Title: Is Your Office Stressing You Out and Making You Fat? Probably Yes.
Authors: Joshua Radoff and Karin Miller

Abstract:
Are the buildings we work in good for us? Do they make us healthy or do they stress us out? The reality is that buildings are often selected, designed, and managed without the health and wellbeing of occupants in mind, and as we continue to realize the important link between health and the built environment, these questions are becoming increasingly relevant. In this paper, we present the growing body of research that links health, the built environment, and occupant behavior, highlighting strategies for designing, building, and managing spaces that support a healthy, engaged, and sustainable workforce.

We know the problems: Obesity, diabetes, heart disease and asthma have all been on the rise in the last few decades, but we attribute most of the blame to our bad habits and lowly personalities. However, many of these negative trends can be attributed to changes in the physical environmental, spatial and social contexts of our society. Our physical environments cause us to be sedentary, often isolated, lacking basic connection to natural elements like daylight, and surrounded by stressful urban and suburban landscapes, from a car in traffic to an office cube. “In the early 1960's almost half the jobs in private industry in the U.S. required at least moderate intensity physical activity whereas now less than 20% demand this level of energy expenditure.” (Church et. al, 2011) What have we done to accommodate for this shift?

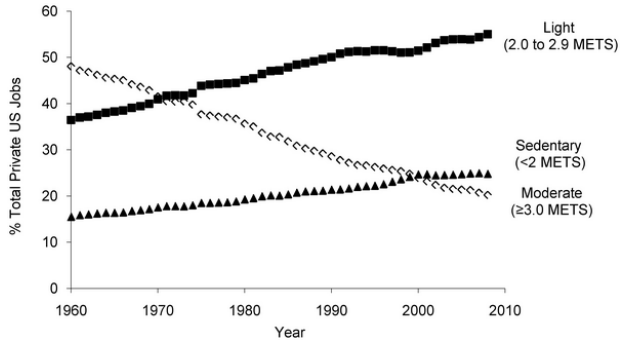
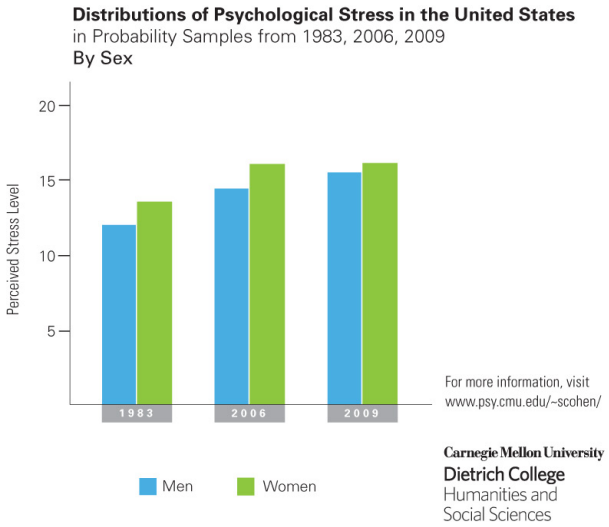


Figure 2. Trends in the prevalence of sedentary, light and moderate intensity occupations from 1960 to 2008 (Church et. al, 2011)

The shift from jobs requiring moderate physical intensity to jobs of a sedentary nature has had myriad health implications. The decrease in physical activity is clear, but more time spent indoors also affects air quality, exposure to nature, changes in dietary factors and stress, which can all contribute to health issues.



There has been an 18% increase in stress for women and 24% for men from 1983 to 2009 (Cohen and Janicki-Deverts, 2012) – alarming, but what does it have to do with health? Stress can influence the way an individual eats and their psychological well-being and has been linked to obesity (Torres SJ, Nowson CA, 2007) and heart disease. Unfortunately, it looks like this trend will continue; a recent survey (Stress in America™, 2012) by the American Psychological Association has shown that Millenials (those aged 18-34) are the most stressed generation and that 49% of them don’t adequately manage the stress. The survey

reports that on average, Americans are dealing with their stress in unhealthy ways.

25% report eating to manage stress

13% report drinking alcohol to manage stress

34% report watching television or movies for more than two hours per day to manage stress

Due to the health implications of stress, finding ways to reduce stress and encourage healthy ways to manage it become increasingly necessary in the workplace.

Where and how do environmental factors come into the picture? The built environment can make use sick or enable healthy living in a variety of ways.

