Wollt Ihr nach Regeln messen, was nicht nach Eurer Regeln Lauf, der eignen Spur vergessen, sucht davon erst die Regel auf. Richard Wagner, *Die Meistersinger von Nürnberg* (1868), 1st Act, 3rd Scene

A neural network account to Kant's philosophical aesthetics

Peter beim Graben*

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Abstract

According to Kant's (1724 – 1804) philosophical aesthetics, laid down in his Critique of the Power of Judgement (1790), beauty is "subjective purposefulness", reflected by the "harmony of the cognitive faculties", which are "understanding" and "imagination". On the one hand, understanding refers to the mental capability to find regularities in sensory manifolds, while imagination refers to intuition, phantasy, and creativity of the mind, on the other hand. Inspired by the reinforcement learning theory of Schmidhuber, I present a neural network analogy for the harmony of the faculties in terms of generative adversarial networks (GAN) — also often employed for artificial music composition — by identifying the generator module with the faculty of imagination and the discriminator module with the faculty of understanding. According to the GAN algorithm, both modules are engaged in an adversarial game, thereby optimizing a particular objective function. In my reconstruction, the convergence of the GAN algorithm during the reception of art, either music or fine, entails the harmony of the faculties and thereby a neural network analogue of subjective purposefulness, i.e., beauty.

^{*}Bernstein Center for Computational Neuroscience, Berlin, Germany Email: peter.beimgraben@b-tu.de

1 Introduction

In October 2018, Christie's auction house in New York City had sold the painting *Portrait of Edmond Belamy* by a formerly unknown artist with pseudonym "GAN" for \$432,500 (Christie's 2018). The signature of the artist, drawn into the bottom right corner of the masterpiece, which reads

$$\min_{G} \max_{D} \mathbb{E}_{x}[\log D(x)] + \mathbb{E}_{z}[\log(1 - D(G(z)))], \qquad (1)$$

instead of "GAN", indicates that the artist was an *artificial intelligence (AI)*, called *generative adversarial network* (Goodfellow et al. 2014), a particular kind of a deep neural network (LeCun et al. 2015, Schmidhuber 2015). The AI engineers behind "GAN" is the French collective *Obvious*¹ and the signature (1) essentially codifies the objective function of the network's training algorithm.

Indeed, *Obvious'* "GAN" was not the very first artistic AI application. One interesting precursor from the mid 2010-s was DeepArt,² an initiative from the German University of Tübingen, for the image style transfer from specified examples to uploaded photographs (Gatys et al. 2016). Figure 1 displays one of my own experiments with DeepArt from April 2016. Here, Fig. 1(a) shows the painting *Autumn* by mannerist artist Giuseppe Arcimboldo.³ The result from the style transfer to a portrait photograph of myself is shown in Fig. 1(b).

¹https://obvious-art.com/

²https://creativitywith.ai/deepartio/

³https://en.wikipedia.org/wiki/Giuseppe_Arcimboldo#/media/File: Arcimboldo,_Giuseppe_~_Autumn,_1573,_oil_on_canvas,_Mus\%C3\%A9e_du_ Louvre,_Paris.jpg



Figure 1: *DeepArt* artistic playground. (a) Giuseppe Arcimboldo: *Autumn*, 1573, Louvre, Paris. (b) *DeepArt* converted portrait of the author, April, 25, 2016. (Color online)

Obviously, the style transfer from Arcimboldo to the photograph had substantially failed. Instead of replacing my nose by a pea, my ear by a mushroom, or any other kind of palpable representational manipulation, the uploaded image was simply transformed by means of a low-pass filter, mostly blurring the details of my physiognomy. This is not really miraculous, since *DeepArt*'s algorithm was a deep convolutional neural network (CNN) (Gatys et al. 2016), and thus a particular kind of a moving average filter (Russell and Norvig 2010). More recently, numerous improved AI applications for fine art are available (Murray 2019, McCormack and d'Inverno 2012, Vear and Poltronieri 2022), such as, e.g., *Stable Diffusion* or *Dall-E*.⁴

Deep neural networks in general and also generative adversarial networks in particular have found applications also in musical AI (Briot et al. 2020). Specifically, Mogren (2016) used continuous recurrent neural networks (C-RNN) for artificial music composition,⁵ exploiting time-dynamical long shortterm memory (LSTM) units (Hochreiter and Schmidhuber 1997), whereas

⁴https://stability.ai/news/stable-diffusion-public-release https://openai.com/dall-e-3

⁵For code and audio results of Mogren (2016), see https://mogren.one/

the original proposal by Goodfellow et al. (2014) essentially based on a perceptron architecture (Hertz et al. 1991). Another approach by Yang et al. (2017) combined the GAN and CNN architectures for producing compositions in MIDI format, which was also used for network training.⁶ As a last example for musical AI applications, I mention a network for melody generation from lyrics by Yu et al. (2021), also utilizing an LSTM architecture that is trained on MIDI examples.⁷

Now, the crucial question arises whether and to which extend, AI generated paintings or music pieces could be considered as *real* art works (Christie's 2018). In order to approach this question, one has to refer to empirical and philosophical aesthetics (Gibbs 2022, Menninghaus et al. 2019, Tedesco 2024).

