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KANTIAN BEAUTY, FRACTALS, AND UNIVERSAL COMMUNITY¹

ABSTRACT

Benoit B. Mandelbrot, when discussing the global appeal of fractal patterns and designs, draws upon examples from across numerous world cultures. What may be missed in Mandelbrot's presentation is Immanuel Kant's precedence in recognizing this sort of widespread beauty in art and nature, fractals *avant la lettre*. More importantly, the idea of the fractal may itself assist the aesthetic attitude which Kantian beauty requires. In addition, from a Kantian perspective, fractal patterns may offer a source for a sense of community with humanity. I close with an excursus on the more sombre note of Kantian sublimity which fractals can also present.

Keywords: aesthetics, animation, beauty, community, fractal, Immanuel Kant, Benoit B. Mandelbrot, sublime, universality.

Benoit B. Mandelbrot, mathematician and creator of the concept and name, "fractal,"² when discussing the beauty and global appeal of fractal patterns and designs, often turns to examples from across numerous world cultures. Over and above the strange absence of discussions of fractals in the light of Immanuel Kant's aesthetics, what may be missed in focusing on Mandelbrot's own presentation is Kant's precedence in recognizing this sort of widespread beauty

¹ This article grew out of ideas I first presented in "Kant's Aesthetics and Fractal Art," a paper presented for the Society for the Philosophic Study of the Contemporary Visual Arts panel, "Philosophy and the Visual Arts," at the Eastern Division American Philosophical Association conference, Atlanta, Georgia 28 December 2001. I expanded upon those ideas in a paper at the ISUD XII World Congress in Lima, Peru 11 July 2018.

² Mandelbrot, B. 1982. *The Fractal Geometry of Nature: Expanded and Augmented*. New York: W. H. Freeman & Co., 4. See also Gleick, J. 1989. *Chaos: Making a New Science*. New York: Viking Books, 98.

in art and nature—fractals, as it were, *avant la lettre*.³ What is more, an awareness of fractals may itself provide an especially efficient way of creating the state of mind needed to appreciate the sort of beauty Kant was interested in bringing to our attention. If fractals and Kantian beauty are indeed intimately related, then there is the possibility that Kant’s appeal to the *sensus communis* (a universal basis for human connection) would find an anchor also in fractals. But by approaching fractal patterns from a Kantian perspective, a more serious note emerges as well, namely, that of sublimity, which fractals can also occasion (though I will only be able to touch briefly on this sublime aspect here).

Fractal forms, designs, and images exploded into the public imagination in 1989 with the publication of James Gleick’s popularization of chaos theory, *Chaos: Making a New Science*.⁴ Nonetheless, though fractal forms might seem well-suited for pairing with Kant’s critical aesthetic theory, and even though fractal forms were for a time almost ubiquitous in the public mind, fractal forms have almost never received an extensive discussion in terms of Kant’s aesthetics, other than brief asides. (I will discuss one exception below.) Mandelbrot himself does mention Kant in his own book-length introduction to fractals, *The Fractal Geometry of Nature*, but focuses there on the fractal structure of the universe in Kant’s description, and does not draw any explicit connection to Kant’s mature aesthetics.⁵

FRACTALS

What are fractals, then? Mandelbrot describes them in the following way:

“mathematical and natural fractals are shapes whose roughness and fragmentation *neither* tend to vanish, *nor* fluctuate up and down, but remain *essentially unchanged* as one zooms in continually and examination is refined. Hence, the structure of every piece holds the key to the whole structure. An alternative term is ‘self-similar’...”⁶

This is in contrast to the simpler forms of standard geometry, such as triangles, rectangles, and circles.

³ Those of Kant’s near predecessors who explored the macro- and microcosmos were also pointing in this direction. Even earlier, Zeno’s paradoxes hint at the fractal as well. Mandelbrot himself generously lists numerous precursors.

⁴ Gleick, J. 1989, op. cit. Fractals were also popularized to a lesser degree by Peitgen, H.-O. and P. Richter. 1986. *The Beauty of Fractals: Images of Complex Dynamical Systems*. Berlin: Springer.

⁵ Mandelbrot, B. 1982, op. cit., 407.

⁶ Mandelbrot, B., A. Blumen. 1989. “Fractal Geometry: What Is It, and What Does It Do?” *Proceedings of the Royal Society of London. Series A, Mathematical and Physical Sciences*, May 8, 423, (No. 1864: Fractals in the Natural Sciences), 3–16, here 4 (italics in original). Mandelbrot also has more mathematically precise definitions, but the quoted description here, meant for popular consumption, will serve in the present context, namely, an aesthetic one.

The crucial passage here states that “the structure of every piece holds the key to the whole structure,” so that zooming in on a fractal or zooming out from a fractal could (in principle) go on forever, continuously generating more of the “same” pattern in either direction. What is striking is how quickly and effectively *images* of fractal forms (especially images of the famous “Mandelbrot set”) make clear *in a visual way* the implications of the idea of the fractal. It is the “click” of understanding fractals which occurs upon seeing images of the Mandelbrot set and other fractals which leads so easily to Mandelbrot’s (and others’) discussions of the “discovery” of the fractal, which was, it seems, always already there, waiting to be discovered.⁷ Once they learn about fractals, many people remark that they begin to see fractals—to *recognize* them—everywhere. This seeming objectivity of which people speak also resembles the way in which people can talk about the beautiful, as if it were an actual predicate or object of knowledge, a cornerstone of Kant’s analysis.

