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SPECIAL ISSUE

DAC 09

after media : embodiment and context

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Making Inroads: Promoting Quality and Excellency of Contemporary Digital Cultural Practices and Interdisciplinarity

I would like to welcome you to the first special volume of the Leonardo Electronic Almanac. *DAC09: After Media: Embodiment and Context*, is a volume that generated from the conference by the same name that Prof. Penny chaired at the end of 2009.

DAC09: After Media: Embodiment and Context is the first of a series of special volumes of the Leonardo Electronic Almanac that are realized in collaboration with international academic, editors and authors.

Prof. Penny was inspired for this LEA special issue by the continuous developments in the interdisciplinary arena and in the fields of new media and digital art culture. He wanted to collate research papers that would provide the seeds for innovative thinking and new research directions. The authors featured in this volume, to whom we are most grateful for their hard work, will provide the reader with the opportunity to understand and imagine future developments in the fields of digital art culture and interdisciplinarity.

As I look at the electronic file of what we now internally refer to simply as *DAC09* the first issue of the revamped LEA, *Mish Mash*, printed and delivered by Amazon, sits on the desk next to my keyboard. The possibilities and opportunities of e-publishing, which also has physically printed outcomes, provide me with further thoughts on the importance and necessity of the work that is done by 'small publishers' in the academic field. The promising news of a new open access journal to be launched by The Wellcome Trust or the 'revolution' of researchers against Elsevier through the website http://thecostofknowledge.com/ with 9510 Researchers Taking a Stand (Thursday, April 12, 2012 at 10:57 AM) highlights the problems and issues that the industry faces and the struggles of young researchers and academics.

The contemporary academic publishing industry has come a long way from the first attempts at e-publishing and the revolution, if it can be defined as such, has benefited some and harmed others.

As the struggle continues between open access and copyrighted ownership,[1] the 'revelation' of a lucrative academic publishing industry, of economies of scales, of academics exploited by a system put in place by publishing giants (into which some universities around the globe have bought into in order to have an internationally recognized ranking system) and the publishers' system of exploitation structured to increase the share of free academic content to then be re-sold, raises some essential questions on academic activity and its outputs.

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The answers to these problems can perhaps be found in the creativity of the individuals who participate in what is, at times, an harrowing process of revisions, changes, reviews, replies and rebuttals. This is a process that is managed by academics who donate their time to generate alternatives to a system based on the exploitation of content producers. For these reasons I wish to thank Prof. Simon Penny and all the authors who have contributed to *DAC09: After Media: Embodiment and Context*.

Simon Penny in his introduction to this first LEA special volume clearly states a) the importance of the *DAC09* and b) the gravitas and professional profile of the contributors. These are two points that I can support wholeheartedly, knowing intimately the amount of work that this volume has required in order to maintain the high standards set by *Mish Mash* and the good reception it received.

For this reason in announcing and presenting this first special volume I am proud to offer readers the possibility of engaging with the work of professionals who are contributing to redefining the roles, structures and semantics of new media, digital art practices and interdisciplinarity, as well as attempting to clarify what digital creativity is today and what it may become in the future.

The field of new media (which are no longer so new and so young – I guess they could be better described as middle aged, slightly plump and balding) and digital practices (historical and contemporary) require new definitions and new engagements that move away from and explore beyond traditional structures and proven interdisciplinary partnerships.

DAC09: After Media: Embodiment and Context is a volume that, by collating papers presented at the DAC09 conference, chaired by Prof. Simon Penny, is also providing recent innovative perspectives and planting seeds of new thinking that will redefine conceptualizations and practices, both academic and artistic.

It also offers to the reader the possibility of engaging with solid interdisciplinary practices, in a moment in which I believe interdisciplinarity and creative practices are moving away from old structures and definitions, particularly in the fraught relationship between artistic and scientific disciplines. If 'cognitive sciences' is a representation of interdisciplinarity between artificial intelligence, neurobiology and psychology, it is also an example of interdisciplinary interactions of relatively closely related fields. The real problem in interdisciplinary and crossdisciplinary studies is that these fields are hampered by the methodological problems that still today contrapose in an hierarchical structure scientific methodologies versus art and humanities based approaches to knowledge.

This volume is the first of the special issues published by LEA and its appearance coincides with the newly revamped website. It will benefit from a stronger level of advocacy and publicity since LEA has continued to further strengthen its use of social platforms, in fulfillment of its mission of advocacy of projects at the

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intersection of art, science and technology. *DAC09* will be widely distributed across social networks as open access knowledge in PDF format, as well as being available on Amazon.

I extend a great thank you to all of the contributors of *DAC09: After Media: Embodiment and Context* and wish them all the very best in their future artistic and academic endeavors.

Lanfranco Aceti
Editor in Chief, Leonardo Electronic Almanac
Director, Kasa Gallery

ACKNOWLEDGEMENTS

I would like to thank Ozden Sahin, LEA Co-Editor, for having delivered with constancy another project of which LEA could be proud. The LEA special issues are more similar to small books – 200 pages is not a small endeavor – that require special care and attentive selection.

I am very grateful to Prof. Simon Penny for the hard work that he has put into this volume and to the authors who have patiently worked with us.

To all of you my heartfelt thanks.

DAC09: After Media: Embodiment and Context is the first special volume of the Leonardo Electronic Almanac to be followed by many others that are currently in different stages of production, each of them addressing a special theme and focusing on bringing to the mainstream of the academic debate new forms of thinking, challenging traditional perspectives and methodologies not solely in the debates related to contemporary digital culture but also in the way in which these debates are disseminated and made public.

To propose a special volume please see the guidelines webpage at: http://www.leoalmanac.org/lea-special-issues-submission-instructions/

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Two decades of Digital Art and Culture

An introduction to the LEA DAC09 special edition

by

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This volume of LEA is composed of contributions drawn from participants in the 2009 Digital Art and Culture conference held at the University of California, Irvine in December 2009. DAC09 was the eighth in the Digital Art and Culture conference series, the first being in 1998. The DAC conference series is internationally recognized for its progressive interdisciplinarity, its intellectual rigor and its responsiveness to emerging practices and trends. As director of DAC09 it was these qualities that I aimed to foster at the conference.

The title of the event: After Media: Embodiment and Context, was conceived to draw attention to aspects of digital arts discourse which I believe are of central concern to contemporary Digital Cultural Practices. "After Media' queries the value of the term 'Media Arts' – a designation which in my opinion not only erroneously presents the practice as one concerned predominantly with manipulating 'media', but also leaves the question of what constitutes a medium in this context uninterrogated. 'Embodiment and Context' reconnects the realm of the digital with the larger social and physical world.

'Embodiment' asserts the phenomenological reality of the fundamentally embodied nature of our being, and its importance as the ground-reference for digital practices. 'Embodiment' is deployed not only with respect to the biological, but also with reference to material instantiations of world-views and values in technologies, a key example being the largely uninterrogated Cartesianisms and Platonisms which populate computational discourse. Such concerns are addressed in contemporary cognitive science, anthropology and other fields which attend to the realities of the physical dimensions of cognition and culture.

