INTELLIGENCE-BASED DESIGN: A SUSTAINABLE FOUNDATION FOR WORLDWIDE ARCHITECTURAL EDUCATION

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Abstract

Architectural theory as currently taught in modern universities throughout the world no longer provides a plausible basis for the discipline and practice of architecture. Students studying within this model are left to their own inventions if they hope to gain an architectural degree. Forced to formulate a body of work constrained by the paradigm of contemporary design, students learn to copy fashionable images without understanding their geometry; or simply invent forms that look as if they possess a contemporary sense of architecture. By their very nature, such forms are irrelevant to human needs and sensibilities. Contrary to what students are led to believe, this practice does not provide a broader base for creativity, but instead effectively restricts choices to a very narrow design vocabulary. Most architectural institutions continue to propagate a curricular model that has sustained their particular ideals and ideologies for decades. While many innovative didactic materials and ideas for revising the architectural curriculum are available today, they are often overlooked or ignored. If implemented, these new ideas could drastically improve the educational model, allowing students the world over to participate in a learning experience specific to their immediate and local context. By re-situating the education of an architect in more practical and contextual terms, we emphasize components of building design that relate directly to human existence, human perception, and the human values and beliefs that have for millennia served to establish culture and identity. A new model of learning is developed here for students wanting to make real architecture, and for educators and practitioners that seek the same. The following proposal is predicated on the knowledge of human interaction with the physical world and the necessity of corporeal engagement with the built environment. Furthermore, our model re-institutes values in the practice and education of architects, values that once sprang forth naturally from local cultures and traditions throughout the world, but which have in recent decades been usurped by the influence of global capital.

Keywords

Architectural education; architectural practice; architectural theory; biophilia, biophilic design; design studio; human quality; new teaching model; pedagogy; sustainable architecture.

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Outline of This Paper

Outline

This paper proposes a radical new direction for architectural education. We introduce two new theoretical concepts that arise out of recent scientific developments: *Intelligence-Based Design*, and *Biophilia*. Intelligence-based design re-establishes architecture as a knowledge-based discipline, by rebuilding its knowledge base. Intelligence-based design combines design thinking and techniques that use human intelligence to create adaptive environments. The key here is adaptation through human cognition to external information that neurologically engages our human sense of wellbeing, as opposed to the twentieth-century industrial aesthetic so prevalent today. The industrial aesthetic is an abstraction of artificial geometries foreign to the human need for adaptivity. We argue

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that adaptive design thinking is itself intimately connected with human intelligence, whereas current design approaches ultimately subvert our intelligence through the imposition of ideology and the commodification of image-based design.

Biophilia is the notion that human beings require intimate exposure to the structure of biological forms, as essential for human health, both physiological and psychological. Biophilia is grounded in human evolutionary development occurring in a natural environment, and disproves the notion that "modern" human beings can ignore their own genetic make-up and detach themselves from natural settings without consequences. Biophilia helps to explain why human beings gain improved mental and physical health by being close to nature. The greatest of traditional architectures were achieved by instinctively following the operating mechanisms of both intelligence-based design and biophilia, even though those terms were not then known.

This paper is divided into three parts, an organization meant to facilitate readers who are STUDENTS, TEACHERS, and ADMINISTRATORS, and who will doubtlessly have different interests and come from a different perspective. The beginning sections for students are labeled "our proposals, and how they contrast with present content"; whereas the sections for teachers are labeled "attitudes that gave rise to the present system". The third category lumps together all decision-makers: it includes university administrators, both of the architecture program and the university as a whole, as well as directors of architecture firms who hire young graduates. The later sections for administrators

are labeled "objective lack of relevance for the world we build resulting from vested interests". A wholesale revision of architectural education requires the cooperation and participation of all three parties.

We are promoting a new architectural curriculum based on a new concept: *Intelligence-Based Design*. The model is offered to students throughout the world. Our arguments in Part 3 are directed at convincing administrators in the West: academic leaders who are dissatisfied with low employment rates for their recent graduates; and practitioners who are disappointed by the inadequate preparation of recent architecture school graduates (leading to a hesitation to employ them in an architectural office). Our revised program provides a direct means to design adaptive environments, in response to growing needs of the marketplace (client demand). Our suggested educational system is totally unlike the current image-based method. We have assembled here a complete curriculum, textbooks, and course description, plus fairly detailed suggestions for implementation.

PART 1. PRIMARILY FOR STUDENTS: OUR PROPOSALS, AND HOW THEY CONTRAST WITH PRESENT CONTENT.

Introduction

Architectural education is currently mediated through open-ended speculation. Intellectualizing towards unlimited creativity, without an experimental basis either to support or to negate the process or the results, leaves the door open to endless theoretical conjecture and idiosyncratic

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propositions. This non-falsifiable approach does not appear to provide any measurable contribution to the quality of human existence. Architecture operates as a genuine human endeavor only through the process of human intelligence. Through intelligence-based design students can learn to practice an effective architecture, one that reconnects humans in a tangible way to the world in which we live.

If we are to establish a new direction in architecture it will be necessary to turn architectural education on its head, working from the concrete (objective) toward the abstract (subjective). This reform would reverse the existing trend, wherein students are taught unconditional abstraction (subjectivity) and work toward an ineffectual concreteness (objectivity). Our diagnosis reveals not only the weaknesses of the current system, but equally, its philosophical and political bias.

Those who have taken on this issue before us (Bothwell *et. al.*, 2004; Boyer & Mitgang, 1996; Salama, 1995; Salama & Wilkinson, 2007) offer useful suggestions and criticisms through their writings, and we hope that our critique might provide the impetus to overcome the resistance of the *status quo*. We are sponsoring a new model of education; a model situated within the immediate context of the individual's place in the world. Intelligence-based design directly stems from principles of human engagement with the built environment, principles that precede all ideological models.

Students seeking to become architects must first be made aware of the negative effects of current architectural education, juxtaposing this awareness with the values of

real engagement with the world. For example, natural materials work through construction and patterns of assembly to establish our sense of wellbeing in the places we live. Why, then, should students learn to copy an international form of architecture that has been shown to be indifferent, even adversarial, towards human beings and non-Western cultures? Academic institutions should begin to support a local and immediate view of design. They should provide students with the necessary and effective tools to access architectural design in terms of its direct human qualities. Professors of architecture should be encouraged to once again present the built world from within their immediate context.

As the architects of tomorrow, today's students must come to understand the role and responsibility of their profession as something intrinsically tied to human existence and the lived experience. We are aware that decades of promotion and advertising have created a market and client demand for glossy magazine style architecture — through promises of quality lifestyle — that embraces globalization while rejecting local traditions. In spite of this, intelligence-based design is an expression of form and geometry that enables human beings to live a more meaningful, healthy, and full life (Salingaros & Masden, 2006; 2007).

Student Questions

When students enter an architecture program, they normally bring with them expectations of what they hope to learn. These are some of the questions that dwell in the minds of many incoming students:

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1. What is architecture? Does architecture play an inherent role in human engagement with the world or is architecture simply defined as whatever today's star architects do?

2. What is the accumulated knowledge base, i.e. books, articles, oral tradition, and built examples that defines the discipline of architecture? Which individual teacher or course of instruction is more likely to teach me what is most relevant to becoming an architect?

3. Which parts of this body of knowledge do I need to master to prepare myself to be a good architect? What indeed are the qualities of a good architect?

4. What are the characteristics of a good space? How is it created? How far can an architect go in exploring design and innovation, without losing the positive properties of good space?

5. Who are the real architectural champions and leaders of today and the recent past? Whom should I seek to emulate as representing the highest ideals in our discipline? Who has brought significance to architecture among all other human endeavors, and thus serves as true inspiration to students?

6. How do I choose from among differing points of view? Are there any established criteria for judging what is good or bad architecture? Why is it that many buildings that are praised as being great architecture don't instantly appeal to me? Is contemporary architecture meant to be an acquired taste or an exclusive pretense?

7. Can I learn from the architecture of the past and the architecture I have experienced in my own culture? Why are the only architectural examples I see today limited to what is featured in the glossy magazines for and by professional western architects?

8. What methods, materials and systems are required to construct a building adapted to human needs and sensibilities? Is the industrial material palette — preferred by most famous contemporary architects — mandated by modern design, and does its prevalence suggest that it is somehow best for architecture? Are there any moral or historical reasons for this preference? Should what is best for architects not also reflect what is best for human beings?

9. What is the long-term role and responsibility of an architect, as seen in terms of a building's effects on its immediate and global environment, its inhabitants, and their social organization?

10. If I can learn to draw well, does that mean that I also design well? Is there an essential relationship between drawing and design, or has computer-aided design entirely replaced drawing by hand?

What is disconcerting is that these questions, for the most part, go unanswered and remain with many architecture students beyond their university experience. What is worse is that, when answers are given, they are often given in a less than honest manner, principally to promote certain styles, ideologies, or individuals. This misleads students into adopting a set of false principles and values. Current pedagogical models seldom concern themselves with educational imperatives that speak to the nature of the above questions.

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Given these circumstances, we believe that drastic measures are needed for reforming architectural education (Salingaros & Masden, 2006; 2007). Extensive questioning of students, faculty, and the review of curricula throughout architectural academia reveal the manifold issues that exist in today's educational system. We present our assessment of what those issues are, in terms of curriculum and teaching methodologies. By offering suggestions and plausible solutions, we hope to catalyze a movement toward reforming the present institutionalized architectural curriculum across the broader spectrum of a multi-cultural world.

Deficiencies of Present-day Studio and Curriculum

Since the early twentieth century, the design studio as re-defined by the Bauhaus has become the Western standard for imparting architectural design knowledge in an academic setting. Given its role and the importance of its task, however, the current model is deemed by many practitioners and academics as extremely deficient (Bothwell *et. al.*, 2004; Salama, 1995; Salama & Wilkinson, 2007). In today's design studio students seldom learn how to design and construct real, adaptive architecture. More often than not they operate at a distance from any substantive criteria — simply competing for recognition through the manufacture and manipulation of eye-catching forms. The studio component of the architectural curriculum does not address practical issues (such as clients' concerns and needs, costs, safety, regulations, etc.).

Contemporary educational imperatives for unencumbered creativity are based upon a serious misunderstanding and a lack of real scientific data. It is illogical to expect students to design before they possess any understanding of the built environment, human perception, and social patterns. Creative thinking in and of itself does not lead to good architecture. Only after students have a firm grasp of the cause and effect of material structures can they begin to effectively test and apply their knowledge in hands-on design. In the study of other professional and/or scientific-based disciplines — medicine, law, engineering, mathematics, physics, chemistry, and biology — an operating knowledge of that discipline's processes, principles, and procedures is taught first before any theoretical enquiry takes place. Serious learning begins when students have acquired a solid understanding of the evidence-based knowledge for their discipline. The corpus of real knowledge attained through their respective educational systems serves to sustain theoretical investigation, not to limit it.

Students entering any of the above-mentioned programs typically bring with them a very limited understanding of the discipline they are pursuing. For architecture students, this limitation presents itself as an inadequate understanding of the built environment. For most of them, even their personal experience with architecture is limited to some general awareness. With some notable exceptions where students are more involved in construction technologies and practices, few have ever picked up a brick and even fewer have ever built anything. Yet, students are confronted with an educational system that seeks to dismantle (instead of strengthening and reinforcing) any pre-existing thoughts or beliefs that they might have about architecture.

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Divorced from history, and from any evidence-based knowledge or practical applications, beginning students are typically given a series of unnatural design exercises. Presented for the ostensive purpose of extending three-dimensional spatial thinking, these exercises are predicated on abstract notions of form and space but exclude any real understanding of material logic or patterned assembly. Such exercises are supposed to support creative thinking; nevertheless, the underlying thought process is more often than not structured through architectural ideologies. If students ask what any of this has to do with architecture, they are told that the process of education is meant to break any paradigms of practical measure they might already have, allowing them to explore freely the supposed "boundless intellectualized expression of contemporary academic architecture…"

Free to imagine anything at will, with no obligation to address the responsive dimensions of design, students are thus drawn toward endless speculation. Without any evidence-based criterion to guide their explorations, many give in to the temptation and henceforth work to conceive the most unnatural structures imaginable. After students have been mesmerized by this new abstract world, they begin their studies in materials, methods, and structures. At this point, students who have not successfully adapted to the forced abstract design method have typically withdrawn from the school. Those who remain have managed to develop a skill-set of artificial creative expressions, and have begun to internalize their intellectual pretext. Seduced by this abstract process, and no longer concerned about real architecture, the remaining students seldom

attempt to reconcile what their material classes are teaching them with what they are designing. The gulf between what is real and what is imagined is so great by now that few ever attempt to bridge the distance.

It is only when they graduate and step out into the real world that architecture students begin to emerge from their fantasy-based educational conditioning. For many this proves to be difficult if not impossible, and what follows for them is a career of frustration and misgivings. Architectural offices are full of such persons. Recent graduates find that after their formal training, they are unable to draw upon their artificial habits of abstract creative thinking to solve problems of everyday design. Their education has effectively removed, negated, and confused knowledge about the physical world: knowledge that is essential to establish a foundation for architecture authentic to its purpose. If they wish to succeed as everyday architects, they have to learn the practical measure of architecture — how materials work together, traditional/regional construction techniques, budget constraints, legal and safety regulations, clients' expectations — from scratch after graduation. Firms hiring young graduates expecting them to know something about real office concerns are continually disappointed.

Undoubtedly, creative endeavor represents a basic conveyance of human culture. But design that operates artificially or abstractly provides little more than the appearance of culture. Design can offer a substantive product that operates through human awareness to sponsor a greater sense of wellbeing and a more positive engagement with the world. In the course of

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the twentieth century much of the traditional knowledge that served to structure this truer expression of architecture was either forgotten or else categorically abolished. New scientific knowledge, which could provide a sustainable foundation of human interaction with the natural world, has either been excluded from architectural texts, or misappropriated in the service of contemporary architects seeking to propagate their personal ideologies. Training students to look beyond what is right in front of them is both a disservice to them and to the world of architecture.

Intelligence-Based Design

We set forth here the principles, processes, and systems that work through *Intelligence-Based Design* to make architecture once more a tangible, meaningful, and significant human endeavor. The term *Intelligence-Based Design* refers to a model established by the authors through extensive research into the phenomenon of external information processing and retrieval, presented in part in two recent publications (Salingaros & Masden, 2006; 2007). *Intelligence-Based Design*, by nature of its principles of real knowledge, embraces modern scientific thinking. It explains why emotionally-nourishing art has that effect. It combines mathematical and neurological aspects with the practical measure of architecture, material logic, observable structure, the human dimensions of perception and thought, and an underlying respect for the great architectures of our multicultural world.

Intelligence-Based Design refers to the operating processes of design that engage human intelligence mechanisms. In particular,

biological intelligence has evolved to adapt our bodies and actions to the natural environment, enabling our survival through appropriate responses. This deep notion of INTELLIGENCE AS ADAPTIVITY extends to adaptive design (and includes the rapidly-growing movement of sustainable design). Design in nature is driven by adaptation, but not all human design is adaptive. We argue further that architects and urbanists throughout history sought and achieved adaptivity through their intuition. Traditional architectural training was aimed primarily at developing this intuition. It is only recently that we have been able to use scientific knowledge to explain processes that were until now somewhat mysterious, and thus vulnerable to subversion.

Given the recent development of this knowledge there exist few teaching models that could be used as examples, and texts are only now beginning to be written about *Intelligence-Based Design*. This paper is the first attempt by anyone to prescribe clearly the sequence and substance of coursework for teaching this new learning experience. It is expected that faculty and academic programs throughout the world — those that choose to implement this new curricular model — will participate in the further development of new intelligence-based design exercises and new methods of intelligence-based education. The guidelines presented in this paper are intended to underpin and structure a developing corpus of architectural knowledge that is authentic to human life, sponsoring sustained research toward continued advancements in *Intelligence-Based Design*.

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Biophilia

Biophilia is defined as the emotional and sensory attraction that people have toward things in the natural world: habitats, activities, and living objects in their immediate surroundings (Wilson, 2008). It is now believed that human preferences toward things or conditions in nature, while refined through experience and culture, are the hard-wired product of biological evolution and thus inextricably human. Biophilia presents the real science behind a phenomenon that is critical to the natural human sense of wellbeing. Biophilia explains, for the first time in a scientific manner, how the mathematical structure of the environment influences us as human beings on the most basic biological level. Since the relevant information is mathematical, many of our innate responses to our environment can now be more effectively described and more readily understood.

Appreciating biophilia requires us to recognize our basic sense of wellbeing. The combined physiological and psychological state of our own body can either be sick/anxious/oppressed or healthy/comfortable/elevated. A person's wellbeing is negative or positive according to multiple factors. One of those factors is feedback from our environment (others include internal health, influence from external events, etc.). The important point of biophilia is that our internal state of health is positively affected by the external natural environment, and not only by the absence of invading pathogens. The inner world is connected to the external world more than our modern society is willing to admit, although this relationship is a basic focus of traditional philosophies.

