Sustainability through Light

A Case Study, a Mise-en-Scene and a Laboratory in one Exhibition

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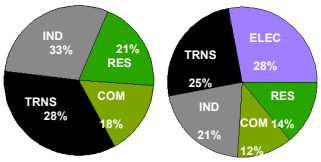
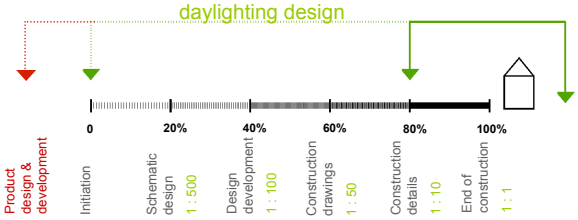


ENERGY FACTS

Fig. 1: Charts showing Energy Usage & CO2 Emissions by Sector (Residential buildings, Commercial buildings, Transportation and Industry), September 2008.

Buildings are responsible for 68% and 39% of the total electricity and energy consumption [3]. Amongst the different end uses of this energy, lighting purposes causes particularly high costs in terms of energy, ecological impact and economics [4].



DAYLIGHTING DESIGN FACTS

Fig. 2: Diagram showing the stages in which the daylighting design takes place, and its desirable displacement towards the initial stages of the building design process.

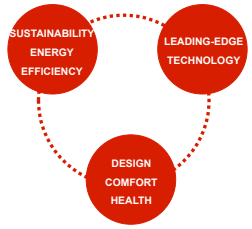


Fig. 3: Main Concept of the Exhibition: Connecting disciplines for integration in design.

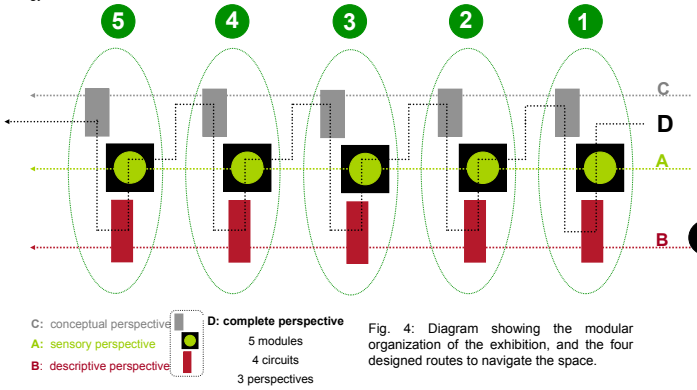
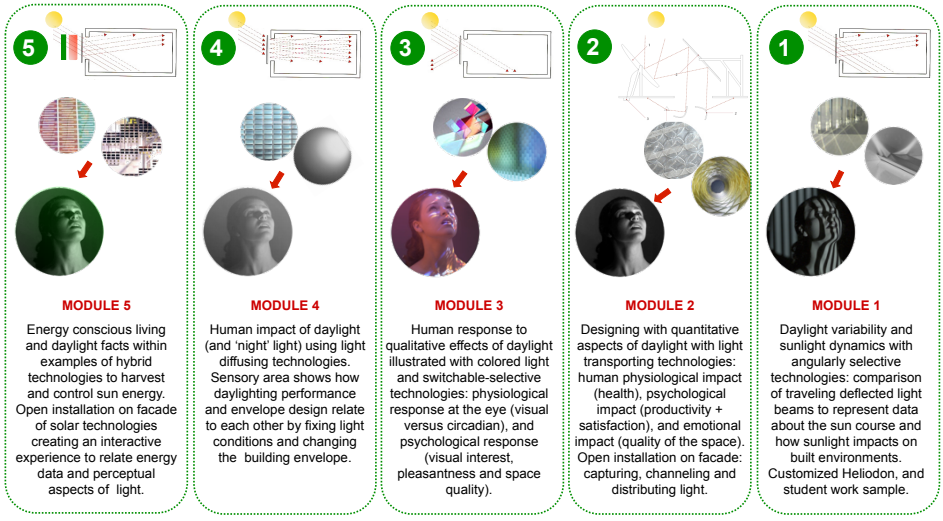


Fig. 4: Diagram showing the modular organization of the exhibition, and the four designed routes to navigate the space.



MODULE 5

Energy conscious living and daylight facts within examples of hybrid technologies to harvest and control sun energy. Open installation on facade of solar technologies creating an interactive experience to relate energy data and perceptual aspects of light.

MODULE 4

Human impact of daylight (and 'night' light) using light diffusing technologies. Sensory area shows how daylighting performance and envelope design relate to each other by fixing light conditions and changing the building envelope.

MODULE 3

Human response to qualitative effects of daylight illustrated with colored light and switchable-selective technologies: physiological response at the eye (visual versus circadian), and psychological response (visual interest, pleasantness and space quality).

