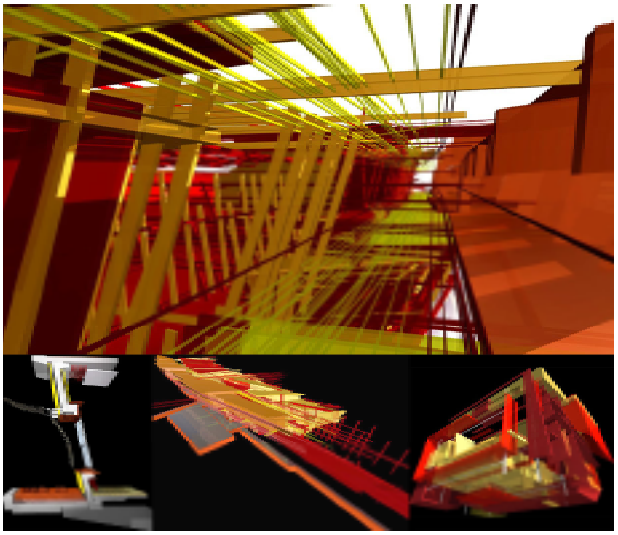

PHYSICAL AND DIGITAL MEDIA STRATEGIES FOR EXPLORING 'IMAGINED' REALITIES OF SPACE, SKIN AND LIGHT

Thomas Fowler, IV, Associate Professor
Cal Poly State University, San Luis Obispo, California, USA
tfowler@calpoly.edu

Brook Muller, Assistant Professor
Cal Poly State University, San Luis Obispo, California, USA
bmuller@calpoly.edu

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Abstract

This paper will discuss an unconventional methodology for using physical and digital media strategies interchangeably in a tightly structured framework for the integration of environmental control systems (ECS) principles into a third year design studio. An eight-step methodology enabled architectural explorations of rich tactile and luminous engagement.
The principles that provide the foundation for these integrative strategies between a design studio and building technology course, spring from a systematic approach that follows the tradition of the Bauhaus principles (e.g., Albers, Moholy-Nagy, Kandinsky and Kepes) of craftsmanship and visual perception.
A series of intense short workshops focused on day lighting, electric lighting, and skin vocabulary to lead students to consider these components as part of their form-making inspiration.
Examples of student work and their feedback on this methodology process will show how the exercises were linked to allow for a clear design progression.

Resumen

Esta ponencia presenta una metodología no convencional que usa estrategias de medios físicos y digitales intercambiablemente para integrar el conocimiento de las tecnologías de control ambiental a un taller de arquitectura de tercer año. Una metodología de ocho pasos permite una exploración arquitectónica rica en calidad tactil y de luz.
Los principios que proveen la fundación para estas estrategias de integración entre el taller y la clase de tecnología constructiva, estan basados en la tradición de la Bauhaus (Albers, Moholy-Nagy, Kandinsky and Kepes), particularmente en referencia a la terminación, el detalle y la percepción visual.
Una serie de workshops cortos e intensos enfocados en la iluminación diurnal y eléctrica, y el vocabulario de la piel edilicia inspira a los estudiantes a considerar estos componentes durante el proceso de formalización arquitectónica.
Se demostrará mediante ejemplos de trabajos estudiantil y su respuesta a esta metodología como los ejercicios fueron organizados para permitir una clara progresión de diseño.

Introduction

A format for integrating third year design studio content with environmental control systems (ECS) topics was first introduced in the winter quarter of 2001 and was continued in the winter quarter of 2002. The group of students enrolled in an ECS studio would be enrolled in a corresponding design studio. These two courses, with different instructors, would meet in the studio space on alternating days.

It was up to the individual instructors how and when ECS topics such as day lighting, electric lighting, thermal behavior, acoustics and water and waste systems would be made part of students' design investigations, in particular their articulation of building space and skin. The difficulty of synchronizing activities in the ECS studio, ECS lecture and design studio were formidable, and it was decided by the authors to link these two studio activities as closely as possible in order to emphasize to students that ECS issues were fundamental to their design work. Readings (the majority of the studio text was taken from "Questions of Perception, Phenomenology of Architecture", by Holl, Pallasmaa, & Perez-Gomes) discussions and sketchbook "aphorisms response" assignments provided a shared thematic framework, with a focus on how experiential, phenomenological aspects of architecture can be enriched and informed by a background understanding in ECS.