Biophilic design merges artificial structures with natural structures, but not in any superficial manner. The design method involves a variety of natural processes such as: using natural materials and surfaces, allowing natural light, and incorporating plants inside a building. (Honest use of natural materials as structural components is best; veneers are only better than having nothing natural at all). It also means more fully incorporating a building within a natural environment instead of purposefully erasing nature beforehand, as too often seen in the reigning authority of the *tabula rasa*. Research has uncovered undisputed clinical advantages (pain relief, faster hospital healing) of natural environments, and artificial environments mimicking geometrical qualities of natural environments. Our neurological mechanism reacts positively to the information field generated by the specific geometry of natural forms, detail, hierarchical subdivisions, color, etc. The mechanism relies on a connection established via external information: visual, aural, tactile, olfactory, etc. We engage emotionally with the built environment when we encounter architectural forms and surfaces, relating to details, surfaces, and architectural spaces. Engagement induces a physiological reaction in the state of our body. Thus, we experience our built surroundings no differently than we experience natural environments, other living creatures, our pets, or other human beings.

List of Goals and Objectives

As a summary of our goals and objectives, we recommend that students be taught to:

1. Design to improve the quality of human life, as judged from physiological and

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psychological effects. Learn to experience architecture first-hand with their own senses, and not from pictures.

2. See architecture as a necessary expression of the human dimension, which is at once physical, perceptual, and emotional. Architecture is an externalization of human biology, not an imposition of technology or ideology on living beings.

3. Separate their preconceptions and their egos from the process of design, and use their bodies honestly as feedback monitors.

4. Sponsor a sustainable condition for humanity through design within the realities of explosive global population growth. Learn that most buildings today and in the past were self-built and naturally adaptive, not contrived or abstracted through an esoteric design process.

5. Recognize that universal scaling is in our biological makeup, and work to re-establish the entire gamut of human scales in structures within the built environment.

6. Use design to provide a positive sensory connection for human beings to their environment in their everyday lives. This is an inalienable right that should never be subverted by the agency of architectural fashion.

7. Build enduring buildings and cities that contribute to the continuity and coherence of place, seeking connections instead of ruptures or fractures with humanity.

8. Learn from past successes and failures, documenting them for historical review and for use in current methodologies. Learn first from their immediate culture, and then learn how to embrace other cultures.

9. Understand and respect the built and natural environments in terms of their intrinsic complexity, observed in the full range of small-scale to large-scale patterns. Mistrust any supposed simplification or abstraction of natural complexity.

10. Engage and harness all means of production and technologies, both traditional and contemporary, whenever appropriate. Don't be fooled into accepting any preference based upon ideology or commercial interests.

Students will inevitably come across a vast body of literature, textbooks, images, and teaching habits based upon the machine aesthetic, which dominated architectural education throughout the twentieth century up to the present day. This material, often cloaked under the misnomer of "cultural discourse", is for the most part irrelevant to intelligence-based design. Since it will take several decades before entrenched attitudes and an obsolete curriculum can be re-aligned, the dominant culture will continue to permeate architecture schools. Students must be taught how to recognize its presence, and be prepared to deal with an overwhelming abundance of information and influence. They should be prepared to face this "culture of images" without being diverted from the goal of learning adaptive architecture. It is the student's ultimate responsibility to become conscious of, to question, and to reject ideological and image-based thinking.

Recommended Texts

To help facilitate the adoption of the intelligence-based educational model, the required coursework re-directs and carefully

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re-defines existing curricular components that most closely relate to these goals and objectives. An overarching pedagogical framework serves to establish the appropriate and immediately available, texts for the new curriculum. What follows is a brief explanation of each recommended text, along with the order in which the different texts should be studied, and an explanation of their function in the development of an intelligence-based model of design thinking.

First Year. As a starting point, we highly recommend printing the short article entitled "If I Were a Young Architect" by architect and urbanist Stefanos Polyzoides (2007) and distributing copies to every incoming student on the first day of every class given in the architecture school. Polyzoides summarizes the malaise of current architectural education, and offers practical advice for breaking through the circular reasoning that acts as a mental roadblock. Although this text has been available for several years, it has immediate relevance through *Intelligence-Based Design*, as does the work of other architects and theorists whose life's work has sought to defend the human dimension of architecture against the aesthetization of form and existence.

At the same time, we recommend printing *The Viseu Declaration on Architectural Education in the 21st Century* (CEU, 2004) and posting it in a prominent place in the architecture school. This document should set the tone for what is taught there, why it is taught, and how it is taught. As discussed in the last sections of this paper, academic architecture desperately needs a set of documents that establish its moral and philosophical foundations in an honest manner

— and *The Viseu Declaration* is one such document. It gives us a set of principles. What are our principles today?

A truer understanding of the actual phenomena that constitute architecture can best be gained through a more intimate knowledge of the physical building blocks of the natural world. No other architectural theorist has been able to express the true nature of physical order with the depth of perception of Christopher Alexander. Alexander's early writings were politicized for having developed a genuine design process predicated on the recognition, understanding, and application of human patterns in the absence of formal design. Alexander's recent work *The Nature of Order* (consisting of four books) (Alexander, 2001-2005) transcends the political constructs of contemporary architecture to reveal the first truly substantive manner of conceiving architecture. In the intelligence-based design curriculum, First Year studies begin by utilizing Book One of this series, entitled *The Phenomenon of Life* (Alexander, 2001), as a principal text. Book One of *The Nature of Order* teaches the geometry of life, and instills an awareness of its power to affect our wellbeing. From this text, students will develop a greater appreciation for the role of architecture as a mediator between human beings and the world, as well as a greater understanding of intelligence-based design as an innate expression derived through the human necessity for engagement with the real/natural world.

The second principal text comes from new scientific knowledge in human biology, where a multi-disciplinary effort is beginning to establish the natural processes underlying

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human existence. The only text that currently addresss the application of biophilic principles in architecture is *Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life* (Kellert, Heerwagen & Mador, 2008). This text constitutes one of the greatest leaps forward in re-situating architectural design outside the dominant architectural lexicon of elite Western institutions. A broad range of cross-disciplinary authors, from scientists to architectural theorists and practitioners, convey here the operating structures of human engagement and the necessity for establishing these extended relationships. Biophilia should be introduced to students immediately following Book One of *The Nature of Order*. It is important that students learn the processes found in biophilic engagement, so that their designs might begin to work to achieve the healthy affects attributed to such human interactions.

Second Year. Architecture is by its very nature an object of practical measure; as such IT MUST NOT BE LEFT TO THE OPEN-ENDED PURSUIT OF PURE ARTISTIC EXPRESSION under the guise of a false intellectual premise. Architecture should be sound in its materials, sound in its structure, and sound in its assembly and construction. Beyond this, it should operate as the foundation for human adaptation to the physical world. The book *A Theory of Architecture* by one of the authors (Salingaros, 2006) provides design principles for a more human architecture. Each chapter speaks to the various dimensions of architecture as a human interface with the earth. Presented as the third text in our curriculum, *A Theory of Architecture* establishes the fundamental necessity of patterns, giving explicit directions for design students to begin to engage intelligence-based design in their work.

With a thorough understanding of these three texts, students will be well equipped to begin to deal with basic design issues, from visual structure to physical engagement. Architecture is a highly complex system of overlapping geometries and phenomena that extend human consciousness outside our bodies in response to the needs and desires of life. Architecture is thus predicated on the multiplicity of human patterns: how humans collect, how they live, how they prepare their meals, and what they seek in terms of comfort from the world. Christopher Alexander set about documenting and defining human patterns of inhabitance. In his ground-breaking book *A Pattern Language* (Alexander *et. al.*, 1977) Alexander presents the geometries that work to delineate the space that humans occupy in their everyday events and over their lifetime. From the patterns set forth in this, our fourth text, students will begin to understand how architecture operates as an extension of human spatio-temporal negotiations with the outside world. Coupled with *A Theory of Architecture* (Salingaros, 2006) (which explains their combinatoric language) human patterns are revealed as fundamental. Having that knowledge prevents patterns from being dismissed as nostalgic and romantic by those who do not fully understand their importance.

Third Year. When considering human patterns as a template for architectural design, it is apparent that such patterns extend beyond the limits of any single structure. Historically, architecture has been contextually urban due to the nature of human patterns. The human instinct to collect in groups sponsored the evolution of urban forms that traditionally worked in a direct dialogue between humans, architecture, and the built environment. As

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modern human beings distanced themselves from the effects of nature, isolating and insulating themselves through the misappropriation of technology, the meaning and purpose of urban structure was lost. Given an overabundance of books on contemporary urban design, some might argue that nothing went missing as far as having instructional manuals. However, most of these texts operate within the paradigm of aesthetic form and ignore or misunderstand the genuine principles of urban structure, which are intelligence-based.

In the book *Principles of Urban Structure* (Salingaros, 2005) one of the authors addresses the urban dimension of the built environment, calling on science, not fiction or fancy, to structure a cohesive theory of urban design for students of architecture worldwide. As our fifth text, it clearly demonstrates that if architecture is to sustain humanity, it must be negotiated within the operational complexity of urban systems. The opposite, which is to teach architecture as a stand-alone edifice or urbanism as an aesthetic exercise, only reinforces the contemporary pursuit of autonomous and insular forms. While there are occasions when architecture might seek to stand alone, it is still a product of human necessity and must carefully address how it fits into a larger coherent whole.

The great Classical architect Léon Krier has long championed a contemporary architecture and urbanism based upon an appreciation of the best typologies from the past. His book *Architecture, Choice or Fate* (Krier, 1998) is an essential text for the new curriculum. Krier is credited (along with Christopher Alexander) with providing credence for the New Urbanist movement. Offering a prophetic look at

architecture itself, and with how it links to the larger urban scale, Krier helps to connect design to tradition without looking backwards. While his perspective may be somewhat Eurocentric, his lessons apply throughout world architecture, because they instill a profound respect for tradition and the human scale. This sixth text should be introduced when students begin to address the broader issues of architecture's role within the urban context.

The preceding six texts represent the core knowledge required to restructure architectural curricula within the objectives of *Intelligence-Based Design*. If administered through design studios and theory courses, students will take with them a body of knowledge that is not subject to change with every new fashion and every contemporary design whim. These texts provide a more substantive foundation for architectural design than has ever been available in the world. Academic entities that incorporate this body of knowledge in their teaching will see firsthand the cognitive response of their students, now driven toward the true creativity of architectural design. It is expected that the process of learning *Intelligence-Based Design* will awaken in students a desire to know even more: more about the world around them and more about their own existence. It will also eliminate the constant doubt that comes from subjective design and the immature search for pretense.

Fourth Year. For students who seek an even greater understanding of the effects the built environment has on people, we would offer yet another dimension to the study of architecture. Book Four of *The Nature of Order*, entitled *The Luminous Ground*, by Alexander (2004)

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addresses the inexplicable dimension of the built environment that transcends practical application. In this book, Alexander speaks to the animating effect of articulated forms and materials. He opens the door again to an architecture that serves to connect humans not only with the world around them, but equally to what lies beyond this world. It is at this juncture that architecture is free once more to serve the higher aspirations of humankind. Rather than glorifying the individual ego or cognitive awareness alone, architecture can put us in touch with the deeper ground which human beings share with each other. Students will discover or rediscover just how crucial adaptive architecture is for understanding our place in the universe. We choose this text so as to solidify a young architect's grasp of the higher meaning of architecture. While Books 2 and 3 of *The Nature of Order* (Alexander, 2002; 2005) are not presented until senior and graduate level studies, we recommend Book 4 as an essential undergraduate text because of its fundamental engagement with the transcendental dimension of design — we believe that phenomenon to be a function of neurological predispositions.

Completing the recommended texts for the fourth year of the new curriculum will be a collection of individual research articles, until they are available in book form. These include the article entitled "Harmony-Seeking Computations" by Alexander (2008), the two defining articles of *Intelligence-Based Design* (Salingaros & Masden, 2006; 2007), and the present article. Other material, as mentioned later in this paper, serves to further bolster the curriculum. We will also recommend a reading list of supplementary texts. Once the proper direction for education towards

an adaptive architecture is established, instructors will know better what to choose to reinforce learning adaptive design. What we have focused on so far are general texts: these must be complemented with attention to local conditions. We do not wish to see a continuation of today's uniformization. Indeed, every different location will need to find instructional material that is relevant to its regional and specific cultural needs. But let us not confuse this necessary human adaptivity with what is know as "Critical Regionalism", which sought to aestheticize the regionally-specific nature of place.

Summary of Recommended Texts. We have presented seven books — *The Phenomenon of Life* (Alexander, 2001); *The Luminous Ground* (Alexander, 2004); *A Pattern Language* (Alexander *et. al.*, 1977); *Biophilic Design* (Kellert, Heerwagen & Mador, 2008); *Architecture, Choice or Fate* (Krier, 1998); *Principles of Urban Structure* (Salingaros, 2005); *A Theory of Architecture* (Salingaros, 2006) — four journal articles — "If I Were a Young Architect" (Polyzoides, 2007); "Architecture: Biological Form and Artificial Intelligence" (Salingaros & Masden, 2006); "Restructuring 21st-Century Architecture Through Human Intelligence" (Salingaros & Masden, 2007), "Harmony-Seeking Computations" (Alexander, 2008) — and one document — *The Viseu Declaration* (CEU, 2004) — as essential instructional material for a new architectural curriculum. This list is certainly not meant to be exhaustive, and will be expanded further, below.

We do offer a caution, however. These texts should be read in exclusion of what is now misleadingly called "architectural theory". The

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current practice of architectural textbooks to present, for the sake of appearing pluralist, multiple texts by self-proclaimed "theorists" whose ideas most often run contrary to each other, leaves students confused about what information is relevant to design (see the later section entitled **Intellectual (dis)Honesty**). We believe, furthermore, that reading those texts re-wires cortical neuronal circuits in a way that diminishes reasoning ability (Salingaros, 2007). Relying upon contemporary architectural readings dilutes our efforts towards establishing a body of knowledge from which students can draw genuine inspiration. Continuing to regurgitate discredited material will prevent students from acquiring a set of values and beliefs that empowers them to operate in their immediate world and to sustain their inherited culture.

Another point to answer in advance is the inevitable reaction claiming that the books by Alexander *et. al.* (1977) and Krier (1998) have been around, but are not used in courses because they are not relevant to what is happening in architecture. Firstly, the new concerns with sustainability and vernacular regionalism make our curriculum vitally important for client needs in contemporary society. Secondly, these two books were indeed isolated from architectural fashion, but that occurred before the enormous commercial success of New Urbanism coupled with the revival of traditional typologies, and a re-awakening to the value of regional adaptive techniques. Thirdly, these two texts could not by themselves undo the deeply-ingrained practice of teaching non-adaptive architecture. Taken together, however, the other recommended texts not only fill in previous gaps, but also define

a mutually-reinforcing curriculum. The whole is much greater than the sum of its parts.

The New Curricular Model

We have noted the inclusion and placement of the theoretical texts within the course work. It is important that the students' knowledge base be structured according to how this information is processed and layered into the next of a series of larger ideas. What follows is an overview of the new curricular model. The framework is necessarily tentative, intended to offer guidelines for the introduction of *Intelligence-Based Design*. Educators from around the world will begin to draw associations from their immediate context, sponsoring a greater awareness of architecture as an intrinsically human endeavor. We give in Appendix I a script for a four-year curriculum structured to provide the knowledge, skills, and abilities for practicing architecture in the 21st century. It rests on a system of values predicated on local vernaculars. Within the new curricular model we seek several individual innovations and/or redirections:

(A) BIOPHILIC DESIGN STUDIO.
At the earliest possible stage, a one-year course on biophilic design and environmental psychology should be instituted. This is a studio/lecture course. Students need knowledge skills about biophilia to design responsive environments. Textbooks in this area of theory are very limited: in the initial stages, the coursework will consist of a compendium of research articles on biophilic design, including the book edited by Kellert *et. al.* (2008), and individual articles by Yannick Joye (2006; 2007a; 2007b) and by the authors (Salingaros & Masden, 2006; 2007).

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The studio part will resemble an experimental laboratory more than the traditional studio, because its purpose will be to build models (with some details at full scale) used to measure physiological and psychological responses. It is anticipated that the architecture school should establish cross-disciplinary investigations with other departments such as the psychology department and the medical school. Collaboration will enable students to borrow physiological sensors such as skin conductivity gauges and blood pressure monitors to measure the level of stress in an observer. Cross-disciplinary investigations will also facilitate discussions about the influence of the physical environment on human wellbeing. Students will measure their own reactions to their models to determine whether those reactions are negative or positive. The aim of this course is to bring a greater awareness of human engagement with the physical and perceptual world while working to establish evidence-based criteria. The course's immediate goal is to classify which volumes and surfaces give either a negative (oppressive, hostile, overly-exciting) or positive (elating, peaceful, nourishing) physiological response.

(B) PATTERN LANGUAGE STUDIO.
We introduce a one-year course based on socio-geometric human patterns. This studio will establish several projects of increasing scale, to be done using a pattern-based method of design: for example, a children's playground; a residence for a small family; a restaurant; and an airport. The recommended text is Alexander *et. al.* (1977), which reflects the best if not the only example of this method. Practicalities for implementing the pattern-based method of design are given in the co-author's book

(Salingaros, 2005). The studio will follow the existing process of design, design review, with a final critique of plans, sections, elevations, and models at the completion of each project. Modifications from the customary studio consist of the addition of full-scale renderings of details, colors, textures, surfaces, and spaces. Whenever possible, at least one portion of each project should be constructed at full scale showing all levels of detail, in order to be able to ascertain the psychological feedback.

