

A Generative Emergent Approach to Graduate Education

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Biography

Bill Seaman received a Ph.D. from the Centre for Advanced Inquiry In Interactive Arts, University of Wales, 1999. He holds a MSvisS degree from MIT, 1985. His work explores an expanded media-oriented poetics through various technological means. Seaman is Department Head of Digital+Media at Rhode Island School of Design. His works have been in many international shows where he has been awarded two prizes from Ars Electronica in Interactive Art (1992 & 1995, Linz, Austria); International Video Art Prize, ZKM, Karlsruhe; Bonn Videonale prize; First Prize, Berlin Film / Video Festival for Multimedia in 1995; and the Awards in the Visual Arts Prize. Seaman was given the Leonardo Award for Excellence in 2002. Selected exhibitions include 1996, Mediascape Guggenheim, NYC; the premiere exhibition of the ZKM in Karlsruhe, Germany; 1997, Barbican Centre (London); 1997, C3 - Center for Culture & Communication, Budapest; in 1998, Portable Sacred Grounds, NTT-ICC Tokyo; Body Mechanique, The Wexner Center, Columbus, Ohio, 1999; David Winton Bell Gallery, Brown University, 2004. Seaman contributed a video set for SLEEPERS GUTS by Ballett Frankfurt. He has been commissioned on a number of occasions. He is currently working on a series of installations and research papers in conversation with the scientist Otto Rössler.

Abstract

I have sought to embody a series of potentials for graduate education — to define a program that enables one to explore and enfold elements of artistic practice, contemporary cultural relations, design pursuits, scientific research (and/or its abstraction) and technological inquiry, in varying degrees, relevant to each differing student. Such a program presents an exciting space for individual expression through contemporary forms of creative investigation. The Digital+Media department opened at Rhode Island School of Design in 2003.

I have been Graduate program director at four different major institutions in the US and in Australia. Thus, over the last 15 years I have adopted and honed a series of approaches to enhance the personal development of the graduate student. My methodology is a generative, combinatoric one. Many different processes are enfolded contributing to the growth of the individual. In my own classes, a series of structured assignments function to help the student define their own particular practice. Along with my personal approach to education, I have developed the notion of interdisciplinary and transdisciplinary “Node” classes that bridge to differing disciplines at RISD and Brown University. These “node” classes also embody current trends that in multiple ways explore contemporary approaches to creative technological practices that employ digital media. Each student articulates an appropriate selection of these classes (in conjunction with their advisor) and defines a unique trajectory through department curriculum, along with study in a core set of classes. The node classes balance theory and practice, provide technological background as well as hands on learning experience.

Multiple readings inform and contextualize the student’s study. Ongoing critique and discussion by lecturers and peers becomes central. The program culminates in a highly articulated written thesis process and final thesis exhibition. Thus, a broad range of potential studies are enfolded in a highly unique educational experience in a manner that becomes relevant to each different student. A rich field of emergent potentials is entertained as part of an ongoing mentoring process which is steeped in thought

mapping, articulate self-reflection, process-oriented growth, hands on technological experience, diverse textual input, articulate feedback and critique, as well as ongoing informed discussion. This study is augmented with multiple generative associative exercises.

Introduction

Educating artists in the digital age is a great challenge. Exploring interdisciplinary and transdisciplinary education calls for a special commitment to learning and growth. In transdisciplinary study, a series of focused research areas are bridged. Because no singular discipline, pairing of disciplines, and/or history of those disciplines can be used to elucidate the work that is arising, the term transdisciplinary is employed, suggesting that such study goes beyond any individual discipline or coupling of disciplines. Transdisciplinary research brings a set of fields of inquiry together in the service of emergent knowledge production. Education that explores this challenging knowledge domain mandates that the graduate mentor continue their own education (be it formally or informally) in an ongoing manner, be open to change, embrace collaboration and continuing communication with multiple colleagues functioning in differing domains. This can mean staying on top of updates of numerous digital programs; keeping abreast of the changes in multiple fields in terms of technology; maintaining their own research practice; reading across a range of research topics and domains; and in general keeping a broad scanning type awareness open to this field of fields.

