from the artist who created the work. This work, along with its underlying concepts and technologies, is now frozen in time. In computing this is known as a legacy system [10]. Assessing the state of a legacy artwork at some point in time may be difficult for any number of reasons. For example, the artwork's existing documentation may be incomplete. Or changing museum business processes (e.g., curatorial milieu) which supported the original acquisition and installation of the artwork may be directed in the future along other trajectories, thus making upkeep of some legacy artworks more difficult. The nature of the digital artwork itself may be difficult to assess. It may have been assembled from many diverse components without a consistent design or programming style. Or it may be in either executable form or written in an obsolete programming language.

Strategically, there are four approaches for dealing with traditional legacy systems. The first is to scrap the system outright, as business practices have changed and the system is no longer needed. If the system continues to work well and can be easily adapted over time, continued maintenance of the software is possible. But if system performance or usability continues to degrade over time, then the system or its parts must be transformed to improve maintainability. Finally, a system must be replaced if obsolete hardware or software precludes further operation, or the new system can be built at reasonable cost.

For conservators, each one of these approaches creates its own set of issues, with degrees of intervention from minimal adaptation to full restoration, many of which are related to the importance of the artwork – an importance that should be expected to change over time. This is why it is most important that the long-term process of conserving a digital artwork

must be based on a thorough understanding of its structure or architecture, as represented by a breadth of documentation.

Documentation is an intrinsic component of any system. Software engineering provides a systematic methodology for creating and maintaining documentation that supports communication, preservation of system and institutional memory, and processes such as system auditing. Within this context a computer system's documentation should provide comprehensive information about its capabilities, architecture, design details, features, and limitations. It should encompass the following components:

Requirements – Statements that identify the capabilities and characteristics of a digital artwork. This is the conceptual foundation for what has been created.

Architecture/Design – An overview of software that includes the software's relationship to its environment and construction principles used in design of the software components. Typically a system's architecture is documented as a collection of diagrams or charts that show its parts and their interconnections.

Technical – Source code, algorithms, and interfaces are documented. Comments may be embedded within the system's source code and/or parts of external documentation.

End User – Manuals are created (e.g., static documents, hypermedia, training videos, etc.) for the end-user, system administrators, and support staff.

Supplementary Materials – Anything else related to the system. This includes: legal documents, design histories, interviews, scholarly books, installation plans, drawings, models, documentary videos, web sites, etc. [11]

Each component is important to the representation of a digital system. Each may operate at a different level of abstraction or within a particular context. *Requirements* documentation presents the conceptual view of *what* the system is expected to do. It is written to be understood by all the stakeholders who comprise the art museum's business practice. *Architecture/Design* documentation functions very much like an architect's sketch of a building, showing all its components and how they fit together. *Technical* documentation represents the bricks-and-mortar of the artwork, conveying information about how the artwork is constructed.

Besides facilitating an artwork's conservation, this documentation could also support scholarship, enabling art historians to understand an artist's working process and evolution of practice. A computer system's structure is a reflection of the conceptual space the artist had been working in at the time the art was created. The number of software components, their hierarchy, and the interconnections among them should give an idea of how the artist viewed a representation problem, and how it was transformed into a computer system. An analysis of documentation should yield answers to questions about:

Authorship – Who wrote what? (Was it by the hand of the artist, or was it built by others?)

Educational/Cultural Context – Who influenced the artist conceptually or technologically?

Craftsmanship – How well was the program written and system built?

Aesthetics – How well conceived and designed is the software? Does it possess an elegance and refinement comparable to any other beautifully created object?

Development Process – What were the design strategies used by the artist?

Technical Context – What were the development tools available at the time the artwork was created?

Theoretical Foundation – What theories of computing did the artist use?

Documentation and Digital Artists

Documentation is a fundamental part of a digital artwork. A program's source code and the data it uses are *de facto* documentation, along with directions for its installation. The question remains – how much more documentation is required to provide a sufficient representation of a digital artwork? This is an open question for any software engineering project, as it is for a digital artwork, and depends on factors such as project size, complexity, and expected system lifespan. It may be argued that it is not the artist's responsibility to provide sufficient documentation for an artwork, but if contemporary curatorial practice is an indication of what the distant future will hold, the following scenario is most likely for a year 2511 exhibition. Artwork selection will not only be based on its importance to the canon, but also the availability of resources (e.g., staffing, time, funds) required for its installation. An artwork that may be the best example of a theme or idiom may need to be replaced in an exhibition by a lesser work, because its own documentation proves insufficient for its recreation.

It is posited here that a digital artist shares a certain responsibility for the long-term preservation of an artwork. Traditional artists who employ archival media and follow well established best practices for creating a stable physical artwork produce works with a high probability of standing the test of time. For those artists who consciously choose to work in a non-archival way, the long-term preservation and ultimate exhibition of their works is a problem with an indeterminate solution. It should be remembered that major museums possess culturally significant artworks that cannot be exhibited because of their fragility or degree of deterioration.

Digital artists have choices analogous to their traditional counterparts for maintaining their artwork's longevity. Best practices exist for the development of computer software in different ways. For example, the use of standard programming styles, data structures, algorithms, and the selective insertion of comments into source code represent programming best practices. Software engineering best practices work at a different level. The software engineering conceptual process of analyze-design-build is consistent with artistic practice. And the tools used by software engineers during the analysis and design phases of software development allow software designers literally to sketch out a system's architectural design. Including these design representations with an artwork's source code expands its representational details to encompass the *Requirements*, *Analysis/Design*, and *Technical* documentation categories discussed above. It should provide as well a sufficient description of the artwork's *identity* to allow it to be recreated at some future time if all other conservation strategies fail.

Back to the Future

One of the works selected for the 2011 retrospective by the 26th century curator was *Trigger*, a site-specific, sensor-activated, immersively projected, interactive art installation by Jody Zellen that debuted at the Pace Digital Gallery in the fall of 2005 [12]. Zellen created *Trigger* to explore the transient stories that emerge from our relationships with urban spaces. The gallery was filled

with overlapping videos from seven projectors and infused with transient sounds. When visitors passed through motion sensors, sounds and videos changed, evoking the ephemeral nature of urban space, and the fleeting and shifting perceptions of it.

Neither *Trigger*'s original hardware nor software made it to the year 2011, much less to 2511; the system was disassembled and repurposed at show's end. The documentation available to the 26th century curator included: the artwork's original videos, a video walkthrough of the artwork, images of the installation, a catalog, and a short technical paper about the artwork [13]. The technical paper provided key information for *Trigger*'s recreation – its functional requirements, architecture, and design. The artwork's functional requirements identified its capabilities and characteristics, simply put: what the artwork was supposed to do. They were recorded in the technical paper as:

- The artwork would support a large number of projectors, sensors, and speakers.
- The artwork's sensors would capture viewer motion.
- Captured motions would trigger events.
- Events would be communicated to the artist's multimedia programs.
- The multimedia programs would change the content of the displays and alter sounds.

Trigger's architecture communicated the high-level interrelationships among its components without specifying the processing details. *Trigger* possessed a simple architecture of three loosely coupled components: a microcontroller-sensor system, application software, and interface software linking the sensor system to the application. Each of these components worked independently, communicating by simple message passing. Such a relationship exhibited the attribute of *low coupling*, a fundamental software design paradigm. Finally, the technical paper briefly described each component's responsibilities. In all, *Trigger*'s technical discussion covered no more than a page, but, combined with its supplemental materials (e.g., video walkthrough and installation images), that was sufficient for the 26th century recreation of the artwork to maintain its *identity* and reflect Zellen's artistic practice.

Trigger's clearly defined functional requirements and simple architecture made its recreation possible. It afforded the curator's team the flexibility of selecting the best computer method for reconstructing the artwork. In contrast, if *Trigger* had been conserved at the source code level, the curator's team would have had to sift through the code to extract its internal workings, and then either adapt the code to its 26th century environment, or reconstruct its architectural representation. In the end, recreation of *Trigger* became a trivial matter, utilizing a 26th century equivalent of a 21st century data-flow programming language for multimedia applications like Cycling 74's Max/MSP. Data-flow programming languages have had a long history, evolving from workstation-based scientific visualization systems such as AVS [14] in the late 1980s. Recognized for their ease and versatility in defining parallel event-based systems, these visual programming languages continued to evolve over time. Indeed, the original developers of *Trigger* had considered using Max/MSP in 2005, but were constrained from doing so.

Ultimately, the retrospective's curator capitalized on each artwork's unique documentation to craft a cogent story of early 21st century art. From *Trigger*'s high-level designs to another artwork's creatively commented source code, all of the artworks' documentation acted in

concert to help recreate a sense of what digital art was like at the dawn of the 21st century.

In Sum

The display of contemporary digital art at some distant future time remains an open problem, the solution to which will come from efforts by artists, conservators, and curators. It has been proposed here that the use of software engineering practices will provide a new jumping-off point for transitioning from the conservation practices used for traditional art to methods more appropriate for time-based media. This process will aid digital art scholarship as well, by organizing an artwork's components in such a way as to enhance accessibility by art historians. Finally, digital artists who choose to adapt software engineering practice to their artistic process will be able to extend the lifespan of their artwork.

References and Notes

1. C. Becker, et al., "Preserving Interactive Multimedia Art: A Case Study in Preservation Planning," *Lecture Notes in Computer Science*, Vol. 4822, 257–266 (2007).
2. NINCH Working Group on Best Practices, "The NINCH Guide to Good Practice in the Digital Representation and Management of Cultural Heritage Materials Online: The National Initiative for a Networked Cultural Heritage" (2002), retrieved January 10, 2011 from www.nyu.edu/its/humanities/ninchguide/.
3. J. Ippolito, "Accommodating the Unpredictable: The Variable Media Questionnaire," *Permanence Through Change: The Variable Media Approach* (New York: Guggenheim Museum Publications and Montréal: The Daniel Langlois Foundation for Art, Science, and Technology, 2003).
4. ERPANET, "The Archiving and Preservation of Born-Digital Art Workshop: Briefing Paper," The ERPANET Workshop on Preservation of Digital Art (2004). Retrieved January 10, 2011 from www.erpanet.org/events/2004/glasgowart/briefingpaper.pdf.
5. For a concise review of the current state of the problem, see T.A. Yeung, S. Carpendale, and S. Greenberg, "Preservation of Art in the Digital Realm," *The Proceedings of iPRES2008: The Fifth International Conference on Digital Preservation* (London: British Library, 2008).
6. International Council of Museums Committee for Conservation, "The Conservator-Restorer: A Definition of the Profession, Section 2.1." Retrieved January 10, 2011 from www.icom-cc.org/47/about-icom-cc/definition-of-profession/.
7. P. Laurenson, "Authenticity, Change and Loss in the Conservation of Time-Based Media Installations," *Tate Papers*, Autumn (2006). Retrieved March 15, 2011 from www.tate.org.uk/research/tateresearch/tatepapers/06autumn/laurenson.htm.
8. R.S. Pressman, *Software Engineering: A Practitioner's Approach*, 6th Edition (New York: McGraw-Hill, 2005).
9. R.K. Ko, "A Computer Scientist's Introductory Guide to Business Process Management (BPM)," *Crossroads*, Vol. 15, No. 4, 11–18 (2009).
10. J. Ransom, I. Sommerville, and I. Warren, "A Method for Assessing Legacy Systems for Evolution," *Proceedings of the 2nd Euromicro Conference on Software Maintenance and Reengineering* (CSMR 98), March 8–11, 1998 (Washington, DC: IEEE Computer Society, 1998) 128.
11. For a complete discussion, see C. Larman, *Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development*, 3rd Edition (Upper Saddle River, NJ: Prentice Hall, 2005).
12. J. Zellen, *Trigger*, Pace Digital Gallery, New York, NY, October 18–November 8, 2005. Retrieved March 15, 2011 from www.jodyzellen.com/pace2.html.
13. F.T. Marchese, "The Making of Trigger and the Agile Engineering of Artist-Scientist Collaboration," *Proceedings of the Tenth International Conference on Information Visualization: IV'06*, London, July 2006 (Washington, DC: IEEE Press, 2006) 839–844.
14. C. Upson, et al., "The Application Visualization System: A Computational Environment for Scientific Visualization," *IEEE Computer Graphics and Applications*, Vol. 9, No. 4, 30–42 (1989).

Art and Code: The Aesthetic Legacy of Aldo Giorgini

Esteban García and David Whittinghill

ABSTRACT

In 1975 Aldo Giorgini developed a software program in FORTRAN called **FIELDS**, a numerical visual laboratory devoted entirely to art production. Working extensively as both artist and scientist, Giorgini was one of the first computer artists to combine software writing with early printing technologies, leaving an aesthetic legacy in the field of the digital arts. His individual process was innovative in that it consisted of producing pen-plotted drawings embellished by the artist's hand with painting, drawing, and screen-printing. This paper is the product of a multi-year study of Giorgini's primary source materials provided by his estate. The authors examine the methods used by Giorgini during the 1970s that allowed him to create computer-aided art, in the hope that publishing this work will ensure that future generations of digital artists, technologists and scientists can be educated in Giorgini's contribution to the history of the digital arts.

Introduction

Aldo Giorgini (1934–1994) was a professor in the School of Civil Engineering at Purdue University. During the 1970s, he adopted the use of computers to visualize simulated terrains. His scientific visualizations as a civil engineer led him to pursue a creative artistic practice, which combined the use of mathematical models, computer graphics, and painting (Figure 1).

In 1975 Giorgini developed a software program called **FIELDS**, a numerical visual laboratory devoted entirely to art production. In **FIELDS**, FORTRAN instructions were loaded in a CalComp plotter and later printed on paper rolls. Giorgini incorporated handmade art techniques to fill in the lines printed by a CalComp 563 plotter. Some of these images were reproduced through an elaborate silk-screen printing process. His versatile technique combined high numerical computation with large-scale silk-screen printing. Working as both artist and scientist, Giorgini developed innovative techniques that left an aesthetic legacy in the field of digital arts. Giorgini was one of the first computer artists to combine software writing with early computer printing technologies to produce artistic images. His creative process consisted of the production of computer-aided images, which were embellished by the artist's hand with painting, drawing and screen-printing.

This research is the result of the analysis of primary sources found at Giorgini's residence in Lafayette,

Esteban García

Artist and PhD Student
Computer Graphics Department
Purdue University
1204 Columbia Street
Lafayette, Indiana 47901
USA
garcia0@purdue.edu

David Whittinghill

Assistant Professor
Computer Graphics Department
Purdue University
Knob Hall
401 N. Grant Street
West Lafayette, Indiana 47907
USA
davewhit@purdue.edu



Figure 1. Aldo Giorgini installing his installation *Fiat Lux*. © 1980 Aldo Giorgini. Courtesy of Massimiliano Giorgini.

Indiana, and the Purdue University Archives and Special Collections. The sampled documents include manuscripts, letters, publications, clippings, printed code, cassette tapes, and CalComp prints related to the FIELDS project. This paper will unveil the methods used by Giorgini to produce his computer-aided art.

Artist and Scientist

Aldo Giorgini was born in Voghera, Italy, in 1934. He was influenced by Ambrogio Casati, an artist who was part of the Italian Futurist movement and who took Giorgini as an apprentice. As a young man in the 1950s, Giorgini helped Casati restore frescoes and oil paintings from the old masters that had been damaged during World War II.

Giorgini developed expertise in painting as a result of his work with Casati. This apprenticeship provided him with a solid groundwork in fine arts training. At age eighteen, Giorgini received a full scholarship to the University of Pavia where he finished his undergraduate studies in engineering. After this period, he commenced work on a doctorate in mechanical engineering, which he completed in 1959. Giorgini was an associate professor of hydraulics at the Polytechnic University of Torino from 1959 to 1961. Subsequently, Giorgini won a Fulbright Grant as an exchange scholar at the Colorado State University in Fort Collins. There, Giorgini completed a second doctorate in civil engineering in 1966. In 1967 he moved to West Lafayette, Indiana, to work as a professor in the School of Civil Engineering at Purdue University [1].

At Purdue's School of Civil Engineering, Giorgini experimented with software production and pen-plotter printers. From 1967 to 1976, he developed an interest in the visualization of numerical data in a graphic form. While a professor of civil engineering, he completed a third doctorate in Physics. Most importantly for this paper, Giorgini developed an extensive body of work as a computer artist from 1974 until his death in 1994. His artistic practice was not limited to art production, but included participation in early computer art exhibitions, publications, symposiums, and conferences. Giorgini was an advocate for this new field in the arts and he organized two symposiums: "Computers and the Design Process" in 1974, and "Computer Art" in 1975 [2].

Art with Computers

The use of the computer as a tool for artistic experimentation dates back to the first programmable computers. The Z3 computer built by Konrad Zuse in 1941 is considered the first binary, electromechanical, programmable computer. In a recent paper, Andrés Burbano explains Zuse's double role as scientist and artist: "While his work includes the creation of the first programming language, the *Plankalkül*, he was also an active visual artist for most of his life, and he himself defined his approach to the world as highly visual" [3].

Another example of early computer art is the work of Charles Csuri, who was a professor at Ohio State University and is known for his early experiments in the field of computer graphics. Csuri began exploring digital art in 1964, inspired by a computer-generated image he saw in a publication from Ohio State University's Department of Electrical Engineering [4].

Csuri used visualization software to produce the first computer-aided film in 1965. Like Csuri, Aldo Giorgini incorporated the use of computers in his artistic practice. However, Csuri's and Giorgini's approaches to computer graphics were fundamentally different. In the case of Csuri, the artist was not required to have the knowledge of the numbers and codes which produced the desired form. It was through the GUI that the digital image was produced. In the words of Csuri: "Additional software capabilities provide the user with the ability to modify system

parameters through interactive devices and to alter curvilinear relationships without ever having to think of numbers” [5].

In contrast, Giorgini argued that a user who plays with a program by changing the value of the parameters at random is hardly intentionally producing the drawing. Giorgini used the term “canned program” to describe software in which a “pleasant” drawing could be produced without the intention of the user. Furthermore, Giorgini defined “intentional computer art” as only achieved when the user acknowledges all of the parameters of the program. According to his definition, if the user understands the mechanism of the program and what all of its parameters mean, it might be assumed the result was intentional [6]. Giorgini explained that art is defined by the intentionality of the artist. This allowed him to include software writing as part of his creative process. He gave priority to the artist's ideas over the tools [7].

Ideas as Art

Giorgini questioned the role of the artist as merely a producer of images. In his writings, he illustrates that the artist is the “ideator” of the drawing, and that several intermediate steps lay between the idea and the final product. In his own words, he explains the relationship between software and artist:

The program is more than a medium: It is a “programme” with built-in directions which, no matter how open, still compel the artist to move with some constraints or on along [sic] some perspective, that are part of the original idea of the program. [8]

Visual artists from the 1960s shared similar thoughts about art, idea, and process. Emphasis on the work of art as an idea was a common characteristic of conceptual art in the 1960s. During this period, many artists explored the aesthetics of programmatic thought and execution. Reas, McWilliams, and Barendse explain how artists and musicians of this era created a different type of work that included writing instructions as a form of art [9].

Sol LeWitt's work is reminiscent of this program-natured visual art. In his writing entitled *{Software} Structures*, Casey Reas argues that LeWitt's instructions for his wall drawings can be compared to computer code [10]. For his wall drawings, LeWitt wrote a set of instructions for draftpersons who produced the physical piece. For example, the instructions for *Wall Drawing #366* read as follows: “Black arcs using the height of the wall as a radius, and black arcs using the midpoints of the wall as radius. The arcs are filled in solid and drawn in india ink” [11].

Although it is unknown how aware Giorgini was of the conceptual art tendencies of the 1960s, he certainly was interested in programmatic explorations in the visual arts. At the Computer Art conference entitled “Computer Art” held at Purdue University in 1975, Charles and Colette Bangert, Richard Helmick, George Chaikin, and Giorgini discussed computational aesthetics. As heard on the audio tape recording from this event, the works of Mondrian were described as compositional programs. According to Charles Bangert, Mondrian's use of the golden section to produce a composition is comparable to the algorithms used in computer art [12].

The computer-aided art pieces of Giorgini provide evidence of his unique array of talents. While at first glance writing software and art making did not seem to have a relationship, a few artists of that time, such as Giorgini and Csuri, sought to explore the aesthetic possibilities of new technologies. In Giorgini's words, “Each output device has its own graphical characteristics which, once fully understood and fully exploited, may yield an incredible amount of possible forms” [13].

In this section we described the context in which Giorgini produced his computer-aided art and how he theorized about the role of software in artistic practice. Giorgini's approach to aesthetics consists of the artist's intentionality and ideas to produce the artwork. Giorgini's focus on the "idea" as the most important value for the definition of visual forms connected his art to the conceptual art tendencies of the 1960s. His ideas in programmable aesthetics resulted in FIELDS, a program intentioned for artistic production. Giorgini established a conceptual separation between tools and ideas, giving more importance to the ideas.

FIELDS: A Numerical Visual Laboratory

In a report published by Purdue's School of Civil Engineering entitled "Interfaces", Giorgini defined FIELDS as a numerical visual laboratory. The use of the words "numerical visual laboratory" reflects Giorgini's approach to the production of images by changing parameters of the program. These numerical parameters were not just variables of a mathematical equation, they were the ingredients to produce lines, points, and ellipses. Giorgini explains the relationship between geometry, form and experimentation:

Families of lines have a strong appeal to the imagination of anybody with [sic] inclination to geometrization. The gradual variation of curvature along each line from the other lines, constitutes an infinite source of aesthetic possibilities for exploitation. [14]

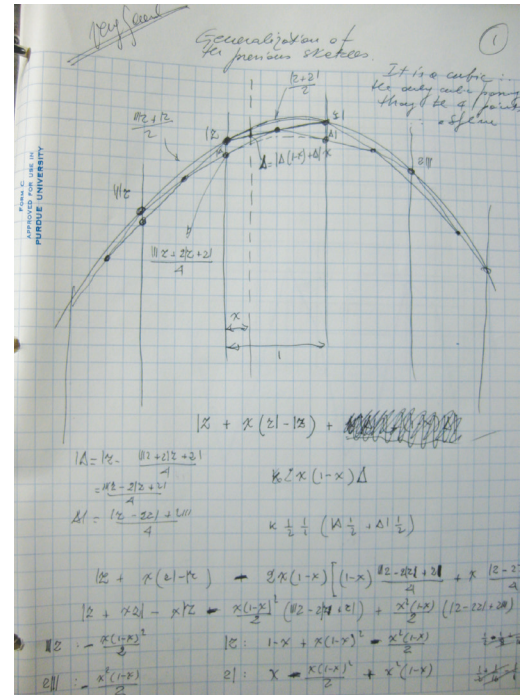


Figure 2. Manuscript. © 1974 Aldo Giorgini.

Giorgini's ability to visualize forms from mathematical functions allowed him to create lines and shapes from numerical values. Several manuscripts found in the Giorgini residence present evidence of his mathematical approach to graphics (Figure 2).

Visualizing the Z Dimension: A Mathematical Model

Giorgini's background in civil engineering and physics allowed him to use equipotential lines to produce contour lines. His research, particularly in terrain visualization while at Purdue, greatly influenced the aesthetics of his work. The computer-aided visual research from the civil engineering work awoke Giorgini's interest in aesthetics. Giorgini explains: "I started 'playing around' with some of the computer drawings that were made as illustration of the research done. From here to the purposeful use of the computer as an art tool the pace was very short" [15].

Some of the parameters of FIELDS are formulated in topographic terms. A piece produced by FIELDS can be described as a map view of mountains and valleys. A topographical representation in these two dimensions suggests a third dimension through the use of successive contour lines, which wrap around the different heights. In FIELDS, the fictitious value of depth was named Z, a highly three-dimensional concept.

FIELDS simulated physical fields by producing a gradation of lines between surfaces of different depth. The surfaces in FIELDS were named "boundaries" and they could be defined as

points, ellipses, or circles. The program would create a field simulation that produced a series of contours around the “tallest” boundary towards the “lowest.” The value of Z at the boundaries was 0 or 1. The contour lines were produced as a transition from these two values. In the words of Giorgini, “...the end product of the operations performed on the elementary potential surfaces will closely resemble the geometrical representation of a physical field” [16].

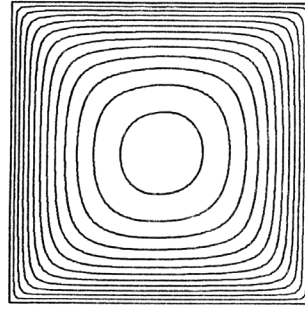


Figure 3. Top view of simulated fields.
From Giorgini and Chen [6]. © 1974
Aldo Giorgini.

The result was an image that represented the top view of simulated fields (Figures 3 and 4). The composition was defined by sets of points in Cartesian coordinates to produce geometric shapes. These shapes were considered to be at $Z=1$ and would gradually transition to the boundary at $Z=0$, producing the effect of the rippled contours. In *FIELDS*, the boundary at $Z=0$ was typically a square that defined the aspect and border of the piece.

Giorgini was aware of technological advances for scientific visualization and had access to them through his laboratory at Purdue. His lab had a CalComp pen plotter, an instrument which draws lines on paper at the execution of a computer code. Giorgini envisioned the creative potential of CalComp as a new medium for art production. His strong background in mathematical concepts allowed him to formulate the visualization of numerical models.

In 1974, Aldo Giorgini asked his colleague at Purdue, Wei-Chung Chen, for assistance in developing a FORTRAN code of his mathematical model. This software was presented in the report entitled “Interfaces,” containing 884 lines of code over 14 pages. The implementation of the mathematical model into FORTRAN code and its further interface with CalComp is the essence of Giorgini’s numerical visual laboratory. Originally, the CalComp pen-plotter in his lab was used to create visual simulations of terrain. Giorgini used mathematical models to visualize real geographical topography.

Later, he used this technology to make large-scale artworks with a topographical aesthetic. In *FIELDS*, the piece is algorithmically produced from initial numerical values and printed in paper at run time. The numerical values defined the geometric boundaries of the initial shapes and the relationships between the different fields (Figures 5 and 6). A CalComp 563 plotter was loaded with bond paper rolls and drew the contour lines in black ink. The standard width of the available paper rolls for CalComp 563 was fifteen inches. However, Giorgini created the large-scale art pieces by printing in separated modules and mounting them together. Examples of his use of modularity in large-scale artwork can be appreciated in *Fiat Lux* and *Sculptural Forms*,

found at the Potter Engineering Center at Purdue. His studio in the basement of his former residence holds hundreds of CalComp prints. It is important to remark that the prints themselves are not the work of art, because it was through Giorgini’s process that these prints became art.

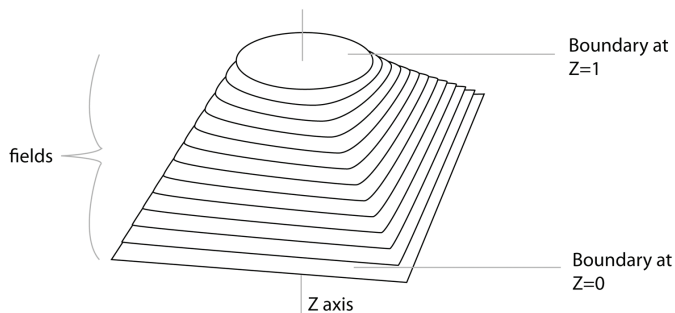


Figure 4. 3D representation of Figure 3, rendered by the authors. © 2011 Esteban García.

After printing on paper, Giorgini started an elaborate handmade process for the completion of the art piece. He was interested in complementing the computer work with paint. In “Interfaces” he explains: “In the case where the output needs further intervention by the artist in order to produce the final art piece, the term of computer-aided art will apply” [17].

