Beauty Beyond Perfection: Aesthetic Values in Japanese Art Resonant with Mathematics

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Abstract

Discussions on mathematics and the arts often emphasize principles such as symmetry and perfection in patterns. In this note we aim to complement and extend the scope of mathematical explorations of aesthetics by zeroing in on wabi-sabi, a Japanese aesthetic centered on three ideas: "nothing lasts, nothing is finished, and nothing is perfect".

Introduction

In [6], Lynn Gamwell states that *Homo sapiens* is biologically and anthropologically "a species that perceives patterns and seeks pleasure;" that is, humans are inclined to gravitate towards patterns and symmetry [5, 19]. In other words, mathematically unified, perfect, and complete things evoke aesthetic pleasure. In Roman art, ideal male human body proportions pointed towards an archetype of the harmonious relation of parts to a whole. Renaissance Italian architect Leon Battista Alberti favored buildings with symmetrical patterns. Symmetry has also served as a guiding principle for many indigenous cultures of the Americas [12] and aesthetic traditions of Muslim societies explored the wide range of possibilities of symmetry and perfection [2]. Thus naturally, many explorations of aesthetics, mathematical or otherwise, emphasize symmetry and perfect patterns; see for example [7, 17, 18, 20]. However, aesthetic sensibilities do not necessarily revolve around perfection and symmetry in all cultures. In the traditional Japanese aesthetic, symmetry is deemphasized and the concept of *wabi-sabi*—the idea that imperfection and transience in nature are valuable—prevails.

This note is our response to the above observations. Narratives tying mathematics and art together through symmetry and perfection felt incomplete to us as they did not seem to account for wabi-sabi. Thus we decided to dig deeper. In particular, we wanted to know: How does *wabi-sabi* relate to various mathematical sensibilities? Here we probe this question by examining two essential principles of mathematics and relating them to Japanese art. This perspective does not deny the aesthetic significance of symmetry and patterns, but instead complements and extends the scope of mathematical explorations of aesthetics.

The Wabi-sabi Aesthetic

Wabi-sabi is a foundational philosophy of Japanese aesthetics centered on three ideas: that nothing lasts, nothing is finished, and nothing is perfect [4, p. 59]. Literally, "wabi" means the enjoyment of austereness, simplicity, and quietness, and "sabi" means the enjoyment of aging and antiquity.

> Wabi-sabi is flea markets, not warehouse stores; aged wood, not laminate. Minimalist wabi-sabi respects age and celebrates humans over invulnerable machines ... It reminds us that we are transient beings—that our bodies and the material world around us are in the process of returning to dust from which they came. [11, p. 51]

Thus wabi-sabi is the aesthetic of earthy, antique, and impermanent things. Wabi-sabi spread in Japan in the 16^{th} century, due to a craving for simplicity and unostentatiousness after a long era of war and extravagance.

The Japanese Way of Tea, a religio-aesthetic tradition aligned with the natural, profound style of the wabi-sabi, also became popular in this era [11, p. 52]. Besides the performance of tea-making, this tradition also involves the design of the pots and bowls used in the ceremonies, the layout of the sweets, and the flower arrangement in the alcove; these components influenced Japanese aesthetic culture deeply in the following centuries [14, p. 28]. Wabi-sabi can be found in tea ceremonies in the chawan, the ceramic bowl used to pour tea. A typical chawan is opaque and cloudy, with uneven shapes and designs, dents, and rough surfaces (Figure 1a). The unevenness, imperfection, and inconspicuousness of the chawan create a natural, frugal, and earthy feel, resonating with the wabi-sabi ideal [4, p. 59].

Traditional Japanese art, in this wabi-sabi perspective, values unevenness, not perfect symmetry. The Japanese aesthete would see an aesthetic focused on symmetry and perfect proportion as artificial and unnatural. This stance may also be seen in Ikebana, the traditional Japanese art of flower arrangement (cf. Figure 1b). An Ikebana artist arranges flowers in a simple unadorned manner. Flowers are presented so as to form a scalene triangle, symbolizing the universe, as the distinct vertices of the triangle represent heavens, earth, and man, respectively. Artificial embellishments are avoided; the natural features of the flowers are enhanced.

Figure 1: *(a) Shino chawan (tea bowl), Japanese artwork. Photo by Marie-Lan Nguyen, Wikimedia Commons / CC-BY 3.0. (b) Yagi Sekkei. (1889). Examples of the Flower Arrangement.*

Mathematical Formalism and Japanese Art

Plato affirms that mathematics is mentally constructed, independent from nature. Theorems are not based on empirical evidence or experience; humans comprehend them by starting with abstract, meaning-free elements such as numbers [6, p. 152]. David Hilbert argues that mathematics is an "indivisible whole" which has "fundamental unity" [6, p. 165] despite (or perhaps because of) its dependence on formal abstractions. Reuben Hersh's humanistic philosophy of mathematics rests on abstract mental models [9]. All three approaches, though diverse in other ways, come together in one of the central tenets of mathematical formalism: complex concepts are comprised of simpler components, represented by otherwise meaningless symbols and primitive shapes. Numbers and symbols have no meaning until combined together and put in context.

