Philosophic Projections

Daniel Lordick, Helga Mettke, Gunter Weiss, and Ritsuko Izuhara

Does your hometown have any mathematical tourist attractions such as statues, plaques, graves, the café where the famous conjecture was made, the desk where the famous initials are scratched, birthplaces, houses, or memorials? Have you encountered a mathematical sight on your travels? If so, we invite you to submit an essay to this column. Be sure to include a picture, a description of its mathematical significance, and either a map or directions so that others may follow in your tracks.

Please send all submissions to Mathematical Tourist Editor,
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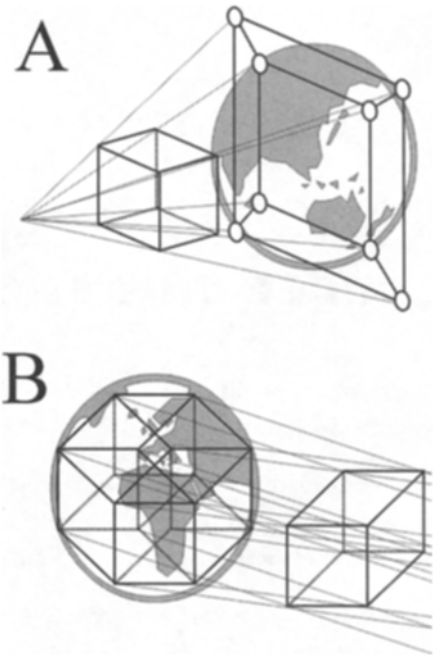
In his recent book "Shadows of Reality," artist Tony Robbins argues that projections are far more important than sections in science and in art (Yale University Press, 2007—see Tom Banchoff's review in *The Mathematical Intelligencer*, 30:1). Regardless of the trustworthiness of this account, two authors from opposite sides of the world seem to agree, independently: in Japan, Ritsuko Izuhara interprets ancient "gengo-zu" diagrams as projections of polyhedra (A), whereas in Germany, Gunter Weiss chooses a projection of a hypercube as the logo of the International Society for Geometry and Graphics as the emblem of a forthcoming meeting (B).—**D. H.**



A. 2-D Projections in Ancient Japanese Diagrams

During the Edo or Tokugawa era (1603–1867), Japan was ruled by the Tokugawa "shogunate," which restricted trade overseas. From that time date the curious diagrams drawn by Baien Miura, born Miura Susumu (1723–1789). Through these so-called "gengo-zu," the philosopher expressed and developed his ideas. His embellished manuscripts are kept in several archives in Japan, such as the "Shido-bunko," a special library of the Keio University in Tokyo. The visitor can consult microfilms in the library, if requested in advance. Two volumes, entitled "Baien Shiryoushu" (1989, Perikansha Pub.), collect his works.

Baien drew over one hundred diagrams. His philosophy was based on the dichotomy principle and contrasting opposite concepts. Consequently, his "gengo-zu" were usually symmetric, since their "mirror reflections" represent what he called the "dichotomy principle of nature."

The interpretation of the diagrams is not straightforward. Baien gives indications in his book: "Don't regard all diagrams as flat and round forms like coins. Regard these as solid and round forms like hand balls." However, he did not draw the spherical forms. Such a transformation of a 2-dimensional image into a 3-dimensional representation is a well-known problem in crystallography. Of course, additional information is required for a unique 3-D representation, but unlike for crystals, no other "physical" information is available in this case. The (re-) construction proposed here was inspired by a careful reading of Baien's texts. It resulted in the interpretation of the diagram shown in Figure 3.

Computer aids allow simulating the 3-D images and comparing them to the original diagrams. Almost all of them respect the symmetry in the sense of mirror reflection. Only a few 3-D images have patterns in which the mirror reflection is not respected, although the original 2-D diagrams are symmetric. In our opinion, Baien's "jorigaku" doctrine of "rationalist studies" may involve more mathematical reasoning than generally assumed and indeed, Baien's approach to physics, medicine, and economics was more scientific than traditional. Thus, besides historical, philosophical, and cultural aspects, the correct interpretation of his work may create new mathematical challenges.

