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Contemporary practices in sustainable design: appraisal and articulation of emerging trend

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Preface

This book contains most of the papers presented at the Eco-Architecture 2010 conference, which was the third edition of the International Conference on Harmonisation between Architecture and Nature. Previous editions were held in the New Forest, UK (2006) and the Algarve, Portugal (2008) and demonstrated the importance of a forum like this to discuss the characteristics and challenges of such architectural vision.

Eco-Architecture implies a new approach to the design process intended to harmonise its products with nature. This involves ideas such as minimum use of energy at each stage of the building process, taking into account the amount required during the extraction and transportation of materials, their fabrication, assembly, building erection, maintenance and eventual future recycling.

Another important issue is the adaptation of the architectural design to the natural environment, learning from nature and long time honoured samples of traditional constructions.

Presentations in the conference were related to topics like building technologies, design by passive systems, design with nature, ecological and cultural sensitivity, life cycle assessment, quantifying sustainability in architecture, resources and rehabilitation, and issues from education, research and practice. Case studies from different places around the world were also presented.

Eco-architecture is very multidisciplinary by definition, attracting, in addition to architects, many other professionals. In that regard the conference participants, in addition to architects, were engineers, planners, psychologist, sociologists and economists, providing an opportunity to share information and ideas with their colleagues from different regions around the world.

The Editors would like to express their gratitude to all authors for their contributions. They are also indebted to the members of the International Scientific Advisory Committee of Eco-Architecture 2010 who reviewed most of the manuscripts efficiently and timely, thus ensuring their quality.

The Editors
A Coruña, 2010

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Contemporary practice in sustainable design: appraisal and articulation of emerging trend

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Abstract

Sustainable design is a phrase commonly used in the realms of design practice and yet the definition of the same remains quite fuzzy, thus providing the motivation for this research. The paper looks at contemporary sustainable design practices in the area of architecture design, building construction and landscape architecture. The objective is to understand what the term "sustainable design" really means as used in practice and what strategies are being employed towards the goal of sustainable development. The practices are assessed for their empathies as per the currently defined social, ecological, economical well-being goals of sustainable development. The paper concludes that out of the conventional triad of social, economic and ecological well-being, the socio-ecological well-being is emerging as the prevalent trend among the contemporary sustainable design practice. The trend needs to be continuously refined in this direction through intelligent employment of social and economic capital.

Keywords: sustainable design, sustainable development, eco-architecture, urban design, landscape

1 The concept of sustainable development

As currently being advocated, "sustainable development means that the needs of the present generation should be met without compromising the ability of future generations to meet their own needs" [1]. This understanding of sustainable development is a progressive refinement of the concept outlaid in the Brundtland commission report in 1987 and then at the 1992 United Nations Conference on

Environment and Development in Rio de Janeiro. The Rio declaration was based on the premise that the development and environment issues are mutually impacting and should be approached as such, through an integrated approach to improve the conditions of impoverished human living and deteriorating ecosystems. "We are confronted with a perpetuation of disparities between and within nations, a worsening of poverty, hunger, ill health and illiteracy, and the continuing deterioration of the ecosystems on which we depend for our well-being. However, integration of environment and development concerns and greater attention to them will lead to the fulfilment of basic needs, improved living standards for all, better protected and managed ecosystems and a safer, more prosperous future. No nation can achieve this on its own; but together we can - in a global partnership for sustainable development" [2].

Agenda 21 affirmed the inter-connections and decreed the conservation and management of resources towards the aim of sustainable development and thus the social, economic and ecological well-being of human society. Social and economic dimensions listed poverty eradication as a high priority followed by issues of consumption patterns, health conditions, human settlements [2]. There seems to be a consistent attempt in communicating the inter-connected nexus among these factors and the issue of the natural resource conservation, but the details of the mutually impacting interconnection have not been clearly put forth.

A not much publicized document by the Barbara Becker in 1997 makes an observation about the inter-linkage of sustainability with the conceptualization of sustainable development [3]. She says "The importance that the term sustainability has gamed in international debate can be attributed to its use in the Brundtland Commission's report [4], Our Common Future, which linked the term to development". Another prevalent understanding of sustainability the one cited within The mission statement of Consultative Group on International Agricultural Research also gives insight into another prevalent understanding of sustainability, where it is referred to as a successful management of resources for agriculture to satisfy changing human needs while maintaining or enhancing the quality of the environment and conserving natural resources and the ecology related understand that used the term in relation to productivity of the ecosystems [3].

Sustainability as understood currently can be inferred as a tripartite balancing act between the economic, environmental and social concerns for the well being of the triad of: social, ecological and economic community [5].