CalComp could produce only lines and Giorgini chose to fill in the shapes formed by the line intersections with checkerboard patterns. These often produced optical illusions such as Moiré patterns. One of the defining characteristics of Giorgini's works with FIELDS is that he only used black acrylic paints or inks to create these patterns. In the appendix of "Interfaces", he explains the perceptual visual qualities of Moiré and checkerboard patterns, however he does not explain the reasons for choosing these patterns. The work is reminiscent of Op Art, such as the work of Victor Vasarely and René Parola, and it can be surmised that Giorgini had an interest in these artists.

Giorgini used high contrast reproductions of his work to produce the negatives for a silk-screen printing process. Silk-screen printing uses photographic emulsions and negative images printed on transparency paper to produce a template for image reproduction. Many of these silk-screen frames and negatives remain at Giorgini's former residence in Lafayette, where his son Massimiliano Adelmo now lives. In an interview, Massimiliano recalled that it took his father a "great deal" of time to master the silk-screening technique for the large-format prints he produced in his studio. Aldo Giorgini also experimented with inks of different colors, but he remained interested in high-contrast color combinations [18].

Giorgini also liked to screenprint T-shirts and sweatshirts and often wore them to teach classes or gave them away to friends. Aldo Giorgini's charismatic and interdisciplinary personality led him to influence the lives of many friends and students. In a dedicated column for the *Maximum Rock and Roll* magazine, record producer Lawrence Livermore explains: "... I would like to tell you about one very special man, who, though I've only spent a few hours in his company, has illuminated my life in a way only a very tiny handful of people have been able to" [19].

Giorgini spent the rest of his days working as an artist and a scientist. Giorgini left an inspiring testimony to early computer-aided art practice, which constitutes an important landmark in the history of the digital arts.

In an effort to preserve the aesthetic legacy of Aldo Giorgini, it is important to consider solutions for the preservation of his **FIELDS** software. One such solution entails the digitization of the 884

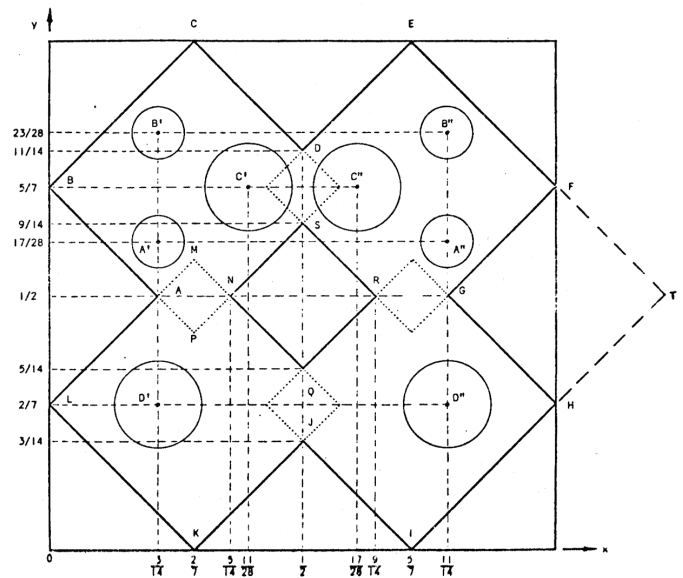


Figure 5. Geometric formulation of *Claustrophobia*. From Giorgini and Chen [6].
© 1974 Aldo Giorgini.

lines of FORTRAN code and implementation in Xcode, a modern-day compiler. Many compilers can read FORTRAN code through the installation of the widely available gfortran library.

In the future, we seek to explore a fully functional code that reproduces the functionality of FIELDS by producing an output image. In “Interfaces,” Giorgini precisely formulated a question of authorship in relation to software art, which still remains unanswered today: “A computer drawing might have been made by a person with a program formulated by another person and programmed by another person again. Who is the artist?” [20]

In Giorgini's case, the work consists of these six steps: creating the software, defining the geometric boundaries of the composition, computation, printing, painting, and screen-printing. Giorgini used FIELDS to produce graphics which would be extremely difficult to calculate without the aid of a computer.

The preservation of Giorgini's FIELDS software in the form of a functional implementation in a contemporary system will allow future generations to revisit his innovative work. In recent years, there has been a rise of code-based toolkits for artists and designers, such as Processing, openFrameworks, Cinder, and Cing. Artistically oriented programmers have released a variety of software and libraries to allow artists to experiment in the realm of digital art. FIELDS constitutes a landmark in code-based art practices. The study of Giorgini's contribution presents a historical framework for artists who use programming as a medium.

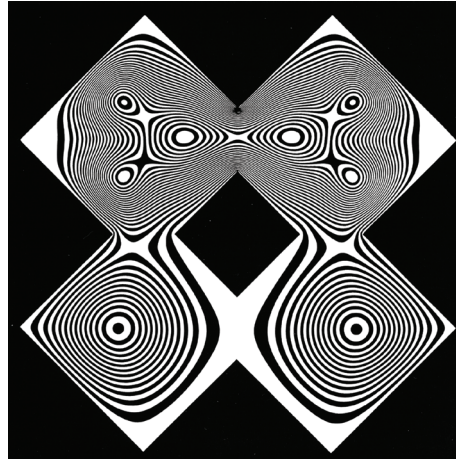


Figure 6. *Claustrophobia*. Acrylic and paint on paper, from “Interfaces” by Giorgini and Chen. From Giorgini and Chen [6]. © 1974 Aldo Giorgini.

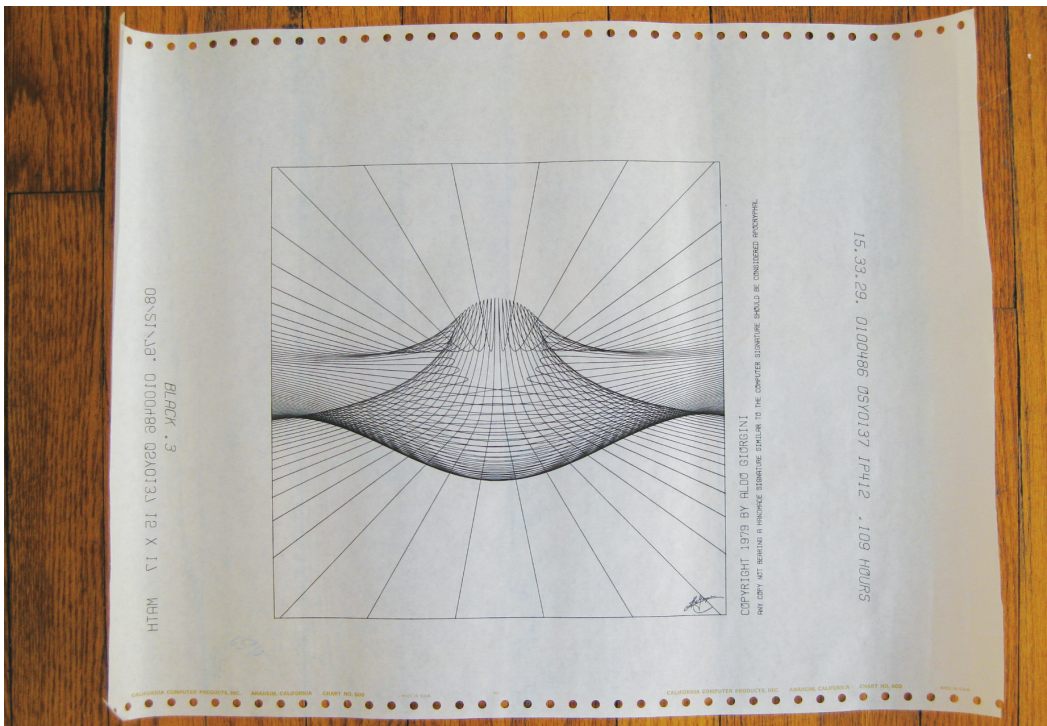


Figure 7. Example of one of Giorgini's CalComp prints. © 1979 Aldo Giorgini.

Conclusion

This research explains the importance of Aldo Giorgini's work in the field of the digital arts. The work of Aldo Giorgini is of historical significance because he adopted early computer technologies to produce computer-aided artworks. FIELDS constitutes an important precedent to software art. The documents found at the Giorgini's former residence in Lafayette possess historical value, and we consider the importance of the preservation of these materials for future generations. Preservation of these materials will capture some of the early methods and techniques used to produce digital art.

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References

1. M. Giorgini, *Aldo Giorgini: 1934–1994*. Unpublished manuscript.
2. Faculty and Staff, *Giorgini, Aldo Vertical File*, Archives and Special Collections, Purdue Libraries. Accessed October 2009.
3. A. Burbano, "Between Punched Film Stock and the First Computers: The Work of Konrad Zuse" (2010).
4. P. Trachtman, "Charles Csuri Is an 'Old Master' in a New Medium." Retrieved December 8, 2010 from www.siggraph.org/artdesign/profile/csur/index.html.
5. C. Csuri, "Charles Csuri," *Artist and Computer*, R. Leavitt, ed. (New York: Creative Computing Press, 1976) 85–87.
6. A. Giorgini and W.C. Chen, *Interfaces, Computer-aided Art: The Program FIELDS* (West Lafayette, IN: School of Civil Engineering, Purdue University, 1974) 3.
7. Ibid., p.4.
8. Ibid., p.3.
9. C. Reas, C. McWilliams, and J. Barendse, *Form and Code in Design, Art, and Architecture* (New York: Princeton Architectural Press, 2010) 21.
10. C. Reas, "{Software} Structures" (2004). Retrieved December 8, 2010, from artport.whitney.org/commissions/softwarestructures/text.html.
11. G. Garrells, ed., *Sol LeWitt: A Retrospective* (London: Yale University Press, 2000).
12. A. Giorgini, "Computer Art Symposium at Purdue" [tape recording] (Lafayette, IN: Aldo Giorgini's personal collection, March 24, 1975).
13. A. Giorgini and W.C. Chen, *Interfaces, Computer-aided Art: The Program FIELDS* (West Lafayette, IN: School of Civil Engineering, Purdue University, 1974) 1.
14. Ibid., p.5.
15. A. Giorgini, "Aldo Giorgini," *Artist and Computer*, R. Leavitt, ed. (New York: Creative Computing Press, 1976) 9–12.
16. A. Giorgini and W.C. Chen, *Interfaces, Computer-aided Art: The Program FIELDS* (West Lafayette, IN: School of Civil Engineering, Purdue University, 1974) 6.
17. Ibid., p.2.
18. M. A. Giorgini, personal communication, October 23, 2010.
19. L. Livermore, "My Last Column for Maximum Rocknroll," *Maximum Rocknroll*, No. 133 (April 1994).
20. A. Giorgini and W.C. Chen, *Interfaces, Computer-aided Art: The Program FIELDS* (West Lafayette, IN: School of Civil Engineering, Purdue University, 1974) 4.

The Readers Project: Procedural Agents and Literary Vectors

Daniel C. Howe and John Cayley

ABSTRACT

The Readers Project is an aesthetically oriented system of software entities designed to explore the culture of human reading. These entities, or “readers,” navigate texts according to specific reading strategies based upon linguistic feature analysis and real-time probability models harvested from search engines. As such, they function as autonomous text generators, writing machines that become visible within and beyond the typographic dimension of the texts on which they operate. Thus far the authors have deployed the system in a number of interactive art installations at which audience members can view the aggregate behavior of the readers on a large screen display and also subscribe, via mobile device, to individual reader outputs. As the structures on which these readers operate are culturally and aesthetically implicated, they shed critical light on a range of institutional practices – particularly those of reading and writing – and explore what it means to engage with the literary in digital media.

Daniel C. Howe

City University, Hong Kong
City University
Hong Kong
China
daniel.c.howe@gmail.com

John Cayley

Brown University
Providence, Rhode Island
USA
john_cayley@brown.edu

Introduction

The Readers Project was begun in 2009 in response to the question, “How might cellular automata play out a ‘game of life’ – or rather a ‘game of reading’ – on the (complex) surface of a text?” [1] In the best-known form of the game of life [2], the grid on which the cellular automata live and die maps out generations of binary distinctions. (Figure 1) This grid and the automata’s behaviors are one and the same. By contrast, a textual grid is inherently complex, bearing all the structure of natural language, despite remaining – as graphic representation – unambiguously two-dimensional and, indeed, both grid-like and cellular [3]. While certain 2D characteristics of visible language may have inspired us to ask our question about reading and cellular automata (CAs), we do not claim any regular or formal relationship between CAs and our expressive natural language processing [4]. In fact, while cellular automata have proven a productive formalism in a range of art contexts [5], there has been surprisingly little experimentation with CAs in the domain of literary art. *The Readers Project* thus represents an initial foray into this interesting and problematic space.

The Framework

Because of the layered and discrete structures of natural language, it is possible to implement cell-based procedural readers at any number of levels. A “cell” might correspond to a letter, a word, a phrase, a sentence, and so on, each an atomic unit of a particular structural layer [6]. We chose the typographic word as our cellular unit. We define the current word – or word being read – as a “live” cell [7]. If a traditional Western linear reading is expressed in terms of cellular rules, then we might say that a live word-cell will, in each generation, bring to life the cell directly to its *right* while, itself, dying. A *simple reader*, defined in this way, could be arbitrarily placed on a textual grid and, generation by generation, would seem to move from left to right through the text. But what happens when such a reader reaches the rightmost word in a line of type on the grid?



We may seem to be over-articulating the most simple of operations, but even here we discover an interesting and problematic encounter between natural language and the formalized vectors of reading [8]. The rules of our simplest automata are determined by a left-to-right culture of reading. However, the definition of “to the right” must be further formalized such that when a live cell is at the end of a line, the cell to its right will be the first word of the next line of text – far to its graphical, if not its “literal” left. In prose, the notion of “end of a line” is determined by *typography*, not by grammar or any other aspect of linguistic structure. In poetry, the composition of the line and thus the choice of a final word is generally deliberate, representing a correspondence between some aspect of poetics (minimally: lineation) and typography. On an arbitrary prose grid however, even our simple automaton must be taught to behave in a manner that implies no less than a poetics of prose reading, a poetics that allows it (and ourselves) to move from line to line without breaking the process of reading itself [9].

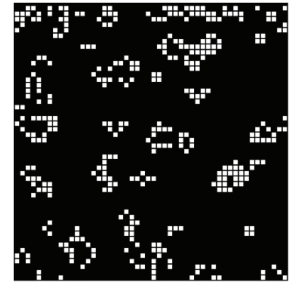


Figure 1. Created by Daniel C. Howe using Conway's Game of Life. © 2010 Daniel C. Howe.

The Typographic Dimension

As the project has progressed, considerations such as these have suggested a distinction between those aspects of typography that are properly the concern of graphic design and what we will characterize as the *typographic dimension*. The latter might be thought of as the typographically embodied space – necessarily shaped and structured – within which reading occurs. Another way to recognize this proposed distinction might be to consider typography in the graphic design sense as guaranteeing the visual legibility (or visual aestheticization) of linguistic elements, whereas the typographic dimension constitutes the space for reading formed from the gathering together of all those typographic elements required by a particular piece of written language. Design in the service of legibility drives typography as is it usually addressed in graphic design, whereas language-as-writing gives rise to a dimension of reading that is necessarily typographic [10].

These considerations impressed themselves upon us as we implemented a formal definition of *typographic neighborhood*. In order for procedural readers to navigate, they need to be formally aware of the space within which they read.

Precisely which words nearby a current live word-cell should be treated as its formal neighbors? In answer to this question, we identified, as in the game of life, eight potential neighbors for each live word-cell, four of which may be null [11]. We say that this definition is an aspect of the text's *typographic dimension*. It is set out in terms of graphic proximities that are dependent on typographic design, but the procedural consequences of the definition are inflections of reading, not graphics.

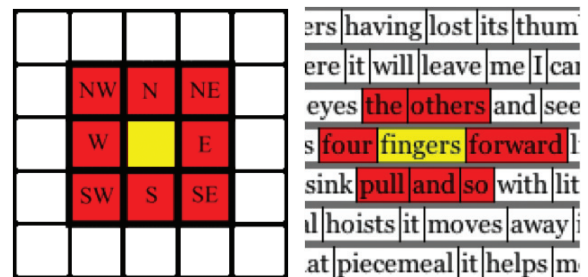


Figure 2: The layout (a) of the traditional Moore neighborhood [12] as generally employed in “the game of life,” contrasted with the typographic neighborhood (b) for a textual grid. Note that neither “eyes” nor “and” are included in the neighborhood due to their lack, in this example, of vertical overlap with the selected word below. The word “others” is considered to occupy the NE neighbor position, while the NW position is null. © 2010 Daniel C. Howe.

Vectors of Reading

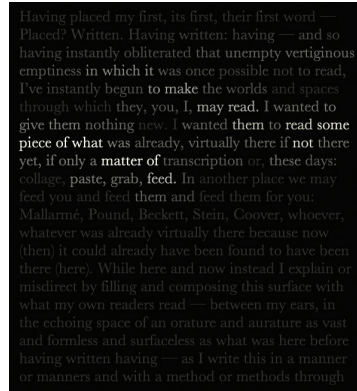
The first major gesture of *The Readers Project* is a re-conception of typography as a dimension for a cellular automata-like “game of reading.” The project’s second significant move is the elabora-

tion of forces that drive the various *vectors* of reading for its automata. A majority of these forces are derived from the engines of relatively straightforward text analysis and generation, e.g., Markov-chains [13], context-free grammars, feature analysis, etc. Effectively, we are re-placing and re-contextualizing such engines *within*, rather than *apart from*, the structures of their own supply texts. This requires our processes to remain responsive to conventional reading and writing even as they disrupt it, since the structures within which they operate are culturally and aesthetically implicated.

To date, apart from the *simple reader*, five readers with distinct behaviors have been coded and implemented for public installations of the *Project*, with a number of others currently in development [14]. Here we will introduce only the Perigram Reader in detail. Nonetheless, this reader highlights both the *Project's* exploration of generative reading in terms of the typographic dimension of visible language, and also the use of live or near-live natural language data-mining to animate and direct its vectors of reading.

The Perigram Reader is a left-to-right reader that also pays attention to its northeast and southeast neighbors, in addition to its immediate neighbor to the “right.” It was designed to be a reader that would progress through a text with a broadly traditional trajectory but that might, on occasion, be deflected from a simple linear path. It looks in particular at the neighbors (NE and SE) that are ahead of it but on the lines above or below. Thus, overall, it maintains a “forwards” reading impetus. As its “game of reading” unfolds, should either of its non-null neighbors (NE or SE) complete a phrase that is what we call a *perigram*, then that word-cell may be selected, instead of the word to the right. We have defined a perigram as a special variety of word-based n-gram (or Markov chain). In a standard word-based n-gram, all possible word combinations in the text may be considered and ranked for frequency. Here we define the perigrams for a given text to be a subset of these phrases that take typographic neighborhood into account. Our current algorithm collects only those combinations of n-words that can be found within a variable reading window, generally around 20 words, around the selected word. This definition is intended to include the selected word and all words that might possibly be set adjacently, according to standard typographic practice [15]. An n-gram sequence composed of perigrams will contain probabilistically assembled phrases with a vocabulary constrained by the typographic neighborhood, as defined above. It will, thus, contain language tending to be more sensitive to the context of the particular passage from which it is assembled.

As the Perigram Reader moves through a text, it remembers each previously read word and checks its NE and SE neighbors as potential next words. (Figure 3) If it finds that a combination of these three words (previous, current, and potential next, in order) constitutes a phrase with a frequency above a certain threshold (i.e., it has been used previously in natural language to some



Having placed my first, its first, their first word — Placed? Written. Having written: having — and so having instantly obliterated that unempty vertiginous emptiness in which it was once possible not to read, I've instantly begun to make the worlds and spaces through which they, you, I, may read. I wanted to give them nothing new. I wanted them to read some piece of what was already, virtually there if not there yet, if only a matter of transcription or, these days: collage, paste, grab, feed. In another place we may feed you and feed them and feed them for you: Mallarmé, Pound, Beckett, Stein, Coover, whoever, whatever was already virtually there because now (then) it could already have been found to have been there (here). While here and now instead I explain or misdirect by filling and composing this surface with what my own readers read — between my ears, in the echoing space of an orature and aurature as vast and formless and surfaceless as what was here before having written having — as I write this in a manner or manners and with a method or methods through

Figure 3: A Perigram Reader moving (a) through Poetic Caption, a text written as a “caption” for the project. Sample output (b) from the reader moving through this same text. As even 2D cellular automata generally have simple visual characteristics, our readers are coded with a variety of configurable visual behaviors that have become an important aspect of the *Project's* aesthetics. For the Perigram Reader (a), we highlight its divergent path through the text in a distinct color and shading, with a gradual return to full color and opacity over time. © 2010 John Cayley.



Figure 4: *Read for us*, an installation from *The Readers Project* at the David Winton Bell Gallery, Brown University, December 2010.
© 2010 Danny Cannizzaro.

extent) then its reading path may diverge, effectively also generating an alternative text that is, as it were, perigrammatic (See Figure 2b). As currently implemented, the Perigram Reader is probabilistically weighted to tend *rightwards* and to proceed steadily through a text, although it does so more quickly than a simple reader would (since it tends to jump down to the line below more frequently than it jumps up to the line above).

Rather than deriving perigrammatic frequency information solely from the domain of the supply text, for existing *Readers Project* works, we have collected “counts” from Google and other search engines [16]. This gives us a loose but near real-time relative frequency for the phrase, or else an indication, in cases where there are no hits, that the phrase searched is not yet within the domain of natural language as currently indexed on the Internet [17]. Further, it enables reader behavior to change over time (from installation to installation), reflecting continuous changes to the corpus as updated by search engine crawlers [18].

Reader Networks

Finally, we have developed a mechanism for distributing the “readings” of each reader. Often, when a text has more than one or two readers moving through it, following a particular reader’s path can become quite difficult for human observers. To address this, each of the words selected by a reader can be sent to a server process listening on a local or remote network port. Browsers and other custom web clients may then

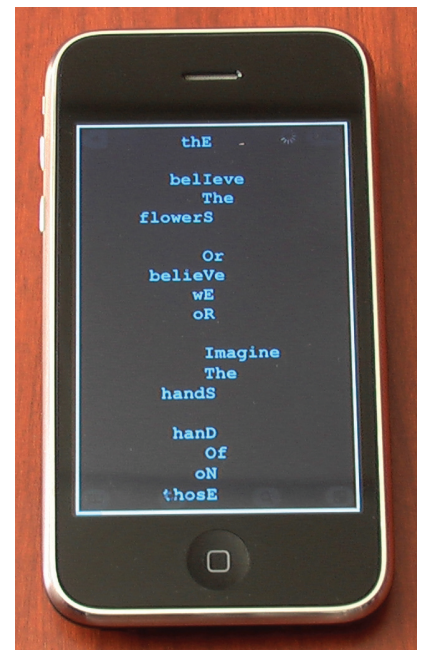


Figure 5: A networked Mesostic Reader’s output displayed on an iPhone. This reader is reading through a text, looking beyond its neighborhood in order to find words from the text that spell out, mesostically, the phrase “It’s over, it’s done, [in aligned capitalized letters] I’ve had the image.”
© 2010 John Cayley.

subscribe to particular readers and receive a relatively straightforward, linear presentation of their chosen reader on the device they used to subscribe.

In this context, any of the project's readers can manifest as a relatively straightforward text generator. For human readers present at an installation, subscribing to a reader allows them to clarify and focus the reader's generated text stream, and to compare this distinct text with the reader's traversal of the original text as visible in the main display.

The features described above were realized for an installation in the fall of 2010. As illustrated in Figures 4 and 5, a large screen with the text laid out in book-like opening displayed up to four distinct readers traversing the text. The viewer was provided with an interactive console which allowed them to select a specific reader for "focus," ensuring its presence on the display, even as it traversed remote sections of the text. Additionally, at each time-step, all readers sent their current words to the server. Audience members with web-enabled devices could then subscribe to any of the four available streams. At the installation site, these four streams were shown on four wall-mounted iPad displays, as seen in Figures 6 and 7.

Further developing the project's relationship to cellular automata, we have also experimented with what we call *Spawning Readers*. A Spawning Reader is a reader that, in addition to the capabilities described above, can spawn other readers in its neighborhood. Whether it spawns or not can depend on any number of criteria. For example, we have implemented a reader that spawns when individual words in its neighborhood complete a perigram. This may happen in any direction except the direction in which the spawning reader is itself moving. So far we have implemented a Simple Spawning Reader, one that moves through the text like the Simple Reader described above. In principle, readers of any type might be generated by a Spawning Reader, and its spawned readers, in turn, might be fertile, that is, capable themselves of spawning. (Figure 8) This would quickly produce a highly complex visual display. Thus, spawned readers may be configured to live only for a limited number of time-steps before "dying." For example, our current Simple Spawning Reader produces infertile Perigram Readers that are constrained to move in the direction in which they were spawned. They can only continue to exist if they find further perigrams in this direction. In the typographic space of conventional prose this means that they will usually die within three generations or less.

Discussion

The attempt to apply a formal construct like "cellular automata" to the act of reading has forced us to rethink the nature and complexities of the inscribed surface. The requirement to map this surface onto a cellular grid has led us to the perhaps surprising realization that it is structured, in the first instance, typographically – not stylistically, and not grammatically. Further, our



Figure 6: Main display, console, and iPad displays at the installation from *The Readers Project* at Pixilerations [v.7], Providence, Rhode Island, October 2010. © 2010 John Cayley.



Figure 7: The output of three separate Readers, presented on networked iPad displays. © 2010 John Cayley.

articulation of the behaviors for our readers, even simple readers, has forced us to recall that the typographic dimension of inscribed language is structured by its material cultural history, leading us to derive somewhat counter-intuitive notions of properties such as proximity and neighborhood, when speaking of typeset words. It appears that the possibility of playing off typographic relations between words and their other linguistic, stylistic, and poetic relations offers much in the way of literary aesthetic potential. For example, consider the relationship between linguistic collocation and typographic neighborhood. Collocation and “simple reading” not only correspond in typography; typography is, precisely, one of the primary mechanisms wherein the collocations of conventional written text are constituted. If readers look for alternative collocations in the typographic neighborhood of a word, the conventional correspondences will be challenged and new sequences – with collocational, and perhaps even literary, momentum – are proposed. Even the slight divergences of the Perigram Reader generate tensions and literary potentials between the collocations of simple reading and the alternates that it discovers.

Having placed my first, its first, their first word —
Placed? Written. Having written: having — and so
having instantly obliterated that unempty veriginous
emptiness in which it was once possible not to read, I’ve
instantly begun to make the worlds and spaces through
which they, you, I, may read. I wanted to give them
nothing new. I wanted them to read some piece of what
was already, virtually there if not there yet, if only a
matter of transcription or, these days: collage, paste,
grab, feed. In another place we may feed you and feed
them and feed them for you: Mallarmé, Pound, Beckett,
Stein, Coover, whoever, whatever was already virtually
there because now (then) it could already have been
found to have been there (here). While here and now
instead I explain or misdirect by filling and composing
this surface with what my own readers read — between
my ears, in the echoing space of an orature and
aurature as vast and formless and surfaceless as what
was here before having written having — as I write this
in a manner or manners and with a method or methods
through which I pretend to poeticize a process or system

Figure 8: Poetic Caption (see Figure 2) with a Perigram Reader (white) moving through it and a fertile Simple Reader (ochre) that is spawning infertile Directional Perigram Readers (gray) in all neighboring directions, except west and east (the Simple Reader’s preceding and following) words. © 2010 Daniel C. Howe.

The *Project’s* readers can, and do, look for other relations between words – alliteration, assonance, rhyme, grammatical or semantic features, shared letters, indeed any stylistic feature or linguistic property – that are within a word-cell’s “visible range,” allowing each reader to discern a vast number of potential reading paths through the typographic space of the text. This process amounts to no less than a dynamic visualization of poetics [19].