For music, some recent ideas have been discussed within the framework of the ITPRA theory by Huron (2006), who suggested "five functionally distinct physiological systems: imagination, tension, prediction, reaction, and appraisal" (Huron 2006, p. 7). In this approach, the imagination module procures a "simple act of daydreaming" creating musical expectations (p. 8). Sometimes, expectations are delayed, e.g. by means of suspension, causing musical tension (pp. 307; 328). When an expected event actually occurs, the prediction module generates a rewarding emotion: "listeners experience positive feelings whenever a future event is successfully predicted" (p. 239), whereas the opposite, a penalizing feeling of surprise takes place upon prediction failure within the phylogenetically ancient reaction module (pp. 13; 21). However, such "inductive failures" lead to an improvement of the prediction module by means of statistical learning (p. 217). Finally, the evolutionary most recent appraisal module may turn a bad reaction response into a consciously appreciated aesthetic emotion (p. 14), through "contrastive valence" (p. 239).

Huron's theory has been challenged and also partially confirmed in a recent experiment by Cheung et al. (2019) (cf. the review of Huron (2019) and the thorough discussion by Blutner (2024)). These researchers manipulated the predictability of chord cadences in either statistically certain or uncertain contexts. In agreement with Huron's ITPRA theory, aesthetic appreciation

publications/2016/c-rnn-gan/

 $^{^6} For audio results of Yang et al. (2017), see https://soundcloud.com/vgtsv6jf5fwq/sets\%20$

⁷See https://www.youtube.com/watch?v=2PHcKhaLxAU for an online demonstration of Yu et al. (2021)

was high for predictable closings in rather uncertain contexts. However, Cheung et al. (2019) also reported high pleasure ratings for surprising events in relatively certain contexts, which has to be attributed to the conscious appreciation response in Huron's theory. This interesting finding will be further addressed in the discussion.

The ITPRA theory by Huron (2006) was essentially inspired by the influential work of Meyer (1956). For Meyer, "aesthetic beliefs" (p. 73) depend on "embodied meaning":

From this point of view what a musical stimulus or a series of stimuli indicate and point to are not extramusical concepts and objects but other musical events which are about to happen. That is, one musical event (be it a tone, a phrase, or a whole section) has meaning because it points to and makes us expect another musical event. [...] Embodied musical meaning is, in short, a product of expectation. If, on the basis of past experience, a present stimulus leads us to expect a more or less definite consequent musical event, then that stimulus has meaning. (Meyer 1956, p. 35)

This view had been prepared by the musical aesthetics of Hanslick (1891):

The most important factor in the mental process which accompanies the act of listening to music, and which converts it into a source of pleasure, is frequently overlooked. We here refer to the intellectual satisfaction which the listener derives from continually following and anticipating the composer's intentions — now, to see his expectations fulfilled, and now, to find himself agreeably mistaken. It is a matter of course that this intellectual flux and reflux, this perpetual giving and receiving takes place unconsciously, and with the rapidity of lightning-flashes. Only *that* music can yield truly aesthetic enjoyment which prompts and rewards the act of thus closely following the composer's thoughts, and which with perfect justice may be called *a pondering of the imagination*. Indeed, without mental activity no aesthetic enjoyment is possible. (Hanslick 1891, p. 135f)

Finally, I mention the book of Michaelis (1795) which lays the ground for my present exposition. He wrote (in my own translation):

Perhaps, musical art could be declared as the art of stirring emotions, of vivifying and engaging the phantasy, and of tuning the mind towards ideas of the beautiful and the sublime through the diversified combination of tones; or briefly: as the art to immediately stimulate aesthetic emotions and aesthetic ideas by the conjunction of tones. (Michaelis 1795, pp. 54)

All those quotations together indicate how music reception (and the reception of art in general) could be regarded as a dynamical process: At one moment of time, a recipient entertains particular "aesthetic beliefs" (Meyer 1956, p. 73), which are mental states comprising all relevant expectations, propensities, or schemata about the world, or shortly, *belief states* in terms of *dynamic semantics* (Gärdenfors 1988, beim Graben 2006, 2014) and partially observable decision processes in AI research (Russell and Norvig 2010). Then, a musical episode (or a particular view upon a painting, a building, a dance, or a sculpture) is perceived that induces a transition from an "antecedent" state to a "consequent" state (Meyer 1956, p. 26). Hence, the *meaning* of the episode (or view) is represented by an *operator* (like in quantum physics) on the space of belief states of a cognitive agent (beim Graben 2006, 2014).

Yet, the crucial keyword of the quotation from Michaelis (1795, pp. 54) is "aesthetic ideas" which directly refers to the context of my study, namely Kant's philosophical aesthetics, which is elucidated in the next section. More specifically, my present account does not aim at a literal, hermeneutic interpretation of Kant's aesthetic theory, but rather at a reconstruction of aesthetic reception in terms of contemporary scientific insights. In a first step, I use model-theoretic semantics in order to illustrate some of the main concepts of Kant's theory (Achourioti and van Lambalgen 2011). In a second step, I demonstrate how Kant's ideas lead straightforwardly to the intended reconstruction by means of artificial intelligence and neural network theory (Kim and Schönecker 2022). In particular, I show that aesthetic reception could be described in terms of generative adversarial network theory (GANT) (Goodfellow et al. 2014, Schmidhuber 2010, 2012).⁸ By analogy, Kant's famous harmonious free play of the cognitive faculties (Ginsborg 1997, Guyer 2006) becomes isomorphic to the adversarial training regime of a GAN. The main focus of my study is art reception; the creation of art and the fundamental question whether AI might be considered as *real* artists will be addressed in

⁸Compare also Schmidhuber's web blog https://people.idsia.ch/~juergen/ artificial-curiosity-since-1990.html, containing a lot of technical reports on that issue.

the concluding discussion.