Curriculum

I have worked at four different institutions as Graduate Director— The College of Fine Art, University of New South Wales (Sydney) in the department of *4D - Time Based Arts*; at the University of Maryland, Baltimore County in the department of *Imaging and Digital Arts*; at UCLA in the department of *Design | Media Arts*; and at Rhode Island School of Design where I am currently Graduate Program Director and Department Head in *Digital+Media*. Each institution has had its own particular qualities and educational demands. At RISD, I was hired to build a curriculum from the ground up with the brief of creating a department that could provide interdisciplinary education for a new department of approximately 30 students in a two year program. Part of the mission was to design a program that could also bridge to the entire RISD graduate division representing sixteen departments; be open to advanced Seniors and 5th year students at RISD; as well as include students (and curriculum) from Brown University. The challenge was to design a curriculum that contemporary interdisciplinary/transdisciplinary artists and designers would want to matriculate through that was unique to the RISD setting — the institution has many existing facilities that might facilitate embodied/physical digital media practice. Thus, the task became to construct an emergent system exploring recombinant educational goals.

I created the concept of ‘Node’ classes, borrowing a navigational concept from the structure of the internet. A ‘Node’ class is a class that balances the study of technology and art (or design) with inquiry that is conceptual, social and cultural. These classes are an extension of “studio related” study, although they tend to be shorter – lasting five hours. They bring core Digital+Media department students together with a broad range of students from other disciplines. Central is the multi-perspective approach to knowledge acquisition — where different students articulate particular relationships that are relevant to their own fields. The notion of defining a bridging language is essential — of communicating and coming to understand multiple approaches to contemporary creative technological practice.

Susan Leigh Star and Geoffrey C. Bowker in their text *Sorting Things Out: Classification and its Consequences*, define the notion of the Boundry Object, relevant to this approach:

Drawing from earlier studies of interdisciplinary scientific cooperation, we define boundary objects as those objects that both inhabit several communities of practice and satisfy the informational requirements of each of them. In working practice, they are objects that are able both to travel across borders and maintain some sort of constant identity. They can be tailored to meet the needs of any one community (they are plastic in this sense, or customizable). At the same time, they have common identities across settings. This is achieved by allowing the objects to be weakly structured in common use, imposing stronger structures

*in the individual-site tailored use.*¹(Star, S. and Bowker, G. 1999: 1)

Thus, Node classes employ such a strategy. Node classes embody a “recombinant” methodology that is drawn from my artistic research² (Seaman 1999) into meaning production, where in this case differing educational modules are recombined to form an emergent educational practice. Each student articulates a particular trajectory through these courses that is specifically relevant to them.

Beginnings

Having had years of experience in Graduate Education, one comes to know that the first semester is a highly chaotic one — the student has just moved to a new place, has potentially taken up major loans, has shifted relationships with their friends and also possibly their significant-others. Unlike undergraduate education they must think primarily for themselves, forming their own particular approach to their practice. The notion is to form an initial grounding experience to enable them to establish a series of bonds with their fellow students. One of the most important elements of graduate education is the contribution the students give to each other through dialogue, technical collaboration and collegiality.

The curriculum at the Digital+Media department begins with a class called the *Continuum Studio*— exploring the continuum from the physical to the digital. This is a “hit the ground running” course that covers many different introductions and approaches to software, while simultaneously building a space for conceptual exchange, critique, and articulate reflection. Central is the defining of a vocabulary of relevant processes to build upon for each student’s practice. This class also helps students define their own working processes. The Grads come to Digital+Media from multiple disciplines so they often have been informed by differing “histories,” bodies of knowledge and modes of critique. The commonality that forms a pre-requisite for the program is as follows: students must have four years of Digital Media study of some kind to come into the program. There are many different potential foci that could play into these four years— this may entail experience with authoring and/or programming for the internet, experience with responsive environments, locative media, digital video, media-oriented programming, digital photography, digitally oriented performance art, rapid prototyping (digital sculpture) and/or digitally driven installation work (or other). Media computer scientists are also considered. One student had studied biology and artificial life and successfully applied. Thus, the department is highly eclectic and each graduate student comes to the department with a slightly different skill set. In the first year, along with the *Continuum Studio*, a history of digital media focusing on interactivity is presented — *Perspectives*; a second class— the *Lecture Series Seminar* presenting relevant visiting artists and/or theorists; and one “node” class are required. A *Seminar / Tutorial* class that I teach is also mandatory. I will speak in depth below about my approach to the *Seminar/Tutorial* class below.