Conclusions

The Readers Project is explicit in its address to the institution of reading. By visualizing alternative vectors for reading, it both celebrates and critiques this institution. As described above, it also reveals and articulates a relatively neglected but vital aspect of this institution, the typographic dimension. The project focuses on typography as a space for reading and writing rather than on what it usually signifies: those far less neglected niceties surrounding the graphical representation of linguistic substance; that is to say, typographic design. *The Readers Project* asserts the importance of typography in the practices of reading and writing, rather than simply illustrating how the traces of these practices are manifest in the world. Less explicitly, the *Project* also concerns itself with the institution and practices of writing, both presenting an alternative vision of text generation and reflecting on writing that may be discovered within or as emergent from prior writing – that is, with writing as performative reading.

References and Notes

1. This paper is largely concerned with the details of our project's analytical and computational methods. However these are pursued as integral to a practice of digital literary art, fully within the context of long-standing discussions concerning the interrelation of digital media and "the literary." There is an extensive critical literature on this subject, recently summarized and extended, although from a relatively theoretical perspective, in N. Katherine Hayles, *Electronic Literature: New Horizons for the Literary* (Notre Dame: University of Notre Dame, 2008).
2. M. Gardner, "The Fantastic Combinations of John Conway's New Solitaire Game of 'Life'," *Scientific American*, 223, 120–123 (1970).
3. In fact, this is historically/culturally determined, a function of the fact that the z-dimension happens to have had little or no significance for the graphic representation of language, or at best only marginal significance, for reasons associated with the media-support for graphic language that have been available to date. This situation could change and, arguably, is now changing as it becomes ever easier to make the z-dimension perceptible within devices that represent graphic language. Note also that in sign language the z-dimension is significant, "phonologically" in the technical linguistic sense, and in other grammatical ways as well.
4. This phrase is intended to invoke both the natural language processing research that underlies our project and also the concept of "expressive processing" as vital aspects of much contemporary aesthetic practice, including literary practice, as elaborated by Noah Wardrip-Fruin, *Expressive Processing: Digital Fictions, Computer Games, and Software Studies* (Cambridge: MIT Press, 2009).
5. See D. Ashlock and J. Tsang, "Evolved Art Via Control of Cellular Automata," *Proceedings of the Eleventh Conference on Congress on Evolutionary Computation* (Piscataway, NJ: IEEE Press, 2009) 3338–3344; D. Burraston and E. Edmonds, *Cellular Automata in Generative Electronic Music and Sonic Art: Historical and Technical Review* (Sydney: Creativity and Cognition Studios, Faculty of Information Technology, University of Technology, 2005); Kenneth E. Perry, "Abstract Mathematical Art," *Byte*, December 1986, 181–190 (1986); and Mitchell Whitelaw, *Metacreation: Art and Artificial Life* (Cambridge: MIT Press, 2004).
6. One might also pre-process texts so as to be able to extract other cellular properties that are not regularly represented in traditional orthography, such as phonemes, morphemes, syllables, etc. As will be clear from our description, while the identity of cells is based on traditional orthographic and typographic distinctions, the strategies and behaviors of particular readers are often based on features extracted by computational analysis of the supply texts. Rhyme, which is based on phonemic analysis, represents one of many such examples.
7. Although we would appreciate connecting our aesthetic research more rigorously with, for example, studies of reading in cognitive science, such relations are only loosely suggested here. The authors are nonetheless involved with UK ARHC-funded research network Poetry Beyond Text, based at the Universities of Dundee and Kent, in which both cognitive scientists concerned with reading and even cognitive aestheticians have a role. See: projects.beyondtext.ac.uk/poetrybeyondtext/.
8. We use "vector" in a figurative sense, related to its definition as: a quantity (e.g., of directed force or attention) that can be resolved into components. "Vector" also provides us with a noun that can refer to what is really, in this case, a potential direction for the choice of a next word to be read.
9. The term "poetics" is used here to encompass any property or method of language that may be composed for rhetorical or aesthetic effect.
10. We are aware that there is much sophisticated discussion of the interrelation between typography and semantics, typography and literary aesthetics, and so on. Johanna Drucker's work is exemplary in this regard. Nonetheless, we believe that the distinction proposed here is both novel and critically generative. J. Drucker, *The Visible Word: Experimental Typography and Modern Art, 1909–1923* (Chicago: University of Chicago Press, 1994).

11. For precise details of the current definition, please see: thereadersproject.org?p=contents/neighborhood.html. In our scheme – as a reflection of traditional left-to-right reading in the West – the NE and SE neighbors will not be null where there are lines of type above or below the current word. The NW, N, SW, and S positions may, however, be null, depending on relative word-lengths.
12. E. F. Moore, “Machine Models of Self-Reproduction,” *Proceedings of Symposia in Applied Mathematics*, The American Mathematical Society, Volume 14, 17–33 (1962).
13. A. A. Markov, “Classical Text in Translation: An Example of Statistical Investigation of the Text *Eugene Onegin* Concerning the Connection of Samples in Chains,” trans. David Link, *Science in Context*, 19.4, 591–600 (2006). Online: journals.cambridge.org/production/action/cjoGetFulltext?fulltextid=637500.
14. See thereadersproject.org/?p=contents/readers.html. We might also count as implemented a subtle variation of a simple reader, the “writing to be found” reader that was deployed in the *Read for us* installation, described here: thereadersproject.org/?p=installations/readforus/readforus.html.
15. Note that the preprocessed identification of perigrams for a text is carried out chiefly for reasons of efficiency. Often, depending on network constraints, the frequencies of particular phrases are cached in advance rather than being searched in real-time. The extraction of perigrams means that considerably fewer word combinations need be considered and processed.
16. *The Readers Project* is written, chiefly, in Processing (processing.org) and Java, and makes use of the RiTa natural language processing library (www.rednoise.org/rita/) developed by Daniel C. Howe. See D. C. Howe, “RiTa: Creativity Support for Computational Literature,” *C&C '09: Proceeding of the 7th ACM Conference on Creativity and Cognition*, Berkeley, October 26–30, 2009 (New York: ACM, 2009) 205–210, retrieved from doi.acm.org/10.1145/1640233. This library also provides objects designed to mine natural language data, in real time, from indexed repositories – those built by certain of the main internet search engines – that represent the most extensive corpus of natural language that has ever been available to language art practitioners. The phrases searched are enclosed in double quotes, providing a rough relative frequency for exact word sequences. There are problems with the way that search engines handle punctuation – whether or not punctuation is considered to break a sequence. (Google, for example, treats punctuation differently in different search portals: all of Google vs. Books.) These problems have been bracketed for the time being.
17. We are also able to constrain our searches to, for example, the indices of Google “books,” thus disregarding much of the commercially or technically implicated Internet text.
18. We believe that the existence of “services” (or pretended cultural vectors) such as those provided by Google, combined with a burgeoning, aesthetically motivated “use” of these services, has profound implications for contemporary artistic practice. Such use also allows artists to engage critically and productively with important socio-economic and political developments in an unprecedented manner. We are unable to address these crucial issues within the scope of this paper, but plan to do so in future contributions.
19. For us, one of the attractions of this approach and these procedures is that they may visualize and perform the workings of protosemantic and sublexical linguistic properties – both traditional poetic properties like rhyme and less-frequently acknowledged properties such as mesostic relations – highlighting their contribution to literary aesthetics. The role of the protosemantic in *The Readers Project* must wait for fuller treatment in the future. See: S. McCaffery, *Prior to Meaning: The Protosemantic and Poetics* (Evanston, IL: Northwestern University Press, 2001).

Shadow Awareness: Enhancing Theater Space Through the Mutual Projection of Images on a Connective Slit Screen

Yoshiyuki Miwa, Shiroh Itai, Takabumi Watanabe, Hiroko Nishi

ABSTRACT

This study discusses media technology that enables the continuous creation of performers' physical improvisation as inspired by the reflection of imagery evoked from the audience. To realize this, the authors have focused on "shadow media," which promote the continuous creation of imagery through "bodily awareness." The authors have developed a system that can project shadows of the performers in various ways, which are then transformed into various shapes and colors. The shadows are connected to the performers' feet and projected on a "passable" slit screen set up between the stage and the audience. As a result, the interactive and mutual creation of imagery by performers and audience can form an "empathetic" stage. To demonstrate its validity, the authors applied the system to a dance performance at Festival della Scienza in Genoa, Italy.

Introduction

We know from experience that stage performers can express a very evocative narrative by integrating reactions from the audience. Specifically, the audience's participation can inform and expand the continuity of a piece in cases where performers use physical improvisation. However, the relationship between performers and audience has not been fully studied in the field of media technology for interactive art and other uses. This paper describes the authors' work on media that allow performers and audience to interactively create a relationship through the use of body and image and the expression of both together during physical improvisation.

We have experience working on technologies that support physical improvisation. While improvising, performers must continuously create new images with their movements. We are interested in presenting medium incompleteness, because it is difficult for performers to stimulate the audience's imagination with ever-changing motion unless the media provide incomplete elements, which encourage the audience's imaginative participation. In other words, the "spatial blanks" (*yohaku*, a Japanese cultural concept of incompleteness) create a space for the audience's imagination within the motion. Good examples of these are those observed in *suiboku-ga* (Japanese ink paintings) and *Utsushi-e* (the Japanese version of a magic lantern) in Eastern culture [1], and shadow puppetry [2, 3], which exists in many cultures. We also considered the awareness of one's own body to be an important element in the process of continuous imagery generation. All this led us to consider the body's shadow. Shadows themselves are incomplete media which provide less information than general video media. Another important element of shadows (related to the concept of body awareness) is that they are always connected to bodies. A body always casts a shadow, yet we are often unaware of our own shadows. Shadows are incomplete embodied media.

In order to externalize the effects of the shadows, we devised a means of changing their forms and colors in various ways to allow continuous creation of the image and to raise awareness of

Yoshiyuki Miwa

Educator/Researcher
3-4-1 Okubo, Shinjuku-ku,
Tokyo, Japan
miwa@waseda.jp

Shiroh Itai

Researcher
3-4-1 Okubo, Shinjuku-ku,
Tokyo, Japan
itai@fuji.waseda.jp

Takabumi Watanabe

Researcher
3-4-1 Okubo, Shinjuku-ku,
Tokyo, Japan
takabumi@fuji.waseda.jp

Hiroko Nishi

Educator/Researcher
32 Mihocho, Midori-ku
Yokohama-shi, Kanagawa
Japan
hiroko@toyoeiwa.ac.jp



Figure 1. Generation of bodily expression through the shadow media. © 2010 Yoshiyuki Miwa et al.

the performers' own bodies. Figure 1 shows various transformed shadow media we developed (we call this an "artificial shadow," which is transformed from a real shadow into "shadow media"). The interaction between the performers' own bodies and the shadow media causes them to move naturally in conjunction with soaring images. Also, when a gap between the shadow media and their own bodies emerges, the performers become aware of their own inner selves. And they can use this gap as the starting point for a new series of physical expressions. Through experiments conducted with expert dancers and pre-school children as part of their physical expression education, we found various effects of the shadow media [4, 5].

Previous studies have not been concerned with the relationship between performers and audience through shadow media. Therefore, in this study, we tried to help performers and audience to create a mutual relationship through both body and image. The method we used to achieve this was to place a screen that performers can pass through (Figure 2b) at the border between the stage and the audience, and to project the performers' shadow media on this screen. The audience encounters the performers' shadow media before encountering the actual performers, and the audience can create images in reaction to the performers' physical expressions while

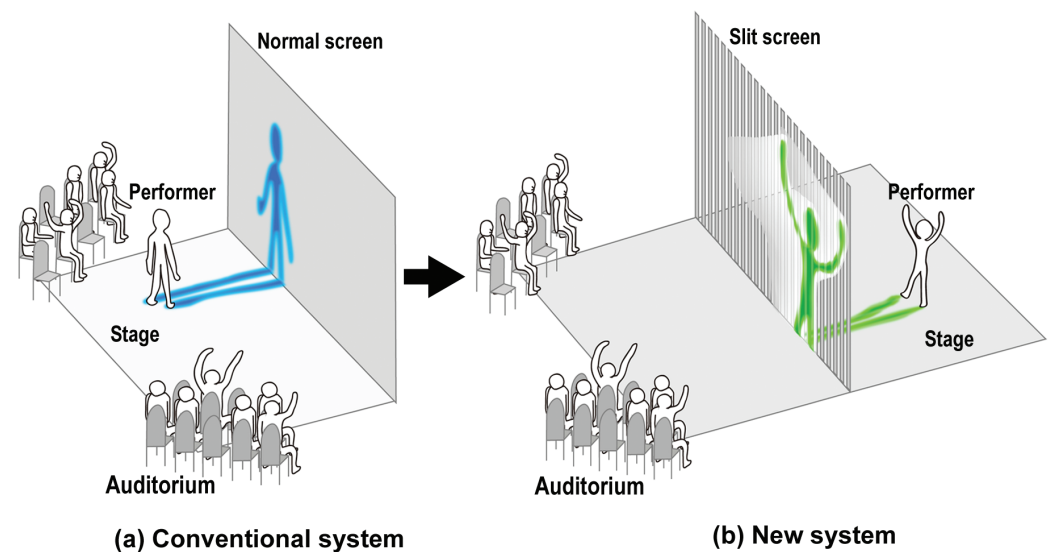


Figure 2. The method of projecting the shadow media. © 2011 Yoshiyuki Miwa et al.

appreciating the performers' shadow media. This shadow media projection offers two benefits to the performers as well. First, the performers can simultaneously see the audience and their shadow media projected on the screen; in other words, the performers can create physical expressions through the shadow media partially in response to the audience. This offers a solution to the conventional system shown in Figure 2a, in which performers cannot see the screen media and the audience simultaneously. The second benefit is that the performers can use the space in front of the audience as well as the space on the stage, which expands the performers' physical range of expression.

The following section describes the details of the system used to project the shadow media on the slit screen placed at the border between the stage and the audience. This system was exhibited at the Festival della Scienza in Genoa, Italy, and was used in our dance performances and co-creative physical expressions shown there. The results of those performances will also be discussed.

Slit Screen Connecting Audience and Performers

This study discusses technology that promotes an interactive relationship between performers and their audience; enables performers to create physical expressions while expanding their range of imagery through reference to their shadows and in reaction to the audience's existence and influence; and enables the audience to generate their own imagery through the shadow media while reacting to the performers' existence and influence. In order to achieve such results (Figure 2b), it is necessary for performers and audience to face each other so that each of them can share the shadow media. In order to maintain the inseparable relationship between a body and its shadow media, the projected shadow media is connected to the performers' feet so that it looks like their actual shadows. Projecting a silhouette image on the screen, disconnected from the body, would not be enough. One method by which the audience and the performers can share the shadow media while facing each other is to install a transmissive screen, which is made of a material, such as scrim or fabric, that allows the background of the stage to be seen, at the border between the stage and the audience. However, this method has a few problems: the projection on the screen shines through the screen itself and gets cast on the stage floor, and the shadow media that is intended to be projected only on the stage floor to show shadows connected to the performer's feet (for maintaining the inseparable relationship between body and shadow) appears on the screen. Therefore, we used a screen with vertical slits (Figure 2) to project the shadow media from the audience's side. This slit screen allows the projection of each individual image to be cast separately on the reed-textured screen (slit screen) and the floor (passing through the slits), which solves the problems mentioned above. This shadow media projection method also offers the following three advantages: (1) The audience can not only see the performers' projected shadow media, but also their bodies through the slit screen. (2) Performers and audience can move back and forth on each side of the stage through the physical gaps in the slit screen. This enables the inseparable integration between performers and audience. (3) Perceptual completion enables performers and audience to see the incomplete image on the slit screen as one cohesive shadow medium, although the image of the shadow media is fragmented (sliced) by the splits.

As shown in Figures 3a and 3b, thermal cameras and projectors placed on both sides of the slit screen to generate shadow media enable performers to pass through the slit screen and to create physical expressions through the shadow media generated on the auditorium and the stage floors. The audience can also participate in an ongoing performance (or enter the stage of physical expressions created by performers – "shadow media space") with their own shadows. This means that performers and audience can encounter and interact with each other through the use of shadow media. This system also makes it possible to project an image across the entire theater,

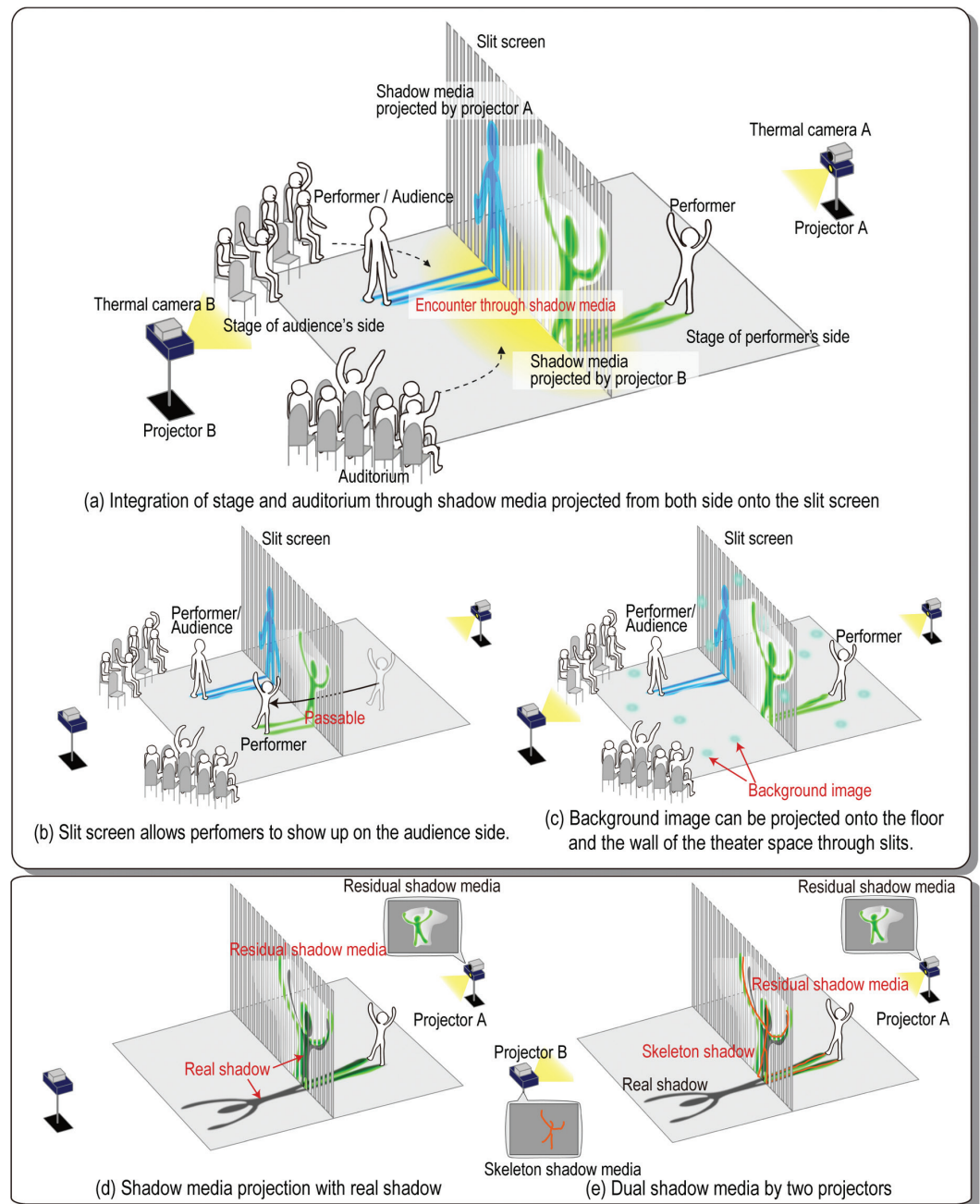


Figure 3. The new method for projecting shadow media images (concept). © 2011 Yoshiyuki Miwa et al.

including the walls and the ceilings above the stage and the auditorium enclosing the entire stage and auditorium in the image (Figure 3c). The slit screen can expand the stage to the entire theater. Finally, the stage and the auditorium can be integrated. Furthermore, as seen in Figure 3d, not only the shadow media, but also the performers' actual shadows can be simultaneously projected on the screen. Additionally, by projecting different shadow media from two projectors, the superimposed (dual) shadow media can be projected on the screen (Figure 3e). In comparison to the existing system (Figure 2a), our method expands the range of physical expressions through the use of shadow media. Thus, this system can be considered as an example of Eastern interactive media art. It projects shadow media on the slit screen which will bring about a spatial expansion and a sense of depth. In other words, this system provides *yohaku*, which is often seen in *suiboku-ga* Japanese ink paintings, enabling the audience and performers to create imagery together.

In general, interactive art that invites audience participation has focused on supporting direct interaction between an audience and a fixed artwork [6-10]. It has focused attention on the relationship between audience and artwork [11]. Myron Krueger, the famous researcher of interactive art, originated the focus on the relationship between performers and audience [12]. He argues that art's future direction is art created by the interaction between performers and audience. He proposes that performers interact with the audience by projecting silhouettes of both performers and audience in the shared visual environment of the video space he developed. However, in his concept, the space where performers and audience interact is virtual – shared, but only virtual – not a shared real environment. There are many technologies, such as those often used in traditional stage settings, that heighten performers' expressions by applying a special effect to either the stage space or the performer [13-16]; or that inseparably enhance the audience's rapport with the performers, such as waving penlights at concerts. In contrast, our new system, which enhances the relationship between performers and audience through their physical interactions in a real space, is the first attempt of its kind in the technological media field. This study attempts to apply technology to achieve interaction through shadow media that can stimulate the audience and performers to create images collaboratively. Shadow media are widely used in the human-interaction field to support interaction between humans. For example, there is the remote communication system (WSCS) [17] that enables the positioning of oneself and a remote partner in one's own physical location by exchanging the physical shadow of both participants between remote locations, and projecting the mutual shadows from each partici-

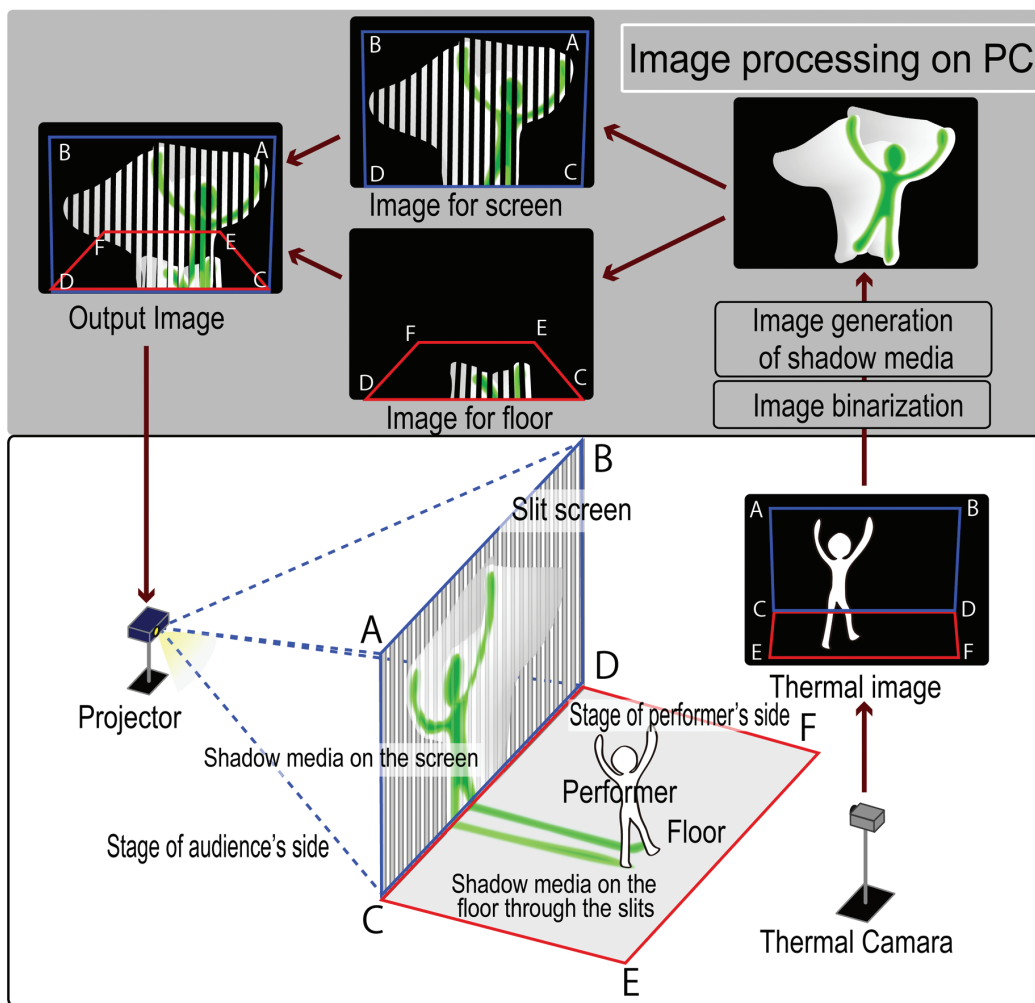


Figure 4. The method of projecting the shadow media on the slit screen. © 2011 Yoshiyuki Miwa et al.

pant's location. The WSCS interaction system generates a situation where, in effect, the participants are actually talking to each other face-to-face. There are also several research programs, such as Passages (Bitton), that attempt to support remote communication by projecting the shadow silhouettes of remote participants on a screen [18]. The Palindrome dance company has conducted performances using performers' shadows to enhance their physical expression [19]; and Lozano-Hemmer has presented an installation in which a video image emerges from one's own shadow in an outdoor space [20], demonstrating that participants can play improvisationally with the help of their shadows. As a result, he successfully transformed a space that people pass through into a space where they meet and play. Among these projects in other arts, our research will be the first use of shadow media to position an audience on the stage and support the co-creation of the image, focusing on the relationship between performer and audience.

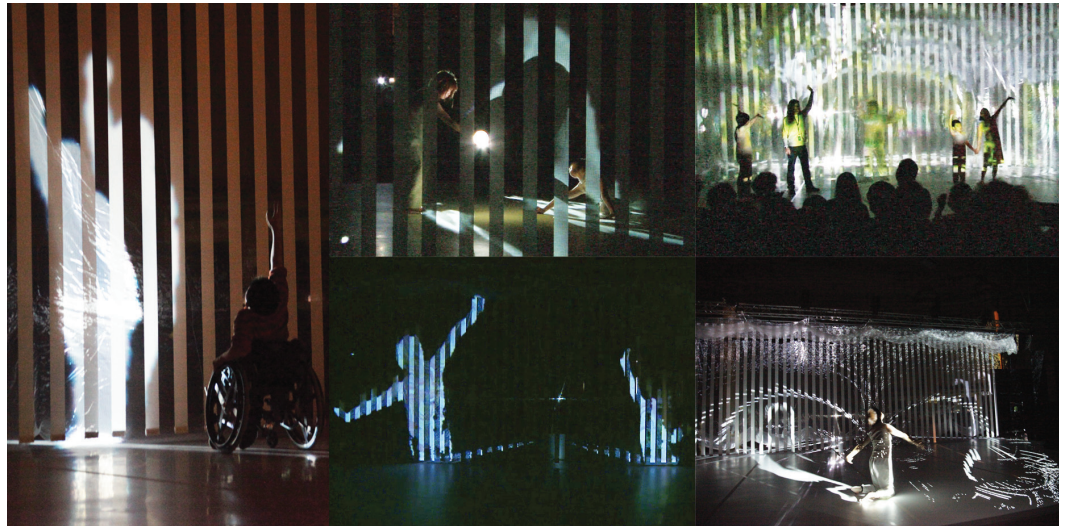


Figure 5. Scenes from *Dual 2010* at Festival della Scienza in Genoa. © 2010 Yoshiyuki Miwa et al.



Figure 6. Scenes from our public exhibit at Festival della Scienza in Genoa. © 2010 Yoshiyuki Miwa et al.



Figure 7. Participants going back and forth through the slit screen. © 2010 Yoshiyuki Miwa et al.

