

Sustainability and Design: An Exploration into the Future of Industrial Design

It is generally agreed upon that the concept of sustainable world development employs three principles: environmental stewardship, social equity, and economic security. As a profession, we surely have a relationship to these tenants. Industrial Design needs to establish it's own context within the concept of sustainability. This paper will explore Industrial Design's current relationship by examining a series of trends beginning to impact the profession. It will specifically examine where we have been, where we are now, and how we might structure our future. My purpose is to expand our dialog so that we may better define our context. My main premise is that within the concept of a sustainable world society lie unprecedented opportunities for our profession.

Design's Early Visionaries of a Sustainable World

The concept of working toward a sustainable world society has been edging into our consciousness for some time. Victor Papanek and Bucky Fuller planted the seeds several decades ago. Papanek saw a moral imperative for the practice of Industrial Design to include all peoples. Fuller looked to science and technology to achieve the same goal.

R. Buckminster Fuller, world citizen, architect, designer, and Professor of Design at Southern Illinois University from 1959-1970, became a leading design visionary for a sustainable world society in the late 1960's. Bucky realized a significant component to the equation was how to optimize use of the world's resources. His approach to human needs of energy, food, housing, and transportation, was based on material science *and* design. *The ability to provide more performance per pound of material* was his primary approach. Practical applications of this approach currently reside within hundreds of geodesic structures around the world. Through material design optimization, he calculated how our finite resources could benefit more people.

These calculations were derived from research conducted at SIU, where he created the first complete inventory of the worlds' resources. Bucky used this information to develop his World Design Game, where players become resource representatives from all parts of the earth. Participants had the goal of trying to balance their regional resource needs with the needs of others. Playing this game drove home the realization that in order to meet competing needs, compromise through dialogue and planning was essential. The game underscored Fuller *and* Papanek's views that a sustainable society must include *all travelers on spaceship earth*. Bucky's plan is embodied in one of his most famous quotes.

“ To make the world work for 100 percent of humanity in the shortest possible time through spontaneous cooperation without ecological offense or the disadvantage of anyone”

More than 30 years have passed since Bucky's democratic world vision, and Papanek's voice of design conscience is now silent. As we debate our role within the context of a sustainable world, the effective use of current global resource requires some fresh perspective.

Dr. Phillip Harter at the Stanford University School of Medicine recently compiled a unique view of the current human condition. He shrank the world's population to a village of precisely 100 people to see how we are doing in some key areas. The following highlights are an edited list of his condensed world village. These findings should be of interest to anyone designing sustainable, global business strategies. The parenthetical remarks are my own.

- **80 villagers live in sub-standard housing**
- **70 are unable to read**
- **50 suffer from malnutrition**
- **1 villager has a college education**
- **1 owns a computer (but what the villager actually does with it is unclear)**
- **6 villagers possess 59% of the world's entire wealth, and they are all from the U.S. (and each owns at least one SUV)**

Papanek understood these realities better than most designers or business people. Bucky believed technology-driven design solutions would become the basis for making his vision a reality. However, I don't believe he predicted the accelerated growth of the world population and the rapid globalization of economies which have combined to create multiple factor increases in the extraction, distribution, and use of resources. The current long-standing U.S. economic expansion has fueled much of this growth, and our profession, like many others, is dependent on the economic health of people and their capacity to prosper. However, being engaged with the current 'good times' has made it easy for many of us to overlook several trends reshaping the world business community and our own profession. We need to better understand the nature and impact of these trends if we wish to shape our own futures.

Major Trends Impacting a Sustainable Future *and* Industrial Design

Trend #1: State of the World's Ecology

This first major trend relates to our ability to extract and process the materials we use in our designs. This in turn is linked to how we manage the earth's natural resources. Resource sustainability practices are based on an understanding of the current state of the world's ecology. One group dedicated to monitoring trends in the earth's ecosystems is The Worldwatch Institute. Included in their annual report are an examination of world resources and their current state of sustainability. Resources include air, land, water, plus all plant and animal species. If we take the view that the world's economy is like a closed ecosystem, we should begin to consider the implications of the institute's major findings for 1999.