My teaching method has been to articulate a core set of concepts and approaches by providing essential texts and central technological methodologies, augmented with a broad range of study related to more individual, eclectic practices and research potentials. Thus, I draw on texts from numerous research domains. If we are “***Learning at the Intersections of Art, Science, Technology, and Culture***” then it goes without saying that a student may be reading texts from a multiplicity of research contexts. This means that the Digital+Media student must pull from a plethora of readings exploring new ideas and methods surrounding digital media production. This potentially includes exploring digital media from one or more perspectives. Because digital media is used in almost every discipline, this means that each student will define their own particular approach to its creative, expressive potentials. One particular text that we have found helpful is the *New Media Reader*, Edited by Noah Wardrip-Fruin and Nick Mountfort³ (Wardrip-Fruin and Mountford 2003). This book brings together a set of readings that I had often drawn upon in the past, earlier providing the texts in Xerox form. A second book that we also recommend is Stephen Wilson’s — *Information Arts: Intersections of Art, Science, and Technology*⁴ (Wilson 2002). In general, each class provides its own suggested reading list and/or reader. These lists are presented along with the focused lists that I provide for each individual. In terms of my own approach to reading I suggest that along with the broad set of foci that one can study in the Digital+Media department, one can also draw on a more personal set of readings — poems, novels, interactive texts, magazines, textual forms originating from, or commenting on pop culture; and a vast range of URLs related to art and/or experimental design practice. In general the above approach is quite inclusive—the course is emergent in nature and each individual, to

some extent. drives the trajectory of the research through their individual interests as focused through directed mentoring.

Central to an education in the department of Digital+Media is a richly focused liberal arts/conceptual/social agenda that falls in relation to a digital practice. This form of education is presented in counter distinction to a set of common practices that are passed on to students in a “cookie cutter” manner, characteristic of some digital media departments. Education at D+M becomes emergent as a general methodology where multiple foci are informing the student’s practice. As students share their work and research a very broad education is fostered across multiple research frontiers. The graduating student explores and builds a broad knowledge-base and develops a particular approach relevant to their own practice in concert with their advisors, their peers, lecturers, independent study mentors and eventually through their thesis committee and thesis chair.

In the RISD Digital+Media department, the core conception is to take a series of “Node” classes to become fluent in multiple aspects of digital media practice, where exploration via the computer falls somewhere in the loop of production. It is interesting to note that sometimes the fact that the work arises from computer-oriented practice does not preclude that the computer will be visually present in exhibitions of the work arising from the curriculum. Sometimes the computer falls entirely out of view later in the process, if the process leads to an artifact, like a 3D model, a digital print, a particular form of installation or the articulation of new approach to digital/physical processes. This is why we have given the department the ‘+Media’ designation, pointing toward creative production that is embodied, embraces physicality and explores digital/physical relationships.

A Digital+Media student will choose the set of node classes that best fit their particular needs. They work in conjunction with myself and others to pull salient information from these differing classes and enfold that information and knowledge within the sphere of their individual practice. Mentoring in this instance helps them to define how these diverse studies can be brought together in their artwork or design practice. One comes to see how their practice might expand to take on board the new knowledge that has been gained through the multiple perspectives that the node classes offer. Mentoring also includes suggesting people to the student who might be actively sought out as mentors at RISD in other departments and Brown University (and in terms of the broader artistic community) to meet the needs of the student’s research and practice. We have also undertaken a rich visiting artist and lecture program in the department and once the artist or designer has visited and critiqued the student’s work, there is a potential for them to develop a continuing dialogue.

Working in Concert With the Individual Graduate Student to Develop Their “Voice”

The most rewarding part of graduate education arises out of a series of deep creative relationships that are fostered with each individual student. In particular this has to do with helping each student find their own voice — this includes discussing their conceptual methodology, outlining a set of viable working processes, articulating their field of interest, and honing their personal and/or collaborative research and practice in an ongoing manner.

Associative Diagram

The first assignment given, as I am getting to know an incoming class, relates to the development of an elaborate *associative diagram* as a means to register relevant foci. In particular the ‘thought flows’ of each individual can potentially be brought to the surface, embodied through this exercise. The assignment goes as follows: I suggest that the student start with a very large piece of paper. They write one word in the upper left that is in some way central to their practice.⁵ (Greene 2001) I then ask them to further associate and write a word next to and below this word. They are asked to continue this process as an iterative task until they fill up the page. This process often leads to an extraordinary textual diagram, providing a set of links and relationships that are relevant to each particular individual. The multiple forms that these diagrams take, as each student interprets the assignment in a subtly different manner, are as unique as the individuals partaking in the class.

