With a background in architectural design, Doo Young Kwon is learning to design by points. He is currently a PhD candidate in the Computer Graphics Lab at the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland. During his architectural studies and in the subsequent years thereafter, he spent nearly a decade using solid and surface modeling software, but since he discovered Pointshop3D at ETH, he’s grown fond of point-based graphics. Developed at ETH, Pointshop3D lets Kwon change his design process and express ideas in new ways.

“With solid and surface modeling software, I always had to think about the topological links between point, segment, face, and object,” he explained. “Sometimes it restricted my design idea and it took a lot of time to get a different design feedback. However, with Pointshop3D as a point-based modeling tool, I can create objects not by connecting polygons in the right ways and directions, but by creating points. This allows me to create 3D digital models in more intuitive ways, just like real sculpting and painting.”

He says the main difference is that he doesn’t have to think about polygons when it comes to constructing objects. For example, he sculpts the point-based model by transforming the points and edits the model by deleting certain points. “By repeating this simple process, I can express an abstract design idea with 3D objects. Besides the modeling process, Pointshop3D also allows me to paint different colors directly on the points. Changing the size of the points is more like real painting rather than mapping a polygonal object with a certain image.”

Functional ambiguity

While studying architectural design at Akou University in Korea, Kwon investigated building forms in the schematic design process with computational models. Using computational designs to express his concepts, he deliberately created scenarios of graphic ambiguity. This, in turn, resulted in using computers in all facets of the design process rather than just the finished model.

“Unlike final computer models with details and specifications, this ambiguity provides variety and fluid formal design ideas to me,” he explained. “I could obtain the ambiguity with irregular overlays of various colors, in shapes, spaces, lines, or in images with any specified degree of irregularity.” This process occurred either iteratively from his mind’s eye or from preconceived images. Through these repetitive generational processes, he searched for relationships between the formal and the conceptual.

Which brings us to the cover image, Rhythmical Nature—Waters. Kwon says his works have a musical sensibility—their various rhythmic representations are like playing music in 3D space. That is, in the same way a composer might use themes and variations in an orchestral piece, Kwon uses point-based modeling to explore variations and repetitions.

“In Pointshop3D,” he noted, “I can create several point-based objects in an efficient way and repeat until I get the final design.” To create the cover image—as well as those shown in Figures 1, 2, and 3—he divided his design process into two steps: modeling and painting. The

1 Rhythmical Nature—Blossoms
cover image shows a simple bump-pattern shape painted with two colors (yellow and blue). Influenced by “the vital forces of nature,” he describes it as a journey into the “ocean.” He created the 3D shape by manipulating the points.

Kwon describes Figure 1 as a metaphor for flowers. “The image is like looking through a microscope—I created it so you can see the delicate cells of the petal-like exploration. It represents how different point sizes can be represented in one point-based object. I emphasized the effect by painting different colors on the points.”

For Figure 2, he used a powerful point-based Boolean operation in Pointshop3D. He modeled by subtracting one object from another object and painted different colors on the points of the subtracted parts to express the Boolean effect. Figure 3 was created using his technique of juxtaposing point-based objects that have different point-size renderings.

**Points are the answer**

Currently Kwon is interested in researching human–computer interaction, and he’s about to develop an interface in Pointshop3D to help designers improve their own style. He believes points are the answer because, again, point-based modeling lets users design in a more intuitive way than traditional approaches do. Since computational work is a result of thinking and doing in predefined processes, the computer should provide an interface and interaction metaphor that evolves and allows designers to adapt it to their own creative processes.

“From a designer’s point of view, regardless of type of tools, a designer represents and develops a visual idea repeatedly until he or she finds a building form,” Kwon said. “With conventional painting and sculpture, there is an intimate relationship between the designer and his object. There’s diverse intentions and ambiguity. Therefore I believe that a new design tool that lets designers quickly and intuitively create alternative designs might be useful.”

He believes that even though current 3D modeling software supports the creation of basic drawings, it’s not easy to learn and control these operations. “Even if a designer already knows how to operate the system, it can be time-consuming and labor intensive to produce proposed formal designs. This is one reason why many designers still use a computer only to present a final product, but not in the creative phases of design. I believe point-based modeling can solve this problem.”

Readers may contact Gary Singh at gsingh@email.sjsu.edu.