Design and ECS Studio Calendar Des		
Week	(#)Activity Themes	Reading Themes
01	(1)Analog & Digital Warm-Up Ex. & (2)Conceptual Understandings Ex.	Representation
02	(3)Daylight Precedent Studies	Infrastructure & Water
03	(4A)Space Moods of Day Light & (4B)Spatiality of Night	Light & Materiality
04	(5)Acoustics & Volume	Sound & Senses
05	(6)Volumetric Configurations of Space [MID-Review]	Skin
06	(7)Skintegration (Thermal Optimization - exterior skin)	Space & Body
07	(8)Process Integration	Building Typologies
08	(8)Process Integration	Building Typologies
09	(8)Project Integration	Building Typologies
10	(8)Project Integration [FINAL Review]	Building Typologies

Exercise 1. Analog & Digital Warm-Up Exercise (figure 1)

A previous workshop titled "Analog and Digital Language of Vision (ADLV)" conducted at Cal Poly in the Spring of 2000 (Bermudez, Fowler, Neiman 2000)[1] provided the foundation principles for this exercise. A previous paper "Between Analog and Digital Civilizations" (Bermudez, Neiman 1997)[1] further defined the basic premise of this approach that introduces students to the advantages of going back and forth between the worlds of analog and digital media to enhance ones ability to recognize and maximize design opportunities. This warm-up exercise (figure 1) an exercise accomplished in collaborative teams of 4 students, provided an opportunity for all students in the studio to come up to speed using a range of digital tools in the context of solving a design problem. In addition, the outcomes from this team project became a foundation kit-of parts vocabulary that each individual student would use for developing their own project vocabulary.

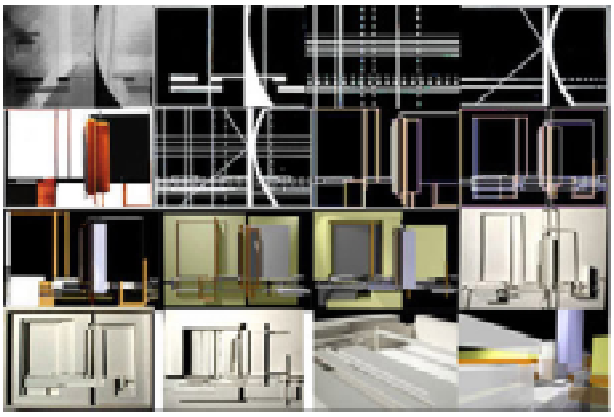

Fig 1 - Analog and Digital Media Warm-Up Exercise (left to right). Top Left-Original Image Manipulation, Bottom Right-Spatial Manipulation Device.

This seven-step analog & digital exercise ***(figure 1)*** is based on Bauhaus principles of craftsmanship and visual perception. A strict set of guidelines applied foundation principles of the Wassily Kandinsky method of analytical drawing that breaks a still life composition into diagrammatic forces to express tension and geometry. Each step alternated between analog and digital media. This exercise started with still life images, then preceded to acetate overlays, to analog/digital diagrams, analog/digital relief models and ended with a spatial manipulation device. The outcomes from these group projects provided a foundation vocabulary for individual student projects.

Exercise 2. Conceptual Understandings – Traces of Infrastructure

Students were asked to work in groups to "trace" water supply and return - from its point of origin to its final destination - and determine where and how in the life of the system interconnections occur within the building that they have studio in. They made rubbings of materials of the system, and crafted physical relief models, drawings and collages. Students were asked to represent these findings with compelling representations and also with 'poetic' written descriptions of the sensory stimuli they experienced. A goal of this assignment was to identify formal and material qualities in infrastructure that is ordinarily out of site and out of mind, and also for students to recognize that buildings are connected to a web of systems that extend well beyond the building footprint.

Exercise 3. Daylight Precedent

Student groups studied significant architecture precedent examples by prominent architects (Aalto, Bruder, Holl, Kahn, Le Corbusier, Piano, Wright, Zumthor) as a way to explore daylight as a form generator. After an initial gathering of information on the precedent, students were asked to develop a hypothesis about the impact of daylight on the experience and functioning of the building. A large-scale model of the precedent enabled an accurate study of interior light conditions. Digital images of the interior of the model were taken at different times of day and year and were presented to the class. Students revisited the original day lighting hypothesis based on their more intensive and refined analysis.