2 Sustainable development and design

There has been no clear and strong reference to the role of design in above discussions on sustainable development as yet. And yet, the contemporary design world is abuzz with the word sustainable development. This indicates that the design profession is taking responsibility for its role in supporting sustainable development.

While the understanding on sustainable development and sustainability is still evolving, the content and scope of sustainable design also needs to be clearly articulated. As McLennan notes "…. the terms sustainable design…have come to mean so many different things to so many different people that, despite the growing interest, most have little true understanding on the subject" [6]. The contemporary designers' ambition to support sustainable development through design is being under-served by the generic, sporadic articulation of the term "sustainable design".

An appraisal of contemporary design practice aiming towards sustainable development collates the sporadic information together and is presented below.

2.1 Sustainable design: A snapshot of prevalent understanding

2.1.1 Multimedia stocktake

McLennan's definition of sustainable design as "... a design philosophy that seeks to maximize the quality of the built environment, while minimizing or eliminating the negative impact to the natural environment" [6] frames the concept within the classic, conventional tenets of deep ecology and sustainability. Subsequent attempts at defining the term and thus responsibility of the design profession include "Sustainable design is essentially about the reduction of impact.." [7] and "...Sustainable design expands the role of design program, moving the design goal from object to community, and then designs the connections…" [8]. Both attempts reflect the struggle to articulate the concept in a way that is immediately useful to an active, professional designer.

The information available on the topic in the world of interactive web-based media was also studied as a critical marker since as it not only informs and influences popular understanding but also is indicative of public opinion. To get a snapshot of the prevalent mass opinion or information available to them, the phrase "sustainable design" was used for a keyword search on the popular media websites. Google showed 18,800,000 results, YouTube showed 2,220 results and TED showed 100 results on 21st may 2009 [9].

Google results on first page included *Guiding principles of sustainable design* (*www.nps.gov/dsc/dsgncnstr/gpsd*), which opens with concerns about overconsumption of natural resources leading to extinction of biodiversity and references to excessive living leading to environmental imbalances and global warming, book results such as *Sustainable design: ecology, architecture, and planning by Daniel Edward Williams; The philosophy of sustainable design by Jason F. McLennan; Sustainable design: the science of sustainability and green engineering by Daniel A. Vallero, Chris Brasier, and links to related resources, blogs, forums and businesses (en.wikipedia.org/wiki/Sustainable_design, www.gsa.gov/sustainabledesign, www.sustaindesign.net, www.sustainabledesign.com, www.asid.org/designknowledge/sustain, www.aiasdrg.org, www.sustainabledesignforum.com, www.inhabitat.com/tag/sustainable-design, www.sustainabledesignguide.umn.edu)* [9].

TED - Technology, Entertainment, Design, since is an invitation-only event where the world's leading thinkers and doers gather to find inspiration thus TED website had a list of talks be such leading thinkers. The topics included *learning from nature by Janine Benyus, open source architecture by Cameron Sinclair, sustainable fridge by Adam Grosser and, human-centered design by David Kelley among other topics on city design by Jaime Lerner and sustainable future by Alex Steffen*. These are not the only prominent voices and concepts on the topic but certainly the most heard ones thus highly influential in shaping the thinking of the masses [9].

For a cursory idea, nine out of twenty results on the first page of YouTube related to the description of sustainable design practices of the practitioner *:Tom Dixon on Sustainable Design,* of the firm: *The Triple Bottom Line, How Going Green Is Compatible With Corporate Profitability, FICOTechTalk; Digital Eskimo on sustainable design, wwfaustralia; 100% Design - Sustainable Design, 100percentlondon; Sustainable Design in Laguna Beach by LPA Inc., lpainc; Sustainable Design in Brea by LPA Inc., lpainc; A sustainable design agency in Sao Paulo-Report-EN-FRANCE24, france24english; Sustainable Design: A Conversation with Design Publishers, inhabitat*; or of the city : *e2 design II — Bogotá: Building a Sustainable City, kontentreal*. While these videos serve as free promotion and advertizing mechanisms with wide outreach, they also act as indicators of current state of thinking and practice related to the topic. Four videos could be interpreted as inquiring into the concept of sustainable design: *Janine Benyus- 12 sustainable design ideas from nature, TEDtalksDirector; Sustainable Design - Janine Benyus, MedicinalRock; Composition of sustainable design, aikokey; UC Davis Newswatch: Sustainable Design, uctelevision*. The videos are not always uploaded by the firms and individuals in the videos themselves but patrons and fans implying that these videos reflect the ideas that the popular mass relate to or patronize. Six of these video uploads were outreach initiatives by the educational institutions advertizing their interest in the topic and ability to educate in currently hot topics: *UC Davis Newswatch: Sustainable Design, uctelevision; Sustainable Design/Build Course at Philadelphia University, egret584; Conway and Sustainable Design, ConwayDesignSchool; Trent Jansen: Sustainable Design, unsw; Sustainable Design with Architectural Precast Concrete 1of6, pcieducation*. Two related to the interpretation of sustainability for software engineering world *:Technical design: Kevin Lynch, Adobe Systems Incorporated, Sustainable Design for a Multiscreen, Info-Overloaded World; OreillyMedia; What Sustainable Design Means to the Bottom Line, BNETvideo;* and three relate to documentaries on topics of sustainable design or perceptually related to it: *Sustainable Design (play all, Pale Blue Dot (3:59), Global Warning (4:43), The 11th Hour Trailer (2:19), 22 videos, gmachadodesign; discovery channel, Janine Benyus: 12 sustainable design ideas from nature (23:59), Sarah Susanka: Sustainable Architecture (4:07), Sarah Susanka: Home Design and Money (2:59), 73 videos auvjam; E&ETV: Sustainable Design - Green Skyscrapers, kpatterson1* [9].