Human activities follow certain patterns, and those patterns generate the forms of traditional architectural and urban elements. Patterns lie at the basis of the complexity of traditional architecture and urbanism. WHEREAS SOME DESIGNS ARE SPECIFIC TO CULTURE AND LOCATION, MANY ARE INDEED UNIVERSAL. For this reason, documenting evolved patterns found in the traditional built environment is a primary step towards achieving adaptive design. Patterns improve the quality of human life, and are not simply someone's individual preference. They are unrelated to formal architecture (which has shown little interest in this information), and are closely tied to biophilic design. Patterns constrain design, but do not dictate form. A building that satisfies human patterns is more flexible and adaptable to other uses later. If students are concerned that using patterns might restrict design creativity, this suggests that they may not yet fully understand the process of combining them, creatively and accurately, according to a set of combinatorial rules.

(C) SUSTAINABILITY.
In the current design paradigm where architecture arises out of an artificially-

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generated worldview, notions of sustainability have to be imported from outside the discipline. There exists a basic incompatibility between formal abstract geometry and our recent understanding of the earth as made of interdependent biological and physical systems. A great deal of effort is now being made to join two incompatible approaches, inventing technological fixes for non-adaptive architecture in order to make it less damaging to the natural environment. Our curricular model bypasses this conceptual mismatch altogether, and offers principles that fundamentally align architecture and sustainability. Intelligence-based design arises out of ARCHITECTURE AS AN EXTENSION OF BIOLOGY. This is the main idea of biophilia (Kellert *et. al.*, 2008) — the built environment is much healthier for human beings when it is compatible with biological structures in a fundamental sense. From the very beginning, buildings and cities are to be understood and studied as essential parts of living systems. If a split between design and natural processes is never created — as was artificially done during the twentieth century — then the new standards of architecture will be inherently sustainable. For this reason, we hardly ever mention "sustainability" — the newly-appropriated buzzword of western architects — in our discussion, since it is intrinsically contained in the revised foundations of the discipline itself. The notion of sustainability has always resided in living systems for over two millennia, prior to the industrial revolution and the alienating influence of technology as an idol.

Regional construction assemblies, using load-bearing walls and local materials, are typically the most sustainable buildings possible. While we look to science and technology to help in achieving sustainability, adaptive solutions have already been developed in vernacular architecture. None of that is "trendy", because fashionable architects prefer to implement high-tech and high-cost solutions to sustainability (or to aestheticize and commodify regional forms to carry their own signature design). We are going to study vernacular architecture for use today, as an affordable solution to the world's building and housing crisis (Asquith & Vellinga, 2006). More contemporary methods can help local traditional construction systems to evolve, without replacing them. A culture of sustainable building can form only if patterns loved by their users can be built easily with relatively low-skilled labor. Lest we forget, THIS IS HOW TRADITIONS ARE FORMED.

(D) ARCHITECTURAL HISTORY MADE RELEVANT TODAY.

A new, hands-on approach to architectural history will replace the usual screening of slides of various famous buildings in courses on architectural history, where purely visual information is passively presented. This now well-established method was a byproduct of Walter Gropius's influence on architectural education, when the history of architecture was relegated to art history. But the history of architecture is the history of the knowledge that actual buildings embody and contain. We have developed a new studio/lecture model that examines in great detail a representative number of the world's greatest buildings. Only one or two examples of each period or style need be utilized, and they should be carefully chosen for their high intelligence quotient of biophilic and adaptive qualities. (For example, the Kimbell Art Museum by Louis Kahn might be a good candidate for western Modernism). Ultimately,

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the list of buildings to be studied depends on the cultural knowledge, values, and beliefs of the instructor and the local school.

Regional vernacular architecture, and not the faceless industrial style, is the product of basic human ingenuity. Students will be required to draw representative regional buildings in plan, section, and elevation, and build an appropriate scale model. The aim is to learn how the buildings' construction was achieved, enough to be able to reproduce them. Since adaptive design arises from culture, students need to understand both HOW and WHY each building was built. Just as in design studios, students must present in a jury format plans, sections, elevations and models of the buildings they have chosen to study. At the end of the year, the students should have an intimate knowledge of these great buildings and their inherent patterns. This knowledge can provide a reservoir of forms and geometries essential for future inspiration.

In addition, the *Intelligence-Based Design* curriculum mandates, through principles and objectives, that the current practice of teaching separate courses on strictly modernist buildings and architects be abandoned. These courses served only to privilege the modernist style by lumping all other architectural traditions and well-developed form languages together into a separate course, which is customarily treated with less importance than buildings in the modernist style. Whether explicit or not, the message is that the modernist buildings are the most useful models for current design. (This conviction we believe is due in part to the imposition of ideological meaning in modernist architecture, giving historians

room for endless interpretation of what these buildings represent). Buildings featured in the "historical" course seldom carry this fabricated dimension of meaning, and are thus presented simply as images of general culture and art history not meant to serve as sources for future design ideas (the opposite of our conclusion!). The faceless and sterile international modernist style, which today's students are expected to assimilate thoroughly, tends to have very low biophilic and adaptive qualities. Modernist forms consequently have very little educational value in the *Intelligence-Based Design* curriculum. Below, we mention those early modernist form languages we turn to for worthwhile examples we can use in today's designs.

(E) NEW MATHEMATICS REQUIREMENTS.
The new curriculum requires more scientific and mathematical background than architecture students are accustomed to getting. The notion that architecture is essentially an art, inaccessible to the uninitiated, has banished courses in engineering and science. Even though the majority of architecture students are no longer required to take physics and biology courses, they usually have a general mathematics requirement. Mathematical training can better serve the needs of architects if it contains certain topics that are not currently covered. We have listed those topics in Appendix II. The department of architecture should negotiate with the department of mathematics to create a new service course, or series of courses, aimed specifically at architecture majors. Already, innovative architects are turning to precisely those topics we wish to include in the new curriculum, such as fractals, information theory, and complexity, in their explorations of form. At this time, however, interested students

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have to learn them on their own, which can be a very difficult and laborious process for non-mathematicians.

There is another, and rather serious concern. Unfortunately, the "architecture as art" movement removes most if not all of the mathematical understanding of form that generations of older architects relied upon. It denies analytical tools for understanding the world. It also condemns creative architects to the same insecurity that abstract visual artists suffer from. We are convinced that architects and students, unequipped as they are to understand the geometrical structure of forms, eventually develop a basic insecurity about their profession. Intuition alone can only go so far, and it can certainly lead to dead ends and frustration. If architects are unable to comprehend and interpret the geometry of what they are constantly creating, how can they maintain a stable worldview? Our ability to understand the world around us contributes to our mental health and psychological wellbeing. Such a cognitive detachment is very unhealthy, if not dangerous, in the design of architecture, which is (or should be) a practice grounded in both materiality and the science of human perception. This insecurity is also at the root of the variety of problems we address later in this paper, since all of them arise from the lack of a secure connection to reality.

(F) THE MERITS OF REVIVALIST ARCHITECTURE.
Many of the world's most beloved and successful buildings have been built in what have come to be called revivalist styles. Our students will be taught that ANY FORM LANGUAGE CAN BE USED ANYWHERE, AND AT ANY TIME, AS LONG AS IT ADAPTS TO LOCAL CONDITIONS. Surprisingly, this realization in itself is a revolution in thinking about architecture, and is a necessary component of the new intelligence-based history of architecture course. Ever since the Bauhaus, apologists have condemned non-modernist buildings as supposedly "not of their time". Looking around the world, we see the absurdity of this assertion. Examples to be discussed include the Palace of Westminster and the Houses of Parliament, built in London in Gothic style in the 19th century, as well as twentieth-century railroad stations such as the Milan Terminus and the demolished New York Pennsylvania Station, both modeled upon the Roman Baths of Caracalla. The inadequate term "revivalist style" describes a vast range of successful applications of older form languages in a modern setting (built considerably later than the language's original period of introduction). Classical architecture around the world is in fact revivalist — it was not built in Greece during the Classical era!

(G) WESTERN CLASSICAL ARCHITECTURE.
One of the most successful form languages in Western civilization, with an enormous number of subsequent adaptations to local conditions, is the Greco-Roman architecture that we have come to call classical. It has unfortunately been viciously attacked by architectural academics ever since the 1920s, despite the vast number of successful classical buildings built throughout several millennia. So many successful buildings have been built throughout several millennia of human existence by applying the strict classical form language. Separately, older buildings built throughout the world in a hybrid classical-vernacular idiom adapted to the local culture, lifestyle, climatic conditions, materials, etc. are now seen as infinitely more relevant to society

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than the modernist intrusions of the past several decades. Such buildings are hardly ever studied today for their successful adaptive qualities. The classical form language is to be prominently featured in our courses, not as an exclusive vocabulary for design, but as a form language containing a very high informational quotient, which is crucial to, and evident in a timeless architecture. The seminal books by the great classical architect Léon Krier (1984; 1998) will be used. An intensive classical design course will also be taught at the upper level, drawing on the educational structure already followed by such schools as the University of Notre Dame. We will teach an adaptive Classicism that employs the latest materials and technology to create buildings appropriate for today's society and construction methods. Contrary to what Western architectural media and architectural academics might lead students to believe, there is a tremendous client demand today for classically-trained architects. And unless you are a *starchitect*, there seem to be fewer and fewer commissions available for the self-indulgence of costly contemporary designs.

(H) TEACHING ADAPTIVE MODERNISM.
Stripped from its dangerous ideology, modernism is simply a celebration of industrial materials and technology. Individual modernist form languages do indeed give us useful tools for design today. As such, the best, and more adaptive examples are to be found in the works of Otto Wagner, Erich Mendelssohn and the other expressionist architects, Art Deco, and the relatively short-lived Art Nouveau. These were transient movements; yet contain a wealth of useful design precedents. Their richly-developed form languages were displaced by the commercially successful but faceless industrial minimalism. The richer form languages did not survive precisely because they were adaptive, whereas the modernist ideology wished to eliminate adaptivity so that the same de-contextualized building could be built all over the world. The early, more creative modernist expressions were marginalized, and consigned to the historical niche of organic architecture. There is also a great deal of useful knowledge to learn from local adaptive form languages based on modernism, which broke with dogma to develop many regional adaptations. Through the appropriation of these other modernist examples perhaps we can finally implement — after one century — the unrealized promise of early modernism (not the Bauhaus). A subversive symptom (see the later section entitled **Intellectual (dis)Honesty**) is to see architectural historians showing Bauhaus buildings but mislabeling them as Art Deco. The former have none of the exuberance and life of the latter!

(I) LIVING STRUCTURE.
Our goal is to give students the tools to imagine "how can I generate a space in which I feel most alive?" — the definition of wellbeing — and to be able to generate living structure that nourishes human beings. Virtual models have their uses, but the danger is that they cannot show living structure. The architectural experience is real and emotion-based, and its essential qualities — as opposed to its formal ones — are almost impossible to judge on a computer screen. In advanced studios students will delve more deeply into the living geometry of matter. Both the Pattern Language and Biophilic Design studios are established as pre-requisites. Students will learn techniques for generating living form, and will apply them to

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one extensive project. Having mastered the technique of documenting "how do I respond emotionally to this design?" they will move on to its more challenging corollary: "what space and texture will produce this particular emotional response?" Different techniques will apply to the same project, in order to develop different aspects of it. Final critique will be via the usual pin-ups of drawings and presentation of models, but the criteria for judgment will be those according to how closely the result follows pattern logics like Alexander's theories (whether a particular design satisfies certain positive qualities). After learning experimental techniques of objective judgment in the Biophilic Design studio, teachers and students can apply them to the final analysis of the projects.

Advanced and graduate courses will use the other two volumes of Alexander's *The Nature of Order* (Books 2 & 3) (Alexander, 2002; 2005). From Alexander comes the notion of laying out the building's plan in an organic manner. A revolutionary teaching studio will take students out to an existing lot or open field and have them stake out a building, just as squatters build a house in a favela or any informal settlement. The building's exact location, orientation, size, and shape are determined by the brief but equally by everything existing on the site and in the surroundings. The students will use materials (sticks, cloth, panels, boards, string) as props to mark out the building as much as possible. The empirical design process using markers is 100% adaptive! Then, and only then, will the students draw a ground plan. This drawing serves not as the conception for the building, but as the humble record of a building already designed on the ground. Real-world details, normally ignored, now determine the entire building. This process will then be extrapolated to include the vertical spatial dimension of human beings.

(J) ARCHITECTURAL SPACE.

Architectural space is arguably the key concept in all of architecture, yet it is woefully misunderstood. It is certainly not taught in any satisfactory manner today, probably because it is still not fully understood how to produce it successfully, or by what criterion it would be considered successful. We (the authors) are involved in researching how to form architectural space that is experienced with positive emotions, judged by the criteria appropriate to *Intelligence-Based Design*. Architectural space — the space we make when we build buildings — is formed as a material volume containing human beings and their perceptive fields. The inhabited, perceived volume itself should determine the material structures, and not the other way around. Unfortunately, we have to do battle with the decades-old misrepresentation of treating architecture as a strictly two-dimensional design problem, teaching at best two dimensions plus one. Since the beginning of the twentieth century teachers have either emphasized the building's external elevation, ignoring both the interior volumes and the exterior urban space, or have concentrated on the plan, relying upon the absurd dogma that the plan is the generator of the entire design. The volume is then simply the vertical extension of the plan — a method that denies design in the vertical dimensions altogether! Neither approach teaches a student how to generate intelligent and connective space. We will teach our students to create genuine architectural space, by experiencing it on the real scale.

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(K) USEFUL TYPOLOGICAL ELEMENTS.

The usual elements of a building — windows, doors, exposed beams, ceilings, walls, stairs, and roofs — can be categorized according to a particular region and era of a specific traditional architecture. Altogether, we have recourse to a vast collection of typologies that have proven useful in constructing adaptive buildings. Those typological elements have for the most part evolved according to basic human needs and circumstances, and thus represent the most sustainable and efficient solution overall. Typological elements combine into a "form language", which is a broader concept explained in our recommended texts. Incredibly, all of this rich variety of typological elements is ignored today, and only an extremely narrow set of Western industrial or high-tech elements is to be seen employed in buildings throughout the world. In the majority of cases, those elements are either inefficient or inappropriate climatically, structurally, and culturally. We plan to introduce a detailed course on typological elements, which will lay the foundational memory for young architects to draw upon in their practice (Bothwell *et. al.*, 2004). Knowledge of typological elements is an adaptive design storehouse. Students should be encouraged to learn to express themselves using a rich vocabulary of elements; otherwise they will remain architecturally speech-impaired.

(L) MATERIALITY AND TECTONICS.

The material component of architecture provides one the most tangible aspects of the built environment: its physical presence. People throughout history who have come in contact with truly great architecture speak of their connection to this architecture as something almost metaphysical. We believe that the animating force permitting both forms and materials to transcend their physical limits is a dimension of informational content wherein the building actually speaks to users on a neurological level. This hypothesis is of great importance to the understanding and manufacture of architecture: it should therefore be paramount in the education of our students. As with other courses in the new curriculum a HANDS-ON FULL-SCALE enquiry is expected. Just as in engineering labs, students in an architecture school need to participate in assembling and working with real materials. Architecture schools should begin to develop real modeling in their own material labs. Materials are going to be tested for how they relate to structural integrity, and also equally how these materials and their patterns of assembly work to provide the informational content necessary to the human sense of wellbeing and the dimension of transcendence.

(M) MODEL MAKING: SCALE AND COLOR.

At the present time, design studios typically train students by asking them to make models at a scale that is too small. The scale is too small to reveal the structure of the design across a wide perceivable range of scales, or the problems present in that structure. The model teaches students to regard a building as an object, as a thing with a particular form on the largest scale. It reveals little about how the construction has generated the building. As a result, models are now judged by misleading criteria such as: unnatural form, conformity to the latest architectural fashion, conformity to the machine aesthetic (represented today by technological appearance), or dissimilarity to traditional buildings. These criteria are

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irrelevant to how actual structures will perform as buildings. Students are indoctrinated into a false world of visual representations that substitutes for reality. There is a very tenuous connection between a model and a building, yet students are trained exclusively to create the former, while remaining ignorant of the latter. It is therefore necessary to train students in experiencing effects on a larger, near REAL or ACTUAL scale. We are going to build mock-ups using Styrofoam, cardboard panels, wire, sticks, cloth, etc. We will adjust those structures to optimize perceived feedback, then go back and revise our drawings and miniature model to capture the observed physical effect. As with all exercises that utilize full-scale models, these should be accomplished through group effort. Architecture is not the exclusive domain of one person's ideas, so to students must learn to work together on design: holding their egos in check while trying to realize the universality of human physiological perception.

The current situation is even more inadequate for understanding the architectural use (and misuse) of color. Minimalism eschews color, leading to drab and depressing surfaces and interiors. With few exceptions, the minimalist design ideology creates inhuman environments. The proscription of color goes back to extreme political and pseudo-philosophical tenets of the early twentieth century (see the later section entitled **Politics, Philosophy, Critical Theory, and Human Perception**), yet those unfounded ideas continue to be taught in architecture schools today. When color is used within the industrial model, it is most often as an arbitrary artistic gesture, without any understanding of human emotional response to the color experienced in a real building. Colors are harsh, arbitrary,

meant to shock rather than to enhance the geometry and achieve coherence. Few people know that the primary colors used by modernist architects came out of a fanatical religious sect (Salingaros, 2007). Interior designers eventually have to learn about color on their own. There is a wealth of data obtained by experimental psychologists on color, and we are going to use that material in our studio. The best reference on achieving architectural color is Alexander (2004). As in the above discussion, it is impossible to judge the effects of color unless experiments are undertaken at full scale. The experience cannot be reproduced on a play model or on a computer screen.

