




# green analysis and cultural sustainability for office specification

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A paper outlining the inextricable relationship between sustainable design and organization

The author discuss sustainability as a combination of earth-smart and people-smart practices and beliefs. Providing nine criteria of responsible office design – such as energy efficiency and metamorphosis – he discusses what makes a workplace "green" and the process for creating a sustainable organizational culture.



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### Objective

*In this paper, the author link environmental design with organizational sustainability, introducing the concept of being “earth smart” and “people smart” as integrated design concepts. Readers will gain insight and tools helping enable them to make design decisions without being experts on the environment or organizations.*

A new role is opening up for architects and designers. In this role you are the navigators for your clients. You guide the client to design choices that are healthier for the natural environment, people, and organizations.

We’ve dubbed these choices as “earth smart” and “people smart.”

We don’t want to generalize but it appears that the movements toward “green design” and “intelligent design” have been pursued separately, with some people focusing on the environment and others focusing on improving the workplace. We propose to bring these movements together so that choices made to sustain the environment also will sustain the organization. With the right tools, we can measure the benefits to the environment (less use of resources, reduced environmental degradation) and the economic benefits to your clients (greater productivity, lower employee churn).

Consider these facts:

- 80 – 90 % of our lives are now spent in the built environment,<sup>1</sup>
- 80 – 90% of our oxygen is filtered through an artificial delivery system, and
- 40% of the world’s raw material and energy are used to create and maintain the built environment.

Given these statistics, who but architects and designers are better positioned to influence the long-term implications of human interaction within the spaces where people spend most of their lives.

Architects and interior designer are trained to understand design, function, aesthetics, and much more. But the outcome of your work is about far more than buildings and furnishings. It’s about people and organizations.

- Over a ten-year period, 82% of an organization’s operating cost is invested in individual salaries and benefits.<sup>2</sup>

- The lighting, acoustics, thermal properties, and furnishings of a space are physically/psychologically meaningful dimensions of the environment.

How people think and feel is critically important in determining what they accomplish.<sup>3</sup> Herein lies the basis for the designed environment and sustainable design – in a context that goes clearly beyond “doing no harm.” What people accomplish (output) is one of two means to organizational profitability: Either reduce costs (1) or increase output (2).

So, how does an architect or designer who wants to blend environmental responsibility with a client’s best interest begin to evaluate the mountains of data and information available on green design and organizations? What information can the generalist rely on as being meaningful?

Let’s begin with a basic understanding of what the term “sustainability” encompasses. Our definition is that sustainability is “the ability to effectively and efficiently maintain the present without compromising the future.”


This definition applies equally to the natural and social realms.

Now, you may be thinking, “my client is not a tree-hugger, and the introduction of new ways of thinking into a fiscally conservative sphere is difficult at best.”

Your client is, however, a businessperson. You as the navigator must assess if they are early or late adopters of trends. Whether you present your ideas as “good for the environment” or “good for the employees” or “good for the bottom line” has a lot to do with where your client fits on the continuum of trend adopters.

Next you must analyze two distinct, important aspects of the business structure:

- (1) It is composed of people.
- (2) It has an environment in which they gather to transact business.



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These two aspects (social and natural systems) are “complex-adaptive,” they both adapt to change and are inter-reliant. The only difference between the two is that the social system is totally dependent on the natural system. Studies of human health in relation to natural light, air quality, potable water and natural views (as an example) have been well documented in their [positive] impact on human behavior.

What does this lead us to consider in the responsible design of the work environment? If we agree that the goal of any “office build” project is to develop a stable workplace that will sustain an organization, then we must consider the following nine points:

- (1) Material content and composition
- (2) Indoor air quality
- (3) Lighting
- (4) Life cycle cost
- (5) Design for disassembly
- (6) Energy efficiency
- (7) Human centric attributes
- (8) Social system adaptability
- (9) Metamorphosis

Within these categories we can acknowledge three levels of difficulty ranging from physical to technologic to social. The real estate question is perhaps the easiest (physical), technology is tougher (evolution and blending), and human behavior (social) is the most difficult.<sup>4</sup>

*“I’m not a chemist, engineer or biologist. What methods can I rely on?”*

One problem for the architect and designer is that the green design movement is still heavily steeped on the “technical” (scientific) side of the equation. Current regulatory and voluntary compliance programs as well as “rule-of-thumb” approaches, can serve as guidelines to develop and plan space, select products, and manage social systems.

