Kanto-Gakuin University
Yokohama, Japan

Fields of Study in the Department of Human Environmental Design(HED)

by Takashi Nakajima

The Department of Human Environmental Design in Kanto-Gakuin University aims at educating professionals who are capable of creating and/or organizing human lives and living spaces in ways that are sensitive to the environment and respectful of every individual, especially those that may be weak.

There are approximately 100 students enrolled in the department and our four-year curriculum leads to a Bachelor's degree in Human Environmental Design (HED). The students are grouped in three fields of study according to their interests; these are Life Design, Residential Environmental Design, and Environmental Conservation Design. A goal of the students in the Residential Environmental Design, both Architects and Planners, is to pass the Governmental Qualification Exams within a few years after graduation and after they complete the required practical experience. In addition, there are also several students who complete their training as industrial designers, costume designers, and display designers.

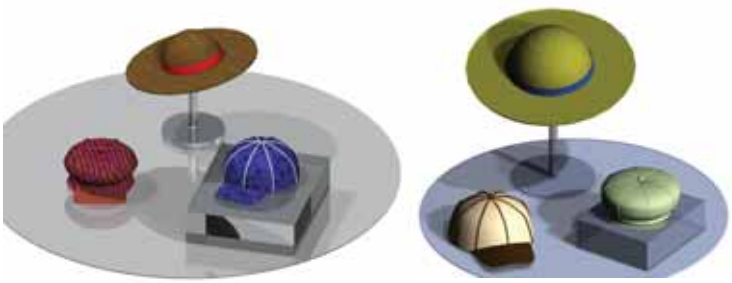
Due to the diversity of career interests among the students, the three digital and eight non-digital design studios deal with a wide variety of design projects whose focus range from toy design to landscape design. In our eight paper studios, students begin with hand drawing techniques and they also learn to do need analysis and architectural programming. They go through the traditional design process step-by-step, and toward the end, they are also trained in design production management.

Digital Studio Orientation

The digital studios place emphasis on teaching computer techniques, which, by today's standards, help produce successful and efficient design solutions. In practice, a most important skill is communication. In Japan, the need for a designer to be able to communicate properly is two-fold: he needs to communicate with professionals at manufacturing and construction sites, and he also needs to communicate with non-professionals, such as the clients and/or the future users of a building. In regards to professionals, one of the most important communication documents is 2D drawings. Also, 3D digital models (either in axonometric or perspective) are considered more important than physical models in Japan. A second very important consideration is participation of all the concerned parties in the design decision-making process aimed at forming a consensus. One of the most efficient methods to achieve this consensus is through the use of digital models that allow evaluation of the various alternative possibilities.

To develop the students' abilities to communicate their designs and to reach consensus, the department offers three digital studios. The first studio (CAD I) teaches 2D CAD software, specifically AutoCAD. This course is considered an introduction to computer usage in architecture. Studio courses are taken in the second semester of the freshmen year. The introductory architectural drawing course taken in the very first semester after enrollment is intended to teach how to use CAD programs for drawing plans and elevations of a single story residential unit.

The second studio (CAD II) is taken during the first semester of the sophomore year and covers 3D modeling with **form•Z**. In this course, the first exercise is to design and model a die placing polygonal blocks on the die's faces. This allows students to practice visualizing objects in a 3D space through a 2D display screen and how to manipulate the views. Then students further develop their 3D skills by modeling objects from our daily life, such as toys, cups, clocks, lamps, chairs, tables, houses, etc. Designing these types of small objects does not necessarily require significant computer skills, as they are relatively simple objects to design.



Figures 1, 2: Different forms, colors, and textures for hats and caps.

Figures 3, 4: Different colors and textures for a house in an environment, by Yoshioki Kambayashiand Sanae Ishii.

The emphasis in these exercises is on visual simulation. The choice of form, materials, colors, and fitness to the environment are judged through accurate renderings (see Figures 1-4). That is, when a particular design project is given, students are also expected to decide on an environment where to place their object. Using rendered images as backgrounds in 3D space, they try and evaluate different volumetric solutions that include color and textures. Through these exercises, students learn how to use the computer for conceptual design.

The third studio (CG•Rendering) is offered in the second semester of the sophomore year and helps students strengthen their 3D presentation skills. In this studio, in addition to **form•Z**, Photoshop is taught and is used to refine the renderings produced by **form•Z**. Specifically, Photoshop's masking techniques are utilized often, which helps reduce both the modeling time and file size that are normally required by **form•Z**. The final project of the studio also requires interior renderings of a commercial unit, including materials, colors, textures, and lighting. These are intended to provide a rather complete feel of the interior space (Figures 5-7).

Figure 5: Interior design simulation: No1 case, by Takahisa Morisaki.

Figure 6: Interior design simulation: No2 case, Kenichi Nakano.

Figure 7: Interior design simulation: No3 case, by Yuko Otaki.

Frequently Used form•Z Functions

In CADII, a chair model and a house model are used to evaluate both the interior and the exterior, as they relate to the surrounding environment. Students select and scan a photograph and then use it as a background environment. When inserting the 3D object in the photograph, the 3D viewpoint is determined using the Match View operation (Figure 8).