Understanding the relationship between the built environment and health issues is important as it provides an opportunity to make changes that may positively impact the populations that use the space.

Location

The contextual location of a workplace comes with a layer of environmental factors that can have health impacts. Long commutes (greater than 30 min by car or public transit) can impact employee health through poor sleep quality, reduced social interaction, and increased stress based on variability and unpredictability of the commute – think driving through congested city streets, waiting for transfers, and overcrowding. However, those employees that had an under 30 minute commute time by public transit showed a decrease in stress levels. (Hansson, Erik, Kristoffer Mattisson, et al., 2011)

Proximity to public transit, and encouraging its use, can lead to decreased employee stress levels and potentially greater physical activity.

The site surrounding a building and its use can have an effect on employee health. The results of a study on the relationship between access to a green outdoor environment at work and employees' perceived level of stress and attitude toward the workplace showed that there was a significant relationship between physical and visual access to workplace greenery, and a positive workplace attitude. (Lottrup, Grahn, and Stigsdotter, 2013)

Establishing outdoor green space at a workplace, and encouraging access by employees, can help to improve employee satisfaction and decrease stress levels.

Office Layout and Architectural Design

Tapping into the vast body of research around healthcare and consumers, one can begin to investigate further how architectural detail influences data processing, well-being and choice. A study of architectural detail (Fischl and Garling, 2004), as it relates to health care and psychological well-being, found that one can hierarchically rank the psychological impact of details as 1) window; 2) floor and wall; 3) ceiling and furniture; 4) handicraft, photograph, chair and curtain; 5) noise level, safety, and space for moving. Preliminary results show that the significant architectural details may influence individual psychological skills, which in turn can affect the individual social skills and self-management. Building upon this research, Roger Ulrich, Lennart Bogren, and Stefan Lunden have recently published an paper titled "Toward a Design Theory of Reducing Aggression in Psychiatric Facilities" (November 2012) which links stress to aggression and identifies architectural design features that reduce stress including many of the same details identified above. The results have been applied to the Östra Psychiatry Hospital.

The same elements that reduce stress in a healthcare environment have similar effects in other contexts. Many of these elements can also be associated with the concept of biophilia, which is defined by E.O. Wilson as “the innately emotional affiliation of human beings to other living organisms.” The concept of biophilia implies that humans hold a biological need for connection with nature on physical, mental, and social levels, and that this connection affects our personal well-being, productivity, and societal relationships. (Terrapin Bright Green)

Daylight and views to nature have a measurable impact on the performance and satisfaction of employees. In a study completed by the California Energy Commission in 2003 at the Sacramento Municipal Utility District, a better view (based on size and vegetation content) was the most consistent explanatory variable associated with improved office worker performance. Additionally, daylight illumination levels were significant and positive in predicting better performance on one test of mental function and attention.

There is intrinsic value in the relationship between humans and nature, a view of nature will reduce stress levels and even a technological view of nature (a live feed through an LCD screen, for example) was found to show positive impacts. (Friedman, et. al. 2008)

A study on the Economics of Biophilia, published by Terrapin Bright Green, makes the connection between absenteeism, productivity and views to nature - demonstrating through various case studies that there are significant economic benefits to the consideration of biophilia in the built environment.

Incorporating daylight and views can lead to decreased employee stress levels and improved productivity levels.

Studies on “Open Office” plans have shown that they can be negatively related to workers’ satisfaction and productivity rates. (Brennan, Chugh, Kline, 2002) This can be attributed to a number of factors, but include acoustical stress, perception of control over immediate environment and lack of privacy. In a study to test the impact of low-intensity noise on behavioral decision-making it was found that individuals had motivational deficits and were less likely to make ergonomic, postural adjustments in their computer work station while working under noisy, relative to quiet, conditions. (Evans and Johnson, 2000)

Acoustical comfort and the implementation design strategies to control noise levels may have an impact on productivity and absenteeism through employee satisfaction, focus, and stress levels.