System for Generating and Projecting Shadow Media on Slit Screen

This section describes the system used for projecting the shadow media on the slit screen. As seen in Figure 3, this system can project shadow media on the slit screen in a variety of ways. The basic shadow media projection method projects the shadow media of a person standing in the performer's stage space. The system's structure is shown in Figure 4. First, the system creates the shadow media by acquiring a thermal image via a thermal camera located at the back of the stage, extracting the body's region, which has a different temperature from the surroundings, and processing this image with a computer. Assuming that the shadow media's light source is located in the position of the thermal camera, projecting this shadow media onto the performer's feet ensures a geometric consistency between the body shape and the shadow media. In this case, to avoid having the performer's actual shadows projected on the slit screen, the projector is situated on the side of the audience, and the shadow media stretching from the performer's feet must be projected onto the screen as well as the stage floor beyond the screen. The projected image must be divided into two sections: one projected onto the screen, and the other onto the stage floor. Each section is subjected to projective transformation for projecting on the screen or on the stage floor. In other words, the projected image is a composite of two images with alternate vertical stripes (Figure 4). This composite shadow is projected from the audience's side. The slit screen is made of polyester, which enables rear projection. Thus, this system can simultaneously project shadow media on the floor (to recreate a shadow stretching from the performer's feet) and on the slit screen. Although the shadow media system developed in the past had to be installed on the ceiling as a projecting source, the current projecting method does not require installation of projectors on the ceiling. This is quite beneficial because it halves the number of projectors required. Furthermore, as mentioned above, we can project the audience's shadow media by bilaterally and symmetrically arranging the new shadow media projection system with a central focus on the slit screen.

Exhibiting the System

This system was exhibited at the Festival della Scienza in Genoa (October 29 to November 7, 2010). This festival showcases communication through science, boasts participants of all ages and nationalities, and offers an opportunity for scientists and artists to create communities of practice. The Palazzo della Borsa, where the system was exhibited, was a circular space with a flat floor 25 meters in diameter. We set up the slit screen, which was four meters high and 10 meters wide, in the center of this space, making one part of the space a stage for the performers and the other a space for the audience. The opaque elements and the slits were, respectively, 10 and 12 centimeters wide. Each width was determined by conducting several experiments to see if audiences could see both shadow media projected on the slit screen and the performers behind the slit screen.

We produced a performance titled *Dual 2010*, which integrated shadow media and physical expression with the theme "Ancestors plant trees, descendants rest under the trees." We also conducted lectures on the system's technology. The system was open to the public, and we offered visitors an opportunity to experience this system freely.

The dance performance and the lectures on the technology, as well as several scenes from participatory exhibitions, can be seen in Figures 5 and 6. It was recognized that this system can project the shadow media of people on either the near or far side of the slit screen. Figures 5 and 6 also show that the shadow media are connected to the performers' feet. During the actual dance performance, we observed that the motion of children in the audience was elicited while performers showed physical expressions through the change of shadow media. And, at the end of the dance performance, the audience entered the shadow media stage space and created an

embracing stage with the performers. Comments from the audiences included remarks such as, “I could feel a sense of involvement with the scene expressed through the shadow media, which yielded an exchange of minds among the performers and the audience members, along with the storyline of the performance.” During our exhibition, we observed interactions between performers and audience across the slit screen. Children in particular often ran between the stage and the audience area, playing in an improvisational way through the shadow media (Figure 7).

We have been discussing our dance performance and exhibitions in Genoa so far. Their results indicate that the shadow media projected on the slit screen can work as a stage setting to create a scene where the performers and the audience can feel as if they were integrated as one large expression. Therefore, we think that this system has the potential to support empathic interactions between performers and audience. More than 2,500 people visited the shadow system exhibition at the Festival della Scienza in Genoa. It was extremely well received, and the *Dual 2010* performance was featured on the festival’s official web site and in the local media.

Conclusion

The present study discusses media technology that enables performers and audience to interactively create a mutual relationship through both body and image, and mutual expression through physical improvisation. Specifically, this study invents and implements the method of projecting shadow media through a transmissive slit screen placed at the border between the stage and the auditorium, transforming a body’s shadow form. We have developed the system in which performer and audience face each other, and in which the shadow media and the performers themselves can be seen simultaneously. We have also applied our newly invented method of projecting the shadow media onto the slit screen with the shadow media connected to the performers’ feet. In addition, projecting shadow media from both sides of the slit screen can accommodate the audience’s shadow media as well as the performers’, enabling the audience and the performers to share a common stage with the help of the projections on the screen. This system can also be used to project shadow media across the entire theater space. At the public exhibition of this system at Festival della Scienza in Genoa, which attracted considerable attention, performers and audience interacted to create a series of continuous narrative physical expressions, while the performers became aware of their own bodies and the effect of the audience. From these observations, we conclude that this system has potential as an interactive expressive media system that achieves co-creative physical expression.

Acknowledgments

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References

1. E. Huhtamo, "Elements of Screenology: Toward an Archaeology of the Screen," *International Studies of the Modern Image*, Vol. 7, 31–82 (2004).
2. B. James, *On Thrones of Gold: Three Javanese Shadow Plays* (Cambridge: Harvard University Press, 1970).
3. L. Danforth, "Humour and Status Reversal in Greek Shadow Theatre," *Byzantine and Modern Greek Studies*, Vol. 2, 99–111 (1976).
4. Y. Miwa, et al., "Shadow Awareness: Bodily Expression Supporting System with Use of Artificial Shadow," *Human-Computer Interaction, HCII 2009, Part II*, LNCS 5611, 226–235 (2009).
5. K. Iida, et al., "Supporting for Creation of Bodily Expression in a Group Activity with Shadow Media," *Proceedings of HIS 2010* (2010) 91–94.
6. S. Fels and K. Mase, "Iamascope: A Musical Application for Image Processing," *Proceedings of FG1998* (1998) 610–615.
7. C. Nicolai and M. Peljhan, "Polarm," *YCAM* (2010) polar-m.ycam.jp/index_en.html.
8. W. Muench and K. Furukawa, "Bubbles," *ZKM* (2000) hosting.zkm.de/wmuench/bubbles.
9. J. Lewis, et al., "Night Lights" (2010) yesyesno.com/night-lights.
10. MSNBC, "NewsBreaker" (2007) www.msnbc.msn.com/id/24114408/.
11. L. Candy and E. Edmonds, "Interaction in Art and Technology," *Crossings: Electronic Journal of Art and Technology*, Vol. 2, Issue 1 (2002) crossings.tcd.ie/.
12. M. Krueger, *Artificial Reality 2* (Boston: Addison-Wesley Professional, 1991).
13. K. Vincs and J. McCormick, "Touching Space: Using Motion Capture and Stereo Projection to Create a 'Virtual Haptics' of Dance," *Leonardo*, Vol. 43, No. 4, 359–366 (2010).
14. D. Manabe, "True," *YCAM* (2007) www.youtube.com/watch?v=xG6rBB4VYJo&feature=player_embedded#at=44.
15. J. Watanabe, et al., "Test-patches" (2001) www.66bcell.com/test-patches-1/.
16. A. Camurri, et al., "Mappe per Affetti Erranti: A Multimodal System for Social Active Listening and Expressive Performance," *Proceedings of New Interfaces for Musical Expression* (2008).
17. Y. Miwa and C. Ishibiki, "Shadow Communication: System for Embodied Interaction with Remote Partners," *Proceedings of CSCW 2004* (2004) 467–476.
18. J. Bitton, "Flirting Across a Distance: How a Screen Creates Intimacy with the Shadow," *Ambidextrous*, Fall 2008, 32–33 (2008).
19. R. Wechsler, F. Weiß, and P. Dowling, "EyeCon – A Motion Sensing Tool for Creating Interactive Dance, Music and Video Projections," *Proceedings of the Society for the Study of Artificial Intelligence and the Simulation of Behavior and Cognition* (Leeds: University of Leeds, 2004).
20. M. Fernández, "Illuminating Embodiment: Rafael Lozano-Hemmer's Relational Architectures," *4dsocial: Interactive Design Environments*, ed. L. Bullivant, AD Architectural Design, 78–87 (2007).

Collaboration with the Future: An Infrastructure for Art+Technology at the San José International Airport

Matt Gorbet

Designer, Artist, Educator
Gorbet Design, Inc.
matt@gorbetdesign.com
www.gorbetdesign.com

Susan LK Gorbet

Designer, Artist, Educator
Gorbet Design, Inc.
susan@gorbetdesign.com
www.gorbetdesign.com

Banny Banerjee

Designer, Artist, Educator
Stanford University
banny@stanford.edu
dschool.stanford.edu

Matt Gorbet, Susan LK Gorbet, Banny Banerjee

ABSTRACT

This paper summarizes the development and implementation of a three-part infrastructure for the ongoing program of technology-based public artwork at Silicon Valley's newly expanded airport. The physical, technological, and human infrastructure provides flexibility and opportunities for future artists and future technologies while providing a robust framework for the ongoing maintenance and evolution of the program and mediating between the needs of artists and the constraints of an airport.

Introduction

The City of San José's Office of Cultural Affairs has established an ongoing, rotating program of technology-based and technology-themed public art in conjunction with the revitalization of Silicon Valley's Norman Y. Mineta International Airport (SJC). Three major permanent artworks and ten short-term (18–24 month) “rotating” installations make up the first round of Art+Technology commissions, launched with the opening of the airport's new terminal in June 2010.

Airports that include technology-based artwork typically have a small number of individual works [1–4] within more traditional public art collections, and any infrastructure installed to support them is designed specifically for those pieces.

When more general, building-wide infrastructures have been created to support evolving collections of technology artwork, these are found in facilities that are dedicated to technology art as their primary purpose, such as museums, galleries, and exhibition centers [5–8].

San José Airport's Art Activation project brought these two directions together. We created an architecturally integrated infrastructure consisting of physical, technological, and human systems to enable the SJC Art+Technology program to be robust and extensible within the constraints of a functioning airport.

Background**Master Planning**

The Airport Public Art Master Plan [9], completed in 2004, defined a framework for a unified program of “Art+Technology,” showcasing the innovation, diversity, and change that defines San José and Silicon Valley. The Art+Technology program:

Aims to give travelers an immediate sense of San José as a place where ideas are born, and reinforce its stature as a creative and tech-savvy city. [10]

Art+Technology is defined in the Master Plan as:

- Art that uses technology
- Art that is inspired by technology
- Art that is developed with technology
- Art that comments on technology [11]

Airport Art Activation

The planners recognized the need for “activating” the airport buildings to enable Art+Technology work:

Architectural Infrastructure

A qualified team of artists will be selected to work with the architectural design team to identify sites and integrate appropriate accommodations for a program of Art+Technology. [12]

The City put out a call for artists to form the Airport Art Activation Team. Of 24 qualified international submissions, our team was chosen in May 2005. Our mandate was threefold:

1. Work with the airport’s design team to analyze the architecture, discover opportunities, and integrate the public art infrastructure.
2. Design and install “flexible technological platforms” to enable a rotating program of commissioned works. The Master Plan established that:

Sites within the architecture and/or landscape will be designed as flexible Art+Technology platforms to incorporate dynamic projects that rotate over time. [13]

3. Create three “pilot” artworks (of the initial 10) to showcase and test these platforms.

Initial Research

We investigated the airport art program context, speaking with many types of people to gain insight on the role of art in an airport and the goals for an enabling infrastructure. The research [14] included:

- San José Public Art Program: Understand public art processes with respect to the community and to economic development plans for San José.
- Airport Design & Operations: 13 meetings with over 35 airport staff and stakeholders, including architects, IT, maintenance, landside and airside operations staff.
- Art and Technology Field Research: Field trips and online research exploring emerging technologies and their use in art and design.
- Airport Observations and Research: Observations and interviews of airport users at SJC, and observations at other airports: PHX, YYZ, YYC, DEN, SFO, ORD, BUR, LAS.

- Artists' Input: Research visits to Art+Technology shows, public “community visioning” groups for both traditional and technology artists, an invited roundtable, and one-on-one artist interviews.

Guiding Principles

Collaboration with the Future

The most significant challenge of activating the airport for technology-based artwork is that technology changes rapidly, and there is no way of knowing what tools, media, or genres future artists will be working with. Every activation must be thought of as a *collaboration with the future*: the infrastructure will be part of each artist's piece, and therefore must contribute functionally while allowing the largest possible aesthetic and thematic flexibility.

Integration with Airport Function and Passenger Experience

Because this is a highly functional space, the art should enhance the existing experience of travelers through the airport rather than requiring a detour to view artwork or to visit a gallery. This also means that the infrastructure must integrate tightly with the airport architecture, disappearing when not in use.

Physical, Technology, & Human Systems

To create a flexible and sustainable program, the Art+Technology infrastructure must provide physical systems, technology systems, and human systems, further detailed in the Curatorial Process section of this paper.

Platforms

Technology Art and Public Art

In our research, it became clear that in the context of traditional, permanent public art, working with technology is a challenge because it is a constantly changing, somewhat ephemeral medium. The “flexible platforms” are a way to bridge this gap and allow artists to create public art with technology.

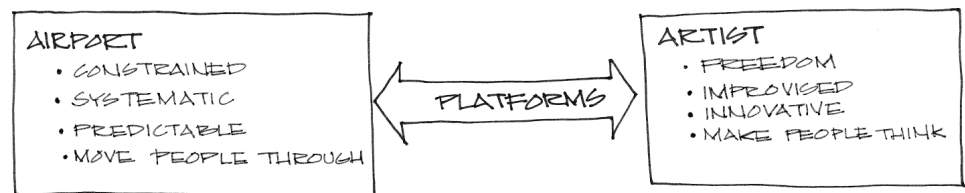


Figure 1. Platforms mediate between the constraints of the airport and the needs of the artist. © 2010 Matt Gorbet et al.

Mediation Between Airport and Artist

The Art Activation infrastructure enables artists to create art within the airport environment by mediating interactions between artists and the airport (Figure 1). Unlike a museum or gallery, many aspects of the airport are inflexible, from strict data access and security concerns to physical needs such as wall space or power outlets. Negotiating for these needs in advance provides opportunities as well as constraints for future artists.

(Re-)Defining Platforms

While the Master Plan introduced the concept of *flexible technological platforms*, the term was originally understood in the context of media systems that could be installed and reused for a variety of content, e.g., screens and playback systems for video art.

Rethinking the meaning of “platform,” it became clear that specialized display equipment should be avoided wherever possible. These are the most visible and fastest-changing technologies, so they are likely to constrain the expression of future artists and quickly obsolesce. Instead, activations focus on the mostly invisible infrastructure that connects artworks to airport systems.

To give both the art program and the artists flexibility, the platforms are conceived of as a “kit of parts” supplied to artists. These “parts” take the form of simple infrastructure elements located at specified sites within the airport, like hooks and power sources, as well as universal elements like flight data and camera inputs. These can then be combined in the curatorial process to create the platforms for which art is commissioned.

Curatorial Process

Though this paper focuses on the supporting infrastructure and not the motivations or processes of the overall program, it may be useful to understand the curatorial process that led to the current round of commissions. The City of San José has a well-defined ideological approach to its public art program:

The San José Public Art Program strives to select artists versus specific artworks, so that each artwork that is added to the City’s collection is unique and specifically designed for its site. Community outreach is extensive and involvement is encouraged at all levels. [15]

Within this framework there is flexibility around the specific curatorial approach to take for any given commission. For the first rotating commissions, guest curators were invited by the Public Art program to select artists for specific platforms and sites after the infrastructure and platforms had been finalized. The artists were selected from a pre-qualified pool of artists that is maintained with a rolling open call. Once commissioned, the airport artists were asked to reflect on issues of concern to travelers and the local community and, where possible, to engage with the local community in the development of their artworks.

As designers of the infrastructure, we contributed general curatorial guidelines to this process. We also proposed three of the platforms for our own “pilot” artworks, to showcase the possibilities and explore the limits of the infrastructure we had designed.

The Infrastructure

Physical Systems

Physical systems such as mounts, power and data ports, space for equipment, and display cases provide both ready-made opportunities and guidance for artists in their approach to the airport environment. The physical activations that comprise the Art Activation Program are fully detailed in public design development documents [16, 17] created for the project. Following are illustrative examples of physical systems in specific locations:

Gate Seating Areas

In the gate seating areas, passengers await their departing aircraft. Power and data are provided in the floors of gate seating areas to accommodate custom display cases or sculptural artwork. Ceilings in three of the nineteen gate areas include equipment storage and concealed mounting points above the tiles for hanging artwork, projectors, sensors, displays, etc.

Among the program’s first ten rotating commissions are two gate seating area works. *Dreaming F.I.D.S.*, by Ben Hooker and Shona Kitchen, is a custom-built aquarium with live fish and

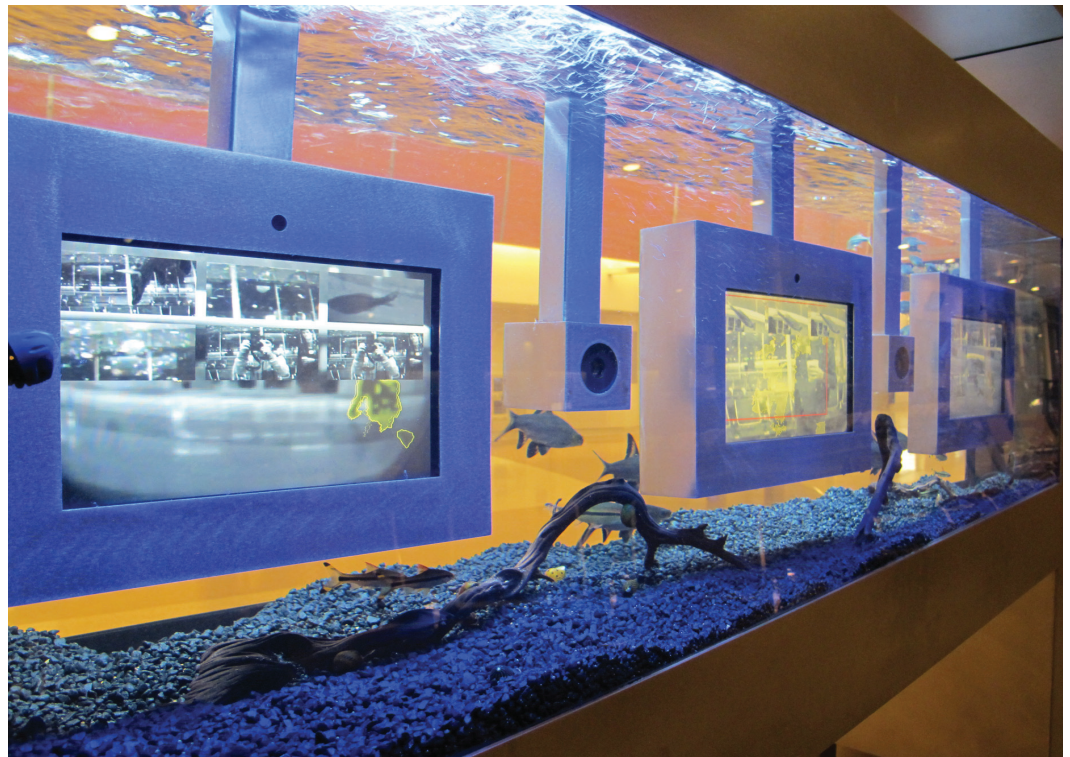


Figure 2. *Dreaming F.I.D.S.* by Ben Hooker and Shona Kitchen. Collection of the City of San José. © 2010 Ben Hooker and Shona Kitchen. Photo © 2010 Daniel Brown.

submerged video displays showing custom graphics and fish-tracking software from underwater cameras (Figure 2). The piece uses floor-mounted power and a concealed data jack to remain connected to the network for monitoring and maintenance.

Another gate seating area features *Chronos & Kairos*, a ceiling-mounted robotic sculpture consisting of 130 paired aluminum arcs that move in choreographed patterns and respond to the movement of people below via video tracking (Figure 3). Concealed in the ceiling are power supplies, a control computer, and a rigid mounting system.

Passenger Bridges

Six-channel speakers, data connections, audio equipment, and sensors are integrated into the ceilings of passenger boarding bridges, driven by a digital audio distribution system [18] to enable context-specific soundscapes (reflecting a particular flight's destination or origin, for instance) to be experienced by boarding or deplaning travelers.

Curved Concourse Wall

Large sections of a curved overhead concourse wall are activated with simple, architecturally integrated mounting points, enabling art to play a prominent role in creating interest over long distances. Standardized threaded inserts provide hanging opportunities. Space for equipment and power are accessible from a catwalk behind the wall, and cabling can be passed through distributed openings in the wall.

Dedicated IP-based video cameras (“ArtCams”) can be flexibly repositioned along the wall, allowing input for active artwork located anywhere in the airport, plus visual monitoring of artwork for maintenance.

Baggage Claim Projection

As travelers await their bags, their attention is focused on the moving belt. Projectors and a video tracking system integrated into the ceiling allow artists to augment the flowing stream of luggage with projected interventions that respond to the presence of the bags.

Reactive Wall

Centrally located between arrivals and departures on the main level is a space outside the restrooms where people often stand and wait with their travel companions' bags. It is also the wall with the least natural light in the airport, due to the low ceiling. Two edge-blended projectors are concealed in the ceiling, and a removable front wall with access behind it for equipment and sensors enables projected images to react to passersby.

The first reactive wall commission is a piece by Camille Utterback, *Shifting Time*. The artwork uses tracking from a camera mounted in the ceiling to detect a viewer's location. Video images of San José's past and present are juxtaposed in response to people's movements (Figure 4).

Showcases

Two very large showcases (15' long x 5' wide x 8' tall) were designed for the non-ticketed area between the ticketing lobby and arrivals. This is the only space where both departing and arriving passengers come together. Viewable from all sides, these glass cases (Figure 5) use an architectural support column to support the weight of the ceiling, which also provides concealed space for equipment, power and data, and lighting controls. They include a false floor and ceiling for cable management, as well as removable sliding panels and rails for flexible display opportunities.

Another long and shallow display case (48' long x 8' high x 1' deep) is integrated into the long wall leading to security. This case also incorporates concealed, ventilated storage with power and data, as well as removable rear panels and floor for cable management.



Figure 3. *Chronos & Kairos* by Banny Banerjee, Matt Gorbet, Susan LK Gorbet, and Margaret Orth. Collection of the City of San José. © 2010 Banny Banerjee et al. Photo © 2010 James Lin.



Figure 4. *Shifting Time* by Camille Utterback. Collection of the City of San José. © 2010 Camille Utterback. Photo © 2010 Camille Utterback/Creative Nerve.



Figure 5. One of two large showcases, featuring *Small Wonders*, curated by ZeroOne. Collection of the City of San José. © 2010 ZeroOne. Photo © 2010 Matt Gorbet.



Figure 6. *eCloud*, a permanent artwork by Nik Hafermaas, Dan Goods, and Aaron Koblin, uses real-time weather data from around the world (provided by the Art Server) to render cloud forms in thousands of glass “pixels” suspended over the concourse. Collection of the City of San José. © 2010 Nik Hafermaas et al. Photo © 2010 Ben Blackwell.

Technology Systems

An IT infrastructure enables artworks to connect to data sources for input, as well as providing tools for monitoring and maintenance.

Art VLAN

The SJC airport’s integrated network is divided into virtual local area networks (VLANs) for the departments and tenants of the facility (e.g., airlines, operations, security, concessions). The public art program has its own VLAN that is monitored by airport IT staff but configured and maintained by the program to suit the specific needs of artists. Access, security and network protocol restrictions were negotiated with the airport IT department during the design phase. Every artwork-specific terminal location incorporates CAT-6 data connections to the art VLAN, sometimes in unusual places, such as behind ceiling tiles or walls, supporting installation of concealed equipment and sensors.

Art Server

At the heart of the Art VLAN is a Linux-based server aggregating data from various sources, including weather data from the National Oceanic and Atmospheric Administration (NOAA) and flight information from the Airport Operations Database (AODB). APIs and open-source sample scripts for artists’ use (Figure 6) are provided in multiple programming languages.

The Art Server also plays a vital maintenance role, controlling peripherals such as IP video cameras and network-enabled power switches for easy troubleshooting and remote control of lighting and projectors. Access to the Art Server is available on-site or remotely via VPN. A browser-based interface to its functionality has been implemented using the Django web framework [19].

Art Cloud

To provide flexible functionality without full knowledge of future requirements, a second server is implemented using Amazon's EC2 [20] service. This server provides access to data about each piece, including regular status-monitoring "heartbeats" (Figure 7). In addition, the Art Cloud provides a gateway between the highly secured on-site Art VLAN and third-party web services such as the Twilio [21] telephony application, enabling artists to build external application controls for their artwork. Finally, the Art Cloud also hosts a Wiki-based handbook for artists, an inventory system, and other documentation for use in administering the Art Program.



Figure 7. *Space Observer*, a permanent work by Björn Schülke, sends status "heartbeats" to the Art Cloud. Every active artwork can be monitored in this way. Collection of the City of San José. © 2010 Björn Schülke.

Human Systems

An essential part of the Art Activation infrastructure is the human element. Human systems maintain and enhance the infrastructure and its capabilities, ensuring the long-term viability of this complex and dynamic program in the real-world context of the Airport.

Art Technician

The Art Technician is an individual with a technical background and an understanding of art practice who acts as support for planning, installation, and ongoing maintenance of the artwork. This part-time contract position has full understanding of the art program IT infrastructure and works to maintain and extend it as the program grows. The Art Technician's role includes:

- Working with artists in advance to help them navigate the airport tech environment
- Helping artists plan technology decisions for easier maintenance and better fit with the airport systems
- Acting as liaison between the art program and the airport IT, Facilities, and Operations

- Helping with installation logistics
- Monitoring day-to-day status of airport artwork
- Responding to on-site problems with artwork, and contacting artists for troubleshooting
- Maintaining the Airport Art Program infrastructure, including troubleshooting and making changes as needed
- Updating the inventory system for pieces of the Airport Art infrastructure, including current location and status

The Art Technician has dedicated office, storage, and workbench space at the airport.

Airport Art Handbook

The Airport Art Handbook informs participating artists and other stakeholders, such as program staff, about the infrastructure. From receiving a commission to guidelines for creating work in the airport to installation to maintenance, all parts of the process are documented. The Handbook is implemented using MediaWiki [22] to act as an ongoing repository for experience gained as the program grows. It is editable by the Art Technician, the OCA staff, and the artists.

Close Cooperation with Airport Operations

The program can only succeed into the future if airport staff such as IT personnel, groundside operations, security, and maintenance staff remain aware of the artwork, understand its intent and functioning, and know how to work with and around it. The OCA staff actively maintain relationships with key advocates at the airport in order to foster a sense of ownership and pride in the collection, meaning it will be looked after and promoted.

Reflections

Though the infrastructure and the Art+Technology program are still very new and designed to evolve over time, it is worth noting some of the successes and surprises encountered so far. As of this writing, the airport has been open for nine months and has been through only one initial round of commissions, so several of the elements, such as the integrated API for mobile device interaction and the mounting system on the large Curved Concourse Wall, have not yet been used by artists.

The first ten rotating and three permanent artworks were installed simultaneously with the completion of the building, and in parallel with the final implementation of the technology infrastructure. One drawback of this was that maintenance documentation was not initially available for all artworks (and is still being compiled for some). Further, the Art Technician was hired after installation of the first round of artworks had begun, so he had a lot of learning to do very quickly.

The collection has experienced understandable maintenance issues with several pieces, in particular those with moving parts or water. This was anticipated, and the presence of the Art Technician has been enormously helpful, as has the presence of ArtCams and the ArtVLAN for monitoring and remotely diagnosing the work.

The experimental and dynamic nature of much of the work means that some of the artists have continued to contribute, tweaking software parameters and making adjustments to the behavior

of their pieces. This ongoing relationship is facilitated by the artworks' being online and software-based, and raises logistical, contractual, and theoretical questions about when a work is "complete." See [23, 24] for further general discussion of these issues.