(N) INTENSIVE STUDY OF A FEW CANONICAL TEXTS.

Insight is oftentimes achieved by eliminating distracting clutter. Contrary to the current habit followed in architecture schools, where students are given a different (and equally long) reading list of peripherally-relevant texts for each course, we will focus primarily on our recommended texts. (Teachers try to rectify a lack of content specific to adaptive design by giving vast amounts of reading material: beware of courses with a long reading list!). Our few recommended texts, being repositories of architectural information, are densely packed with information that pertains directly to design. We believe that these books have the power to forever change the perspective of design students, giving them the insight and direction needed to make the greatest buildings of their times. The texts deserve to be studied in great detail and digested thoroughly over several years' exposure. Every subsequent course will depend and build upon every one of these books. As such, they are not meant to be

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skimmed superficially as architecture students are now encouraged to do with books. Rather, these texts are to be studied exactly like science and engineering texts — the more time one spends with them re-reading the arguments, the more understanding one accumulates. These recommended texts should become the students' constant companions throughout their education, and to continue to serve as invaluable design aids when the student enters professional practice.

(O) TRAVEL AND SEMESTER ABROAD.

Nowadays, when students see an example of great architecture or urbanism in person, the best they can do is to copy its superficial appearance because they have never been taught to understand how and why it works on so many levels. They cannot reproduce its hidden dimensions and mechanisms. The end result of copying does not have the essential qualities that are experienced in the original. Students then abandon those excellent learning models, drawing the false conclusion that they do not apply to our times. We hear this negative assessment repeatedly: that, supposedly, the life-enhancing qualities of historical buildings are impossible to reproduce today, with today's materials, under today's conditions, within today's society — a truly monstrous misunderstanding. Unfortunately, even architecture faculty that appreciates the qualities of traditional environments comes to believe this. It is an admission of a failure to learn (and teach) design that captures human qualities in the animating potential of form, patterns, and materials. The blame is thrown on the traditional environments themselves, instead of being accepted by those incapable of understanding the basis of humanistic design,

and how it is synthesized through human intelligence to provide both information and meaning.

In the current architectural paradigm that seeks to employ what is irrelevant, it is hard to establish for the students the relevance of truly meaningful work. Thus, they cannot understand WHY what they see in traditional forms functions so well. Certainly, they will perceive in front of them a wonderful example of human architecture and urbanism that affects them deeply and viscerally. But can they ever figure out WHY it has such an incredible and positive effect on them? More important, can they learn from those experiences how to duplicate the positive effects in a building they will themselves eventually design? They are not going to duplicate the building, but should learn how to mimic its influence and underlying qualities. Without proper theoretical and practical principles, they will never be able to apply those experiences to design a contemporary environment. The way to assure learning success is to teach them the genuine languages of architecture and urbanism before they ever go abroad, so they can then "read" the mechanisms through which historical cities work.

Learning Creativity and Inspiration

An open approach to design depends upon learning previously-developed techniques that work. We are promoting the heretofore unthinkable and now forbidden topic: learning traditional design techniques hand-in-hand with whatever new and innovative ideas develop. Learning from the successful architecture of the past requires a new application of

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academic openness to enable free-flowing communication. Self-discipline is needed to overcome the almost universal ignorance and condemnation of evidence-based design techniques. Unfortunately, the rejection of evidence-based precedents is an attitude that now permeates much of architectural academia.

During the second part of the twentieth century, creativity has been the principal criterion for teaching design. Students challenged to be original have been led to believe that pure creativity depends upon having no preconceptions. That idea is false. What students haven't been told is that CREATIVITY IS POSSIBLE ONLY WHEN ONE HAS GENERAL WORKING KNOWLEDGE AND RULES TO APPLY TO NEW SITUATIONS. Problem solving occurs by developing alternative solutions and knowing how to choose from among them (see the later section entitled **Heuristic Models**). When students are given no definite principles, but are told to "create" without precedents, consequence, or understanding they can only turn to copying that which appears to be original — what they see as "originality" in the work of the designated fashionable architects. But since it is magazines and critics that select from what the elite and powerful vested interests choose to promote on society, the quest for originality has become little more than mindless conformity.

It is the moral and ethical obligation of schools of architecture neither to promote any particular tenets, nor to exclude valuable sources of design inspiration, but instead to free a student's mind to develop its maximum creativity. We believe that all schools proclaim that is what they do, but either they are not being honest or

they are fooling themselves. The actual situation may be described more accurately as a rigid narrowing into an approved design aesthetic and vocabulary. This "official" design style conforms to and supports the latest fashions, while anything else is vigorously condemned. Sometimes the condemnation is explicit; at other times it is very subtle but no less powerful in its influence on students.

As today's architectural practice becomes more and more dependent upon the commodity of images, architectural education has begun to focus exclusively on the manufacture of such image-based designs. The criterion is that they appear particularly "creative", "original", or "innovative". However, image-based design and education have subverted architecture away from its substantive nature to become an expendable product — an imaged-based commodity. When students are asked to design a building their reaction is to try to create something that looks "architectural". Image-based design is what happens when the designer is primarily concerned about their work's "look". In this way, architects have actually limited the application of their services, thus severely curtailing architectural creativity. An infinite variety of excellent, adaptive design choices are now avoided because they break this conditioned expectation of client and designer, professor and student.

Today, most professors are unable to critique design outside the current philosophical and image-based paradigm. Given the paradigm's carefully constructed (but utterly false) illusion of open interpretation, instructors are free to impose the full gamut of their own thoughts, establishing for students what is good or bad in

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architecture without having to provide anything more than an invented intellectual defense. Since professors are more experienced at this intellectual posturing than their students are, they have little trouble making their point appear credible. What happens to true critical thinking?

We believe that teachers do not recognize the damage this process has done and is doing both to students' creativity and to the practice of architecture. Teachers themselves encourage the situation of historical and cultural amnesia by presenting and valuing the work of fashionable architects, regardless if that work is non-adaptive and ill suited to human needs. Newly famous architects, idolized by their academic followers, provide the worst possible model for students in the intellectual vacuum created when *Intelligence-Based Design* is absent, yet they still seem to exert the greatest influence (see the later section entitled **Intellectual (dis)Honesty**).

Even in departments that attempt to offer pluralistic views of design, it simply doesn't work to bring in one guest speaker. Listening to a real-world designer — someone who understands the intimate workings of structure, space, surface, and form — does not register; as soon as he or she finishes talking, the student is pushed back by the prevailing design culture into imitating the latest architectural fashions. The design culture is stuck with a narrow focus, and the reigning architectural paradigm is so polarizing that it excludes most genuine sources of design inspiration. Socialization of design attitudes appears far too strong to change from within, because it is supported by every component of the present establishment (Salingaros, 2007).

How did the design attitudes and their socialization become so entrenched? Obscure twentieth-century Western philosophical texts that hardly anyone can comprehend are not natural candidates for helping students learn how to design buildings and cities worldwide. Why, then, turn to those texts for inspiration? And why did our most prestigious architecture schools embrace them so enthusiastically? The reason is that adopting formalistic philosophers — who are far removed from human qualities and human interaction with the environment — is a way of preventing an "architecture of appearance" from being judged deficient. A dependence upon meaningless philosophy drives architecture even further towards unnatural forms that are purely self-referential, and valid only within the designer's mind.

By rejecting natural and human mechanisms, people have oriented architecture and the teaching of architecture away from fundamental principles of structure — from visual and physical coherence. The motivation for this ultimately goes back to an ideological insistence that a "machine aesthetic" replace what is human and natural. This *Machine-Age Design* (MAD) is best described as the misapplication of an agenda (a set of goals) through the institution of image-based criteria. These have little or nothing to do with architecture, and everything to do with appearances. Whoever originally proposed this as a guiding principle totally misunderstood how machines actually work; they were only attracted by the superficial appearance of unnatural-looking forms as a "sign of the times".

In the last 100 years humankind has seen an incredible advance in the understanding of

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machine complexity. We now understand far more about technology than the architectural gurus of the 1920s did when they promoted their primitive machine aesthetic. Extraordinarily complex machines such as computers, software systems, electrical grids, etc. obey structural laws similar to biological organisms, traditional cities, human artifacts, and buildings. Those results support our own views and sustain an adaptive and intelligent form of architectural design (Salingaros, 2005; 2006; Salingaros & Masden, 2006; 2007).

Machine beauty is undeniably a phenomenon that attracts human perception when it works on the human range of scales: the fine-tuned scientific instrument; professional racecar; sailing yacht; interplanetary explorer vehicle, etc. Technology has talked to us since we manufactured the first stone axes. But all those products are beautiful because they are exquisitely tuned to their materials and functions; nothing is "style" or superficial application. Indeed, "style" comes out of the ruthless adaptation of those creations to their purpose, not the other way around. Our own age is confused on this point because we are inundated by stylistic copies based upon mistaken analogies (see the next section entitled **Architectural Education and Human Intelligence**). A house is not a machine. The sleek machines of the 1920s that inspired the Bauhaus in fact hid their beauty — their working articulations — with a superficial finish.

Great architectural works of the past derive from an understanding of some aspect of nature. Rejecting those sources of inspiration, as is done in architecture schools today, impoverishes both students and practitioners. Justifications

of "novelty", "form-follows-function", and "conformance to the spirit of the age" are simply buzzwords for bad mistakes. By studying the geometry of nature, future architects can achieve the same level of inspiration in their work as did the great architects of the past. But architecture is far more than copying natural forms. You also need to study applications of this natural geometry to what has been built over the last 5,000 years. Today's architectural education has neglected geometry found in nature and in actual buildings, focusing instead on a narrow group of philosophers and philosophical texts (Salingaros, 2007).

We must take care to recognize the current condition wherein architectural theorists work to aestheticize every form of information that comes into their self-defined purview. This practice of aesthetization is as dangerous as it is arrogant, but the architectural media rewards such theorists by publishing them extensively and therefore reduces architecture to a mere commodity of appearance, or spectacle. The greater dimension of architecture — its power to affect us and our world — is overlooked and not ever fully realized.

Architectural Education and Human Intelligence

It is true that our new curriculum may be challenging to many undergraduate students — certainly much more so than what they are taught today. Most students attracted to architecture possess a relatively high visual intelligence, compared to their rankings in verbal and mathematical intelligences (D'Souza, 2007). Nevertheless, we firmly believe that the new curriculum, if correctly implemented, will

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increase the students' effective intelligence. This expectation contrasts with our assessment of current architectural education. The mental training found in contemporary architectural education appears to limit neural connections, since the process of reading self-referential texts re-wires neuronal circuits in a way that diminishes reasoning ability (Salingaros, 2007). Even in the best circumstances, the present-day curriculum certainly does not prepare students to cope with the complexities of the built world. One of the co-authors has suggested corollaries between the lack of mathematical information content in a minimalist built environment, and students' declining mathematics scores overall (Salingaros, 2006).

Human intelligence depends upon establishing multiple neural connections in the brain. Neural connections create a "mental computer", which helps human beings to deal with and solve real-world problems. Improving our ability to establish connections, either through problem-solving practice or via specific learning techniques, increases our mental power, hence our effective intelligence. The connections have to be of the right type to enable computing. For a long time, intelligence was believed to be fixed, but recent clinical studies on learning exercises disprove this assumption (Olesen, Westerberg & Klingberg, 2004). Specific challenging tasks, such as the mental effort of exploring the space of solutions to a design problem, could possibly modify adult intelligence. Unfortunately, we see no indication of this in current architectural education — quite the opposite.

The predominant theme guiding intellectual development in architecture seems to be conceptual isolation, which is symptomatic of a mind that lacks sufficient connective abilities. By inhibiting connections, students are deliberately isolated from any explanatory elements of architectural learning. Logical, content-based connections between ideas are avoided, whereas spurious connections are encouraged, based on illogical assumptions such as superficial resemblance. Both theory and studio courses address intentionally isolated abstractions with oversimplified yet meaningless exercises. What little knowledge base is even acknowledged is then turned inwards (i.e. disconnected from evidence), due to a fear of diminishing innovation. A learning process that discourages external connections intentionally limits the students' field of enquiry to a select ideological body of opinion.

This process of limiting connections is an operation found in mistaken analogies. We see this phenomenon in individuals and cultures that have a restricted base of scientific knowledge, or are cut off from it. Mistaken analogies could be due to lack of a technological advancement, a lack of education, or a choice for ignorance and superstition in the midst of a knowledge-based society. In extreme cases, human beings raised in isolation do not develop the necessary connections to fully assess systems outside those they have generated. Pre-modern cultures that tried to reconstruct objects of the modern world — airplanes and guns, strictly through appearance — lacked an understanding of how these devices operated, and thus failed to replicate their function/utility. This is not to say those people could not understand the process involved in the design and fabrication of airplanes and guns; they simply were not taught how. Once exposed to the applicable knowledge base, people from those cultures

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were able to make the connections necessary to fully replicate technology.

Mistaken analogy is an established way of thought celebrated by famous contemporary architects, who declare that their buildings are on the point of "flying off" just because the edge resembles a wing. But, like primitive sculptures of airplanes in the jungle, the buildings refuse to take off. Architects embrace mistaken analogies as a way of thinking and talking about their designs, and are ironically awarded prestigious prizes (via the celebrity factor more than the value of their designs). This success through rewards keeps the entire discipline — the media, critics, clients, and academia — fixated on the mistaken analogy of surface appearances. Modern psychology tells us that whenever the human mind is confronted with an insufficient knowledge base for constructing logical connections, it invents or manufactures a nonsensical explanation for phenomena. Inventing untenable models follows an essentially anti-scientific (and also anti-religious) practice. Yet, still, this strategy persists. Mistaken analogy is also behind one of the major misunderstandings that derailed architectural education (see the later section entitled **Heuristic Models**).

In making a comparison between a conceptual construct and actual objects, one needs to pay close attention to the nature of the metaphor. It is crucial to rely upon empirical verification in drawing an analogy. Psychologically indeterminate concepts tempt architects into a false model. Meaning becomes a mental construct, something hidden behind overt behavior. Assertions about reality survive because their truth cannot be assessed in terms

of physiological states and processes. Far from being recognized as a shortcoming, however, a concept's proponents try to make it look more determinate than it really is. Idealizations are concepts that cannot be anchored on observable phenomena.

Mistaken analogies are manifested through trivial associations that make no sense, except on the most superficial level. Such associations employ our most evolutionary primitive neural circuits, bypassing analytical reasoning entirely, and have been used to manipulate and condition people. Contemporary western culture disconnects its members from knowledge in order to manipulate them into a consumerist mind-set, while cults and governments indoctrinate persons and sponsor directed atrocities such as terrorism or genocide (Salingaros, 2007). Both science and genuine religions provide connections that argue against such irrational interpretations of the world.

Not only is contemporary architectural education cut off from other disciplines of learning, but also it is geared towards isolating the student from the real world. Architecture has generated its own artificial, abstruse, and illogical language. Training in schools that depend on such texts generates an artificial worldview for the student, which is based on unnatural images and is supported by a near cult-like ideological structure. Too often, the first years of architectural education today have come to resemble a children's daycare center, in which four-year-olds are kept busy with mindless play. More often than not, undirected play is not a learning initiative, but an expediency of not having effective

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or knowledgeable educators to provide the guidance and structure necessary for students to assimilate their experiences. Undirected play simply keeps children busy until time has come to go home. Surely, this is not what is intended for architecture students today! In architectural academia, "undirected play" is the undying legacy of the Bauhaus, wherein students are supposed to learn architecture through this activity. This is as unrealistic as expecting a child playing with a computer keyboard to come up with a Shakespearean play.

A little bend here, a little crumple there, mixed with some creative dialogue and presto: you have got yourself a fine piece of architecture, or so architecture students are led to believe. The truth is that you have only a piece of construction paper that may at best support an allusion to architecture, but only at the smallest scale. So complex are the geometries at work here that the professor is unable to explain them in any way but as a celebration of abstract form or its superficial appearance. But all this model building occurs at the expense of adapting the design to human needs; indeed, this sculptural process can take place only if adaptation is willfully ignored. Glossing over the real issues of materials and structures necessary to even begin to conceive of such a form, professors encourage (perhaps unwittingly) this type of expression from their students.

We are rather alarmed at the pervasiveness of this disconnecting way of thinking in architecture. Our own conception of architecture is founded upon the mechanism underlying human intelligence that connects thoughts and ideas. We strive to establish connections while at the same time digging

deeply to make sure they are logical ones, and are not based strictly on surface appearances. We make efforts to connect ideas laterally (among topics on the same level) as well as vertically (depth of understanding), in analogy with neural connectivity. In this manner, we can build an intelligent framework into the discipline itself.

For an example of connective reasoning, reading Christopher Alexander often makes a reader react with an exclamation of sudden realization, almost on every page of text. Alexander establishes connections among phenomena in the universe, elements of the built environment, effects that are intrinsically human, etc. Over the course of his life Alexander has been building these connections, seeking them out, and thus his message often resonates with the reader on that level. We believe that reading Alexander's texts trains the reader's mind towards establishing connections, so that the reading experience creates a positive development for a person's perceptual skills. Enhanced connectivity occurs separately, in addition to the information content acquired from his books. A great number of readers report that reading Alexander has "changed their lives"; that they are henceforth able to perceive the world, including familiar everyday things and events, with a new light that makes better sense of its complexity (Davis, 2006). Critics report a sort of philosophical awakening, discovering that Alexander connects them more to the world they see than anyone else has.

