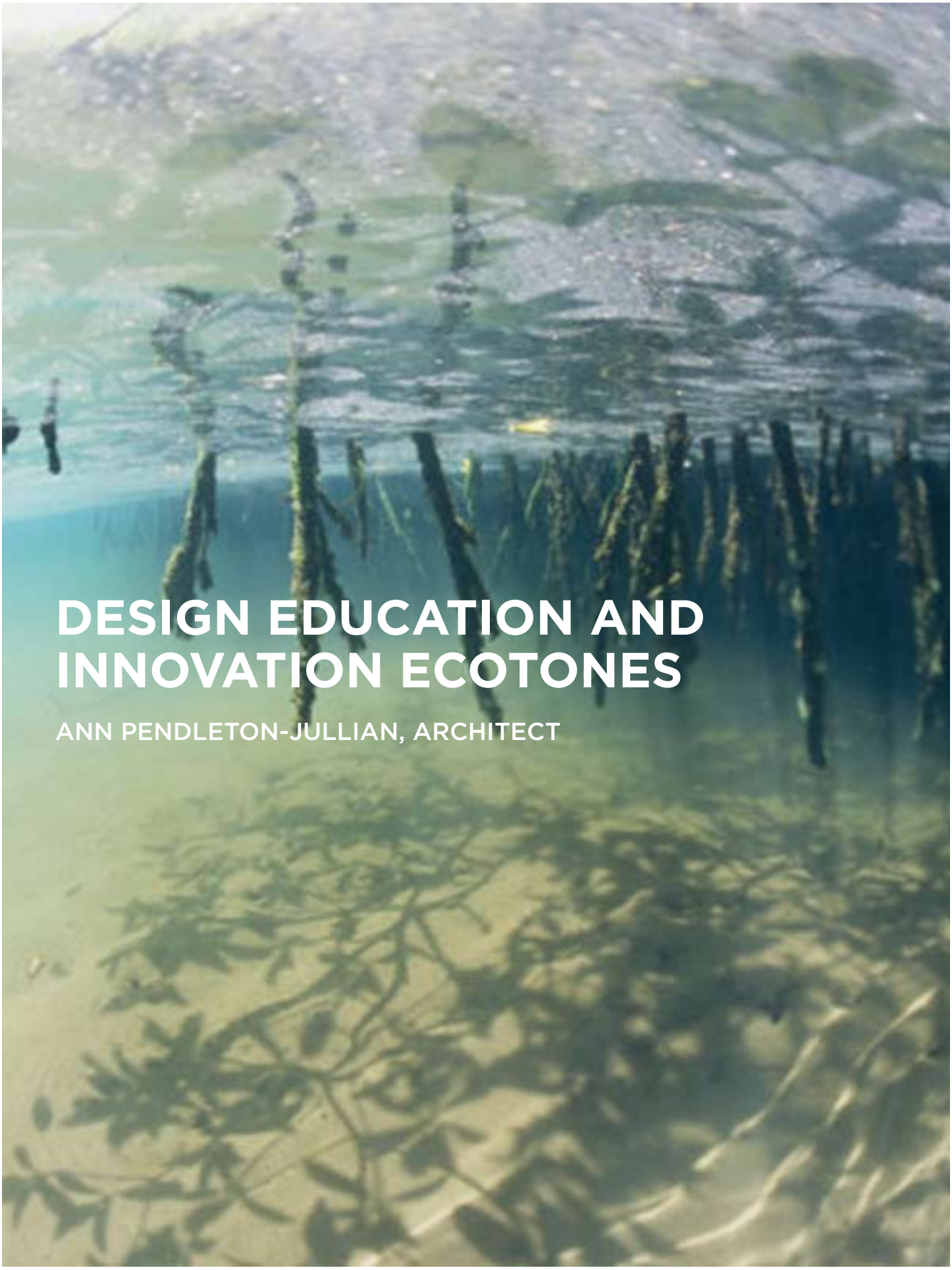

DESIGN EDUCATION AND INNOVATION ECOTONES

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EMANCIPATION

The emancipation of both nature and the human imagination depends first on the capacity to 'unsay' the world and, second, on the ability to image it differently so that wonder might be brought into appearance.
James Corner[1]

Estuarine intertidal zones are extraordinary landscapes and dynamic water-land habitats. As ecological zones where two distinct ecosystems overlap or grade into one another, they contain an abundance of diverse species and a complex set of exchange dynamics. Scientists call these habitats ecotones. Ecotones are typologically unique ecosystems connecting two distinctly different plant and animal communities and the physical characteristics that support those communities.[2]

But these zones are more than just zones of transition. They are areas of disturbance, catalyzed by the differences in the two ecosystems, and they are often zones of conflict as well. The word's etymology derives from a combination of two Greek words: eco(logy) and—tone, from tonos or tension; ecologies in tension. Ecotones are not merely the blending of two habitats and their characteristics, but actually a third thing. "Although ecotones share some characteristics and species with the habitats on either side of them, ecotones also have their own distinct characteristics and species."[3]

Landscape and environmental ecology theory, especially as it relates to spatial configuration at the human scale is barely more than two decades old. Yet in recognizing that "humanity is now in charge of most of the land surface, and responsible for it,"[4] landscape ecology theory explicitly links humanity with the complex structure of our ecosystems, from local sites to vast territories.

From the opposite end, from the scale of the human, as science has re-scaled its focus from the universe to the planet to the body. And as technologies re-tool and shift from operating on things that are external to living organisms to operating on organisms themselves, to operating on the very matter of organisms, we begin to enter truly original cultural terrain in which we grasp

that we are not just affecting the environment at unprecedented scales and at accelerating rates, but that we are actually part of the contiguous matter of these larger material systems.[5]

Given this interconnectedness of humanity and the natural world, theories, models, observations and experiments related to landscape and environmental ecology are proving increasingly useful to our understanding of other kinds of complex systems across diverse disciplines. This understanding allows us to think about change and resiliency dynamics, and it allows us to imagine constructing new models for change and resiliency.

As an architect and educator, I want to apply the concept of the ecotone to the design of an ecosystem for architectural design education. But I want to do this with the belief that it is also scaleable to other disciplines, institutional systems and situations, either directly or as an analogy.

Much discussion in terms of accelerating capability-building in business, sports, government, education, disciplinary entities, or subjects even, focuses on the value of activities that operate at the edge. In this discussion edge can mean many different things, from the edge of an enterprise, the edge of methods and processes associated with the enterprise, geographic edges, demographic edges—a "whole set of edges that create the opportunity for capability-building."[6]

The implication within all these discussions is that work at the edge is unfettered and unencumbered by the inertia of core activity. It is more open to radically transformative and innovative forces and processes. These forces and processes, if tapped into, can re-shape and transform the core, something that the core will not do under its own constraints and conditions—under the shear inertia of its own historical operations. In these discussions edge and core are separate and unique fields of activity—discrete in their operations

except for moments of catalytic communication.

I propose that within the dynamics of the twenty-first century environment, modernist dialectical constructs are not as productive as they once were. And simple polarized positions are not constructive. Instead of honouring the paradigms of edge versus core, or, in our case, teaching versus research—'learning about' versus 'experimenting with', the **innovation ecotone** concept outlined in this paper proposes a third thing—a concept of overlap, transition or gradient. It proposes a sustainable educational environment: a space of pervasive innovation which is talent rich and talent diverse.

‘NOW’ AS THE DESIGN BRIEF

There is now considerable evidence in favor of the Intermediate Disturbance Hypothesis; this new paradigm in ecology explicitly recognizes disturbance as an integral part of natural systems. The Intermediate Disturbance Hypothesis posits that the greatest biological diversity occurs at intermediate levels of disturbance. A ‘disturbance’ in this sense is defined as any relatively discrete event in time that disrupts ecosystem or community structure and changes resource availability or the physical environment. The extension of this hypothesis to the landscape level results in the view that the greatest diversity occurs in landscapes large enough to contain various serial or successional stages as the result of disturbance events in the past. The resulting habitat heterogeneity will help maintain conditions suitable for a greater number of species, including both ***opportunistic species*** *that invade newly created patches and highly competitive species that predominate in older patches.*

H. R. Pulliam and B. R. Johnson[7]

Designers are, by nature, an **opportunistic species.** They work with and on problems, finding or creating openings from which to make things. And where there are no clear and present problems defined, they go out and find them embedded in the intricacy of everyday life. By problems, I do not merely refer to things problematic but to opportunities for working on the questions, puzzles, issues and enigmas that are inherent to human existence, its behavior, and its structures. And in using the word designers, I am speaking inclusively about those who design and those who engage in design thinking —design as a constructive process by which the designer takes on problems, models them, frames them, and creates a response through the distribution of material, real or virtual, in space—and design thinking —the same process but where the product may be thought itself—conceptual, strategic, structural, or systemic in nature.

The beauty of design as an approach to life, specifically as life is associated with the material and human environments in which it is embedded, is its creative opportunistic tendencies. The entrepreneurialism associated with

these tendencies has always been a driving force and one which has been effective in negotiating change. But as the dynamics are now shifting in the contemporary context, as the rate of change quickens and becomes more pervasive and persistent, this effectiveness is at risk.

In the past we had punctuated evolution. Things changed abruptly and after the abrupt change, there were decades of stability. Every major technical or infrastructural shift asymptoted out moderately fast and then stayed fairly stable thereafter. Automobiles, canals, railroads. It is the stability that has enabled us to build really deep institutional models based upon these types of infrastructures and technologies thereafter. But maybe for the first time ever in the history of civilization we are entering a new techno-economic paradigm, a new type of infrastructure, a digital infrastructure that may just not asymptote out. It may just keep on going and going. It is exponential in very interesting ways… Now of course infrastructure is more than just technologies. All serious infrastructures are social-technical paradigms and society and institutions have to fill in and respond.
John Seely Brown, Chicago, May 2008[8]

We are living a moment of great change as opposed to a state of stability in the sciences, technology, and culture. We are facing immense horizons of new knowledge—new knowledge that is continuously influencing this rate of change while, simultaneously, being a result of the new technologies and methods of information production and collation, and knowledge construction associated with this change. And we are embedded in environments of new practices that are both responsible for, and a product of, our emerging global society.

How do we respond to this present environment and the cultural and societal shocks that accompany it, such that these shocks produce evolution and not trauma? What is the role of the designer and how can we train ourselves to be better prepared for these current challenges as well as future possibilities we cannot foresee?

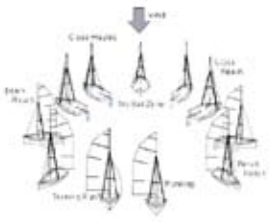
As designers and architects, how well are we engaging with these horizons of new knowledge and environments of new practices? As educators of creative individuals, how best to help them engage with these increasingly immense knowledge horizons and new practices? How best to cultivate motivations through which they will navigate these new environments with purpose, meaning, and intent?

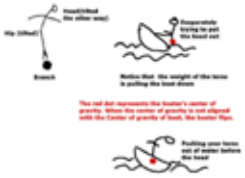
Fifteen years, ago, my image of design was like navigating the course of a sailboat—determining the basic trajectory, finding the north, setting sail and tacking with the wind and currents to keep on course. In this image, the winds and currents are analogous to the parameters of the problem, including the questions, responses and discoveries made along the way. This analogy allowed for unexpected deviations, whether minor, major or even when completely blown off course. Navigating the process, the richness of making new discoveries, and arriving relatively undamaged were all dependent upon the designer's tactical openness while steadily moving through the process with consistent intentions.

But today, the sailboat has been replaced with the image of a kayak in white water moving through changing topologies. Designers now operate in an environment in which major epistemological and cultural shifts are challenging territorialized ideologies and identities at an increasing pace; and where accelerated change, complex problems, and significant scientific innovations are leading to the elasticity of our professional and disciplinary barriers, and our cultural and political practices.

We are no longer sailing along the surface of our environment, responding with some sense of orientation, control, and critical foresight. Today, we are deeply embedded in a fast moving and complex terrain, and must be able to rely on our instincts as much as knowledge—instincts honed from knowledge gained through experience that can be tacitly accessed. Disorientation is

often part of this environment and can be productive when it catalyzes highly situated revisions in prevailing assumptions and practices, or generates deeply creative insights.





The designer as white water kayaker requires highly developed disciplinary expertise (musculature) and creative dexterity. The imagination is the undercurrent for this creative dexterity, and it fuels movement forward at a steady pace and as bursts of adrenalin.