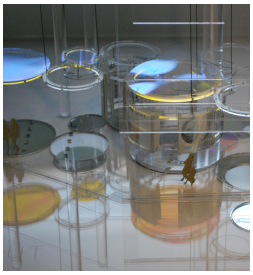
MODULE 2

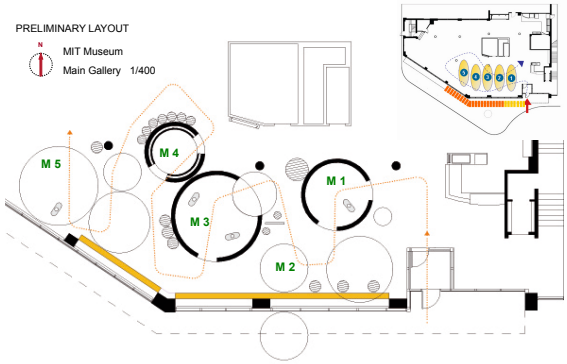
Designing with quantitative aspects of daylight with light transporting technologies: human physiological impact (health), psychological impact (productivity + satisfaction), and emotional impact (quality of the space). Open installation on facade: capturing, channeling and distributing light.

MODULE 1

Daylight variability and sunlight dynamics with angularly selective technologies: comparison of traveling deflected light beams to represent data about the sun course and how sunlight impacts on built environments. Customized Heliodon, and student work sample.

MIT MUSEUM AS CASE STUDY





...a Contemporary Approach to Articulate Design and Technology

Introduction

Throughout the 20th century there has been a progressive distancing between the disciplines of technology and design. This segregation is of particular concern in the area of daylight control, since a decrease in electrical lighting usage and a better control of solar gains are absolute priorities in contemporary energy-efficient architecture (Fig.1).

For this ecological argument, the control of daylight and solar radiation through fenestration systems has received a growing attention in research and has led to the development of a large variety of innovative facade systems. Unfortunately, due to the lack of effective communication between the design and technological fields, a large portion of the contemporary showcase of daylighting systems remains largely unknown to the majority of designers [1], who at best envisage to incorporate these technologies a posteriori (Fig. 2).

We have developed two approaches to generate an effective informative experience to increase the awareness and understanding of designers about integrating advanced daylighting technologies for sustainable architecture.

. D-LITE Project, a Database of Light-Interacting Technologies for Architectural Envelopes (www.d-lite.org) [2].

. Exhibition Project: a platform to promote the collaboration between designers, scientists and manufacturers.

Why an Exhibition on Daylighting?

. Very first exhibition at interface between daylight design and technology: opportunity to gather and display samples of a representative selection of daylighting technologies.

. Intense, physical and effective instrument to actively assure the first contact with these innovative materials, which are the protagonists of the exhibit.

. Installation of materials and creation of scenarios: a key opportunity to explore the potential in integrating the design and construction aspects of these daylighting technologies in building envelopes, and their light performances projected on the space.

. Emphasis on research and education.

Structure

The exhibition is structured into five distinct physical areas that relate to five major subjects regarding the impact of daylight on the environment and on humans, illustrated through specific types of light-control technologies. These areas take the form of modules with similar construction conditions, to endow this configuration with the flexibility of being adaptable to different spaces and venues. The visitor's experience within each of these five modules can follow three different perspectives or itineraries that correspond to sensory, descriptive and conceptual narratives, respectively.

Through the first route (A), visitors will experiment the materials' performance in the space without 'seeing' the actual materials performing. The second itinerary (B) will get visitors to see the material protagonists working. This will allow them to identify specifically experienced environments and particular technical installations. This circuit will be particularly didactic, since it will include explanations and examples of how these technologies are installed, manufactured and used through different built case studies. The third itinerary (C) will be intermingled within the other two and in a way sews the exhibition as a whole. It will investigate which daylighting concepts underlie the visitor's experiences in each module. It will emphasize benefits and challenges in daylighting strategies, educating the visitor about why these concepts are important and why

References

[1] The American Institute of Architects (AIA), (2006). *Firm Survey Overview 2006*, p.13. http://www.aia.org/ aiarchitect/thisweek07/0105/2006FirmSurveyOverview.pdf

[2] Urbano, R., Andersen, M. (2008). D-LITE: a new perspective for searching and selecting light-control technologies as a designer. *Proceedings of the 25th International Passive and Low Energy Architecture Conference (PLEA'08)*, University College Dublin, Ireland, October 22-24.

[3] US Energy Information Administration - Department of Energy (2005). *Annual Energy Outlook* (DOE/EIA-0383).

[4] Federal Register (2007). *Notices 2007 - Representative Energy Costs*, vol. 72, num. 54 (available online at http://www.fra.dot.gov/downloads/safety/ FRA0523281.pdf).

Acknowledgements