In the absence of printed or displayed images, one can bring some images of fractals to mind by imagining some of the many examples of fractals which could be given, in both inorganic and organic nature: clouds in the sky, waves, mountains, dunes, lightning bolts, rivers, stalactites, stalagmites, crystals, interstellar gas clouds, and galaxies; capillaries, tree branches, shellfish (a favorite example of Kant’s), Romanesco broccoli, and leaves; as well as artistic and artificial forms: the walls of the Alhambra in Granada, Leonardo da Vinci’s studies of floods and storms, baroque scrollwork, Lichtenberg figures, Hokusai’s *Great Wave off Kanagawa*, Koch snowflakes, art nouveau designs, and Maurits Cornelis Escher prints.⁸ Take any one of these examples, and notice how, in focusing on a smaller part of it, one sees a modified image of the whole. This aspect of fractal forms is one reason that it is so important to place a ruler for scale in photographs of these forms in nature, e.g., when dealing with a rocky pile of detritus or a view of some clouds or a field of stars: without a ruler as a guide, it is very difficult, sometimes impossible, to know at what scale one is observing the objects in question.⁹ Once one becomes attuned to the

⁷ Noel Gray has perceptively discussed this phenomenon from a number of angles. See Gray, N. 1991. “Critique and a Science for the Sake of Art: Fractals and the Visual Arts.” *Leonardo* 24 (3), 317–320, and Gray, N. 1996. “Geometry and the Sublime: Imagination and the Closure of Creativity.” In: *The Most Sublime Act: Essays on the Sublime*. Jarett, D., T. Rachwał, T. Sławek (Eds.). London: University of North London Press, 1–11.

⁸ Many of these examples have been provided, in one place or another, by Mandelbrot himself.

⁹ One often needs to place a ruler (or at the very least, a person) in photographs to assist the viewer in knowing how large the photographed object is, but often because the viewer may not be familiar with the object in question. With fractal forms, however, this need is compounded, because, due to the self-similarity of fractal forms, even when the viewer is perfectly familiar with the objects in the photograph (and may have even taken the very photograph in question), it becomes impossible to effectively judge the scale of the photograph. A photograph of rocky detritus at a scale of particles could be, for all practical purposes, indistinguishable from a photograph of rocky detritus at the scale of large stones or small boulders. (Though I believe the example of the need for a ruler to establish scale in photographs was one I encountered in a book or film, I cannot currently place its source.)

idea of the fractal, one can have the sensation that it has always already filled the world (more on this below).

One should ultimately distinguish between fractals considered *geometrically* and fractals considered *aesthetically or experientially*. Technically, one is guaranteed not to find geometric fractal forms in nature or images, because, geometrically considered, fractals in their fullest sense infinitely extend their complexity through levels of magnification, whereas the larger objects in the universe are composed of atoms, and the universe (or rather space itself), at least as it is currently understood through quantum mechanics, is (we might say) *pixelated* at the Planck scale—which means that the self-similarity of these forms has a lower boundary, and does *not* extend to infinity. On the other hand, this distinction is similar to the much older distinction between simpler Euclidean shapes, understood *geometrically* as constructed from points and lines, and those shapes understood *experientially*: circles, triangles, squares, and hexagons, as geometric figures, can never be encountered in nature, but we encounter them frequently in nature and art, if we are allowed to speak of these forms in a loose, aesthetic, or experiential sense.¹⁰ Given the focus of this article, I will be dealing with fractals here mostly in the loose, aesthetic, sense.

FRACTAL BEAUTY

Mandelbrot's abstract for his article, "Fractals and an Art for the Sake of Science," serves as a convenient starting point for discussing the aesthetics of fractal forms:

"A new form of art redefines the boundary between 'invention' and 'discovery,' as understood in the sciences, and 'creativity,' as understood in the plastic arts. Can pure geometry be perceived by the 'man in the street' as beautiful? To be more specific, can a shape that is defined by a simple equation or a simple rule of construction be perceived by people other than a geometer as having aesthetic value—namely, as being at least surprisingly decorative—or perhaps even as being a work of art? When the geometric shape is a fractal, the answer is yes. Even when fractals are taken 'raw' they are attractive. They lend themselves to 'painting by numbers' that is surprisingly effective, even in the hands of the rank amateur. And the true artist's sensibility finds in them a novel and attractive support."¹¹

The above passage, already interesting for its own sake, invites more exploration when considered from a Kantian perspective. Mandelbrot mentions that fractal forms can be "surprisingly decorative," seemingly without realizing that

¹⁰ Plato, for one, was an early thinker who made this distinction, most famously in the "divided line" in his dialog, the *Republic*. This Platonic distinction is, by the way, one focus of Noel Gray's 1996 article, *op. cit.*

¹¹ Mandelbrot, B. 1989, *op. cit.*, 21.

Kant had defended the decorative arts as a form of beauty;¹² furthermore, Mandelbrot raises an issue which touches on a crucial aspect of Kant's aesthetics, namely, Kant's claim that beauty cannot be captured by a rule or checklist.¹³ Even though Kantian beauty cannot be captured by a rule, something *generated* by a rule, such as a fractal form, may still exhibit beauty in its Kantian sense if the form's generation from a rule itself is not overly obvious *in its appearance*.¹⁴ In addition, this abstract, when it asks whether "a shape that is defined by a simple equation or a simple rule of construction [can] be perceived by people other than a geometer as having aesthetic value," seems (whether Mandelbrot intends it or not) to be bringing into play Kant's discussion of the "aesthetic" from the third *Critique* where Kant (using almost the same wording) remarks that

"Flowers are free natural beauties. Hardly anyone apart from the botanist knows what sort of thing a flower is [meant] to be; and even he, while recognizing it as the reproductive organ of a plant, pays no attention to this natural purpose when he judges the flower by taste."¹⁵

From Mandelbrot's abstract alone it seems that fractals call for a Kantian analysis!