But I would suggest that there is something more that goes beyond skill and dexterity that allows one to maintain a given course, goal, or points of focus while responding skillfully and creatively to situations at hand. I would suggest that it has to do with **elasticity**—elasticity as "the property of a substance that enables it to change its volume or shape in direct response to a force and to recover its original form upon the removal of the force."

In her introduction to the catalogue for the MoMA/SEED magazine exhibit, *Design and the Elastic Mind*, Paola Antonelli, Senior Curator of the Department of Architecture and Design at MoMA, used the term elasticity in a more resonant way.

Adaptability is an ancestral distinction of human intelligence, but today's distinct variations in rhythm call for something stronger: elasticity. The by-product of adaptability + acceleration, elasticity is the ability to negotiate change and innovation without letting them interfere excessively with one's own rhythms and goals. It means being able to embrace progress, understanding how to make it our own.

Paola Antonelli, New York, 2008[9]

Elasticity as 'adaptability + acceleration' is an inspired concept because it implies shape deformation in response to external conditions without a change in material composition. Over time the elastic object may deform its shape permanently as it repeatedly stretches and adapts, but the molecular composition remains intact. If one makes the analogy between molecular composition and an individual's rhythms and goals (motivations), this implies that a designer can negotiate extreme change by adapting to situations and problems at hand, and adapt more quickly over time without losing his or her individual point of view and inherent motivations. One can then extend this metaphor to imagine that significant changes in a creative individual's goals and motivations do occur as part of the natural process of evolution, but at a different pace—a pace that is associated with resistance. The key is the concept of adaptability + acceleration, but with resistance.

This species—the designer—inhabits an environment where expertise and imagination interact to shape undercurrents of creativity. But expertise, creative dexterity, imagination, and elasticity, without **agency** (the ability to have an impact on the world) only suggest adaptability of the individual to this fluid and topologically complex environment. The capacity to adapt *and* act to shape circumstances in this environment is critical. Elasticity of the individual creates greater resilience for the entire species, as an ensemble of individuals, but only when agency affects change in the ensemble's network of rules, norms, relationships, and practices.

So here we bring in the term **innovation.** Innovation is a bi-product of agency, expertise, creative dexterity, imagination, and elasticity. While creativity is the use of imagination to transcend traditional ideas, processes, objects and so on, to make new ones of these, innovation is about giving these things new meanings that lead to changes in the system. Because resilience of the entire species depends upon innovation, in a time of perpetual change, we need to understand that innovation is the key nutrient, as well as product, of the ecosystem.

An Opportunistic Species w/ Elasticity + Agency = Innovation
(for evolution, not trauma)

TOWARD THE DESIGN OF A DESIGN EDUCATION ECOSYSTEM

Given the dynamic and multivalent nature of current knowledge acquisition in our evolving global society, it is very easy to become quickly dissatisfied with the rigid binary oppositions put in place by the western cultural paradigm of modernity. In particular with regard to education, the systemic polarization between teaching and research seems especially problematic. This split is based on an historical bias that distinguishes teaching, as a system to deliver rigorously vetted information, from the practice of research as a methodical investigation of a subject or topic to develop new knowledge.

The argument against the blending of teaching and research has revolved around several key assumptions: that information delivered through teaching unquestionably leads to the building of knowledge, and therefore authoritative teaching is the most assured way to knowledge building; that the most efficient way to build knowledge from information is through a disciplinary structure; and finally, that building knowledge systematically is a necessary prerequisite to any new thought on a subject, implying a strictly linear sequence from teaching what is known to finding new things.

I would like to suggest that the linear route is no longer effective in a time of exponential increase in information. Today, massive amounts of information can no longer be sorted into distinct disciplinary territories. Nor can they be comprehensively learned or assimilated within the traditional educational structure and time frame of degree-granting, even within one given field.

So, if instead of polarizations, we think of continuums in which there is a sliding proportional scale between the extremes, and where the extremes themselves are tendencies and not absolute terms, then there is greater room for adaptability to situations at hand and variability of means of engagement.

And if we break apart the traditional linear process, in which learning about what is known preceeds new actions, and instead construct an idea space in

which how one acts in the world can be mapped relative to how one learns about the world, and vice versa, then I believe we can envision a design concept for a new kind of ecosystem of learning, engagement, and impact.

This idea space is scaffolded by a double continuum in which the horizontal continuum maps approaches to knowledge construction, and more specifically, the paradigm shift that is occurring as we move from twentieth-century thinking to twenty-first century thinking; and the vertical continuum maps ways of engaging with the contemporary context, which I have suggested is one in which we are faced with 'immense horizons of new knowledge' and are embedded in 'environments of new practices.' The horizontal continuum is an epistemological one and the vertical continuum is ontological in nature.

THE HORIZONTAL (EPISTEMOLOGICAL) DIMENSION APPROACH-TO-EDUCATION

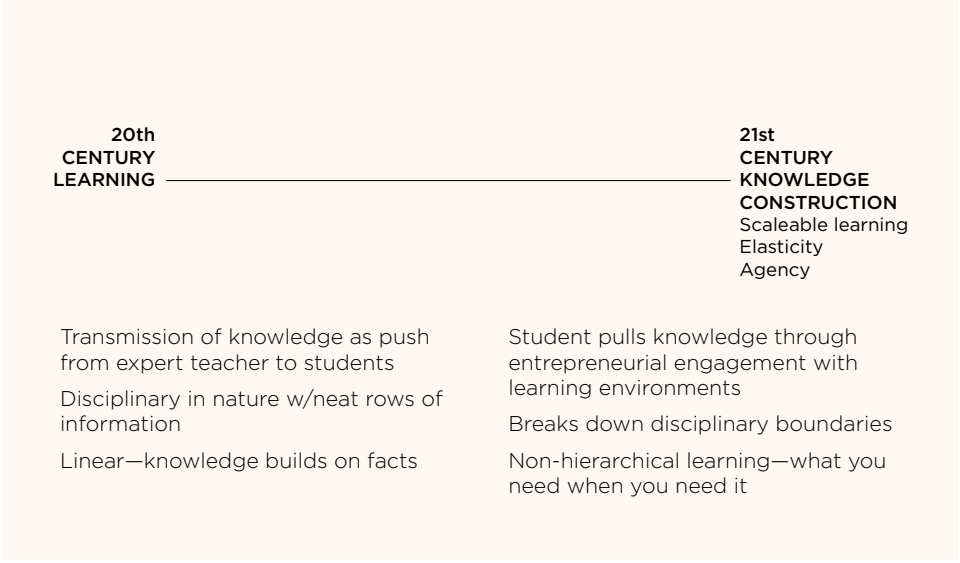


FIGURE 1 The Horizontal Dimension/ Approach-to-Education

The left side of this continuum corresponds to models, methods, and mechanisms associated with twentieth century learning and the right side cor-

responds to how we are beginning to conceive of knowledge construction for the twenty-first century. A twentieth-century approach to education holds fast to the notion of teaching as a systematic delivery of knowledge—knowledge that is vetted and sanctioned and delivered in discipline-based packages from expert teachers to students. It is education in which one learns about specific stuff and how to do specific things.

In contrast, twenty-first century learning environments are about learning that extends far beyond the classroom (it scales), which in turn promotes elasticity and agency. The assumption is that we need to prepare for futures in which the specific things we will be doing, and specific stuff we will need to know, do not yet exist. Implicated in an education for the twenty-first century are all sorts of new mechanisms—cultural, social, and intellectual mechanisms—that are either directly or indirectly affiliated with the digital age as a global phenomenon.

Intuitively, we understand that a twenty-first century approach to learning is radically different from education that focuses on the accumulation of information and the simplistic transfer of culture and ideas associated with this information. But what is it more precisely?

I would suggest that it begins with an epistemological shift in which learning how to learn and act (learning to be), in a highly situated manner, replaces learning about[10] something. And then it is about how this scales, so as to create elasticity and agency.

Scaleable learning is learning that extends beyond the duration of a particular instance of learning—a class, a course, or an extended sequence of courses even—and beyond the defined content and knowledge boundaries of that particular instance. It is learning that may be locally situated, and regionally constructed, but is ultimately globally oriented, focusing on the relationship between the regional and the global in how one constructs and applies knowledge.

Scaleable learning is not discrete learning, but learning that connects with other knowledge bases, and fosters easy adaptability and application to multiple instances, multiple scenarios, and multiple applications. It is the inverse of instructional teaching environments, promoting and in fact requiring students to actively and entrepreneurially engage in their own education. It is authentic learning, highly situated but extensively connected.

This is a second paradigm shift in how we think about knowledge, action, interaction, and agency. It is about learning to manage a complex network of informational resources and skills so as to develop the capacity to assimilate them, internalize them and then access them under a variety of situations—changing, adapting and innovating in different situations and circumstances.

Project-based environments like the design studio are an excellent example of scaleable learning because in order to engage the problem, the students must first decipher it and then determine what they will need to work through the problem—what skills and information they will need to move forward, including elements outside the specific domain where the work began. And then they engage in work that, as it progresses, continually reforms the problem, its constraints, and information + skills needed. Information-rich courses can also operate in this entrepreneurial manner and there are many well-proven examples,[11] as well as more experimental ones still under development.

So if twenty-first century learning is about 'scaleable learning to create elasticity and agency,' how do we understand elasticity in this context? And agency? Elasticity was defined earlier as 'adaptability and acceleration' but we can elaborate here. Adaptability and acceleration imply flexibility and speed, both associated with agility and dexterity. Dexterity and agility require tremendous skill that may be part of one's natural talent. More often, however, and even with inherent talent, this skill is developed through tremendous amounts of concerted work that is done to build strength in multiple areas. Design dexterity and agility also require that knowledge and skills not only be extensive but that they are assimilated so thoroughly that they become internalized as tacit

knowledge that is accessed instinctually as needed.

Agency is the ability to have an impact on the world, and is the product of scaleable learning and elasticity. Architecture has always been a visionary discipline and a visionary practice. Between vision and its achievement is agency. The development of agency is dependent on many things, including, most importantly, the ability to deeply read the context and the systems of values embedded in it—the frames—to formulate actions that support or mediate change, or operate on that context.

If agency can be defined as 'instrumental actions'—that is, actions that shape their environment as opposed to being merely shaped by it—then the the fundamentals of agency are a deep understanding of that environment, a vision, and being able to make that vision operational through elasticity of response.

It must be emphasized that the horizontal axis is a continuum, not a time line, and the two ends are not mutually exclusive. There will be educators deep in the future still teaching with twentieth-century principles and there are many instances of 'teaching' in the last century that attempted self-sustaining learning practices and project-based environments.

THE VERTICAL (ONTOLOGICAL) DIMENSION / ENGAGEMENT OF THE CONTEXT

This dimension maps ways of engaging the contemporary context: a context in which we are faced with 'immense horizons of new knowledge' and embedded in 'environments of new practices.' The top of this continuum has been labelled 'accreditation.' It is accreditation that defines the role and content of professional architectural education today. Therefore, accreditation at the top can be taken to mean, literally, that the dynamic and complex context is engaged and acted on through the consistency of professional standards and practices for accreditation as architects. Experience is assimilated through these filters, new knowledge is constructed in direct relationship to existing

knowledge, and new practices are studied and understood relative to existing and historical practices.

But the term accreditation can also more broadly represent the imperative of any core disciplinary teaching or core body of knowledge, and the standards and practices associated with that knowledge. This is to say that the context is made sense of through these core knowledge filters and historical practices. Or, analogically, it can also mean any epistemological system—or any outlook, fact, or belief for that matter—that is accessed and employed to help organize and act on the context we are in. Accreditation, as a term broadly interpreted, is about sanctioned authority. It therefore implies that the context, as dynamic as it might be, is engaged through accepted categories of knowledge and perspectives (value frames), that existing knowledge and practices are reliable, and that they hold authority over emerging questions and unknown future conditions.