Additionally, a keyword search was done on popular phrases related to sustainable, such as sustainable design, sustainable buildings and sustainable landscape, on YouTube [10]. Figure 1 presents a summary of the results and shows that the sustainable buildings topic had most videos uploaded and increasing over the week, with sustainable landscape being the least populated topic. However, when the components of sustainable landscape such as green roofs and living walls were keyed in, the results were markedly high for living walls than the sustainable buildings topic and even the topic of green roof, indicating the high level of interest in the area or that maybe the green roofs topic has been already popularized enough for producers as well as consumers while living walls is relatively new area to be tapped by both the commercial producers and mass consumers.

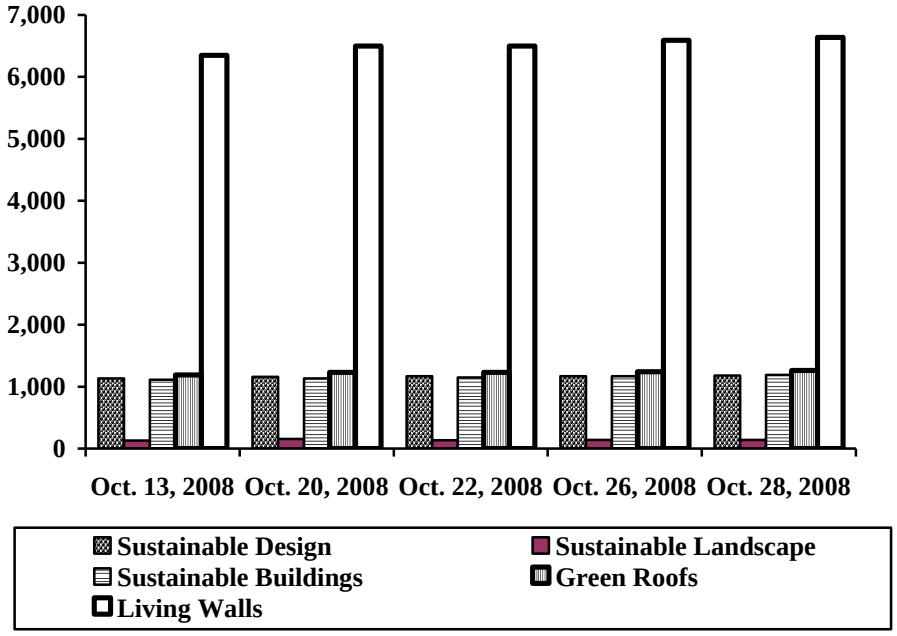

Figure 1: Snapshot of sustainable design related videos on one of the interactive mass communication medium - YouTube

2.1.2 Local survey

To take stock of local familiarity with sustainable design, a survey was conducted on the University of Tennessee campus as a part of the introductory sustainable design course offered by the author. A list of sustainable design related keywords was generated by the students based on the review of available

literature in the realms of sustainable practice. The keywords are listed below [11]:

> recycling, reducing waste, organic food, permaculture, local agriculture, local business, biomass fuel/energy, biodiesel, nuclear energy, solar power, geothermal energy , photovoltaic panels, passive solar energy, carbon-trading, green turf or roof, storm water management, fluorescent light bulbs, invasive species, native vegetation, sustainable design, compost, mass transit, heat island effect, carrying capacity, water reclamation, environmental or ecological footprints, rain gardens, leadership in energy and environmental design, cradle to cradle, industrial ecology, eco-psychology, hydroelectric power, tidal power, wind power, global warming, food security.