As an aid to your investigative efforts you may consider using existing environmental certifications and registrations as evidence of exemplary performance (e.g., FSC, FSI certification, ISO 14001 registered, etc.). Those investigations will cover topics such as:

LEEDS<sup>5</sup> – from the built environment perspective

- Site selection
- Water efficiency
- Energy and Atmosphere
- Materials and Resources
- Indoor Air Quality
- Innovation
- Design process

ISO 14001<sup>6</sup> Environmental Management System – from a manufacturing perspective ISO is composed of areas of concentration addressing:

- Organizational Evaluation
- Product Evaluation
- Environmental policy statement
- Commitment to awareness and minimization of manufacturing and product environmental aspects
- Control procedures and training to reduce risk
- Structured evaluation and documentation of current and proposed manufacturing and product environmental aspects
- Documentation of measurable environmental performance targets
- Sharing of environmental best practices


Organizational Assessments – from a social systems perspective

- Individual assessment
- Work group assessment
- Cultural assessment
- Organizational assessments

Let’s look at our nine essential points in greater detail:

### Material Content and Composition

The environmental impact of producing, distributing, and applying materials in a building is an area that has had significant analysis by the environmental community. Insulation, flame retardants, paint, wall and floor coverings, and ceiling materials release gases known as volatile organic compounds (VOCs). Some VOCs can be irritants to the eyes and respiratory system. An office with no off-gassing concerns is a place where people can work productively. Being aware of off-gassing, choosing water-based coatings, and balancing VOC emissions with the appropriate ventilation rates are important steps to take. Guidelines from the US Green Buildings Council can lead you through materials selection.



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The environmental community and manufacturers have heavily researched the environmental impact of how materials are produced. This information is readily available from most suppliers and can guide your choices. For instance, chrome is popular but the powder-coated chrome look is a better environmental choice. Materials with recycled content typically require less energy consumption and use fewer virgin resources. The exception to this is wood, which is renewable and requires little energy consumption in processing.

### Indoor Air Quality

"I don't like my job because it's stuffy in here."

Thermal comfort and air quality are among the top items noted by "end users" and occupants in several studies focused on *job satisfaction*. They are also the source of half the annual energy budget of a building. Unfortunately indoor air quality is traditionally a "problem driven" issue. Little attention or legislation is given until after chronic conditions have arisen. Inadequate ventilation – insufficient outside air – is the essence of the problem. The problem has the following attributes:

- Internal VOC's
- Outdoor pollutants trapped inside
- Mold or microorganisms that grow and disperse through HVAC systems

Perceptual issues relating to indoor air quality fit into the categories of:

### Thermal

- "Thermal comfort and its effect on health and productivity has been extensively studied for years resulting in the standard "Thermal Conditions for Human Occupancy" (ASHRAE, 1974)

### Humidity

- Consistent DBT (dry bulb temperature) within an environment is insufficient to successfully achieve a "comfortable" thermal rating. Humidity, radiant temperature profiles are essential components.<sup>7</sup>

Planning for effective and efficient air management systems can pay your client back lower health-related costs and absenteeism and in increased positive moods. "Control over specific environmental factors was anticipated to reduce stress among users of space and thereby increase positive affect" (Evans and Cohen, 1987). Positive moods have been linked by Isen (1990) and others to improved decision making, better memory function, greater job satisfaction, increased organizational commitment, and creative problem solving."<sup>8</sup>

What's the best temperature/humidity/air flow range for people?  
The ones they don't notice!

### Lighting

The environmental focus on lighting has been toward reduced energy consumption. Environmental designers have encouraged the use of more daylight to reduce energy costs and create a more natural atmosphere. Lighting plays a key role in employee satisfaction, as well.


Access to natural daylight has been studied by a vast number of researchers ranging from medical interest in the affect of daylight deprivation in submariners (circadian rhythm)<sup>9</sup>, to the sales volumes in retail stores with natural light vs. artificial light.<sup>10</sup> The overwhelming body of evidence is in favor of the relationship that humans have with natural light. From psychoneuroimmunology<sup>11</sup> to simple applications in which it has been observed that when offices are darker, employees are more inclined to leave their work areas whenever possible.<sup>12</sup> The implications of these studies reach into the early planning phase of design development in architecture.