2 Kant's Analytic of the Beautiful

The foundation of Kant's critical philosophy, presented in the three volumes *Critique of Pure Reason* (Kant 1999), *Critique of Practical Reason* (Kant 2000), and *Critique of the Power of Judgement* (Kant 1914)⁹ relies upon a tripartite "division of the higher faculties of cognition", which are "Understanding", "Judgement", and "Reason" (Kant 1999, B169). "Understanding" denotes the "faculty of rules" (Kant 1999, B171), or, in other words, the "faculty of concepts" (Kant 1914, §29, p. 131). "Judgement", i.e. the "power of judgment is the faculty of subsuming under rules" (Kant 1999, B171), and "Reason" refers to the "faculty of Ideas" (Kant 1914, §29, p. 137), or, equivalently to the faculty "for the derivation from principles" (Kant 2000, p. 201), i.e., the capability of logical deduction and consistence (Stangneth 2019).

In the *Critique of the Power of Judgement*, Kant further differentiates between "determinant" Judgement (Kant 1914, §IV, p. 17), and "reflective" Judgement (cf. also (Kant 1999, B171)):

Judgement in general is the faculty of thinking the particular as contained under the Universal. If the universal (the rule, the principle, the law) be given, the Judgement which subsumes the particular under it $[\dots]$ is determinant. But if only the particular be given for which the universal has to be found, the Judgement is merely reflective. (Kant 1914, §IV, p. 17)

While the determinant Judgement is the power of *subsumption*, the reflective Judgement can be regarded as the capability of *unification* (Russell and

⁹Note that the *Critique of the Power of Judgement* in the Cambridge Edition was not available for the present study. Therefore, I quote this book not, as usual, in concordance with the German *Akademie Ausgabe*, but rather with the pagination of the translation by J. H. Bernard, entitled *Kant's Critique of Judgement*, together with the (invariant) enumeration of paragraphs therein (Kant 1914). Further note that some of Kant's key concepts, such as "Understanding", "Reason", or "Imagination" are written in capital letters in this edition. Specifically, a distinction between "Judgement" [*Urteilskraft*] (i.e. "power of judgment") and "judgement" [*Urteil*] is made. For further comparison, consult the Kant glossary (Kant 1914, pp. xlvii). All other citations refer to the *Akademie Ausgabe*, herein.

Norvig 2010), driving the advancement of science as well as artistic enculturation of humanity (Mizraji 2023). Both aspects of mental life are tightly intermingled to emotionality:

For all faculties or capacities of the soul can be reduced to three, which cannot be any further derived from one common ground: the faculty of knowledge, the feeling of pleasure and pain, and the faculty of desire. (Kant 1914, §III, p. 15)

Specifically, Kant drew here an analogy between Understanding as the "faculty of knowledge", reinforcing Judgement, and finally Reason as the (moral) "faculty of desire". Because Judgement is regulated by the transcendental idea of purposiveness (Kant 1914, §78, p. 331),

[...] the object is only called purposive, when its representation is immediately combined with the feeling of pleasure; and this very representation is an aesthetical representation of purposiveness. (Kant 1914, §VII, p. 31)

An important prerequisite for cognition is the power of determinant judgement, which Kant models as a "threefold synthesis" of *apprehension*, *reproduction*, and *recognition* (Kant 1999, A97) (cf. also Achourioti and van Lambalgen (2011)). More specifically, he argued:

Every empirical concept requires three acts of the spontaneous faculty of cognition: 1. The apprehension [Auffassung] (apprehensio) of the manifold of intuition 2. the comprehension [Zusammenfassung] i.e. the synthetic unity of the consciousness of this manifold in the concept of an object (apperceptio comprehensiva) 3. the exhibition [Darstellung] (exhibitio) in intuition of the object corresponding to this concept. For the first act imagination is required, for the second understanding, and for the third judgement. (Kant 2000, p. 220)

Productive imagination (Kant (1999, B181), Kant (1914, §49, p. 198)) is likewise regarded as "the faculty of presentation" (Kant 1914, §17, p. 85), or "as faculty of intuition" (Kant 1914, §39, p. 168), sometimes governed by the "laws of Association" (Kant 1914, §29, p. 136).

A corresponding combination of imagination, understanding and reflective judgement is also crucial for aesthetic experiences where "the Imagination is here creative", which "gets to fiction [...] in the peculiar fancies with which the mind entertains itself" (Kant 1914, §22, p. 100). Thus, one may interpret Imagination as the productive and creative faculty of the human mind.

Now, the central idea of Kant's analytic of the beautiful can be captured by the following passage:

The consciousness of the mere formal purposiveness in the play of the subject's cognitive powers, in a representation through which an object is given, is the pleasure itself; because it contains a determining ground of the activity of the subject in respect of the excitement of its cognitive powers, and therefore an inner causality (which is purposive) in respect of cognition in general without however being limited to any definite cognition; and consequently contains a mere form of the subjective purposiveness of a representation in an aesthetical judgement. (Kant 1914, §12, p. 71).

Hence, a person judges a given object *beautiful*, when its perception excites a "free play" of her "cognitive powers", Imagination and Understanding (Kant 1914, §9, p. 64). When this interaction appears as being "harmonious" (Kant 1914, §39, p. 168), it is felt pleasurable (Kant 1914, §15, p. 80), and eventually the object is regarded as being subjectively purposive (Kant 1914, §11, p. 69), meaning that it has no other end than eliciting pleasure through the subjectively experienced harmony of the free play between Imagination and Understanding.