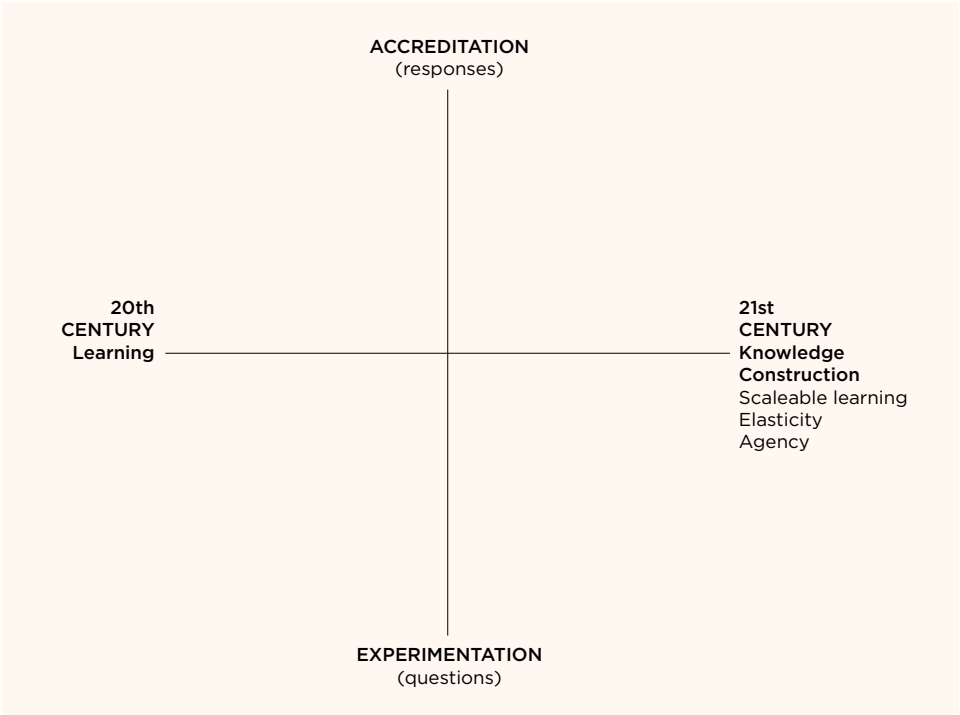


FIGURE 2 The Vertical Dimension. Engagement of Context

At the foot of this continuum is experimentation as an imperative and a practice. Here, the context is engaged through creative research, and a conscious way of working that prioritizes questions over authoritative responses. This can be seen as an ontological distinction: while *accreditation* is about 'I exist, and act, through how I define myself,' *experimentation* is about acting and *existing* through questions.

Experimentation is explicitly about the framing of questions through which we learn about the things we are experimenting with and on. Experimentation also implies that it is not merely a process of providing questions and answers, but a recursive process of repeated questioning in which partial, possible, or probable 'answers' are tested and then subjected to new questions with new responses leading to new propositions, more questions, and so on. Because experimentation is recursive and because it is ongoing (fueled by curiosity), this process of knowledge building has the potential to keep pace with its environment while simultaneously affecting this environment.

Experimentation is the conducting of specific pieces of work (acts or operations) for the purposes of discovering something unknown, or for testing an idea, a principle, a proposition. It is the means through which creativity is linked to innovation. Innovation requires deeply contextualized knowledge; knowledge that comes from engagement of the context, not before engagement of the context. Knowledge that leads to innovation is built from working deeply situated in the context to know it (the kayak again), rather than applied over the context to make sense of it (the sailboat).

Because I understand 'accreditation,' and all that it implies and makes analogy to as an overlay of knowledge and practices onto the context, and 'experimentation' as a way of operating through an underlayment of questions that generate new knowledge and practices, I have placed 'experimentation' below the learning continuum and accreditation above it.

(THE TEST: HEDGEHOGS AND FOXES)

As a testing of the creative ecology of this idea space, it could be useful to subject an existing creativity paradigm to this space in order to better understand the relational nature of its two dimensions.

In 1953 Sir Isaiah Berlin wrote the essay, The Hedgehog and the Fox, in which he proposed a classification of writers and thinkers, and perhaps all human beings, into two opposing psychological orientations and personalities. His classification is based upon a line from the Greek poet Archilochus, which says "The fox knows many things, but the hedgehog knows one big thing."

Taken figuratively, the words mark… a great chasm between those, on one side, who relate everything to a single central vision, one system less or more coherent or articulate, in terms of which they understand, think and feel—a single, universal, organizing principle…—and, on the other side, those who pursue many ends, often unrelated and even contradictory… related by no moral or aesthetic <single> principle; these last lead lives, perform acts, and entertain ideas that are centrifugal rather than centripetal, their thought is scattered or diffused, moving among many levels, seizing upon the essence of a vast variety of experiences and objects… The first kind of intellectual and artistic personality belongs to the hedgehogs, the second to the foxes.[12]

Although Berlin himself agreed that "over-simple classifications of this type create dichotomies that, if pressed, are artificial, scholastic, and ultimately absurd," he still felt that "all distinctions which embody any degree of truth, offer a point of view from which to look and compare, a starting point for genuine investigation." Certainly enough people have cited this metaphoric dichotomy to contrast artists, thinkers, architects, business models, political figures, and others.

Taking his cue from Berlin, the well-known modern architectural historian and theoretician Colin Rowe, in *Collage City,* applies the hedgehog/fox model as well. He uses it to discuss the different motivations attributable to Louis

XIV at Versailles and Hadrian at Villa Adriana.

Versailles is "certainly an exhibition of total architecture and design… the triumph of generality, the prevalence of the overwhelming idea and the refusal of the exception,… the complete unitary model," while Villa Adriana "attempts to dissimulate all reference to any controlling idea." Compared with the 'single-minded performance of Louis XIV, we have the curiosity of Hadrian… who proposes the reverse of any totality in the Villa Adriana… an uncoordinated amalgam of discrete enthusiasms.' So to paraphrase loosely in hopes of expediting this characterization, we have 'exhibition of the overwhelming idea' on the part of the hedgehog personality in contrast to the 'curiosity' and 'discrete enthusiasms' of the fox personality. The fox is 'preoccupied with a multiplicity of stimuli' while the hedgehog is 'concerned with the primacy of the single idea.'[13]

Looking again at the vertical dimension of the idea space I have delineated, if one takes the broader understanding of the word 'accreditation' as meaning authoritative knowledge and practices (or even analogically as a core epistemological system seen as a complete and unitary system), and experimentation to mean a practice of curiosity of 'discrete enthusiasms,' then one can clearly see how the hedgehog maps into the top-left-hand space and the fox into the lower-left-hand space. Because the hedgehog organizes his understanding of reality through a clear single a priori idea, holding steadfast to this image of reality regardless of the changes in the context, it is clear that reality is understood through the authoritative. The fox, on the other hand, is open to changes in the environment, adapting with it. The implication in Berlin's text is that the fox is not merely scattered in thinking and formation because of an incapacity to be otherwise, but that foxes 'seize upon the essence of a vast variety of experiences.' They modify their behaviour—they adapt—and possess a situated understanding of reality. Given this, I would actually place foxes closer to the right of this lower realm, just as I would place hedgehogs closer to the top left of their quadrant.

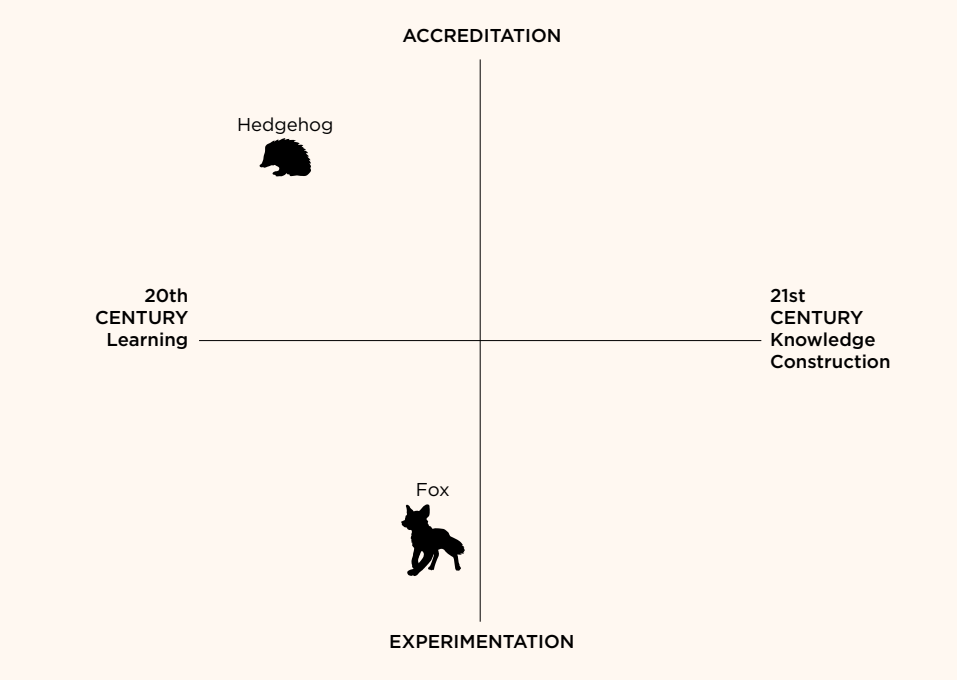


FIGURE 3 The Test

But both of these species are still very much part of the pre-twenty-first century context—a polarization that is problematic in the shifting, altering, dynamic context of the twenty-first century. If we want to think about the affect a twenty-first learning paradigm might have on this context, and more particularly how to design an ecosystem that would occupy the other two quadrants, what would it take? And what species would we find evolving there?

‘ACCREDITATION +’

The amount of information available today, the pace at which it is coming in, and therefore the amount an architect is expected—required—to master is exponentially increasing. The formal academic phase of becoming an architect is one component of the education. The professional internship, during which the student is actively practicing, under the guidance of professionally licensed architects, on real full-scale projects, is another. Despite this greater amount of information and the manner in which it keeps adding to, and refreshing itself, the length and time available within the academic portion of an architect’s education is not increasing. In fact, in some cases it is decreasing.

As a result, certain bodies of information are being replaced by new bodies of information, not because they are outdated or irrelevant, but because there is just not enough time for all to be consumed under the traditional learning models.

For example, looking at technical coursework alone: Ten years ago, coursework on structures was about statics of materials; today, in addition to this, we have new materials, new methods of construction, and an entire new field that relates structures, materials, and performance to environmental concerns and sustainable responses. And this multiplication of information and concerns—sub-fields even—proliferates throughout the coursework from structures, to history and theory, representational methods, building systems, and design methodologies, even.

Furthermore, this gap between the amount of consumable information and skills that can be learned under traditional teaching models, and the information and skills available and critical to an architect today, can produce unintended shifts in values and focus as the immediacies of new concerns and information create competition within the system. In an effort to answer the really tough questions really quickly, with ever-new information and practices, we stand to lose the human social and reflective dimensions of our work and our identities—of who we are and what we do, as individuals and together. In that which is most immediate being attended to first, the more tacit aspects of

our social, cultural and political practices often stand to be neglected. Without a critical assessment of these possible and unintended shifts in values, the discipline is vulnerable to fracture and loss of purpose.

In addition to this increased amount and pace of new information acquisition, we have the development of new sub-disciplines. One example is computation as a tool for design, simulation, research, and construction methods, and as a field with its own theoretical ground. Environmental systems and processes is another. And as deep areas of expertise are developing within these sub-disciplines, sub-sub-disciplines are emerging. The risk of losing the discipline's integrative imperative is severe without new mechanisms and networks of connective tissue.

All of this implies that the designer must master core knowledge and skills in a different way: one that is about greater assimilation, in a more compressed manner, of an ever broader range of knowledge. Engagement with 'immense horizons of new knowledge' and 'new practices,' in the disciplinary context described above, requires re-envisioning the core of design education.

Mechanisms, means, and methods associated with a twenty-first century approach to learning promote entrepreneurial learning. In an environment in which knowledge and skills are built and acquired in situated contexts that promote scaleability, elasticity, and agency, there is greater possibility that the student will acquire, assimilate, and synthesize valuable skills and more information associated with new practices.