'Context' emphasises the realities of cultural, historical, geographical and gender-related specificities. 'Context' brings together site-specificity of cultural practices, the understandings of situated cognition and practices in locative media. The re-emergence of concerns with such locative and material specificity within the Digital Cultures community is foregrounded in such DAC09 Themes as Software and Platform Studies and Embodiment and Performativity.

The DAC09 conference included around 100 papers by an international array of contributors. In a desire to be maximally responsive to current trends, the conference was to some extent an exercise in self-organisation by the DAC09 community. The call for papers and the structure of the event was organized around nine conference themes which were themselves the result of a call to the community for conference themes. The selected themes were managed largely by those who proposed them. Much credit for the success of the event therefore goes to these hard-working 'Theme Leaders' : Nell Tenhaaf, Melanie Baljko, Kim Sawchuk, Marc Böhlen, Jeremy Douglass, Noah Wardrip-Fruin, Andrea Polli, Cynthia Beth Rubin, Nina Czegledy, Fox Harrell, Susanna Paasonen, Jordan Crandall, Ulrik Ekman, Mark Hansen, Terry Harpold, Lisbeth Klastrup, and Susana Tosca, and also to the Event Organisers: David Familian, Michael Dessen, Chris Dobrian, Mark Marino and Jessica Pressman. I am particularly grateful to Ward Smith, Information Systems Manager for DAC09, who for two years, as my sole colleague on the project, managed electronic communications, web design and the review and paper submission processes amid, as he would put it, a 'parade of indignities'. In the several months of final planning and preparation for the event, the acumen and commitment of Elizabeth Losh and Sean Voisen was invaluable.

I first published on what we now refer to as digital arts in 1987. [1] Not long after, I was lucky enough to have the opportunity to attend the first ISEA conference in 1988. Since that date I have been actively involved in supporting the development of critical discourses in the field, as a writer, an editor and an organizer of events. My role as director of the DAC09 conference gave me a perspective from which to reflect on the state of digital arts discourse and its development over two decades. As I discussed in a recent paper, [2] the first decade on media art theory was a cacophonous interdisciplinary period in which commentators from diverse fields and disciplines brought their expertise to bear on their perceived subject. This created a scenario not unlike that of various viewers looking into a house via various windows, none of them perceiving the layout of the house, nor the contents of the other rooms. In the ensuing decade, a very necessary reconciliation of various disciplinary perspectives has occurred as the field has become truly a 'field'.

While post structuralist stalwarts such as Deleuze and Derrida continue to be referenced in much of the more critical-theory oriented work in Digital Cultures, and the condition of the posthuman and posthumanist are constantly referenced, theoretical reference points for the field are usefully broadening. The emerging field of Science and Technology Studies has brought valuable new perspectives to media arts discourses, counterbalancing the excesses of techno-utopianism and the sometimes abstruse intellectualism of post-structuralist theoretical discourses. In this volume, Mark Tuters provides an exemplar of this approach in his *Forget Psychogeography: Locative Media as Cosmopolitics*, bringing Rancière and Latour to bear on a discussion of HCI, Tactical Media and Locative Media practices. Tuters provides a nuanced argument replete with examples which questions the sometimes, superficial and dogmatic re-citation of the originary role of the Situationists with respect to such practices. At DAC09, Connor McGarrigle also took a thoughtful revisionist position with respect to the Situationists. [3]

In this context, the new areas of Software Studies and Platform Studies have emerged and have been nurtured in previous DAC conferences. In this spirit, Chandler McWilliams attempt to "thread the needle between a reading of code-as-text that obfuscates the procedural nature of code, and an overly technical description of programming that reinstates the machine as the essential arbiter of authentic acts of programming" is emblematic of the emergence of Software Studies discourses which are quintessentially interdisciplinary and erudite on both sides of the science wars divide. Similarly, Mark Marino's meditations on heteronormativity of code and the Anna Kournikova worm call for what he calls Critical Code Studies, here informed by queer theory. In their proposal for an 'AI Hermenteutic Network' Zhu and Harrell address the question of intentionality, a familiar theme in AI critical discourse (i.e., John Searle 'Minds,

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Brains and Programs' 1980). Citing Latour, Agre, Hayles and others, they offer another example of the science-wars-sidestepping technical development based in interdisciplinary scholarship noted in the discussion of Chandler McWilliams' contribution.

Another trend indicative of the maturation of this field is its (re)-connection with philosophical discourse. In this context, the deep analysis of Electronic Literature in terms of Wittgensteinian Language Games by Mauro Carassia is something of a tour de force. While a tendency to extropianism is here not explicitly discouraged, this discussion places such technological practices squarely as indicators of transition to post-human subjectivity, and in the process, open the discussion to phenomenological, enactive and situated critiques as well a drawing in the relevance of pre-cognitivist cybernetic theorisation.

One of the aspects of contemporary media arts discourse which I hoped to foreground at DAC09 was questions of embodiment and engagement with contemporary post-cognitivist cognitive science. Several papers in the current collection reflect such concerns, and indeed they were foregrounded in several conference themes. One example of the value of the application of such theory is evidenced in Kenny Chow and Fox Harrells leveraging of contemporary neuroscience and cognitive linguistics in their deployment of the concept of "material-based imagination" in their discussion of Interactive Digital Artworks. In a quite different approach to embodiment and computation, Carrie Noland discusses choreography and particularly the choreography of Cunningham, with reference to Mauss and Leroi-Gourhan, and with respect to digital choreographic tools.

The DAC community did not choose to make Game Culture a focal theme in DAC09 – perhaps because the field has grown so quickly and has built up a structure of conferences and journals. Nonetheless, gaming culture was referenced throughout the event, and was the subject of numerous presentations, such as Josh and Karen Tannenbaums reconsideration of 'agency as commitment to meaning', which addressed the acknowledged problematic of the tension between authorial and user agency in terms of a critique of the humanist subject. Like wise, phraseology such as Boluk/Lemieux's: "player performance in and around games has matured to the point of beginning to express underlying serial logics through heavily mannered gameplay mechanics" (in their contribution to this volume) signals the establishment of a mature and erudite critical theory of games and gaming. On a more technical note, Sullivan/WardripFruin/Mateas make an argument for enriching computer game play by application of artificial intelligence techniques to the authoring of 'quests'.

As Digital Arts became established as a practice the question of pedagogy inevitably arose – what to teach and how to teach it. Though rhetorics of convergence pretend to the contrary, one cannot dispute the profound epistemological and ontological dilemmas involved in attempting to bring together intellectual environments of such disparate communities as engineers, artists and critical theorists, in the classroom and the lab. Interdisciplinarity was therefore the ground upon which these programs were developed, and each context inflected that idea with its own color. My own reflections on the subject are published at *Convergence.* [4] It therefore seemed timely to address pedagogy at DAC09. In the process of elaboration of digital cultural practices, such emerging practices have themselves come into consideration as pedagogical tools and systems. In this volume, Elizabeth Losh surveys and discusses various pedagogical initiatives (mostly in Southern California) deploying digital tools and environments. In a contribution which crosses between the pedagogy thematic and concerns with cognition, Harrell and Veeragoudar Harrell offer a report on a science, technology, engineering, and mathematics (STEM) educational initiative among at-risk students which considers the relationships between users and their virtual identities.