On Kant's account of beauty, the imagination (from the sensuous side) and understanding (from the conceptual side) enter into a playful relationship: the particular form presented by imagination, read off from the sensed object (in the case of visual forms), is presented to the understanding (the power of concepts), which then playfully explores the form by briefly comparing it to various concepts which the form suggests.¹⁶ And this phenomenon is precisely what people

¹² Something for which, perhaps surprisingly, Kant is sometimes criticized. Kant, I. 1987. *Critique of Judgment, Including the First Introduction*. Pluhar, W. (Trans.) Indianapolis: Hackett, § 16 (229) and § 51 (323). References to the *Critique of Judgment* will generally give the section number followed by the "Akademie-Ausgabe" (königlich Preußische Akademie der Wissenschaften) pagination from volume V of *Kant's gesammelte Schriften*. Berlin–New York: Walter de Gruyter & Co. and Predecessors, 1902–). Translations from the *Critique of Judgment* will be Pluhar's. The Pluhar translation supplies the Akademie-Ausgabe pagination, so English pagination will not be necessary. I will sometimes refer to the *Critique of Judgment* by its nickname, the "third *Critique*."

¹³ *Ibid.*, § 8 (215) and § 33 (284–285).

¹⁴ *Ibid.*, § 22, General Comment (241–243), where Kant discusses the alleged "beauty" of regular figures such as circles and squares, which tires quickly in comparison with the genuine beauty of the playful forms Kant has in mind.

¹⁵ *Ibid.*, § 16 (229).

¹⁶ Kant opens the body of the third *Critique* with a reference to "a very special power of discriminating and judging [which] does not contribute anything to cognition, but merely compares the given presentation in the subject with the entire presentational power, of which the mind becomes conscious when it feels its own state." *Ibid.*, § 1 (204). At § 16 (229–230) he goes on to explain that "we presuppose [...] no concept [as to] what the object is [meant] to represent; our imagination is playing, as it were, while it contemplates the shape, and such a concept would only restrict its freedom."

report when they behold fractal forms: an imaginative play with concepts. For example, when people attempt to describe images of the Mandelbrot set, they compare it, and segments of it, to curlicues, hair, seahorses, dragons, and black beetles.¹⁷ Likewise, to return to the walls of the Alhambra, famous for their astounding beauty, the patterns seen there can suggest waves, waterfalls, fire, stalactites, crystals, and overhanging leaves, as the mind flits from one suggestion another (as many who have seen it for themselves can attest).¹⁸ Many fractal forms seem, at least, to match the phenomenology which Kant provides in his analysis of the beautiful.

Kant's examples and description of beautiful forms ultimately track very well with fractal forms. Even the iterative process of creating fractals by means of a computer approaches the natural formation of crystals, made especially clear in the case of natural snowflakes and one geometrical analog, the Koch snowflake. Kant singles out crystals for often providing "exceedingly beautiful shapes" and is clearly fascinated by the fact that these beautiful forms arise merely from the repeated iteration of simple mechanical steps (just as do computer-generated fractals, we contemporaries add).¹⁹ As mentioned already, Kant discusses beautiful forms which, though they cannot be discovered by a rule, can nonetheless be generated by a rule.

DIFFERENT BEAUTIES

Clearly, here I would like to appeal to Kant's critical aesthetic theory, as presented in the *Critique of Judgment*, the so-called "third *Critique*." But why refer to Kant at all? Does one have to always mention some well-known figure from the history of philosophy in order to talk about an issue? No, one does not. Now, I have spent plenty of time reading and thinking about Kant, and so I am more likely to see connections to his thought. But we also have to admit that those who have attempted to think systematically about beauty have arrived at different conceptions of what the beautiful is. Diotima, so goes the story, advo-

¹⁷ "Hunting the Hidden Dimension." *NOVA* episode aired on the Public Broadcasting Service in the United States, on October 28, 2008 (season 35, episode 14). Transcript available via <<https://www.pbs.org/>>. Here, I am drawing upon numerous interview subjects from the broadcast.

¹⁸ Kant notes that "Perhaps the most sublime passage in the Jewish Law is the commandment: Thou shalt not make unto thee any graven image, or any likeness of any thing that is in heaven or on earth, or under the earth, etc. This commandment alone can explain the enthusiasm that the Jewish people in its civilized era felt for its religion when it compared itself with other peoples, or can explain the pride that Islam inspires." *Ibid.*, § 29, General Comment (274). Likewise, the artisans of the Alhambra, by avoiding representational artwork, provide wonderful examples of the potential beauty of the "concept-free," decorative art Kant highlights and which has given recent abstract artists so much food for thought.