Therefore, I propose that as one moves increasingly toward an operational twenty-first century architectural education, accreditation (which I now use to refer to the system of core principles, knowledge, and practices that specifically correspond to the professional certification given to schools of architecture) incrementally and significantly improves and becomes *hyper accreditation.* That is, it becomes accreditation + (plus) and it can be drawn like this:

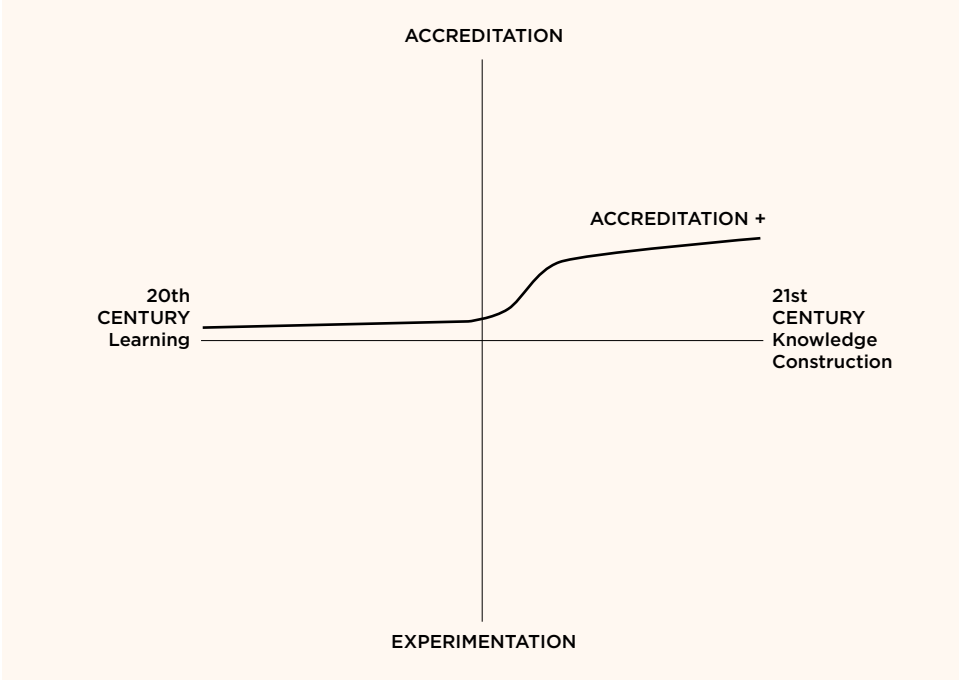


FIGURE 4 'Accreditation +' Curve

The curve is not an even gradient because the moment one makes the shift in thinking from delivering knowledge through teaching, to providing mechanisms that cultivate entrepreneurial and scaleable learning—the incremental increase in affect is significant.

But this broader range of knowledge and skills is of little value on its own terms. For it to be deployed in a manner that meaningfully responds to the complex issues of today, learning must advance beyond information and skills. It must ultimately lead to the development of a creative inquiring disposition. The designer must be able to understand a specific situation or problem, unpack it, and then determine and go after the specific deeper or finer-grained information and skills necessary to move forward.

Learning in this environment of hyper accreditation is about three things. It involves sorting information and skills into those that you have to have on hand, to have mastered, so that they are part of any tacit synthetic response, from those that are best left in the bank of stuff to be accessed as necessary in a given situation. It is also about developing an entrepreneurial disposition—one that is fueled by inquiry and manifest through the creative imagination. Finally, mechanisms of communication and connectivity are essential to create a rich integrative environment of deep and broad work.

'Accreditation +' is not so much about more knowledge, more skills, as it is about key knowledge and skills, well assimilated and well linked across the sub-disciplines—design, technology, history and theory, representation, computation—as well as the capacity to find and build the knowledge and skills necessary for any given situation. This requires the development of new learning mechanisms; injected into the system, these new mechanisms can instigate transformative change in the system itself. There are already mechanisms that have been in place for many years in key places, such as MIT's Open Course Work platform, Rice's Connexions Project, and other more experimental projects and sites such as USC's Vectors Journal for Culture and Technology or the NASA-sponsored Virtual Telescopes in Education (there are vitual microscopes too), simulation devices, etc. Many of these mechanisms, but not all, are facilitated by digital technology and the Internet.

Within a school of architecture and design there are, even traditionally, substantially different modes of engaging with 'course' content throughout the education process. But new technologies, new theories related to information collation and visualization, lead us to think about possible new models for specifically working toward 'accreditation +.'[14] And 'accreditation +,' as a concept, challenges us to design these.

MICRO-LABS / SEEDING A CULTURE OF INNOVATION

As we navigate toward a twenty-first century approach to learning that honors elasticity and agency, and engages the context through inquiry and experimentation, we gain a greater chance of authentic innovation. Greater design elasticity, founded upon better assimilated skills and knowledge, creates the dexterity and agency that are needed for design that is more than just instrumental or critical problem solving. This is design in which constraints are reframed as opportunities. Increased knowledge and skill assimilation—increased dexterity—means an increased capacity to offer design responses to these opportunities. And increased agency means that these design responses can alter existing understandings, practices, and boundaries.

This shift in emphasis in architectural education from learning how to make things *in response* to a problem's constraints and opportunities, to learning as a form of experimentation where *questions are framed around* problems (moving from the upper quadrant to the lower one) activates **design as a form of inquiry.** Here, opportunism is not a perceptual shift applied to a given problem (valuable as that might be in opening up unexpected trajectories of work). It is not an aikido move that turns constraints into opportunities. It is problem-seeking itself.

Questions framed around problems become much more important than intentional responses with intended consequences. Intelligent, well-framed questions are the essence of meaningful, creative design inquiry—design as research—because they instigate an abundance of work testing different approaches, priorities, and possibilities through multiple responses. And great questions, intricately framed around problems that are even mildly complex in nature, have a tendency to trespass across disciplinary boundaries, leading naturally to work that co-opts material and methods from other disciplines.

An approach to design that focuses on experimentation, inquiry and ongoing creative research, multidisciplinary / multitalented in scope, around intricate questions, creates a culture of innovation. A **culture of innovation** also implies distribution of innovative practices throughout a particular environment. Culture, as the shared beliefs, customs, practices, and social behavior of a group *and* culture as the growth of biological material in a nutrient-rich medium, both rely on distribution as opposed to concentration of activity.

This culture of innovation can emerge as individuals embrace new knowledge and practices as active participants in their work. Or it can be catalyzed through mechanisms that encourage individuals—and specifically individuals from different areas—to do design work together. Catalytic mechanisms can be heavy or light: large-scale multidisciplinary centers with major funding, lots of people, and clear planning, or they can be something else.

Given the fast pace of the world today, I suggest that creativity and experimentation must be quicker and more agile than traditional, heavy innovation mechanisms allow. A lighter, more agile mechanism is called for; one that is capable of elasticity—maybe even conceived as elastic. As an alternative, I propose design labs, where the organizational structure is light, emergent, networked, and elastic, are different from design studios in that they are driven by inquiry rather than organized around pedagogy.

I would suggest that a culture of innovation looks very different from a traditional research funding model. As a culture, it cannot be mandated or structured, but it can be facilitated. These design labs, instead of comprehensive large units, could be richly networked design micro-labs. Easier and quicker than large centers to plan, build and reconfigure as projects shift and move in other directions, they facilitate grassroots creative research. These highly networked micro labs, focused on topics of deep inquiry, need not have dozens of participants sitting in the same room. A team of participants with the necessary skills might be distributed among several institutions, several countries, networked digitally and through ongoing academic relationships.

The creative research can then move beyond the home discipline, the home academic institution, and beyond academia itself, while being built on these home resources, strengths, and talents.[15]

Like a pace line[16]—or echelon—of cyclists, these design micro-labs, in concept, consist of a small, agile team of diverse talent and expertise, non-hierarchically organized, drafting from each other's strengths. An example is a four-person team of track cyclists. The front cyclist leads the effort until it is his turn to drop back and draft at the rear, to rest, recuperate, and regenerate. The two cyclists in the middle draft and pull simultaneously, and the person in the rear waits and prepares to move forward.

My daughter is one of these cyclists and she explained the dynamics of effort to me. There is generally a movement cycle of twenty seconds to several minutes until a specific event occurs, such as a hill. In preparation for the hill, the team positions the member who is most effective at pulling up hills into the lead position where this cyclist will build uphill momentum and hold until the hill is attained—ar at least long enough to break the inertia of the effort on flat ground. On a straightaway, where speed must be built, the team rotates continually with no more than a two-pedal-stroke hold in the front position.

In the micro-lab, the various strengths and areas of expertise would pull, draft, and rest at different moments during a project, depending on different needs and events. While drafting, one has the chance to learn new material, research new information and re-direct a portion of the research/work in preparation for leading again.

Returning to our idea space, if we understand that these design micro-labs are part of an ethos of experimentation and can only be achieved within twenty-first century teaching/learning methods, I suggest that the conceptual curve of the design micro-labs looks something like this:

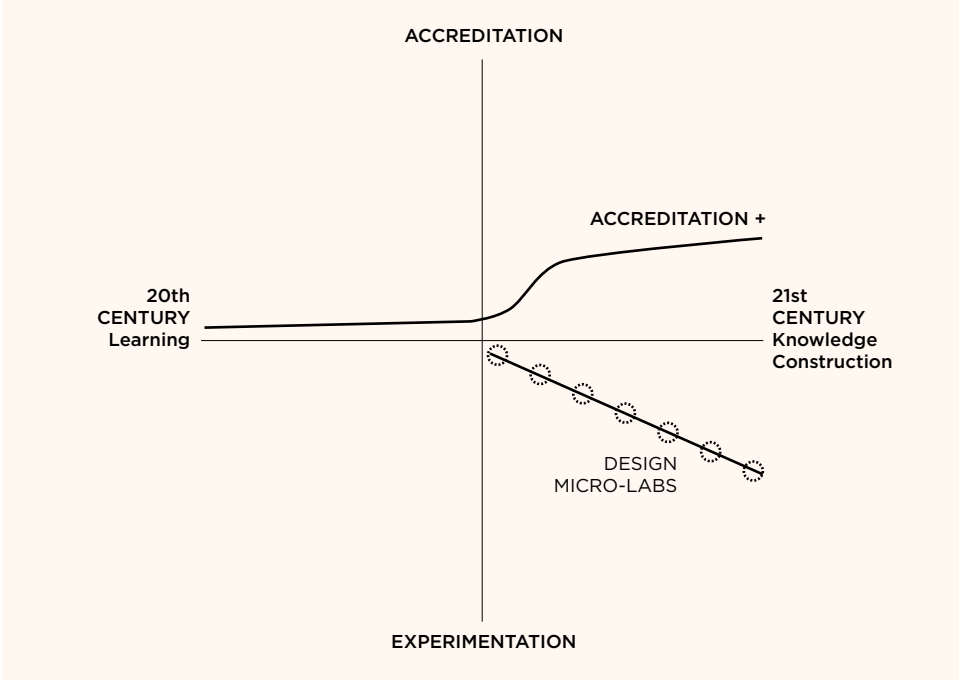


FIGURE 5 The Micro-lab Curve

Just as the 'accreditation +' curve starts with talent and life experiences, building knowledge and skills in a structured setting, the "design micro-lab" curve also begins with talent and life experiences. It relies on knowledge and skills built within the 'accreditation +' activity zone, but these new skills and this new knowledge become more tacit, supporting instinct and intuition around projects. What is important is that the design micro-labs seed a culture of innovation as elastic mechanisms. They are mechanisms not structures, and as mechanisms they are a means of creative grassroots research and innovation.

Because they are networked, a single micro-lab's reach extends beyond the team itself or the duration of a specific project. When the opportunity arises, these micro-labs can coalesce into one larger lab with tremendous diversity and richness of talent. Breaking apart again, they may redistribute talent and

resources. Analogous to the way "process networks" mobilize highly specialized small companies across an extended integrated design and manufacturing process,[17] a network of micro-labs creates a horizontal rhizomic structure in which the whole is much greater than the sum of the parts. The networked micro-lab can adapt to new questions and opportunities from outside as well as inside the network.

It is important that both the *emergence of* individual grass roots efforts and the *seeding for* grass roots activity are of value to this model. Easy to support, quick to build, networked together, they are capable of creating an impact far beyond what a single larger lab could.

A CULTURE OF INNOVATION AS (CORRIDORS AND) ECOTONE

As has been previously stated, much of the discussion about building business capability focuses on the value of activities that operate at the edge, where edge can mean several things—the edge of an enterprise, the edge of the processes associated with the enterprise, geographic edges, demographic edges, etc.—a "whole set of edges that create the opportunity for capability building. (JH) The point is that by being able to listen deeply and participate on the edge, you can pick up things before anybody else picks them up, and you can use them to accelerate you own capability building… My sense is that there are more edges today, and the edges themselves are becoming more important. (JSB)"[18]

The implication is that work at the edge is unfettered and unencumbered by the inertia of core activity. It is more open to innovative forces that can reshape and transform the core, which the core will not do under its own constraints and conditions.

The 'design micro-lab' curve is analogous to edge activity, while the 'accreditation +' curve relates to core activity. While some people are most valuable working within the 'accreditation +' environment, others bring value working in the micro-labs-as-seeds-of-innovation environment.