- Nearly one half of the world's old growth forests have been harvested
- The world population will grow from its current 6.1 billion to approximately 8.9 billion by 2050.
- Arable cropland demand due to growing population centers is creating a major conversion of forests to land use for non-biologically diverse crop species.
- The average global temperature in 1970 was 57.2F. The 1999 average was 58.0F.
- Water aquifer depletion is in an unsustainable state of extraction for 480 million people worldwide.
- From 1950-1997 oceanic fish catch went from 19 million tons to 95 million tons creating unprecedented declines and near extinction's of many fish species.
- The past 20 years has marked an accelerating extinction potential for many plant and animal species. In 1999 11% of birds, 25% of all mammals, and 34% of all fish species were on endangered lists.
Leading cause of extinction: The destruction of habitats through human activity.

Bio-Diversity Reality: The earth's local ecosystems for all species have a synergistic dependency. As any regional ecosystem declines due to natural events or human intervention, the earth's primary ecosystem becomes more susceptible to entering a state of decline. Most earth scientists and biologists acknowledge this scientific reality. This reality is also the underlying framework for an organization called The Natural Step. In the next trend, I will highlight this group's influence on sustainable business strategies and the design process.

Taken individually any one of institute's findings may or may not pose an immediate threat to global economic activity and ecological health. When viewed comprehensively, over time, these ecological trends may transform our own livelihood along with billions of others. This overview helps frame the importance of the next major trend. Businesses are changing their methods in resource use for the creation of new goods and services.

Trend #2: New Business Models for Sustainable Growth

An increasing number of free market business people are beginning to understand the true relationship between current linear economic growth models and the world's ecological health. *Just what is our planets' capacity to sustain our existing, unlimited economic growth models?* Today, no one can answer that question with absolute certainty. Some businesses have already decided they do not want to be conducting "business as usual" if the answer leaves them few options. Many are busy creating and

implementing new business models that integrate sustainable strategies. Their goal is to achieve a viable form of sustained growth, while improving their environmental stewardship. They have learned from their own experiences that few sustainable options exist within the old models. The new models represent a fundamental shift in how they plan resource use for the creation of new products and services. The companies, the markets they serve, and our earth's environment are already benefiting from the changes. Our profession needs to become better informed about these new business models because they employ sustainable design principles. IKEA, a 7 billion-dollar corporation, has created such a new model. Their case study serves as a benchmark for how these changes are impacting Industrial Design.

IKEA, The Natural Step and Product Design

To many, IKEA's success in the international home furnishings market is a familiar business story. The underlying *design story* is how their environmentally based business model is transforming over 10,000 products. Denmark headquartered IKEA has been creating affordable home furnishings for over 30 years. Their original core business mission: *To create a better everyday life for the majority of people*. Their initial business plan targeted young families, couples, and students of modest space and means, through catalog sales. Mail order meant the design of knock down products for easy shipment and assembly. Their reputation for high quality furnishings at affordable prices fueled growth during the 70's and into the 80's.

During the middle 1980's and in the early 90's a series of negative environmental incidents impacted IKEA's business. European agencies in the process of enforcing environmental policy through product testing uncovered 'off gassing' of formaldehydes used in some of IKEA's high volume particleboard products. This resulted in fines and press articles. IKEA tried to attack the problem through their material supply chain, but failed. Meanwhile they experienced a major sales decline and damage to their reputation. They decided to embark on a comprehensive evaluation of their environmental practices.

A 1990 task force report detailed a number of key environmental problems, but concluded IKEA did not have the internal competency to address these issues. At about the same time, cancer researcher Doctor Karl-Henrick Robert was introducing new environmental planning through a recently launched group called The Natural Step. IKEA asked Dr. Robert to help them develop an environmental action plan. The plan was introduced to top management in early 1992. The task force first presented the environmental basis behind the plan and where the company was at that moment. Their summary: *IKEA was an environmental gangster, a threat to the environment, and they had no current potential for contributing to a sustainable society*. The previous year IKEA had distributed three million cubic meters of product material the task force termed "future waste". Dr. Robert then presented the principles behind The Natural Step framework as a way to begin to re-designing IKEA's relationship with the natural environment.