Recognizing the increase in sedentary nature of many occupations has lead to an increase in attention to the ergonomics of the built environment. Adjustments to individual workstations can improve employee well-being, however, “even when work processes and ergonomic job requirements are improved, static tension and limited mobility remain major predictors for musculoskeletal problems, pain, sick leave, and ill-health effects.” (Berqvist, 1995) An increase in physical activity can help to counteract sedentary health risks and associated effects. “Although the relationship between physical activity on productivity indicators remains inconclusive, emerging evidence indicates positive effects of physical activity on work performance, fitness program participation on absenteeism, and vigorous physical activity on sick leave.” (Pronk and Kottke, 2009)

Looking at the office environment, there is potential to influence the behavior and activity of occupants in their use of the physical space. The Active Design Guidelines published by the City of New York help to define design strategies to create healthier buildings by encouraging physical activity of their users through interaction with the built environment.

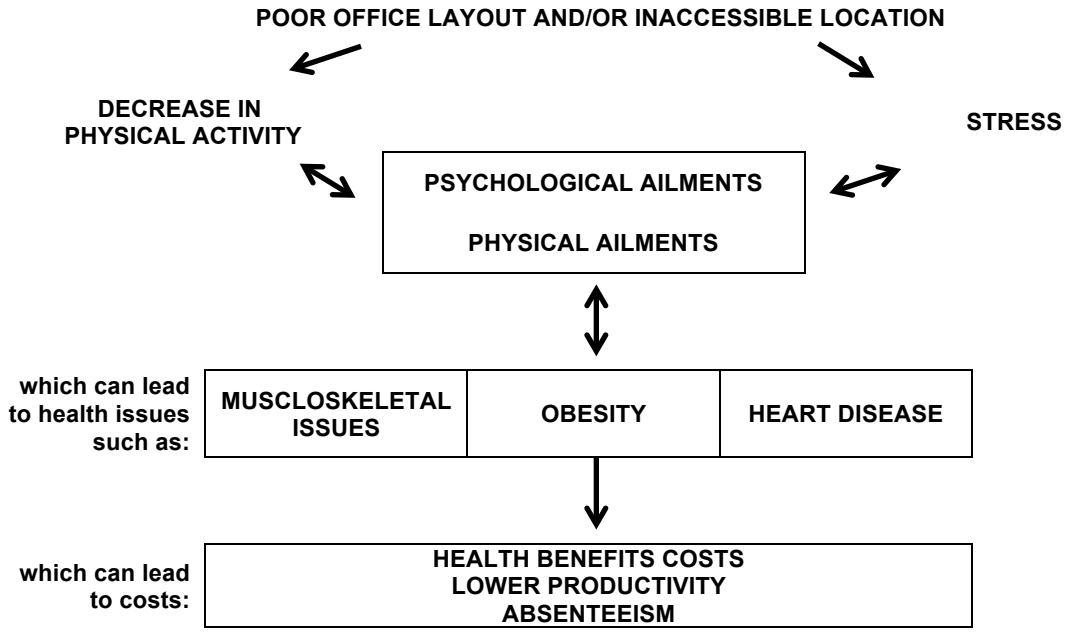
One of the primary opportunities for increased physical activity at the workplace is through stair use. “Encouraging stair use at work is effective for improving fitness, body composition, blood pressure, and lipid profile in asymptomatic individuals with an inactive lifestyle and thus may be a simple way to

significantly reduce cardiovascular disease risk at the population level." (Meyer, Philippe, Bengt Kayser, et al, 2010). When looking at stair design, one should consider convenience, legibility, appeal, comfort and safety as those are primary drivers behind the behavioral decision to use the stairs. Skip-stop elevators (those that only service certain floor sections and require the user to move to a different elevator to continue) have been successfully implemented and studied at the Caltrans District 7 Headquarters Building, which provides an example of a positive example for incorporating stair use across the general population of a high-rise building (72.8% of employees reported daily stair use). The integration of skip-stop elevators provided an innovative but cost-effective means to get people who might not otherwise engage in physical activity to take the stairs. (Nicoll and Zimring, 2013)

Incorporating Active Design, and encouraging the use of stairs, can improve overall health and well-being of employees.

Designing for healthy spaces is just the beginning. Operating facilities so that people are active, engaged, and part of a social network that rewards and reinforces healthy habits and behavior is critical for a successful healthy workplace and for a larger sustainability program.

How can companies encourage improved employee health through design decisions and communicative strategies? And why should they care?