In addition to the artworks that are currently installed, three other artists were originally offered commissions in the initial round. One artwork was not completed due to the artist's lack of time to engage appropriately with the demands of the infrastructure. One artwork was not approved by the Public Art Commission in the design development phase due to difficulty designing within the required constraints of the platform, and one commissioned work has been delayed due to unforeseen technical issues with the artwork. One of the "pilot" artworks in the collection is also likely to undergo revisions, as its impact on the travelling public has not been as strong as desired by the artist or by the Public Art program. Such conditions illustrate the need for commissioned artists to be aware of the infrastructure's specific constraints, the importance of strong oversight during the commissioning and design process, as well as flexibility with management of the work once installed. Now that the constraints and possibilities of the infrastructure have become more tangible, it will be easier for future curatorial teams to match artists to the platform opportunities.

Going forward, there are many possible ways for the San José Public Art program to approach commissioning new rounds of artwork for the airport (guest curatorial teams can be established, proposals can be solicited, residencies can be created, etc.). Every approach has its own ideological, political, procedural, and practical ramifications. We view this as a healthy situation, as curatorial practices, notions of "site-specificity" and "community" are continuously shifting in public art discourse. Art historian Miwon Kwon describes the "resilience of the concept of site-specificity, as indicated by its many permutations" [25]. In fact, during the course of the Art Activation project, San José's Office of Cultural Affairs produced a new master plan for the city's Public Art program [26] which recommends new approaches to such issues as site-specificity and community engagement.

By integrating closely with the architecture, while providing abundant potential for bold commissioning opportunities, the SJC Art Activation infrastructure is designed to accommodate flexibility of curatorial and stylistic strategies in addition to ever-changing technological opportunities.

Conclusions

Technology presents artists with ever-evolving opportunities for creative expression, demanding a flexible art program that can easily evolve. The practical constraints of a functioning airport, on the other hand, demand a high level of standardization, forethought, and structure.

The Art Activation infrastructure at SJC bridges these two worlds, offering a simple and flexible kit of parts that mediates between the structures and systems of the airport and the creative potential of artists. This enables new opportunities to enhance the experience of the airport while providing a robust framework for the ongoing maintenance and evolution of the program.

As the San José Airport Public Art Program evolves and embraces different curatorial and aesthetic approaches, we are hopeful and confident that the activation infrastructure at the airport will evolve as well, continuing to support meaningful, engaging, and groundbreaking work – in collaboration with the future.

Acknowledgments

Special thanks to Mary Rubin, Senior Project Manager with the City of San José Office of Cultural Affairs, without whose dedication and creative problem-solving the Art Activation project would not have been possible. Thanks also to Barbara Goldstein and to members of the Airport Art Program Oversight Committee for their faith in the project's vision and their critical input.

References

1. Troika, *Cloud* (2008), retrieved January 13, 2011, from www.troika.uk.com/cloud?image=17.
2. C. Moeller, *Daisy* (2008), retrieved January 13, 2011, from www.christian-moeller.com/display.php?project_id=60.
3. C. Janney, *Circling* (2005), retrieved March 22, 2011, from www.dfairport.com/art/Pt_017254.php.
4. Electroland, *Connection* (2008), retrieved March 22, 2011, from electroland.net/projects/connection.
5. ARS Electronica Center, retrieved January 13, 2011, from www.aec.at/center_exhibitions_en.php.
6. Center for Art and Media (ZKM), retrieved January 13, 2011, from on1.zkm.de/zkm/e/about.
7. phaeno, retrieved March 22, 2011, from www.phaeno.de/en/index-en.html.
8. NTT InterCommunication Center (ICC), retrieved March 22, 2011, from www.ntticc.or.jp/About/introduction.html.
9. The Rome Group and the San José Office of Cultural Affairs, *Norman Y. Mineta San José International Airport Public Art Master Plan* (2004), retrieved from www.sanjoseculture.org/downloads/SJA_MasterPlan.pdf.
10. *Ibid.*, p. ii.
11. *Ibid.*, p. 13.
12. *Ibid.*, p. 27.
13. *Ibid.*, p. 26.
14. Gorbet+Banerjee and the San José Office of Cultural Affairs, *Norman Y. Mineta San José International Airport Art Activation Research Report* (2005), retrieved from www.sanjoseculture.org/downloads/ArtActivationTeamResearchReport805.pdf.
15. Climate Clock Initiative, City of San José Public Art Program, retrieved March 22, 2011, from sj-climateclock.org/sjpublicart.
16. Gorbet+Banerjee and the San José Office of Cultural Affairs, *Norman Y. Mineta San José International Airport Art Activation Design Development Proposal* (2006), retrieved from www.sanjoseculture.org/downloads/Mineta_AAAP.pdf.
17. Gorbet+Banerjee and the San José Office of Cultural Affairs, *Norman Y. Mineta San José International Airport Art Activation Design Development Proposal #2 TAIP: Terminal B Phase I / Terminal A* (2005), retrieved from www.sanjoseculture.org/downloads/AATDDOct07.pdf.
18. Richmond Sound Design Ltd., Audiobox II, retrieved January 11, 2011, from www.richmondsounddesign.com/audiobox-ii.html.
19. Django Software Foundation, Django Web Framework, retrieved January 13, 2011, from www.djangoproject.com/.
20. Amazon Web Services LLC, Amazon Elastic Compute Cloud, retrieved January 13, 2011, from <http://aws.amazon.com/ec2/>.
21. Twilio, Inc., Twilio Cloud Communications, retrieved January 12, 2011, from www.twilio.com/.
22. Wikimedia Foundation, Mediawiki, retrieved January 12, 2011, from www.mediawiki.org/.
23. S. Dietz, "Collecting New-Media Art: Just Like Anything Else, Only Different," *Collecting the New: Museums and Contemporary Art*, ed. B. Altshuler (Princeton, NJ: Princeton University Press, 2005) 85–101, retrieved March 22, 2011, from www.neme.org/524/collecting-new-media-art.

24. A. Depocas, J. Ippolito, and C. Jones, eds., *Permanence Through Change: The Variable Media Approach* (New York: The Solomon R. Guggenheim Foundation and Montréal: The Daniel Langlois Foundation for Art, Science, and Technology, 2003), retrieved March 22, 2011, from www.variablemedia.net/e/preserving/html/var_pub_index.html.
25. M. Kwon, *One Place After Another* (Cambridge: MIT Press, 2002), MIT Press paperback edition, 2004, p. 8.
26. Brown and Keener Bressi, Via Partnership, and the San José Office of Cultural Affairs, *Public Art NEXT! San José's New Public Art Master Plan* (2007), retrieved from www.sanjoseculture.org/downloads/PA_Next031307.pdf.



Annick Bureau

Annick Bureau is an independent art critic, curator, event organizer, researcher, and teacher of arts and technosciences. She is the director of Leonardo/Olats (www.olats.org), the European sister organization to Leonardo/Isast (www.leonardo.info), and is a contributor to the French contemporary art magazine *Art Press*. She has organized many symposia, conferences, and workshops, including Artmedia VIII: From Aesthetics of Communication to Net Art, Paris, 2002; and Visibility – Legibility of Space Art. Art and Zero Gravity: The Experience of Parabolic Flight, Paris, 2003. In 2009 she co-curated the exhibition (Un)Inhabitable? Art of Extreme Environments, Festival @rt Outsiders, MEP/European House of Photography, Paris. Her current research focuses on art and extreme environments, art and smart textiles, and art and non-humans.

Michael Hohl

Michael Hohl graduated in 2000 in visual communication/digital media design from the Universität der Künste Berlin. During his studies he also worked as a designer and consultant for several Berlin-based media companies, such as ImStall, Pixelpark, and Cityscope. In 2006 he completed an interdisciplinary practice-based PhD in fine art and computer science at Sheffield Hallam University, United Kingdom. His research interests lie in telematics, data visualization, and ambient displays. He has published in journals for the arts, design, and the computer sciences. At present he is a research fellow in design at the University of Huddersfield, UK, where he teaches information systems and also advises staff on art and design research methods and methodologies. In March 2011 he organized the ADS-VIS2011: Making Visible the Invisible: Art, Design and Science in Data Visualisation conference.

Frank Dufour

Frank Dufour has been a sound designer and hypermedia designer for over 25 years. He holds a bachelor's degree in film, a master's degree in hypermedia design, and a PhD in digital audiovisual. His current research is in psycho-acoustics on the development of a system of phenomenological/ecological units to describe the perception of changes and movements in time-based arts. A recent outcome of this research is the exploration of *Acoustic Shadows*: the auditory perception of the movements of silent objects in noisy environments. He is currently teaching undergraduate and graduate classes in sound design and sound art in the Arts and Technology (ATEC) program in the School of Arts and Humanities at the University of Texas at Dallas, and serves as an advisor for the PhD students in Arts and Technology.

Victoria Szabo

Victoria Szabo is an assistant research professor in visual studies and new media in the Department of Art, Art History & Visual Studies at Duke University. She is also the program director for information science and information studies, and teaches in the new MFA program in experimental and documentary arts. Her work focuses on digital media authorship in scholarly contexts, with special attention to virtual worlds, geotemporal platforms, and immersive narrative environments. She was the chair of the Information Aesthetics Showcase at SIGGRAPH 2009. She holds a PhD in English, with a certificate in gender and women's studies from the University of Rochester.

Tracing Home



Tomorrow will get better.
© 2007 Matthew Cox.

Introduction

Mona Kasra

In recent years, our highly mediated and networked communications environment has further connected us, overcoming physical distances and territorial boundaries. The telematically assisted interplay of physical and virtual within our lived experiences has gradually transformed our engagement with the world, made us less dependent on physical space, and enabled us to reside, simultaneously and discontinuously, in a multitude of deterritorialized, ubiquitous places at the touch of a button, echo of a voice, or nudge of a sensor. Not only has this degree of virtual interconnectivity and hyperconnectivity altered and dematerialized our sense of body, space, and time, but it has also reconfigured our relations with ourselves, with one another, and with the physical and digital environments we inhabit. As we embrace the new dynamics of the 21st century's connectivity and existence, we begin to wonder: where – and what – is home?

The juried selection for Tracing Home, the SIGGRAPH 2011 Art Gallery, exhibits a diverse range of digital artworks that explore the concept of home in the age of networked technology. Inspired by the new life trajectories in an integrated global community where human relations and perceptions are conceived through various manifestations of a non-physical world of connections, the participating artists respond to the main theme of the exhibition and examine current cultural, emotional, structural, or metaphorical definitions of home, or construct new realities, experiences, and meanings. They creatively plug into the variety of mediated reality sub-themes and draw attention to the shift in humanity's sense of identity, place, and belonging, and offer new interpretations for familiar concepts such as intimacy, loss, and desire.

Whether tracing home as a personal or a universal concept, the artworks selected for this exhibition utilize a combination of digital and analog technologies to mediate fresh perspectives and consolidate different discourses around home in the 21st century. Together, they either alter time and space by eliminating physical distances and transporting viewers to faraway locations, or stir a sense of nostalgia through virtual recollections and simulated objects and interactions. In addition, they respond to various issues of our time, such as surveillance, privacy, control, disasters, immigration, spirituality, and companionship in order to comment on the social, political, and cultural attributes of the contemporary home apart from its physicality.

A significant commonality among the artworks assembled for Tracing Home is their preoccupation with the interaction between physical and virtual, actively trying to blur the line between the two – at times even attempting to occupy or operate both. They trigger viewers to question the reality of what they are confronting without fetishizing or celebrating one realm over the other. For these works, virtual and physical are only different representations of a single hybrid reality, and separation of technology from culture, or virtual from physical, is perhaps nothing but a hopeless task.

Mona Kasra

UNIVERSITY OF TEXAS AT DALLAS

Julie Andreyev and Simon Overstall

Julie Andreyev

Simon Overstall

Emily Carr University of Art + Design

Vancouver, British Columbia

Canada

julie@animallover.ca

www.animallover.ca

Wait

The human–companion species relationship is the starting point for the critique explored in *Wait*. *Wait* is part of the larger *Animal Lover* body of work, which is situated within a developing area of artistic practice referred to as “interspecies collaboration.” Contemporary cultures for the most part consider animals in terms of consumption: as food source, experimental subject, ecological resource, entertainment, etc. Critical to *Animal Lover* are questions and critiques addressing human relations with non-humans, particularly companion species. These works reconsider the animal as conscious, expressive, and creative, with complex states of being different from, but potentially as rich as, those of humans. In *Wait*, human and canine communication methods are brought to bear within an interactive video installation. The piece uses interactive technologies that track the physical presence and movement of visitors to the work, allowing for direct contribution to the creation of meaning. Taking cues from the movements of the visitor, the dog (as imaged in the video) points to the relationship of control. The dog appears to be waiting for direction – looking directly at the visitor, implying a state of suspended urgency. Visitors are compelled to ask questions about their relationship to the dog. In this way, the piece depicts the complex relationship between humans and companion species who share the domestic space. For the most part, companions such as dogs, cats, and birds are subject to conditions of human dwelling (home) and the systems and codes of power, space, and communication associated with it. *Wait* was produced in partnership with Banff New Media Institute, The Banff Centre, Banff, Canada.

Animal Lover logo.

© 2011 Julie Andreyev.



Julie Andreyev is an artist involved in two areas of practice: *Four Wheel Drift* (www.fourwheel-drift.com) examines the social and spatial character of the city using mobility, performance, and participatory engagement; *Animal Lover* (www.animallover.com) explores animal consciousness and creativity through interactive installation, interspecies collaboration, and video. Andreyev's work has been shown across Canada and in the US, Europe, and Japan in galleries and at media arts festivals. Her work is supported by The Canada Council for the Arts, The British Columbia Arts Council, Foreign Affairs Canada, and The Social Sciences and Humanities Research Council of Canada. She is an associate professor at Emily Carr University of Art + Design in Vancouver and artistic director of Interactive Futures (www.interactivefutures.ca).



Wait. © 2011 Julie Andreyev.

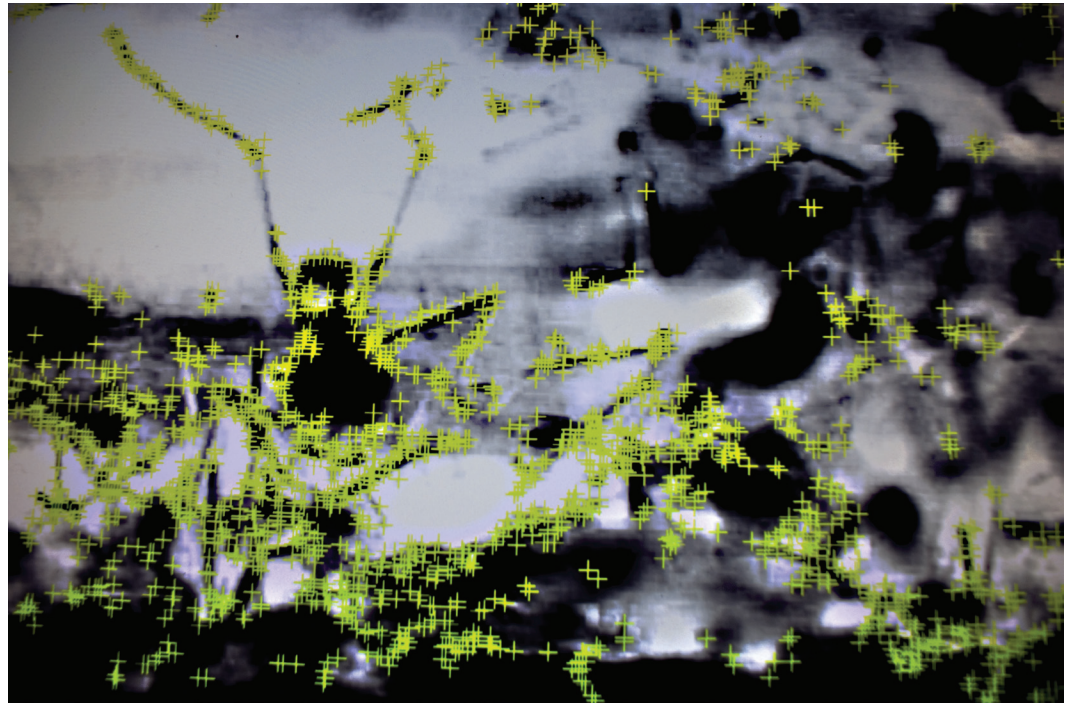
Simon Lysander Overstall is an artist working in digital arts and new media, in particular audio art and music. He has a BFA in music composition from the School for Contemporary Arts at Simon Fraser University and an associate's diploma in music (jazz) from Malaspina University-College. He has produced sound designs and compositions for dance, theater, and installations. In addition, he designs software for both performance systems and installations. Currently, he is a research technician at Intersections Digital Studios at Emily Carr University of Art + Design in Vancouver.

Kuai Shen Auson

Kunsthochschule für Medien Köln
Cologne, Germany
yo@kuaishen.tv

www.kuaishen.tv/Ohm1gas

Oh!m1gas: biomimetic stridulation environment



Oh!m1gas: biomimetic stridulation environment. © 2010 Kuai Shen Auson.

Oh!m1gas: biomimetic stridulation environment is an installation-based exploration of a socially responsible art form, drawing on sustainable organic materials (in this case, a live ant colony) and stimulating interspecific interactions. As artist Kuai Shen Auson first observed at home in Ecuador, ants represent a natural superorganism which stands out due to its emergent social structure and self-organization. They generate bottom-up structures in order to solve problems by means of a complex network of local interactions. Kuai Shen explores the social similarities and differences between humans and ants through four key areas: cybernetics, autopoiesis, self-organization, and emergence. In this piece, the activity of an ant colony is observed, archiving the ants' movements and sounds inside a digital matrix. A pair of turntables constantly reacts to the changes that emerge from the colony (e.g., recruiting units for defense, task allocation when rebuilding the nest, organizing the harvesting of vegetation), thus spinning vinyl records that produce scratching sounds similar to the original stridulations of some ants. Leafcutter ants use the stridulatory organ, human DJ's use the turntable: a reactive soundscape, which reveals the connection between scratching as an aesthetic expression created by human culture, and the stridulation phenomena of leafcutter ants as a modulation mechanism for communication. Kuai Shen believes we can learn from the way the ants construct their miniature ecosystems. Like them, we can apply an experimental design approach based on organic architecture, where sounds and physical interaction, instead of divided living spaces, promote and consolidate the interaction of life.



Oh!m1gas: biomimetic stridulation environment. © 2010 Kuai Shen Auson.

Kuai Shen Auson was born in Guayaquil, Ecuador. He holds a BA in digital arts and an MA in media arts with honors from the Kunsthochschule für Medien Köln. He has brought his work exploring the cybernetic emergence of ants into new territories, from Quito to New York and now to Cologne. His current research focuses on game design and theory based on his interdisciplinary artistic/scientific work with ants at Cologne Game Lab of the University of Applied Sciences.

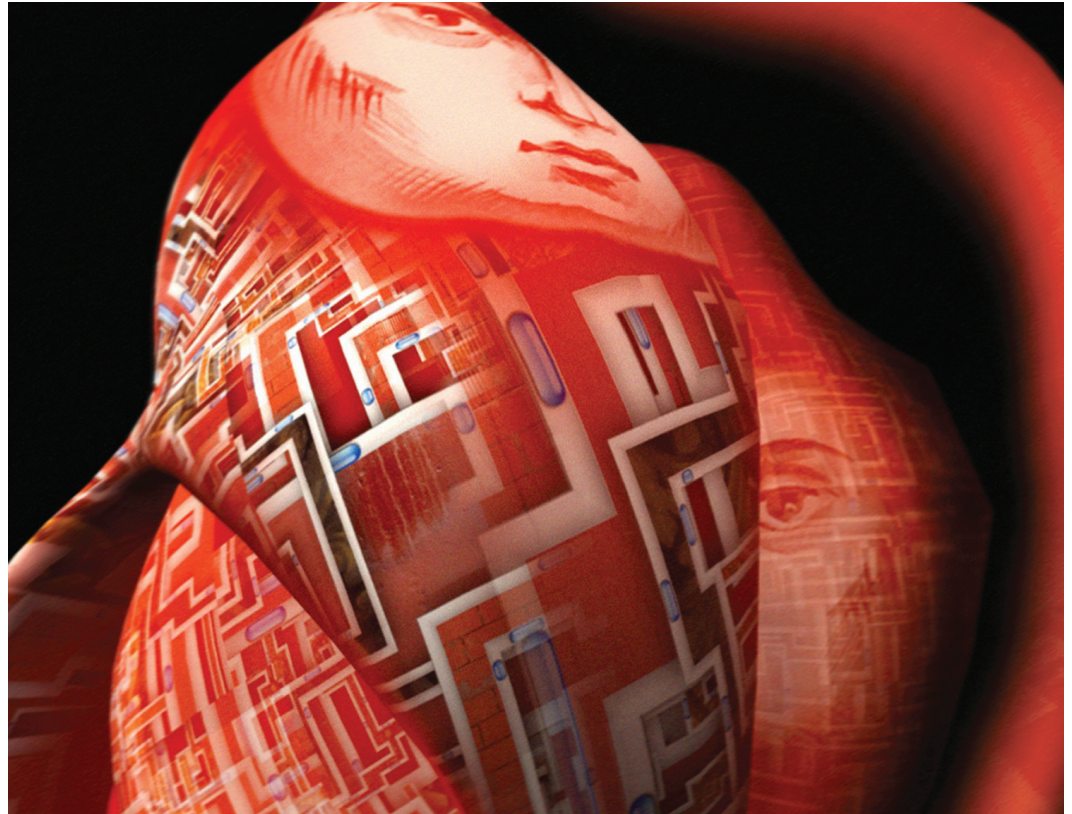
Anya Belkina

Anya Belkina

Emerson College
Boston, Massachusetts
USA
anya_belkina@emerson.edu

www.anyabelkina.com

MOSTON



MOSTON. © 2011 Anya Belkina.

Ideas and observations stemming from bicultural experience and the larger issues of identity, immigration, and globalization are central to Anya Belkina's work. She fuses art with inquiry in the areas of biology, physics, and computer science. *MOSTON*, a 12-foot-tall suspended inflatable sculpture, embodies an internal conception of home and the cyberfusion of two geographically distant locales: Moscow and Boston. Its surface design of printed artwork and documentary footage projection explores visual and historical commonalities of the two cities, commonalities that are more easily researched, documented, and shared in the era of instant global networking. While *MOSTON*'s three-dimensional form references ethnically specific artifacts, the visual appeal and conceptual ingenuity of *matryoshkas* reach audiences beyond Russia and the Russian diaspora. A universally understood symbol of sequential creation, these toys offer a fitting framework for evoking the concentric evolution of Moscow's and Boston's city armatures. The implied nestedness of *MOSTON* is also congruent with the layered mental construct of "home," especially as perceived by individuals with multicultural backgrounds. Belkina describes the scale of the project as essential, not only because her motherland is the largest country in the world, with an impressive record of pursuing hopeless megalomaniac ventures, but also because "there is no place like home."

Anya Belkina is assistant professor of new media at Emerson College in Boston. Prior to joining Emerson in 2007, she held the position of assistant professor in the practice of art at Duke University. Belkina received her MFA from the University of California, San Diego, and her BFA from the Rhode Island School of Design. In Russia, she studied at the Moscow Art College in Memory of 1905. Belkina's work in the area of new media has been presented nationally and abroad at conventional exhibition venues, as well as in the form of large-scale site-specific installations, video projections, broadcast media, and cover art for literary journals. Her award-winning animated shorts have screened at numerous national and international venues, including SIGGRAPH, ANIMATOR, RIIFF, the Boston Museum of Fine Arts, and The Light Factory Museum in Charlotte, North Carolina.



MOSTON. © 2011 Anya Belkina.



MOSTON. © 2011 Anya Belkina.

Michael Bielicky and Kamila B. Richter

Michael Bielicky

HFG/ZKM Karlsruhe
Karlsruhe, Germany
mbielicky@hfg-karlsruhe.de

Kamila B. Richter

HFG/ZKM Karlsruhe
Karlsruhe, Germany

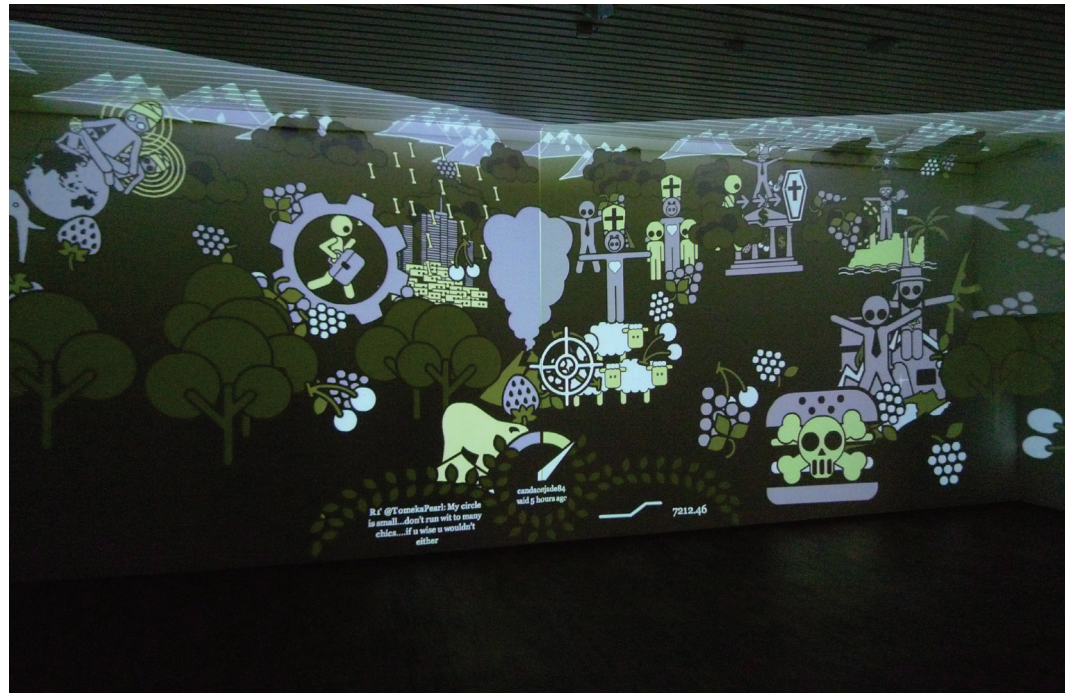
Programmer: Dirk Reinbold
Sound: Lorenz Schwarz

www.gardenoferroranddecay.net

The Garden of Error and Decay.

© 2011 Michael Bielicky and
Kamila B. Richter.

The Garden of Error and Decay



The Garden of Error and Decay is a poetic visualization of real-time world catastrophes. It reflects on the network media reality of the 21st century through a continuous story of current world disasters, expressed by animated pictograms. Every time a disaster-related topic is discussed on Twitter, a new animation appears. Stock exchange information also influences the storytelling. Users interacting with the Garden have the opportunity to either eliminate or multiply the disaster scenes with a shooting device. However, it is not the user who actually has the power to decide in which direction the story develops once an event is triggered. As in real life, everything is driven by stock exchange dynamics; these dictate whether disasters proliferate or die down. This innovative moving image format is not a film, not a game, and not a nonlinear interactive story, but instead a real-time, data-driven narrative.



The Garden of Error and Decay.
© 2011 Michael Bielicky and
Kamila B. Richter.

Michael Bielicky founded and was a professor in the New Media department at the Academy of Fine Arts in Prague. Since 2006 he has been a professor of digital media art at the Staatliche Hochschule für Gestaltung Karlsruhe and the Zentrum für Kunst und Medientechnologie Karlsruhe. Over the past 25 years, he has participated in many international exhibitions, festivals, and symposia. His work uses communication, navigation, video, and VR technologies and, most recently, real-time web-based information technologies. He has exhibited at ZKM Karlsruhe, Ars Electronica Linz, High Tech Center Berlin-Babelsberg, Centre Pompidou Paris, MoMA New York, the National Gallery in Prague, Kunsthaus Zürich, and many other venues around the world.