Exercise 4A. Space Moods of Light – use of charcoal media and light box

Students were required to generate "initial concepts" in response to design projects. During an in-class charrette, students developed a concept narrative ("catch phrases") on a predetermined theme and created a charcoal concept 'light' sketch of a 48' wide, 80' long and 48' high interactive main space. This space became the form-generating programmatic component of their final design. From these initial studies, and using the daylight precedent study as inspiration, students developed a 1/2" scale 'double wall construction' day lighting model of the interactive main space.

Exercise 4B. Spatiality of Night: Designing with the Effects of Electric Light - an electric expression to mimic daylight scheme

Students were asked to create "DYNAMIC ATMOSPHERE" with electric lighting working with the same model they generated for the daylight exercise. Electric lighting was simulated in the model using Christmas lights, Plexiglas/acetate sheets, rods, etc., and

digital images were taken of the interior and exterior of the space "at night". The original lighting concept was re-evaluated and refined based on discoveries made with the model. In-class discussions centered on light distribution, the interrelationship of light and the surfaces on which it falls, and the role of electric lighting relative to day lighting. Students were encouraged to 'mimic' day lighting after dark through the deployment of electric lighting.

Exercise 5. Acoustics & Volumes

Students developed physical models for understanding acoustic performance in their interactive main space. They first calculated the reverberation time (RT) for the space, which required them to make preliminary decisions about building materials and finishes. In most cases the RT's were high and unsuitable for speech and similar functions. Students reevaluated decisions about materials in an effort to lower the RT. In most cases this led to an enrichment of the palette; perforated panels and fabrics for example were introduced in many projects in configurations that supported the established architectural vocabulary.

Exercise 6. Volumetric Configurations of Space — expressing the project's concept in the spatial configuration

Transforming all of the separate components of the project (e.g., skin, interactive main space, volumetric configurations of space, etc) into an integrated architectural expression allowed students to build on and further integrate lessons learned in earlier exercises.

Exercise 7. Skintegration — expressing the project's concept in the skin

Addressing thermal optimization principles required that each of the students develop four skin model details. Each detail had to embody the concept of the project and at the same time explicitly express the response to each of the four orientations.

Exercise 8 – Process Integration *(figure 2)*

During the seventh week of the quarter, students completed the last of the specific ECS studio assignments and spent the remainder of the studio (3 weeks) integrating ECS topics in their final design project. Instructors required that students meaningfully integrate day lighting and thermal optimization ("skintegration"). They were also asked to select an additional optional ECS topic to explore out of electrical lighting, acoustics and water and waste. Students' overall performance in the ECS studio was measured in part by their ability to skillfully and beautifully synthesize ECS issues with other design concerns in their projects.

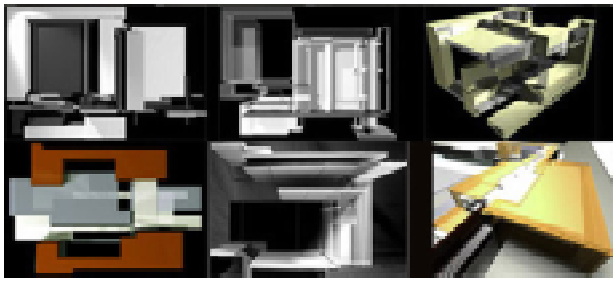

Fig 2 - Process Integration of Project Sequence – Steve Saude "Resourcefulness Center", Concept "Crescendo" (left to right). Top Left-Vocabulary Precedent from Warm-up Exercise, Vocabulary Analysis, Spatial Study, Skin Study, Acoustics Study, Perspectival View of Project.

Final Student E-mail Journal Feedback

"I really enjoyed the ECS/Design collaboration this quarter. I don't think I've ever had a quarter in which the two were so well integrated. I liked the fact that we got to explore the ECS side of design by focusing on the general concepts rather than the number-crunching side."

"I think the skin is a great opportunity to create spaces that people will find inviting and to create a different relationship with the exterior."

