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CAA 2005: Hybridity: Arts, Sciences and Cultural Effects

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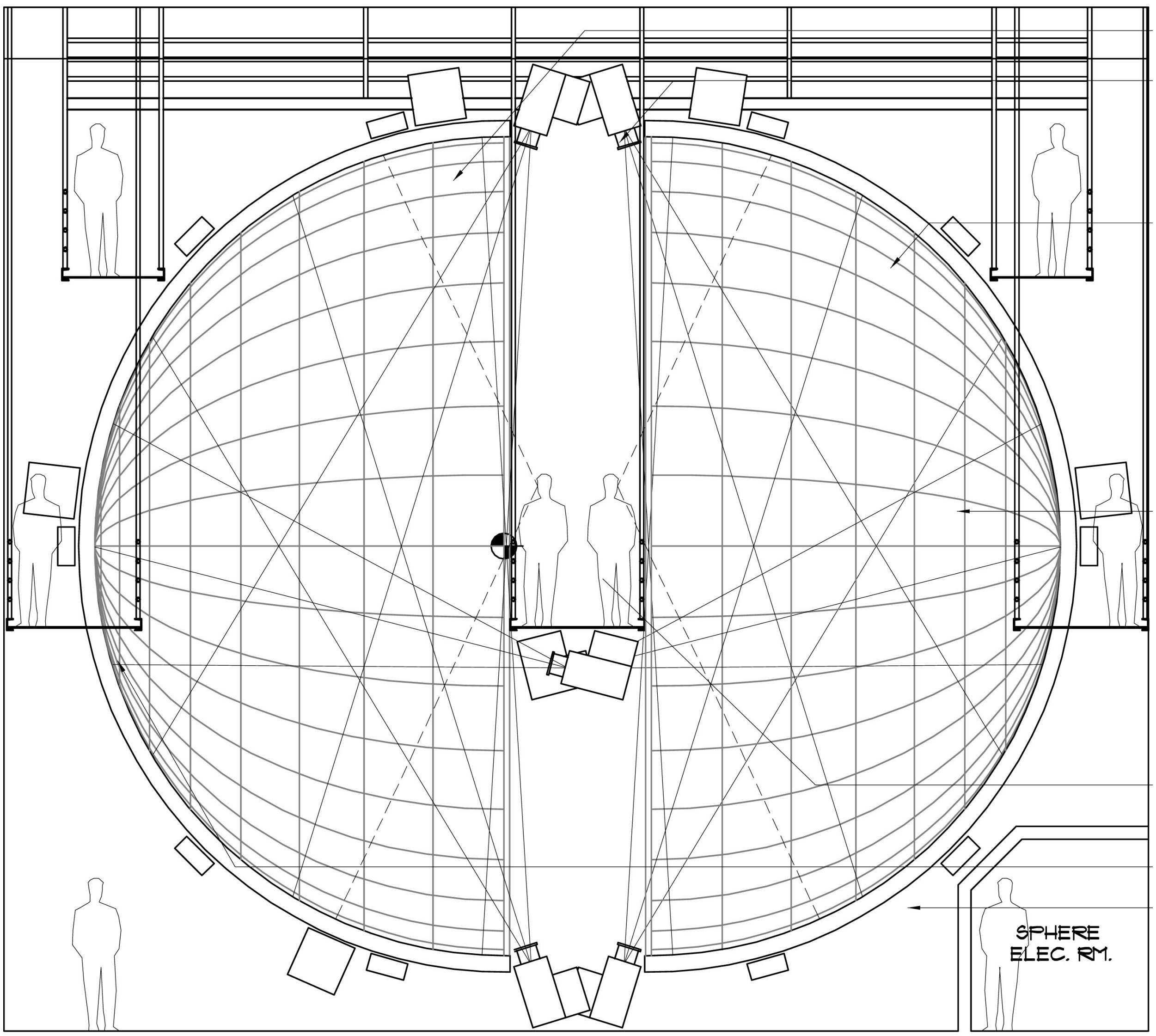
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Perspectives on Collaborative Research and Education in Media Arts

George Legrady

ABSTRACT

Digital arts is by nature a hybrid practice, integrating the poetics, aesthetics and conceptual strategies of art with the logical, systematic methods of technological processes from engineering and the sciences. This article reviews the development of interdisciplinary, collaborative arts-engineering research and education at the University of California at Santa Barbara, focusing on the Media Arts & Technology graduate program from a visual/spatial arts perspective.