In his essay, Garnet Hertz discusses the work of three artists – Reed Ghazala, Natalie Jeremijenko, and Tom Jennings. None of them 'media artists' in the conventional sense, they, in different ways and for different purposes, re-purpose digital technologies. Rounding out this volume is presentation of two online artworks by Sharon Daniels which were presented at DAC09. *Public Secrets* and *Blood Sugar* are elegant web-based art-works, both poetic and examples of a committed activist practice.

In my opinion, this collection offers readers a survey of fields addressed at DAC09, and an indication key areas of active growth in the field. Most of them display the kind of rigorous interdisciplinarity I regard as characteristic of the best work in the field. While the science-wars rage on in certain quarters, in media arts discourse there appears to be an attitude of intelligent resolution – a result in no small measure of the fact that a great many such commentators and theorists have taken the trouble to be trained, study and practice on both sides of the great divide of the 'two cultures', and to take the next necessary step of attempting to reconciling or negotiate ontologies traditionally at odds. This professional profile was very evident at DAC09 and is represented by many of the contributors in this volume. Such interdisciplinary pursuits are in my opinion, extremely intellectually demanding. The obvious danger in such work is of superficial understandings, or worse, a simple re-citation of a new canon of interdisciplinary media studies. Dangers that, happily, none of the papers grouped here, and few of the papers presented at DAC09, fell victim of. ■

The electronic proceedings of DAC09 are available at this link: http://escholarship.org/uc/ace_dac09

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Leonardo Electronic Almanac

Volume 17 Issue 2

4 **EDITORIAL** Lanfranco Aceti

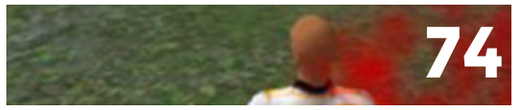
8 **INTRODUCTION** Simon Penny

HUNDRED THOUSAND BILLION FINGERS: SERIALITY AND CRITICAL GAME PRACTICES
Stephanie Boluk & Patrick LeMieux

36 **ELECTRONIC LITERATURE AS LANGUAGE GAME: A PHILOSOPHICAL APPROACH TO DIGITAL ARTIFACT SUBJECTIVITY**
Mauro Carassai

UNDERSTANDING MATERIAL-BASED IMAGINATION: COGNITIVE COUPLING OF ANIMATION AND USER ACTION IN INTERACTIVE DIGITAL ARTWORKS
Kenny K. N. Chow & D. Fox Harrell

PUBLIC RECORDS / SECRET PUBLICS: INFORMATION ARCHITECTURE FOR NEW POLITICAL SUBJECTS
Sharon Daniel



IMAGINATION, COMPUTATION, AND SELF-EXPRESSION: SITUATED CHARACTER AND AVATAR MEDIATED IDENTITY
D. Fox Harrell & S. Veeragoudar Harrell

92 **PLAY, THINGS, RULES, AND INFORMATION: HYBRIDIZED LEARNING IN THE DIGITAL UNIVERSITY**
Elizabeth Losh

110 **LANGUAGE IN THE OTHER SOFTWARE**
Chandler B. McWilliams

ENERGY GEARED TO AN INTENSITY HIGH ENOUGH TO MELT STEEL: MERCE CUNNINGHAM, MOVEMENT, AND MOTION CAPTURE
Carrie Noland

AN INTERVIEW WITH SIMON PENNY: TECHNO-UTOPIANISM, EMBODIED INTERACTION AND THE AESTHETICS OF BEHAVIOR
Jihoon Felix Kim & Kristen Galvin

146 **MAKING QUESTS PLAYABLE: CHOICES, CRPGS, AND THE GRAIL FRAMEWORK**
Anne Sullivan, Michael Mateas, Noah Wardrip-Fruin

160 **NARRATING SYSTEM INTENTIONALITY: COPYCAT AND THE ARTIFICIAL INTELLIGENCE HERMENEUTIC NETWORK**
Jichen Zhu & D. Fox Harrell

ART AFTER NEW MEDIA: EXPLORING BLACK BOXES, TACTICS AND ARCHAEOLOGIES
Garnet Hertz

184 **OF SEX, CYLONS, AND WORMS: A CRITICAL CODE STUDY OF HETERONORMATIVITY**
Mark C. Marino

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PLAY, THINGS, RULES, AND INFORMATION

Hybridized Learning in the Digital University

by

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The term "hybrid learning" has recently been appropriated by the distance learning movement to delineate the features of a specific type of educational experience that blends traditional lecture and Socratic discussion with online computer-mediated instruction. In many ways, however, this "hybridity" only reinforces traditional boundaries between learner and teacher, learner and learner, and teacher and teacher, because this kind of courseware-driven pedagogy ultimately only reifies certain ideologies of late capitalism oriented around efficiency, modularity, linearity, and surveillance in which the interfaces of so-called learning management systems are structured like a conventional teacher's grade-book, and spontaneous forms of improvisation made possible by the unexpected connections facilitated by a course

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syllabus and particular aggregations of students are constrained by highly scripted interactions.

In contrast to courseware driven classes, courses that use digital platforms specifically to combine media theory with design and production not only trouble the assigned hierarchical roles of the classroom situation but these truly hybrid courses also disrupt norms about disciplinarity that institutions may hold dear, especially as students and learners perform knowledge work that appeals to broader publics. For example, California public university students have explored a number of rhetorical spaces that use computational media platforms to support innovative pedagogies. Creative writing students have used a 3-D cave to move phrase clusters around in an immersive composition in the same space used by biology students. Archeology and architecture students have explored a vast computer-generated 3-D model of ancient Rome in a visualization portal as part of their professional training. Upper-division writing and rhetoric students have toured a "Virtual Guantánamo" and visited a representation of Dante's *Inferno* in *Second Life* guided by the avatars of the artists and architects who created these structures before returning to the home island for their class to experiment with building rhetorical landscapes for themselves.

Several interdisciplinary courses are currently taught in the Southern California region that use rich media publishing systems, information visualization software, geographic information systems, virtual worlds, caves, HIPer walls, visualization portals, participatory screen systems, teleconferencing, 3-D modeling labs and light stages, digital editing bays, machinima, videogames, robotics, and even paper prototyping. In this way, the local area around Southern California serves as a milieu of innovation in which encounters can take place between colleagues pursuing similar experimental interdisciplinary digital pedagogies in an instructional testbed of what AnnaLee Saxenian has in the context of other high-tech development practices called "regional advantage." [1]

Many examples of such interdisciplinary pedagogy in Southern California come from computer science programs or studio art programs that emphasize science and art paradigms of *technê*, but there are also a number of notable local efforts representing the *epistêmê* of the "digital humanities" that bring students and teachers from many majors and departments together from disciplines traditionally associated with print culture and the classical trivium. Although individual universities have developed particular pedagogical specialties, examining case studies from the University of Southern California and three University of California campuses – UCLA, UC Irvine, and UC San Diego – seems to reveal some meaningful cross-institutional trends that also might have resonance for digital educators elsewhere in the country.