Kant also used another paradoxical phrasing:¹⁰

Now if in the judgement of taste the Imagination must be considered in its freedom, it is in the first place not regarded as

¹⁰Similarly, citing Wagner (1984, p. 219): "Only through phantasy, understanding is able to consort with emotion." ["Nur durch die Phantasie vermag der Verstand mit dem Gefühle zu verkehren." My translation]

reproductive, as it is subject to the laws of association, but as productive and spontaneous [...] The Understanding alone gives the law [...] Hence it is a conformity to law without a law; and a subjective agreement of the Imagination and Understanding, without such an objective agreement as there is when the representation is referred to a definite concept of an object, can subsist along with the free conformity to law of the Understanding (which is also called purposiveness without purpose) and with the peculiar feature of a judgement of taste. (Kant 1914, §22, p. 96)

Yet, taste as the sense for the beautiful does not appear absolutely useless in Kant's philosophy, because it "brings with it a feeling of the furtherance of life" (Kant 1914, §23, p. 102), and therefore "quickens the cognitive faculties" (Kant 1914, §49, p. 201), eventually promoting "the feeling of health" (Kant 1914, §54, p. 221).

Consequently, Kant defined "aesthetical Ideas" through:

Spirit, in an aesthetical sense, is the name given to the animating principle of the mind. But that whereby this principle animates the soul, the material which it applies to that [purpose], is that which puts the mental powers purposively into swing, i.e. into such a play as maintains itself and strengthens the [mental] powers in their exercise. Now I maintain that this principle is no other than the faculty of presenting aesthetical Ideas. And by an aesthetical Idea I understand that representation of the Imagination which occasions much thought, without, however, any definite thought, i.e. any concept, being capable of being adequate to it; it consequently cannot be completely compassed and made intelligible by language. (Kant 1914, §49, p. 197).

Which can finally be related to music:

On the other hand, music and that which excites laughter are two different kinds of play with aesthetical Ideas, or with representations of the Understanding through which ultimately nothing is thought; and yet they can give lively gratification merely by their changes. (Kant 1914, §54, p. 222).

In this sense, Kant had paved the way for the music aesthetics of Michaelis (1795), Hanslick (1891), Meyer (1956), and Huron (2006), discussed above in terms of dynamic semantics (Gärdenfors 1988, beim Graben 2006, 2014).

2.1 Model Theory on Kant

Kant's metaphors and paradoxical formulations as summarized above have presented hermeneutic challenges to his interprets (e.g. Ginsborg (1997, 2003), Guyer (2006)). Ginsborg, e.g., gave the following interpretation

[...] first the feeling of pleasure, which judges the subjective purposiveness of the object or its representation for our cognitive faculties; second, the judgment which ascribes universal validity to the pleasure; and third, the still higher-order judgment which claims that the previously mentioned judgment is pure and hence, itself, universally valid [...] Ginsborg (2003, p. 169)

for some passages in Kant (1914, §9, p. 65; §35, p. 161), while Guyer (2006) distinguished between *precognitive*, *multicognitive*, and — his own suggestion — *metacognitive* (Guyer 2006, p. 182) approaches for the interpretation of the "harmony of the cognitive faculties" (Kant 1914, §9, p. 65).

In order to avoid such interpretational problems and for further illustrating Kant's essential ideas of aesthetic philosophy, I propose a model-theoretic account in the present subsection (Achourioti and van Lambalgen 2011). In model-theoretic semantics, judgements are simply propositions. Thus, it suggests itself to consider propositional logic. Moreover, for understanding is the "faculty of concepts" (Kant 1914, §29, p. 131), and concepts can be identified with predicates of first-order predicate logic, one has to consider predicate logic as well. The syntax of predicate logic is prescribed as a term algebra over the disjoint symbol sets of variables, constants, predicates, and logical operators, comprising the quantors and the connectives of propositional logic. Then, its model-theoretic semantics is basically given by an interpretation function, mapping constants onto elements of a suitably chosen discourse domain M of individual entities and mapping predicates onto relations over the direct products of M. In this way, the model-theoretic meaning of a unary predicate is given as a subset of the discourse domain M, or, in other words, predicates are interpreted extensionally (Russell and Norvig 2010).

In order to present an intuitive illustration, I consider optic perception in Fig. 2(a), instead of music, which is hardly to visualize. Figure 2(a) depicts a red rose with black background, as "flowers are free natural beauties." (Kant 1914, §16, p. 81).¹¹ Let r be constant and R be a predicate of first order logic such that $[\![r]\!] \in M$ (the meaning of r in the domain M) refers to the object shown in Fig. 2(a) and $[\![R]\!] \subseteq M$ (the meaning of R in the domain M) is the subset of all roses contained in M.

Now, the effect of the *determinant* power of judgement (Kant 1914, §IV, p. 17) can be easily identified with *predication*. Subsuming an empirical object under a given concept, such as 'the object in Fig. 2(a) is a rose' expresses the model-theoretic relation

$$[\![R(r)]\!] = ([\![r]\!] \in [\![R]\!]).$$
⁽²⁾

In order to illustrate the *reflective* power of judgement (Kant 1914, §IV, p. 17) in terms of model theory, consider Fig. 2(b). This panel depicts a number of image tiles, some of them (e.g. tiles (c), (h), (i), (m) and many others) showing roses, while others presenting persons, astronomic objects or book covers, etc. (for image sources see Appendix).