As the design micro-labs become more and more deeply engaged with experimentation—as their members and methods become more and more elastic with increasing dexterity and agency—the distance between the 'accreditation +' and the micro-lab activities diverges. This diverging propensity and a continued disinterest on my part in the value of polarizing classifications, means that instead of focusing on these as separate and unique fields of activity, discrete in their operations except for moments of productive communication (irritation), I prefer instead to focus on the opportunities for connection offered by the space in between.

This space is not a void between two kinds of activity, but a space of pursuit itself. Work within this space would be different from ongoing work pursued at the edge, different from work associated with hyper disciplinary learning, and

different from the experimental project-based work of the micro-labs.

Connectivity would begin as events in sequence—corridors—capable of transferring both information and methodologies between the two ongoing activities. These 'corridors' can be manifest as many things: symposia, micro-symposia, seminars, short topic-oriented design workshops, informal research presentations, or any mechanisms that move the work of the design labs out into the space. The corridors would be supported by informal social networks as well, developed digitally (Facebook, Twitter, et al) and physically (cafes, game rooms, etc.). Students or participants within the 'accreditation +' activity can be conscripted to work in the micro-labs just as non-local participants in the design labs might be poached for work within the 'accreditation +' activity.

The crucial point is that this in-between space of pursuit and the corridors of connectivity create a condition that disrupts the traditional operational understanding of the edge-vs-core relationship. This environment depends on both and therefore honors both. To break the non-productive resistance of the historically sanctioned core/accreditation activity, this edge environment must be prepared with internal mechanisms of connectivity—intellectual, social, and digital—provide that preparation. *(See endnote 19 for how digital tools/means/ mechanisms operate to sustain the ecotone)*[19]

FIGURE 6 Corridors + Distribution

But beyond connectivity, corridors also have the capacity to create other spin-off activity that distributes itself entropically, seeding the space in between to create a fully distributed culture of creativity and innovation.

In landscape systems, corridors create connectivity between different habitats. A system of corridors can lace together two distinct ecosystems, or two pursuits such that the impact of one on the other is not purely incidental. "Channelled movements of matter that are spatially differentiated from an adjacent static area may produce or maintain an observable corridor. Here, movement of objects is greater within a strip than in the surroundings."[20]

Corridors in the landscape are "strips that differ from their surroundings; (and they) permeate the land."[21] They are movement paths for species, for water, for wind—for material of the landscape. They exist as qualitatively different zones of conduit that connect two ecosystems, end to end. But in addition to connectivity, they also provide distribution as they open up their contiguous surroundings to the stuff that is moving within them, whether species, air, information, or creative practices.

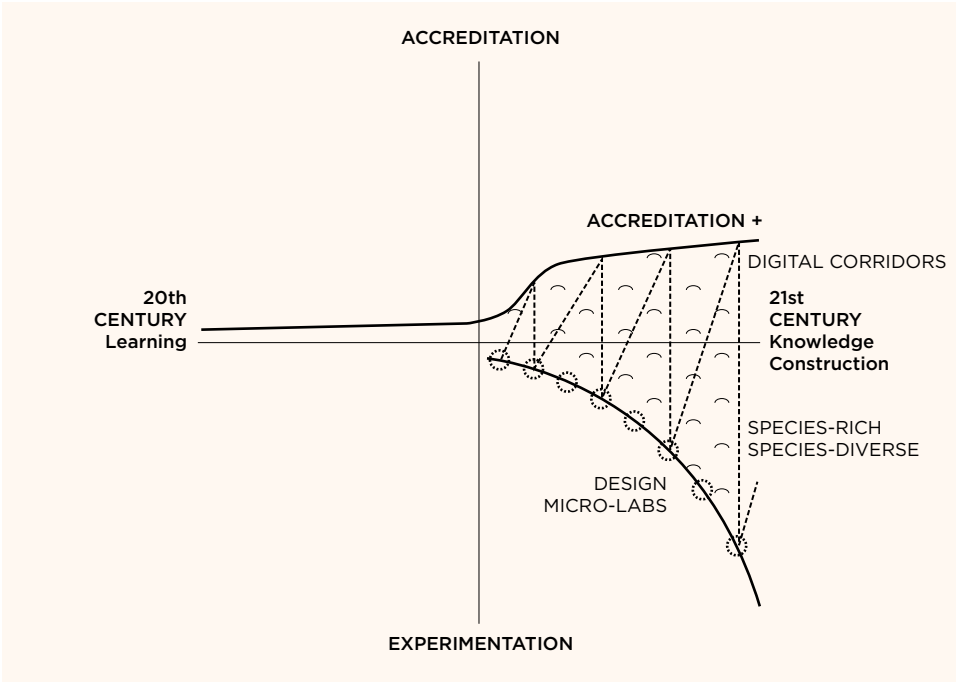


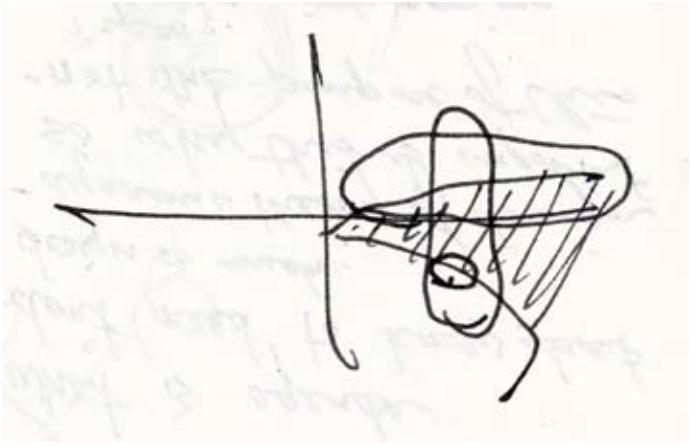
FIGURE 7 Digital Corridors + The Innovation Ecotone

The space between the two curves is intended as an inhabited space, and I suggest that its inhabitation has an effect on the activity curves that were originally drawn. As the two curves diverge, the increasing distance across the space calls for longer connective corridors; more numerous, more diverse activities, and completely new mechanisms are necessary to exploit the value of the most experimental of the micro-labs. These longer corridors seed more spin-off activities and engage more people. The capacity for experimental work

is increasingly amplified and what was a straight arithmetic proportion now becomes a curve transformed by the rapidly expanding area of the ecotone.

Because people and creative work are involved and because curiosity is a driver, the more people involved, the more work achieved. If this work and these people are well connected through involvement in dynamic mechanisms of communication, and are intellectually generous, then the growth, volume, and impact of this space increases. The density, diversity, and richness of the work increases.

While I suggest that many of the professors and researchers would choose to work in one of the two edge regions—the hyper-accreditation or the micro-labs—some cross the space to work in both. But the principle inhabitants of the ecotonal space in between will be the students. They will be raised in that space, migrating from one edge to another as they choose their own courses of learning and discover their own strengths, talents, and motivations.



"Several categories or types of (ecotone) species are usefully recognized, independent of taxonometric group. Most species are generalists that tolerate frequent disturbance, as well as the contrasting environmental conditions on opposite sides of the (ecotone)…

In addition to edge residents, (ecotones) often contain multihabitat species, those requiring or frequently using two or more habitat types. These organisms capitalize on the complementarity of resources provided by the zone between two ecosystems or land uses. Though subject to disturbance regimes of both ecosystems, these locations offer ready access to diverse resources, plus stability during stress periods."[22]

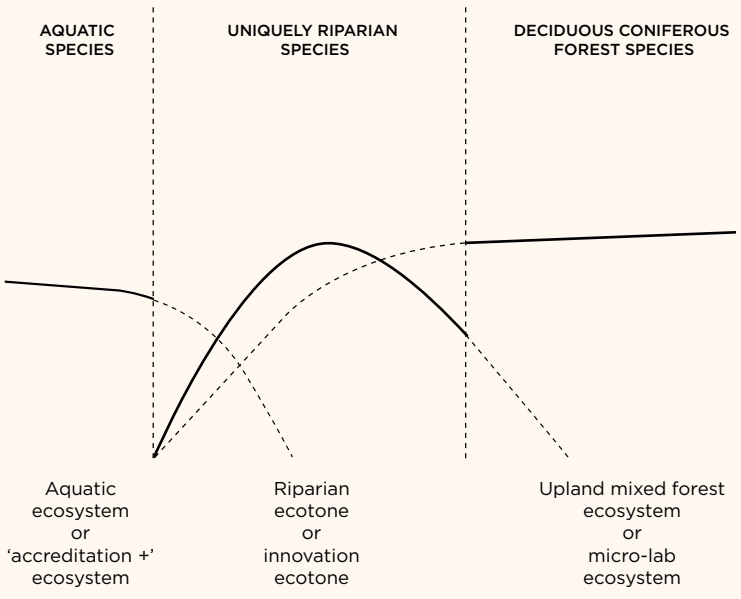


FIGURE 8 Species distribution for a riparian ecotone (or an innovation ecotone)[23]

But, even more importantly:

"(Ecotones) are often biological cornucopias. High species richness and density, or biomass, are documented for many groups… Edges may also play an important role in ***species evolution.****"*[24]

Within the deep interior of the Cameroon rain forest there is an abundance of bird species inhabiting the dense canopy. One of these is a green robin-sized bird known as the greenbul. Drab and unremarkable in appearance, this bird is extremely interesting to the biologists at UCLA's Center for Tropical

Research and Leiden University in the Netherlands because its existence and characteristics run counter to the traditional argument that species generation and modification occur within distinct geographically isolated ecosystems.[25] This bird can be found both within the deep rain forest and the wooded fringe (the ecotone) where jungle meets savannah. Although there is no geographic barrier between the two populations, the greenbuls living on the forest edge are distinctly different from those living in the interior of the forest. In fact, the morphological differences between the two are more pronounced than those found between separate bird species living within the same habitat.

The greenbul is a highly vocal bird species. One of the most significant discoveries of the UCLA/Leiden group was that the greenbuls living within the forest edge have a distinctly different song pitch from those that live within the forest. This change in pitch allows those greenbuls living on the edge to overcome the distinctly different ambient sounds of the savannah, thus influencing mating choices and ensuring reproductive success.

Additionally, the greenbuls living in the gradient zone between forest and savannah have longer wings, deeper bills and are heavier than the rainforest dwellers. These characteristics confer competitive advantage in an environment where this small bird is more vulnerable to aerial predators. Rainforest edges are inherently environments of increased predatorship due to the greater density of small herbivore species. These species forage on certain plants that can only be found on the edges because the boundary soils tend to be mineral rich and because greater penetration of sun and wind opens up the forest floor to growth. The abundance of small herbivore species attracts predators turning it into an ecological trap for species such as the greenbul.

It is the greenbul's ability to adapt its song to acoustical variation and its aeronautic capabilites in response to increased vulnerability within the gradient zone of the rainforest edge that ensures its survival. The biologists studying the greenbul believe that they are witnessing something very important. Together with other species that have been discovered and studied within this

particular ecosystem, but also across the globe, the greenbul substantiates the theory that ecological gradients—in this case between rainforest and savannah—"encourage species adaptation and experimentation."[26] They even encourage species evolution and generation. In this particular ecotone, savanna species are adapting to forest environments, and forest species are adapting to savanna environments. But even more than this, species such as the greenbul have evolved to a degree that they can no longer occupy any habitat but the ecotone, which is distinctly different from either bounding habitat.

Because the students of the ecotone culture share the space and their work with others unlike themselves – with diverse species – there will be those cases in which one enters as one thing and evolves into something else: an architect, for instance, evolves into a musician/architect; or an astronomer evolves into an astronomer/environmentalist.[27] Like the Greenbul, though, it is not a change of song but a new tonality that honors both the song structure and the new context. This means that this new talent will acquire the ability to contribute in more than one field and maintain a key presence in multiple camps.

The **ecotone analogy** is extensive and highly productive. Diversity of species, new species development, keystone species as engineers, distribution of nutrients, corridors for transfer of creatures and stuff—even the idea of microhabitats (smaller habitats within larger habitats, like a tidal pool)—are all intensely relevant in terms of conceiving, designing, and implementing organizational structures and mechanisms for this innovation ecology model. Each component might independently have an impact and add value to the system, but the fact that the ecotone is a system, rather than a collection of components, means that their collective impact scales.