TEN PEDAGOGICAL TRENDS

In the Southern California community of educators who use social computing, there has been a wide-ranging discussion about pedagogical philosophy, which has involved interrogation of the logics, ethics, politics, epistemologies, aesthetics, and even metaphysics of teaching. As ideas, people, and forms of hardware and software circulate between regional campuses, theoretical discussions about teaching have explored topics from the following ten areas:

Playable Simulations differ from conventional computer models that depict change over time in that users can alter inputs to learn how different influences, factors, or catalysts may play a role in the outcomes that a given system generates and represents. In higher education, computational media have been

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developed for visualizing solutions to a number of problems – and ways that cascading failures can be anticipated – in research areas that range from climate science to international relations. Like traditional role-playing games, students can study the interactions between different physical, biological, psychological, political, cultural, or national actors by experimenting with different combinations of inputs and forming hypotheses about causality. For example, in the playable simulation *Segregation and Assimilation*, an artificial life C++ program used with students by Professor Nick Gessler, students exploring sociology or urban planning can attempt to choose a mix of ethnic residents that will not eventually result in the propagation of disconnected ghettos. [2]

However, imaginatively conceived playable simulations should not be confused with conventional educational games that might be of more dubious value to learning and fostering understanding and consensus. After all, the danger always exists that well-meaning philanthropists or administrators will merely support so-called "chocolate covered broccoli" projects, in which games are assumed only to be meaningful educational tools if they make repetitive learning tasks marginally more appealing to a captive audience. These incoherent "serious games" that randomly connect game mechanics to Skinnerian feedback mechanisms also tend to lack a clear pedagogical focus supporting an ethics of constructive sociality in the classroom. Scot Ostrow's imagined *Grand Theft Calculus* game in which the main urban outlaw character from the *Grand Theft Auto* franchise carries a giant calculator and cheerfully performs math problems represents the *reductio ad absurdum* of this kind of digital pedagogy. [3]

Procedural Literacy Events encourage students to figure out underlying rule sets through experience rather than through didactic delivery and direct instruction. By experimenting with different algorithms at work in a digital representation, students can see how a set of implicit rules can be made explicit or vice versa. For example, U.C. Irvine's Emily Navarro and André van der Hoek have developed *Sim SE* to mimic the procedural aspects of common practices and protocols that are observed in a software engineering work environment. [4] Like the literacy events described by Shirley Brice Heath that take place within print cultures, in which "oral performance surrounding a written piece of material" [5] is a key component of membership in an educated community, procedural literacy events in which students deduce the rule at work in a given system collectively can be profoundly social, as they are discovered in group work.

In defining the term more precisely, Michael Mateas has written, "By procedural literacy I mean the ability to read and write processes, to engage procedural representation and aesthetics, to understand the interplay between the culturally-embedded practices of human meaning-making and technically-mediated processes. With appropriate programming, a computer can embody any conceivable process; code is the most versatile, general process language ever created." [6] Of course, not all learners achieve the level of code literacy that Mateas hopes for or embrace the linguistic competencies in code that he promotes. Many use brute force trial-and-error methods or collective intelligence harvested from others in the classroom to deduce the path to an outcome that might mimic solving procedural puzzles without understanding them. Furthermore, strong cultures of interest around cheating, hacking, modding, or short cuts may actually encourage these practices, which constitute a form of learning, albeit not the desired one of educators who emphasize academic integrity. As Amy Bruckman and Betsy DiSalvo have pointed out, urban youth who believe in a similar ethic of fair play that has been shaped by traditional sports competitions often are at a significant disadvantage when it comes to participating in informal learning practices that can lead to careers in computer science or related fields. [7]

Database Mash-Ups enable new forms of data mining in educational contexts as students work with more than one database at a time. A general pedagogical mash-up culture has been promulgated in recent years by a number of corporate software providers who would like to encourage educators to use products that are simultaneously open and proprietary, such as Keyhole Markup Language (KML) from Google, and by government entities that are encouraging the use of completely open applications programming interfaces (API) technologies to make complicated and very large data sets about the federal budget, national demographics, transportation records, or biodiversity more easily usable by the public. As hacktivist and self-described "disruptive technologist" Virgil Griffith, creator of the WikiScanner that can identify the source of anonymous edits to Wikipedia, explains this landscape, "the web today contains vast amounts of useful information, but it is scattered within a disconnected archipelago of web sites as well as public and private databases. By fusing information from disparate or little-known databases, I aim to empower everyday users by giving them powerful, promiscuously interoperable digital intelligence tools typically reserved for major corporations." [8] However, the synthetic powers of database mash-ups can mask discrete features of individual sources and the explanatory force of a database mash-up can also mask other causal factors at work. For example, Griffith's own mash-up of SAT scores and favorite books derived from all the Facebook profiles associated with a given campus, "Books That Make You Dumb," seemed to show African-American literature in a negative light, largely because of poor performance on standardized testing by students attending historically black colleges. Griffith eventually posted his own admission that "I'm aware correlation ≠ causation" but defended what he saw as results that were "hilarity incarnate regardless of causality." [9]

Network Epistemologies assume that relationships between objects of study are complex and cannot be simply characterized by one-way cause and effect relationships or Bloomian models of influence. Of course, Mark C. Taylor was ridiculed when he proposed in the editorial pages of the *New York Times* that conventional academic departments should be abolished and the academy should be reorganized around "zones of inquiry" such as "Mind, Body, Law, Information, Networks, Language, Space, Time, Media, Money, Life and Water." [10] But universities can not continue to resist what Manuel Castells has called "the rise of the network society" [11] and what Albert-László Barabási has characterized as a correction to science's long history of reductionism. As Barabási explains, "Today we increasingly recognize that nothing happens in isolation. Most events and phenomena are connected, caused by, and interacting with a huge number of other pieces . . . Everything is linked to something else. We are witnessing a revolution in the making as scientists from all different disciplines discover that complexity has a strict architecture." [12] However, modeling these networks in the context of existing computational power can pose particular challenges to classrooms lacking robust computing resources. As Micki McGee discovered in attempting to create a database to model the influences, rivalries, love affairs, and publication channels at work in just one artist's colony to create the *Yaddo: Making American Culture* installation at the New York Public Library, [13] the computer system was repeatedly overtaxed.