"Also the class showed me the way to include the computer in my everyday work and how it is important to go back and forth from analog to digital."

Assessment

•The Bauhaus methods provided the theoretical framework for maximizing design opportunity through the interactive use of analog-digital procedures in developing analytical drawings and models. It's difficult to separate the methods from the procedures to determine which aspect of the framework is more effective, since both work together to provide the clear and strict set of rules for the students to react to throughout the quarter.

•The success of developing these Bauhaus methods into an analog-digital framework is that it introduces students to a pedagogy of play and interpretation which focuses more on the poetics of representation (and not its technicalities) as the driving force to generate architectural understanding. The act of playing (execution) precedes results (conception) or, interpretation follows form and form follows action. This allows for the development of an experimental yet critical attitude towards the value, rationale and logistics of media in architectural design. (Bermudez, Fowler, Neiman 2001) [2]. As one student stated, "this process allows no one in the class to be left behind". All students in the class are equally engaged in the design process and all have visibly significant components to develop as a result, which also adds to the dynamically charged nature of the studio environment which does feed into each of the students' project development. Another student best summed up the difference of using both of these mediums along with indicating what happens when these mediums become interactive with the following statement, "(The) ANALOG (medium) states the tangible while (the) DIGITAL (medium) inclines the mood. (The) DIGITAL and ANALOG combine to communicate what sits behind my eye-lid-curtain".

•The overall quality of the studio projects — when compared holistically to the other seven third year ECS/design studios both years — was mostly visible in the strength of both the interior and exterior architectural vocabulary of students' projects. There was also an ease of understanding how a student's project (in looking at the documented design process) related to the concept, ECS issues and how project evolved over the duration of the quarter. Both the vocabulary development and the clarity of the process was due to the following: first, the quarter started with the analog-digital warm-up exercise (which established the foundation for design tools framework and architectural vocabulary); second, this same framework was used for the strategy of studying the ECS components for their individual project; and finally, continuing to use this framework for the synthesis of the significant ECS components into total development of project. A few student insights that shed additional light on the quality of projects based on this process include: "The … process was very integral in developing a design vocabulary, in terms of form and most importantly skin. It

provided a firm inspiration for defining that skin, without that it would have proved a difficult struggle to find a foundation to leap from." "(The process) has helped me in creating a strong architectural language that has guided me throughout my project. Thus, I was not distracted by the many issues that faced me, but was able to rationalize and keep my idea(s) clear and strong." "The use of multi media (analog-digital tools) and the intense pace of this studio created a strong and direct process that inspired my design throughout the quarter. While all the parts remain exercises within themselves, it is when you see how they all relate to one another and speak of a unified process that makes this design approach so significant."

Lessons

•Going back and forth between digital and analog media has the advantage of revealing more quickly and more clearly weaknesses in a project as well as inconsistencies between a student's original intentions (for example about how light will work in a building) and what is revealed in their work. The most successful students quickly identified shared qualities of images generated on the computer and on paper and a composite idea of the project seemed to emerge as they proceeded. These students committed to a consistent formal language that they could articulate and develop in both digital and analog realms.

•A goal as students move from the generation of a graphic vocabulary to a building design would be to have them quickly model the energy and environmental performance implications of their design (such as it is, at that point). This would force a preliminary consideration of building materials, glazing areas and so on. As they proceed they will be able to translate what is in many cases a rich kit-of-parts vocabulary into something that is compelling architecturally and that also makes sense in terms of energy use regarding light quality and so on. A survey of computer energy modeling tools with strong graphic interfaces would be a logical next step in the development of the ECS/design integration model.

•One of the challenges of the quarter system (tem weeks) and of design education in general is the difficulty of exposing students to a new topic, acoustics as but one example, having them explore it in a design problem, and expect them to meaningfully integrate the topic in a final project. The ECS/ Design integration model and the Bauhaus analog-digital methodology attempted this past winter would benefit from a more rigorous project evaluation of environmental criteria at the quarter's end in addition to feedback about the quality and spirit of their work, time constraints notwithstanding, so students have a clear idea of the extent of their success.

Endnotes

- Bermudez, Neiman, Between Analog and Digital Civilizations, The Spatial Manipulation Media Workshop Association of computer Aided Design in Architecture (ACADIA) 97, "Representation and Design", Cincinnati
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