These discrete components, which are light, agile, and diverse in nature, are easier to bring together and to fund, and they can take risk. Failure of one component, or one piece of work, does not mean failure for the system, and risk-taking is supported and sanctioned. Multiple talents (species) can be tapped as opposed to forcing talent to adapt to larger top-down goals. Talent

buys in and work equity builds.

"A mechanical system—a watch for instance—is divisible, while an ecosystem is indivisible because of well developed interdependences."[28]

Because ecosystems are indivisible, they are environments where all work feeds back into the system, affecting the entire system. This means that while the innovation ecology model may be structured around discrete packages of work done by individuals and groups (classes, seminars, labs, micro-labs, micro-symposia, etc), the actual work of the ecosystem is interconnected, interdependent, and limitless. Work done over a week, or over months, continually feeds back into the system, altering the existing and future course of the work. The complex series of exchanges adapts to emerging trends, information and practices.

Because ecotones are constantly negotiating the interaction of two different habitats in tension, the two activities/pursuits depend upon and sustain each other. The experimental work (the work of inquiry) feeds back into the 'accreditation +' work (the core work), keeping it relevant, informed, and moving forward at the pace of the environment around it. The 'accreditation +' work grounds the work of inquiry through successful practices. This interdependence is achieved through the work in the middle which is the work of the innovation ecotone.

The innovation ecotone's resilience comes from its indivisibility and its capacity to incorporate even disruptive change, thanks to its species diversity and richness. As conditions in the environment change—new problems, projects, information, and practices—different talents from diverse areas of expertise respond, taking up the challenges and forming new alliances. These alliances form new practices with different inflection points; sometimes one entity is the driver, sometimes another.

"The great urbanist Jane Jacobs was among the first to identify cities' diverse economic and social structures as the true engines of growth… Jacobs argued that the jostling of many different professions and different types of people, all in a dense environment, is an essential spur to innovation—to the creation of things that are truly new." [29]

"Jostling" can be interpreted as physical contact, but it can also refer to the critical infrastructure of connectivity. Because the innovation ecotone is a distributed culture containing many smaller events and mechanisms, communication infrastructure of all sorts is essential.

It is expected that certain individuals in the model proposed will inhabit both the adjacent edge and the ecotone. Those in 'accreditation +'—faculty, teaching assistants, adjunct faculty, technical consultants of all sorts, digital and library support staff, etc.,—can and will move into the space in between to work on certain problems and for certain events.

Those individuals who work in the 'micro-lab edge' can also occupy the in between: faculty (tenured or not and including those from other disciplines, schools and countries), research assistants, industry researchers and consultants, artists, film makers, business, and anyone valuable from anywhere with the necessary talent for the situation at hand. Since the micro-labs are experimental and multidisciplinary, when these individuals inhabit the space in between, they bring a different ethos. They add richness, diversity, hyper-disciplinary expertise, and implementation know-how. The different talents/species associated with this edge, along with their capacity to adapt and communicate, energize the space with curiosity and the belief that anything can be done.

Ecotones are specifically known for being sources of evolutionary novelty.[30] Here, the species of evolutionary novelty is the students. Students are capable of inhabiting both edges of the innovation culture. But more importantly, like the greenbul of the rainforest/savannah edge with its own song and increased

aeronautic capabilities, they survive and thrive by their ability to exploit the variety of conditions within the ecotone itself. They participate in the events and mechanisms. Held together by social networking, digital (and non-digital) protocols that are prevalent and ubiquitous today, they are the biological, psychological, and sociological matter of the innovation culture. The more they participate in this interstitial zone, the more their disposition for inquiry develops in relationship to grounded skills and knowledge. They will become elastic. They will become accustomed to change and in fact will thrive on change, debate, friction and risk, all essential to operating in the twenty-first century.

Ecotones function like the membrane of a cell, negotiating the movement of materials and conditions around them, and are subject to competition, conflict, and friction, even in their most stable states.

When disturbances of significance occur, the impact on the ecotone is greater than on the bordering ecosystems. A storm does not have as great an effect on the marine ecosystem at sea as it does within the tidal zone. The edge of a rainforest is more fragile than the interior because its proximity to the savannah creates sun and wind conditions that penetrate the canopy, drying out the soil so that fire is a greater risk and more destructive on the edge than in the interior. Therefore, species that live in ecotones have greater adaptability. In fact "generally species of an ecotone (actually) require a level of disturbance for regeneration."[31]

INNOVATION ECOTONE AS A CONCEPT FOR A SUSTAINABLE INNOVATION ECOLOGY (in education and elsewhere)

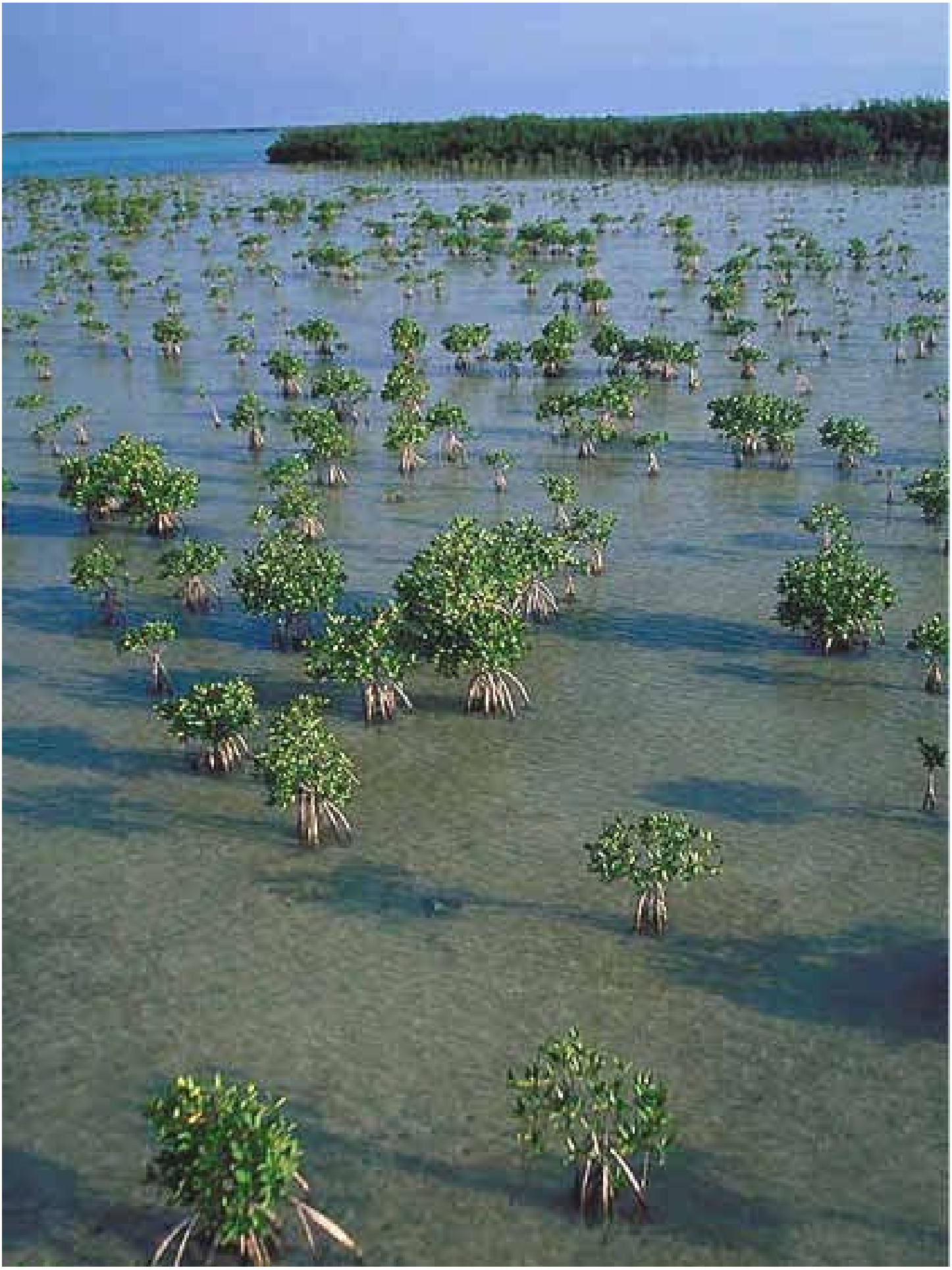
As proposed at the outset, this paper outlines an innovation ecotone model as a sustainable environment of pervasive innovation that is talent rich and talent diverse.

As an ecosystem that is indivisible, that is species (talent) rich and species diverse, it is about sustainability at two levels. It is about sustainable innovation at the level of the system. And it is about sustainable innovation at the level of deep, and even highly specialized, talent.[32]

As an ecotone that is a specific type of indivisible ecosystem connecting two habitats, it means that the talent that develops within this environment is uniquely adapted to negotiate core activity—sanctioned knowledge bases, sanctioned power bases, etc.—and also the creative experimentation that is allowed to occur in an edge environment of irrepressible curiosity, specialized talent, and where learning through failures is its own agency for progress. Innovation is sustainable because it is pervasive, and because it negotiates both core/sanctioned activities and the pull of the dynamics of change.

Emerging ecology theory recognizes not only the impact, but the valuable role of disturbance to evolution. Disturbance is not only an integral part of any natural system, but the "greatest diversity occurs in landscapes large enough to contain various serial or successional stages as the result of disturbance events in the past… The resulting habitat heterogeneity maintains conditions suitable for a greater number of species."[33] Implied in this is the assumption that greater diversity and richness of species contributes to the resiliency of the system.

The twenty-first century is one that promises perpetual and persistent change. The ecotone analogy, as more than a metaphor—as a structural and operational construct—is invaluable as a model that uses disturbance and change to develop talent that can sustain itself and thrive on disturbance and change. This learning environment is intended to cultivate the education/evolution of students with new capacities, behaviors, and tendencies that are open, adaptable and elastic.



EPILOGUE

INTEGRAL to the Indo-Pacific, and much of the tropical, estuarine zones, mangroves and mudskippers—*rhizophora and periophthalmus*—can live nowhere else. One, a terrestrial organism turned aquatic and the other aquatic turned terrestrial, they both manage the air-water interface, which is one of the most complex transitions to overcome. In addition to negotiating an environment of difference, they are also subjected to continuous disturbances both cyclical (tides) and event-driven in nature (typhoons). As such they have developed unique characteristics of adaptation.

Mangroves dominate tropical coastlines. Few other plant species can tolerate the salinity, the cyclical flooding, and the soft bottomed anaerobic soil conditions. Mangroves filter salt out through their roots and leaves, creating their own supply of nearly salt-free water that they store in their thick leaves. They deal with the anaerobic soil conditions and continual flooding by taking in oxygen from the air through specialized aerial and/or snorkel-like roots that rise up from the mud. These woven spidery roots create a structural integrity that holds fast to the soft soil in the tidal zone.

Mangroves not only survive under these conditions, they also create an ecological habitat that supports many intricate coastal ecosystems. Their tangled root systems filter out sedimentation and pollutants while providing the smaller fish critical cover from predators. This unique root structure neutralizes tidal activity as well, and by calming waves during sea storms, delicate species—coral, shrimp, crabs, sea grass—can flourish. Additionally, decomposing leaves and branches on the seabottom provide rich nutrients for plant and animal life, such as the mudskipper.

The mudskipper is a class of amphibious fish that shuttles back and forth from land to water. Compared with its fully aquatic cousins, the mudskipper exhibits a series of unusual physiological and behavioral adaptations to its land/water lifestyle.

The mudskipper's pectoral fins provide buoyancy but also permit them to walk, jump, and climb across sand and obstacles. Some mudskippers can jump as high as two feet. Their uniquely engineered eyes and lenses allow them to extend their eyes above water like periscopes, and move them independently, increasing their field of vision. Breathing through their gills like all submerged fish, they fill enlarged gill chambers with water before moving on to land. This portable oxygen tank allows them to breathe while on land and to burrow deep into the mud, where they thermoregulate, lay their eggs, and avoid high-tide marine predators and low-tide aerial predators. Their capillary-rich skin and mouth membranes provide additional air.

Even more curious are the behavioral adaptations of this species. As an aquatic creature, mudskippers school like any other fish. On land, however, they become highly aggressive and territorial, building low mud ridges around their particular plots of mud. While on land where the temperature changes are more extreme, the mudskipper has developed several thermoregulatory mechanisms: changing color; adjusting body positioning relative to the sun; burrowing; and clinging to shaded wet zones of planks and rocks.