Object-Oriented Ontology attempts to correct what it sees as a tendency to view the world solely in terms of human intention. Following Bruno Latour and philosopher Graham Harman, who has asserted Latour's importance in metaphysics, [14] a number of academics

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are teaching in ways that foreground object-oriented ontology, which Ian Bogost defines in the following way: "In contemporary thought, things are usually taken either as the aggregation of ever smaller bits (scientific naturalism) or as constructions of human behavior and society (social relativism). OOO steers a path between the two, drawing attention to things at all scales (from atoms to alpacas, bits to blinis), and pondering their nature and relations with one another as much with ourselves." [15] By extension, OOO also suggests that traditional taxonomic models of branching knowledge are less viable, particularly in the digital age, because the task of interpreting scholarly objects of study is less about cataloguing elements into fixed categories and more about attaching metadata that does not preclude other kinds of organizational and interpretive schemes. At the popular level this could be seen as what David Weinberger has described as an "everything is miscellaneous" approach to categorizing knowledge. [16]

The international conference on Digital Arts and Culture often has been a place for previewing coming theoretical trends in digital scholarship. For example, long before the formation of separate conferences for the Electronic Literature Organization and the Digital Games Research Association, DAC was at the forefront of interactive literature and game studies. The 2009 DAC conference, "After Media: Embodiment and Context," included a prominent "Interdisciplinary Pedagogy" theme led by digital artist Cynthia Beth Rubin that tried to make connections between the cutting-edge, sophisticated theory that the conference represented and the more mundane practical challenges posed by instructional technology and augmented classroom learning, which also reflected interest at the conference in object-oriented ontology. The conference opened with a plenary talk by N. Katherine Hayles about this "new focus on objects" in the humanities, and speakers at the conference who expressed an alliance with OOO included media artists like Garnet Hertz and Marc Tuters of the Networked Publics project. The Interdisciplinary Pedagogy track at the DAC conference also offered two model examples of teaching in a way that is oriented toward what has been called "the new ecology of things."

Using the pedagogical directive "empathy + design for complex processes," Katherine Lambert of the California College of the Arts initiated a course titled "Lifecycle." The primary goal of the class was to familiarize students with a collaborative, cross-disciplinary design process. The pedagogical vehicle was research into the urban waste disposal process and sustainability practices, and the class focused on the development of a product, a service or an environment – which is often a container for products and services. As Lambert explained, students "working in collaborative groups of five" representing "distinct disciplines" that included architecture, digital media, environment design and industrial design selected iconic representations of waste production. [17] They then took on the challenge of reinventing each product within the context of its discrete lifecycle, making it "smart," culturally specific, user-centered, and ecologically responsive. Addressing a range of disciplinary perspectives, the prioritization of the entire lifecycle – the "loop" of consumer goods from creation research, design, production, use, and ultimate disposal – served as the conceptual underpinnings and point of departure for this collaborative research and study. As a CCA story on the Lifecycle course indicated, the students approached products, normally thought of as inert and inconsequential, in a fundamentally different manner. [18] They were now viewed as distinct agents comprising landfills teeming over with waste, clogging waterways, and proving detrimental to life. The project development and critique process received support from the IDEO design firm and was orchestrated and documented on the Lifecycle Blog. The prototypes of all the student projects created in the class were honored by an invitation from the Thoreau Center for Sustainability for public exhibition in its San Francisco Presidio gallery.

Having a public presence was also important to Cornell University's Renate Ferro, whose Tinker Factory, a "lab for research design, creativity and interdisciplinary technology," drew inspiration from Andy Warhol's famous New York art space. The Tinker Factory's mission was to encourage cross-disciplinary collaboration, sharing of resources, equipment, technical expertise, and knowledge so that new directions in forging the arts with technology could be realized. In an interview, Ferro argued that the Tinker Factory's focus on material objects associated with computational media platforms such as circuit boards, switches, wires, and sensor technologies creates more lively interchanges: "It's a physical place to springboard critical concepts for discussion instead of the other way around." [19] Ferro describes the mission of the lab as "definitely object-oriented" and explains that by starting "with the physical art-making," moments of innovation and creation can take place.

Information Aesthetics interrogates how representation and abstraction have been used traditionally in the visual arts and also builds on work being done in information design and data visualization. "Information visualization has recently emerged as an independent research field which aims to amplify cognition by developing effective visual metaphors for mapping abstract data . . . Some researchers have suggested that information visualization may be further augmented by engaging in an interdisciplinary discourse with design and art communities, or vice versa." [20] Research projects oriented around pattern recognition may use open-source collaboratively authored data mining and data visualization tools to ask new scholarly questions that would not have been possible with the material generated only by traditional text encoding initiatives.

Furthermore, as Franco Moretti proposes in *Graphs, Maps, Trees*, students of literary history who are willing to attend to "the explanation of general structures over the interpretation of individual texts" can better understand the unstable sites of literary production that are "halfway between the social *doxa* and the individual voice." [21] Learners generate content that reflects a stylized reality of numerical extrapolations by engaging with code practices that go beyond the highly scripted charts and graphs that are part of the default Microsoft Office package to use visualization tools that show fluid relationships and very large data sets. For example, initiatives such as the MONK Workbench allow literary scholars to see clusters of lexical choices that might otherwise be invisible in a conventional reading of a literary text.

However, this pedagogical strategy also has potential pitfalls. In particular, Ian Bogost has argued against "chartporn" and has complained that infographics "may be beautiful, but they are not necessarily *informative*" and that "pretty charts often fail to *synthesize* the meaning, relevance, and impact of information as it pertains to decision making." [22] Furthermore, the level of abstraction in some schemes for information aesthetics radically depersonalizes the human subject. For example, Digital Monument to the Jewish Community in the Netherlands reduces Anne Frank to a single colored pixel in its scheme. [23]

Tactical Media takes advantage of the availability and flexibility of new digital tools and Internet venues for user-generated content, along with the vulnerability of traditional one-to-many forms of print and broadcast media, to publicize politically or culturally subversive parodies, hoaxes, hacks, DIY projects, or other unauthorized appropriations of branded products from the mainstream culture industry. In an early

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manifesto Geert Lovink and David Garcia explain how these media practices arose: "Tactical Media are what happens when the cheap 'do it yourself' media, made possible by the revolution in consumer electronics and expanded forms of distribution (from public access cable to the Internet) are exploited by groups and individuals who feel aggrieved by or excluded from the wider culture." [24] Rather than be shielded from public audiences behind ivy walls or ivory towers, students in courses with instruction in tactical media are encouraged to participate in (and critique) a larger economy of attention in which the standard procedures of passive consumption are to be ignored and any exploits found are to be capitalized upon. [25] For example, at Pitzer College, students have competed to compose YouTube videos that earn over a million views, and then they deconstruct the makings of potentially viral content. At the same time they have been encouraged to explore "NicheTube" and the counterpublics that spaces for alternative politics and socialities offer. [26]

Digital Rhetorics not only interrogate the relationship between technological affordances and techniques of persuasion but also consider the embodiment and occasionality of electronic speech acts – as well as conditions of distance and asynchrony – that shape contemporary rhetorical situations. Richard Lanham has suggested that such rhetorics have created a crisis for the traditional structures of universities as public institutions of knowledge that depend on maintaining existing hierarchies of power and systems of exclusion. Lanham argues that these new rhetorics also present a "fictionalized modeling" that characterizes a range of "real" simulations both inside and outside of academia. [27] Faculty associated with "computers and composition" or "computers and writing" have a long history as early adopters of instructional technology with professional associations that go back to the nineteen eighties and nineties. In this body of criticism, software development, gaming, and practices associated with social computing are treated rhetorically, and specific audiences, purposes, acts, actors, and agents can be explored and appropriated for new use.