Artistic Practice in Transition

Digital media-arts practice can be considered a hybrid art form, with distinctive roots in a number of historically separate knowledge bases. It coalesces the aesthetic, plastic and formal methodologies of art with the physicality of electronic hardware material, the procedural logical language of mathematically defined symbolic code and the systematic processes of information management. Media arts is a discursive discipline that through aesthetic means reflects upon how technology transforms culture. I can easily trace the influence of the development of digital technologies in my transition from research into the syntax and visual impact of the photographic image to my current artistic works, which rely extensively on information-science methodologies as they explore the collection, digitization, processing and visualization of data. The transition from the analogue to the digital has reformulated conceptual and practical methods of artistic engagement with the materials, tools and project directions, shifting greater emphasis to the experiential and to the recalibration of cultural meaning into information. My recent projects rely on mathematically generated organizational methods and visualizations to explore how they might reveal unexpected and new forms of expression. Motion-sensing technologies have enhanced interactivity in my public installations by transforming the passive viewer into an active contributor.

As my projects have increased in scale and technological complexity during the past 15 years, my artistic-production mode transformed itself from individual to a team-based model, with specialists and knowledgeable assistants contributing to the work. Under such circumstances, the role of the artist shifts from that of an individual developer to one of project designer and manager, focusing on conceptualization, planning and production supervision. This is a working approach familiar to those in the music, architecture, film and theater disciplines, but relatively new to the visual arts. Implicit in such collaborative situations is the understanding that no individual can have all the necessary knowledge to fully realize a project. The collaborative approach leads to new insights and unexpected results as the work evolves; the challenge is to maintain the integrity of the original concept. Given the flexibility of such a situation, the artwork becomes a research opportunity for the participants as they explore how their knowledge and approaches can synthesize with those of the other contributors. The development of digital media art can comprise many highly diverse disciplines. In the case of the *Pockets Full of Memories* project I realized in 2001 for the Centre Pompidou [1], the team of experts included a cognitive-science natural-language scientist from Helsinki, an industrial/organization psychologist from Germany, a visual-communication design team from Germany, a production team led by a database and hardware design engineer from Budapest, an interaction designer from Germany and a web engineer from the Center for Research in Electronic Art Technology (CREATE) lab at the University of California at Santa Barbara (UCSB). The critical components for the success of such projects are common ground and a shared understanding of the projects' goals and how to realize them as quickly as possible. Consequently, one of the implicit goals of the introductory core courses in the UCSB Media Arts & Technology (MAT) graduate program is to learn to communicate between different areas of expertise.

UCSB's Media Arts & Technology Program

Interdisciplinarity has been at the core of the MAT program since its inception in 2000. The chair reports to the Dean of Letters and Science (Humanities) and the Dean of Engineering. Students apply to one of three study areas: multimedia engineering, sound/music or visual/spatial arts; but all cycle through a set of courses that promote interdisciplinary learning with the expectation that they will hybridize their research. Students enter the program with diverse backgrounds such as architecture, visual communication, computer science, electrical computing engineering, electronic sound research, signal processing and contemporary music composition. In contrast to a few years ago, recent applicants possess basic