One of the key messages of this paper, therefore, is that DESIGN ADAPTIVE TO HUMAN BEINGS IS INTIMATELY LINKED WITH HUMAN

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INTELLIGENCE. This interrelation is true for fundamental biological reasons. Experiencing adaptive design establishes mental connections that aid intelligence, and conversely, engaging in adaptive design is an exercise in problem solving. We have every reason to believe that adaptive design increases the conceptual and reasoning abilities of the designer — that it can actually raise the designer's overall intelligence. An analogous reasoning lies behind parents' conviction that exposure to complex structures such as mathematics, other languages, and music at an early age increases their child's intelligence.

PART 2. PRIMARILY FOR TEACHERS: ATTITUDES THAT GAVE RISE TO THE PRESENT SYSTEM.

Curriculum Re-Alignment

Architectural education today has evolved its particular structure and lexicon to address an untenably broad set of ideas from a very narrow and select viewpoint. It is improbable that any meaningful reconstruction of institutionalized elements in architectural academia would take place automatically. Who wants to shed familiar teaching habits? An immense effort is required to make the transition into conceptual territory that feels counterintuitive to those unused to it. Given the urgency in what needs to occur, the situation requires us to frame a new architectural education on top of existing and familiar academic structures.

It goes without saying that some courses presently taught in architecture schools will have to be eliminated or completely altered to make room for the new proposed courses. The

criterion for selection is a simple one. If existing courses reinforce the newly-defined program for architectural education, they may be retained as they are, or modified as needed to support the re-aligned objectives. If they do not support it, then they are redundant and ineffective, and thus have no place in the new curriculum. Opting for compromise, a superficial revision or minor adjustment may dilute our ideas too much — such a step cannot lead to genuine reform towards teaching a truly sustainable and adaptive form of architecture.

Currently, the most senior teachers in architecture schools aspire to teach primarily upper level or graduate level courses, leaving the formative years mostly to less permanent junior faculty: assistant and adjunct professors, and guest lecturers. The more dynamic nature of employment at these levels creates an inconsistency in administering the curriculum at its most crucial juncture. While adjuncts often provide a critical element to the education of student as practitioners, the new curriculum cannot succeed unless sufficient teacher resources are delegated to the first two years. We recommend that permanent senior faculty with a full knowledge of *Intelligence-Based Design* spearhead the efforts of all faculty teaching at this level.

Our recommended texts, while written for a general audience, are not the usual oversimplified textbooks specially written for freshmen. Students will need to be guided through the deep concepts of Christopher Alexander's *The Phenomenon of Life* (2002), and Kellert *et. al.*'s *Biophilic Design* (2008). Otherwise, beginning students, unaccustomed to such intellectual challenges, may fail to

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absorb sufficient material necessary for their subsequent courses in architecture. Many will, of course, be excited and energized by the content of these books, but the school must guarantee the courses' effectiveness by providing a teaching structure that supports the educational objectives. Therefore, our proposal includes as an additional feature the re-organization of curriculum emphasis, placing the knowledge base of the program at the bottom of the hierarchical coursework pyramid, rather than primarily at the top.

Educating and De-Programming the Teachers

Anticipating that most of today's architecture instructors trained in the contemporary educational model might not possess a full understanding of the knowledge base needed to teach these essential courses, we envision special faculty training sessions. These sessions will be held to coalesce and direct the knowledge and methodologies of theorists, educators, and academic institutions throughout the world. A separate program could be arranged as special continuing education lectures for architectural licensing requirements. Teachers will need to read essential background studies (Bothwell *et. al.*, 2004; Salama, 1995; Salama & Wilkinson, 2007), in addition to mastering the recommended course textbooks.

Academics trained in the prevalent Western model have inherited a peculiar way of teaching architecture that encourages abstractness while shying away from materiality. It stems directly from the pursuit of "architecture for architecture's sake", an attitude of late modernism wherein the practical function of

architecture was rendered irrelevant (Masden, 2006). Architecture was stripped of most of its functions, down to a bare visual minimalism, while falsely claiming that this was "functional". The majority of schools around the world, unfortunately, are now copying this model of the world presented exclusively through a western minimalist industrial perspective. If left unchallenged, the world's architecture, once a rich collection of multi-cultural expressions, will be forced to represent a single ideology: an ideology of capital consumption. Here, architecture operates strictly as image-based commodity. The pursuit of material prosperity, and its collateral forces, have set into motion a system of unnatural values and beliefs that are more evident than ever in today's youth. The extended reach of this influence continues to appear in the skylines of many of the great cities of the world. As an expression of the global capitalist venture, Western iconic structures now hover over the intimate ground plane of older cultural entities throughout the world. Architectural educators must stop acting, consciously or unconsciously, as agents of what is nothing less that cultural hegemony.

Like employees anywhere, architectural educators have a vested interest in preserving their job. Given the right conditions, the transition to teaching intelligence-based design could actually be quite smooth. Instead of a radical discontinuity, we could witness a smooth evolution. This process would all but alleviate the ideological posturing that so often occurs in the absence of any applied knowledge base. It would also enhance the present academic and professional working environments, since a new generation of students will be taught something far more worthwhile, which is

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more likely to help them in their careers and personal development. Students will eventually realize this as a change for the better, and be thankful to their teachers for offering it. So much depends on the administration, however, which must embrace and implement the process with integrity.

The Information Generation

In recent years, the "information generation" has become more and more reliant on image-based learning, moving students into a near co-dependent relationship with visual forms of information. Exposing students to obscure philosophical writings, dialogue, and discourse only creates in them a greater dependency on images. This practice has allowed architectural academia to de-contextualize architecture even further through the conveyance of images and rhetoric, where endless forms of visual speculation replace what is real. If we are to maintain our humanity, architecture must once again be grounded in an information-rich reality. Physical structures provide our evolved mind with the information content needed to navigate our surroundings, and to manufacture beliefs and values that sustain human existence through culture and community.

Many professional and academic architects believe that the computer modeling which has become so prevalent today, if introduced too early, can effectively ruin a student's ability to conceive genuine architectural space. Working with small digital images on an abstract digital interface does not allow the brain and hand to learn to synchronize, or couple, in generating a design. As a result, the student never develops the neurological connections so essential to

their training. Instead, they grow even more dependent on the superficial manipulation of images. In addition, the software system itself has its own logic, which imposes its own peculiar form of intuition, totally distinct from the human intuition about massing in three dimensions. We recognize these concerns, and solve the problem by grounding a student in feedback techniques from real, physical structures. While we would not go so far as to eliminate computer modeling from the undergraduate curriculum (or even from the first three years), we warn against creating a dependence on artificial techniques at this phase. Digital modeling is a wonderful tool when used to express intuitions solidly developed by physiological means.

Nothing replaces the neurological training and cognitive development that occurs when the human visual system is tied to immediate feedback from physical activities such as drawing. Many firms practicing traditional design first draw all their projects by hand, and only transfer them to a Computer-Aided Design program after they are finished. They have discovered that, otherwise, they lose essential qualities of the design. Alexander (2002) goes further and explains WHY a rough pencil sketch can capture details and essential human qualities. Those qualities are found in the roughness itself, which actually represents an informational complexity that connects with our deeper perceptual and cognitive systems. A rough sketch can show multiple dimensions of a design — most important, its feeling and immediate effect on the user — that should be the goal and essence of the completed building. Such qualities make a user wish to be in such a building. It is very difficult to make more exact working drawings from such a

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rough sketch without losing the sketch's positive qualities, yet this skill must be developed. Representing a building's morphological "warmth" is impossible via computer modeling using existing Computer-Aided Design systems.

Science has demonstrated how the abstract forms of modernist architecture lack the structured information that buildings throughout history have embodied and conveyed. Today, scientists understand more clearly the neurologically-dependent geometries behind structures possessing emergent properties and animate forces. We find that these same general structures are embedded in traditional architectures, but are largely absent from most twentieth-century buildings and cities. This absence of animate forces (architectural life) can be traced to the lack of very precise mathematical qualities in modernist buildings as a whole (Alexander, 2001; Salingaros, 2006). Architectural life is clearly found in the ornamentation and ordered detail of traditional (including early twentieth-century) form languages, which minimalism and brutalism erased.

The emphasis of architectural education on contemporary images tied to electronic media trains students through cognitive feedback processes to produce specifically non-adaptive structures. Students have all but lost their ability to make corporeal value judgments on their own, or to understand how to decipher perceptual and physical stimuli. Architectural training thus, in effect, psychologically conditions future architects to work against their own basic impulses and physiology (Kellert *et. al.*, 2008). Students become co-dependent on image making, which leaves them at the mercy of their

professors' value system. This unbalanced state creates an anxiety in the study and practice of architecture, which manifests itself in design arrogance, an arrogance based on insecurity. Having forgotten how to perceive and judge for themselves what good space is, what good light is, what good materials are, students are left to contend with the designs of the strongest egos. Forgetting how to recognize our innate perceptions — those that instinctively guide us through information content towards what is nourishing to our body and our psyche — allows us to be controlled by the people in power and the dominant paradigm.

Today more than ever, useless information — images, slogans, and memes — saturates our conscious mind. Like white noise, an unintelligible veil disrupts our ability to engage genuinely with useful information when it is presented. Abstract forms in our surroundings (modernist buildings devoid of organized information content) further exacerbate this condition by intensifying or concentrating the barrage of useless information. This experience is unhealthy. An architectural education adequate to our psychological needs teaches students about the levels and types of information that buildings can present.

Heuristic Models

Students struggle to make sense of design problems and instructions that purposefully lead them away from reality. Their assignments are couched in the notion that such exploration removes limits or preconceptions that students might place on their design. Students are given abstract paintings, poems, literature, or digital metaphors to guide their work, none of which

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is related to genuine architectural solutions. In an open-ended question, students are told to proceed without any direct instruction about architecture from their professors. Operating under a mistaken analogy with the heuristic method, professors believe that students must simply begin to produce with as little influence as possible, in the hopes that they might discover something — the so-called "eureka moment" — beyond themselves and their understanding of architecture! This practice goes back to a misunderstanding about similarities between the process of design and heuristic scientific models. Ironically enough, this design process is not directly heuristic in structure or observance: the method presents false positives, triggering the desire for the fashionable image.

Each new supposition, in a series of invented ways to conceive of a new architecture, is supposed to develop from the position of not knowing what that new architecture would be. The initial problem given is most often biased in such a way as to skew the outcome towards an architectural expression that is anything but architecture. Given the unreal nature of these models, real knowledge is cast off, and in its absence, ideology is substituted. Used properly, heuristics requires constraints such as pattern languages. Much can be learned from a process led by evidence-based knowledge; but equally, everything can go wrong if heuristics are misused as the means to a pre-determined end. The consistent suppression of pattern languages in Western architectural education set the stage for failure.

Genuinely heuristic exploration is in fact a directed inquiry guided by known principles — freedom is given to explore within a well-

defined solution space. People make decisions, come to judgments, and solve problems, typically when facing complex problems with incomplete information. The discovery process occurs because the student finds pieces of information along the way — pieces that the instructor already knows to be there. By contrast, the so-called heuristic method in architecture is little more than the appearance thereof, which presents itself as a case of the blind leading the blind.

Heuristic design directs a search through the space of solutions to a problem. A heuristic method is an exploration based on experience, which can be used as an aid (but not as the only means) to solve design problems. This method uses successive evaluations of trial and error to arrive at a final result. Each intermediate result is tested empirically against reality, thus each attempt at a solution is assessed and used to improve subsequent attempts. The search method follows an iterative process in which information gathered at each step is used to decide on the next step. Solutions are assumed to exist, and the method is supposed to locate an adequate (but not optimal) solution under a given set of conditions. Any heuristic design method therefore takes place within a solution space that is already defined.

For example, in architectural design, a designer explores the solution space by varying the forms and materials, which can lead to unexpected solutions. This is what happens in the best cases: variation of the parameters expands the loop in solution space so as to catch a solution that had previously escaped. This exploration is made possible by an injection of randomness (corresponding to genetic mutations in

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Darwinian processes) that generates variants away from the original position in solution space. Of course, deviations from a known solution will most often not lead to any solution at all, and this is where feedback and evaluation become critical. A single, optimal solution usually does not exist in complex problems such as can be solved using heuristic methods.

Genetic algorithms based on Darwinian processes try to mimic evolution and natural selection. These are an application of heuristic design, with selection based upon well-defined fitness and survival criteria. One of the co-authors has written about Darwinian processes in architectural design (Salingaros, 2006). Pattern languages (Alexander *et. al.*, 1977) provide constraints for locating general solutions. Nowadays, the architectural solution space is frequently narrowed by a specific style, and thus the designer is not free to find any adaptive form. This conformity is the opposite of the process of natural selection, where organisms adapt to optimize their chances for survival in a given environment. Despite the expectation of design freedom, selection criteria are not based on fitness, but are instead used to match pre-determined iconic prototypes. Unsurprisingly, therefore, heuristic design in architecture schools leads to the same image-based results.

Worldwide Architectural Education

We are promoting an educational system that respects and learns from local traditions, and does not blindly copy global styles shown in the glossy magazines. Since the authors are Western-trained, our practical recommendations are meant for teachers and administrators in the U.S. Nevertheless, our arguments try to be universal without being another attempt at globalization. We hope that our model will work for different contexts and will be useful for the reader in any culture. Wellbeing is universal for all cultures, with local factors important but not predominant. Taking into account different realities in different parts of the world, we offer students everywhere a validation of their own culture, even as architectural education has probably turned them against it. We do not suggest a new globalism in the service of localism, but instead a universal understanding of human values, and how they are expressed in different but equally valid architectural traditions.

Central to intelligence-based design is the theory of evolved form languages. Form languages have been developed by different people at different times, and encompass the most important components of a region's architectural and artistic heritage. A particular form language is infinitely applicable to generate an enormous variety of buildings, each of which embodies particular and unique cultural characteristics. Every form language is also constantly evolving. Intelligence-based design teaches students how to use documented vernacular and historical form languages, not as a dead academic exercise, but to extend their creativity and the space of solutions for designing contemporary buildings. A form language discourages the superficial "quotation" of design elements outside their grammatical context. Modernist architects never accepted the concept of a form language, and only used isolated words from the language without understanding how every language works according to a deep

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combinatorial structure.

Our proposals for world architecture are free from any stylistic prejudices. The texts we use respect all architectural traditions that connect human beings with their environment in a positive manner. Many twentieth-century buildings fail in this crucial requirement, and are thus poor models to study. Nevertheless, architecture schools teach the international modernist style and/or its derivatives almost exclusively, proclaiming it the only valid expression for architecture today. This narrow worldview is highly intolerant, disdaining the rich architectural traditions of the world as being "primitive" and "backward" and not worth preserving. In place of those traditions, schools and the media now promote the bizarre work of a handful of Western architects, who are supported by politically powerful commercial and academic interests.

Architectural institutions the world over have unfortunately fallen victim to this indoctrination (promoting a select group of practitioners and a fashionable style), and have turned against their own heritage (Salingaros, 2007; Salingaros & Masden, 2007). Architects and academics who respect traditional typologies and call for their continued use as viable models are consequently condemned by their colleagues. They are overcome by the academic and economic influence of Western-looking fashion seekers, who have continued to buy into the myth of a superior Western ideology. The problem is that the West doesn't completely subscribe to this idea either; it is as much a case of supply-and-demand as purpose. If the power brokers can convince others around the world that what they are selling

is the latest and the greatest, then they can continue to control the market. In addition, the political machine promises to elevate those that subscribe to its tenets with the same power and influence. Given this reward system, it is easy to find individuals who are willing to copy the latest Western fashions at the expense of genuine culture and heritage. These agents promote the propaganda that adopting fashionable architectural and urban typologies will overcome problems of economic or technological development in any country. People fail to see that the West can offer positive examples of science, technology, and economic models, but fails almost totally in preserving culture and religion.

We are witnessing today what can only be described as a type of cultural imperialism (aesthetic hegemony) in world architecture and urbanism. And while there is a very strong backlash against it, those who recognize the problem are most often unable to do anything about it. One way to stop the damage would be to adopt the principles of architectural education offered by *Intelligence-Based Design*. This adoption would re-institute an immediate respect of local traditions, culture, and a country's historical achievements. Most important, the proposals of intelligence-based design are backed by science, and not by any nostalgia for the past or for any particular typology. We believe this to be the strongest argument yet for saving the world's architectural heritage, and those processes and traditions that create truly great architecture. To date, appeals to the value of this knowledge have not been strong enough to overcome the massive capital consumption and annihilation of cultural entities throughout the world.

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Stop Teaching Ecophobia: the Hatred of Culture and Nature

The term "ecophobia" refers to an unreasonable but deeply conditioned reaction against natural forms. It has also been used in clinical psychology to denote a phobia against one's dwelling, but that specific use now appears to be antiquated. The philosopher Roger Scruton (2006) coined the related term "oikophobia" to denote an unreasonable hatred of one's native culture. We believe that these two terms "ecophobia" and "oikophobia" may in many cases be used interchangeably. (Linguistically, the common Greek root for "house" can be written either as *ecos* or *oikos*).