¹⁹ *Ibid.*, § 58 (349).

cated for one kind of beauty, an intellectual beauty which explained all the other, even very sensuous beauties. Edmund Burke, in his discussion of beauty, focuses on a sensuous variety, a sweet, relaxing feeling which fosters love and tenderness, in the person who feels it, for that which is beautiful. Kant, on the other hand, summarizes a different tradition (against which Burke argues) in the idea of “dependent” or “accessory” beauty, the feeling of pleasure we have towards things which are especially well-suited to their purpose or aim, such as a well-carried-off skateboard flip or a well-made, well-functioning bicycle.

My own conception of beauty might be said to loosely follow Diotima’s discussion, insofar as she presents a range of different *kinds* of beauties (merely that I would not follow her bold claim that one intellectual beauty explains them all). There are many forms of beauty. And they are not the same. I am certainly not denying that these other types of beauty exist. In short, the type of beauty to which I am appealing here in connection to fractals is the specific, “Kantian” beauty we find in his third *Critique*: that kind of beauty which stands at a meeting place between the body and the mind, an intersection where the imagination finds itself encouraged to *play* with *perceptual form*. And, as I have been arguing, the beauty of fractals seems to belong to the Kantian type of beauty. To spell it out as clearly as possible, the phenomenology of fractal beauty matches the specific kind of beauty which Kant points to. At the very least, I am asserting that this holds phenomenologically whether or not one accepts Kant’s metaphysical assumptions or wider philosophy. (My core claim, then, mostly uses “Kant” as a placeholder for certain aesthetic phenomena. Building out from that to connected elements of Kant’s thought, which requires accepting more of Kant’s philosophy, I make more tentative claims.)

Now, not every form which might fit Kant’s discussion of the beautiful is a fractal, but many fractal forms would arguably serve to support judgments of Kantian beauty—in other words, many beautiful forms (in Kant’s sense) are also fractal. Likewise, not all fractal forms will turn out, upon inspection, to be beautiful. (The connection between fractals and beauty is not simply *automatic*.) But many fractal forms, as we have seen, wonderfully fit Kant’s description.

NOEL GRAY’S CRITIQUE

One notable exception to the silence on considering fractals from a Kantian angle is Noel Gray.²⁰ Ironically, for the purposes of this article, his critique of Mandelbrot’s discussion of fractal geometry supports the connection I am trying to draw here, since one of Gray’s main complaints is that Mandelbrot’s understanding of fractals is overly influenced by a Kantian sort of aesthetics. Gray quotes Mandelbrot’s remark,

²⁰ Gray, N. 1991, op. cit.

“The earliest explicit uses of fractals gave me the privilege of being the first person to tackle in a new way some problems that must be among the oldest that humanity had asked itself: how to obtain ‘figures’ that represent the shapes of mountains, clouds and rivers? It turns out that, when the representation of nature by fractal is perceived as successful, it also tends to be perceived as beautiful.”²¹

to which Gray remarks,

“Evident in these statements is Mandelbrot’s notion of an unproblematic beauty that is assumed to be transsubjective and an a priori truth. Its presence in relation to fractals is undisputed, although unobserved by past mathematicians. Thus, Mandelbrot’s aesthetic emerges as basically Kantian in character in that he assumes beauty is an inherent universal feature of nature and is recognised as such by everyone. As his fractals ‘imitate nature,’ it follows by association that they also will be perceived as universally beautiful.”²²

In the remainder of his article, Gray also takes issue with what he sees as Mandelbrot’s precipitous ascription of fractal geometry to nature itself, contests Mandelbrot’s assertion of the primacy of fractal theory to fractal images, and examines the idea of an art “for the sake of science,” but here Gray’s concern is what he sees as an uncritical, ungrounded assumption that natural forms and fractal forms are beautiful.

One could quibble with Gray’s contention that Kantian aesthetics ascribes beauty to nature itself, since Kant’s theory actually holds back from doing that and instead merely states that natural forms are often capable of being occasions for a feeling of the beautiful, but that would in fact be quibbling, since Gray’s goal is not to exactly replicate Kant’s theory; instead, Gray’s real point is that Mandelbrot simply assumes a universal recognition of the beauty of fractal forms in art and nature.²³

This particular complaint of Gray’s has some problems, however. For one, even if Mandelbrot is on some level ultimately mistaken about the status of fractals, it seems unjust to claim that his assertion of a widespread recognition of the beauty of fractal forms in art and nature is completely ungrounded and assumed a priori, since Mandelbrot’s discussions indicate that he has repeatedly received affirmations of the presence, beauty, and power of fractal forms in art and nature from all around the globe. As he put it in an interview for a public television broadcast on fractals, “After my book mentioned that Hokusai was

²¹ Mandelbrot, B. 1989, op. cit., 22–23, quoted by Gray, N. 1991, op. cit., 318.

²² Ibid., 318.

²³ See note 2 on 318 of *ibid.* for Gray’s own explanation of what he means by the phrases, “Kantian aesthetic” and “traditional transcendental aesthetic.”

fractal, I got inundated with people saying, ‘Now we understand Hokusai. Hokusai was drawing fractals’.”²⁴

The very thing that the repeated assertion, “Hokusai was drawing fractals,” may be showing is that being introduced to fractals allows viewers to take note of Kantian beauty more effectively or more deeply, perhaps in some cases even allowing them to recognize that kind of beauty there in the first place. Indeed, focusing on Hokusai’s work *as containing fractals* may be a very direct way of making it easier for many viewers to attain the abstraction from both concepts and sensuous content which is required to properly attend to the perceptual forms which are the focus of a judgment of beauty on Kant’s theory.²⁵