To honor Miura Baien, a museum was opened in October 2000, near Baien's House, in the Oita Prefecture of

Figure 1. The "Shido-Bunko" library at Keio University (2-15-45 Mita, Minato-ku, Tokyo, 108-8345).

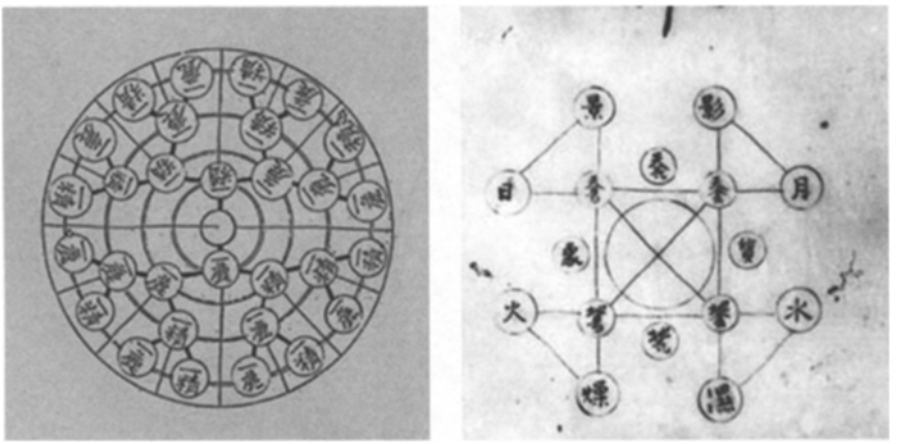


Figure 2. The "Ichichi-seiso-zu" (left) stands for the distinction between "rough and fine in nature" whereas the "Inyou-bouseki" (right) is a "representation of the universe through Yin and Yang."

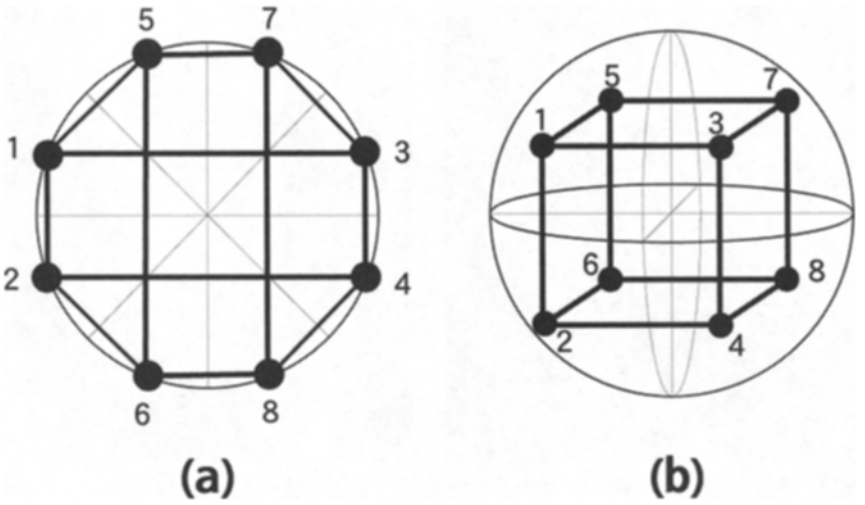


Figure 3. A transformation method for Baien's constructions.