The main environmental stewardship principles embodied in The Natural Step's framework are now guiding product design at IKEA. All IKEA employees undergo comprehensive environmental training and their suppliers are given strict environmental specifications for all components. Vendor partners are encouraged to adapt IKEA's own environmental goals and strategies. This is sustainable business leadership from the top down that spreads laterally to everyone and everything connected to the organization. The principles guiding product design at IKEA flow from a main tenant of The Natural Step framework termed, The System Condition, which describes four basic environmental conditions of nature and our responsibility to other humans.

Condition #1: Substances from the earth's crust do not systematically increase in nature.

Our responsibility: Fossil fuels, metals, and other minerals must not be extracted at a rate faster than their redeposit into the earth's crust.

Design context: To what extent does a given design depend on relatively scarce substances?

Condition #2: Substances produced by society must not systematically increase in nature.

Our responsibility: Substances must not be produced faster than they can be integrated into natural cycles.

Design context: To what degree does a given design depend on persistent human-designed compounds?

Condition #3: The physical basis for the productivity and diversity of nature must not systematically be diminished.

Our responsibility: We cannot manipulate ecosystems in such a way that their productive capacity and diversity are diminished.

Design context: To what degree does a design depend on reduction of 'green' surfaces?

Condition #4: We must be fair and efficient in meeting basic human needs.

Our responsibility: Basic human needs must be met with the most resource efficient methods possible, including a just resource distribution.

Design context: To what degree does a given design encourage resource waste?

All IKEA product concepts are now evaluated based on these criteria. A recent example of new IKEA products employing these principles is a line of inflatable furniture named SoftAir. This innovative line combines performance, comfort, affordability, and user convenience while incorporating sustainable design principles. The durable product structure has been approved in Sweden for public use areas. Each piece needs only 15% of the materials and production resources required for a conventional item. Environmental impact of product transportation is reduced due to lightweight and minimal shipping size. The main air cells are made from fully recyclable Polyolefin. User convenience is multi-fold and the original corporate mission is reinforced in a dramatic new way. This type of design innovation is driven directly by IKEA's new sustainable business model.

Trend #3: New Industrial Design Methods for Sustainability

The IKEA example of product design represents a fundamental shift in product design methodology. Sustainable design can be measured. Industrial Design should be looking to incorporate new strategies and methods that will compliment these trends because success could produce unprecedented opportunities. If we wait too long, we may be handed our options and be relegated to bit player status.

Before examining the next major trend, we should recall how just how easy it is to be left out of our own evolution. A case in point is computer aided industrial design software. Better planning ten years ago would have resulted in today's CAID software being more 'designer friendly' and intuitive to our process. Fortunately, I believe we are at precise moment in our history when we can purposefully shape our roles. The methodology employed in **EcoDesign** represents such an opportunity.

Ecodesign and Sustainability

This relatively new design process tool is derived from the principles of environmental stewardship found in The Natural Step and sustainable business models. The emerging field of Industrial Ecology has also provided a major portion of the framework. The heart of the process uses Product Lifecycle Analysis (PLA) techniques for evaluating material flow and their environmental impact throughout a product's useful life or for any commercial process. These process tools structured as Ecodesign allow designers to measure the environmental impact of any concept. The information evaluation step directs the design team to alternative environmental design strategies. Ways to quantify an analysis come from European created Eco-indicator factors, which are numerical values representing environmental impact of specific materials. This entire methodology is described in detail within the IDSA publication Business-Ecodesign Tools. The IDSA Environmental Responsibility Section created the piece with the help of member experts. This design process tool is rapidly gaining currency throughout the world design community. In the U.S., the prestigious IDEA competition sponsored by IDSA and Business Week has placed ecological issues on an equal plane with traditional business and design criteria. More and more companies are beginning to develop sustainable business models integrating Ecodesign practice. To better understand this trend we will examine the roots of Ecodesign.