Furthermore, in his wider discussion of Mandelbrot on fractals, Gray repeatedly focuses on the centrality and importance of the *image* of fractals (or at the very least, a sort of coequality the images have with fractal theory). He points out not only that images of fractals play an important role in the growth of fractal theory, but also underscores the way in which fractal images are singled out by Mandelbrot as the locus of a change of perception which transforms the viewer from a ‘pre-fractal’ subject to one who sees fractals all around. At one point (in a different text), Gray quotes Mandelbrot’s assertion about fractals: “to see is to believe.”²⁶ But if the *image* is central to believing in the beauty and power of fractals, it would seem that Kant’s focus on the *aesthetic* dimension of beauty (namely, that it is neither directly conceptual nor directly sensual, depending instead on a feeling connected to the *particularity of perceptual form*), is in some way justified.²⁷

At any rate, if Gray’s contention is right that Mandelbrot himself surreptitiously (and perhaps without realizing it) applies a Kantian aesthetic to fractal forms, we have at least one important contender, the inventor (discoverer?) of fractals himself, who takes a basically Kantian approach to understanding them. Apparently there is something about fractals that pushes one to see them in a Kantian light.

²⁴ “Hunting the Hidden Dimension.” 2008, op. cit.

²⁵ It is of course possible that some of these exclamations about the fractals in Hokusai merely expressed delight at recognizing the fractals there, along the lines of what Aristotle famously observed about imitation or representation: “everyone delights in representations. [...] The cause of this is that learning is most pleasant, not only for philosophers but for others likewise (but they share in it to a small extent). For this reason they delight in seeing images, because it comes about that they learn as they observe, and infer what each thing is, e.g. that this person [represents] that one. For if one has not seen the thing [that is represented] before, [its image] will not produce pleasure as a representation, but because of its accomplishment, color, or some other cause.” Aristotle. 1987. *Poetics*. Janko, R. (Trans.). Indianapolis: Hackett, Chap. 2 (48b 9–18), 4–5.

²⁶ Mandelbrot, B. 1982, op. cit., 21, quoted by Gray, N. 1996, op. cit., note 9 on 10.

²⁷ Kant explains that “a judgment of taste [...] is an aesthetic and not a cognitive judgment [...] it involves merely the relation of the presentational powers to each other, insofar as they are determined by a presentation. [...] Hence neither an agreeableness accompanying the presentation, nor a presentation of the object’s perfection and the concept of the good, can contain the basis that determines [such a judgment].” Kant, I. 1987, op. cit., § 11 (221).

More importantly, when armed with a perception for fractals (having become “believers”), that focus on fractals can assist viewers in attending to those very aspects of perception that Kant is pointing to with his idea of the “aesthetic” in the third *Critique*. This aesthetic aspect, as Kant himself emphasizes, can be difficult to attend to precisely because some people in certain situations are not good at making the proper abstraction.²⁸ In looking at natural and artistic objects with the fractal in mind, one ignores what the object is or is supposed to be or do, and instead attends to the perceptual *forms* one is seeing. This special turn of attention is just the mental move which e.g. the botanist (or geometer) has to make in order to ignore their knowledge of botany (or geometry) and effectively focus on the beautiful form which Kant’s analysis singles out.

COMMUNAL HOPE

Especially given that Kant himself emphasizes that the beauty he is concerned with does not rest on a cognition of results, consequences, goals, and effects (as opposed to dependent beauty) how could fractals, then, have any connection to practical, social, or ethical concerns? Though he emphasized the autonomy of aesthetics from ethics, Kant also called attention to the social implications of judgments of beauty: when someone is struck by the beauty of a form, they are simultaneously gripped by a connection to the *community* of all humans, insofar as they expect (in principle) others to join their appreciation for that beautiful form because they understand others to have recourse to the same mental capacities. Kant places his discussion of this social assumption which he takes the judgment of beauty to imply under the term, *sensus communis* (or even the *sensus communis aestheticus*).²⁹ If, then, fractals contain an important subset of beautiful forms in the Kantian sense, it would turn out that many fractals are potentially bases for a connection out to the rest of humanity.

In addition to the *sensus communis* (the appeal to a shared human capacity for the appreciation of beauty), Kant’s whole discussion of beauty suggests that the appreciation of beauty in nature additionally creates, if not an awareness, then at least a promise or hope, that the world itself hangs together in some orderly way, and holds together in a way connected to us. This hope rests on the need for some agreement between *human mental capacities* and the *forms of nature* in order for us to be able to appreciate the beauty of the forms of nature so readily, and so frequently. With this, we potentially have the basis for a deeper impression of the *community* between humanity and the natural world (a corrective, perhaps, for Kant’s treatment of nature under the aegis of hypo-

²⁸ Kant speaks e.g. of “someone who judges with taste (provided he is not mistaken in this consciousness and does not mistake the matter for the form, i.e., charm for beauty).” *Ibid.*, § 39 (293).

²⁹ *Ibid.*, § 40 (entire).

thetical imperatives, particularly in its unforgiving presentation in the “Speculative Beginning of Human History”).³⁰

Thus, if I am correct that the beauty of fractals are outstanding examples of the beauty that Kant had in mind, then bringing attention to the beauty of many fractal forms—whether created by an artist, constructed with the help of a computer, or found in nature (and regardless whether they are called “fractals”)—could (if we trust Kant) provide a basis (admittedly fragile) for widespread agreement and (such is the hope) an accompanying recognition of shared humanity and community with the natural world.