Mathematical formalism finds resonance in the aesthetic stance known as formalism [6, Chapters 4-5]. "All simple aesthetic elements must themselves be relations, viz., relations whose relata, considered in themselves, have no aesthetic value" [8, p. 331]. So, what gives a work of art aesthetic value is not its individual components but the way those components come together and relate to one another. One work of art made of abstract elements assembled together is "Groundsel" by Paul Klee. Klee arranges abstract geometric shapes (such as squares, triangles, and circles) that mean nothing by themselves, but assembled together in a specific way, are perceived as a portrait of a face. Thus, the process of creating formalist art resembles assembling obscure puzzle pieces together into a coherent big picture.

This type of formalism can be observed in Ikebana. The central frame of Ikebana consists of a scalene triangle symbolizing the whole universe (cf. Figure 1b). The simple, meaning-free abstract shape of a triangle is presented in the form of Ikebana, creating meaning (heavens, earth, and man). In other words, the artist

gives meaning to and finds aesthetic value in the triangle by using it as the basic unit of the work. We can find resonances with aspects of mathematical formalism in other traditional forms of Japanese art as well. For instance, in the Japanese Way of Tea, there is a general form of practicing tea ceremonies, where guests and hosts move in fixed ceremonious ways [21, p. 34]. An individual action signifies nothing without context, but when carried out in order, it becomes integral in constructing a single work of art: the tea ceremony.

The formalistic aspects of Japanese art we point to above are linked to the simplicity and minimalism of wabi-sabi. The individual ingredients of the work of art are simple and basic; they are unadorned, without meaning or connotations. However their particular arrangement and presentation, together with all the other ingredients, each simple and unadorned, bring forth meaning and aesthetic value. Thus form is essential: it is how the ingredients comprise the whole that matters, not the particulars of each individual component.

Abstraction and Imagination as Essential Features

Platonists assert that mathematics relies on human imagination as the objects it engages with are not concrete but rather abstract ideas (forms) in a realm inaccessible to the usual senses.[1] The non-Platonist, too, will admit that many mathematical concepts (e.g., higher dimensions) cannot be found in the real world. In the absence of concrete objects to base our understanding on, we must use our imagination. Imagination is "the faculty of invention, and is linked with genius, in particular in mathematics" [1, p. 463]. With no concrete object to lean upon, the mind is free to imagine, giving pure mathematics its freedom and power.

Analogously the traditional Japanese artist values the absence of certain things as such absence elicits imagination and leads to an appreciation of beauty. The simplicity and lack of detail in wabi-sabi create the space to imagine. Japanese ceramic pottery maker Akiko Hirao explains that breaking symmetry in her work gives it life and movement, and allows the audience to complete the imperfect artwork in their imagination [3]. The lack of detailed depiction forces the audience to be more attentive to the artwork. These interactions between the art and the humans observing the art bring out the true beauty of the art. The work is incomplete without the viewer's reaction to it (imagination), and abstraction is the catalyst for these interactions.

In an essay "In Praise of Shadows" [16], the modern Japanese novelist Junichiro Tanizaki discusses the aesthetic values in darkness and shadows. Here is an excerpt about the art of lacquer soup bowls:

> There is a beauty in that moment between removing the lid and lifting the bowl to the mouth when one gazes at the still silent liquid in the dark depths of the bowl . . . What lies within the darkness one cannot distinguish but the palm senses the gentle movements of the liquid, vapor rises from within forming droplets on the rim, and the fragrance carried upon the vapor brings a delicate anticipation. (p. 15)

The murkiness and visual ambiguity of the soup causes one to note other features such as the movement of the liquid and the aroma of the soup. This evokes "anticipation," stimulating imagination of the taste. Aesthetic pleasure derives from imagination stimulated by absence. Matsuo Basho's haiku below, from his 1702 travel diary *Oku no Hosomichi*, offers another instance of the notion that absence prompts imagination [10, p. 6]:

> In the utter silence
> Of a temple,
> A cicada's voice alone
> Penetrates the rocks.

Here the cicada's piercing voice is an indicator of how quiet everything else is. It accentuates the quietness and stillness. Thus yet again, an absence (in this case the absence of silent things) triggers imagination.

[1] Imagination here is not necessarily synonymous with visualization or mental construction, as Plato strongly criticizes the use of the latter in geometry, viewing them as limiting and limited ways of accessing the eternal truth of geometry; see [1].

Wabi-sabi and Mathematical Aesthetics

In [15], likely the first article[2] to connect wabi-sabi to mathematics, Jean-François Maheux relates Gödel's incompleteness results and other foundational crises of the 20th century to the type of incompleteness cherished in wabi-sabi: "Wabi-sabi aesthetics offers us a chance to contemplate this fundamental incompleteness in a positive way, to find beauty in it, and embrace it as part of the profoundly rich nature and texture of mathematics" (p. 177). Maheux then teases out a wabi-sabi aesthetic in mathematics, so the complexities and the ambiguities of mathematics may be appreciated "as a reflection of our human condition" (p. 178). In this note, we explored two mathematical principles resonant with the wabi-sabi aesthetic, to extend and complement [15]. We hope our work will contribute to a full investigation of the connections of traditional Japanese art[3] with the "often non-functional, contradictory, uncontrolla[ble], organic face of mathematics" (p. 190).

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[2] We couldn't locate any other references to this idea via our preliminary search in standard Japanese databases.

[3] We mainly explored the visual aspects of wabi-sabi here, but wabi-sabi is not always elicited visually; for instance, the sound of water is associated with change in time, transience, and nature, and is commonly used in Japanese gardens [13].