These keywords were included in a survey form and handed out to people asking them to estimate their familiarity with the keywords in the range of very familiar, somewhat familiar, and not very familiar. About 200 surveys were handed out at the University of Tennessee, Knoxville campus with approximately 100 responses. The survey showed that the respondents had highest familiarity with the aspects of recycling and waste reduction. Terms embedded with conceptual rethinking related to sustainable design, such as eco-psychology, industrial ecology and carrying capacity, were noted as least familiar.

All the sustainability keywords respond to either or all of the sustainability goals of social, ecological and economical well-being goals as currently identified by the United Nations [2,5] and Chapman and Gant [7]. These sustainable practice related keywords are indicative of currently operational sustainable design tools. Table 1 categorizes these as per the obvious realms of action and primary empathies within the sustainable development triad of social, ecological and economical well-being.

Table 1 Operational tools of sustainable design and corresponding realms and empathies

Operational sustainable design tools	Predominant realm of action	Primary empathies
native vegetation storm-water management composting green roofs living walls bioswales constructed wetlands and ponds rain gardens recycling waste reduction	landscape urbanism and policy design	socio-ecological

mass transit storm-water management water reclamation rain gardens organic food permaculture	urban design and policy design	social
biomass fuel biodiesel nuclear energy solar power photovoltaic panels passive solar energy geothermal energy hydroelectric power tidal power wind power fluorescent light bulbs	technology and policy design	socio-economical
local agriculture local business carbon-trading food security	economy and policy design	socio-economical

The survey when analyzed based on the above categorization indicates that the respondents had highest familiarity with sustainable design tools situated within the realm of landscape urbanism and with predominantly socio-ecological empathies.

2.3 Sustainable design: A snapshot of prevalent practice

2.3.1 Construction and development industry

A number of suggestions have been put forth to facilitate environmentally accountable or sustainable architectural design and construction. Efficient and optimum use of natural resources is being emphatically advocated. A sustainable architectural design practice has been recommended through employment of renewable resources, and, low energy-consuming techniques, for construction and continuous running of buildings through due attention to issues of insulation, ventilation, lighting design, day lighting and end-of the life recycling potential of the materials. Guzowski too emphasizes that sustainability aspect of architectural design could be improved through better use of day lighting [12].

Use of sustainable and /or indigenous materials and products is being highly recommended [13,14]. The translation of this concept into practice is reflected in the private game reserve lodge in South Africa at Sabi Sabi Private Game Reserve. The lodge uses locally resourced materials such as sand, cement and grasses cut from the surrounding hillside. The lodge has been finished with a cement plaster blended with the natural materials such as straw, and stone. Other suggestions on recycling materials from demolished buildings, using concrete

from old runways and building foundations for the foundation of new buildings and retaining walls [15] have been made towards the objective of resource conservation.

Towards increasing the mass awareness regarding resource efficiency and green residences, a system of labelling homes to display the information such as electricity use, carbon emissions, and insulation efficiency is being advocated, predominantly by Architect Michelle Kaufmann [16]. This is similar to eco-labelling concept generated in the realm of industrial ecology. Simultaneously, a new tool called Living Building Challenge is being proposed as a "move toward true sustainability" [17]. This system is idealistic and warrants for 'NetZero' prerequisites such as zero percent wastage or a hundred percent reuse of resources, for example, rainwater. Williams [8] also strongly supports the idea of efficient or almost complete re-use of all the rainwater falling on the land area of the building site.

2.3.2 Architecture and landscape architecture profession

Conservation of natural resources is a concern not limited to architecture profession. A number of contemporary practices reflect an integrated approach in designing the built and landscaped environment. Campus planning of Emory University was aimed towards sustainability [18]. The steps taken towards the goal of sustainability included construction of dormitories integrated with rainwater collection systems. The rainwater collection system is activated through a combination of architecture and landscape design. The runoff collected from the roof is directed down through downspouts to fall into brick runnels within the exterior landscape and then into a bio-swale for removal of silt and pollution. From the bio-swale the water is transported to a below grade cistern, with a capacity to hold enough water to flush toilets on a daily basis for several weeks.