As extraordinary as both mudskippers and mangroves are, these are only two of a plenitude of species inhabiting this complex and dynamic water-land ecotonal habitat—most all of them dependent on the mangrove's unique root system.

The intricate root system of the mangroves that shelters small fish like the mudskipper is a rhizomic system. A rhizome is a horizontal stem that stores food and enables reproduction. Rhizomic structures are networks of stems that scatter in all directions, in contrast to hierarchically organized vertical tree structures. "There are not a million roots growing into an orderly tree, but a milllion little underground proliferations." [34] Any point of the rhizome may be connected to any other point. The stems intertwine, scatter and spread, and as a rootstock rather than a conventional root, when broken at any spot, they grow again.

Rhizomic systems can be small or vast; ginger roots, a garden of irises, a clump of mangroves, a grass lawn, or an entire bamboo forest. Because its roots are horizontal, because they can reproduce in any direction from any spot, and because they connect to each other, a rhizome is a single, but highly complex system, and functions as a single organism. They defy any classification as individual entities. Instead, these distributed plant systems are populations—multiplicites—rather than single unified upright things. If one root—or an entire portion of the root system—fails, others fill in. If nutrients are not consistently available across a habitat, the interconnection of the system allows distribution of food to all parts. In a rhizomic system, failure can occur and the truism of a 'chain being only as strong as its weakest link' is not valid; here weaker links are tolerated and supported. Failure can feed back as nutrients for the entire system, allowing rhizomic systems to tolerate a lot of distress.

While mangroves, themselves, are the dominant, or keystone species, of the tropical estuarine ecotone, their rhizomic root system is also analogous to the entire ecotonal ecosystem itself. It negotiates the air/water interface as a third thing.

From Carl Jung, to Deleuze and Guattari, to authors of hypertext, rhizomic systems have fascinated so many because they replace hierarchical constructs with an alternate model of heteregeneity and multiplicity. The rhizomic system is a model of integrated multiplicity and managed disturbance, both made highly productive for the regeneration and evolution of the total system. As a distributed system of populations, but one that functions as a single organism, the rhizomic structure is a precise and prolific analogy for the innovation ecotone space that this paper has put forward.

END[35]

ENDNOTES

1 James Corner, "Ecology and Landscape as Agents of Creativity," in *Ecological design and planning,* George F. Thompson and Frederick R. Steiner, editors, (New York: John Wiley, 1997), p.99.

2 In an intertidal zone, conditions exist that are similar to those in the ocean: water—in movement; salinity; sea creatures; sea flora; the composition, form, and structure of its geological substrate, etc. At the same time, conditions exist that are similar to those on land: the composition and structure of the same geological substrate; no water; air—in movement—wind; land creatures; land flora, etc. But conditions in the tidal zone oscillate between 'being like' one condition and 'being like' the other, as the tides rise and recede. Even when most like the sea, at high tide, the intertidal zone is still different from the sea. The water temperature is higher; wave action and the movement around rocks and other articulations of the geological substrate is more dynamic; the salinity is different; sea flora and fauna are subjected to moments of dryness. When most like the land, at low tide, it is still different from the land. The ground, whether beach or exposed bedrock, is more saturated; its chemical composition is different as decaying sea creatures add material; pockets of trapped sea water hold unique micro-environments. And even more significantly, as the intertidal zone transitions from one state to another, as it cycles through water moving in and water moving out, it creates a unique environment of change and disturbance.

3 "Creek Connections Riparian Buffers Module, Eco-Tones." Adapted from: "The Edge of Home" in Project WILD Aquatic Council for Environmental Education, 1992 AND "Field Lab: Measuring Species Diversity" by Jim Palmer, Ph.D., Director of Creek Connections, Box 10, Allegheny College, p. 2.

4 Richard T.T. Forman, Land Mosaics. *The ecology of landscapes and regions.* (Cambridge: Cambridge University Press, 1995), pp. xiii-xiv.

5 Conversations with Jane Amidon, Landscape Section Head at the Knowlton School of Architecture, Ohio State University. Also referenced in 'Entrepreneurial Environments', a working position paper for the Landscape Section at the KSA. 8/1/08.

6 John Hagel and John Seely Brown in "Can Your Firm Develop a Sustainable Edge? An interview with J.Hagel & J. S. Brown: Knowledge@Wharton". (http://knowledge.wharton.upenn.edu/article.cfm?articleid=1220).

7 H. Ronald Pulliam and Bart R. Johnson, "Ecology's New Paradigm: What Does It Offer Designers and Planners?" *Ecological thinking for design and planning education,* (Washington, DC: Island Press, 2001), pp. 58-59.

8 John Seely Brown, keynote at IIT Institute of Design Strategy Conference May 2008.

9 Paola Antonelli, Senior Curator of the Department of Architecture and Design at MOMA, Design and the Elastic Mind, published on the occasion of the exhibition *"Design and the Elastic Mind",* February 24 – May 12, 2008. (New York: MOMA Publications, 2008), pp. 14-15.

10 Douglas Thomas and John Seely Brown, "Why Virtual Worlds can Matter," *International Journal of Media and Learning,* Vol. 1, No.1, January 2009, pp. 6-9. In their work on the value of MMOG's and other virtual reality games as valuable environments of highly situated 'inverse' learning, Thomas and Brown speak about a paradigm shift in thinking about education today. This shift is one that moves from learning about topics, to developing deep knowledge and action structures which are fundamental to acting as part of a community of practice. They speak about "a two step process in the movement of learning about (something, a topic) to learning to be. Initially, people learn the basics or fundamentals about a topic or context through "scaffolding', or acquiring enough information to make sense of the languages, ideas and practices which constitute a specific domain of knowledge. At that point, one becomes immersed within the culture or sets of practices where one starts "learning to be", engaging in the practices and absorbing the tacit knowledge that forms the cultural and social underpinnings for a community"

Instead of learning about architecture, for instance, one learns to be an architect. The difference is subtle but critical. Instead of applying what one has learned about a discipline to a specific situation, one learns how to respond creatively with the disposition-of. Instead of building another Falling Water on a site with a creek, one builds something unique and new with similar sensibilities applied to the requisite disciplinary constraints (i.e. it needs to respond to gravity, weather etc.)

11 MIT Open Course: In the early to mid nineties when Open Coursework was first introduced to MIT, the first courses to go online did so in a rather traditional manner. Course content such as lecture notes, images and slides were put up on line. The students were able to review material given out in class. Over time, as content became more complete and pervasive, the students often stopped coming to class, preferring to learn the material in small social groups. They would come to class for greater clarification which actually often occurred more effectively in lab or seminar settings. This, as can be imagined, disturbed the professors immensely until the students started to return to class, but now, with questions that were formulated out of the material they had assimilated on their own – questions that moved out beyond the course material itself. These questions and subsequent discussions led to the 'pulling' of several classes into more sophisticated and advanced territory than originally conceived. Over time MIT's Open Course has matured to an advanced level where classes now could not exist at the level that they do without it.

The Harkness method at Phillips Exeter Academy in New Hampshire, a grades one through twelve boarding school, is another example of how entrepreneurial learning is advanced in place of the non-critical dissemination of 'expert' knowledge through information rich lectures. The method takes its name from an elliptical table which seats thirteen to fourteen people. This table is situated in the professor's office with his, or her, material accessible at all times. The students are required to do all of their first source informational reading outside of class. They then arrive to the class prepared to apply this material in different scenarios from seminar-like discussions to science labs, to problem based math 'studios' in which the students place their answers up

and discuss them together to assess not only the solutions, but methods to get to the solutions. The classes are student discussion based. The role of the teacher is to structure the particular course's source material and the sequence of the learning, to put the 'problems' to be discussed out on the table and then, in the best cases, to act as efficient air traffic controllers for the discussion.

It is clear how this kind of 'class' works within the humanities, which are conducive to subjective discussion based analysis and debate. But, of all the classes I have seen, it is a method that seems most transformative for the sciences and math. Science labs become places of true discovery as discrepancies in results are pulled apart to understand why, where and how they occur. In doing this, the students themselves revise the experiments and aggressively go after information they have not yet assimilated from the class, or information that may actually be outside of the specific class' domain.

The math classes are just as thrilling. The history (and culture) of mathematics is overlaid on the doing of math. But even more importantly, instead of being supplied theorems to be used, the students actually construct them themselves, through a series of word problems which, in solving them, re-create the process of the original discoveries. After one series of word problems that took place over a two-week period, the students were informed that they had just developed the first theorem of calculus.

12 Sir Isaiah Berlin, The Hedgehog and the Fox: an essay on Tolstoy's view of history, (Chicago, Ivan R. Dee, Inc Publishers, Elephants Paperbacks edition, 1993)

13 Colin Rowe and Fred Koetter, *Collage City,* (Cambridge, Mass: The MIT Press, 1978), pp. 90–91. The second way Colin Rowe uses the paradigm is it to look at modern architects, specifically those of the heroic era—the middle portion of the twentieth century—to see how they classify as personalities. He arrives at the conclusion that "as we approach the area of modern architecture, we begin to recognize the impossibility of arriving at any symmetrical balance. For if (Wright), Gropius, Mies, Hannes Meyer, Buckminster Fuller are clearly eminent hedgehogs, then where are the foxes whom we can enter into the same league? The preference is obviously one way. The 'single central' vision prevails." He then goes on to present a rather convincing analysis of Le Corbusier as both: Le Corbuser, the architect (writer and painter) as a convincing fox and Le Corbusier, the urbanist, as a distinct hedgehog or "fox assuming hedgehog disguise for the purposes of public appearance." The implication in this second portion of Rowe's discussion of the hedgehog/fox paradigm is that modernity as a project is more about absolutes, manifestos, self-conscious and prescriptively constructed for what many considered a 'moral' imperative in changing times.

I have referenced this discussion of Rowe's not only to illustrate the distinctions between the two personalities—the single unitary vision versus the curiosity associated with a multiplicity of stimulus, the centripetal and the centrifugal—but also to illustrate their similarity in terms of approach so as to determine how to situate them in the conceptual space. I would suggest that the key component of a twenty-first century approach is 'elasticity', which in the case of practice, as opposed to education, would suggest that design responses—things designed—are highly attuned to the conditions of the context, both physically/materially and in terms of the

present socio-cultural conditions. This would suggest that the architects' methods, precedents and assumptions would be elastic under different conditions. All of the architects and projects cited by Rowe, whether classified as hedgehog or fox, belong to a tradition in which the built material response is dominantly influenced by the overarching metaframe of the designer(s). A tradition that is more about architecture influenced by ideology – which is manifest symbolically, didactically, or syntactically - than elasticity. Therefore, the hedgehogs and foxes would map into the left side of the idea space.

14 For example, in a large lecture course in which the particular opinion or point of view of the lecturer is the binding agent of a wealth of other content, there is often an assumption of a base of knowledge to work off of, which means that these lectures are either reserved for advanced students, or they are simplified, or one accepts that partial assimilation corresponding to one's own level of development is acceptable. Whether Noam Chomsky at MIT or Jeffrey Kipnis at the Knowlton School of Architecture at Ohio State, these individuals are rich resources for how to look at the world with a mind toward integrated concepts, approaches, and disciplines – meta-concepts and meta-critiques. Capturing and publishing these lectures on video with footnotes and hypertext allows for deeper exploration of the content that sits backstage of the lecture. Because these courses are less about distributing information and more about building a point of view, this ability for the individual students to understand the difference between the two and then construct their own point of view is an invaluable lesson and should advance the entire arena of discussion with the lecture as entry point. During these lectures, micro-blogging (Twitter) establishes informal immediate discussion around the lecture/event; collected online, these micro-blogs can be sorted and organized through on-line discussion and kept with the banked information associated with the lecture.

A second model, for those courses that are content rich and in which whole subfields have developed, is one in which finer-grained packets of information are built and assembled as a constellation of packets that constitute the 'course.' In these courses the amount of information associated with the topic now far exceeds what one can distribute in the framework of semesters and, indeed, if it were advantageous to assimilate all of the content, our degree programs would at least double in required time for completion. In the disciplines of architecture and landscape architecture, technology and history courses would certainly fall into this category. Instead of sequentially constructed distribution of a selected body of information associated with a topic, packets of content with specific expertise can be built by those who work in depth in the particular areas involved. In our landscape architecture program, a course on landscape technology is being built with packets on: wetlands ecologies, landscape materials, productive landscapes, etc. These are each two-week segments when delivered in class. For course completion the students are responsible for a certain number of these micro-courses, some of which are available during the semester at hand, others of which are on-line. They increase in number from year to year and they evolve as new information coming from both the 'author's' and the ongoing students' work is folded in. Accessible beyond the space of the class, they are also an invaluable resource for work of other classes, especially studio. An architectural studio project sited in the Florida everglades can easily take advantage of a wetlands segment from this course while also accessing an architectural history packet on modernist architecture of the tropics. What is key is that while they are 'packets' of information, discrete in their coherence, the finer grained they are and the

more they are used for projects, the more the interconnectivity between them supersedes the discreteness of their focus and/or orientations.