 $\label{eq:source:https://commons.wikimedia.org/wiki/File:Red_rose_with_black_background.jpg$







Figure 2: Rose associations. (a) Red rose with black background. (b) Image tiling. (c) Photomosaic of (a) with details shown in (b). (Color online)

One important function of the reflective power of judgement is the opposite of subsumption, namely unification: The principle of reflection on given objects of nature is that for all things in nature empirically determinate *concepts* can be found. Kant (2000, p. 211)

Where the "reflective Judgement [...] is obliged to ascend from the particular in nature to the universal" (Kant 1914, §IV, p. 18). Now, given some roseobjects in Fig. 2(b), the reflective power of judgement unifies these together under the concept label 'roses', or, formally,

$$\llbracket R \rrbracket = \bigcup_{r:R(r)} \llbracket r \rrbracket .$$
(3)

Yet, another eminent function of the reflective power of judgement besides unification is *representation* (also called "presentation" or "exhibition"):¹²

If the concept of an object is given, the business of the Judgement in the use of the concept for cognition consists in presentation (*exhibitio*) i.e. in setting a corresponding intuition beside the concept. (Kant 1914, §VIII, p. 35).

For the aim of representation, the cognitive faculties, reflective power of judgement, understanding, and imagination have to play tightly together. In model-theoretic semantics, this interaction could be straightforwardly described by means of Zermelo's *axiom of choice*, stating that for a non-empty family \mathcal{P} of subsets $P \in \mathcal{P}, P \subseteq M$, there is a selection function $\sigma : \mathcal{P} \to M$, such that $\sigma(P) = m \in M$ (Moore 1978). Therefore, Kant's idea of (re-)presentation can be captured in the following way: Given a concept, i.e. a predicate, R (e.g. 'rose'), apply the selection function σ to its extension,

$$\sigma(\llbracket R \rrbracket) = \llbracket r \rrbracket \in \llbracket R \rrbracket \tag{4}$$

to present a characteristically representing image [r] of a rose in intuition.

Finally, these model-theoretic reconstructions can be brought together for illustrating Kant's key concept of the "free play of the cognitive faculties" (Kant 1914, §9, p. 64). To this end, *photomosaics* present a suitable mean

¹²Also cf. Kant (2000, p. 220))

of illustration (Silvers 1996, Mizraji 2023). A photomosaic is a computergenerated tiling of a given image such that the tiles are appropriately adjusted through their mean optical properties, such as color and brightness. Photomosaics share also some interesting properties with fractals such as the Mandelbrot set which exhibit their own aesthetic appeal (Peitgen and Richter 1986). Clearly, by iteratively generating a photomosaic through recursive photomosaic tiles, would produce a fractal-like structure.

Consider Fig. 2(c), depicting a photomosaic of the rose shown in Fig. 2(a), that I have created with $AndreaMosaic^{13}$ with Fig. 2(b) as a zoom view into its details. Most of the tiles within the rose domain present different kinds of roses, altogether constituting the extension of the empirical concept 'rose'. By contrast, the black background is tiled with dark images of some astronomical objects.

Looking at the details in Fig. 2(b), reveals a clipping of my personal semantic web: I am writing an article about Kant's philosophical aesthetics, therefore tile (d) shows a picture of Kant in the very same year when he published the Critique of the Power of Judgement. There, Kant discusses flowers as examples of "free natural beauties" (Kant 1914, §16, p. 81). The concept of 'flower' is a unification of the concept of 'rose', hence, tiles (c), (i), (h), (m) present particular roses in my imagination. In the *Critique of* Practical Reason, Kant (2015, p. 162) talked about "the starry heavens above me" as one object of "increasing admiration and reverence". Thus, I have selected images (a), (b), (j), and (g) as representatives for heavenly objects. Thinking about roses in literary art, I am further associating The Name of the *Rose* (tile f) of Italian semiotician Umberto Eco (tile k), but also Dan Brown because of his "sub rosa" leitmotif in the Da Vinci Code (tile l). Finally, my mind is wandering back to my own scientific work, as indicated by tile (e). In different regions of the photomosaic Fig. 2(c), other related associations have taken place: e.g. there is one tile showing Gertrude Stein: "a rose is a rose [...]" and another one with the book cover of music psychologist Diana Deutsch's Musical Illusions and Phantom Words, etc. (not shown).

Thus, during my reception of the photomosaic Fig. 2(c), I am experiencing a kind of "free play" (Kant 1914, §9, p. 64) of my own intuitive imagination, though under the "laws of association" (Kant 1914, §29, p. 136) imposed by my understanding of concepts. This lawfulness play without a law somehow appears "harmonious" (Kant 1914, §39, p. 168), thereby con-

¹³http://www.andreaplanet.com/andreamosaic/

veying a feeling of pleasure to my soul (Kant 1914, §15, p. 80). Finally, I am judging the mosaic Fig. 2(c) (but also the rose Fig. 2(a)) 'beautiful', not, because 'beauty' can directly be attributed to the rose, but because it is the reason for my pleasure in the harmonious interaction between imagination and understanding (Kant 1914, §12, p. 71). Now, employing an idea of Huron (2006, p. 138), the aesthetic judgement comprises a *missattribution* from the source of the feeling of pleasure, the harmony of the faculties, to its stimulus, the given 'beautiful' object.¹⁴

2.2 Generative Adversarial Network Theory on Kant

Another crucial aspect of the reflective power of judgement refers to the situation "if only the particular be given for which the universal has to be found" (Kant 1914, §IV, p. 17). This is generally the case for *concept formation*, *categorization*, and *learning* (Russell and Norvig 2010). By identifying concepts with the extensions of predicates, every predicate P together with its logical negation $\neg P$, defines a binary partition $\mathcal{P} = \{A_1, A_2\}$ of the model-theoretic discourse domain $M = A_1 \cup A_2$, such that $A_1 = \llbracket P \rrbracket$ and $A_2 = \llbracket \neg P \rrbracket$. (Likewise, a family of disjoint concepts, e.g. color terms, provides a non-binary partition of M). Thus, concept formation turns out as clustering through the acquisition of partition boundaries (Russell and Norvig 2010).