Face to face meetings are facilitated with each person in the class. We work through these diagrams in depth, beginning with my own associative set of processes — What artists and/or designers would this person most benefit from looking at? What does the greater field of their work encompass? What is at operation in their work? What technologies might this person use to expand their work? What classes might be best for them to take from the school's offerings? What other professors should they meet in the local area? Who might they contact nationally or internationally? What books should they look at? What URLs might help to inform their practice? What other fields are relevant for them to study? In general this discussion begins a dialogue that continues throughout their entire graduate education. This relationship grows and can in some ways continue long after graduation as a life-long dialogue that shifts from a perspective of lecturer /student, to a peer to peer relationship. Thus, these exercises and discussions foster the initial seeding of a dialogical process related to ongoing thesis development that expands over their entire graduate educational experience.

Generative Bridging Diagram

Related to this initial associative diagram is a second diagram they develop. I call this the *Generative Bridging Diagram*. This diagram takes the individual modules of conceptual thought that each word or phrase represents in the initial associative diagram, and seeks to build a *generative thought engine* that is relevant to the individual. I ask them to take their grid and in this case, type or write out the words in a long list along the left edge of a page. I then ask them then to copy this list on the right hand border. Subsequently they work to articulate a series of bridging words (or concepts)[this might include the development of an imagistic, sonic, textual, or technological relation] that bridges each word on the right to each of the words on the left, articulating a relationship between the two. This potentially becomes a vast process. In general each individual finds a method of self-editing that enables them to pull out the most salient foci from this conceptual bridging process.

This generative procedure enables the student to make a much more complete registering of the field of ideas they have outlined in their associative diagram. The working through of this process actually suggests ways to approach and 'grow' new projects. Thus, it suggests entirely new potential works based on their articulated 'vocabulary' of ideas and processes. These ideas get further developed via discussion both with myself and through class critique. Again, such a process is central in articulating each individual's unique 'voice'. Dialogue surrounding these lists, and the processes that bring them to life, are often deeply rewarding and "eye opening" to the student. Much is revealed about their conceptual processes that in the past, lived buried beneath the surface of their thought processes. Often these meetings are highly inspiring and open out a much more clear understanding for the individual of their oeuvre. Such exercises can be repeated at different stages of the matriculation as well. It is also stimulating to revisit these exercises some years later to see elements of ongoing interest as well as to articulate changes in the flow of their work processes.

The Book of Notice

I have for many years asked students to keep what I call a "*Book of Notice*." I suggest that that students pay attention to the different things that they are "noticing" or that stand out to them across a series of differing domains. Often we pass by particular environmental relationships or aspects of media-related phenomena as we wing our way through the average day, without taking mindfully aware⁶ (Varela, Thompson and Rosch 1996) notice of particular relationships, objects, situations, concepts, and/or unique aesthetic qualities. This kind of "collection" process makes people begin to take time and re-see the world and its complex relations. I also suggest they find a format that is pertinent to them as individuals, to collect and/or register their observations. For some, this becomes the standard artist sketchbook. Yet, I suggest that each person articulate a specific form to present their observations that is relevant to their own particular practice: this might become a catalogue of video clips, a series of photographs, a set of URLs, a list of words, a collection of images of every kind, an accumulation of objects, a compendium of quotes, a set of computer graphic animations etc. Each "Book of Notice" should be unique to the person defining the collection process. One can use these compendiums to help them define elements and qualities of their oeuvre. One can also go mining in them to seed ideas for new projects or to articulate elements of nuanced artistic sensibility.

Thinking Large

Another assignment I give to beginning graduates relates to ‘thinking large’. I assign a major presentation that asks students to articulate a proposal for a major work, without the normal economic, technological and/or space related constraints. I discuss the potentials of this work with them at length. The student draws from their *associative diagrams* and past works as well as their *Book of Notice* to develop a major piece, or suite of related works in proposal form. This assignment is highly pragmatic. Students working with digital media need to be able to articulate their ideas in order to apply for grants and funding — to define elements of their working processes. Large scale digital works can take years and often draw on the expertise of an interdisciplinary team. Such an assignment gets them to visualize and lay out the salient aspects of a given work in a clear and cogent manner, from multiple perspectives. I later suggest ways the work could be developed given the current resources and restraints, once the student has completed the process of thinking large. Often a scaled down version of this assignment becomes the thesis work. I always imagine the two years of graduate study as opening out a 10 year research agenda that is different for each student where such a project might later fully be developed, or grown into a new, related project.