European Groups Lead the Way

Many Ecodesign based organizations have their roots in Europe. This isn't necessarily because Europeans have better environmental values than we have in North America. Europeans have always dealt with space and natural resource limitations. On balance, they pay more for finding, processing, using, and disposing of resources so consumers and businesses have strong economic incentives to optimize their use. In addition strong legislation and environmental standards groups are combining to impact resource management. In short, it has been a *natural* process for Ecodesign to bloom in European soil.

The best known Ecodesign entity in Europe is the "o2 Network". This network consists of a group of international design professionals with a wide range of theoretical and practical experience with sustainable design. Their agenda is simple. They provide information and ideas that help designers worldwide develop new product and service strategies using sustainable methods. Their web site is a virtual clearinghouse for all that is Ecodesign. People, case histories, organizations, practices, conferences, competitions and a myriad of links are all major information components at their site. Philosophy, theory, and methodology are also debated among members who represent some of the brightest design thinkers in the world.

An active member group of the o2 Network is PRe, "Product Ecology Consultants". PRe developed the eco-indicator factors used in the IDSA Business-Ecodesign Tools publication. They have recently published updated eco-indicators covering more materials and ways to improved process accuracy as compared to the original 1995 standards. This latest information (PDF formatted online) is the best available for quantifying the total environmental impact of any new product concept.

Ecodesign Research Down-Under

One key to establishing credibility in any developing field is to advance theory and practice through research. In Australia research is occurring for the process of Ecodesign through academic and business collaborations. The Center for Design within the Melbourne Technical Institute is testing and developing new process tools in partnership with several Australian durable goods companies. The emphasis is on the redesign of existing resource-intensive products like dishwashers. Institute resources integrate Industrial Design students and engineering students from various disciplines. Students work teams work with instructors, design consultants, and client team members. Results to date include a series of redesigned products incorporating the theories and practices developing at the Center. The Center for Design has documented some of this research through the publication and video entitled "EcoReDesign".

Ecodesign Developments in North America

Ecodesign issues have registered with many U.S. companies like 3M, Weston, Ben and Jerry's, and Xerox. Individual case histories of these and other companies, large and small, are reviewed in detail by Paul Hawken in [The Ecology of Commerce](#), by Jacquelyn Ottman in [Green Marketing-Opportunity for Innovation](#) and by David Wann in [Deep Design, Pathways to a Livable Future](#). These authors, and many others, explore the new opportunities for U.S. businesses to create both sustainable futures and competitive advantages through environmental stewardship. These companies all recognize that current environmental resource practices will become their lifeline for future growth. But they also realize it is a significant challenge to alter lifelong practices and habits.

Overall, the evolution of sustainable business practice in the U.S. appears to be moving slowly. Short-term financial incentives are outweighing long term payback strategies. Our relatively low cost methods for extracting and processing natural resources have prevented many companies from considering green product development as a major part of their long term planning. The low cost model will prove to be "an illusion over time" according to Paul Hawken. He explains that we are not accurately accounting for the hidden costs of our earth's capacity to renew and regenerate future resources. Still, there are other encouraging developments in the U.S.

- IDSA's Environmental Responsibility section is actively pursuing action items serving society members through surveys, publications, and speaker programs.
- U.S. based Green Design marketing consultants like Jacquelyn Ottman are emerging as resource partners for U.S. businesses.
- Several U.S. based design firms specializing in Ecodesign processes and sustainable strategies, like "Informing Ecological Design, LLC" and "Sustainable Products, Inc."; are raising their profiles and expanding influence with domestic and international clients.
- U.S. Ecodesign research, through corporate collaborations with U.S. design educators and their students, is beginning. *A benchmark project* was recently completed at the University of Washington's industrial design program. The "Whole Product" design project was structured by ID Professor Louise St. Pierre to help students rethink local products using ecologically sustainable design strategies. Corporate participants included the Microsoft electronics group, REI outdoor wear group, and the Resolute lighting company. The project also integrated domestic and international Ecodesign experts and other design educators who contributed their philosophies and experience. The project produced major shifts in the design methodology thinking of the students and afforded sustainability insights for participating companies. The results are currently being summarized for publication.
- U.S. sponsored international Ecodesign competitions for students and professionals are increasing in scope, frequency, and profile.
- A shift is underway in how many U.S. companies view their environmental responsibilities. Many high profile U.S. corporations are adapting the ISO standard 14001. This standard outlines methods for planning, implementing and monitoring environmental stewardship policies.