Regarding the social domain, our age is experiencing deep philosophical and social tensions. These are as serious as the concerns with our detachment from nature. The 21st century has begun with a continuation, and perhaps intensification, of the worst prejudices seen in the twentieth. Those prejudices include a disdain of traditional cultures, and all that links a human being to his/her local history. Scruton (2006) reminds us that: "the oikophobe repudiates national loyalties and defines his goals and ideals *against* the nation, promoting transnational institutions over national governments … defining his political vision in terms of universal values that have been purified of all reference to the particular attachments of a real historical community." Here we have the "modern man", who embraces all forms of technological toys while he rejects evolved solutions that have held society together for millennia. As Scruton points out, there is a deep political component in ecophobia, since many political parties promote themselves by promising liberation from society's problems through embracing universal (yet abstract) utopias.

Governments of radically distinct political orientations nevertheless fall prey to an infatuation with foreign goods and ideas, and this dependence is manipulated for the benefit of multinational corporations. It is easy to be helped along by advertising, now reaching into even the most remote places on this planet, which promotes foreign products loudly in the local market. At the same time, local traditions are erased, along with what held that society together. The underlying phenomenon is a disregard or even loathing of one's own culture, and its artifacts and practices. This hatred drives people to reject what is traditionally theirs, and to embrace new foreign symbols of capital progress as somehow better.

Architecture as image, operating in the service of global capital, is now present in everyone's backyard. To sacrifice identity for globalization corrupts the values and beliefs that people of traditional cultures have sustained for millennia. Today's fashionable architecture instead serves a culture of "capital and consumption". That culture's values and beliefs underlie and structure architectural practice in the U.S.A. and increasingly throughout the world. Fueled by billions of dollars in capital, this process of promoting new foreign symbols is sustained by influencing the rest of the world to buy what the West is selling. As universities and cultural institutions from the West seek greater access to the untapped resources of other industrializing countries, they present, under the guise of Western prosperity, a set of circumstances that serve only to destroy culture. Those values

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effectively destabilize traditional civilization.

Strong commercial interests are aligned with economic exploitation via the imposition of hyped-up contemporary architects on the rest of the world. Governments mistakenly believe that they are doing good for their people by erecting "showcase" buildings such as museums by internationally famous architects. Instead, they are letting in agents of intolerance, paving the way for an extinction of the local architectural heritage. Young persons are exposed to promotional images of design in schools and the media, and are told that this is what they must value from now on. They are indoctrinated to hate and destroy traditional architectural expressions — as something noble to pursue. Many people correctly blame the West and powerful local interests for turning the country's young against their own culture. For the wealthy Western nations, teaching nihilism is just another silliness of contemporary society, along with pseudo-art that intentionally profanes God. But developing countries stand to risk all they have — their traditional art and architecture — in imitating the West on this point.

Our proposals for education reform would immediately stop teaching hatred of one's own architectural heritage and culture. No crime is more unpardonable than parricide — killing one's own parents. But how do we judge an architecture school that teaches students to despise their own heritage, and instills in them an eagerness to destroy it? The target is the society that brought forth those individuals, in a shared responsibility with their biological parents. We read with alarm about Bauhaus images and practices introduced into the architectural education of developing countries. The press announces these as "progressive" moves, little realizing what danger that poses to that country's tradition.

Architecture and Science

A great deal is gained from utilizing scientifically-based knowledge as a new paradigm of how to teach architecture. The way to re-establish architecture as a knowledge-based discipline is simply to rebuild its knowledge base. Without a knowledge base grounded in the reality of human perception and science, architecture remains open to corruption and is prey to the whims of ideology, fashion, and the cult of the individual. Making allowances for the inherent differences between architecture and science as disciplines, there are many lessons to be learned through the immediate juxtaposition of their intellectual structures.

Science and scientific enquiry operate through the application of an accumulated knowledge base. Scientists undertake research desiring to extend their discipline's corpus of knowledge. They meticulously document successful results of their investigations for inclusion into the greater body of knowledge. To this end, scientific disciplines develop languages for this explicit purpose over time, to enable transcribing and saving discovered knowledge for posterity. Knowledge itself rests upon having efficient information storage systems. This process of documentation allows scientists to build upon previous discoveries. It saves having to reinvent the wheel every time one needs to perform a basic application.

Science also has a mechanism that allows one

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to sift useless or outdated information from the working corpus of knowledge. A theory that is superseded or proven wrong is immediately discarded or consigned to having strictly historical interest. This replacement occurs because a better method than the old one is found THAT EXPLAINS THE PHENOMENA. Science is therefore constantly expanding its information base, while maintaining its order and relevance in a compact corpus of knowledge. This process exists through an ordering and compacting of scientific information, much as libraries develop a coherent ordering system to handle enormous and steadily increasing amounts of information. Knowledge can only be useful if it is easily retrievable, and that depends upon having an efficient systematization.

By contrast, architecture has yet to develop an effective system of ordering its inherited information. In fact, what happened in architecture is unthinkable in the sciences: sometime in the 1920s, in their quest for design innovation, a group of ideologues arbitrarily threw out architecture's informational basis. The excuse for this elimination was to help the discipline to venture off into new territories. Those wanting to do this in the name of innovation felt no obligation to conserve the knowledge previously developed or discovered. Obviously, since those individuals felt no need to document inherited information, they also considered it unnecessary to develop an ordering system for current knowledge. Ever since, architectural innovation has been judged to be successful strictly by how completely it disregards previous knowledge.

Paradoxically, this devastating practice has led to the accumulation of both rigid dogma and a plethora of mutually contradictory styles.

Architects failed to develop or implement an ordering system even for architectural styles that they deal with and refer to daily. Champions of each distinct style fight against the other styles, declaring them to be useless, outdated, or morally indefensible. This irresolvable dispute is the source of tremendous systemic conflict and instability (which hinders instead of encouraging development). Styles are validated only if approved by the discipline's self-appointed "taste makers", a defensive gesture to make architecture more mysterious and unavailable to those who are not tutored in its multifarious "theories".

Scientific debate, on the other hand, while it can become quite contentious, has strict guidelines for resolution. The scientific criterion for validity is whether any knowledge works to explain phenomena adequately, and whether in the process it creates or establishes something of value to humanity. Scientists abandon an old belief even though it may be supported by a large number of followers, if it fails to explain observed structures. Conflicts can be intense, but are usually brief. Eventually, scientists reach a consensus on an experimental basis.

If we adopt the scientific approach, we drop nothing arbitrarily from a discipline's informational store. Most architects don't yet treat architecture as a scientist would, since they refrain from looking for its evidence base. The catastrophic loss of urban and architectural information that occurred following World War II, implemented by modernist-trained teachers taking over architectural schools, would never have been allowed to occur if we had followed a scientific model in determining our architecture. Derived knowledge is far too valuable to throw

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away capriciously. Older knowledge can be superseded only by an updated explanatory framework — not by unproven ideas or opinions. Again and again, we return to the need for a set of evidence-based criteria for judging what is valuable in architecture.

In typical courses of architectural theory, a collection of mutually contradictory and oftentimes obscure readings leave a student bewildered about what is relevant or irrelevant. Yet, all are presented as being equally valid, since they are included in some authoritative anthology (see the later section entitled **Intellectual (dis)Honesty**). Students are not given any criteria for judgment: indeed, neither their professor, nor the author of the anthology would dare adopt any measure that makes such a judgment possible. Doing so would be perceived as preferring one point of view over another, hence undemocratic. Nevertheless, this flawed notion of plurality unravels what any intellectually-developed discipline has found necessary to evolve. Outdated or discredited notions that keep reappearing in architectural readings should finally be allowed to fade into obscurity. Without a criterion of what is valid or not, architects cannot really allow anything to drop if it is associated with a reigning ideology. This means that they endlessly perpetuate useless intellectual bric-a-brac.

Diverse styles can indeed be tied together by the commonality among positive solutions that each has to offer (Salingaros, 2006). Introducing a theoretical classification of architectural typologies is an essential part of the new curriculum. Such an explanation ties together diverse styles from among competing contemporary movements, and from those

developed in the past. Some of these styles are judged inadequate because they do not serve human needs, and the faculty of existing architectural programs must be prepared for this. If one looks carefully, one discovers that many of the unstated principles in use today are not founded on anything architectural, but rest strictly on ideological arguments. Architecture can never go forward if it continues to blindly support design dogmas.

PART 3. PRIMARILY FOR ADMINISTRATORS: OBJECTIVE LACK OF RELEVANCE FOR THE WORLD WE BUILD RESULTING FROM VESTED INTERESTS.

The Looming Threat of Irrelevance

Architectural academia has taken on a life of its own. In trying to teach architecture, it is propagating a certain set of beliefs and practices. Many of these are antithetical to good architecture. Builders realize that architecture schools no longer train graduates to function as architects. As long as the universities themselves see no need for change, however, they will continue to harbor academic architecture because it attracts paying students. It doesn't matter what those students actually learn… It is therefore only a matter of time before independent institutions take over the training of young architects. Those graduates will eventually replace the graduates of established architecture schools that follow the present system of training. Two generations of academic architects will become redundant, since their training precludes their ability to teach adaptive architecture.

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The emphasis in architectural education on contemporary images, supposed innovation at the expense of inherited knowledge and prototypes, unlimited personal expression (but only as long as it fits within the approved models), nihilistic philosophy, and contemporary relevance as defined by fashion seems to be destined towards one goal: to train students to produce structures in a specific style. Models produced in studios therefore tend to be generated within a severely restricted design vocabulary. The students learn subconsciously how to produce models and projects that lack the identifiable characteristics of life, humor, or joy seen in both natural structures and in traditional architectures and artifacts. Already, it is the first employer of an architectural graduate who is the source of practical architectural training. It is common knowledge in the profession that fresh graduates have their heads filled with useless images and are totally ignorant of basic techniques.

We (the authors) are in contact with several groups of educators around the world readying alternatives to established university architectural training. Those alternatives include establishing schools outside existing universities, and transforming existing architecture schools. Such efforts in the past were chiefly directed at teaching more traditional design skills, and the architectural establishment sabotaged them (Salingaros, 2007). The time has finally come for massive change, however, and this new effort by those who are planning innovative programs is positioned to bypass "academic architecture" altogether. This is not an ideological movement so much as a market-driven one: architecture firms are begging for well-trained graduates who know how to design traditional buildings

and environments. Those firms are simply responding to overwhelming client demand. In addition, we are seeing a surge in expectations from the parents of university students that their children be provided a more practical body of knowledge, which will allow them to be more competitive upon graduation. This pressure is already being felt at most universities throughout the world as they compete for new students, and for the revenue those students bring.

Prominent architectural offices now prefer to invite lecturers, rather than send their staff to the local architecture school. This measure is a response to the desperate situation in getting useful real-world training. The current faculty in architecture schools simply does not offer (and in many cases does not know) the information that the firm needs in its practice. Those firms are setting up in-house continuing architectural education programs, so far informal, but many larger offices have plans to expand these as an integral part of training their staff. Such educational programs within an architecture office could become the seeds for replacing the current dependence upon schools of architecture for all training.

The future opens up exciting possibilities for training a new generation of architecture students to be better architects and urbanists than their predecessors in the late twentieth century. The most optimistic expectation for substantial change from within the system in the institutions that train architects is 20 years. Schools outside established training programs will, given the need for architects well-versed in their craft, eventually supercede existing institutes — perhaps in as short a time as

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five years. Universities so far appear blind to the institutional factors responsible for these problems. Most discourage constructive change out of a desire for things just to run smoothly according to an established model. The higher university administration keeps its hands off internal affairs in the architecture schools, thus allowing inertia to rule. Department chairs hire supporters who work in the standard areas but are afraid to hire someone who does truly innovative work, someone who might challenge established opinions. Faculty committees select new faculty members, choosing people most like themselves. The result is uniformity of thought, an insular mentality, and an impregnable defense.

Program Accreditation

In U.S. programs, the Master's of Architecture has become, for the most part, the accredited degree for professional licensing. One expects therefore that criteria for curricular models at this level would be practical in nature, and geared to teaching the practice of architecture as a profession. An examination of existing programs, however, reveals a dearth of practical knowledge in recent graduates. The practical measure of what is taught in the current Master's degree is more than surpassed by the undergraduate curriculum of the new intelligence-based architecture. By contrast, we consider philosophical enquiry and abstract theory, which play a weighty role in the existing Bachelor's curriculum, as more appropriate for the study of architecture at a Master's level. For such courses to be of any value, we believe the student has to be more mature and actively prepared so as not to be misled or confused by ideology.

The accreditation of the professional degree of architecture at a Master's level is meant to place architecture as a profession on a par with law and medicine. This leads to a requirement of a Master's degree in order to become registered. Nevertheless, the current education system confuses and frustrates students, given the reverse order of how it sequences the study of architecture. After having been taught for four years to challenge any and all conventions of architecture and the built environment, the current Master's program, as a capstone, teaches just enough about the practical dimensions of architecture to satisfy accreditation criteria, but not enough to reconcile the early conditioning of students carried out within the existing undergraduate curriculum. Our proposals resolve this inherent contradiction. They lead to an undergraduate education that supports professional knowledge skills. Students who can only afford the four-year degree will graduate with an effective knowledge of architecture that can be immediately applied in their employment as junior architects. Students who undertake further study follow a program that teaches them how buildings actually work to engage and inform humans through their physical form and construction. Students' creative explorations at the Master's level thus rest on the knowledge that their designs are something that can actually be built, and which will provide the requisite information content humans need in order to establish a sense of wellbeing.

The National Architectural Accrediting Board (NAAB, 2004) has set forth educational criteria that reflect upon many of the issues we have identified. In addition, NAAB maintains a continuing dialogue with the *American Institute*

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of Architects (AIA) about the knowledge, skills and abilities of architectural graduates. Nevertheless, the academic institutes, whether through influence, power, or arrogance, more often than not continue to teach an ineffective creativity. When the time comes for a review of their degree program, much effort is needed to frame their pet classes and ideologies into an argument for having met the established registration criteria.

NAAB is beginning to see trends in the business of architecture wherein architects are being relegated to the limited capacity of designing or decorating building façades for engineering firms or developers. The balance of the design process is left to those individuals who possess the best practical knowledge of floor systems, wall systems, curtain-wall systems, store-front systems, and the like. This situation (professional marginalization) stems directly from the education architects are currently receiving. American architectural firms have come to expect that they will have to teach the practical application of their profession to all new graduates, since most simply do not know enough about materials, structures, and systems of assembly to direct the design and construction of real-world projects. Thus, the building industry is rightfully beginning to relegate architects to a secondary role. While there are attempts within the curricula of most architecture schools to meet some national accreditation based upon what they believe to be real knowledge, it is the descendants of the existing model of teaching that are policing the educational efficacy of these schools.

An additional concern is the entirely unintended role that NAAB may be playing to discourage educational innovation and reform. University administrators correctly view program accreditation as their most important priority. Nevertheless, nervous academics fearful of risking their school's accreditation become ever more reluctant to try out new ideas, even if they personally see their merit in fixing the flaws of the current system. Needed reforms are postponed indefinitely because they do not fit into the explicit NAAB guidelines. Innovators from outside the *status quo* are seldom, if ever, hired to teach; instead available positions are offered to candidates who simply fit the mold even if their work brings nothing meaningful to the education process. The result is inertia.

NAAB maintains its position by certifying programs that ostensibly meet their requirements, even though many of those programs fail to produce architects who can enter the professional world effectively. But students hoping to become practicing architects have no choice but to attend a NAAB-accredited school. Equally disconcerting is a trend we have begun to see in non-Western architectural programs that embrace the structure provided by NAAB as a model to copy. If Western architectural programs are demonstrably ineffective, why should they be copied? And even if the programs were effective in the West, why should we assume they would be adequate for other cultures and circumstances? While we applaud the efforts of both the NAAB and the AIA, we must recognize the shortfalls of the existing system if we hope to overcome its limitations.

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Politics, Philosophy, Critical Theory, and Human Perception

Evolutionary compulsion forces human beings to establish a system of relationships between the physical body and the human mind's mental perceptions, which enable us to experience the world and our existence. These relationships provide us with our sense of wellbeing, our sense of belonging, and our deeper sense of who we are. Through the physical and the visual aspects of human perception, the body managed humankind's earliest interactions with the world. Evolution developed a neurological structure in humans by which they could negotiate the immediate conditions of their lives. Through the surrounding informational fields — physical and visual information embedded in the natural structure of the world — humans successfully evolved to construct artifacts for living. These creations range from jewelry, to furniture, to buildings, and ultimately to cities.

As the human mind continued to develop through the impulse of emotion, there came a point where humans were able to manufacture abstract ideas and thoughts, outside the physical reality that confronted them on a daily basis. The schism between the subject/object natures of perception permits the manufacture of an alternative reality. This mental capacity has been the protagonist of human thought and enquiry for millennia — leading to some of the greatest achievements of the human mind — at other times it led humankind towards the greatest atrocities imaginable. During the last century, architecture — as the formation of a world outside our bodies — has been consigned by contemporary doctrine to the intellectual creations of a purely subjective mind.

The informational fields that surround us are more important today than ever, given the dependency of students on image-based learning. Supplanting natural information by intellectual abstraction effectively removes the essential informational content needed for human engagement with the outside world, replacing it with blank walls. Throughout the twentieth century, one of the important situational constructs that enabled architects to substitute images for what is real was their ability to use the written word to subsidize their informationally-poor structures. So began a long history of political and polemical texts operating as the philosophical surrogate for embedded knowledge, which was henceforth lost from the built world.