15 In late summer 2004, a small group of individuals headed by a passionate young Bangladeshi lawyer approached me—I was teaching graduate level design studios at MIT—and a professor of Landscape Architecture at the Rhode Island School of Design about putting together a research studio to look at the master planning and design of a University for Women in Bangladesh. The Asian University for Women was to be a five-year combined liberal arts and professionally oriented program. Although sited in Chittagong, Bangladesh, it was to be open to rural women throughout Southeast Asia. We started it as a studio project using design as a form of inquiry in which concrete proposals, in drawing and model form, were intensely reviewed for how they addressed various issues. Only through the proposals and their assessment were we able to understand the opportunities and paradoxes in the project—to unearth the nuances and complexities.

From this studio work, which was rich and highly suggestive, but not fully formed or professional in nature, we put together a 'micro-lab' team of people from the studio team, from the relationships we had formed to embark on the studio project, and other necessary disciplines and talents. This became a two-year project based endeavor in which we generated the space planning for the master plan, a first master plan, fund-raising documents, and a developed design proposal for the first buildings. We formed the team organically, bringing on talent as it was needed. The original team was myself, three advanced graduate students from the studio, an architect from Dhaka whose expertise was in the cultural and material aspects of Southeast Asia, a second architect from Dhaka whose talent lay in the engagement of local authorities and in application of global construction techniques to regional parameters, a highly respected Indian author and social theorist on issues related to women and women's education in Southeast Asia, a landscape architect and planner from Chittagong who was associated with this author, a landscape historian from Harvard, a space and university planner from a firm expert in this area, a computer scientist who worked with a small team on the algorithms we used to generate highly situated climatic responses for our building skins, and an engineer from an integrated engineering firm out of London (the integration of structural, environmental, and mechanical engineering). This team of twelve, over two years, was based in Boston but worked in Boston, in Dhaka and in Chittagong, through digital means and different short design encounters of impact. The work produced was highly responsive to cultural, environmental and programmatic concerns and produced a series of proposals that probed deeply these aspects in an integrated manner, utilizing diverse talents from MIT to Chittagong that would not be found in a single professional firm.

This is one example of a project-based emergent structure that is the sub-thought for these project based 'micro-labs'. The key is the combination of diversity, extreme talent and ease of communication. They can come together, form and re-form based upon different contexts. More an IM (Mission Impossible) 'task force' than a professional office, they allow expertise to migrate and small core groups to mine highly specialized skills as needed.

16 The difference between a pace line and an echelon is that a pace line has each rider pull at the front of the line, anywhere from a few seconds to several minutes. In an echelon there's no pause

at the front. The riders are continually moving in a circle. As soon as a rider hits the front of the line, he or she swings off and starts to move back in line. Straight rotation—pull off into wind (around 30 strokes – 25 seconds)

http://ngm.nationalgeographic.com/2007/11/marine-miniatures/liittschwager-photography

17 "Few Westerners could find Chongqing on a map. Yet this central Chinese city is home to a network of companies whose vibrant new way of designing and manufacturing motorcycles is a prototype for disruptive innovation. The network uses a distinctive management process that economists at Tokyo University, who have studied such networks in depth, call "localized modularization"—a loosely controlled, supplier-driven approach that speeds up time to market, cuts costs, and enhances quality. The heart of this new system is a series of "process networks" mobilizing specialized companies across many levels of an extended business process. Entrepreneurial, privately owned motorcycle assemblers such as Dachangjiang, Longxin, and Zongshen orchestrate the networks.

These companies got their start by competing with established state-owned assemblers that had partnered with leading Japanese motorcycle makers like Honda, Suzuki, and Yamaha. The private assemblers refined the Japanese companies' tightly integrated product architecture into one that was more flexible and modular but just as functional. The Chinese system makes it possible for the assemblers to modularize production in parallel by outsourcing components and subassemblies to independent suppliers. In contrast to more traditional, top-down approaches, the assemblers succeed not by preparing detailed design drawings of components and subsystems for their suppliers but by defining only a product's key modules and specifying broad performance parameters, like weight and size, in rough design blueprints. The suppliers take collective responsibility for the detailed design of components and subsystems. Since they are free to improvise within broad limits, they have cut their costs and improved the quality of their products quite rapidly.

Locating major suppliers and assemblers in the same city helps to mobilize the appropriate specializations. Informal social networks, developed in crowded teahouses and restaurants, supplement more formal efforts to coordinate suppliers and assemblers." John Hagel III & John Seely Brown. "Globalization and Innovation: Some Contrarian Perspectives," Prepared for the Annual Meeting of the World Economic Forum in Davos, Switzerland, January 25–30, 2007, p. 3.

18 Hagel and Brown:" To transform the core start at the edge: For many executives, when core business activities require fundamental change, the strong instinct is to embark on massive organizational changes. These organizational transformations rarely succeed. An alternative path is to start on the edge and move back into the core over time. By engaging the edge first, it is often possible to find innovative leaders with energy and passion to try new approaches. Inertial forces are weaker on the edge because there are fewer entrenched interests."

19 It is important to recognize the vast value of digital tools and means to all components of the ecotone. The ecotone concept is not motivated by the digital per se. It is, however an environment for responding to and, even more importantly, exploiting the opportunities associated

with the digital age – an age of flux replete with possibilities still unformed and undefined.

'Accreditation +' is about learning in an information rich and diverse environment. Digital tools and means act as scaffolding for entrepreneurial learning, socially constructed. They provide access to information – access that is not time and space specific - and information that is not neatly compartmentalized. Social tools provide connectivity to work on this information in group and on projects.

The micro-lab construct uses these same tools and means for access and work but it requires additional tools to play in this information rich and diverse environment. The micro-lab work is experimental in nature, operating through questions and conjecture with an exponentially broadening base of information. Because, the work of this component relies on finding productive connections between research paths and methods that are premeditated – often highly targeted – and serendipitous discoveries and exchanges, three genres of tools are necessary: tools to represent, visualize and collate diverse types of work, research and information; highly targeted tools that correspond to specific questions and research (visualization tools, simulations tools, modeling and making tools, information collation and formal research tools, tools related to material research, etc.); and communication tools to network together the multi-disciplinary, multi-entity members of the micro-labs. The design micro-labs are technology rich and they are highly networked.

But more importantly, digital tools of all sorts - and especially communication tools - are pervasive throughout the ecotone. The ecotone's success, both in terms of sustaining itself and evolving, depends upon the ability to self-generate spontaneous events of work, play and communication which can, themselves, evolve improvisationally. And it values the serendipitous connections between events and their content. These events and mechanisms, as the ecotone corridors, seed the ecotone. They bring work from the edges into the system, transfer work into new questions, these questions back into new work, etc, all of which plays back into the system. Non time and space dependent, the corridors form an ether of connectivity as opposed to point to point conversations or lines of thought.

As an indivisible entity, one in which the spontaneous, improvised and serendipitous are valued, the ecotone requires a communication infrastructure that is diverse in it forms, highly responsive in its operations, so easy as to become tacit in nature, and of high capacity. In fact, the ecotone concept can only be realized in our digital age with the new media tools and methods we now have at hand.

20 Richard T. T. Forman, p.147.

21 Ibid., p. 145.

22 Richard Forman, pp 96-97.

23 "The gradual and distinct ecotone edges of a riparian transition zone between a stream and a deciduous-coniferous forest. Adapted from Godwin, Derek. Life on the Edge: Improving Riparian Function. Oregon State University, Corvallis, OR: 1999 and Nebel, Bernard J. and

Richard T. Wright. Environmental Science: The Way the World Works. Upper Saddle River, NJ: Prentice Hall, 1996." From "Creek Connections Riparian Buffers Module, Eco-Tones."

Another specifically ecotonal species, the carnivorous purple ochre sea star *(Pisaster Ochraceus)* of the Pacific intertidal zone moves at high tide to the upper tidal zone and, using the flexibility of its arms, pries open mussel shells for food. As the tide recedes, the arms dry and stiffen allowing it to anchor itself to the rocks or under crevices as protection from predators. The purple sea start is uniquely adapted to support a transition from predator to prey as it goes from wet to dry. In the shallow water it is flexible, highly mobile and dangerous for mussels; dry, clinging to a rock it is vulnerable and relies on its ability to sequester and camouflage itself. And, it is uniquely adapted to allow it to spend as much as seven hours out of water and sustain greater temperature differentials than many other species.

24 Richard Forman, pp 96-97.

25 Steve Nadis, "The Lands Where Species are Born," *National Wildlife Magazine,* Feb/Mar 2005, vol. 43 no.2. "According to the traditional theory of speciation, developed by Harvard university biologist Ernst Mayr, a geographic barrier such as a mountain range or a river could, for example, isolate two populations of a species, interrupting gene flow between them. Gradually, random mutations would cause the tow populations to evolve to the point where they would be

unable to mate and produce fertile offspring should they ever encounter one another again. This state of reproductive isolation is the fundamental definition of a species."

26 Ibid.

27 I am reminded of my friendship with the astronomer Carl Sagan and his disappointment when he was passed over for election into the National Academy of Sciences because of the Academy's perspective on what was considered valued scientific achievement. Dr. Sagan, in addition to working in the field of Astronomy and Planetary Science, worked as an environmentalist and activist, and was also involved with promoting the sciences more broadly in an embryonic global society.

28 Sven E. Jorgensen, Felix Muller, editors, *Handbook of Ecosystem Theories and Management* (Boca Raton, Florida: Lewis Publishers/CRC Press LLC, 2000), P.14

29 Richard Florida, "How the Crash Will Reshape America," *Atlantic Monthly,* March 2009. http://www.theatlantic.com/doc/print/200903/meltdown-geography

30 T.B. Smith, R.K. Wayne, D.J. Girman, M.W. Braford, "A Role for Ecotones in Generating Rainforest Biodiversity," *Science Magazine,* 20 June 1997, Vol. 276, no.5320, pp. 1855-1857.

31 Shannon Parr, "Some Species of the South-East Queensland Rainforest Ecotone," the Queensland Herbarium project, http://www.brisrain.webcentral.com.au/_dbase_upl/poster_species.pdf.

32 Sometimes referred to as 'niche' talent, it is generally recognized that niche specialization has a tendency to die very quickly when it is no longer useful to a particular context or project. As part of a larger culture/system/ecology, the niche players are in an environment in which they are forced to constantly reframe themselves as they create new alliances, partnerships, partake in new projects, new mechanisms of exchange. This gives them a truly dynamic competitive edge to work within a rapidly changing condition.

33 See endnote 7.

34 Alice van der Klei, "Repeating the Rhizome," *SubStance* #97, Vol. 31, no. 1, (2002) p. 48

35 POSTSCRIPT

In Octavio Paz's essay, "the Poetry of Solitude and the Poetry of Communion," (*The Bow and the Lyre,* trans. Ruth L.C. Simms. Austin, Texas: University of Texas Press, 1973, p. 164.), he talks about two personalities that define one's relationship to the world (a different version of the hedgehog and the fox)—these personalities are characterized as those of the mystic and the warrior. The warrior attitude tries to dominate, subjugate and conquer reality through knowledge as power. "Like a warrior, man struggles to subdue nature and reality. His instinct for power is expressed not only in war, in politics in technics but also in science and philosophy, in everything that has come to be called disinterested knowledge." The other attitude—that of the mystic—the alternative to separation and domination—is immersion in reality. The warrior wants to control reality/knowledge and the mystic wants to be in it. One has answers, arguments and policies to

implement reality as they know it, while the other has questions, propositions, thoughts and concepts about the reality they are situated in.

If one believes that actions and approaches taken in the twenty-first century require both perspectives not as separate compartmentalized entities but as a blending of both, then a new diagram might look like this if we fold one curve onto the other. The amount of activity in the ecotone is compressed and density increases. It goes from gradual to distinct. The ecotone looks more and more like a thick edge; in essence the entire ecosystem is now an 'edge' condition.