Annotated URLs and Bibliography of Quotes

Students are asked to collect a series of bibliographic references and URLs in an ongoing manner. When they are doing their collecting I ask them to annotate each entry — to write down some form of relation to their work. These text references and annotations become part of the fabric of the written thesis and can also inform in a meaningful manner aspects of the thesis project. The concept here is to break down the process of writing so it becomes less of a Herculean task and more process-oriented, direct and effortless as an ongoing pursuit.

Input / Functionality / Output

I have more recently begun a new generative exercise related to interactive projects. This suggests mapping out a series of potential ‘inputs’, ‘functionalities’, and ‘outputs’ (both conceptual and technological). This exercise draws from my work *The Hybrid Invention Generator* (see below). This assignment enables students to register a series of different options to consider in terms of brainstorming surrounding the generation of new interactive works. “Inputs” would be related to different interface strategies; “functionality” relates to what processes the use of the system will set in motion; and “output” suggests both the outcome of the interaction as well as the technological platform that might be used to display this output.

Generative System Texts

Along with the above exercises I have also (where needed) provided my own generative system texts for students to employ as creative tools. One text is entitled *Toward a Vocabulary of Image, Sound, Text Relations*. This text, generated initially two decades ago as a teaching tool for video classes (and subsequently honed over the years), provides a breakdown of video related processes such that an author can draw from them to think through new ideas in a combinatoric manner. Topic areas are elaborated in a set of lists within the text which include the following headings:

THE FRAME / SHOT;
LIGHT;
SOUND RELATIONS TO THE FRAME/SHOT;
KINDS OF EDITS - VIDEO AND AUDIO;
SOUND ;
KINDS OF STRUCTURES;
TIME;
FUNCTIONS;
GENRES;

INTERFACES;
TEXT;
COMBINATION OF THE ABOVE RELATIONS.

Another generative text I authored to help students brainstorm, in this case virtual space authorship, is entitled: *VR/Variables — Periodic Table of VR*. This text was authored in the 90's to extend the thinking of students surrounding Virtual Reality production. It includes many variables to consider in the production of virtual reality works and again can be approached as a combinatoric tool.

Current Processes

As students take the multiple 'node' classes at RISD described above, they begin to amass a broad vocabulary of potential technological processes and conceptual approaches to their work. It is my role as advisor to help each student pull out the particular salient aspects that are relevant to their practice. Thus their work becomes informed by their associative writings and "book of notice" as well as other ongoing research. I see another of my roles as helping them see how they can enfold multiple observations in a single work, drawing from the breadth of their investigative experiences. Such an approach enables one to focus the complexity of their research foci. Alternately, some students explore simplicity in their approach. Even here one asks how they might enfold their ideas in the service of a 'minimal' work. I seek to be pluralistic in my support methodology, reflecting back the needs of each individual.

Assigned Readings

In terms of assigned readings that I provide, I tend to draw from a broad set of categories. Central to my role as advisor relates to providing a bibliography that will enable them to expand a core body of concepts relevant to their individual practice. I point out to them a series of pertinent artists and or experimental designers that they should come to know as well as discuss with them the work of artists they may have uncovered in their research. I often suggest for them to seek out the writings that the artists (or designers) themselves have undertaken. I also often draw from 20th century art history but my suggestions can encompass older traditions as well. Thus, this necessitates the development of an individual reading list for each student. Along with this selection of artists and historical texts, I also suggest critical texts, the writings of relevant theorists, as well as more popular texts — novels, poetry, magazines etc. This broad set of texts enables them to build out their ideas in a clear manner. In many ways this is opposite to the notion of a "cannon" for digital media. Yet, in Digital+Media's curriculum we also provide a core set of readings that do function somewhat like a "cannon." My emphasis is to have each person define a field of literature that contextualizes their work and establishes a broad focused context from which their work can be discussed and understood. In this way, each student graduating from the department brings with them a unique, articulate sphere of conceptual underpinnings they can draw upon in discussion, in artist talks and in future published texts that they author. In this way, the work does not spiral inward, being informed by a few central theorists, but expands outward in an articulate manner, broadening the scope of creative artistic and/or design related thought and production.

Growth

Perhaps the most difficult question for the graduates (and ourselves) is how do we go beyond what we know? This is actually a matter of personal courage. I have used the above methodology as a means to help students through this very process. I must also admit that the set of processes described above also continues to foster my own growth and learning. I often do my own research related to the student's inquiry to keep well informed about new development in the field. The exploration of such generative processes in the service of creative production is a life long concern. Working with top students is a deeply fulfilling way to live, continue to learn and study multiple fields.