In machine learning approaches, discourse domains are usually codified as high-dimensional feature spaces $X \subseteq \mathbb{R}^n$, with dimensionality $n \in \mathbb{N}$ (Russell and Norvig 2010). In vision science, e.g., a grey scale image such as the rose in the hard copy version of Fig. 2(a), that was discretized into $n = 1024 \times 787 = 805, 888$ pixels, each one contributing a real value ranging from black (=0) to white (=1), becomes represented by a vector $\boldsymbol{x} \in X =$ $[0, 1]^n \subseteq \mathbb{R}^n$. Correspondingly, an acoustic spectrogram can be regarded as a real-valued image in the dimensions of time \times frequency, leading to a similar vectorial sampling. Such high-dimensional images have to be compressed by virtue of advanced data analysis techniques (such as principal component analysis, hidden Markov models, etc) in order to obtain a suitable feature

¹⁴Compare:

This Deduction is thus easy, because it has no need to justify the objective reality of any concept, for Beauty is not a concept of the Object and the judgement of taste is not cognitive. (Kant 1914, §38, p. 166).

See also the thorough discussion by Blutner (2024).

space for subsequently employing machine learning techniques (Russell and Norvig 2010).

An important class of classifiers are *perceptrons*, which are one- or multilayered feed-forward neural networks with nonlinear activation functions (Hertz et al. 1991, Russell and Norvig 2010). Let $\boldsymbol{x} \in X$ be an *n*-dimensional input vector and $\boldsymbol{y} \in Y \subseteq \mathbb{R}^m$ be an *m*-dimensional output vector, such that admissible outputs are restricted to $y_i = 1$ for one output unit *i* and $y_k = 0$ for all other output units $k \neq i$. Then, the neural network equation

$$\boldsymbol{y} = \Theta(\boldsymbol{W} \cdot \boldsymbol{x}) \tag{5}$$

with Heaviside step activation function $\Theta(x) = 1(0)$ if $x \ge 0 (< 0)$, and synaptic weight matrix W could describe a one-layered perceptron that works as a linear classifier separating several data clusters in input space though linear partition boundaries where the activation function acts as a decision function over some decision thresholds that are encoded as biases in the weight matrix (Hertz et al. 1991, Russell and Norvig 2010). Training such a network by means of the perceptron learning rule (a simplification of the multi-layered backpropagation rule) leads to the emergence of average prototype representations in input space,¹⁵ from which classification results are obtained through minimizing the distances of an actual input vector to the respective class prototypes. This method underlies, e.g., the key-finding algorithm of Krumhansl (1990) in music retrieval.

Replacing the Heaviside function in (5) by the logistic activation function

$$f(x) = \frac{1}{1 + e^{-x}},$$
(6)

converts the hard decision problem into a soft, probabilistic, one such that $f(x) = \Pr(x \ge 0)$ becomes the probability that input x belongs to a given class (Hertz et al. 1991, Russell and Norvig 2010).

¹⁵Interestingly, Kant already speculated about an "archetype of beauty" (Kant 1914, §17, p. 88) produced by a kind of averaging algorithm:

Further, if the mind is concerned with comparisons, the Imagination can, in all probability, actually though unconsciously let one image glide into another, and thus by the concurrence of several of the same kind come by an average, which serves as the common measure of all. (Kant 1914, §17, p. 87)

This idea has been empirically validated for a first time by Galton (1878); cf. the more recent review by Collins (2012). Also note the close connection to matrix memory neural networks (Mizraji 2010).

A binary classifier with a single output unit y is called *discriminator*. For a probabilistic discriminator, the input space X is partitioned into two categories $X = A_1 \cup A_2$, corresponding to the decisions that $\boldsymbol{x} \in A_1$ or $\boldsymbol{x} \notin A_1$ when $A_2 = X \setminus A_1$ is the complement of class A_1 . Then,

$$y = D(\boldsymbol{x}) = \Pr(\boldsymbol{x} \in A_1) = \Pr(A_1 | \boldsymbol{x})$$
(7)

is the (conditional) probability that the input \boldsymbol{x} is correctly classified as a member of A_1 . Correspondingly, $1 - D(\boldsymbol{x}) = \Pr(\boldsymbol{x} \notin A_1)$ becomes the probability of the converse classification problem that \boldsymbol{x} belongs to A_2 , instead.

Now, a generative adversarial network (GAN) is a (deep) neural network, where two modules (Carmantini et al. 2017), a discriminator and another one, called *generator*, are recurrently coupled together in a *reinforcement* loop (Goodfellow et al. 2014). Figure 3 presents its architecture schematically, where both modules are indicated as 'black boxes' comprising quite different neural topologies, ranging from multi-layered perceptrons (Goodfellow et al. 2014), to continuous recurrent neural networks (C-RNN) (Mogren 2016) or convolutional neural networks (CNN) (Yang et al. 2017), as used for AI music composition.