Ecodesign and Industrial Design Education for Students and Practitioners

In the U.S. it has taken our profession decades to earn the respect of business partners and the public. This respect has been achieved through a focused education effort conducted by IDSA, its members and through partnerships with entities such as Business Week. The investment in education is starting to pay large dividends. IDSA President Mark Dzierzk characterizes our recent growth as "entering a new golden age of Industrial Design". But we must ask ourselves if this 'age' is sustainable given the nature of change in today's world. If uncertain, we must next determine how we can best grow our profession into a future position of business leadership.

I am convinced Ecodesign will become a major factor in our growth. Incorporating EcoDesign practices into client product development processes will help them rethink their own growth strategies. Developing options for strategic planning will certainly help elevate our status in the minds of many clients. This will require a new education effort focused both internally and externally. We will have to know how to best help our clients achieve new goals using new design process tools. If we are successful, I predict the future return on our efforts will make today's "golden age" look like a brief footnote in our history.

The first step in the education process requires our profession to acknowledge Ecodesign and that the principles of sustainability should be part of our Industrial Design process. Internal efforts should begin simultaneously with design educators *and* practicing professionals. I believe we have evidence that this process is already underway. A well structured design education plan will enable our ID graduates to approach their responsibilities equipped with Ecodesign methodology tools that are as natural as sketching, ergonomics, and CAID. This basic knowledge will influence other designers, team members and clients.

Now is the time for design educators and practitioners to begin formalizing Ecodesign standards and guidelines. I ask both to consider the following initiatives as a framework for discussion in formulating new methodologies. Some of the dialog is already being structured based on responses from a recent IDSA survey on Ecodesign information needs. Others will require more planning between professionals and educator's. We also need to acknowledge that over the years, several leading design educators have been integrating sustainable thinking and design methods into their course work, including Victor Papanek and others. But for Ecodesign to be fully embraced, we will need a sustained dialog between educators, students, and professionals.

- Design educators can facilitate learning about Ecodesign through student competition participation. Life Cycle Analysis/Eco-indicator methodology can also be integrated into all major students projects.
- Educators should seek partnerships with corporate sponsors to engage in projects that focus on Ecodesign evaluations for new or environmentally improved products. (i.e. “Whole Product”)
- Educators can structure student research of Ecodesign topics by their use of various websites. Many professionals using Ecodesign methods appear anxious to inform the thinking of young designers. This interaction can result in developing international contacts for Ecodesign based projects.
- Seek outside professionals in Industrial Ecology and Ecodesign practices and structure seminars for course-based projects. Several experts have structured mini-courses. IDSA member John Paul Kusz is a benchmark resource.
- Integrate Ecodesign methodologies into team projects involving engineering, marketing, manufacturing and design students. The process needs to have multi-disciplined support.
- Restructure course content in material and process classes so they fully integrate Life Cycle Analysis, renewable materials and related energy technologies.
- Professors should structure some of their own research to include Ecodesign process steps and sustainable strategies. Engage your graduate students and share your finding with all students. *Personal Research Footnote:* A colleague and I, in conjunction with two industry partners, are currently designing a flywheel battery powered wheelchair platform. The system will improve long distance and off road travel while offering a service life of 20-25years with the potential for integration into other personal power platforms like riding lawnmowers.
- A need exists to compile more in-depth case studies of best practices and they need to be made available to educators, students, and practitioners. (some are online already)
- IDSA student chapters and professionals should seek out the resources of the IDSA section on Environmental Responsibility by planning presentations from section members.
- IDSA educators and practitioners should together, through a task force, develop suitable guidelines for specific Ecodesign methodologies that will impact course content.