Born in Olomouc, Czechoslovak Socialist Republic, Kamila B. Richter earned her MFA (2001) and PhD (2010) at the Academy of Fine Arts in Prague. From 2000 to 2002, she lived in the Republic of South Africa (Durban, Johannesburg) and studied at Technikon Natal, Durban. Richter has participated in many national and international exhibitions since 1999. She now lives in Düsseldorf, Germany, and operates in public spaces through the media of print and interactive urban screenings.

David Bowen

David Bowen

University of Minnesota
Duluth, Minnesota
USA
dwbowen@hotmail.com

www.dwbowen.com

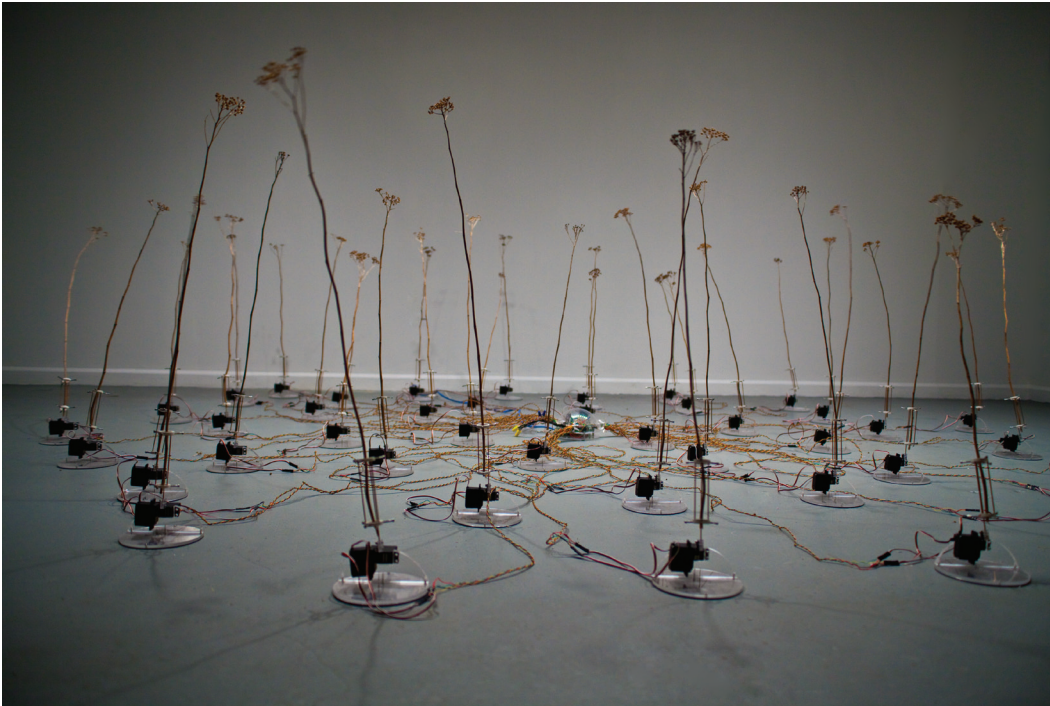
tele-present wind

tele-present wind. © 2011 David Bowen.



David Bowen's work is concerned with aesthetics that result from interactive, reactive, and generative processes as they relate to intersections between natural and mechanical systems. *tele-present wind* consists of a field of x/y tilting devices connected to thin, dried plant stalks installed in the gallery, and a dried plant stalk connected to an accelerometer installed outdoors. When the wind blows, it causes the stalk outside to sway. The accelerometer detects this movement, transmitting it in real time to the grouping of devices in the gallery. The stalks in the gallery space move in unison, based on the movement of the wind outside. Bowen says of his work, "I produce devices and situations that are set in motion to create drawings, movements, compositions, sounds, and objects based on their perception of and interaction with the space and time they occupy. The devices I construct often play the roles of both observer and creator, providing limited and mechanical perspectives of dynamic situations and living objects. The

work is a result of the combination of a particular event and the residue left after the event.” His work thus offers an imperfect and revealing transposition of data. “In some ways, the devices are attempting, often futilely, to simulate or mimic a natural form, system, or function. When the mechanisms fail to replicate the natural system, the result is a completely unique outcome. It is these unpredictable occurrences that I find most fascinating. These outcomes are a collaboration between the natural form or function, the mechanism, and myself. This combination can be seen as an elaborate and even absurd method of capturing qualified data. I see the data collected in this manner as aesthetic data.”



tele-present wind. © 2011 David Bowen.
Photo © 2011 Shannon Di.

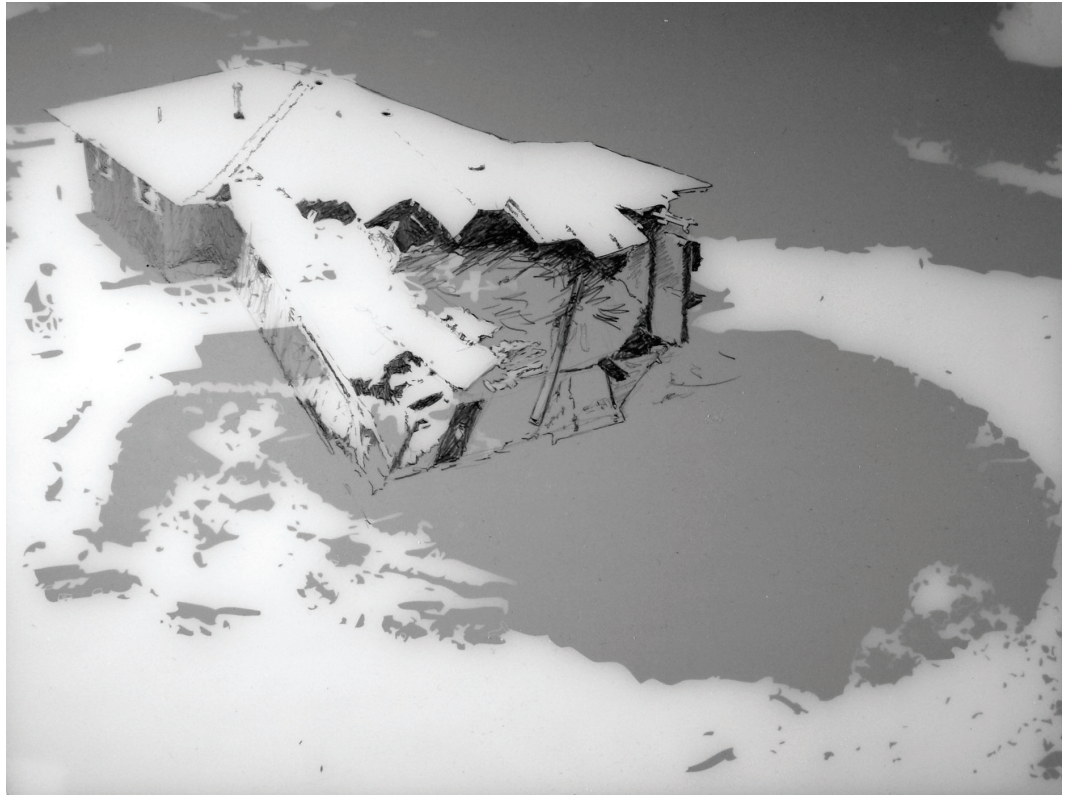
David Bowen is a studio artist and educator. He received his BFA from the Herron School of Art and Design in 1999, and his MFA from the University of Minnesota, Minneapolis, in 2004. He is currently associate professor of sculpture and physical computing at the University of Minnesota, Duluth. His work has been featured in numerous group and solo exhibitions, including *Brainwave* at Exit Art, New York City; *The Japan Media Arts Festival* at The National Art Center, Tokyo; *if/then* at Vox Populi, Philadelphia; *Artbots* at Eyebeam, New York City; and *Data + Art* at The NASA Jet Propulsion Laboratory, Pasadena. His work has been featured in such publications as *Art in America*, *Leonardo*, and *Sculpture Magazine*. He was recently awarded Grand Prize in the Art Division at The Japan Media Arts Festival and Third Prize at the Vida 12.0 Art and Artificial Life International Awards.

Matthew Cox

Matthew Cox
Independent Artist
New York, New York
USA
xocttam@gmail.com

www.mjcox.com

Tomorrow will get better



Tomorrow will get better.
© 2007 Matthew Cox.

Tomorrow will get better is a graphite drawing and laser-cut paper series of homes destroyed by various natural and man-made disasters. The images become ephemeral portraits of the houses that artist Matthew Cox has been “collecting” and using as drawing subjects. He describes them as characters in a narrative, similar to a gothic noir film. This series exhibits the final moments of a home before it is sent to a landfill, a premature burial that no one ever expects. Cox suggests that a relationship between the house and its inhabitants develops and evolves through daily events that take place within the confines of a home. A tragic event will jeopardize the physical stability of the home, resulting in the emotional instability of its inhabitants. The home has the potential to live and die just like its inhabitants, instead of remaining a solid structure built to survive through generations. A home develops character from its exterior surroundings as well as from its interior dialogue with the characters, who create a bond through memories and interactions. What are our attachments to our physical surroundings? How do they strengthen or weaken us? Houses, taken for granted as private property with equity and security, have the potential to reveal our vulnerability when their stability is subtracted from our lives.



Tomorrow will get better.
© 2007 Matthew Cox.

Matthew Cox was born in Baton Rouge, Louisiana, and grew up in Miami, Florida, where he attended Florida International University, receiving a BFA in drawing in 2002. In 2006 he graduated from the University of Miami with an MFA in film. He currently lives and works in New York City.

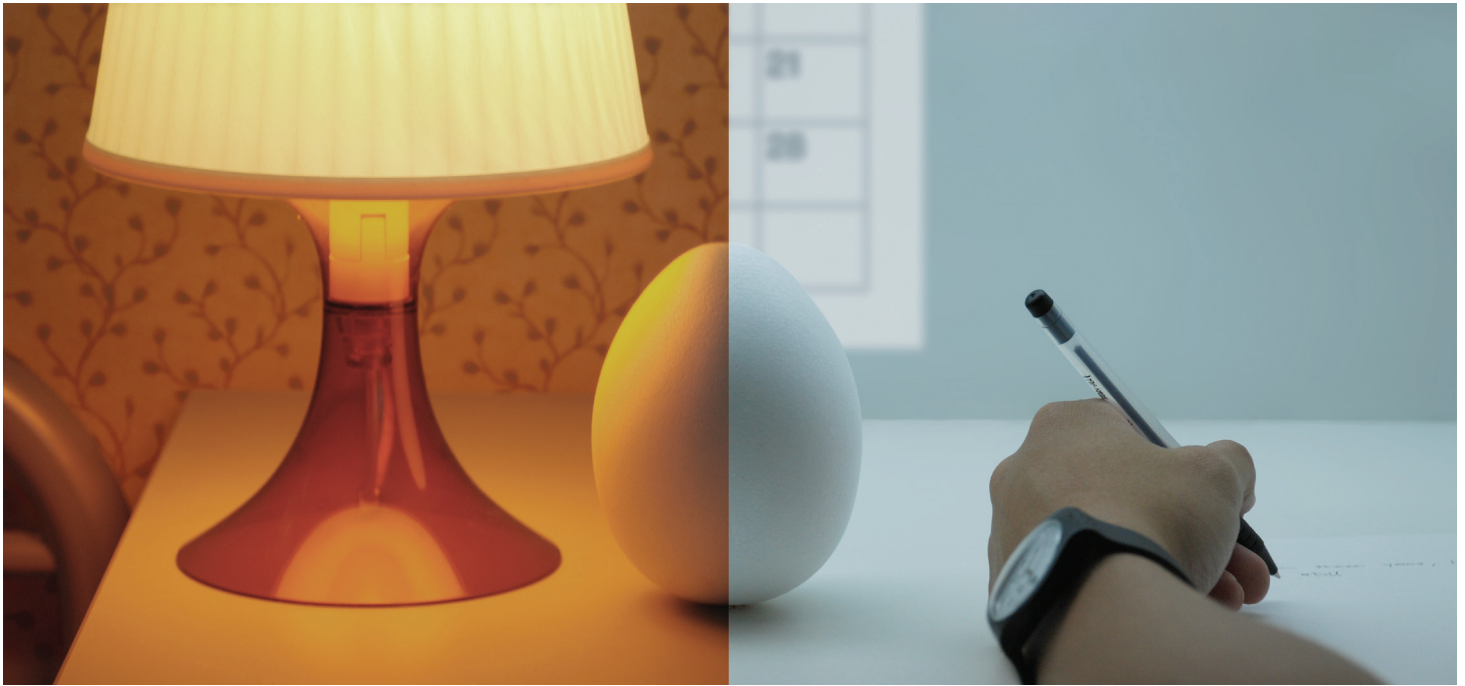
Design Incubation Centre

Design Incubation Centre

Division of Industrial Design
School of Design and Environment
National University of Singapore
Singapore
info@designincubationcentre.com

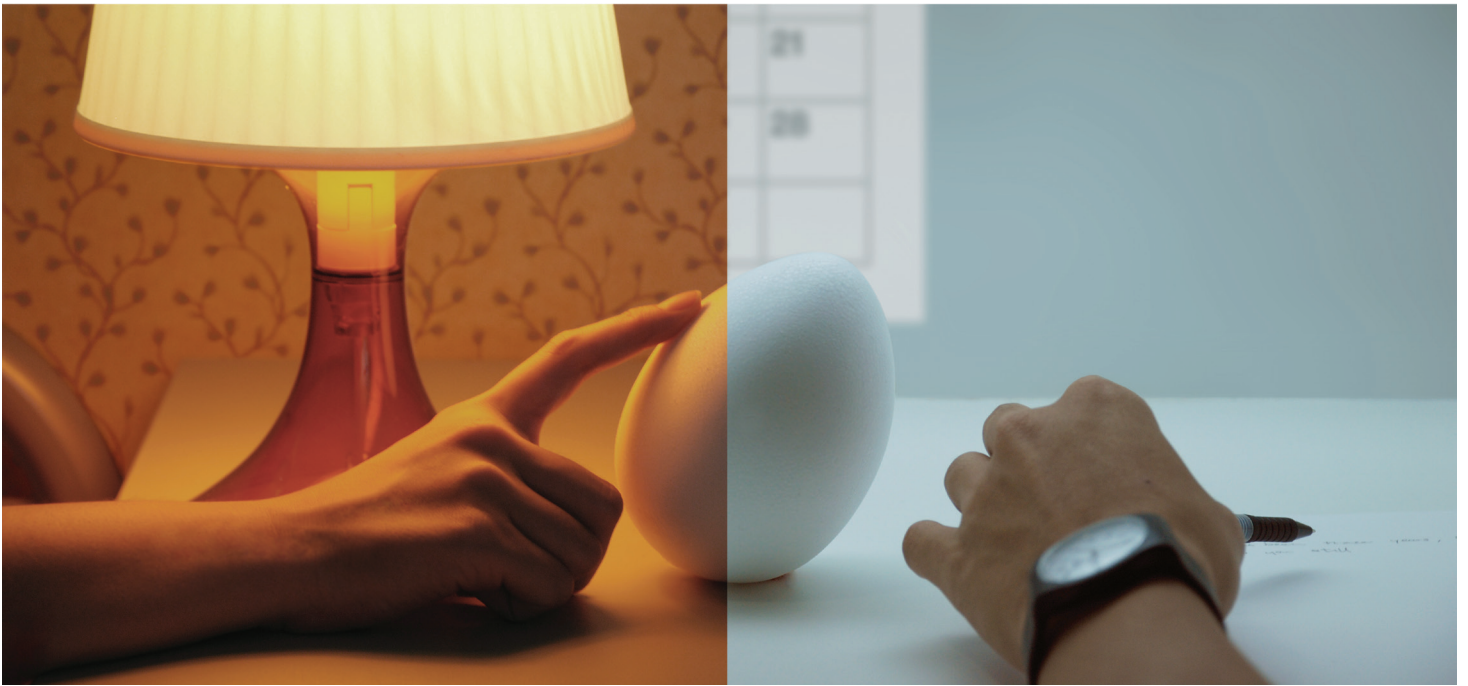
www.designincubationcentre.com

RolyPoly



RolyPoly. © 2011 National University of Singapore.

RolyPoly is a networked installation designed to enable two individuals to “sense” the presence of each other, even though they may be physically apart. The mirrored movements in a pair of *RolyPolys* is such that a soft tap to rock one will simultaneously rock its partner to the same degree, instantly creating a corresponding reaction in the other. While the Internet provides a vast array of text messaging and video interaction options, *RolyPoly* offers a unique, spontaneous, and subtle mode of instant communication, exclusively between two individuals. *RolyPoly* addresses the phenomenon of people living apart and examines gesture as a different mode of communication from speech and text. Through gestures, one is able to bring intimate familiarity to the other party, even when miles apart.



The Design Incubation Centre is a design research laboratory that investigates and develops innovative tools to find new possibilities for the practice of design through projects that analyze emerging and evolving human needs, technologies, and social trends. The Design Incubation Centre is part of the Division of Industrial Design at the School of Design and Environment, National University of Singapore.

RolyPoly. © 2011 National University of Singapore.

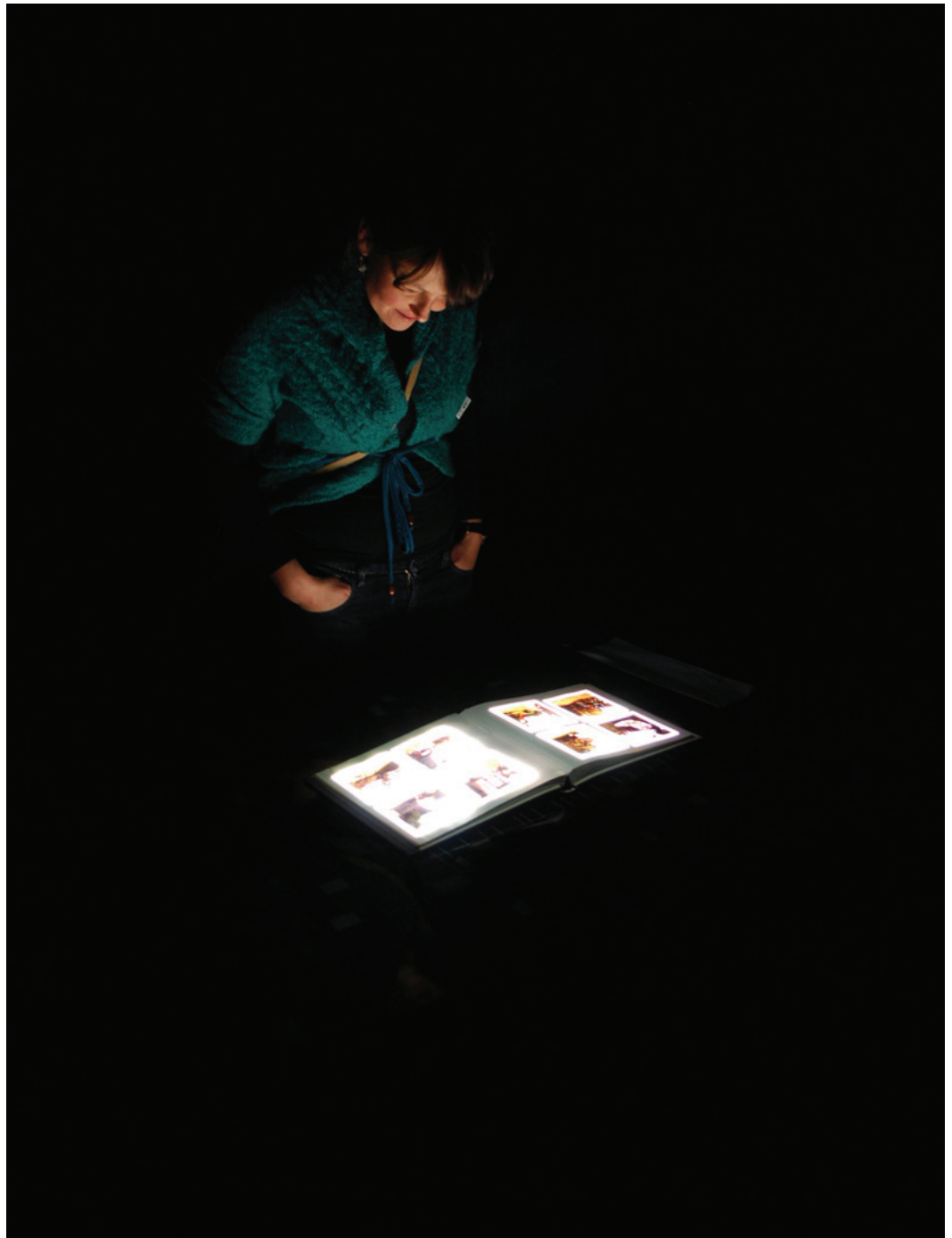
Philipp Engelhardt

Philipp Engelhardt

HfG Karlsruhe
Karlsruhe, Germany
pengelhar@hfg-karlsruhe.de

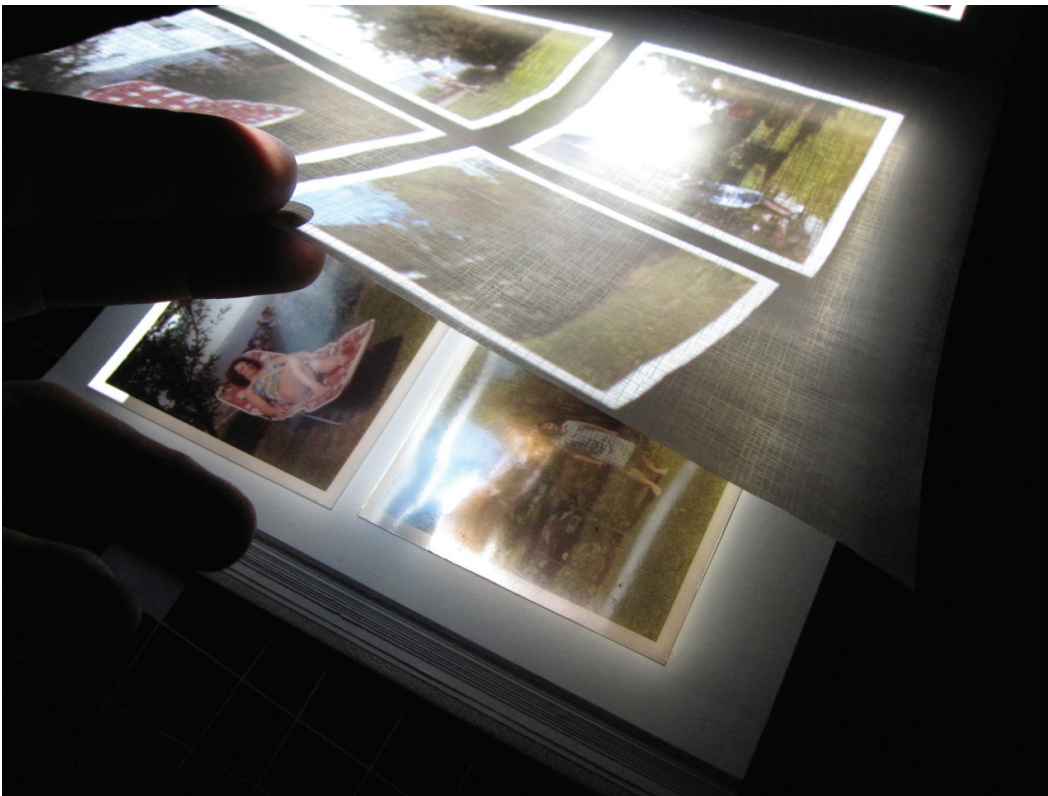
www.piripi.de

Hildapromenade 4



Hildapromenade 4. © 2011 Philipp Engelhardt. Photo © 2010 We Find Wildness, Sophie Yerly.

Philipp Engelhardt's *Hildapromenade 4* installation visualizes the magical “in-between” of a set of photographs from a photo album he found on the street. The piece combines 3D technology and animations with the eight original Polaroid images to allow the spectator to enter the world of the woman shown in the pictures, narrating her story in a new context. Engelhardt uses his own graphical material in combination with the existing images to create his effects. In this way, the images are combined, reconstructed, and repeated so they can be seen in a new context on their own. To the observer, the visible alterations in the pictures are not immediately apparent; the manipulation is seen as the reality which the interface superposes. Engelhardt describes the piece's impact: “*Hildapromenade 4* reflects upon the value of the memories brought together in a photo album. At a time when photographs are increasingly stored on hard drives, and thus seem ever more elusive and intangible, it raises the question of which stories are able to be discovered in such often-unstructured visual material.”



Hildapromenade 4. © 2011 Philipp Engelhardt.

Philipp Engelhardt is from Calw, Germany. From 2006 to 2011, he studied media art at the HfG Karlsruhe with Professors Elger Esser, Michael Bielicky, and Isaac Julien. He is a freelance artist.

Yunsil Heo and Hyunwoo Bang

Yunsil Heo

School of Crafts and Design
Seoul National University
Seoul, South Korea
yunsil@snu.ac.kr

Hyunwoo Bang

School of Mechanical
and Aerospace Engineering
Seoul National University
Seoul, South Korea
savoy@snu.ac.kr

[www.everyware.kr/portfolio/contents/
10_memoires/index.htm](http://www.everyware.kr/portfolio/contents/10_memoires/index.htm)

Memoirs. © 2010 Yunsil Heo and
Hyunwoo Bang.

Memoirs



Memoirs is an interactive installation piece. It is a memoir of humanity's struggle to invent home appliances in pursuit of happiness. The piece is composed of a brown TV tube panel with a Polaroid camera on top. Its antique look stimulates a sense of nostalgia for old-fashioned home appliances. As you come close to the piece, a custom-made Polaroid camera automatically recognizes your face and takes a picture of you, and a physically simulated photo paper falls down and hits the pile of photos inside the virtual interior of the piece. Its digital data travels halfway around the earth to a web server in a distant country. Even though film-based photography is perishing and digital cameras are penetrating everyday objects, nothing can substitute for the feeling of anticipation while waiting for a photo to develop. Like bringing film to the photo printing office, taking a card with a printed web address from a stack creates a space in which to reminisce about the good old days. As you stand in front of the piece, the line between the virtual self and the physical self blurs. With photos stacking up on the web server, participants collectively build and share a single memory through the piece. Because of its intense and antique visual imprint, even when our experience with this piece dims, our shared childhood memories of electronic home appliances will remain.



Memoirs. © 2010 Yunsil Heo and Hyunwoo Bang. Photo © 2010 Jaehong Park, Museum of Art Seoul National University.

Memoirs. © 2010 Yunsil Heo and Hyunwoo Bang.

Yunsil Heo and Hyunwoo Bang are new media artists exploring intuitive and fun communications between the real and virtual worlds. They have exhibited their work at festivals and in galleries, including SIGGRAPH 2008 (Los Angeles), Ars Electronica Center (Linz, Austria), the National Art Center Tokyo, Incheon Digital Art Pavilion (Incheon, Korea), and the Victoria & Albert Museum (London).

Heo earned her MFA at the Department of Design | Media Arts at the University of California, Los Angeles, and is currently pursuing her PhD at Seoul National University. She operates an interactive media design company, New Media Lab Inc., in South Korea.

Bang earned his PhD in mechanical engineering from Seoul National University and worked as a post-doctoral fellow in the Department of BioEngineering at the University of California, Los Angeles. He is now an assistant professor at Seoul National University.

Heidi Kumao

Heidi Kumao

University of Michigan School of Art & Design

Ann Arbor, Michigan

USA

hkumao@umich.edu

www.heidikumao.net

Transplant



Transplant. © 2009 Heidi Kumao.