I might here add that the universality indicated by Kantian beauty is arguably not a bland, blanket, overpowering universality, but one which necessarily recognizes the singular, because Kantian beauty can only be appreciated by being directed to or focusing on the *particulars* of a specific form. As mentioned before, beauty cannot be made to meet a rule. It is this very particularity and singularity which makes the judgment of beauty an *aesthetic* judgment.³¹

But here, of all places, where it might appear that I am hurrying to a utopian crescendo, I should perhaps sound a few warnings. The first proviso calls attention to the ever-present danger that beauty will be used to distract from violence and human rights abuses. However, this danger would usually be more pressing in the case of Burkean beauty (a non-Kantian beauty, and, it would seem, a less fractal beauty).³² Nonetheless, even a Kantian beauty could serve as a tool for propaganda, though here the appeal would presumably have to pass through a step which would take it outside of Kant’s conception of beauty—if, say, a Nazi or a white supremacist poster were to use beautiful forms in its design. In such a case, as long as the beauty were of the Kantian variety, no conceptual

³⁰ “The first time he [viz., Adam, representing early humanity] said to the sheep, ‘the pelt that you bear was given to you by nature not for yourself, but for me;’ the first time he took that pelt off the sheep and put it on himself (Gen. 3:21); at that time he saw within himself a privilege by virtue of which his nature surpassed that of all animals, which he now no longer regarded as his fellows in creation, but as subject to his will as means and tools for achieving his own chosen objectives.” Kant, I. 1983. “Speculative Beginning of Human History.” In: *Perpetual Peace and Other Essays*. Humphrey, T. (Trans.) Indianapolis: Hackett, 49–60.

³¹ “... all judgments of taste are singular judgments, because they do not connect their predicate, the liking, with a concept but connect it with a singular empirical presentation that is given.” Kant, I. 1987, op. cit., § 37 (289).

³² Emmer, C. E. 2017. “Burkean Beauty in the Service of Violence.” *Dialogue and Universalism*, 27 (3), 55–64. See also Emmer, C. 2007. “The Flower and the Breaking Wheel: Burkean Beauty and Political Kitsch” *The International Journal of the Arts in Society*, 2 (1), 153–164. At least one passage in Edmund Burke’s *A Philosophical Enquiry* approaches something, aspects of which might suggest fractality (namely, Part III, Section XV, on “Gradual Variation”), but Burkean beauty seems less well-suited to supporting fractal forms, or at least Burke does not describe it in a way that through its details suggests fractal forms (though fractal forms could not be ruled out on that basis alone). At least when considered from a phenomenological perspective, the melting and swooning of Burkean beauty do not call to mind interactions with fractal forms. Burke, E. 1990. *A Philosophical Enquiry into the Origin of our Ideas of the Sublime and Beautiful*. Oxford–New York: Oxford University Press.

connection could be made to the political party or program (since Kantian beauty rules out direct conceptual content). But a mental association could be made by the spectator between the beauty of the design and the desirability of the political party or program.

A second proviso would be that, even if Kant's theory of beauty is correct, that judgment of beauty might well lead to division instead of community. That is because, under the *sensus communis*, we presume or demand that others will agree with us about the beauty of a particular form. The problem is that others are not guaranteed to do so. Of course, the problem may be at our own doorstep because we have not made a legitimate judgment of beauty. But, on the assumption that our judgment was correctly made, we might be led to a dangerous conclusion. Instead of simply writing it off as a case where the other does not agree with our judgment of beauty because they simply did not make the required abstraction, one might instead, on the basis of an assumption of a shared human capacity, *blame* the other for *refusing* to make the required abstraction, or *question their status* as a fully-fledged human being. In either case, one might treat the other differently, categorize them as an outsider, or refuse to recognize their human rights.

The third proviso is that, on Kant's own theory, one must always be careful not to claim an aesthetic universality precipitously. Here, Noel Gray would presumably agree somewhat with Kant, at least insofar as Kant points out ways in which aesthetic universality might fail, particularly when the universally presumed free judgment of beauty is unmasked as merely another case of mistaken identity: it was in fact, instead of free beauty, (say) sensuous "charm," personal preference, or conceptually constrained "dependent beauty." Gray, however, would warn that even the limited universality of which Kant speaks is precipitous. Indeed, Gray raises deep questions about the viability of Kantian aesthetics (as well as some theories of science, which is not my concern here). If Gray is right that Kant's basic theoretical approach is seriously mistaken, then many of the suggestions I have made here would have to be recast, reconsidered, or abandoned. But, to the degree that Kant's phenomenology of beauty still stands once his metaphysics or theory of mind is disregarded, some of these suggestions might still stand as well.

AN EXCURSUS ON KANT'S FRACTAL SUBLIME

In looking at fractal forms from a Kantian perspective, one other possibility might be overlooked. As I have been maintaining, fractals wonderfully fit Kant's description of the beautiful. But, strangely enough, it is these often *beautiful* forms—fractals—which can *also* serve as occasions for the *sublime* in Kant's sense, particularly the computer-generated fractal forms presented in the form of a zoom video which allows the viewer to see increasingly more detailed

portions of the fractal form. Depending upon the exact image construction selected and the speed at which they occur, these “zoom in” videos can often produce an odd and very striking effect of falling into the fractal shape (an effect which, in my experience, generally seems stronger and more striking than the corresponding effect of “zoom out” videos). And this effect can be sublime.

