Open and Closed
Reflections from the Boundaries of Form

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When we say "shape", we may be thinking of mathematics or art, design or philosophy. Today, we may also be thinking of computing science. We certainly do so when the announcement says "Shapes 1.0". The particle "1.0" in the title of this meeting announces nothing but: this is, in some way, the first of a kind. But the innocent particle also defines a specific context, the context of versioning. The very moment, the organizers seem to be telling us, that we prepare for a first meeting, we declare it to be the first and thus a succession is needed or else we have failed. The particle "1.0" in the name of this meeting is a form-particle.

Fig. 1. Children's drawings of humans: open and closed shapes (from [2])

Semiotically speaking it is a rheme, i.e. an open sign-particle that needs other signs to become a closed form. Among all kinds of distinguishing shapes and forms, structures and gestalts, order and chaos, the arrangement of things in space is the kind that, in my observation, forces me to detect "shape". Among the shapes, I want here to distinguish open and closed shapes. In doing so, I need to refer to the shape in relation to its surroundings (Fig. 1). Which act, in turn, forces me to establish a boundary around or along the shape (that I also call "form").

The view I take in this short contribution is simple and naive. It is the view of *generating* shape. More specifically yet, I study two cases of algorithmic generation of something. That something we may call "color-shape". In one word, to indicate that color can appear only by creating shape, and shape can appear only by applying color. So the generation of shape and, therefore, the algorithmic generation of shape a fortiori, is a generation of color-shape or shape-color.

Ben Shahn puts us into a state of despair when he proclaims that "form is the visible shape of content" [7]. That's a nice way of pretending to clarify the eternal dance of form and content. Shahn declares one to be the visible shape of the other and, thus, is getting rid of the dialectics, i.e., the movement. We can think and talk about form vs. content in myriads of ways, and humankind (at least in Europe) has actually done so over the centuries. But we can do so only in terms of their eternal contradictions. They are one and the same, never separate, never apart, Siamese twins: dialectics.

We may say something like "Shape is the equivalence class of Euclidean point-sets under geometric transformation.". Besides the fact that not too many will follow us in this, it is a clear and unambiguous statement as long as we have a joint understanding of the terms "equivalence class", "Euclidean point sets", and "geometric transformation". Mathematics is the only discipline that allows for definite assuring statements. It can do so because it is purely mind-driven. It creates ideas out of ideas with no clay or steel applied. (Of course, this is an idealization.)

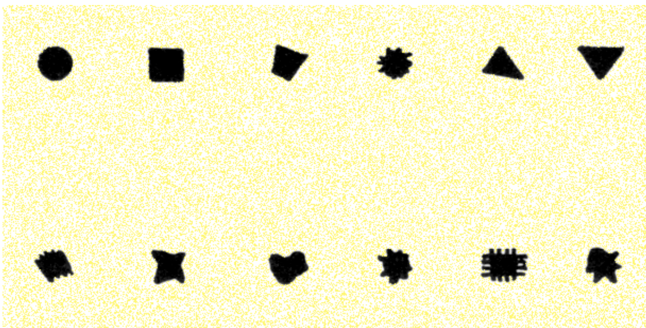

Fig. 2. Forms of points (from W. Kandinsky, Point and Line to Plane [3])

The seminal book by Wassily Kandinsky, Point and Line to Plane (1926) [3], contains a series of shapes of points (Fig. 2). Isn't this ridiculous? The point is invisible forever. It must remain inside our skulls, never to be found and seen. And yet Kandinsky, the artist, one of the great masters of form, seems to have no problem with talking about *forms* of points. As an artist, he *must* do so! He has no choice.

Christopher Alexander, in his early Notes on the Synthesis of Form [1], lifts form up to "the ultimate object of design"—again, seemingly an act of separating form from the rest (content, context, environment). But wait, no: form is that part of the world that we are in control of, whereas context, the necessary balance, is that part of the world that demands. Requirements and design, software engineers would probably say.

We may again paraphrase this by using terms like artefact and description to characterize our topic of the boundary. From description to artefact would then be the act of form-generation. Form-generation is here viewed as a transformation of the description into the appearing artefact, from the virtual to the actual form. The other direction, from artefact to description is, of course, an act of interpretation.

Detail from Drawing for Machine and Four Hands, *by Harold Cohen, a 14′ × 40′ mural in existence for three weeks at the University of California, San Diego, May 1976.*

Fig. 3. Harold Cohen: one of Aaron's early shape creations (from [4])

One of the most famous cases of algorithmic form generation is the program Aaron that Harold Cohen has been working on for forty years. During this time, it has undergone tremendous changes. The program was originally a rule-based system that grew dramatically to contain in its, perhaps, 300 rules an enormous externalized experience of the artist. Aaron is probably the only expert system that ever worked, and worked in never ending development over a full generation's time. Its rule base is the greatest treasure of algorithmic shape. A very early artefact is Fig. 3. By the time (mid 1970s) the system had acquired rules to control some open and closed forms and their interactions.

Georg Nees in his generative art experimented with algorithms that, by controlling parameter settings, establish a case of parametric design [6]. Parametric design clearly belongs to the stronghold of artificial art.

Not as famous as Cohen's Aaron, in fact, almost not known at all (although published before Aaron), is Nake's program Generative Aesthetics I. It was the result of only one year's work in Toronto in 1968/69. Its aspiration may have been similarly daring as Cohen's. Nake aimed at algorithmically generating color-shapes from numeric specifications. For those specifications he chose measures of information aesthetics. Those measures are based on Shannon's information theory. Nake concluded that the attempt showed the fundamental weaknesses of the information aesthetic approach at automatic form generation (cf. [5]).

Certain features of form, like being closed or open, and even interactions between these two basic form aspects, may be formulated algorithmically, i.e. ready for computation. Other important (and more complex) features remain beyond the boundaries of computability.

References

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