Architecture schools now rely heavily, if not exclusively, on loosely-construed philosophical postulates for educating their students. Schools proffer philosophical doctrines (we cannot call them theories) in the absence of intelligence-based design and direct human experience. The way philosophy is currently taught to architects tends to mix political ideology with idiosyncratic and subjective insights into society, and this muddled mess is presented as a theoretical basis for architectural and urban design. This practice is a terribly dangerous mix, as it gives students a perverted and erroneous, if not fraudulent basis for their profession. Students are normally unable to separate what is useful analysis from what is political rhetoric and so learn little or nothing about buildings and cities.

Certain authors on the political left provide a picture of what is wrong with aspects of contemporary society, offering useful critiques from outside the capitalist economic system.

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Nevertheless, their proposed solutions are the same unworkable utopian dreams that have in the past led to totalitarian states. One stream of philosophy running throughout contemporary architectural education goes back to the Frankfurt School, which introduced "Critical Theory" into philosophy. The essence of this 1930's movement was to apply extreme anti-traditional prejudices to the new industrial society of the post World-War-I era. The original Marxist authors proposed radical social change through revolution, technology, and the subjection of the individual to collective class structure. They declared tradition to be the enemy of progress, a position that of course included all architectural traditions. Historical notions of beauty were condemned, while art was to be produced henceforth though the negation of universal truths, inspired instead by contradiction, despair, and the shock of human suffering. Schools inherited this prejudiced approach to analyzing built form, in many writings that bear the epithet "critical". Such texts are not helpful in designing buildings but only in the formation of ideological tenets.

Independent of the written legacy of Critical Theory and the Frankfurt school, the post-war tradition in architecture and the arts has inherited the misdirected anger and desperation of 1930's European intellectuals. Those individuals were reacting against earlier class oppression while being threatened by the rise of Nazism. After the Second World War, those same intellectuals reacted to the horrors that had just been perpetrated by casting the blame onto traditional society and its humanistic architecture. These extremely powerful emotions survive in a visceral hatred of traditional architectural forms — an indignation that is transmitted to architecture students today through Pavlovian conditioning.

Even though the majority of architecture professors are not overtly political, and even less declared Marxists, architecture schools have been dominated by a philosophy that arose from the radical political left. Critical theory and its architectural derivatives (which represent ideology rather than theory) continue to dictate architectural texts. Students lack sufficient knowledge to recognize when fourth-generation derivative authors talk about architecture using hidden agendas about the supremacy of technology, class struggle, and abolishing traditional society. While this ideological objective is never made explicit, it colors supposedly theoretical expositions and situates itself in the values of students. After all these years, few people have caught onto the original deceit: while pretending to censure the aristocracy, this rhetoric in fact reviled all of popular vernacular architecture, to boost the personal careers of the Bauhaus members. Now the very same system is used to prop up an architectural elite.

Critical Theory has had its most insidious effect on architecture with the spread of the doctrine known as "Critical Regionalism". Proponents of this self-contradictory ideology assert that vernacular tradition and culture are dead, and that henceforth, regional architecture must adapt to modernist uniformization. They proclaim that the patterns and practices from which a region's identity is derived are mere "nostalgia", and instead recommend the abstract aesthetics of international modernism (Cassidy, 2007). Any architectural expression, other than those possible within the restricted

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modernist aesthetic, is rejected. Those writers' avowed intention is to create forms that do not belong to the vernacular form language. What results from this schizophrenic approach is not regional architecture in any sense, but a set of self-referential objects detached from their cultural roots, created and manipulated without regard to their regional context. (One occasionally sees an attempt at site-specific climatic adaptation, but nothing more).

Teachers thus use purely ideological arguments to validate a narrow set of design styles for students. That is as wrong as it is unsupported. It is only a means to further sustain a cult ideology that has dominated architectural education for the past several decades. The point is that good architecture and urbanism have nothing to do with political beliefs. Worst of all, teachers apply techniques learned from political ideologues to coerce students and other academics into intellectual submission. Such forms of censorship are typical of a system that considers itself above all others. It gives itself the authority to re-frame every member's worldview. Whenever evidence is ignored, and is substituted by the irrational, that creates dogma. This erroneous style of teaching has become solidly established in today's system.

One way to maintain the mystique of "architecture as an art" was to embrace ever more abstruse and incomprehensible texts, so as to shield the discipline's shaky intellectual core from outside scrutiny. This obsession (or defensive tactic) has led architecture to embrace the nihilistic and deconstructive philosophers. Having architecture students read Derridean and Deleuzean philosophical texts disorients them, breaking down their

critical faculties. Such disorientation could in fact be deliberate: a necessary psychological preparation for imprinting stylistic preferences in their minds (Salingaros, 2007). Throwing the burden of teaching architects onto obscure philosophical texts enables architecture schools to endorse a very narrow set of design styles, embracing those currently in fashion.

The common justification given for studying philosophy is that architecture and urbanism are intimately tied to social phenomena, so that philosophy prepares a student to confront architectural problems. This explanation is a subterfuge, however, operating more as a means to avoid teaching architecture to students directly. The modernist teaching method, wherein all useful derived knowledge is thrown out in the *tabula rasa* approach, cannot openly admit that architectural and urban knowledge ever existed. If it did, then someone would have to explain how over 2,000 years of knowledge was lost, discarded, or ignored during the modernists' 70-year reign. By diverting architecture students towards carefully selected philosophical authors, this action conveniently covers up the deliberate avoidance of any genuine, newly-derived or historically-relevant architectural theory.

So much of what now passes for "architectural theory" is therefore little more than doctrine. It conditions students to have absolute faith in a body of beliefs established in the absence of real-world criteria. Those beliefs set up the student's worldview as shaped by the dynamics of in-group affiliation: a cognitive filter that bends information to fit, and rejects information that does not fit. Architectural education must in the future clearly separate architecture from

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politics, and also separate architecture from self-referential philosophy. Only teachers can train their students to do this. Both teachers and students can achieve this clarity of thought only after they understand the genuine theoretical basis of architecture, expressed in strictly architectural terms. Schools have a responsibility to teach a genuinely architectural basis for design.

Architecture students should ultimately study philosophy, but that is productive once they have formed a basis of what is really going on in architecture. And the philosophy they study has to be positive and humanistic. Many philosophers throughout history emphasize the necessity for human beings to connect to the universe, but architects hardly ever study those authors. *Intelligence-Based Design* has deep philosophical foundations. Humanly-adaptive architecture and urbanism arise out of a respect for humanity's higher meaning in an infinite universe. There exists a vast body of philosophical work connecting humanity both with nature and with the sublime. One of our recommended texts, *The Luminous Ground* (Alexander, 2004) establishes a genuine philosophical foundation for an adaptive architecture.

Philosophers whose writings are essential for the sustainability of humankind try to understand otherwise puzzling human actions outside a strictly scientific framework. They help us to delineate good from bad in human activities. This historical notion of "morality" recurs throughout the traditional treatises on philosophy of the entire world. Numerous contemporary philosophers celebrate life and the sacredness of humanity. Traditional religious texts are founded upon morality stories that help humanity to see beyond the limitations of human beings existing as animals or purely subjective beings. But none of this is ever incorporated into architectural teaching today — which still turns to the same peculiar handful of (Western) philosophers, relying upon them to justify "architecture for architecture's sake". Judging by how inhuman its forms are, the driving ideology is purely nihilistic, even as it serves global capital.

The separation between nihilism and humanism is total and uncompromising, however. We have to choose very carefully which philosophers, and which texts to offer students for their reading assignments. A school cannot abrogate its responsibility by teaching architecture as a set of self-serving beliefs. In the twentieth century, architecture became a mass movement under the influence of leading architects who exploited specific philosophical texts to support their ideals and to promote themselves (Salingaros, 2007). Architecture detached itself from any higher order in human existence, turning away from both nature and from the sacred. It was the first time in human history that humans began to intentionally create unnatural structures that are uncomfortable to inhabit and to experience.

Intellectual (dis)Honesty

The discipline of architecture has garnered a dubious reputation among other disciplines as an arena where self-validating criteria perpetuate arguments of self-importance. Reified in the ideological premise of "architecture for architecture's sake", perpetrators of a pure

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architectural expression denounce program, function, purpose, and site — all practical measures. The expressions of its unconventional and unnatural forms are sacrosanct, so much so that architectural academia, the design industry, and Western media are compelled to consecrate its images through the institutes of capital and commodity. So unusual are the aberrations of fashionable architecture that many are fooled into thinking they are seeing genuine advancement in architectural thinking. Unnatural in appearance, images of fashionable architecture circulate the globe, establishing, legitimizing, and forging an esoteric language of design. As a result, the ideas that accompany these forms realized through ideology have become institutionalized in the modern education of an architect. To that end, architectural education has spent the past several decades insulating itself by way of its own internalized valuing system. This isolation has bred an exclusive community of like-minded persons who would rather, it seems, pursue a purely aesthetic expression of the built world in place of any practical measure the universe might hold.

By removing genuine architectural knowledge from the architecture curriculum, academics are better able to perpetuate their empty theories, indoctrinating defenseless students into their peculiar ideologies. Architecture schools that originally were part of the College of Engineering had to distance themselves from the scrutiny of more practically-minded people. They thus joined the College of Art, or became administratively independent altogether. Since their course structure was no longer that of engineering schools, it became very easy to water down the intellectual level and course

content. Nowadays, strong students tend to go into the sciences and engineering, whereas today's architecture schools attract the weaker or somewhat dysfunctional student by ostensibly promising four years of arts and crafts. True, at some point students are given impossible tasks that require they stay up working all night: this satisfies them psychologically, making them think they really did something. Through this experience, erroneously termed "design rigor", students can easily become convinced that they are gifted designers. The lack of sleep such exercises require only enables the deception.

It is time to explain to students some of the facts, as we see them, about the architectural establishment's support for the current crop of illustrious architects. These prize-winning architects appear to be principally seeking fame and profits, and are apparently willing to do just about anything to achieve their goal. This includes writing nonsensical texts and talking prattle to justify their otherwise absurd buildings. If those buildings were fine for human use, then it wouldn't matter what the architect utters, but many contemporary "showcase" buildings are in fact dysfunctional (Silber, 2007). We blame those architects for their work — but even more the clients who actually commissioned it. There is something morally wrong with selling a defective product, even if that is permitted in the amoral view of how capital markets work. Users might eventually outgrow their dependency on image-based designs, realize the deception, and stop commissioning non-adaptive buildings (it just hasn't happened yet).

We are alarmed that intellectual dishonesty begins at the top of the profession — with some of today's most famous architects — and

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permeates down into architectural academia. Lacking a solid intellectual basis as a discipline, architecture is exposed to the personal whims and political ambitions of its key players. These power games define the system's intellectual structure, a condition we refer to as "the politics of architectural discourse". There is purposefully no system of checks and balances, such as occurs in disciplines with a solid knowledge base like the sciences. Politics may play out in academic scientific departments, but the core body of knowledge survives these conflicts, and is transmitted to the younger generation. Architecture removed this guarantee when the Bauhaus scrapped the discipline's inherited knowledge. The Bauhaus teachers then took over both architectural education and practice worldwide, resulting in a resounding personal success at the expense of the entire discipline.

Overturning architecture's prior dependence on the natural aspects of materials and methods, formalistic arguments were substituted in place of direct observation. The Bauhaus studiously developed design techniques that REMOVED natural geometrical qualities from built structures. While Bauhaus readings might suggest that their design philosophy stemmed directly from nature as a source of design inspiration, the unnatural quality of their designs belies any such claims. Within the paradigm of *Machine-Age Design* (MAD) instituted by the Bauhaus teachers, new ways of teaching and evaluating the work of architecture students and practitioners created the basis for what was to come — a descent into self-congratulatory sycophancy.

Architectural academics have long utilized clever propaganda ploys in shaping students'

minds. They publish collections labeled as "Essential Readings in Architectural Theory", which are then used to teach entire generations of architecture students. The deception consists of two tactics: (*i*) proclaiming ideology as "theory"; and (*ii*) presenting the views of trendy contemporary architects and ideologues, with just one or two honest authors thrown in. This token gesture of inclusion is essential for misrepresenting the book as an unbiased selection, meant to educate students through broad exposure to different viewpoints. Teachers and schools fall for that trick. The preponderance of text in such books, however, is self-serving and irrelevant. The early, "historical" section is oftentimes limited to the Bauhaus authors — nothing before that; little or nothing outside the closed confines of the Western industrial aesthetic; little or nothing about the vast building heritage of humankind.

Turning to an analogy from history and politics helps us understand this phenomenon better. The removal of inherited architectural knowledge also removes the conditions for loyalty to the discipline. There is nothing left to be loyal to — other than individuals or an ideology — and thus the door opens wide for opportunism and systemic corruption. Abusing the democratic process, a small elite gained power, confined rewards and privileges to its own members, and set up a framework (or commandeered an existing one) to protect its power base. Mechanisms for accountability were diligently abolished. Loyalty is no longer towards the discipline, but only to the controlling elite. A larger entity to which people owe loyalty is always defined by some solidly-established historical ideals. Those foundations lend systemic stability, which in turn permits

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disagreements, innovation, and debate while preserving the sanctity of the discipline itself.

We are now witnessing a devious effort to co-opt our own work and the results of our friends. Clever members of the current establishment realize that a major new market is developing, and wish to "ride the wave" and establish a monopoly (which continues the old modernist monopoly). Those individuals are beginning to embrace our vocabulary and ideas, but only to subvert them so as to bolster their own cult heroes and ideology. Others shamelessly appropriate our ideas as their own, and use them in self-promotion. Architectural academics lecture on mathematics and the new sciences applied to architecture; algorithmic design; adaptivity and sustainability; nature and the human dimension; the sacred aspects of built form, etc. Such efforts are dishonest when judged by their concluding line: they promote the same set of nihilistic architectural heroes. Appropriating the ideas of intelligence-based design in order to twist them to opposite ends is simply an exercise in deception.

Even allowing for temperamental differences between artists and scientists (and treating architects as artists, which is the way they prefer it), the behavior of many of the West's key architectural figures tends to be rather sordid. Their lives and actions are marked by dishonesty and a lack of personal morality. No comparable behavior is to be found among, say, famous doctors throughout recent history. Famous architects court unsavory powers and regimes in search for commissions, apparently not bothered by any moral conscience. Worse of all, such historical facts are suppressed by architectural academia, which is complicit in covering up the ugly deeds of its famous names. By presenting these individuals as models, architectural academics have been offering a great lie to their students and to the rest of the world.

Conclusion

Contemporary architecture has become an esoteric language, framed within a self-perpetuating argument rolled into an ideology, which sits above reason and rational purpose. At the heart of its argument is the appropriation of all ideas and information through an aesthetic paradigm. But we know — and soon the rest of the world will know — that if architecture is to sustain humanity, it has to be fundamentally based on structural principles found in the physical universe, supplemented with a deep understanding of the human psyche: of human needs, activities, and perceptive mechanisms. Contemporary architects fool themselves into believing that philosophy or ideology can substitute for these. Engineers and other construction professions are beginning to bypass the ineffectual dimension of architectural philosophy; capitalizing on its inability to work through realistic problems and leaving architects with less and less work to do.

As we structure a new educational model for the future it is important that we set forth on the work-to-be-done with a newfound (or rediscovered) paradigm. This paradigm reveals a greater concern in the workings of the human mind than the formal ordering systems of the twentieth century allowed. Beyond the party line of the *tabula rasa*, this new approach seeks to leave in place those elements and structures that imbue the built environment

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with a morphology that respects both time and space, both history and phenomenology. If indeed *Intelligence-Based Design* develops into a new tradition, it will sponsor forms of design that spring from existing conditions and traditions to render ever-greater expressions in the work of multi-cultural world architects and urbanists.

The future opens up exciting possibilities for training a new generation of architecture students beyond the conditioning of modernist architectural educational systems. We are calling for nothing less than a fundamental change to the discipline's basis. We do not expect that the changes we are suggesting will be immediately embraced and applied unilaterally throughout the academic and professional institutions of architecture around the world. But we hope that those among us who have the passion, courage, and vision to see a better way will begin to reconstruct architectural academia through *Intelligence-Based Design.* We strongly believe that *Intelligence-Based Design* represents a new model for the world. The reason is that its principles and governing sciences inherently validate all other cultural forms, traditions, and sensibilities. The dominating iconic forms of the reigning Western model, by contrast, effectively disrespect all architectures and cultures of the world except for their own.

Appendix I:
Detailed Curriculum for Intelligence-Based Design System for Architectural Education.

BACHELOR OF SCIENCE IN ARCHITECTURE

Freshman Year

Basic Design 1 & 2
Texts: *Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life* (Kellert, Heerwagen & Mador, 2008), "If I Were a Young Architect" (Polyzoides, 2007), "The Viseu Declaration on Architectural Education in the 21st Century" (CEU, 2004).
Content: The study and application of Biophilic principles in architectural design. Students will learn to discern degrees of human engagement with the natural world and how to make good choices towards positive human responses. They will work through full-scale models and physiological testing using their own bodies as feedback monitors. Projects will be established in increasing scales, and designs will consider pattern-based methods of design. This course will establish a pedagogical model of designing, building, and testing that will serve students well in their continued studies. The readings will establish the moral and philosophical foundations of architecture in an honest and ethical manner. (studio/lecture format).

Architectural Theory 1
Texts: *The Nature of Order, Book One: The Phenomenon of Life* (Alexander, 2001), *Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life* (Kellert, Heerwagen & Mador, 2008).
Content: The study of Biophilic principles and the recognition of the animating forces of material

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and form that proffer a sense of life within a structure, and a sense of human wellbeing in the built environment. Alexander's principles of connection will applied to architectural form, using his 15 fundamental properties and the "Mirror of the Self" test. Students will learn to see architecture as a necessary expression of the human dimension, which is at once physical, perceptual, and emotional. Architecture will be taught as an externalization of human biology, not an imposition of technology or ideology on living beings. This course will teach the geometry of life while instilling in students an awareness of its power to affect wellbeing.