The workplace represents a unique environment in which physical activity promotion initiatives can repeatedly reach a large number of people over an extended period of time, thereby optimizing the likelihood for successful outcomes. (Pronk and Kottke, 2009) Companies have an opportunity to influence the physical activity of employees through engagement in health programs on site. The type of intervention can have varied results based on context and organizational structure, though positive reinforcement and an individualized approach have both been shown to positively influence efficacy of health programs. (Goetzel and Ozminkowski, 2008)

Behavioral psychology and choice can impact health in a number of ways and be used to reinforce positive behavior. Drawing on research that indicated a behavioral change in food selection based on color coding (Thorndike, et al., 2012), as well as the integration of several other strategies including plate size, food placement and opaque containers, Google was able to influence the way that employees made food selections and saw positive results.

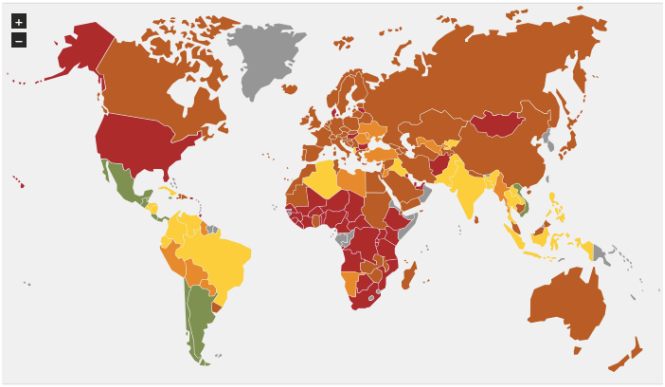
Companies can also enhance the well being of employees through programs that encourage participation in the surrounding community and volunteerism. Patagonia clothing company has implemented a number of social strategies, including the Patagonia Employee Internship Program, which allows employees to volunteer at an organization of their choice for 1-2 months at full pay, that have decreased absenteeism and stress of workers and improved employee satisfaction.

Additionally, programs that encourage the use of public transportation through combined social and individualized marketing campaign in the workplace setting can increase the use of active transport for the journey to work and trips on weekends (Wen, et. al., 2005) and employee sponsored public transit passes play a significant role in employees meeting physical activity recommendations (Lachapelle and Frank, 2008).

Green building programs, such as LEED® and the Living Building Challenge^{SM} have recognized the importance of these issues and have integrated them into the requirements. The Living Building Challenge, a performance based standard requiring that twenty imperatives are met, approaches health through the following imperatives: civilized environment, healthy air, and biophilia. Looking at civilized environment and biophilia, one can find the relation between the previously discussed architectural elements and the intended outcomes of these requirements.

> **Civilized Environment**: Every occupiable interior space of the project must have operable windows that provide access to fresh air and daylight.
>
> **Biophilia**: The project must be designed to include elements that nurture the innate human attraction to natural systems and processes. Each of the six established Biophilic Design Elements must be represented for every 2,000 m^2 of the project:
> - Environmental features
> - Natural shapes and forms
> - Natural patterns and processes
> - Light and Space
> - Place-based relationships
> - Evolved human-nature relationships
>
> *These attributes of Biophilic design are defined and described in Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life by Stephen R. Kellert, Judith Jeerwagen, and Martin Mador.*
>
> International Living Future Institute – Living Building Challenge^{SM} 2.1

The Happy Planet Index attempts to look at the success of countries through their relationship between quality of life and ecological footprint, and it's important to remember that those variables can also be considered when in it comes to the workplace. A building that saves energy but doesn't consider the health and comfort of its occupants isn't a happy building.