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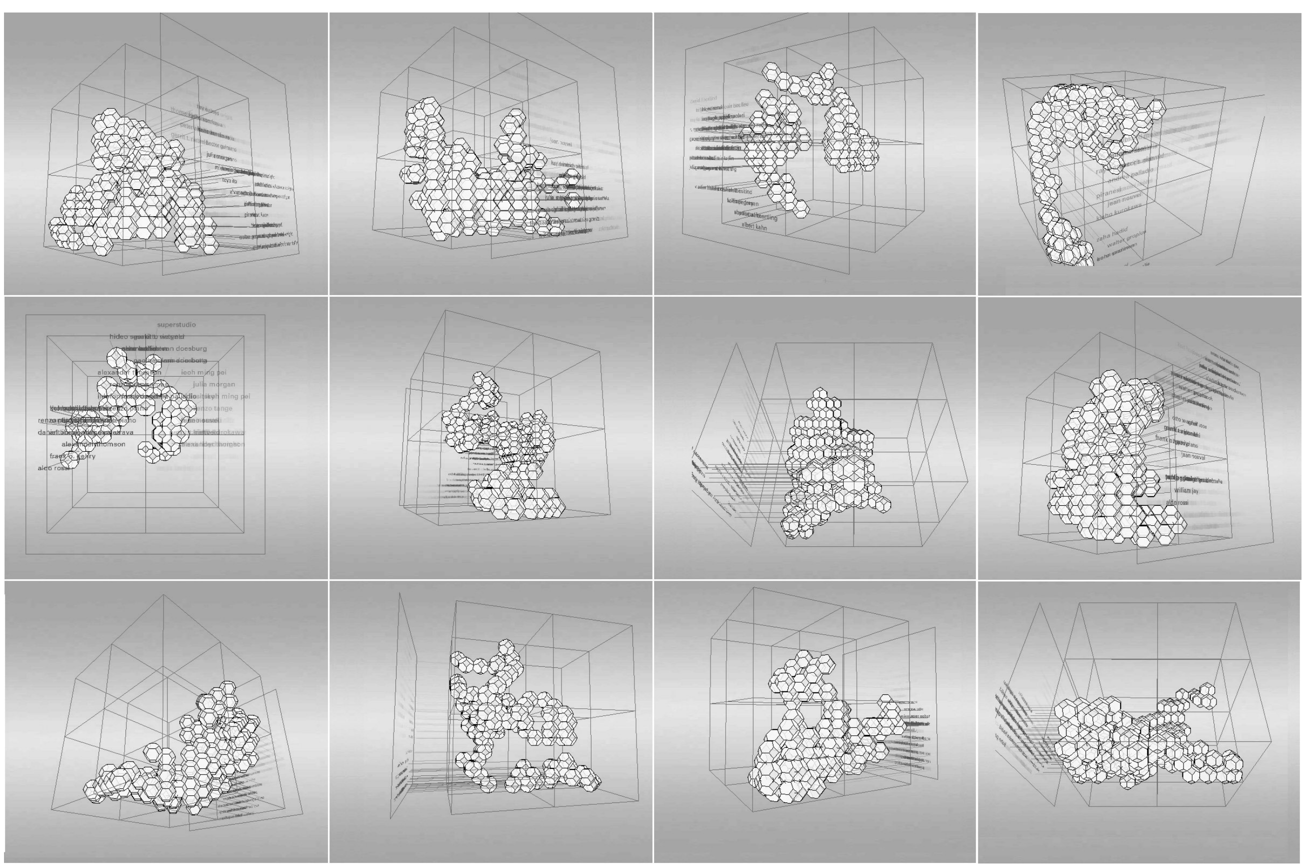
Article Frontispiece. The CNSI AlloSphere, a fully spherical, immersive audiovisual environment, is situated in MAT's new research facilities in the California Nanosystems Institute Building at the University of California at Santa Barbara. (© UCSB)

computer programming competence even though many may not have the mathematics fundamentals necessary for a graduate engineering degree. Most MAT faculty have joint appointments with departments that represent their research areas. These consist of computer science, electrical computing engineering (ECE), music, art and film studies. All of the visual/spatial arts faculty (Lisa Jevbratt, Marcos Novak, Marko Peljhan and myself) hold joint appointments in the Department of Art [2] and entertain a broad range of interests that include data mapping and visualization, interactive installations, telecommunications and locative media, wireless technologies, database aesthetics, networks, interaction design, digital 3D, virtual reality, transarchitecture, mixed-reality immersive environments, algorithmic aesthetics, biological systems and media theory.