Figure 3: Architecture of a generative adversarial network (GAN).

The discriminator in Fig. 3 is trained on two different data sets, natural examples \boldsymbol{x} , drawn from a big data pool (*data*) and *creations* \boldsymbol{y} delivered by the generator module. Both inputs must have the same dimensionality,

 $\boldsymbol{x}, \boldsymbol{y} \in X \subseteq \mathbb{R}^n$, but are initially governed by two different probability distribution density functions: $\boldsymbol{x} \sim \rho$ and $\boldsymbol{y} \sim \gamma$, with $\rho, \gamma : X \to \mathbb{R}$. The discriminator returns a single output $D(\boldsymbol{x}) \in \mathbb{R}$ which is the probability that the input vector \boldsymbol{x} belongs to the class of natural examples A_1 , according to (7).

The output of the discriminator module is fed into the generator module as a reinforcement signal from which the generator can determine its actual reward or penalty. The purpose of the generator is to hocus the discriminator by creating outputs that cannot be distinguished from the natural example data. Thus, the generator may apply a simple thresholding algorithm: if $D(\boldsymbol{y}) > 0.5$ for its own output \boldsymbol{y} the discriminator has successfully been fooled because the generated datum \boldsymbol{y} had mistakenly been classified as natural $\boldsymbol{y} \in A_1$ by the discriminator, thereby leading to the generator's reward. If, on the other hand, $D(\boldsymbol{y}) < 0.5$, the discriminator was successful in telling the difference between the generated datum \boldsymbol{y} and a natural representative, which leads to the generator's punishment.

More specifically, the generator is able to freely create its output by filtering some random noise signal $\boldsymbol{z} \in X$ from its input. Under the assumption that the noise has another probability distribution density function $\nu: X \to \mathbb{R}$, the action of the generator can mathematically be described by a transfer function $G: X \to X$, such that $\boldsymbol{y} = G(\boldsymbol{z})$, implementing a Frobenius-Perron operator (Ott 1993, Troll and beim Graben 1998)

$$\gamma(\boldsymbol{x}) = \mathbb{E}_{\boldsymbol{z} \sim \nu}[\delta(\boldsymbol{x} - G(\boldsymbol{z}))]$$
(8)

with Dirac's delta distribution as integration kernel in the expectation value functional \mathbb{E} for the random variable z drawn from the noise distribution ν .

The training objective of the GAN is then formalized by the temporal limit

$$\gamma \stackrel{T \to \infty}{\longrightarrow} \rho , \qquad (9)$$

i.e., the output distribution of the generator approaches the distribution of the natural training data for increasing training time T. This is achieved by reinforcement learning (Williams 1988, Hertz et al. 1991, Schmidhuber 2010, 2012) through an *adversarial minimax game*, played by the interacting modules (Russell and Norvig 2010).

To this end, one defines a *utility function* of the discriminator as

$$U(D,G) = \mathbb{E}_{\boldsymbol{x} \sim \rho}[\log(D(\boldsymbol{x}))] + \mathbb{E}_{\boldsymbol{z} \sim \nu}[\log(1 - D(G(\boldsymbol{z})))]$$
(10)

where is first term denotes the discriminator's reward from correctly classifying a natural example $\boldsymbol{x} \in X$, while the second term describes the rewarding contribution from correctly rejecting a creation $\boldsymbol{y} = G(\boldsymbol{z})$ of the generator. Correspondingly, a *cost function* of the generator

$$C(D,G) = \mathbb{E}_{\boldsymbol{z} \sim \nu}[\log(1 - D(G(\boldsymbol{z})))]$$
(11)

is given by the second term of the discriminator's utility function, since a correct rejection of a generator's creation $\boldsymbol{y} = G(\boldsymbol{z})$ by the discriminator is penalized as a failed attempt to fool the latter module. Hence, the GAN training objective is expressed as

$$\min_{G} \max_{D} \mathbb{E} \boldsymbol{x}_{\sim \rho}[\log D(x)] + \mathbb{E} \boldsymbol{z}_{\sim \nu}[\log(1 - D(G(z)))]$$
(12)

which is essentially GAN's signature Eq. (1) from the auction at Christie's (2018).

Provided that the GAN architecture Fig. 3 has unlimited resources, Goodfellow et al. (2014) were able to prove the convergence (9) of the training algorithm. One important step in their proof comprises the statement that for a given generator transfer function G and its corresponding probability density function γ , there is one optimal discriminator function D^* , that maximizes the utility (10), entailing

$$D^*(\boldsymbol{x}) = \frac{\rho(\boldsymbol{x})}{\rho(\boldsymbol{x}) + \gamma(\boldsymbol{x})} \,. \tag{13}$$

Then, the discriminator's utility function can be expressed either by Kullback-Leibler divergences, or, likewise, by its symmetrical counterpart, called Jensen-Shannon divergence (Goodfellow et al. 2014), which relates its optimization to Bayesian exploration (Itti and Baldi 2005, Sun et al. 2011) and pragmatic information theory in dynamic semantics (beim Graben 2006). In the limit (9), when the generator's distribution reproduces the natural data distribution, $\gamma = \rho$, Eq. (13) yields $D^*(\boldsymbol{x}) = 0.5$, i.e. the generator outperforms the discriminator, that is thereby acting at chance level.