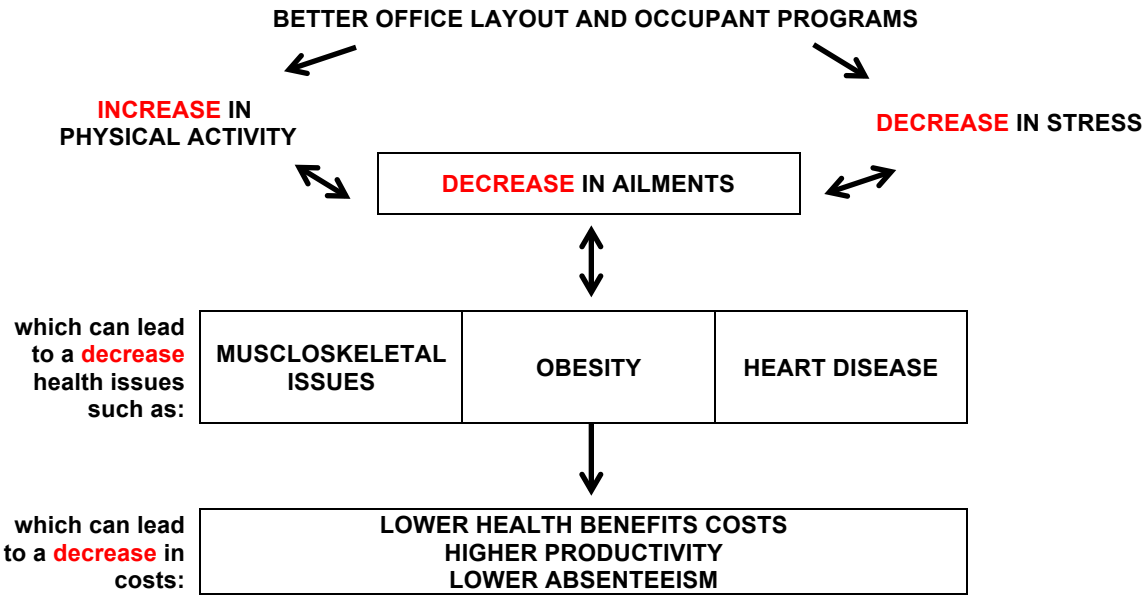


Experienced Well-Being x Life Expectancy
Ecological Footprint

Happy Planet Index – 2013 New Economics Foundation

HAPPIER

By actively pursuing design and communicative strategies that encourage physical activity and reduce stress, workplaces can help to improve employee satisfaction, potentially lower health related costs and absenteeism, and may see higher levels of productivity. Revisiting the previous diagram, a combination of architectural and social strategies can alter the flow.



The increase in physical activity can stem from Active Design elements, health programs and behavioral influence. A decrease in stress levels can be achieved through architectural elements such as acoustical controls, daylight and views to nature, as well as proximity to public transportation and employee benefit programs. These represent only a few of the potential strategies that a workplace could implement to combat stress and improve health and well-being of employees.

References for "Is Your Office Stressing You Out and Making You Fat?"

American Psychological Association. ""Stress in America™" 2013. <http://www.apa.org/news/press/releases/stress/index.aspx>

Berqvist, U., 1995. Musculoskeletal Disorders and the Workplace: Low Back and Upper Extremities. National Academies Press, Washington, DC, USA.

Brennan, Aoife, Jasdeep S. Chugh, and Theresa Kiline. "Traditional versus Open Office Design – A Longitudinal Field Study." Environment and Behavior. 34.3 (2002): 279-299. Print.

California Energy Commission Technical Report. "Windows and Offices: A Study of Office Worker performance and the indoor environment." Oct. 2003. P500-03-082-A-9.

City of New York. "Active Design Guidelines." (2010). <http://www.nyc.gov/html/ddc/html/design/active_design.shtml>

Cohen, Sheldon, Denise Janicki-Deverts. "Who's Stressed? Distributions of Psychological Stress in the United States in Probability Samples from 1983, 2006, and 2009." Journal of Applied Social Psychology. 42:6 (2012): 1320-1334. Print.

Church TS, Thomas DM, Tudor-Locke C, Katzmarzyk PT, Earnest CP, et al. "Trends over 5 Decades in U.S. Occupation-Related Physical Activity and Their Associations with Obesity." PLoS ONE 6.5 (2011). <10.1371/journal.pone.0019657>

Elder, CR, CM Gullion, et al. "Impact of sleep, screen time, depression and stress on weight change in the intensive weight loss phase of the LIFE study." International Journal of Obesity. 1.7 (2011): n. page. Web. 7 Feb. 2013. <http://www.nature.com/ijo>.

Evans, Gary W., and Dana Johnson. "Stress and open-office noise." Journal of Applied Psychology, 85.5 (Oct 2000): 779-783. Print.

Fischl, Geza and Anita Garling (2004), "Enhancing Well-Being in Health Care Facilities," in Evaluation in Progress—Strategies for Environmental Research and Implementation, ed. Bob Martens and Alexander G. Keul, July 7–9 (IAPS 18 Conference Proceedings on CD-Rom; ISBN 3-85437-263-9).

Friedman, Batya, Nathan G. Freier, Peter H. Kahn Jr., Peyina Lin, and Robin Sodeman. "Office window of the future? - Field-based analyses of a new use of a large display." International Journal of Human-computer Studies. 66.6 (2008): 452-465.