Many of these initiatives will be straightforward to implement for educators, students, and professionals. When formalized, they could be integrated into current NASAD ID program guidelines. With a modest effort major Ecodesign and sustainability principles could be adapted as guidelines for all IDSA professional members.

Trend #4: Beyond the Durable Product Mindset

The majority of Ecodesign practice today addresses the environmental impact of durable products. But within the evaluation phase, teams are encouraged to seek dematerialized concept strategies and more radical alternatives. Those designing emerging businesses, like pervasive computing, recognize that process, content, and context, are deeply linked to the fundamental needs of users. We should look at this process closer since it is coupled to our own. The recent IDSA/IBM sponsored conference “Pervasive Computing” provides some insight. Trends occurring here and in Ecodesign are presenting us new models for thinking. But some designers express a legitimate concern about the *dematerializing* of our own profession.

Ed Dorsa and Stuart Walker explored the economics of design and sustainability through the creation of new durable goods at last year’s IDSA Education Conference. Their paper, Making Design Work, challenged us to find ways to reconcile environmental responsibility, economic security, and social well being within our designs. The paper brings into focus the economic and work related implications of sustainability.

Author Michael Renner in his Worldwatch 2000 article, Creating Jobs, Preserving the Environment, also examined some future fallout of a sustainable economic model. He states that new product manufacturing employment will be reduced as we increase Ecodesign practices. Similar trends have been occurring through automation. But here the retraining of workers became a social priority. Renner predicts Ecodesign strategies will open up new opportunities for the retraining of workers to participate in

re-manufacturing, product upgrades, and end of life-cycle disposal processes. He also sees designers and marketing consultants being in high demand as new sustainable product and service strategies emerge.

Another IDSA paper helps illustrate the potential for fundamental change in design thinking by linking users needs with sustainable design principles. Tad Toulis, a Senior Designer at Lunar Design, presented his paper, Service as Product- New Directions for Industrial Design, at last year's education and national conferences. One of the conceptual projects he outlined was the creation of a personal information device for travelers. The concept embodies an approach he defined as "Low Tech Containers/High Tech Content". This thinking was born out of his personal frustrations associated with developing new technology products with abbreviated life spans. Tad's *TravelTote* electronic guidebook provides users with information specific to their itinerary. The environmentally sensitive solution is based on a *rent and reuse business model*. The device is valued most for its' information content, not its' unadorned, low cost, recyclable enclosure design. Yet the device affords a nice form, a simple interface, and a satisfying user experience. His business model has the devices being rented through a service provider who programs customized content for each user. After use and return it is reformatted via the Internet. We can all relate to the hardware design, but how do we focus design problem solving so we consider the rent and reuse business model? Ecodesign is one methodology that aids this thinking, and others are emerging,

Trend #5: Human Centered Design

Ecodesign has significant and far-reaching implications for our profession. I believe its true potential will be multiplied when we integrate with it with methods for expanding our understanding of human experience. One such methodology, entitled "Human Centered Design", is being developed at IIT's Institute of Design. Their methodology brings together the physical, cognitive, social, and cultural aspects that influence people's interactions with their world. The often-ambiguous social and cultural factors are being explored at the center so improved design methodology models can be tried.

Human Centered Design principles are emerging from what some of us see as a 'dehumanization' of the world through pervasive design brands that homogenize the environment. We are accomplishing this by combining various design and marketing disciplines with unlimited economic growth models. This process usually occurs without asking those impacted if they want to be part of the results. Equally important, ecosystems aren't asked if *they* want to be included. This approach has deprived many designers of the opportunity to learn a great deal from different peoples of world through better understanding of their experiences, cultures, beliefs, practices, and traditions.