Media Arts & Technology is closely connected to a number of research labs, such as CREATE [3], which was established in 1986 by former MAT department chair JoAnn Kuchera-Morin, who holds a joint affiliation with the Department of Music. The associate director of CREATE is Curtis Roads. CREATE serves as a productive environment available to students, researchers and media artists for the realization of music and multimedia works. The center also serves as a laboratory for research and development of a new generation of software and hardware tools to aid in media-based composition. On the engineering side, MAT and Computer Science professor Matthew Turk, who is now chair of MAT, is co-director of the Four Eyes Lab [4], which focuses on research in imaging, interaction and innovative interfaces, a mix of computer vision, augmented reality, mobile and wearable computing, and human-computer interaction. B.S. Manjunath, a MAT/ECE professor, directs the Vision Research Lab [5], which focuses on multimedia signal processing and analysis, including applications in large multimedia databases, bio-image informatics, digital libraries, steganography (data hiding) and image processing. The MAT program is closely aligned with the National Science Foundation–funded Integrated Graduate Education and Research Training (IGERT) program [6], focused on interactive digital multimedia; four of the five co-principals are MAT faculty, with Manjunath being the primary principal. The multimedia IGERT initiative at UCSB is an interdisciplinary, collaborative research program funding doctoral student research in the areas of (a) multimedia systems (storage, transmission and programming of digital multimedia); (b) multimedia content (representation and analysis of multimedia information and advanced tools for creating, analyzing and manipulating multimedia content); and (c) interactivity (presentation of, and human interaction with, multimedia information in the context of interactive multimedia applications). The NSF IGERT program has recently been identified by the National Academy of Sciences as an interdisciplinary success story in its report "Facilitating Interdisciplinary Research" [7].

The MAT program is in the planning stage of moving into new research facilities at the California Nanosystems Institute (CNSI) [8], which is to take place in 2006. The facilities will include a number of research-specific labs, such as a motion-capture lab to track, model and recognize human movement and gesture in

Fig. 1. Ben Ritter, Ashok Basawapatna and Uli Schmidts, *The Shape of Discourse*, *Truncated Octahedron*, 2004. (© Ben Ritter, Ashok Basawapatna and Uli Schmidts) *The Shape of Discourse* visualizes the degree of connectedness of a list of 64 architects in two ways: as a 3D, dynamically clustering assortment of cuboctahedrons and as a 2D map of interconnected lines [13].



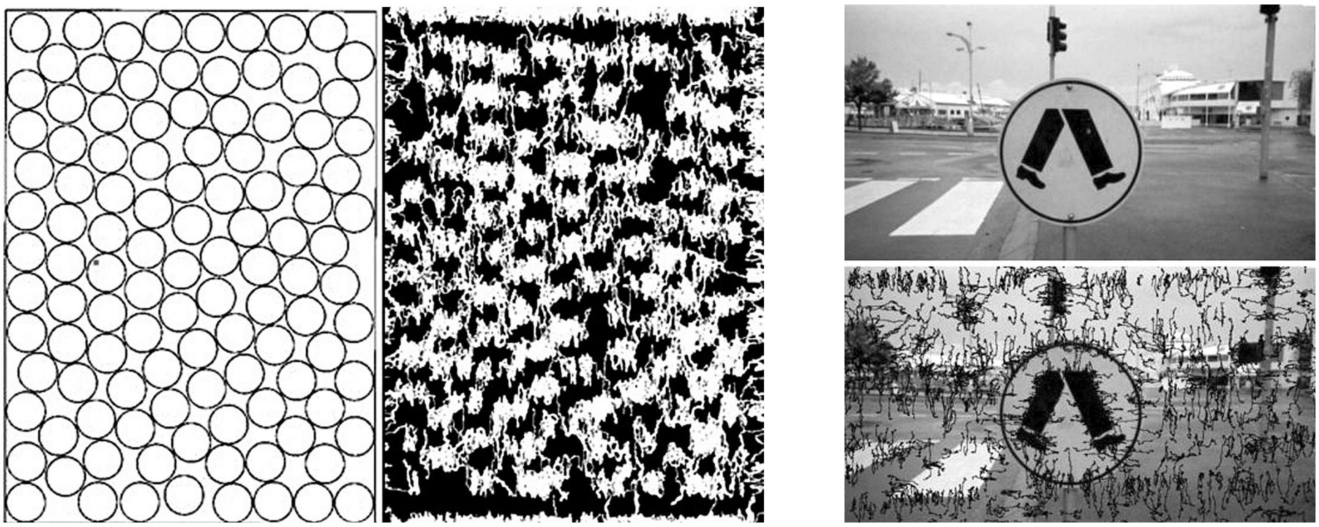


Fig. 2. August Black and Lance Putnam, *Worm Walker*, 2004. (© August Black and Lance Putnam) Visual examples of a result of *Worm Walker*, which uses frequency information from an image to control a separate stochastic walk based on an image's pixel data [14].