Green roofs is another approach bordering architecture and landscape architecture professions that is widely used and advocated as sustainable design practice. Green roofs serve multiple purposes of harvesting rainwater, managing the storm water and insulating the building, which in turn reduces energy costs. Sky vegetables was a brainchild of Keith Agaoda [19,20] to grow vegetables hydroponically on the rooftops of grocery stores, proposed for the University of Wisconsin School of Business G. Steven Burrill Business Plan Competition. Agri-based green roofs provide an option to backyard kitchen gardening and community gardening. Urban-agriculture concept of greening roofs for economic gains may have indirect ecological benefits in terms of reducing pressure on land for farming purpose and by bringing in a variety of other plants and associated communities thus adding to the richness of urbanized biodiversity.

While rainwater conservation is a prevalent trend, storm water management is also a common and popular practice. The neighbourhoods in Seattle, Washington had several problems with storm water runoff, including muddy streets, and other flooding problems. The problem was resolved through incorporation of bio-swale as a remedial strategy. This would not have been

possible without the pro-active role of residents who went through petition process for the approval of the bio-swale incorporation [21]. Another storm water management strategy is to use the porous paving materials thus facilitating percolation of water into the soil for recharging the sub-surface basin, watering the landscape and reducing the surface water run-off. Chicago is considering implementing the strategy by replacing the existing asphalt with pervious concrete on existing pavements as a step to reduce the storm water runoff and meet new storm water management requirements; pervious concrete mixes contain limited or no fine aggregates, which produces concrete with approximately twenty percent voids [15]. Other porous surfaces that are generally being recommended as permeable surfaces include are grass pave, and geocells placed under the sod of a site [22].

Rain gardens too have the ability to survive drought and floods and could be planted with native plants to create a basic filtration system and to hold soil on steeper slopes with their root systems. Williams recommends the wider use of rain gardens for educational as well as water conservation purposes [8]. A study on park designs by Cranz and Boland observed that approximately 86% parks out the ones they looked at exhibited traits of sustainability such as interventions encouraging on-site recycling, use of native plantings and exercise areas [27]. The authors suggest that more urban parks need to incorporate these sustainable design strategies.

Sustainable site design is another concept that figures prominently in architecture as well as landscape design practice as in codes laid out by LEED- the Leadership in Energy and Environmental Design [23] and sustainable site initiative of ASLA- the American Society of Landscape Architecture [24]. These and other similar discussions advocate for the use of existing features and natural resources of the project to design the site with less environmental impact and a more efficient use of resources in a way that helps prevent natural hazard risks like landslides and erosion [25,26]. Consideration of pre-conditions of the site from the initial design stages itself is another aspect being emphasized.

3 Discussion and further direction: socio-ecological well being as the emerging trend

All the design practices documented in this paper aspire to align with the sustainable development goal of maximizing use of available resources with minimum environmental impact. Key sustainable design strategies in place to towards the goal of sustainable development are:

- Consideration of tapping from alternative energy resources such as photovoltaic panels and geothermal sources, where possible
- Rain water collection and reuse through a combination of water collection ponds, green roofs, bio-swales and rain gardens
- Storm water management through a combination of constructed wetlands, porous pavements and bio-swales

- Environmentally judicious response to given landforms, materials and ecological processes occurring on the site
- Optimized use of other natural and renewable resources through designing for best use of sunlight and wind
- Use of on-site and locally available material and indigenous vegetation.
  While onsite consumption and recycling of resources has been heavily emphasized by contemporary design practice, onsite recycling of waste needs to be acknowledged as equally important sustainable design practice.

These practices indicate that the design profession is taking its role seriously in contributing towards sustainable development. Yet, the global statutory bodies driving the sustainability agenda such as the European Union and the United Nations need to clearly articulate "product design: architectural, landscape, urban, industrial" as one of the key drivers and indicators of sustainable development.

Although economic well-being may have been a tacit driver of contemporary sustainable design practice, the increasing trend seems to be empathizing equally with social and ecological issues. I am thus compelled to acknowledge the practice through the term socio-ecological well-being as the contemporary trend being favoured by prevalent sustainable design practices. The quantification of empathies outlined in this paper would help in validating this conclusion, understanding the extent to which the social, ecological and economic concerns are being favoured and aiding in balancing out these favours if the need be.

Being a society constantly developing for its own sake, it is only fair to be concerned about the existence of human species. That we are concerned about the extinction of other biotic species is also for our own sake because it is linked to our own existence through some eco-systemic connection. The shift to socio-ecological trend should thus be further investigated and encouraged rather than being undermined for its secondary emphasis on ecological issues. As a further research, the trend needs to be carefully assessed and operationalized in terms of design: drivers, objectives and outcomes. Besides, whether we are doing enough towards a sustainable future is a question that needs to be continually asked.

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