Thesis

At the center of graduate education is the thesis process. The written thesis is pragmatic and enables the student to position themselves in terms of their work in relation many different kinds of digital practices, as well as art historical, social, conceptual and alternately, more personal/eclectic relations.

At RISD the thesis process entails both the defining of a cogent and thoroughly researched document contextualizing the students work, as well as the development of a thesis show which presents a major culminating artwork— a ‘proof of concept’ technological /art presentation; a design related project; and/or suite of relevant works. I have worked closely with my colleague Teri Rueb in the Digital+Media department to articulate a clear procedure and set of deadlines to streamline the thesis process, drawing on both of our extensive experiences in graduate education. Along with a set of prescribed deadlines, we work with each student individually to help them map out a timeline related to their own production schedule. Each student has a unique working process and early on in the graduate program we try to help each of the students discover their own functioning process methodology.

At the end of the first year, students write a preliminary thesis statement and are assigned a Thesis chair. The chair works with the student to define a relevant thesis committee. This often means working with teachers from other departments at RISD, local artists, adjunct faculty as well as other artists and theorists from around the world. In concert with the chair, the students begin doing a series of related readings over the summer. Often an extensive bibliography is researched in the period before starting the thesis process. In the fall semester of the thesis year students take relevant “node” classes, further developing their ideas as well as key themes related to their thesis. The student undertakes a set of writing workshops. We have been working with Anne West at RISD, who has developed an interesting set of processes for ‘mapping’ the student’s conceptual framework for the thesis. It is fascinating to note that Anne West and I both came to such “mapping” processes from study in quite different domains, although we share a deep interest in facilitating the thought of the individual and we were drawn to working together based on this drive.

At midterm of the fall semester the student works up a “matrix map” related to their thesis, revealing their thought processes, along with their bibliography which is still ‘in progress’. The students develop an outline and preliminary exhibition plan during the fall semester. Their work is ongoing in the studio and they begin to write a first draft of the thesis. This draft of the thesis is honed over the RISD wintersession period (January and early February). In the spring semester a first draft is turned in, approximately 30 pages, double spaced, as informed by the initial outline. In addition the student prepares an official title page, table of contents, endnotes/footnotes, and bibliography. The spring is a period for focused work on further honing the written thesis in concert with the student’s committee and in particular via meeting regularly with their thesis chair. The graduate students develop an in-depth exhibition plan. A final written thesis class and thesis project class are undertaken along with one final “node” class in their culminating semester. The thesis exhibition is mounted and an exciting final critique takes place with top critics, peers, and theorists as well as members of the thesis committee.

The Department of Digital+Media’s written thesis guidelines are flexible in order to support individual approaches. At RISD we have adopted what might be considered a “research university” based approach to the written document. We articulate a series of different options or approaches in laying out the content of the thesis, where the chair works with each individual to define an appropriate methodology and format. We suggest that the thesis should reveal the conceptual and philosophical infrastructure of the student’s practice, focusing on elucidating the thesis exhibition. A concise abstract states the central questions or problems that the work explores. We recommend that the thesis be an articulate research document, footnoted and correctly formatted. Alternately, on occasion, we also work with students to define more individual and experimental frameworks to present their ideas. Again, we see the document as being pragmatic – that is, students can later draw upon their research to inform future practice. The written work thus becomes source material for journal length publications, and can potentially provide the basis for a professional talk after graduation.

We expect that the written document to critically examine and illuminate the individual's practice, positioning it historically and theoretically. Working with each student as an individual, we help them

position their work in a relevant manner. Thus, a student may define for him/herself a particular approach to this articulation in concert with their chair while also getting additional focused advice from their thesis committee. Each committee member may bring a different area of expertise to the table, be it conceptual, technological, historical etc. In general we suggest that the written thesis in the Digital+Media department should address the following: creative process, historical context, a wide variety of influences, conceptual / philosophical / theoretical foundations, and future directions. In terms of format the work may take on one of the following approaches: a critical approach; an anecdotal approach; a catalogue-oriented approach - commenting in a critical autobiographical manner on one's practice at RISD, culminating in the thesis exhibition; a formal research paper discussing philosophical and aesthetic issues as they relate to the student's work; and/or a manifesto approach - articulating ideas about new forms in the arts and/or design in a critical manner.