Perhaps even stranger is that fractals are not more frequently discussed in terms of the sublime at all (that is to say, disregarding for a moment whether the Kantian sublime is the specific focus). This passing over of the *sublime* potential of fractals is particularly remarkable given the frequent (indeed, almost ubiquitous) remarks on the *infinity* (!) involved in fractal forms. Of course the implication of infinity lies at the very heart of Kant’s discussion of the sublime. The crucial starting point here (with an eye to Kant’s aesthetics) is that the infinity of fractal forms can never actually be perceived in, but only suggested by, their images and natural instantiations.

Unless I am mistaken, Mandelbrot himself, who muses repeatedly on the *beauty* of fractal forms, never once uses the term “sublime” or “sublimity” in the entirety of his extended opus, *The Fractal Geometry of Nature* (over 400 pages long)—this, in spite of the fact that, not only does it mention the infinite hundreds of times, but in addition (as noted above) it includes a passage in which Mandelbrot specifically discusses *Kant’s* treatment of the possibly infinite expanse of galaxies contained in the universe!³³ Noel Gray’s article on fractals, Kant, and the sublime, though it does bring all of these elements into one place, does not however analyze fractal forms as occasions for the Kantian sublime. Then again, *his* aim is to reveal kernels of *fracture, collapse, and failure* in Kant’s theory and Kantian theories. It would be strange, then, for Gray to attempt to apply Kant’s theory if he believes that the theory is a shipwreck in the first place.³⁴

But, just as Mandelbrot’s own reflections on the fractal apparently did not come to full fruition until technology advanced far enough for effective computer-generated images of fractals to be made, perhaps the potential sublimity of fractals did not become evident enough for him to remark on it until further technological developments allowed for better computer-generated fractal zoom videos to be made. Though fractal zoom videos which dive into the Mandelbrot set do, I believe, offer ripe occasion for a feeling of the mathematically sublime (a variety of the Kantian sublime), the effect is not always conducive to that

³³ Likewise, unless I am mistaken, the words “sublime” and “sublimity” never once appear in James Gleick’s *Chaos* (op. cit.).

³⁴ Gray, N. 1996, op. cit. A notable exception to passing over the sublime potential of fractal forms is a very recent article by Félix Lambert, which I only began to delve into as I was drawing up this article. His piece not only discusses the potential sublimity of fractals at length (and indeed, seems overall to be in agreement with my brief discussion here), but also specifically discusses fractals in the light of the *Kantian* sublime. I regret that I have not yet fully digested it, but hope to make use of Lambert’s article in the near future. Lambert, F. 2018. “Infinite and Fractal: The Unbearable Quest for the Sublime.” *The International Journal of the Image*, 9 (1), 67–86.

feeling. (Sometimes there is an exhilarating sensation of an infinite fall, but at other times the very flatness of the Mandelbrot set can instead create an impression of watching wet marbled paint spreading, which in my estimation is not as effective.)

A development in technology has changed what can be generated, however. In 2009, the first “Mandelbulb” generators appeared,³⁵ (in effect) three-dimensional kaleidoscopes for the originally flat Mandelbrot set.³⁶ According to the Mandelbulb website,

“The Mandelbulb was discovered by Daniel White and Paul Nylander, and developed collaboratively in the Fractal Forums community. [...] Using a spherical coordinate system, and some ingenious math, White and Nylander projected the Mandelbrot set into three dimensions, creating the Mandelbulb.”³⁷

In my experience, video zooms into images of three-dimensional Mandelbulbs (some of which bear a striking resemblance to Romanesco broccoli) provide an even more effective means of occasioning the sublime effect here under discussion than does zooming into the flat, unadorned Mandelbrot set. In Mandelbulb zoom videos, the effect is often of flying deeper and deeper into the details of the three-dimensional structure (an effect produced not merely by the three-dimensional projection, but also by the shading and rendering used in the videos). The three-dimensionality of the forms in these videos makes the zoom effect less visually ambiguous and therefore more convincing than the older zooms into the flat Mandelbrot set, and this makes the implied infinity of the Mandelbulb forms much more *visually* palpable.³⁸ And this visually palpable suggestion of infinity often has, I find, a sublime effect.³⁹

Finally, it must be admitted that fractal zooms, whether seen as sublime or not, can *also* be seen as fearful, creepy, or disgusting. In some registers, this tracks well with the idea of the Kantian sublime, which (as the dynamically sublime) involves things which are fearful, but of which we are not afraid.⁴⁰ In cases where the fear involved is more active, we then have a sublimity more in line with that discussed by Edmund Burke (which Kant explicitly states is *not*

³⁵ The Mandelbulb website at <<http://www.mandelbulb.com/>>. (Accessed December 2018).

³⁶ Here I should mention that Noel Gray cites Sir David Brewster’s invention of the kaleidoscope as a precursor to Mandelbrot’s fractals. Gray, N. 1991, op. cit., 319. In the case of Mandelbulbs, the kaleidoscope returns as a fractal amplification of fractal imagery.

³⁷ Mandelbulb website, op. cit.

³⁸ In the words of the Mandelbulb website (ibid.), “In 3D-space, we see a more fully realized rendering of the Mandelbrot set. While the flat set exhibits infinite complexity, the Mandelbulb reveals that complexity in a fuller magnitude.”

³⁹ Félix Lambert (op. cit.) was also drawn to examine Mandelbulb images in the course of considering the sublimity of fractals.