various contexts, including office/workstation scenarios, performance/control scenarios and everyday life scenarios; and an interactive installation space to create multimedia engineering projects that test the limits of visual, gestural and audio systems, as well as digital visual art and music installations and audio immersive and touch-sensitive artworks. The Distributed Systems, Robotics & Display I/O Device Lab is a space for research on distributed multimedia software environments and multimedia communications and signal processing, configuring multimedia computer systems and integrating new devices (helmets, gloves and wands with six degrees of motion interaction) as well as constructing them. The lab will be a focal point for the MAT researchers' various expertise in distributed multimedia computing systems, multimedia networking and communications, distributed processing environments and media signal processing. The Pluri audio/video laboratories are production focused for combining multi-channel audio and multi-screen video. The AlloSphere (Article Frontispiece) is a 3-story-high, enclosed, fully immersive 360° virtual visual and audio environment used for advanced research and production applications. The plan for the AlloSphere is to allow creation of virtual simulations that completely immerse the viewer. The CNSI at UCSB comprises faculty, students and researchers from 11 different academic departments. The MAT facilities will be employed for arts-engineering projects and research. The relationship of present to future media is of particular interest, especially in the fields of nanotechnology, biotechnology, new materials and new fabrication methods.

Multidisciplinarity in the Classroom: Signal Processing and Art Practice

Interdisciplinarity is a challenging prospect, not only for students who have yet to fully master their discipline of choice, but also for the teaching faculty with their specialized areas of expertise. It is difficult to cross disciplinary boundaries and achieve results, but it is also a great opportunity to expand horizons and learn about different ways to perceive, define and address problems.

In the spirit of bringing arts-engineering interdisciplinary studies into the classroom, my colleague Jerry Gibson of MAT and ECE proposed a few years ago that he and I teach a graduate course that would combine our knowledge bases (engineering signal processing and media-arts project production) as a way to foster engineering-level research in conjunction with the experimental approach of the visual arts. We have now taught MAT 256: Visual Design through Algorithms with Explorations in Visual Perception [9] twice and plan to do so again in the coming year.

The course consists of weekly lectures by both faculty on subject matter specific to our individual areas of expertise. Engineering signal-processing topics taught by Gibson include sampling, Markov chains, mutual information, fundamentals of information theory, frequency-domain representation and perceptual distortion. My lectures address methods of artistic-project development, the nature of narrative, formal aesthetics, time-space design and other specific aspects of the production of an interactive installation. Technological topics covered focus on visual perception and delivery of real-time televisual signals, with student-driven implementation of 3D devices to control remote cameras and to record viewers' actions. Our future goals are to develop projects to study and measure audience responses to insertion of controlled distortions in real-time video.

For the production phase of student projects, we are interested in two-person teams consisting of an engineer and an artist. Weekly lectures are followed by small project assignments in which students must demonstrate an understanding of the week's lectures through a project realized in the software application of their choice. During the second half of the course, they are expected to realize a final project that synthesizes arts and engineering knowledge with results meaningful to both perspectives (Figs 1,2).

The past two courses revealed that students approached the projects' planning and development based on worldviews and problem-solving approaches defined according to training in their individual disciplines. Whereas the engineers were interested in technical problem-solving opportunities, one psychology student was interested in visual-perception issues, and the arts students tended to focus on the cultural aspects of media messages. The artists' interests in the difficult-to-measure noise of cultural messages and subtexts stood in contrast to the engineering desire for a purer signal: the collection of reliable and measurable data.

Evaluation and Interpretation in an Interdisciplinary Context

The scientific literature in research journals speaks of the necessity and wisdom of interdisciplinary collaboration and coordination in IT research. The NSF endorses this approach: "Today the boundaries between all disciplines overlap and converge at an accelerating pace. Progress in one area seeds advances in another" [10]. Crossing interdisciplinary boundaries in the sciences is challenging enough. What, then, to make of artistic-engineering interactions? By what method does one identify, define and perhaps measure value? In the classroom, I am continually reminded that my engineering colleague delivers information that is grounded in proven measurable facts, whereas my observations as an artist are at best opinions, formed through experience but without the authority of scientific testing.