Materials & Methods

Content: This course will provide students direct contact with construction materials and methods. Exercises in material logic and patterns of assembly will be introduced in conjunction with design projects. Students will study the properties and characteristics of materials specific to a region, and the physical and physiological cause-and-effect of material assemblies that develop out of material logic. The course will teach the effectual dimension of architecture through its immediate presence. Students will experience architecture first-hand with their own senses, and not from pictures. (requires extensive site visits).

Sophomore Year

Basic Design 3 & 4

Texts: *A Pattern Language* (Alexander, Ishikawa, Silverstein, Jacobson, Fiksdahl-King & Angel, 1977), "Restructuring 21st-Century Architecture Through Human Intelligence" (Salingaros & Masden, 2007).
Content: The study and application of human

patterns in design. Deals with the highly complex systems of overlapping geometries and phenomena found in architecture and urbanism, which serve to extend human consciousness outside our bodies in response to the needs and desires of life. Design is predicated on the multiplicity of human patterns: how humans collect, how they live, how they prepare their meals, and what they seek in terms of comfort from the world. Students will work to develop patterns for projects that include Biophilic concepts, through full-scale renderings of details, colors, textures, and surfaces. This course will also identify the necessity of universal scaling as part of our biological makeup, and teach students to re-establish the full gamut of human scales in structures within the built environment. (studio/lecture format).

Architectural Theory II

Texts: *A Pattern Language* (Alexander, Ishikawa, Silverstein, Jacobson, Fiksdahl-King & Angel, 1977), *A Theory of Architecture* (Salingaros, 2006).
Content: This course establishes the fundamental necessity of spatial organization based on patterns and gives explicit directions for design students to begin to engage intelligence-based design in their work. Teaches patterns in design as an extension of human neuro-physiological needs and connectivity. Provides an intimate knowledge of the physical building blocks of the natural world. At the same time, we will gain a greater understanding of other geometries and the role they play, when incorporated correctly, in effective form generation.

History of Architecture

Content: This is not a survey course about the

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history of architectural styles and ideologies. This course will utilize historic models to teach how these building were first built through the materials and methods of the time, and ask students to consider what it might take to build these buildings today with the tools and technologies we now possess. For example, would we be better able to build the Pantheon in Rome or the Duomo in Florence with new materials and methods that were then unavailable? And what effect would this have on the building's engagement with humans? The course will be taught through greater detail of select examples. Students will learn how materials and patterns worked together in the past to create the emergent properties that human beings sense as life in a building. Students will be asked to prepare actual drawings of historic structures, i.e. plans, sections and elevations, as well as large-scale models of details. This process will provide students with an intimate knowledge of these great buildings, and an understanding of genuinely human forms and geometries essential for future inspiration.

Junior Year

Advanced Design 1 & 2
Content: Students will establish evidence-based design criteria and a classification system for forms and surfaces that give either a negative or positive physiological response. By way of intelligence-based design projects, students will develop a detailed knowledge of physiological processes through which evidence-based results can be interpreted and later applied. This course will teach a sustainable form of intelligence-based design wherein students learn to more effectively situate their buildings

within the operational complexities of urban systems. This leads students away from the idea of architecture as a stand-alone edifice or urbanism as an aesthetic exercise, by revealing the negation of place that occurs through the contemporary pursuit of autonomous and insular forms. Students utilizing physiological sensors such as skin conductivity gauges, blood pressure monitors, etc. to measure the level of stress in an observer when exposed to good and bad examples of architecture, will see firsthand the immediate implications of the physical environment on human wellbeing. Physical and virtual modeling, as well as image-sequenced processes will be tested to determine their effectiveness on large-scale investigations. Students will be required to develop methods of documenting and evaluating the experiential dimension of architecture in an urban context. (Cross-disciplinary investigations with other departments such as the Psychology Department or the Medical School are highly recommended, as are multiple visits to urban sites within the immediate area) (studio/lecture format).

Architectural Theory III
Texts: *Architecture: Choice or Fate* (Krier, 1998*), Principles of Urban Structure* (Salingaros, 2005).
Content: The course work establishes a cohesive theory of urban design for students of architecture worldwide, based upon an appreciation of the best typologies from the past. Students will be asked to study historic and contemporary precedence-seeking design solutions that reflect the human necessity of place, and the effectual dimension of the built environment. From this, students will learn how enduring buildings and cities develop to contribute to the continuity and coherence

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of place, by providing greater connectivity instead of ruptures or fractures with humanity.

Tectonics and Structure

Content: Students will be taught the tectonics and structures of architecture through hands-on construction projects. They will be required to identify and critique systems of construction and their inherent detailed forms of assembly and structural geometries. By way of imaginary disassembly, students with consider the implications of such connective devices on the human perceptual and physiological sense of rightness. This course will require the assembly of full-scale detailed models showing the operation and performance of physical connections.

Senior Year

Advanced Design 3 & 4

Text: *The Nature of Order, Book Four: The Luminous Ground* (Alexander, 2004).

Content: Students will learn to recognize and cultivate emergent properties in their designs. Given design problems that operate at the highest level of culture and identity, students will seek to re-establish architecture on the deeper ground that human beings share with each other and with the infinite. This course will teach experimental techniques of objective judgment, operating methods for engaging animate forces, and strategies for transcendent design that work at all scales, for example on ornamental detail up to the scale of an entire city. (studio/lecture format)

Architectural Theory IV

Texts: *Nature of Order, Book 4: The Luminous Ground* (Alexander, 2004), "Harmony Seeking Computations" (Alexander, 2008), "Architecture: Biological Form and Artificial Intelligence" (Salingaros & Masden, 2006), "Restructuring 21st-Century Architecture Through Human Intelligence" (Salingaros & Masden, 2007).

Content: Students will learn the broader implications of Intelligence-Based Design and the processes of human emotional health that frame the experiential dimensions of the everyday. From this vantage point, an array of contemporary issues will be addressed, i.e., emergent urban patterns and building types, democratic planning and community participation, social life and healthy communities, and the role of heritage. Twentieth-century architectural typologies, and their associated ideologies, will be reviewed using the criterion of adaptability to human emotional needs.

MASTER OF ARCHITECTURE

This is a two-year graduate curriculum, to be determined by each school according to the school's immediate needs. We list only tentative titles of topics to be covered, along with some recommended textbooks.

Origins of Living Structure.

Texts: *The Timeless Way of Building* (Alexander, 1979), *The Nature of Order, Book 2: The Process of Creating Life* (Alexander, 2002), *The Nature of Order, Book 3: A Vision of a Living World* (Alexander, 2005).

Content: Patterns of being alive. Life in traditional artifacts, architecture, and urbanism. Alexander's "Mirror of the Self" test. Wholeness-extending transformations. The sequence of unfolding. Belonging to the world. The process

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of building uniqueness. Ornament as an essential part of the unfolding process. Form language and formal geometry.

Practical Urban Design and City Planning.

Texts: *A New Theory of Urban Design* (Alexander *et. al.*, 1987), *Suburban Nation* (Duany *et. al.*, 2001), *Smart Code* (Duany *et. al.*, 2007), *New Urbanism and Beyond* (Haas, 2008), *Principles of Urban Structure* (Salingaros, 2005).

Content: Code-based urbanism and Neo-traditional development. Network city planning. Sustainable development. Interventions to combat sprawl. Retrofitting the suburbs in an era of scarce oil. Commercial architecture in today's world. Informal housing and favelas. Self-organizing urban systems. Minimal interventions in social housing.

Classical Architecture for Today.

Content: Foundations of Classical design. Origins of the Classical form language in wooden construction. Theory of proportions. Neo-classical typological evolution. Adaptations for different climates and societies. Colonial architecture.

Hands-on Islamic Architecture.

Content: Principal typologies and archetypes based on tradition and religious practice. Variation and adaptation of regional form languages. Techniques and methods using contemporary construction methods and materials. Islamic models for today's building typologies.

Algorithmic Sustainable Design.

Texts: "Harmony-seeking computations" (Alexander, 2008), *The Nature of Order: Books 1, 2, and 3*

(Alexander, 2001; 2002; 2005).

Content: Recursion and the Fibonacci sequence. Universal scaling. Fractals and the Sierpinski gasket. Perforation, bending, and folding: the "push-pull" model. Universal distribution of sizes. Alexander's theory of centers. Cellular automata. Generating a Sierpinski carpet with a 1-D cellular automaton. Harmony-seeking computations. Alexander's 15 Fundamental Properties. Biologically-inspired computation and genetic algorithms. Emergent systems. Examples from Artificial Life. Symmetry production and symmetry breaking. Generative codes and their application to building and urban morphology. Duany-Plater-Zyberk New Urbanist codes and the Transect. Implementation of generative codes in design.

Appendix II:
A New Mathematics Curriculum for Students of Architecture: Directives for the Intelligence-Based Studio

A new service course put together by the Department of Mathematics will include all the mathematical tools relevant to Intelligence-Based Design. These include mathematical topics that are not very advanced in themselves, but which are not all taught in lower-level mathematics courses, even to mathematics majors. Some topics do come from advanced mathematics, but we only need the most elementary description of them, largely qualitative, to serve architecture students. It is convenient to bring them all together into a basic topics course lasting anywhere from two to four semesters. Here is a list of recommended topics.

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Functions. Logarithmic and exponential functions. Logarithm as the inverse of the exponential function. Graphing functions. Log-log graphs. Polar coordinates. Transformation between Polar and Cartesian coordinates. Archimedean and logarithmic spirals. Animal horns, snails, and seashells.

Power laws. Allometric growth and scaling. Inverse power-law distributions. The slope of the log-log graph.

Sequences. Arithmetic, geometric, and exponential sequences. Rules and recursion relations. The Fibonacci sequence and the Golden Mean. The exponential sequence $\{e^n\}$ and its approximate relation to the Fibonacci sequence.

Fractals. The Sierpinski and von Koch fractals. Cellular automata that generate the Sierpinski carpet. Cantor sets and space-filling curves. Sponges. Self-similarity on different scales. Fractal dimension. Inverse-power laws and fractals. Natural fractals, patterns on seashells, fern leaves, rivers, and the formation of cracks in materials. The box-counting method. Fractal properties of Classical and Gothic architectures.

Elementary graph theory. Nodes and connections. Topological equivalence among graphs. The simplest graphs of small order. Notion of a fully connected graph. 'Small-world' networks. The distribution of nerve cells in invertebrate animals. Random graphs. The Erdös-Renyi theorem on the sudden transition from an unconnected to a connected graph.

Information theory. Compression of information through redundancy. Irreducibility of information content. Comparison of random versus ordered information.

Symmetries. Reflectional, rotational, and translational symmetries. Glide reflections. Scaling symmetry. Counting the number of symmetries in simple arrays. Visual connectivity and the Harmony measure H.

Acknowledgements

References

Alexander, C. (1979). The Timeless Way of Building, Oxford University Press, New York, USA.

Alexander, C. (2001-2005). The Nature of Order, Books 1-4, Center for Environmental Structure, Berkeley, California, USA. Book 1: The Phenomenon of Life, 2001; Book 2: The Process of Creating Life, 2002; Book 3: A Vision of a Living World, 2005; Book 4: The Luminous Ground, 2004.

Alexander, C. (2008). Harmony-Seeking Computations, International Journal of Unconventional Computing, Volume 4 (in press).

Alexander, C., Ishikawa, S., Silverstein, M., Jacobson, M., Fiksdahl-King I. & Angel, S. (1977). A Pattern Language, Oxford University Press, New York, USA.

Alexander, C., Neis, H., Anninou, A. & King, I. (1978). A New Theory of Urban Design, Oxford University Press, New York, USA.

NIKOS A. SALINGAROS & KENNETH G. MASDEN II

Asquith, L. & Vellinga, M., Editors (2006). Vernacular Architecture in the Twenty-First Century, Taylor & Francis, London, United Kingdom.

Bothwell, S., Duany, A., Hetzel, P., Hurtt, S. & Thadani, D. (2004). Windsor Forum on Design Education, New Urban Press, Miami, Florida, USA.

Boyer E. & Mitgang, L. (1996). Building Community: A New Forum for Architecture Education and Practice, Carnegie Foundation, Princeton, New Jersey, USA.

Cassidy, T. J. (2007). Becoming Regional Over Time: Toward a Reflexive Regionalism, in: V. B. Canizaro, Editor, Architectural Regionalism, Princeton Architectural Press, New York, USA, pp. 411-419.

CEU (2004). The Viseu Declaration on Architectural Education in the 21st Century, Council for European Urbanism <http://www.ceunet.org/viseu.htm>. Reprinted as an Appendix in Bothwell et. al. (2004).

Davis, H. (2006). Review of Christopher Alexander's The Nature of Order, Book 1: The Phenomenon of Life, The Structurist, No. 45/46, pp. 22-28.

D'Souza, N. (2007). Design Intelligences: A Case for Multiple Intelligences in Architectural Design, Archnet-IJAR: International Journal of Architectural Research, Volume 1, Issue 2, pp. 15-34. http://archnet.org/library/documents/one-document.jsp?document_id=10102

Duany, A., Plater-Zyberk, E. & Speck, J. (2001). Suburban Nation: The Rise of Sprawl and the Decline of the American Dream, North Point Press, New York, USA.

Duany, A., Wright, W. & Sorlien, S. (2007). Smart Code, Version 9.0, New Urban Publications, Ithaca, New York, USA. < http://www.smartcodecentral.org/index.html>

Haas, T., Editor (2008). New Urbanism & Beyond: Contemporary and Future Trends in Urban Design,

Rizzoli, New York.

Joye, Y. (2006). An Interdisciplinary Argument for Natural Morphologies in Architectural Design, Environment and Planning B, Volume 33, pp. 239-252.

Joye, Y. (2007a). Fractal Architecture Could be Good for You, Nexus Network Journal, Volume 9, No. 2, pp. 311-320.

Joye, Y. (2007b). Architectural Lessons From Environmental Psychology: The Case of Biophilic Architecture, Review of General Psychology, Volume 11, No. 4, pp. 305–328.

Kellert, S. R., Heerwagen, J. & Mador, M., Editors (2008). Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life, John Wiley, New York, USA.

Krier, L. (1984). Houses, Palaces, Cities, Edited by Demetri Porphyrios, Academy Publications, London, United Kingdom.

Krier, L. (1998) Architecture: Choice or Fate, Andreas Papadakis Publisher, Windsor, UK. The student edition, published in 2007, is available from the UK <www.papadakis.net>. A new American edition is expected in 2008.

Masden, K. G. II (2006). The Education of an Urbanist: a Real Point of View, in José Baganha, Editor, The Teaching of Architecture and Urbanism in the Age of Globalization (The 2004 Viseu Conference), Caleidoscopio Ediçao e Artes Graficas, Casal de Cambra, Portugal: pp. 173-179.

NAAB (2004). NAAB Conditions for Accreditation for Professional Degree Programs in Architecture, The National Architectural Accrediting Board, Washington, DC, USA.

Olesen, P. J., Westerberg, H. & Klingberg, T. (2004). "Increased Prefrontal and Parietal Activity After Training of Working Memory", Nature Neuroscience,

NIKOS A. SALINGAROS & KENNETH G. MASDEN II

Volume 7, Number 1, pp. 75-79.

Polyzoides, S. (2007). If I Were a Young Architect, Archnet-IJAR: International Journal of Architectural Research, Volume 1, Issue 3, pp. 183-188. <http://archnet.org/library/documents/one-document.jsp?document_id=10277>

Salama, A. (1995). New Trends in Architectural Education: Designing the Design Studio, Tailored Text and Unlimited Potential Publishing, Raleigh, North Carolina, USA. Available online from <http://archnet.org/library/documents/onedocument.tcl?document_id=6330>. A second edition is expected in 2008.

Salama A. & Wilkinson, N. (eds.) (2007). Design Studio Pedagogy: Horizons for the Future, The Urban International Press, Gateshead, United Kingdom.

Salingaros, N. A. (2005). Principles of Urban Structure, Techne Press, Amsterdam, The Netherlands.

Salingaros, N. A. (2006). A Theory of Architecture, Umbau-Verlag, Solingen, Germany.

Salingaros, N. A. (2007). Anti-Architecture and Deconstruction, Second Edition, Umbau-Verlag, Solingen, Germany.

Salingaros, N. A. & Masden, K. G. II (2006). Architecture: Biological Form and Artificial Intelligence, The Structurist, No. 45/46, pages 54-61.

Salingaros, N. A. & Masden, K. G. II (2007). Restructuring 21st-Century Architecture Through Human Intelligence, Archnet-IJAR: International Journal of Architectural Research, Volume 1, Issue 1, pp. 36-52. <http://archnet.org/library/documents/one-document.jsp?document_id=10066>

Scruton, R. (2006). England & the Need for Nations, 2nd Edition, Civitas, London, United Kingdom.

Silber, J. (2007). Architecture of the Absurd,

Quantuck Lane Press, New York, USA.

Wilson, E. O. (2008). The Nature of Human Nature, Chapter 2 of: Biophilic Design: The Theory, Science, and Practice of Bringing Buildings to Life, edited by Stephen R. Kellert, Judith Heerwagen, & Martin Mador, John Wiley, New York, USA.

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