⁴⁰ Kant, I. 1987, op. cit., § 28 (260).

what he has in mind).⁴¹ However, what cannot be denied is that fractal images, and particularly fractal zooms, can evince feelings of creepiness, disgust, or even horror, especially if one senses a revulsion at the feeling of a loss of stability which the unending metamorphoses in these videos can bring about.

This is a place where Noel Gray's concerns about the automatically assumed beauty of fractal images might have a serious foothold (on the assumption, with Kant, that the beautiful and the disgusting cannot be combined).⁴² Then again, this could also be a foundation for Kant's claim that the beautiful cannot be guaranteed by a rule or a definition: as was observed above, the mere fact that a form is fractal does not ensure that it can serve as an occasion for a feeling of the beautiful. One has to see each particular form (or play of forms) for oneself in order to judge whether it deserves to be called beautiful. To believe, one first has to see. Nonetheless, if Mandelbrot *were* guilty of claiming that all fractal forms whatsoever are beautiful, then he would definitely be breaking a Kantian prohibition and would additionally be in denial of the evidence.

FRACTALS AS BEAUTIFUL, COMMUNAL, AND SUBLIME

As announced at the outset, a case was made that Kant's conception of beauty opened up a space for instances that in retrospect turned out to be frequently populated with fractal forms before the term had been coined. The point, though, is not merely that Kant anticipated fractal beauty, but that beholding things with fractals in mind may very well help bring about the very attitude required to encounter the type of beauty which Kant had in mind. This examination, then, allowed for fractals to potentially inherit aspects from Kant's aesthetics which are not usually considered outside of a Kantian analysis, in particular the possibility for fractal forms to serve as a basis for fostering universal community through judgments of beauty. Finally, I briefly considered the sublime potential of fractal forms.

Fractals, then, when examined in the light of Kant's aesthetics, emerge as a family of forms which can serve as occasions *both* for Kantian beauty *and* Kantian sublimity. Kant of course recognizes and indeed promotes the *combination* of the beautiful and sublime in works of art, but here, a new aspect has been revealed by considering fractals: insofar as there are also fractal forms *in nature*, then, we have something Kant did not frequently discuss: the possibility for *natural* forms which could support both the beautiful and the sublime (in their Kantian senses).

⁴¹ *Ibid.*, § 29, General Comment (277).

⁴² *Ibid.*, §48 (312).

REFERENCES

- Aristotle. 1987. *Poetics*. Janko, Richard (Trans.). Indianapolis: Hackett Publishing Company.
- Burke, E. 1990. *A Philosophical Enquiry into the Origin of our Ideas of the Sublime and Beautiful*. Oxford–New York: Oxford University Press.
- Emmer, C. 2001. “Kant’s Aesthetics and Fractal Art,” paper presented for the SPSCVA panel, “Philosophy and the Visual Arts,” at the Eastern Division American Philosophical Association conference, Atlanta, Georgia, USA, 28 December 2001.
- . 2007. “The Flower and the Breaking Wheel: Burkean Beauty and Political Kitsch.” *The International Journal of the Arts in Society*, 2 (1), 153–164.
- . 2017. “Burkean Beauty in the Service of Violence,” *Dialogue and Universalism*, 27 (3), 55–64.
- Gleick, J. 1989. *Chaos: Making a New Science*. New York: Viking Books.
- Gray, N. 1991. “Critique and a Science for the Sake of Art: Fractals and the Visual Arts.” *Leonardo* 24 (3), 317–320.
- . 1996. “Geometry and the Sublime: Imagination and the Closure of Creativity.” In: *The Most Sublime Act: Essays on the Sublime*. Jarett, D., T. Rachwał, T. Sławek (Eds.). London: University of North London Press, 1–11.
- “Hunting the Hidden Dimension.” 2008. *NOVA* episode aired on PBS in the United States. Transcript available via <<https://www.pbs.org/>>.
- Kant, I. 1908 (1790/1793). *Kritik der Urtheilskraft*. Volume V of *Kant’s gesammelte Schriften*. Berlin–New York: Walter de Gruyter & Co. and Predecessors.
- . 1983 (1786). “Speculative Beginning of Human History.” In: *Perpetual Peace and Other Essays*. Humphrey, T. (Trans.). Indianapolis: Hackett Publishing Company, 49–60.
- . 1987. *Critique of Judgment, Including the First Introduction*. Pluhar, W. (Trans.). Indianapolis: Hackett Publishing Company.
- Lambert, F. 2018. “Infinite and Fractal: The Unbearable Quest for the Sublime.” *The International Journal of the Image* 9 (1), 67–86.
- Mandelbrot, B. 1982. *The Fractal Geometry of Nature: Expanded and Augmented*. New York: W. H. Freeman & Co.
- . 1989. “Fractals and an Art for the Sake of Science” *Leonardo* 2; supplemental issue: Computer Art in Context: SIGGRAPH ’89 Art Show Catalog, 21–24.
- Mandelbrot, B., A. Blumen. 1989. “Fractal Geometry: What is it, and What Does it Do?” *Proceedings of the Royal Society of London. Series A, Mathematical and Physical Sciences*, May 8, 423; No. 1864: Fractals in the Natural Sciences, 3–16.
- Mandelbulb website. <<http://www.mandelbulb.com/>>. Accessed December 2018.
- Peitgen, H.-O., P. Richter. 1986. *The Beauty of Fractals: Images of Complex Dynamical Systems*. Berlin: Springer.

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