What are the implications/paybacks on a window or a particular choice of light in terms of human output? The financial implications of just one aspect of health in relation to one aspect of lighting namely, glare can manifest itself in a condition known as Computer Vision Syndrome (CVS). CVS has been linked to productivity losses 4-19% of among transactional style workers. Treatment costs of \$2 billion have been reported.<sup>13</sup> Furthermore, it has been estimated that input errors relational to VDT usage cost employers with "poor" lighting schemes \$5 to \$10 per square foot annually as opposed to a typical cost of \$1 to \$2 psf under "good lighting" conditions.<sup>14</sup>

Additionally, research has shown:

- 68% of employees surveyed felt that the quality of illumination in their offices was less than adequate.<sup>15</sup>
- There is a direct relationship between sunlight and positive moods.<sup>16</sup>
- Positive moods have been linked to better decision making, improved memory function, greater job satisfaction, increased organizational commitment and creative problem solving.<sup>17</sup> (Isen, 1990)

Lighting strategies in lieu of growing age differences between workers, types of industry (call centers, 24/7 operations, after-hours lighting plans), and desired perception of the area to be lit (as an output of color temperature) are all key ingredients of general ambient and task-level lighting concerns.



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### Life Cycle Cost

Whether you retrofit an existing building or design a new facility, sustainability is a long-term vision. The majority of investors in the US are looking for a payback in ten years versus a payback of 50 years in Western Europe. We must begin the process of thinking and purchasing on a scale much broader than current scope allows.

Following are some considerations in analyzing life -cycle cost as opposed to short duration cost:

- Durability – can the item being purchased be adapted to changing business conditions?
- Product example – Vinyl flooring vs. Linoleum; environmental concerns aside, consider the 6-year cost/maintenance consideration of these two products.
- Furnishings selections – adaptability, investment, supportive of changing organizational alignments
- Systems products
- Electrical components
- Data components (North American companies spend \$16 billion dollars annually on recabling for moves, adds, and changes.)<sup>18</sup>
- Constructive Solutions by SMED, a Haworth company – Construction logic reconsidered
- Refined development model
- Modular architecture
- Churn - the silent expense
- 25-30% annual reconfiguration of commercial office space
- Pennsylvania Department of Environmental Protection estimated churn cost @ \$2,500 per employee was reduced to \$250 through use of raised floor, adjustable systems furnishings, and adjustable HVAC. This net savings of \$843,750 exceeds the annual energy costs of the facility.<sup>19</sup>

### Design for Disassembly

In a recent discussion by Peter Senge (author of the book “The Fifth Discipline”), business leaders were metaphorically characterized as “designers,” placing a heavy mantle of responsibility upon them in their spheres of influence.

Senge’s comments are aimed at transforming the old design theme of “form and function” into a new design theme of “form and content.” This perspective is distinguished in, not the rejection of function but rather the recognition that without intrinsic understanding of the content of the object (artifact) created, their work will have little meaning in our complex world.<sup>20</sup>

That meaning is inclusive of what that artifact becomes after its useful or “valid” life comes to an end. The process required to allow it to become something else is the essence of “cradle to cradle”<sup>21</sup> design and is part of the intrinsic understanding of the item as a whole.

Components of that understanding include:


- Reuse or refurbishment of materials is considered.
- Material selection considers reuse and minimal toxicity.
- A minimum of materials are used to facilitate disassembly.
- Materials are identified for potential recycling or reuse.
- Disassembly aids are designed into the material (fracture points, fastening vs. bonding).
- The item is designed for replacement of obsolete parts vs. replacing the whole.

### Energy Efficiency

The energy efficiency of a building, inclusive of mechanical and electrical systems, has proven to provide one of the most compelling financial models for introducing change within building/design considerations. Cost savings gained by reducing the use of natural resources and to a lesser degree, savings gained through reuse (or avoidance) of materials, has captured the attention of fiscal decision-makers and has been one area that “green” and “non-green” proponents find agreement. Clearly defined and achieved performance targets in building efficiencies have been noted and seemingly pervade the press. This approach of blending fiscal responsibility with environmental efficiency is noble, yet lacking in soul. Sustenance is far more than simple conservation of limited resources, its success depends critically upon its ability to be substituted with renewable resources.