Along with critical reflection we ask that students present quality documentation — visual material that will be integrated into the text of the thesis to support its salient points. All visual materials are appropriately captioned and cross-referenced in the text. This may also take a digital form. Sometimes this means defining a secondary document that is specifically formatted in a relevant manner to extend the content of their thesis. There is also the potential to develop a hyperlinked document or interactive documentation environment, potentially publishable on the internet. A hypertext on DVD or CD ROM can be submitted to augment the written document. This might include related programs, video and audio materials.

An extensive dialogue is facilitated with the chair and committee. In all cases the form and content of the thesis is discussed and agreed upon with the thesis chair. Although there is often a deep interest to make this written document be a creative and poetic work, we stress that the thesis exhibition is the place for experimental practice and functions as the central arena for the student's inquiry and creative expression, where the written thesis functions in a scholarly manner. Thus the document presents a clear examination of the issues that become operative through the work(s) of art and/or design practice presented in the thesis exhibition.

Art, Science and Technology

There are many educational potentials that flow from the research that bridges art, science and technology. Most recently I team taught a class entitled *Cognitive Science and Digital Media* with Dr. Barbara Von Eckardt, Dean of Liberal Arts at RISD, cognitive scientist and author. The course provided students with an introduction to important approaches and findings in cognitive science and contemporary analytic philosophy (especially, philosophy of mind, epistemology, and metaphysics) relevant to the field of digital media. It also explored a number of specific digital media works which connected with those approaches and findings. Some of the questions that were addressed in the class included: How has perception/sensing been modeled in cognitive science and within digital media works? What are current cognitive science theories related to language, meaning, and language acquisition? What is the relevance of empirical findings related to the mind/brain, to artistic practice and in particular to the field of digital media? What is the mind/body problem and how can it be solved? Can machines think or be persons? How do we come to know the world? What is the relevance of theoretical discussions in analytic philosophy to digital media?

Here is a list of strategies that came out of the class in relation to approaching a potential bridging between Cognitive Science and Digital Media:

A work can function as a question.

A work can function as a pointing mechanism.

A work can embody a critique.

A work can function as a documentary.

A work can use the principles of one field to explore another i.e. Artificial Intelligence.

A work can make fun or be a parody of another field.

A work can use the formal qualities derived from one field to approach another, i.e. cognitive experiments to inform the making of performance art.

A work can employ abstracted terminology from one field as a poetic strategy.

A work can function as a map of a potential approach in an alternate field.
A work can explore related issues from an alternate set of perspectives.
A work can poetically describe processes and research that CS explores via digital media.
A work can explore the strategy – *displacement illuminates placement*.
A work can explore a subject in a nonsensical manner.
A work can employ a strategy from one arena and use it in another, i.e. telerobotics/telepistemology.
A work can function as a database of ideas that enable differing people to access particular aspects of information from multiple fields.
A work can try to present approaches to particular questions that science will not allow.

The class provided a space for reflection across the fields and fueled many interesting discussions pertaining to the above topics.

Research Projects – Art/Science/Technology/Culture

Along with the formal aspect of holding a class, I have undertaken a number of research projects that have included students that explore art/science issues. I have also published a number of papers that explore art/science relations⁷.

The Poly-sensing Environment is one such project. The Principal Investigators include Dr. Ingrid Verbauwhede — UCLA Electrical Engineering, Mark Hansen - Statistical Computer Science, UCLA and myself.

As a research team, we have been exploring the exciting potentials related to the development of new sensing technology. In particular in the research for the *Poly-sensing Environment* we were seeking to explore the creation of a poetic/informational interactive IT system, that would be facilitated through the use of multi-modal sensory devices that could collaborate in a distributed fashion, linked to a dynamic virtual imaging environment and the internet. Many researchers have seen the importance of parsing "sense" data within interactive environments. The biological model of the human body, parsing a series of sensory modalities in the service of knowledge acquisition and general functioning, became one focus for the development of our model. We came to understand that technologies might enable the appurtenant extension of the senses. Organism like, self organizing technological systems have in the past enabled new forms of poetic/informational interaction. Other organisms also provide sensory models that we could draw upon to inform the authorship of the system. Our goal was to create a "poly-sensing" environment. We were seeking to facilitate the integration of multiple heterogeneous sensors on one "system-on-a-chip." The unique aspect of our technology was the collection of information from the parsing of an integrated "collaboration" between a diverse collection of micro-scale sensing devices. Such a system could be focused for multiple kinds of uses, be they artistic, scientific and/or cultural.

