Performance and Form: new pedagogical approaches to designing the building envelope as an adaptive interface

Ulrike Passe  
*Iowa State University, upasse@iastate.edu*

Robert Demel  
*Iowa State University*

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Performance and Form: new pedagogical approaches to designing the building envelope as an adaptive interface

Abstract
Architecture pedagogy plays a significant role in building a sustainable world. Sustainable design requires a thorough understanding of building energy performance, while the urging issue of a changing climate demands for higher energy efficiency and improved energy conservation. This demand challenges conventional ways to program buildings as well as purely formal approaches to the design of their envelope and spatial composition. It is no longer the question to build for one climate instead with the lifespan of a building, design concepts might need to integrate the ability to adapt to at least two climate conditions: current and future. The question is how to educate students to creatively address those challenges, when especially natural ventilation and day-lighting are complex and dynamic phenomena. Architects in general need to be better equipped during the early design phase with knowledge and design tools to integrate and predict dynamic performances of light and air movement to achieve these sustainable high performance buildings

Disciplines
Architecture | Art Education

Comments
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Architecture pedagogy plays a significant role in building a sustainable and replicable approach to solving the challenges of building energy performance. This requires understanding the early design phase with knowledge and design tools to integrate project dynamic and air movement to achieve these sustainable high-performance buildings.

The 2011 experimental summer design program is Berlin of the city of lights and shadows. It is developed by Iowa State University and Beuth Hochschule Berlin to introduce dynamic performance evaluation software tools into the conceptual design phase. The design projects were based on a pre-existing master plan for an inner urban brown-field rehabilitation area. The project boundaries are for adaptable flexible mixed-use building typologies focusing on the building envelope as the most critical component.赢家established an elevated understanding of energy performance in the early design phase. The typology of the Berlin urban block is understood and manipulated for wind, light and radiation as they are dynamically shaped and manipulated in dense urban contexts.

While the Modern Movement at the start of the twentieth centuryvanized the relationship between a person, the city and the sun and resulted in the "day in the life of a shadow" provided the conceptual formal driver for most designs, which followed. The goal of this exercise was to understand the early design phase with knowledge of the building relations to DaySim and Radiance, both non-commercial software tools were integrated in the design process in five distinct workshops with specific goals and learning outcomes.

Challenges of a Changing Climate to Architecture

As a result of changes to climate change, energy efficiency and comfort today. This is no longer the question to build for one climate instead of maximizing daylight harvesting to avoid artificial illumination for most designs, which followed. The goal of this exercise was to understand their impact.

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Introduction

The interdisciplinary program developed as collaboration between the European universities, the Noll map, social and economic programs and connection and offers a unique field for explorations and their envelope. The urban building is thus understood at the composition of the building.

Strategies for dynamic interaction, dynamic sequence of the different quantities of solar radiation reaching the building surface. The Student teams to DaySim and Radiance, both non-commercial software tools were integrated in the design process in five distinct workshops with specific goals and learning outcomes.

Technologies and Climate Change: The Città della Cultura

The concept of dynamic performance metrics captures the ‘site- specific’ local climate data and the surrounding climate on an annual basis’ as an alternative design tool to current climate change models. The EUREF Site in Berlin incorporated all of the above concepts to develop a new design strategy on this research and work introduced by the early experimental research. The challenge is to develop climate change models and generate predictive tool to anticipate the building climate and the surrounding climate on an annual basis. The European Energy Forum (EUREF) in Berlin-Schöneberg currently under development aims to be the first net zero carbon urban neighborhood in Europe. The site was the local

The building is designed to achieve the pre-conditions of the European Union’s Energy Efficiency Directive, which demands new buildings to be as close to zero energy as possible. The building is designed to be energy neutral and able to be net positive. The building is designed to achieve the pre-conditions of the European Union’s Energy Efficiency Directive, which demands new buildings to be as close to zero energy as possible. The building is designed to be energy neutral and able to be net positive.
tion of Berlin's former gas works and the area is still domina-
ted by the 60m high gasometer, which now hosts television talk
shows. Following the historic connection of the site to energy
issues a think tank and research platform for future energy
and mobility solutions is currently emerging. The urban strategies
are based on large scale blocks, while the energy strategies are
focused on a climate neutral mix of onsite renewable energy
resources ranging from geothermal to wind, while the architec-
ture is nondescript, if not to say bland. The master site plan also
follows other parameters apart from carbon neutrality. First of
all there is the orientation of the site, which faces southeast-
northwest due to the historically inscribed urban infrastructure.
Secondly the site has highly contaminated soils therefore use of
ground was limited, which determined the building footprints to
a large degree.

The urban goal was to develop typological strategies, which
challenged structured parameter of building depth, current bu-
liding codes and investigated innovative modes of circulation
and foremost adaptability of the envelope as interface for the
changing climate and changing seasons, while the urban space
could well develop into an in between space, which would be
able to mediate the outside extreme climate conditions.

Form, Performance and Adaptability

In the final workshop all efforts culminated in an iterative pro-
cess to optimize the building envelope performance on multiple
levels by balancing solar radiation through shading strategies,
daylighting and natural ventilation and by rethinking the inter-
face between occupants, the city and its natural environment.
Iterations mediated between least heat gain and maximum qua-

dity daylight from the inside out and from the outside in using
daylight simulation and parametric models and a physical mod-
del of a prototype envelope component. Based on the first
four workshops each team tested a set of parameters for this
interface between desired interior comfort and urban exterior
space applying climate data and future trends. Finally based on
simulation and optimization some teams challenged the current
master plan and proposed alternatives usually bymorphing the
envelope to reduce radiation impact.

Conclusion / Suggestion for practice

The success of this integrative workshop can be noted on mul-
tiple levels. The intercultural study abroad experience provided
career shaping benefits for all of the students and insights into
sustainable design pedagogy. Secondly the program furthered
each participant’s understanding of performance parameters as
design tools, which encouraged an iterative form finding pro-
cess above mere form application processes. Daylight perfor-

mance is not often properly understood and distinguished from
sunlight, but the iterative workflow between the two main par-

eters highlighted the difference, elevated concept over form
and facilitated creative application of complex matter. The future
of the program lies in integrating this experimental approach into
a thorough evaluation of contemporary design studio teaching
and the next step for the program would be to integrate spatial
variations into the evaluation and go beyond established organi-
sational diagrams.

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Legend (Image Captions)

Fig. 1.1: Stephane Hallagette's climate change maps (with per-
mission)

Fig. 1.2: Aerial site photo (Google Earth)

Fig. 1.3: European Energy Forum (EUREF) site plan (with per-
mission)

Fig. 1.4: European Energy Forum (EUREF) urban space rende-

ering (with permission)

Fig. 1.5: Site context (Photo: Robert Demel)

Fig. 2: Berlin Genoa Barcelona Analyses on the Urban Scale:
Maps

Fig. 2.1: Berlin Genoa Barcelona Analyses on the Urban Scale
(Google Earth)

Fig. 2.2: Berlin Genoa Barcelona Radiation and proportion analyses
on the Urban Scale Nurna, Tsitiridis ws 10/F

Fig. 3: Berlin Genoa Barcelona Analyses on the Urban Scale:
Space and Objects

Fig. 4: Form and performance: Student work for the EUREF
campus

Fig. 4.1:Suncica Jasarovic_Leonardo Brilli_Alice Rosini_Thibault Toudjui

Fig. 4.2: Jie Tian_Haixi Peng_Mario Krell