Federal Programs aimed at reduction of energy include:

- US-EPA Green Lights Program
- US-EPA Waste Wise Program
- US-EPA 33/50 Program



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Organizations that have benefited financially from conservation efforts include:

- Boeing – 90% lighting electricity reduction/2 year payback (53% ROI).<sup>22</sup>
- Lockheed – Engineering development and design facility/ \$500,000 annual energy bill reduction/ 15% increase in productivity /15% drop in absenteeism.<sup>23</sup>
- Pennsylvania Department of Environmental Protection – reduction of energy through building materials and process initially evaluated through the process of energy modeling.

### Human-Centric Attributes

It is within the context of human-centric concern we begin the most complex undertaking. While the case has been built for the effect that the environment has on individuals, the attributes of optimal design for work space are less studied.

- Motivation, meaning, inspiration/stimulation are three elements that comprise the “attributes” of human performance.
- Health, insulation, interaction, externalization and embedding<sup>24</sup> are the balance of attributes that impact human cognition.

The first three are the key ingredients in creative endeavor, the stuff that successful organizations are addicted to and rightly so. The business value of an “engaged” employee is beyond the simple equation of salary. Oddly enough, without the guidance of organizational development specialists, discovering the source of these attributes is as likely to yield positive results as did de Leon’s 16th century search for the “Fountain of Youth.”

The latter attributes have a broader range of relationship to the individual. These attributes range from personal health and genetic predisposition to the macro and micro ergonomic consideration of the human within the built environment. Fiscal value is demonstrated in terms of the physical and social benefits that include:

- Reduction of illnesses
- Reduction of company (direct) costs by reducing worker’s compensation costs (estimated at \$15 to \$20 billion dollars per year)<sup>25</sup>
- Improved employee effectiveness (self reported as well as “output” measurements)
- Improved attraction and retention

Acknowledging the existence of these attributes is key in underpinning the sustainability of an organization. Like the natural system, an organizational system is balanced/sustained through the interaction of these attributes that exist “interdependent” of us as observers. A little metaphysics for you here... *“Buildings that reproduce in real or analog fashion the biologically preferred environmental qualities of the natural world also produce benefits for people.”*<sup>26</sup>

These attributes fall into three broad categories, “physical,” “socio-cultural” and “compensatory.” Of these attributes, the ability of architecture/interior design to influence significantly is somewhat constrained to the category “physical.”


Within the context of “physical” the area that we are appealing to could best be described as “human preference” and is perhaps the area we can best develop design targets to address. In general the following simple observations can be made:

### Social construct

- Windows increase social desirability of a space. (“Transitory window gazing” allows for the seeking of a break from attentive listening through “soft attention” as opposed to “fixed focus activity” such as doodling from which is more difficult to refocus.)<sup>27</sup>
- Well lit rooms with high ceilings and sociopetal (inward facing) arrangements are more desirable than inverse conditions
- Furnishings that provide no status cues within groups
- Since an estimated 60% of learning occurs in informal situations – design for “social channeling”
- Allow for self-organization

### Workstation design

- We feel more comfortable with a wall behind us or to one side.
- A blank wall should be no closer than 8 feet in front of us.
- Work spaces where we spend all day should be at least 60 square feet in area.
- Each work space should be 50 to 75% enclosed by walls or windows.
- Every work space should have a view to the outside. (Exterior views have been proven to decrease occupational and medical stress and increase creative performance.)<sup>28</sup>
- No other person should work closer than within 8 feet of our work space.
- It is uncomfortable if we are not aware of at least two other



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- We should not be able to hear noises very different from the kind of noise we make from our work space (relates to acoustic disturbances and their impacts on concentration).
- Work spaces should allow us to face in different directions.
- No one should be sitting directly opposite of us and facing us in our work space.

These “overarching” human preferences have been applied (here) into environmental contexts to illustrate a general preference that can be translated into a physical response.

### Social System Adaptability

Keeping in mind that change is difficult for individuals, the question beckons “how do I flex the bale (the business) without snapping the straw?”

How can we identify where a company is prior to instituting organizational gymnastics?

Determining organizational composition is a complex process. Methods range from written surveys, oral interviews of individuals, focus groups and activities to observations or ethnographic studies. The Gallup organization relies on a simple 12-question survey from which they can determine the level of employee engagement – “engaged, not engaged, or disengaged” – which they quantify to determine overall organizational health (at many levels).