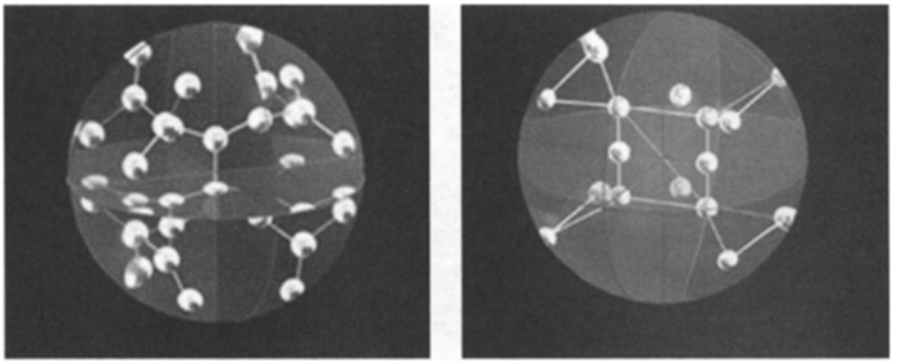


Figure 4. The 3-D images of Figure 2.

Figure 5. Baien's House, Oita Prefecture.

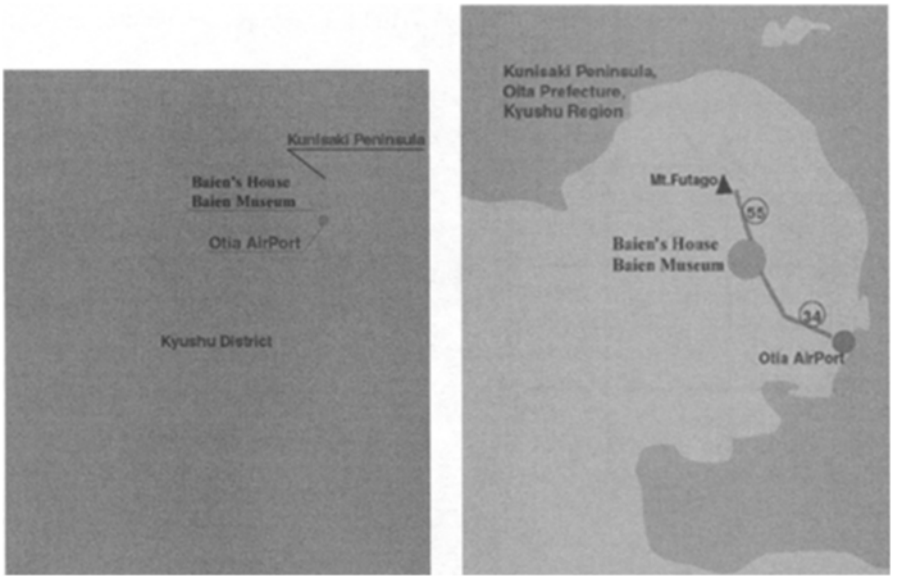


Figure 6. Maps locating Baien's House on Kyushu, the third-largest and most southerly of Japan's four main islands.

Figure 7. The logo of the ISGG (left) and its projection centered on Dresden, for the logo of the 2008 ICGG conference (right).

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B. Projection of a Hyper World

Gunter Weiss, chief organizer of the 13th International Conference on Geometry and Graphics (ICGG) 2008 in Dresden, asked Helga Mettke and Daniel Lordick to design the conference logo. They came up with a projection of the logo of the International Society for Geometry and Graphics ISGG, the global organizer of the conference, onto an orthographic projection of the earth, in such a way that Dresden, venue of the conference, meets the center of the outline. The arrangement of the earth's projection was implemented by Hans Havlicek, Vienna University of Technology, but the parallel projection of the hypercube into the plane is of course well known.

On their web site http://icgg2008.math.tu-dresden.de the organizers wax philosophic about their logo. A conference implies a lot of traveling, and they imagine the participants of the ICGG hopping from all over the globe, thus interpreting the hypercube lines and vertices as an allegory of a worldwide network and airports. The logo's color, mainly a fresh and inviting green, would refer to both a young and dynamic conference and to Dresden as a city of cultural richness; it is situated in the Elbe Valley, a cultural landscape on the UNESCO World Heritage List.

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