Of course, the challenge for teachers deploying tactical media and digital rhetorics in the classroom is that students may choose to champion particular political, ethnic, religious, or social causes that the teacher may find reprehensible. Student privacy can also be compromised when digital learning becomes the platform for public speech.

Software Studies examines software as a cultural product that represents and performs a number of different historical, literary, philosophical, social, and political meanings. This interpretive activity seeks input from "computer scientists, artists, designers, cultural theorists, programmers, and others from a range of disciplines" to understand the "ways of thinking and doing" that are distinct to computer programming. "Computing and digital media are essential to the way we work and live, and much has been said about their influence. But the very material of software has often been left invisible. These include algorithms; logical structures; ways of thinking and doing that leak out of the domain of logic and into everyday life; the value and aesthetic judgments built into computing; programming's own subcultures; and the tightly formulated building blocks that work to make, name, multiply, control, and interweave reality." [28]

Software studies can direct students' attention to objects of study that range from individual sections in a line of code [29] to entire platforms for programming [30] and it argues that print culture, architecture, contemporary art, and the face-to-face social networking of knowledge workers cannot be apprehended without considering the role of both proprietary and open-source software products, because of a principle of what Lev Manovich has called "transcoding." [31] However, not all students want to open up the black boxes that control their daily experiences of computer-mediated communication and interaction. In student evaluations, first-year college students enrolled in an ambitious course on "Computer Games as Art, Culture, and Technology" complained about being asked to write even simple computer programs or create design documents with illustrations. [32]

Critical Information Studies, the subject of a "manifesto" by Siva Vaidhyanathan, focuses on four areas: 1) "the abilities and liberties to use, revise, criticize, and manipulate cultural texts, images, ideas, and information;" 2) "the rights and abilities of users (or consumers or citizens) to alter the means and techniques through which cultural texts and information are rendered, displayed, and distributed;" 3) "the relationship among information control, property rights, technologies, and social norms;" and 4) "the cultural, political, social, and economic ramifications of global flows of culture and information." [33] As Vaidhyanathan describes it, its subject matter could include "copyright policy, electronic voting, encryption, the state of libraries, the preservation of ancient cultural traditions, and markets for cultural production." Its interdisciplinary encounter is foregrounded by collaboration between "economists, sociologists, linguists, anthropologists, ethnomusicologists, communication scholars, lawyers, computer scientists, philosophers, and librarians." [34] For example, the Critical Commons project at the University of Southern California is attempting to regain territory for fair use with an archive of digital video clips for teaching situations that emphasize possible uses that are "transformative, culturally enriching and both legally and ethically defensible." [35]

What all of these pedagogies of things, play, rules, and information share is a concern with material conditions and constraints on sensuous representation rather than a disembodied virtuality that is magically uncoupled from the limits of the body and of social realities. Many of these pedagogical approaches could be understood as responses to a "posthuman" condition, one that N. Katherine Hayles argues does not preclude embodiment, situatedness, mediation, enframement, or connections with material and messy infrastructures. [36] For Hayles, when the Enlightenment subject is no longer privileged, the actors in question are hardly the hyper-rationalized abstractions of disembodied technological imaginaries and technocratic dreams.

TOPOGRAPHY AND TOPOI: UCLA

At the University of California, Los Angeles, a group of scholars funded by the MacArthur Foundation, many of whom have also participated in the year-long 2008-2009 digital humanities public seminar sponsored by the Mellon Foundation, have used the metaphors of geography and urbanism to develop new schemes for what they call "geo-temporal argumentation" and forms of teaching and scholarship that provide alternatives to the "single-authored, fixed, discrete, and print publications" [37] that characterize the conventional textbook and the scholarly monograph.

By focusing on the "digital city" as a theme for learning rather than the more self-reflexive trope of the "digital campus," Hypercities-affiliated students are urged to adopt an attitude toward "making things public," which encourages civic engagement and deploying various figures of the *res publica*. [38] Many of the Hypercities interfaces are designed eventually to accommodate collective histories of community narratives and to use mobile devices and smart objects to engage learners who are situated at the human scale in the urban landscape. For example, recent webwork on the Hypercities site included "Election Protests in Iran," which tracked minute-by-minute social media

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production on YouTube, Twitter, and other sites that could be mapped to particular locations of unrest in Tehran. [39]

One of the original projects built by the UCLA contingent was Todd Presner's Hypermedia Berlin which attempts to present the "densely layered architectural, social, political, and cultural palimpsests" [40] of the traditional cultural and political center of Germany by presenting both traditional landmarks that represent hubs of social and economic activity and the dynamic networks of civic mobility and the transportation of goods, such as the railroad, which have shaped conditions of modernity in the city both spatially and temporally. Presner identifies three key areas for his pedagogical and scholarly project, which allows students and their professors to annotate maps of Berlin from many different overlaid time periods: 1) "network theory and contingency," 2) "embodiment and navigation," and 3) "participatory platforms and remix culture." [41] Although Presner uses technologies in this pedagogical project from Google Maps and Google Earth that are associated with traditions of military strategies of command and control, he wants participants also to understand how conditions of modernity may undermine the possibility of a "privileged position of spectatorship" or an "external view of the system" to reflect Berliners' experiences of "built space or cinematic space" as they take part in the practices of everyday life of the urban flâneur. [42]

Presner has not been alone in seeking to use these multidisciplinary new media teaching and learning opportunities offered by the Hypercities project to engage in theoretically and critically sophisticated forms of inquiry that question existing systems of knowledge and power that had conventionally been legitimated in universities. Historian Philip Ethington from the nearby University of Southern California explains a larger "spatial turn" in the late 1980s, "philosophers, critical theorists, intellectual historians, and others had developed a very advanced debate about the possibilities of producing knowledge of society," which "was not a debate between some naive believers in objective, scientistic value-neutral knowledge on one hand, and relativistic poststructuralists, on the other." [43] According to Ethington, this group agreed that they were living in a "post-foundational age, aware that linguistic construction, cultural difference, and historical contingency have eliminated the possibility of appealing to timeless, underlying truths, impartial epistemological methods, and the positive accumulation of uncontested knowledge." [44]

Ethington uses the mapping tools of Google's KML to create a vision of Los Angeles as a "Ghost Metropolis" to indicate important cultural landmarks that might otherwise be consigned to the rhetorics of extinction, abandonment, and obsolescence. This project has become one of the featured collections in the Hypercities project, which shows the "global history of Los Angeles since earliest human habitation, written in narrative, non-academic prose" that is "inspired by the Renaissance atlases of the 16th and 17th century, which are rich mixtures of typography, graphic arts, and of course cartography."

Many of the projects in Hypercities initiatives are designed to be open-ended repositories that can archive personal histories, community stories, and collective narratives of habitation, refuge, migration, segregation, and banishment to appeal to a large population of so-called "life-long learners" outside of the academy's traditional confines. For example, Historic Filipinotown appeals to community activists who support cultural preservation efforts in the face of continuing urban development. Given advances in ubiquitous computing technologies with location-aware devices, Hypercities promoters are also planning to use cellular telephones as platforms for these materials, so that those situated in the urban environment can experience an augmented reality provided by the record of the past.