While at UCLA we worked with two different student researchers, Shenglin Yang - Electrical Engineering (UCLA) and Fabian Winkler - Design | Media Arts (UCLA). Fabian went on to Teach at Carnegie Melon and more recently has taken on a post in the Department of Visual and Performing Arts at Purdue University. The research continues to this day yet the universality of the project has made it difficult to fund in an ongoing manner from 'scientific' funding sources. Ongoing funding becomes a central concern for research scientists and a deep challenge to Art/Science collaborations. The work was funded initially by a special interdisciplinary fund at UCLA. It was further funded for one year by the Langlois Foundation.

During my time at UCLA I was also awarded an Intel Research gift over a period of three years. I worked on a project entitled *The Hybrid Invention Generator*. The work was a computer-based language system exploring hybrid invention generation. It was developed by Seaman working in conjunction with the programmer Gideon May. Initial research was undertaken by a student team from UCLA including Daksh Sahni – Architecture; Gustavo Rincon –Architecture; Kalim Chan – Design | Media Arts; Grace Tsai – Architecture; Craig Chun — Design | Media Arts and consultant Kostas Terzidis, PhD – Assistant professor in Architecture (Kostas now works at the Harvard GSD); with Seaman functioning as principle investigator. This work explored 3D visualization with related generative texts and recombinant audio/music, as well as a series of textual descriptions. Computer-based environmental meaning was

explored through the inter-authorship and operative experiential examination of a diverse set of media-elements and media-processes, focusing on the virtual construction of hybrid inventions. Varying combinations of individual inventions could be experienced through direct interaction with the system. Each participant potentially had a different experience with this open work, combining two differing inventions at a time to create a kind of “machinic” genetic process with related visualization . Thus, students gained direct experience with an exciting and challenging research process.

Along with continuing aspects of this earlier research, I have been most recently working with the theoretical Biologist and Physicist Otto Rössler. In this research the potential is to generate an intelligent, situated computer-driven robotic system. Two different initial approaches have been discussed: the creation of such a machine via the embodiment of a series of specific algorithms on a parallel computing platform working in conjunction with a specific situated machinic sensing environment and robot; and the development of a new paradigm for computing through the generation of an Electrochemical Computer, functioning in conjunction with a robot and related sensing system. Rössler’s seminal concepts including *A Relational Approach to Brain function*, and *An Artificial Cognitive-plus-motivational System* (among others) will be enfolded and form a top down “relational” analogical/biologic perspective informing both projects. We will also employ a bottom up inquiry exploring an approach for the development of an electrochemical device, abstracting and applying Rossler’s “relational” approach via an electrochemical articulation. This will include the development of a *Poly-sensing Environment* as it might be used to inform the machinic senses for both “entities”; and the notion of *Pattern Flows* of sense perturbations as applied to potential learning, language acquisition, embodied navigation and robotic behavior. The long term goal of this part of the project includes mapping and abstracting specific neural processes into an electrochemical/sensing/situated robotic environment which I have entitled *The Thoughtbody Environment*. Many papers have been written related to this topic and these are shared with students. Along with the knowledge that papers provide, David Dao at the Digital+Media department at RISD has assisted in transcribing a complex research diagram that Rössler and Seaman have been working on. The project is large in scope and has a long term potential with the hope of including students in differing aspects of the research.

Currently I am seeking to create a new form of multi-modal database to house the various research related to the Thoughtbody Environment with the computer scientist David Durand. I will be seeking student help with this project as well in the coming months. I also hope to facilitate an approach to the creation of the electrochemical computer. I have had a number of discussions with Peter Cariani, scientist and participated in a major symposium entitled Finding Fluid Form⁸ (Cariani 2006), at the University of Sussex in the Fall of 2005 where a number of researchers working on related topics gathered.

I have been very active in writing papers over the last two decades. I also share these papers and research findings with students in an ongoing manner, where the research informs both my practice and teaching. These diverse papers can be found on line at <http://www.billseaman.com>

Common to many of my research activities has been an emergent, combinatoric approach to meaning production. I have drawn on this set of processes to inform the larger sphere of my ongoing research, educational techniques and artistic practice. Thus, a rich set of processes, teaching methodologies, projects and concepts have become enfolded in the service of *Educating Artists in a Digital Age*. It is clear that students are *Learning at the Intersections of Art, Science, Technology, and Culture* via this *Generative Emergent Approach to Graduate Education*.

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