It is difficult to convey to non-specialists the rules by which works of art are evaluated, as they exist at the implicit level and are continuously shifting. The meanings and evaluations of works of art do not generally follow clear and predetermined means of understanding and evaluation. Meaning in an artwork operates at multiple levels, including those of metaphor, material form, contextual situation, nature of production, institutional affiliation, market value, etc. The situation is quite slippery in relation to the quantifiable scientific paradigm. Artistic and related practices such as design and architecture focus on contextual relationships, where the meaning of the work may lie outside itself. Consider, for instance, a particular building's design as a response to its cultural situation defined through the collection of data about occupants, traffic fluctuations, noise levels, surrounding buildings, political and economic implications, etc. Art-oriented production requires acute understanding of such things as the context in which it is to be situated, how it is to be interpreted and what rules it follows or twists inside out. A work of art is therefore always in conversation with the conditions of its production and its institutional history. The artist John Baldessari aptly summed it up in the work "Painting for Kubler," which consisted of the following sentences on canvas:

> This painting owes its existence to prior paintings.... Ideas of former painting had to be rethought in order to transcend former work. To like this painting you will have to understand prior work. Ultimately this work will amalgamate with the existing body of knowledge [11].

Whereas the artist is by nature a generalist, as his or her work often depends on the juxtaposition of sampled information from a wide spectrum of sources, the scientific research model operates at the micro and specific level. Research addresses a specific problem, and when a solution is achieved, it requires the experiment to be repeatable. In contrast, an artwork's value lies in its unique approach in addressing a problem, and to reduce it to its integral components to understand its inner workings may result in the dissolution of its essential qualities in the process.

The interdisciplinary, collaborative processes and interactions of our team-taught course became a topic of discussion itself. My engineer colleague Gibson voiced three pertinent concerns: (a) The interaction between the arts and engineering faculty members out of class is as important as what happens in class. (b) Having both faculty members present at all class sessions allows the faculty to interact and the students to observe this interaction and benefit. (c) The engineering faculty should feel free to present very technical topics without oversimplification of the ideas involved as long as there are visual and audio demos to illustrate the concepts. The nontechnical students are thus exposed to more rigorous definitions of topics such as complexity, information, noise, filtering, etc., although they cannot derive the result or perhaps write out the equations [12].

We have learned from each other that each discipline accepts divergences in research directions at the early stages, but there are differences along the way. Gibson has described a recurring situation in basic research in which a proposed engineering research plan may open up unexpected insights leading to a reformulation or redirection of the research. Once a commitment to a research topic is agreed upon, however, engineering and scientific research stays firmly focused on its intended research goals. Artistic projects tend to be open-ended, having the luxury to deviate from their intended course to arrive at an unplanned outcome in cases where the final results have not been committed to, as in public commissions. The artist additionally benefits from the flexibility to deviate to pursue a project that may not be clear at all in its essence until it reaches completion. In the short run, the free-form arts approach may not contribute to resolution of the research problem at hand but may nonetheless have an impact down the road by opening up new vistas that might benefit collaborative research in the future.

References

1. Brigitte Steinheider and George Legrady, "Interdisciplinary Collaboration in Digital Media Arts: A Psychological Perspective on the Production Process," in Special Section "ISEA 2002 Selected Papers," *Leonardo* **37**, No. 4, 315–321 (2004).

2. <www.arts.ucsb.edu>.

3. <www.create.ucsb.edu>.

4. <http://ilab.cs.ucsb.edu/>.

5. <http://vision.ece.ucsb.edu/>.

6. <http://media.igert.ucsb.edu>.

7. <www.nap.edu/catalog/11153.html>.

8. <www.cnsi.ucsb.edu/index.html>.

9. <www.mat.ucsb.edu/~g.legrady/academic/courses/05w256/05w256.html>.

10. Introductory quote by Rita Colwell, Director, NSF, "Crossing Boundaries—Interdisciplinary Science," <www.nsf.gov/od/lpa/forum/colwell/rc030220aucklandnz.htm>.

11. C. van Bruggen, *John Baldessari* (New York: Rizzoli, 1990) p. 33.

12. Jerry Gibson, e-mail, 31 January 2005.

13. <www.mat.ucsb.edu/~g.legrady/academic/courses/04w594/toh/index.html>.

14. <www.mat.ucsb.edu/~g.legrady/academic/courses/04w594/wormwalker/index.html>.

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