The roster of team members shows the fundamentally interdisciplinary character of the Hypercities project, which includes faculty from a number of foreign language departments, Comparative Literature, History, Classics, Cognitive Science, Computer Science, Fine and Performing Arts, and Architecture and Urban Design. Some faculty members actually identity with multiple disciplines that might be seen as extremely different in conventional schemes for academic organization. For example, one team member lists her affiliations as "History and Statistics." The digital record of the past in the Hypercities project may also be a product of computer models that use 3-D software packages such as Maya to reconstruct vanished architectures and to visualize both the built and the natural environments of the past. In this way, the design practices among teams of digital artists and scholars must foster the reconciliation of different interpretations of the historical evidence to create materials for students that are both vivid and interactive.

Since 1997, "Rome Reborn" has involved the UCLA Cultural Virtual Reality Laboratory, the UCLA Experiential Technology Center, the Institute for Advanced Technology in the Humanities of the University of Virginia, the Reverse Engineering Lab at the Politecnico di Milano, the Ausonius Institute of the CNRS and the University of Bordeaux-3, and the University of Caen to create a hyperrealistic model of ancient Rome as it appeared in late antiquity, which can now be seen on Google Earth. In the Hypercities interface learners can tour the Temple of Saturn and view different time slices that present a visual interpretation of the archeological record as it has been reconstructed by archeologists and architectural historians.

UCLA is also known for using its visualization portal as a space for scholarly lectures and classroom discussions in which students experience a more immersive version of the Rome simulation in which the "fly-through" experience occurs on a much larger scale. Unlike many cave experiences, however, many of the architectural features of the traditional classroom space are preserved, because this mixed configuration encourages needed social interaction both between students and with the instructor. Immersion in the volumes of the space of these archeological simulations is also mediated by a faculty member who serves as a guide to help the group navigate and move through the simulation purposefully.

INTERFACE RHETORICS: UC SAN DIEGO

An even more immersive teaching environment has been planned for the StarCAVE at the University of California, San Diego, which uses polarized 3-D glasses to make visual research in biology, archaeology, structural engineering, and architecture more captivating to potential student spectators. However, critics note that in many ways this StarCAVE installation for all its vividness lacks real interactivity, because students are excluded from the role of content-creators. Even curious or pedagogically adventurous UCSD faculty members are kept out of the StarCAVE, because the access to the display technology requires specialized key cards to get through two locked doors.

However, UC San Diego is also contemplating a more pedagogically radical approach to large scale display technologies, one that includes students as content-creators and treats them as active participants in what Jeremy Douglass has called "the rhetorics of demo culture." UCSD has been the recipient of a number of grants related to Lev Manovich's Software Studies initiative and his related Cultural Analytics project, which attempts to represent the cultural production of up to

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a million professional and vernacular cultural producers who are engaged in creating the art, literature, design, fashion, and music not only of the past but of the present and the proximate future. To show such a huge data set that might include thousands of paintings or buildings or design portfolios, Manovich and Douglass have produced demos on the HIPerSpace wall, which offers one of the world's largest displays with screen resolution up to 220 million pixels.

For Manovich, one of the central issues in knowledge production and scholarly representation in the twenty-first century is expanding scale. Manovich also points to new disciplines like "meta-genomics" as representative of forms of academic inquiry that are emerging in response to accelerating computational power, as the many variants of Moore's law are made manifest. Manovich argues that scholarship is moving from a model based on "discrete communication," "discrete recording," and "analysis of past data" to "near continuous communication, connections, and recording" with "real-time analysis." [45] For example, a student working on an independent study project with Manovich on LookBook.nu, an international site about street fashion and vernacular design, could "drink directly from the firehose," according to Douglass, as new data for her project streamed in every hour.

As teachers of digital rhetorics and interdisciplinary subject matter, Douglass and Manovich have modeled new presentation techniques with sizable data sets and these large-scale computer display walls that have been subsequently posted for mass-consumption as online videos on YouTube. In their first demo, they present a general introduction to the topic of cultural analytics before an audience of conference attendees from the Humanities, Arts, Science, and Technology Advanced Collaboratory at nearby UC Irvine. Later Douglass performed a solo demo at his home UC San Diego campus that showed how a more conventional art history lecture about the paintings of Mark Rothko could be staged.

First, it is important to note that these two rhetorical performances took place at two separate physical sites with similar and yet different display technologies that used different software and hardware that proved to be not entirely compatible, since one of the inventors had introduced elements of proprietary code to the wall at UC Irvine, unbeknownst to the UC San Diego presenters. This happened because of common patterns of faculty mobility between campuses in which researchers leave one California campus to take a position at another. As Saxenian has noted, regional advantage produces both collaboration and competition, and in this case the similarities and differences between the HIPerWall and the HIPerSpace wall manifest how flows and resistances are created by the movement of persons and technologies between specific sites of pedagogical innovation.

Second, it is interesting to observe how Douglass compares this demo experience to a more conventional classroom presentation technology, PowerPoint, which has been understandably castigated by Edward Tufte and many other educators and information designers, because of its corporate mass-market aesthetics, communicative constraints, and proprietary software. Douglass and the CalIT2 HIPerWall group had actually created their own software application called "PowerWall Presenter" for the demo. However, Douglass noted that in some ways a given presenter actually has much less personal control of the content that is situated on the display than even standard PowerPoint affords, because the wireless mouse that seems to allow more natural interaction with the screen in Douglass's performances proved not to be as effective in "driving the wall," so that an unseen technician at a keyboard with his back to the wall is needed to serve as an offstage assistant.

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However, despite this technology's potential reputation for legitimating a "sage on the stage" approach to teaching, UCSD students themselves have been able to create individual projects for coursework that have been displayed on the HIPerSpace wall. To prepare them for this task, Manovich instructed his pupils in VIS 149 who had already studied a number of genres of data visualizations to think about a more familiar set of rhetorical conventions, specifically those associated with the academic poster presentation. Students in the class essentially composed giant posters for their final projects that were uploaded into the HIPerSpace wall for graded evaluation.

Nonetheless, like the StarCAVE, Manovich's pedagogical experiment took place in the context of several architectures of prohibition. Most importantly, the building in which his class meetings took place actually explicitly prohibited such pedagogical uses of its rooms, and Manovich had to disregard other stakeholders' desires to control access to their instructional technologies.

COMMAND CENTER AND BACKCHANNEL: USC

At the University of Southern California, a private university in which students are entrusted with much more access to costly technologies, classroom learners have been encouraged to take an even more hands-on role when interacting with multiscreen displays. Students in the Interactive Media program who take part in creating playable and procedural media experiences can enroll in classes taught in the Zemeckis Media Lab (ZML) multi-screen space, which was designed by Scott Fisher and mirrors many elements of similar spaces built by Fisher for Keio University in Japan. In the ZML instructors might choose to serve as desktop DJs who manage a much more complex rhythm of visual materials around the room than a single-screen room allows. Or they may encourage students to make the private screens of their own laptops into public space, so that all participants can see the content of their screens.