Emerging from the intersection of sculpture, theater, and engineering, Heidi Kumao's video and machine art generates artistic spectacles in order to visualize the unseen: thought patterns, mental states, emotions, compulsions, and dreams. Through the creation of hybrid art forms (kinetic sculptures, animations, and interactive works), she explores the psychological underpinnings of everyday situations and institutional contexts, such as the nuclear family, mainstream media, and traditional gender roles. *Transplant* explores the lives of Japanese nationals and citizens who were interned in War Relocation Centers in the dusty desert of California during World War II, and how they cultivated gardens as a creative outlet to survive their confinement. Despite the horrendous conditions, residents of these "camps" constructed beautifully landscaped parks, ponds, and rock gardens. *Transplant* pays homage to their ingenuity and personal drive to transform gravel into gardens, altering their built environment as an act of defiance. This piece is part of the project *Timed Release*, a continuing series of intimate theater pieces about surviving confinement, supported by a 2009 Guggenheim Fellowship.



Transplant. © 2009 Heidi Kumao.

Heidi Kumao received her MFA from the School of the Art Institute of Chicago and is an associate professor at the School of Art & Design at the University of Michigan. Kumao has exhibited her work nationally and internationally in one-person exhibitions at the Museo de Arte Moderno, Buenos Aires; Fundació Joan Miró, Barcelona; and Center for the Arts, Yerba Buena Gardens, San Francisco. Group exhibition venues include ZeroOne San Jose, Museo Universitario Arte Contemporáneo in Mexico City, Wing Luke Asian Art Museum in Seattle, and the National Academy Museum in New York City. Her work has been reviewed in *Artforum*, *ArtPapers*, and *Sculpture Magazine*, and is held in a number of private and public collections. She has received fellowships from the Guggenheim Foundation, the Creative Capital Foundation, New York Foundation for the Arts, American Association of University Women, and the National Endowment for the Arts.

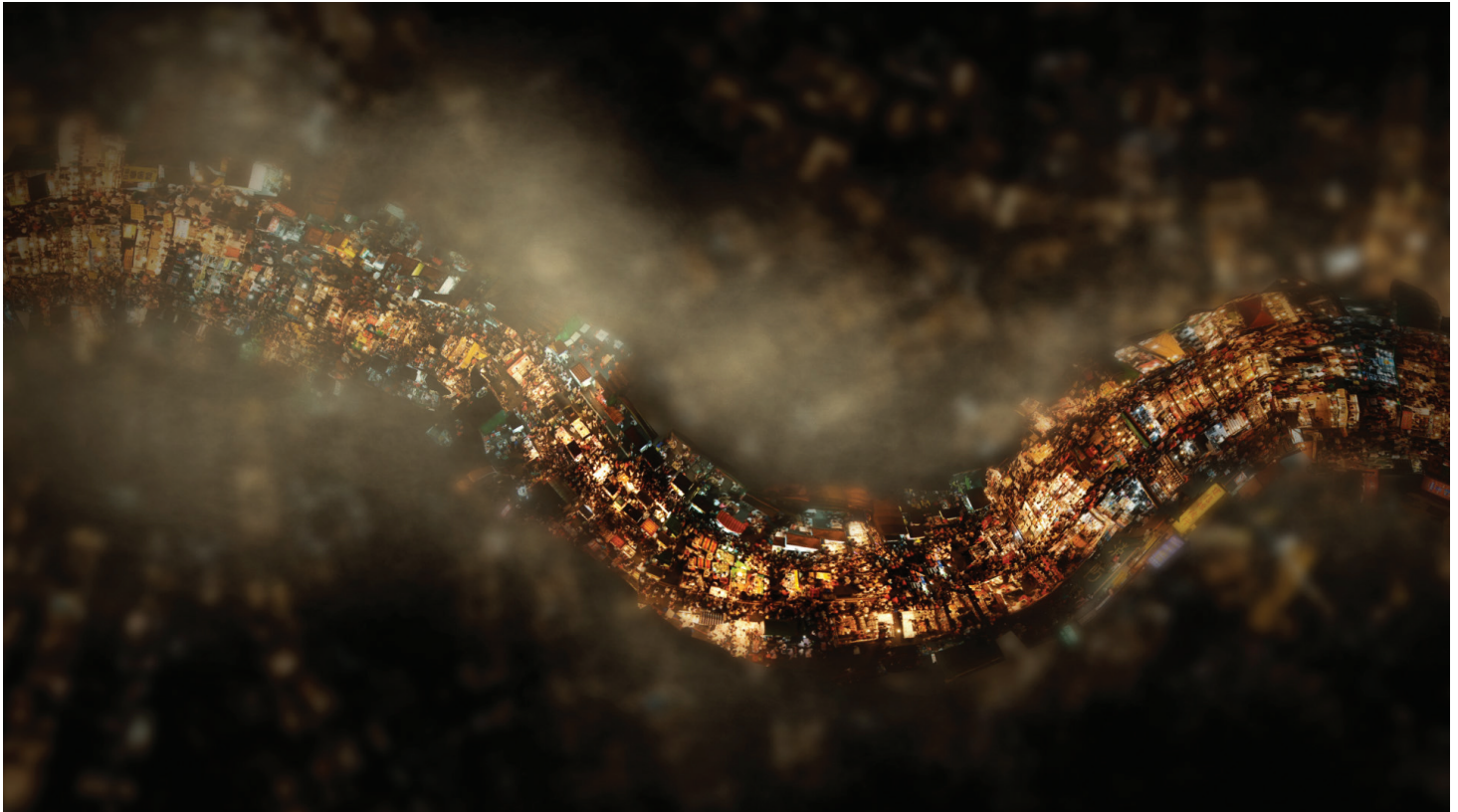
Jawshing Arthur Liou

Jawshing Arthur Liou

Indiana University
Bloomington, Indiana
USA
liou@indiana.edu

www.arthurliou.com

The Insatiable



The Insatiable.
© 2010 Jawshing Arthur Liou.

The Insatiable is a video installation composited from a dozen sets of footage filmed at an open night market in Taiwan. It is part of the *Things that are edible* series, created by artist Jawshing Arthur Liou during an artistic residency in his hometown of Taipei after 16 years of living abroad. Working with both lens-based representation and digital post-production, Liou aims to transform recognizable imagery into realms only the mind can reach. His photographically realistic digital videos are filled with details with which he responds to the experience of illness, spiritual sanctuary, and the spectacles of life. The street scenes here are only half a mile away from his home. The visual strategy is a fusion of macro and micro views. The streetlights and mingling walkers are transformed into bodies of massive creatures, bearing resemblance to snakes, dragons, or even huge intestines. Liou says, “Our intimacy with food and food-related culture makes this my first choice of subject matter. With digital post-production tools, I transformed the night market into massive bodies in the sky, a wedding banquet into jewelry-banded plates, and my mother’s rice dish into landscapes.” In this way he creates “a rewarding treat in and of itself.”



The Insatiable.
© 2010 Jawshing Arthur Liou.

Originally from Taiwan, artist Jawshing Arthur Liou has resided in the US since 1994. He received his MFA in electronic intermedia and photography from the University of Florida. He is currently an associate professor and area head of digital art at Indiana University Bloomington. Liou's videos and prints are held in numerous public and private collections. Recent acquisitions include the Museum of Fine Arts Houston and the Indianapolis Museum of Art. Liou's work has traveled internationally, including exhibitions in New York, Chicago, London, Montréal, Houston, and Taipei. Liou is the recipient of the Garry B. Fritz Award from the Society for Photographic Education, the Rising Star Award at Fotofusion, and an Efroymsen Contemporary Arts Fellowship.

Jacquelyn Martino

Jacquelyn Martino

IBM T.J. Watson Research Center
Yorktown Heights, New York
USA
jacquelyn.martino@gmail.com

www.jacquelynmartino.com

Travel Stones



Travel Stones.
© 2011 Jacquelyn Martino.

For the last decade, Jacquelyn Martino has focused her artistic practice on the design of a rule-based computational language to generate works in the visual design language of her evolving style. *Travel Stones* is an installation that applies this computational language to the creation of a collection of cultural artifacts from a fictitious ancient culture. Martino makes use of her rule system to generate a series of realistic cultural artifacts made plausible by the combination of their consistent design language and their grounding in a number of historical references. In the installation, the viewer reads a museum-style exhibition text detailing the origins of the artifacts. The imagined culture derives from an ancient people who carry their travel stones – much as house keys – as a way to access their home center, which is ultimately more spiritual than physical. The text leads the viewer to believe that the four accompanying paintings document a first-hand exposure to the stones by someone external to the culture. Passed from generation to generation, the stones further serve as resonant objects in the tracing of the people's history. Prompted by the drawings on the stones, the ancients recount tales of their origins to the next generations as well as to those they meet in travel. Through their stories, they maintain their sense of identity and place while simultaneously transferring fragments of their culture to others. In this piece, the enabling algorithmic production system is integral to Martino's process, but not particularly apparent to the viewer. The visual separation of high-tech process from pseudo-historic product calls into question any easy distinction between technology and culture in our own place and time.



Travel Stones.
© 2011 Jacquelyn Martino.

Jacquelyn Martino is an artist-researcher concentrating on emerging forms of computational design and interaction technology. She holds a PhD in design computation from Massachusetts Institute of Technology, an MFA in computer graphics and interactive techniques from Pratt Institute, and a BA in mathematics/computer science from Mount Holyoke College. She is currently a research scientist at The IBM Thomas J. Watson Research Center. Martino combines art, design, and algorithms in a technology-intersected artistic practice. Her current art-research focus is on design computation as it relates to computational drawing and human-computer interaction. Concerned with issues of visual language development within the contexts of exploration of self and cultural relevance, her artwork has been shown in venues such as SIGGRAPH, ISEA, and ArCade. Her written research has been published in peer-reviewed forums as diverse as *Leonardo*, IEEE Visualization (INFOVIS), SIGCHI, and AAAI.

Jack Stenner and Patrick LeMieux

Jack Stenner

University of Florida
Gainesville, Florida
USA
stenner@ufl.edu

Patrick LeMieux

Duke University
Durham, North Carolina
USA
patrick.lemieux@duke.edu

www.no-place.org/open_house

Open House. © 2010 Jack Stenner
and Patrick LeMieux.

Open House



When the US housing market collapsed in 2008, so did the dreams of many middle- and lower-class Americans. Florida, California, Nevada, and Arizona were hit particularly hard, and not by a force of nature, but by the abstract and invisible hand of the market. Prior to the collapse, the movement of global capital seemed like a distant reality to most homeowners, but in the end it was the imaginary systems of value, and not bricks and mortar, that asserted the ultimate authority over our homes. *Open House* is an installation by Jack Stenner and Patrick LeMieux that allows visitors to telematically inhabit a “distressed” home in Gainesville, Florida. The house at 1617 NW 12th Road is currently in financial limbo, while undergoing the process of foreclosure due to the housing collapse. Virtual markets have transformed this otherwise livable property into a ghost house. *Open House* allows individuals to repopulate this disenfranchised space and assume the role of virtual squatters – opening the door, flicking the lights, rattling the shutters, and remotely occupying the abandoned property. Live video feedback integrates real-time physical effects with one’s virtual actions. Through *Open House*, virtual squatters can temporarily resist eviction by mirroring the market and becoming hybrid subjects occupying both virtual and physical space. Like the foolish man who builds his house on sand, we watch the architecture crumble around us. Download *Open House* at www.no-place.org/open_house.



Open House. © 2010 Jack Stenner and Patrick LeMieux.

Jack Stenner is an artist who has worked with technology, video, and installation since the mid-1990s. He is currently an assistant professor of art and technology at the University of Florida, School of Art and Art History. His work addresses issues related to our socio-culturally constructed “reality” and the ways we create meaning. He is interested in “place” and how meaning is embedded, manipulated, and transcoded in the environment. His work explores the construction of a “hybrid subject”: a subject that is neither entirely human nor machinic. Combining techniques from information retrieval and visualization, content analysis, video gaming, computer vision, and experimental video, he seeks to create experiences that encourage us to reconsider what we think we know about our world and to imagine an alternative utopia.



Open House. © 2010 Jack Stenner and Patrick LeMieux.

Patrick LeMieux is an artist and PhD student in the Department of Art, Art History, and Visual Studies at Duke University. His artwork, scholarship, and teaching focus on the ethics of viewership, alternative histories of art, and critical game design. Investigating those puzzles, puns, riddles, and games employed by artists throughout the twentieth century, LeMieux builds “art games” featuring monochromatic mechanics, infinite inactivity, and simulated silence. He has exhibited artwork in the Tampa Museum of Art, Tallahassee Museum of Fine Arts, and the Samuel P. Harn Museum of Art. His scholarly publications are forthcoming in *Digital Humanities Quarterly*, *Electronic Book Review*, and the *Leonardo Electronic Almanac*.

Peter Michael Traub

Peter Michael Traub

Independent Artist
Charlottesville, Virginia
USA
ptraub@virginia.edu

www.petertraub.net

ItSpace

ItSpace. © 2008 Peter Traub.



In the first version of *ItSpace* (2007), artist Peter Traub subverted the convention of the online social network by creating nine profile pages on the web site MySpace that featured everyday objects from his house. Each page had a photo of an object, a description, and, most importantly, a one-minute piece of music composed of recordings of the object being struck and resonated in various ways. The objects were “friends” with each other, and visitors to the site were invited to create new *ItSpace* pages to friend the existing ones. In the physical version of *ItSpace*, the original nine objects are brought partly back into the physical world through photographs affixed to backing boards. Each photo board has a push-button embedded in the featured object. When a visitor presses the button, it triggers a one- to two-minute remix of the object’s sounds in real time. No two remixes are the same, and visitors may press multiple buttons and combine objects to create a collage. From an interface perspective, the interactive possibilities are limited by the push-button switches – similar to how interaction and control on a site like Facebook or MySpace is limited within the tightly controlled confines of the commercial social network. In both the online and physical versions of *ItSpace*, Traub says, “I want visitors to learn something about me that could not fit into the limiting format of a personal profile. Instead, they encounter



ItSpace. © 2008 Peter Traub.

a collection of objects from where I live and listen to how I treat those objects musically and aesthetically. *ItSpace* traces connections, imagined and real, between me and these objects in my home, telling the viewer/listener about the space in which I live in a way that language cannot convey.”

Peter Traub is a composer/installationist/net artist currently living in Charlottesville, Virginia. He received his master’s in electro-acoustic music from Dartmouth College in 1999 and completed his PhD in 2010 in the Composition and Computer Technologies program at the University of Virginia. Between Dartmouth and UVA, Peter lived in the San Francisco Bay Area for five years and worked as a software developer for various internet start-ups. He has composed numerous works of electronic music, net art, and sound installations, and his works have been performed and exhibited internationally. *ItSpace* was featured on National Public Radio’s Day to Day in 2008.

Georgia Wall and Nick Bastis

Georgia Wall

School of the Art Institute of Chicago
Chicago, Illinois
USA
georgiawall@gmail.com

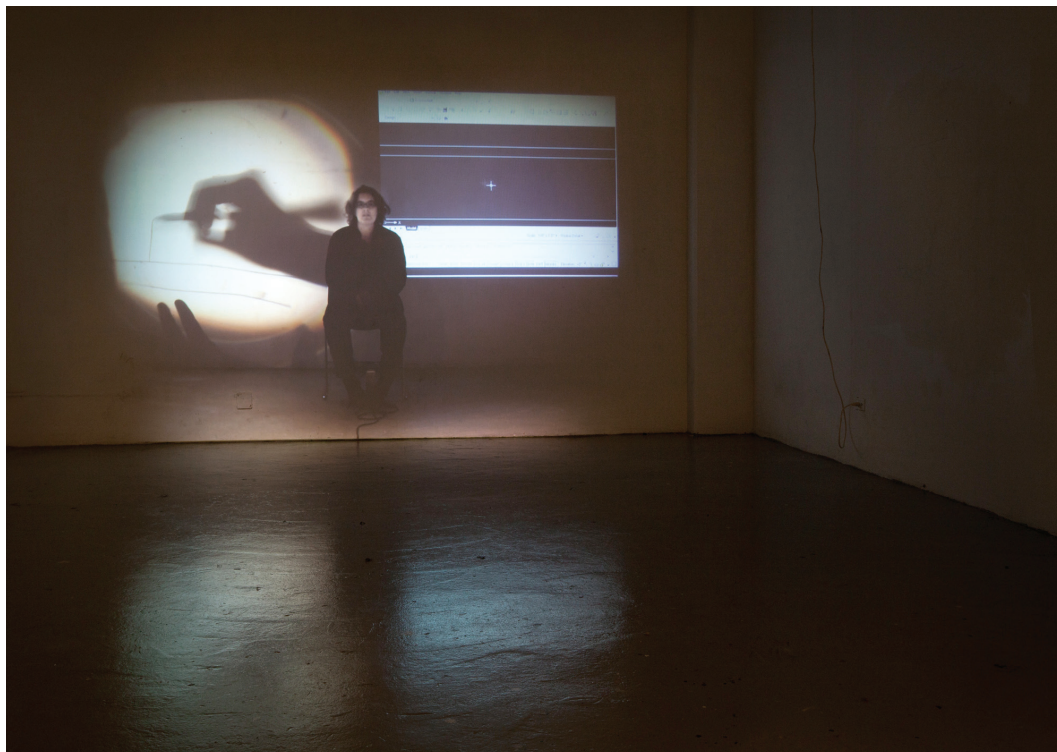
Nick Bastis

University of Chicago
Chicago, Illinois
USA
nbastis@gmail.com

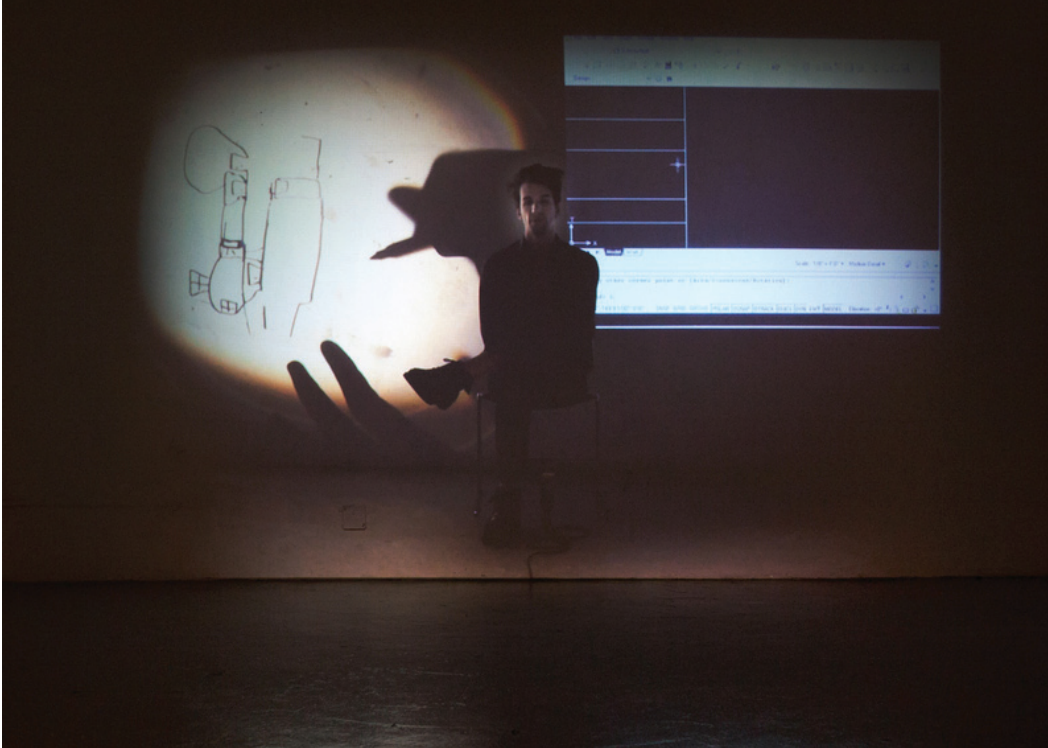
www.georgiawall.com
www.nickbastis.com

Reveries and Line Drawings.
© 2010 Georgia Wall and Nick Bastis.

Reveries and Line Drawings



In *Reveries and Line Drawings*, a projected video piece first shown at the School of the Art Institute of Chicago's New Blood exhibition, artists Georgia Wall and Nick Bastis offer methods in which stored spatial reveries can be recalled and represented using both analog and digital technologies. The piece posits forms in which spaces can be visualized without being physically present through the use of technology and memory. This process was explored with two participants, who visualized places they had never visited: Rebecca Zorach, an art historian at the University of Chicago, visualized Art & Soul, an experimental art center founded by a street gang and the MCA in the Lawndale neighborhood of Chicago that existed from 1968 to 1972; and Andrew Norman Wilson, an MFA candidate at SAIC, visualized the home of his collaborator in Bangalore, India – he has come to know both the person and the place through the internet.



Reveries and Line Drawings.
 © 2010 Georgia Wall and Nick Bastis.

Georgia Wall received her BA in 2008 from Oberlin College in Ohio. She is currently an MFA student at the School of the Art Institute of Chicago. With a background in both dance and visual art, Wall's practice is grounded in performance, but her deliverables often take form through video and audio pieces. Wall has shown work both nationally – in New York, Chicago, and San Francisco – and abroad, in Italy, Turkey, and Canada.

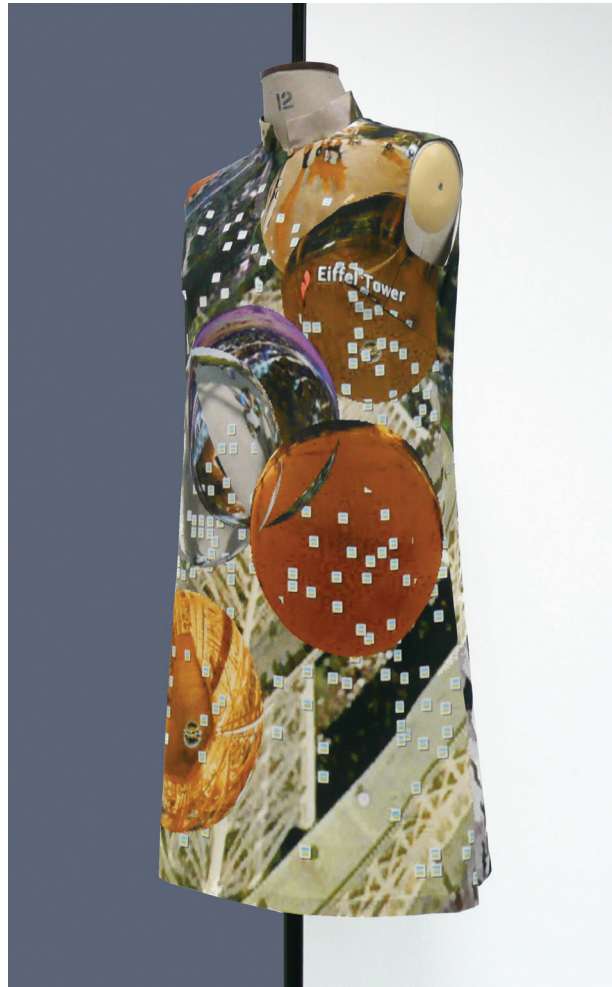
Nick Bastis graduated with a BA in architecture and geography from Middlebury College and studied at the master's level at the Royal Institute in Sweden. Most recently, Bastis was a visiting artist at the School of the Art Institute of Chicago and a Propeller Fund Grant winner through Gallery 400 and the Andy Warhol Foundation. He is currently a researcher for the Metropolitan Planning Council, a non-profit urban planning and advocacy group.

Andrea Zapp

Manchester Metropolitan University
Manchester, United Kingdom
zapp@snafu.de

www.andreazapp.com

Third Skin



Third Skin. © 2011 Andrea Zapp.

“Analogue becomes the new Digital” in Andrea Zapp’s experiments in textile media narratives. Her work explores digital media and the mapping of collective space through fabric print, image patterns, embroidery techniques, and other formats of physical object and embellishment. *Third Skin* captures imagery of our social, digital, and urban neighborhoods and interiors and transfers them to fabric and dress design. Zapp plays with Marshall McLuhan’s idea of “clothing being an extension of skin, the way that media are an extension of the body.” In these pieces, photography, surveillance, and online footage become the sources for hand-manufactured dresses as media narratives. They map the collective and shared (images, digital and physical scenarios, and objects) onto the domestic: a one-off garment as individual statement and choice. Skin is explored as a media surface and as a metaphor for mapping and merging physical and digital realities. Zapp’s goal here is to establish a stronger emotional link between audience and media

artwork. The virtual space is framed as the other place of memory and home by capturing it in analogue paraphernalia, modeled on and manufactured from the digital. Craft and media design objects and artifacts render the digital space domestic and decorative, but with the intention of provoking a surreal and paradoxical sense of longing and belonging to a parallel world. As Zapp suggests, “the idea of a digital habitat, a shared environment, is the main driving narrative in my installations, down to the actual physical architecture in many of my earlier works resembling physical living spaces, hotels, houses, and private webcam scenarios to create related metaphors.”



Third Skin. © 2011 Andrea Zapp.

Andrea Zapp is a senior research fellow in media arts at Manchester Metropolitan University School of Art and programme leader of the Media Lab. She published *Networked Narrative Environments as Imaginary Spaces of Being* and *New Screen Media: Cinema/Art/Narrative*, with Martin Rieser. She has curated the international exhibitions *StoryRooms: Interactive Networks, Media Art and Installations*, at The Museum of Science and Industry in Manchester; *The World is My Imagination: Media-Model-Miniature*, at CUBE Gallery, Manchester; *POI: Moving, Mapping, Memory*, at Cornerhouse, Manchester; and *Analogue is the New Digital*, an exhibition across the digital networks of Manchester, in collaboration with Simon Blackmore, as part of AND Festival. She currently curates an online exhibition and publication on the same topic, in collaboration with the SIGGRAPH Digital Arts Community. She has lectured and shown her artwork at numerous international venues, museums, exhibitions, and festivals since the mid-1990s, including Tate Modern, BEAP, ISEA, Ars Electronica, and SIGGRAPH. Visit www.andreazapp.com for a full list of projects.

The Newsletter of the International Society for the Arts, Sciences and Technology and of l'Observatoire Leonardo des Arts et Technosciences

Leonardo Network News Coordinator: Kathleen Quillian

E-mail: <kq@leonardo.info>

NEW LOW-COST ACCESS AVAILABLE FOR MIT PRESS PUBLICATIONS

The MIT Press journals division is now able to offer low-cost article rentals through Deep Dyve. Users can now rent articles published in *Leonardo*, *Leonardo Music Journal* and other MIT Press journals for a 24-hour period for \$3.99. Users may also choose to take out a membership to the Deep Dyve site for longer rental periods. This service is in addition to the other article access options currently provided by the MIT Press. Find out more about how to access *Leonardo* and *Leonardo Music Journal* articles: <leonardo.info/order.html>.

PATRICIA OLYNYK STEPS UP AS LEAF CHAIR

Patricia Olynyk took over chair duties for the Leonardo Education and Art Forum (LEAF) from outgoing chair Ellen K. Levy after the College Art Association conference in February 2011.

Patricia Olynyk is an artist and educator whose work frequently employs microscopy, biomedical imaging technologies and other methodologies found in the life sciences to explore the nature of life at the micro and macro levels. She is also Director of the Graduate School of Art and the Florence and Frank Bush Professor of Art in the Sam Fox School of Design and Visual Arts, Washington University in St. Louis. She is currently developing new curricular initiatives for graduate education that will provide significant opportunities for cross-disciplinary creative work and research, which will engage the university's Media and Machines Laboratory in the Department of Computer Science and Engineering, Biotechnology and Medicine and the Center for the Study of Ethics and Human Values. Olynyk is also co-author of the College Art Association's new Standards and Guidelines for MFA Programs, which were amended last year.