In these types of visual exercises, the ability to cast shadows is one of the most important features. An invisible object is placed on the background photo and receives shadows, which appear to be part of the environment (Figure 9). This shadow casting technique is particularly important for freshmen students who typically have difficulty perceiving 3D space. In general, architectural spaces are initially conceived as 2D layout plans. A 3D digital model with shadows is then placed onto a 2D background image, and this is the moment when students' visualization of 3D space typically begins to improve. This perceptual experience of reading 3D through 2D represents a positive moment within the evolution of a student's learning.

Figure 8: The Y chair and the coffee table are placed by using Match View, by Ayaka Kitajima.

Figure 10: A BMP file with an alpha channel is attatched on the glass to draw a figure on it, by Minori Goto.

Figure 12: **form•Z** lighting function Projector simulates a large TV screen, by Kaoru Hirabayashi.

Figure 9: The 3D Y chair casts its shadow in the 2D photo, by Takahisa Morisaki.

Figure 11: A BMP file with an alpha channel is attatched on the glass to write letters on it, by Takahisa Morisaki.

Figure 13: **form•Z** lighting function "glare" simulates spot lights on the counter, by Minori Goto.

In professional interior design practices, figures and letters often decorate glazed doors and windows. To achieve the same effects in the virtual world, color images are mapped with alpha channel (Figures 10, 11). Lighting design is also as important as interior finishes and for some types of commercial buildings even more important. The light modeling tools in **form•Z** are quite effective for simulating various lighting effects. For example, Light Glow and Projector are features that provide visually interesting modeling possibilities (Figures 12, 13).

To place a building next to a group of existing buildings, which is useful when wanting to evaluate the impact of the new building on the environment, the surrounding buildings are modeled as volumes and, for the details, photos of the façades are mapped as decals, which reduces the modeling time required significantly (Figure 14).

Figure 14: The new building (the tallest) is modelled in detail in 3D, while the others are simply decaled with facade photos, by Takahisa Morisaki and Azuma Seki.

Research Projects

One of the oldest and largest Buddhist temples in Kamakura City is Kenchouji Temple. In 2003, we attempted to model its entrance gate (Sanmon) for an exhibition on Kenchouji Temple at Tokyo National Museum (Figures 15,16). The intent was to visualize its very complex wood structure, particularly the joint systems. Thousands of pieces modeled with texture, as well as relief patterns were assembled together. Part of this process was presented as a **form•Z** animation (Figure 17) with finely-rendered images that were very effective.

Another research project dealing with the evaluations of the landscape of an urban waterway bank wall was also produced with **form•Z**. One-hundred-and-eighty-degree panoramic photos were taken around a target point, which corresponded to the landscape of both sides of the waterway, and modified walls were inserted, intended to improve the landscape (Figure 18). The evaluators navigate around the landscape and observe the effects of the modifications in color, form, and texture. Since its initial completion in 2003, this simulation system has been further refined and is now significantly more accurate.

Buildings and other structures tend to remain in our physical environment for a very long time. Consequently, a designer has the responsibility to deal with design sustainability considerations in several different ways. In particular, new landscape designs should be examined thoroughly for their suitability, with the understanding that the urban landscape belongs to all the people

that live in the area. This is where highly accurate and detailed digital models are required before the construction of a new design in order to be able to evaluate the impact. Consequently, it is important that universities offer their design students opportunities to learn accurate 3D modeling techniques.

We have also spent time modeling the Kanto-Gakuin School campus, which consists of approximately 50 buildings. This was intended for the evaluation of the impact of a proposed new building. As was mentioned earlier, while the new building was modeled in detail, the elevations of all the existing buildings were modeled by mapping photos of their façades as decals.

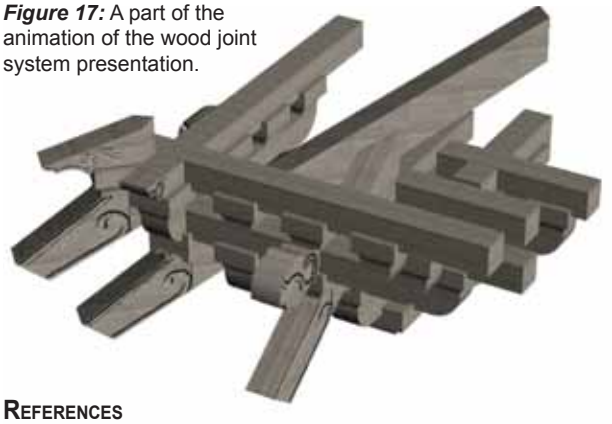
Figure 15: Gate of Kenchouji Temple.

Figure 16: A close view of the gate of Kenchouji Temple.

Figure 18: Panoramic view of CG animation using VR to evaluate landscape design of water way bank walls.

Figure 19: Analysis of the urban profile with the new proposed building (the tallest on the left side) in the university.

Figure 17: A part of the animation of the wood joint system presentation.



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Takashi Nakajima is a graduate from the Department of Architecture, Waseda University of Japan '68, PhD in CE from UIUC '72, Taught architectural design studios and CAD courses at School of Architecture, Laval University, Quebec,'71-'99. Nakajima is now teaching CG and CAD courses as well as Residential Environment courses at the Department of Human Environmental Design, Kanto-Gakuin University, Japan, 00~. He worked as a staff member of CAD divisions in Construction Companies for many years. Research topics include the following; Simulation of human behavior in architectural spaces; Landscape evaluation by CG simulations and 3D model construction of Japanese traditional buildings; The most recent topic deals with evaluations of environmental aspects of Japanese traditional building materials.