Like the command centers of professionals engaged in managing air traffic control, space missions, or subway systems, which have been studied by ethnographers of technology, the use of the ZML space can not be reduced to a simple pyramid structure oriented around hierarchies of power and authority. Although the instructor is nominally in charge, the arrangement of instructional technology encourages awareness of simultaneous activity by others and attention to distributed and yet coordinated actions by a range of social actors who may have different roles in the classroom.

Because students may be assigned specific tasks for finding and displaying materials to others, the pedagogical space of the ZML emphasizes modes of situated learning in which the students' social roles in the classroom are part of the explicit instruction. Holly Willis, head of the Digital Educators Consortium, which has facilitated interdisciplinary pedagogical conversations between USC and many other regional campuses, has called this shift the transition from "learning about to learning to be." [46]

In addition to this "command center" or "control room" aesthetic that feeds multiple channels of information to participants in the room simultaneously, ZML classes often also incorporate display of a "backchannel," where attendees who may not be participating in the main class discussion can still provide commentary and criticism that indicates a different kind of engagement in the room's pedagogical drama. Often these students provide links and further research resources to extend class discussion into time-on-task devoted to self-study that is enhanced by online chat.

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As Fisher and his collaborators acknowledge, because of the potential for distraction and subversion of authority, this backchannel can also be seen as "threatening to the institutionalized learning environment," so that "most of what happens in technology-augmented classrooms today is still traditional – students take notes, and professors lecture." [47] Nonetheless, the USC group argues that "the potential exists for new and important forms of collaborative learning within these spaces, harnessing the power of network multimedia for augmented learning experiences." [48]

In an essay called "A Pedagogy of Original Synners," Steve Anderson and Ann Balsamo, who have taught in the occasionally free-for-all environment of the ZML pedagogical space, describe how they might manage even more transgressive students in the "game matrix" of a sci-fi virtual classroom in 2020 in which their charges are instructed to "Pick your Medium: Physical, Mental, Chance, or Arts." [49] They hypothesize that new instructional situations could be generated by "evaluation bots" who would serve up the following options: "a) naked, b) tool, c) machine, d) animal." Although the third "machine" option emphasizes "digital devices and applications, as well as engines, robots, biolution devices, flickercladding and other nano manufacturing gadgets," the second "tool" option includes present-day learning aids that are familiar to instructors who use paper prototyping and rapid prototyping technique in game development: "markers, dice, picks, hammers and pens." [50]

RAPID PROTOTYPING: UC IRVINE

Rapid prototyping is also an important part of interdisciplinary pedagogy at the University of California, Irvine. Of course, part of this interest in rapid prototyping in student composition is driven by the constraints of course scheduling, since classes are taught in ten-week quarters rather than offered at the more leisurely pace of other campuses. In 2006, the campus launched a Freshman Integrated Program that aimed to provide first-year students with precisely the kinds of interdisciplinary faculty team experiences that Taylor's manifesto in the *New York Times* had argued should be implemented. The most popular course in FIP focused on computer games and was taught by three faculty members from different programs: film and media studies, software engineering, and informatics. According to the syllabus, freshmen who were enrolled in "Computer Games as Art, Culture & Technology" or US 12 would be exposed to the "vocabularies, perspectives, tools, and skills from multiple disciplines necessary to create and critique computer games" and "contemporary art practices utilizing game metaphors, design principles, and technologies."

After being trained in paper prototyping techniques, a number of the students from US 12 continue to work together with their teaching assistant Garnet Hertz on projects in the Laboratory for Ubiquitous Computing and Interaction on projects aimed at public audiences. For example, currently a group of five students is working on "OutRun," an augmented reality game that combines a real world street vehicle with an arcade driving game that had been released by Sega in 1986.

Also at UC Irvine, upper-division writing students in "Digital Rhetorics" or WR 139 produce digital files in a variety of Internet genres, such as Facebook profile, multi-week blog, wiki entry, and YouTube video. The reading list covers a period of several decades, beginning with Vannevar Bush's "As We May Think," and includes texts from several different disciplines that bridge the arts, the humanities, the social sciences, and computer science.

These graduating seniors, who soon will be deploying digital rhetorics in situations outside of the university, are also asked to read work about procedural rhetorics and persuasive games and to write a proposal for a game that adapts a work of print literature. Although students were instructed that their final project, an online video could be as simple as a webcam recording of themselves reading a script or a converted PowerPoint presentation, all students decided to engage in learning new software practices, and the group experimented with editing, image manipulation, machinima, and computer animation.

At one point, however, a fierce debate broke out on the class blog, after one student praised the multi-screen experimental teaching classroom and expressed his appreciation for having access to its resources. The student said the class was a "great example of how we are actually applying the things we learn in class to the real world," and he argued that "with the help of various tools we use in class, we are able to do things that I would never have thought possible in a regular writing class," which included having access to "projection screens, wireless devices, YouTube, blogging, and other new technology." He closed by expressing his "hope" that these technologies "will be applied to all classes in the future." Other students protested that these technologies should be available in *all* classes now and that they actually had been cheated in their other classes rather than blessed in this one learning experience. Subsequent use of the university's teleconference facility by the class only made these students more vocal in their objections about their previous lack of exposure to instructional technologies that were paid for using public taxes and their student fees.

It is worth noting that both WR 139 and US 12 also took advantage of the availability of classroom space in "Anteater Island," property that the university had purchased in the virtual world *Second Life* to be used for pedagogical purposes. However, the instructors of these courses wanted to avoid the distance learning pitfall of many *Second Life* based courses in which conventional classroom spaces and interactions are merely recreated in 3-D digital environment. Instead, the emphasis was placed on individual production and the design of collaborative projects, as students spent their time engaged in sandbox activities and actively creating built environments on Anteater Island for others to appreciate. Rather than watching videos or PowerPoint presentations as passive spectators, as far too many students do in *Second Life*, these students were engaged with the software interface for building architecture.

Furthermore many of the large-enrollment interdisciplinary courses at U.C. Irvine for undergraduates that deploy these kinds of technologies are also writing-intensive. Thus, these courses require students to compose in multiple media and through multiple modalities in a variety of genres with a "demo-or-die" fast-paced approach. For example, both US 12 and WR 139 satisfy four units of the undergraduate writing requirement, which mandates at least eight units of lower-division writing instruction and at least four units of upper-division writing instruction. The courses have also shared pedagogical capital, in that faculty teaching one course have guest lectured in the other, and there is a continuing conversation about the two syllabi.

This essay has attempted to provide several examples of courses that are designed to prepare college students for exciting contemporary academic and professional environments of intellectual collaboration, simulation, prototyping, and play and to explain what factors encourage pedagogical innovation across disciplinary boundaries. It has argued that the unique cultural geography of Southern California that relies on the availability of hubs for pedagogical discussion has encouraged exchanges about teaching practices

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that cross disciplines and intersect with new forms of computational media at four local universities. Furthermore, although these initiatives are primarily faculty-driven, students are also imagined as critical partners for developing lasting art-science alliances and interdisciplinary collaborations. For effective digital pedagogy to function, learner-participants must be allowed to air concerns about access, equity, usability, and sustainability and to raise objections to proprietary software, costly hardware, or untested prototypes. ■

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