Goetzel, Ron Z. and Ronald J. Ozminkowski. "The Health and Cost Benefits of Work Site Health-Promotion Programs." Annual Review of Public Health. 29 (2008): 303-323. <http://publhealth.annualreviews.org>

Hansson, Erik, Kristoffer Mattisson, et al. "Relationship between commuting and health outcomes in a cross-sectional population survey in southern Sweden." BMC Public Health. 11.834 (2011): n. page. Web. 7 Feb. 2013. <http://www.biomedcentral.com/1471-2458/11/834>.

Hoehner, Christine M., and Carolyn E. Barlow. "Commuting Distance, Cardiorespiratory Fitness, and Metabolic Risk." American Journal of Preventative Medicine. 42.6 (2012): 571-578. Print.

Peter H. Kahn, Jr., Rachel L. Severson, and Jolina H. Ruckert. "The Human Relation With Nature and Technological Nature." Current Directions in Psychological Science. 18.1 (2009) 37-42.

Lachapelle, Ugo, and Lawrence D Frank. "Transit and Health: Mode of Transport, Employer-Sponsored Public Transit Pass Programs, and Physical Activity." Journal of Public Health Policy. 30.S1 (2008): n. page. Print. <http://dx.doi.org/10.1057/jphp.2008.52>.

Lottrup, Lene , Patrik Grahn, and Ulrika K. Stigsdotter. “Workplace greenery and perceived level of stress: Benefits of access to a green outdoor environment at the workplace.” Landscape and Urban Planning. 110 (2013): 5-11. Print.

Meyer, Philippe, Bengt Kayser, et al. "Stairs instead of elevators at workplace: cardioprotective effects of a pragmatic intervention." European Journal of Preventive Cardiology. 17.5 (2010): n. page. Print.

Nicoll, Gayle, and Craig Zimring. "Effect of Innovative Building Design on Physical Activity." Journal of Public Health Policy. 30.S1 (2009): n. page. Web. 7 Feb. 2013. <http://dx.doi.org/10.1057/jphp.2008.55>.

Pratt, Charlotte, Stephanie Lemon, et al. "Design Characteristics of Worksite Environmental Interventions for Obesity Prevention." Obesity. 15.9 (2007): 2171–2180. Print. <DOI: 10.1038/oby.2007.258>.

Pronk, Nicolaas P., and Thomas E. Kottke. "Physical activity promotion as a strategic corporate priority to improve worker health and business performance." Journal of Preventative Medicine. 49. (2009): 316-321. Print.

Proper, K., van Mechelen, W., “Effectiveness and economic impact of worksite interventions to promote physical activity and healthy diet.” World Health Organization, 2008.
<http://www.who.int/dietphysicalactivity/Proper_K.pdf>
Rodahl, K., 1989. The Physiology of Work. Taylor and Francis, Inc., Bristol, PA, USA.

Saarloos, Dick, Jae-Eun Kim, and Harry Timmermans. "The Built Environment and Health: Introducing Individual Space-Time Behavior." International Journal of Environmental Research and Public Health. 6. (2009): 1724-1743. Print.

Terrapin Bright Green. “The Economics of Biophilia”. 2012. <http://www.terrapinbrightgreen.com>

Thorndike, Anne N., Lillian Sonnenberg, Jason Riis, Susan Barraclough, and Douglas E. Levy. “A 2-Phase Labeling and Choice Architecture Intervention to Improve Healthy Food and Beverage Choices” American Journal of Public Health. 102:3 (2012): 527-533

Torres SJ, Nowson CA. “Relationship between stress, eating behavior, and obesity.” Nutrition 2007; 23: 887–894.

Wen, Li Ming, Neil Orr, et al. "Promoting active transport in a workplace setting: evaluation of a pilot study in Australia." Health Promotion International. 20.2 (2005): 123-133. Print. <10.1093/heapro/dah602>.

http://www.aia.org/practicing/AIAB096792
http://www.fastcodesign.com/1663272/a-new-design-movement-that-can-help-us-beat-obesity
http://www.happyplanetindex.org/about/
http://ideas.time.com/2012/08/15/why-the-open-office-is-a-hotbed-of-stress/
http://www.nytimes.com/2013/01/13/opinion/sunday/building-a-space-for-calm.html?_r=0
http://well.blogs.nytimes.com/2011/05/25/less-active-at-work-americans-have-packed-on-pounds/