Another example of a survey that aims to determine organization type is one administered by Deshpande, Farley and Webster.<sup>29</sup> In this survey, organizations are characterized as one of four types: Market culture (emphasis on competitiveness and goal achievement), Adhocracy (emphasis on entrepreneurship and creativity), Clan culture (emphasis on teamwork and cooperation), or a Hierarchical culture (one that stresses order and regulations).

The implications of this information may manifest themselves in interior designs that fit the culture. Examples are:

### Market culture (call centers)

- Open environment and displayed thinking
- Tools that allow everyone to keep track of group and individual performance

### Clan culture (healthcare – educational institutions)

- Environments with group work spaces and relaxation areas
- Individual work areas
- Environment must maximize opportunities for communication and collaboration

### Adhocracy culture (advertising agencies)

- Environments with group work spaces and relaxation areas
- Increased need for concentration
- Group areas must provide tools that encourage desired activities
- Need to balance or “mirror” the spirit of excitement in the organization

### Hierarchical culture (law firms)

- Status needs to be reflected individually and organizationally
- Fixed-wall offices are prevalent (higher social status)
- The environment cannot be frivolous – must promote maintenance and order


### Metamorphosis

(Managing change and expectations over time.)

Capitalizing on the strengths of individuals is the key to instilling the same diversity that allows the model in nature to flourish. These strengths promote organizational sustainability. The 1927 Western Electric “Hawthorne” studies pointed out that workplaces are social environments and within them people are motivated by more than merely economic self-interest. These social systems are made up of *interdependent* parts. Socio-technical systems (STS) is the term given to organizations that employ a combination of people, tools and knowledge to produce goods and services.<sup>30</sup> Franklin Becker uses the term “organizational ecology” to describe the workplace as a designed strategy of physical settings and social process that are managed through time.<sup>31</sup> Nature is a system composed of interdependent parts. STS’s or “organizational ecologies” are complimentary to that natural system, borrowing from John Muir in his thoughts on nature, “When one tugs at a single thing in nature, he finds it attached to the whole world.”

What elements compose this fabric? It’s a combination of tangible and seemingly intangible items that include:

- The work itself (is there meaning?)
- Recognition



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- Advancement
- Company administrative policies
- Supervision
- Salary
- Interpersonal relations
- Working conditions
- Job design

How do we begin to assess what we have? Traditionally that aspect of discovery has been noted as “programming” and is essentially a way to “identify the needs and behaviors of the eventual users of an environment, the factors that will be a central focus for later, more detailed design work.”<sup>32</sup>

The ultimate goal of assessing the organization is to gain insight on organizational and dynamic requirements for a new space. What people do, what they want and what they lack in existing settings is not typically something they can clearly articulate. We need to understand the perceptions of individuals in relation to their workspace. It is employee perceptions of their situations that guide their responses to the situations they encounter.

J. Mays of Ford Motor Company recently relayed a story about a response he got when he asked this somewhat open-ended question, “What do you want in an automobile?” The response was, “I’d like to have a car that makes me smile every day.”<sup>33</sup> Wouldn’t that make a great design performance target?

We must begin to inform design through the use of tools like “Visual Quality Programming,” and survey tools such as Haworth’s “OfficeLook” – tools that strive to place quantitative and qualitative measurement and attribute to unarticulated needs (perceptions) like wanting a car “that makes me smile, every day.” The tangible elements are easy (the car), the intangible (the smile) much more difficult.

Measuring the attitudes and perceptions prior to and after “morphing the organization” (changing the whole from the perspective of the individual) is essential to determine if the change was worth the effort. Successful implementation of this process requires vision, communication, concern, and most important, involvement by affected individuals. As highlighted in the Hawthorne studies, inclusion in a process with sincere intent

to use learned insights goes a long way in fostering a supportive mindset. That supportive mindset is critical to the success of any change in social environment.

### Toward the future


Clearly within this body of work the complexities and details are of global magnitude, touching on specialized areas dealing with everything from molecular biology to theology, from sustenance – basic on Maslow’s hierarchy of needs – to the giddy joy one feels at seeing a beautiful sunset. The goal here has been to help inform you who are charged with “design” to begin considering the scope of impacts that occur when working with humans in the built environment, and to afford you some points from which to begin the undertaking.

“What’s the sense of having a house if I don’t have a tolerable planet on which to place it?” Words from Henry David Thoreau, words that if reversed give a new light to the Sustainable Design movement and give credence to the term “Holistic.” What’s the sense of building a house if I don’t have anyone who can live in it?

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