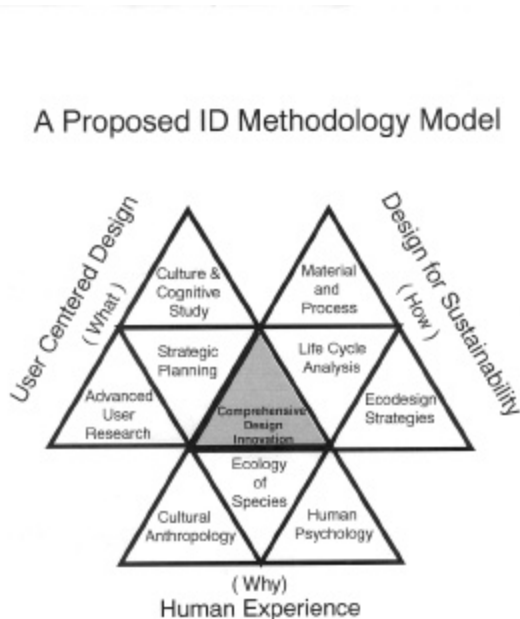
Human focused design thinking is about looking at the local and regional relationships between people and their environment. To better understand these concepts we need to expand our knowledge of basic human psychology, socio-cultural anthropology, and living ecosystems. By incorporating these facets of life, design teams can better answer the *why* before creating *what* and *how*. If invite people to participate in the process, we will learn more about their underlying needs, and our solutions will be better informed. We will know *why* we are creating a specific solution. If the users also know *why*, they will be more likely to think about their responsibilities to the environment and other people. This 'human context' represents a powerful factor within our design process. It can help enrich the human spirit while helping providing appropriate and environmentally sustainable design solutions.

Writer Alan Wiseman embodies a convergence of these ideas in the book Gaviotos, A Village to Reinvent the World. The book documents an experiment within the vast plains of Columbia, SA with the goal of creating a small, self-sustainable village that offers a viable alternative to the dehumanized quality of life experienced by many in large, urban centers. The infrastructure systems designs were led by a small group of dedicated university professors and their engineering students. It is a remarkable story about the human spirit overcoming adversity. It contains many examples of design innovations that fit the local environment and the needs of local people. Most concepts integrate local resources and sustainable practices, while connecting local cultural and human needs. The elegant design of a ground water pump that also serves as a child's teeter-totter, is such an example. Residents can easily service its simple design. Its' function provides fresh ground water, exercise, recreation, and a social setting simultaneously.

Learning to Play Jazz: A New Model for Industrial Design in a Sustainable World

The major trends impacting sustainable design and business practices will continue to influence design education, students and practitioners. But how do we plan for the next ten or twenty years? I think many of us could benefit from some new design models. I equate the current state of our profession to a group of jazz musicians who haven't yet played together. We know some of the players by reputation, and others have just walked in with unique instruments. Still others are in town and may drop by sometime. We all understand that an innovative jazz performance occurs when each player contributes to the whole, while occasionally taking the lead and improvising on the main melody. So how do we blend these new instruments and how do we determine who takes the lead when, so we can create our future improvisation on Industrial Design? We need a framework for some new music.

I would like to propose a basis for this framework in a new Industrial Design model combining the principles behind Design for Sustainability, Human Centered Design, and Human Experience. The result occurs within the overlap. I call this result **Comprehensive Design Innovative**. I hope this model can be added to the discussion as we plan our professional evolution.



To structure the relationships within the model, I have chosen Bucky Fuller's tetrahedron. The diagram illustrates three overlapping, unfolded tetrahedrons, each representing a major design concentration. The three outer panels of each concentration contain major sub-sets. Most traditional methods of Industrial Design reside within the User Centered Design and Design for Sustainability segments. Together all three concentrations become the basis for determining the *why*, the *how*, and the *of* creative design problem solving.

Can Ecodesign principles combined with other new design methods really help our profession achieve leadership status in a sustainable world? We already have many of the components in place, while others are evolving through the research and experimentation of our peers. Now we need the vision to pick up our instruments and begin playing new improvisations we will title **sustainable design**.

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