Prior to her appointment at Washington University in 2007, she taught at the University of Michigan in Ann Arbor, where she directed the Penny W. Stamps Distinguished Visitors Program and the Roman J. Witt Visiting Faculty Program. In 2005, she became the first non-scientist appointed to the University of Michigan's Life Sciences Institute.

Olynyk received her MFA degree with Distinction from the California College of the Arts and then studied in Japan for four years as a Monbusho Scholar and Tokyu Foundation Research Scholar at Kyoto Seika University. Her work has been featured in solo and group exhibitions at the Brooklyn Museum; the New York Hall of Science; the Museo del Corso in Rome; Galleria Grafica and the Saitama Modern Art Museum in Japan; the Universität der Künste, Berlin; the Denise Bibro Gallery in New York; and the Toby Moss Gallery in Los Angeles. In 2005, she created the installation *Sensing Terrains* for the rotunda of the National Academy of Sciences in Washington, D.C. Soon thereafter, she was awarded a Francis C. Wood Institute for the History of Medicine Fellowship at the College of Physicians of Philadelphia; and recently, an Analogous Fields: Art + Science Residency from the Banff Center, where she has three times previously been in residence.

Find out more about LEAF and how to participate: <www.leonardo.info/isast/LEAF.html>.

LEONARDO ABSTRACTS SERVICE (LABS) CALL FOR SUBMISSIONS

Leonardo Abstracts Service (LABS), consisting of the English-language database, Spanish-language database and French-language database, is a comprehensive collection of PhD, master's and MFA thesis abstracts on topics in the emerging intersection between art, science and technology. Individuals receiving advanced degrees in the arts (visual, sound, performance, text), computer sciences, the sciences and/or technology that in some way investigate philosophical, historical or critical applications of science or technology to the arts are invited to submit abstracts of their theses for consideration.

The LABS project does not seek to duplicate existing thesis databases but rather to give visibility to interdisciplinary work that is often hard to retrieve from existing databases. Abstracts will be reviewed for inclusion in their respective databases twice a year. The databases will include only approved and filed thesis abstracts. Abstracts of theses filed in prior years may also be submitted for inclusion.

The English LABS, Spanish LABS and French LABS international Peer Review Panels review abstracts for inclusion in their respective databases. Authors of abstracts most highly ranked by the panel will also be invited to submit an article for publication consideration in the journal *Leonardo*.

For more information visit: <www.leonardo.info/isast/LABS.html>.

LEAF AT THE COLLEGE ART ASSOCIATION CONFERENCE 2011

The February 2011 College Art Association (CAA) conference was by no means typical; it marked the start of a Centennial celebration (CAA's 99th birthday) that continues through February's 2012 conference in Los Angeles. It also indicated growing internationalization and movement away from standard panel presentations. One branch of this evolution was made apparent by interviews held via Skype with 23 speakers, which were organized by Mark Tribe and Chris Csikszentmihályi. Another branch was evidenced by the topic "The Aesthetics of Sonic Spaces."

Despite the poor economy and concomitant expectations among job seekers, attendance was higher than usual, even for New York (apparently over 7,000), and standing room was all that remained for attendees of all three Leonardo Education and Art Forum (LEAF) sessions and for a packed art and technology exhibition featuring classics from the likes of Nam June Paik, I/O/D and the Bureau of Inverse Technology. Its focus derived from Paik's 1974 coinage of the term "electronic superhighway." Margot Lovejoy's excellent exhibition, opening the same evening, was also very much attuned with LEAF aims.

Unlike past years, Leonardo's contributions in terms of interdisciplinarity, technology and education were no longer placed in a somewhat marginalized position but were received by many CAA members as now central to their own interests. A younger generation of artists and art historians

who are maturing in pace with the Internet are very much in tune with Leonardo's goals, and an older generation is now open to exploring such compelling alternatives.

Adrienne Klein's panel, Into Focus: Art/Science in the University Classroom, held off-site at the Graduate Center at CUNY, offered concrete, highly imaginative examples of transdisciplinary educational practices and inspirational collaboration. For example, Palma Catravas discussed links between the arts and engineering and also her co-teaching of a Frontiers of Nanotechnology and Photography course with Kevin Bubliski, in which students use a scanning electron microscope.

LEAF's one-and-a-half hour "Designing a New Joint Studio, Art History, and Theory Program: A Gedanken Art/Science Experiment" developed into an engaging discussion involving many of the attendees. With the help of a whiteboard, markers and fearless contributors from the audience, more than half of the time was given over to discussion, while Patricia Olynyk, Joe Davis III, Victoria Vesna, Meredith Tromble and Ellen Levy contributed to the remainder.

Edward Shanken's international panel provocatively addressed the gap between the discourses of mainstream contemporary art and new media art. This topic, along with the other LEAF sessions on art/science interrelationships and education, attracted substantial scholarly attention from CAA attendees. At least one of the individuals, Ronald Jones, made the journey from mainstream art to contribute to an emerging new discipline of Experience Design at Konstfack University College of Art, Craft and Design, Stockholm. Christiane Paul, Paul Thomas, Jane Prophet and Philip Galanter were among those who gave notable presentations.

Time was taken at the LEAF business meeting to introduce Patricia Olynyk, who will be concentrating on art and the environment as the new LEAF chair. The timing of this critical subject is again in tune with CAA, whose keynote was delivered by Helen and Newton Harrison. Although pressed for time, they offered some eloquent remarks, stressing the importance of jargon-free communication. Helen's closing comment summarized all our hopes: If artists can turn their attention and ideas toward the LAND, wonderful things can happen!

For more about LEAF visit: <<http://Leonardo.info/isast/LEAF.html>>.

Leonardo, The International Society for the Arts, Sciences and Technology

Leonardo/ISAST Headquarters

211 Sutter Street, Ste. 501
San Francisco, CA 94108, U.S.A.
Tel: 415-391-1110
Fax: 415-391-2385
E-mail: <isast@leonardo.info>
Web: <leonardo.info>

Leonardo Music Journal

E-mail: <lmj@leonardo.info>
Web: <leonardo.info/lmj>

Association Leonardo

8, rue Émile Dunois
92100 Boulogne Billancourt, France
E-mail: <info@olats.org>
Web: <www.olats.org>

Leonardo Book Series

211 Sutter Street, Ste. 501
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E-mail: <leonardobooks@mitpress.mit.edu>
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Artists, scientists, engineers, researchers and others interested in the contemporary arts and sciences are invited to join Leonardo/ISAST. Benefits include reduced rates for Leonardo/ISAST publications, eligibility to participate in Leonardo working groups and special invitations to Leonardo-sponsored events.

For further details visit:
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Affiliate memberships also available for non-profit organizations, educational institutions and corporations working at the intersection of art, science and technology.

MISSION STATEMENT

The critical challenges of the 21st century require mobilization and cross-fertilization among the domains of art, science and technology. Leonardo/ISAST fosters collaborative explorations both nationally and internationally by facilitating interdisciplinary projects and documenting and disseminating information about interdisciplinary practice.

PUBLICATIONS

Print Journals

The *Leonardo* journals are scholarly peer-reviewed journals of record. *Leonardo*, published bimonthly, is the official journal of Leonardo/ISAST. *Executive Editor*: Roger F. Malina. *Leonardo Music Journal* with CD is published annually. *Editor-in-Chief*: Nicolas Collins.

World Wide Web

The Leonardo On-Line web site (www.leonardo.info) publishes organizational information, the Leonardo Electronic Directory and more. *Managing Editor*: Patricia Bentson.

Electronic Journal

Leonardo Electronic Almanac (leoalmanac.org) is an electronic journal dedicated to providing a forum for those who are interested in the realm where art, science and technology converge. *Editor-in-Chief*: Lanfranco Aceti. *Co-Editor*: Paul Brown.

Leonardo Reviews

The Leonardo Reviews Project, through a panel of reviewers, publishes reviews of relevant books, journals, electronic publications and events. Reviews are published on the Web (leonardo.info/ldr.html), and selected reviews are published in *Leonardo Electronic Almanac* and in *Leonardo*. *Editor-in-Chief*: Michael Punt.

Books

The Leonardo Book Series (leonardo.info/isast/leobooks.html), published by the MIT Press, highlights topics related to art, science and developing technologies. *Editor-in-Chief*: Sean Cubitt.

Labs Databases

Databases of master's and Ph.D. theses.
English LABS: <leonardolabs.pomona.edu>; *Coordinator*: Sheila Pinkel.
Spanish LABS: <www.uoc.edu/artnodes/leonardolabs>; *Coordinator*: Pau Alsina.
French LABS: <francolabs.univ-paris1.fr>; *Coordinator*: Annick Bureau.

AWARDS

Frank J. Malina Leonardo Award for Lifetime Achievement recognizes eminent artists who through a lifetime of work have achieved a synthesis of contemporary art, science and technology. Winners include Gyorgy Kepes, Nicolas Schöffer, Max Bill, Takis and Abraham Palatnik.

Leonardo Award for Excellence recognizes excellence in articles published in Leonardo publications. Winners include Rudolf Arnheim, Otto Piene, Charles Ames, Frieda Stahl, Donna Cox, Janet Saad-Cook, George Gessert, Alvin Curran, Karen O'Rourke, Eduardo Kac, Hubert Duprat with Christian Besson, José Carlos Casado with Harkaitz Cano, Bill Seaman, Arthur Elsenaar with Remko Scha, and Steve Mann.

Leonardo New Horizons Award for Innovation is given to individuals or groups for innovation in new media. Winners include Critical Art Ensemble, Gregory Barsamian, Graham Harwood, Evelyn Edelson-Rosenberg, Jean-Marc Philippe, Jaroslav Belik, Peter Callas, Patrick Boyd, Christian Schiess, Kitsou Dubois, I Wayan Sadra, and Ewen Chardonnet.

Makepeace Tsao Leonardo Award recognizes organizations or groups that have increased public awareness of art forms involving science and technology, particularly through exhibitions. The first award was given to La Cité des Arts et Nouvelles Technologies de Montréal.

Leonardo Global Crossings Award recognizes excellent work by international artists, professionals and scholars in the globally emerging art-science-technology field. Winners include Abdel Ghany Kenawy and Amal Kenawy (Cairo, Egypt) (2005).

Leonardo-EMS (Electroacoustic Music Studies) Award for Excellence is awarded for the best contribution to the EMS symposium by a young researcher, as decided by a joint jury. Winners include criticalartware (Jon Cates, Ben Syverson and Jon Satrom) and Michael Bullock (2008).

Leonardo Art Science Student Contest Award is a juried award for student work selected from projects received through an open submission process. The first Leonardo Art Science Student Contest award (2008) was given to Hiroki Nishino, Michiko Tsuda, Jaewook Shin, Byeong Sam Jeon, Margarita Benitez and Markus Vogl.

The Leonardo Scholarship for Media Art Histories, a collaborative project between Leonardo/ISAST and the Department for Image Science (Danube University), awards a juried half-tuition scholarship for the Master of Arts (MA) course in MediaArHistories at Danube University to a candidate who demonstrates the potential to contribute to the new field of Media Art Histories in this time of critical worldwide challenges. The first scholarship has been awarded to Fran Ilich Morales Muñoz (2010).

COLLABORATIONS WITH OTHER ORGANIZATIONS

Leonardo/ISAST frequently collaborates with other organizations on topics of current interest by collaborating on conferences or workshops and by publishing special sections in *Leonardo* or co-sponsoring events. Current collaborators include:

- ACM Multimedia
- ACM SIGGRAPH
- Ars Astronautica
- Artnodes (Spain)
- Association Leonardo (France)
- College Art Association (USA)
- Creativity and Cognition Studios, University of Technology Sydney (Australia)
- Donau University (Austria)
- Electronic Music Foundation (USA)
- Fondation Langlois Research Documentation Center (Canada)
- MIT Press (USA)
- Pomona College (USA)
- School of the Art Institute of Chicago (USA)
- The University of Plymouth (UK)
- Sabanci University (Turkey)

For more information, please visit <leonardo.info/collablist.html>.

LEONARDO PROJECT WORKING GROUPS

Leonardo hosts working groups on projects with a topical focus:

Cultural Roots of Globalization (FCM) Editorial Committee

Mark Beam, Annick Bureau, Steve Dietz, Marina Grzanic, Roger Malina, Yukiko Shikata.

Leonardo Education and Art Forum

Patricia Olynyk, *chair*; Joseph Lewis, *co-chair*. See <www.leonardo.info/isast/LEAF.html> for more information.

Leonardo Space Arts Working Group

Annick Bureau, Richard Clar, Roger Malina, Jean-Luc Soret, Arthur Woods.

Lovely Weather: On the Cultural Context of Climate

Change Editorial Committee: Ramon Guardans, Annick Bureau, John Cunningham, Andrea Polli, Janine Randerson, Jacques Mandelbrojt, Drew Hemment.

Scientists' Working Group: Tami Spector, *chair*; Piero Scaruffi, Roger Malina, Robert Root-Bernstein, Jim Crutchfield.

Artists and Scientists in Times of War Working Group:

Michele Emmer, Sheila Pinkel, Ana Peraica, Randall Packer, Roger Malina.

AFFILIATE MEMBERS

Leonardo/ISAST invites organizations and corporations working at the intersection of art, science and technology to join the Affiliate Membership Program. Visit <leonardo.info/isast/org-membership.html> for more information.

Affiliate Members Arizona State University Art Museum; School of the Art Institute of Chicago, Master of Fine Arts in Sound; School of Visual Arts, MFA Computer Art Dept.; Shristi School of Art, Design & Technology; University of Calabria, Evolutionary Systems Group; University of Illinois, eDREAM Institute; UCLA Art|Sci Center; Australian Network for Art & Technology; Banff New Media Institute; Canadian Film Centre Media Lab; The Exploratorium; Pomona College; UC Santa Barbara, Media Arts and Technology; UC Santa Cruz, Digital Arts and New Media Program; Universidade de San Buenaventura, Multimedia Engineering Program; University of Denver, Electronic Media Arts & Design; University of Leiden, Media Technology Master of Science; University of San Francisco College of Arts and Sciences; ZER01.

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Leonardo/ISAST members will receive a 20% discount!

The WIRED Lab is an art + science project investigating æolian instruments that sonically capture the magnificent and dynamic universe of the natural world. Based in rural southwest NSW, Australia, WIRED Lab was established in 2007 to ensure the legacy of The Wires, a unique and distinctly Australian invention that primarily exists in rural landscapes. The Wires are inherently interdisciplinary with foundations in sculpture, environmental/land art, sound composition, interactivity, behavioral constructs of old/new media, bio-resonance, physics and complex systems sciences. We host research residencies and workshop programs for artists and scientists; for more information go to: <<http://wiredlab.org/>>.

X-RAY PHOTOGRAMS by Sheila Pinkel was published in 2009. This book is an overview of the X-ray images she produced at the Xerox Medical Research Center in Pasadena, California, from 1978 to 1983. This technology, commercially known as mammography, is special because of its ability to image delicate tissue and because it makes visible the internal structure of the natural and man-made world. The book is organized into categories both to clarify the structure of those categories and to create a sense of the marvelous of the natural and fabricated world. It is available through Lulu.com. E-mail: <spinkel@earthlink.net>.

THE CAMBRIDGE LITERARY REVIEW is a new print journal of poetry, fiction and essays. It is committed to publishing interdisciplinary work: essays have covered such topics as Otto Neurath's picture language Isotype, poetry and politics, Hume, Hegel and Walter Benjamin, as well as traditional literary criticism. Issue 3 (June 2010) is dedicated to translation and contains an essay by the composer Peter Zinovieff on the subject of analogue-to-digital music translation. *The Cambridge Literary Review* is available to purchase from <www.cambridgeliteraryreview.org>, and costs £8 for one issue, £20 for a 1-year subscription (3 issues).

ECOTONES is a data-ecological project by Janine Randerson that employs information from satellite telemetry and sonification of the paths of migratory birds from the Northern hemisphere to the Southern hemisphere. The bar-tailed godwit, a bird with the longest non-stop migration of any species, arrives annually in Miranda, an estuary in New Zealand's North Island. This area is an "ecotone" or transitional space between terrestrial and marine ecosystems, where land meets sea, saltwater meets freshwater. The birds are arriving to New Zealand in smaller numbers due to the lack of seasonal availability of foods, a predicted consequence of climate change, and the historical lack of human care for the ecotones, regarded as unwanted, hybrid spaces. Ecotonal space and the flight of the migratory birds are reconceived visually and acoustically in this installation to work against the atomization of North/South, human/non-human, air, sea and earthly relations. Ecotones will be developed at the SCANZ: Eco Sapiens residency in New Zealand in 2011. "Eco sapiens seeks to bring a range of worlds together to investigate the cultural roots of climate change, and explore poetically pragmatic approaches to encouraging the long-term cultural shifts required." Trudy Lane, <<http://intercreate.org/view/eco-sapiens>>. Janine Randerson is also a participant in the Data Ecologies workshop series (2010–2011) conceived by Tom Corby, University of Westminster; "The politicization of climate data, whilst potentially dangerous, offers opportunities for us to re-think our relationships to science and develop discussion around interdisciplinary art/science approaches to our changing environment." Tom Corby, 9 August 2010 <<http://data-ecologies.ning.com>>.

REPRESENTATIONZ is a new blog covering how symbols, images and language affect our daily lives—from representation in art, science and culture to cryptic puzzles. The blog is run by Paul Fishwick and can be viewed on the web or via smartphone apps. Twitter and RSS feeds are available. See <www.representationz.com> for more details.

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ASTRONYMOUS: for recovering astronomers seeking to re-enter society: <www.twine.com/twine/12mkkxp5k-3lm/anonymous-leonardo-art-and-astrophysics-working-group>. This twine is for professional astronomers who have dual careers as both scientists and artists, or for astronomers who have collaborated with artists on the creation of artworks. Professional astronomers wishing to join the twine should e-mail Jayanne English: <Jayanne_English@umanitoba.ca>.

THE THURSDAY CLUB. An open forum discussion group for anyone interested in the theories and practices of cross-disciplinarity, interactivity, technologies and philosophies of the state-of-the-art in today's (and tomorrow's) cultural landscape(s). Originally set up in October 2005 by GDS, the Club has grown to include 300 members: artists, technologists, scientists—in fact, a growing diversity of people from different communities worldwide who are connected via a mailing list and online forum. Organized and supported by the Goldsmiths Digital Studios (GDS) and the Goldsmiths Graduate School, Goldsmiths, University of London, U.K. <www.thethursdayclub.net/>.

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INTERACTIVE ART RESEARCH, Gerfried Stocker, Christa Sommerer, Laurent Mignonneau (Eds.), 2009. Springer Verlag Vienna/New York, ISBN: 978-3-211-99015-5. English, with DVD, <www.springer.com/springerwiennewyork/art/book/978-3-211-99015-5>. This monograph represents a comprehensive overview of Sommerer and Mignonneau's art and research. In addition to providing detailed project descriptions of each interactive artwork, it includes essays and articles by highly recognized media scholars and theoreticians such as Peter Weibel, Christiane Paul, Mathias Michalka, Itsuo Sakane, Erkki Huhtamo, Christine Schoepf, Hannes Leopoldseder, Ingeborg Reichle, John L. Casti, Machiko Kusahara, Tomoe Moriyama, Florence de Mèredieu, Oliver Grau and Roy Ascott.

CHUA's CIRCUIT WEBSITE. The Evolutionary Systems Group (ESG) presents CHUA's CIRCUIT <<http://160.97.10.253/chuaweb/>>, collecting Chua's different Attractors, videos, music, sound and animations. The website shows new forms of digital art and has as starting point six papers with the title "The Gallery of Chua's Attractors," published in six consecutive issues, since January 2007, in the *International Journal of Bifurcation and Chaos*. The six papers, together with a CD-ROM containing music from Chaos, have become a book with the same title. An experimentation with high school students on chaos is the main focus of this site.

SYMMETRY: TWO NEW BOOKS. *Visual Symmetry* by Magdolna and Istvan Hargittai (World Scientific, 2009) is a pictorial presentation in full color, including over 500 photographs from all over the world with easy yet accurate and systematic explanations of the simplest to the most complex occurrences of symmetry in the world around us. *Symmetry through the Eyes of a Chemist*, Third Edition, by Magdolna and Istvan Hargittai (Springer, 2009) is a systematic journey through chemistry from the point of view of symmetry. An independent reviewer claimed about the first edition: "The most delightful book on symmetry ever written!"

DIRECTORY OF UNIVERSITY PROGRAMS IN THE ART SCIENCE TECHNOLOGY FIELDS. Leonardo/OLATS, co-sponsor of YASMIN, is pleased to bring the following resource to your attention: Pier Luigi Capucci, co-moderator of the YASMIN list, has started a resource of academic courses on arts/sciences/technologies, including a directory of existing directories. In Europe it will be of particular interest to students interested in the ERASMUS program for student mobility. The resource can be found at: <<http://www.noemalab.org/sections/projects/edu/>>. If you are running a program and wish to be included please send your information and link to: <staff (at) noemalab.org>.

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FLUDD VIRTUAL POLAR ICECAP MELTDOWN, an artistic assessment. FREE email from author: <dinavonzweck@earthlink.net>.

THE TOPOLOGY OF DESIRE—Artificial Life's Search for Sexuality. Free email article, request from author: <info@writerightnyc.com>.

DIGITAL PERFORMANCE: A HISTORY OF NEW MEDIA IN THEATER, DANCE, PERFORMANCE ART AND INSTALLATION, by Steve Dixon (Leonardo Books/MIT

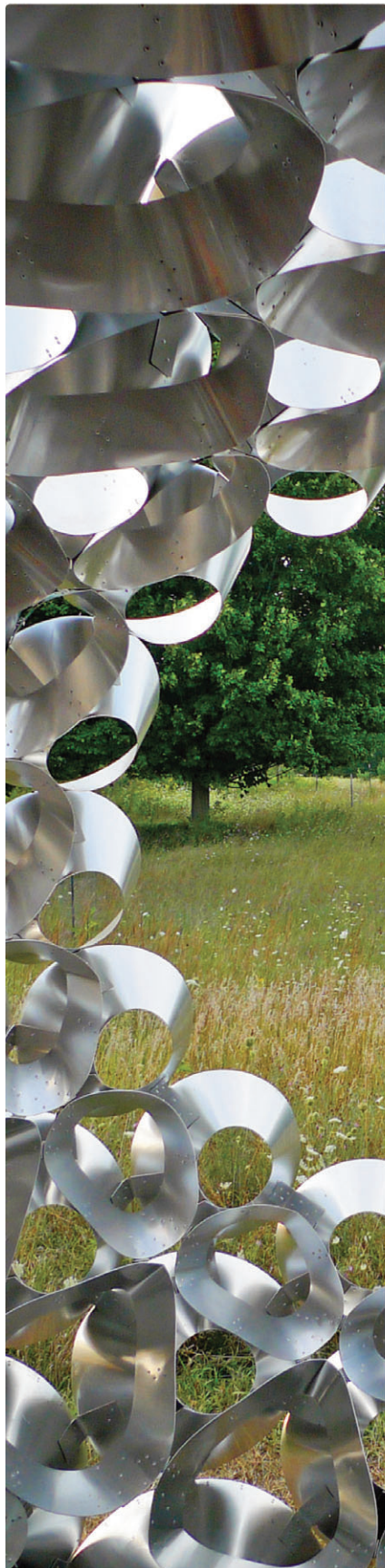
Press, 2007) is now available. Award Winner, Association of American Publishers, Inc. (Professional/Scholarly Publishing Awards for Excellence); Lewis Mumford Award for Outstanding Scholarship (Media Ecology Association). "A Herculean undertaking... Dixon's groundbreaking work will occupy a central position in the evolving canon of digital performance literature" [*Theatre Journal*]; "Remarkable... an absolutely invaluable resource which is unlikely to be surpassed or even challenged" [*The Art Book*]; "It's hard to imagine a bolder or more in-depth book" [Leonardo Reviews]. For more information, or to order this book, visit: <<http://leonardo.info/isast/leobooks/books/dixon.html>>.

LIGHT-MUSIC, SYNESTHESIA, "COLOR HEARING":

annotated bibliography (Russia, 1742–2002). The Prometheus Research Institute (Kazan, Russia) has recently published a unique bibliography of nearly all Russian publications on synesthesia, "color hearing" and related experimental arts such as light-music, abstract musical films, inter-media compositions, etc. (compiled by scientific editor Bulat Galeyev). The bibliography covers the last 260 years and includes nearly 2500 titles of books, journal articles and conference theses. As these works are little known in Western countries, Prometheus Institute suggests a project of making an English version of the bibliography (printed and on-line) with abstracts in English for each item. The project can be realized given sufficient financial support. We will be very grateful for any grants or donations from interested organizations. Publications by the Prometheus Institute are currently available online at: <<http://synesthesia.prometheuskai.ru>>.

THE CONCEPTUAL INFORMATION ARTS (CIA) PROGRAM AT SAN FRANCISCO STATE UNIVERSITY'S ART DEPARTMENT

stresses experimental art at the juncture of science, technology and culture, offering both BA and MFA degrees. Contact Paula Levine. Web site: <<http://userwww.sfsu.edu/~infoarts/>>. Tel: (415) 338-2291.



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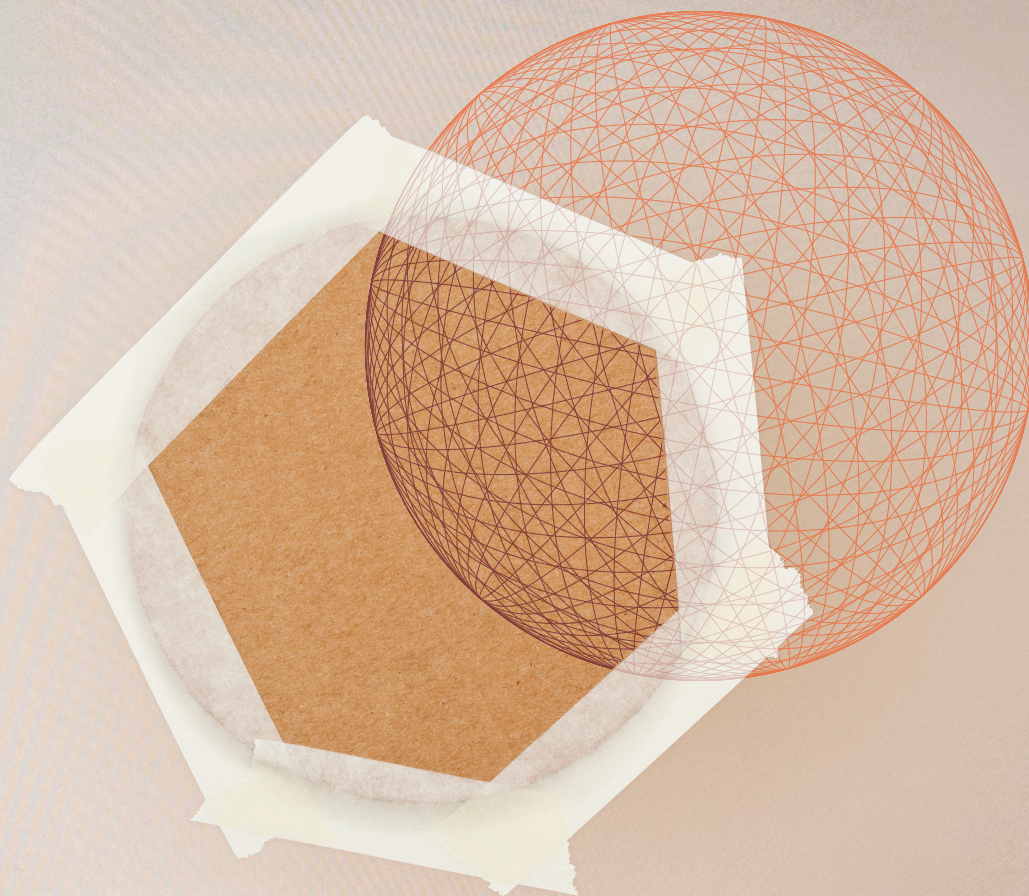
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