Next, I supply the isomorphism between Kant's analytic of the beautiful, outlined in the *Critique of the Power of Judgement* and generative adversarial network theory (GANT) (Goodfellow et al. 2014, Schmidhuber 2010, 2012). To this end, I subsequently discuss a few iterations of the learning algorithm.

At initialization, it could be assumed that the untrained generator acts as the identity operator G(z) = z upon the random noise input $z \in X$. Hence, the generator's output distribution simply reproduces the noise distribution $\gamma(\mathbf{z}) = \nu(\mathbf{z})$. Since the discriminator is also untrained at initialization, it merely classifies at chance level, $D(\mathbf{x}) = 0.5$. After some iterations of batch learning, the discriminator approaches its relative optimum Eq. (13), $D^*(\mathbf{x}) = \rho(\mathbf{x})/(\rho(\mathbf{x}) + \nu(\mathbf{x}))$, therefore becoming able to correctly predict and classify the given natural training vectors.¹⁶ After another round of batch iterations, also the generator has improved its performance hocussing the discriminator from trial to trial. Both modules are engaged in their adversarial game until convergence, when the discriminator is degraded to change level again.

My reconstruction of Kant's theory of art reception in terms of GANT is then elucidated in Tab. 1.

Kant	GANT	Kant (1914)
"feeling of pleasure and pain"	reward and punishment	§III, p. 15
"determinant" Judgement	predication, discrimination	§IV, p. 17
"reflective" Judgement	prediction, learning	§IV, p. 17
"Understanding, as the faculty of concepts"	discriminator	§VII, p. 31
"Imagination (as a productive faculty of cognition)"	generator	§49, p. 197
"free play"	adversarial game	§9, p. 64
"harmony of the cognitive faculties"	algorithm's convergence	§9, p. 65
"spontaneity"	random forcing	§IX, p. 41
"purposiveness without purpose"	generator terminal	§22, p. 96
"law[fulness] without a law"	discriminator terminal	§22, p. 96
"pretty[iness]"	prototypicality	§49, p. 197
"beauty"	interestingness	§39, p. 168
"furtherance of the whole life"	training objective	§54, p. 221

Table 1: Isomorphism between the aesthetic model of Kant's *Critique of the Power of Judgement* and generative adversarial network theory (GANT).

My basic idea for the reconstruction is that during art reception, the human mind acts in analogy to a GAN in its training phase while being stimulated by the many different episodes or views upon a given object. On the one hand, I identify understanding as the faculty of concepts with the GAN discriminator [Fig. 1: *understanding*] which acts as a binary classifier. During GAN training the discriminator acquires law-like categories through

¹⁶Note that Schmidhuber (2010, p. 233) emphasized that "there is a deep connection between optimal prediction and optimal compression", where compression is clearly related to classification.

the successful prediction and classification of natural input patterns. This operation mode is related to the reflective power of judgement. After training, the discriminator behaves in analogy to the determinant power of judgement by subsuming input patterns, either natural ones from the training pool or those ones created by the generator, under learned categories through predication.

On the other hand, I equate the productive faculty of imagination with the GAN generator [Fig. 1: *imagination*]. Its capability to spontaneously create 'art works' is described by the random forcing of the module in the GAN architecture. Both modules are engaged in an adversarial minimax game during the training phase, thus reflecting the free play of the cognitive faculties. As the generator aims at fooling the discriminator, which in turn, tries to make successful predictions about the source of a given input, the game develops towards an optimum, prescribed by the objective function (10), eventually accounting for the harmony of the algorithm (12).¹⁷ Depending on the respective harmony pay-off, both modules are either rewarded or penalized within their reinforcement loop, which causes the feelings of pleasure and pain in a somewhat anthropocentric metaphor.

As soon as the convergence limit is approached, the discriminator becomes increasingly unable to distinguish the origin of its input patterns; thus it terminates in a state of lawfulness (after successfully acquiring many categories) without a law (operating at change level). By contrast, the generator has reached optimal purposiveness (deceiving the discriminator), but without any substantial purpose.

Moreover, my neural reconstruction allows to differentiate between prettiness and beauty according to Kant's formulations. For Kant, prettiness is subjectively appealing without the "spirit" of aesthetical ideas, which "is the name given to the animating principle of the mind" (Kant (1914, §49, p. 197); cf. also Kant (2011, p. 66)) which has to be interpreted as the free, harmonious, and autonomous play of imagination and understanding. For a judgement of prettiness essentially lacks this autonomy of the cognitive faculties, I interpret prettiness as prototypicality in the sense of the "archetype of beauty" (Kant 1914, §17, p. 88). Contrastingly, the judgement of the beautiful resides in mere "reflection [of] the accordance of the representation with the harmonious (subjectively purposive) activity of both cognitive faculties in their freedom, i.e. to feel with pleasure the mental state produced by the

¹⁷Note that a particular approach in computational neuroscience is explicitly dubbed *harmony theory* (Smolensky 1986, Smolensky and Legendre 2006, Smolensky 2006).

representation." (Kant 1914, §39, p. 168).¹⁸

Finally, my reconstruction is completed by the observation that aesthetic reception has an overall positive impact upon the life of the perceiver through the "feeling of the furtherance of life" (Kant 1914, §23, p. 102; §49, p. 201; §54, p. 221). This aspect had also been emphasized by Schmidhuber (2010, 2012):

The current *intrinsic* reward, *creativity* reward, *curiosity* reward, aesthetic reward, or fun $r_{int}(t)$ of the action selector is the current surprise or novelty measured by the improvements of the world model p at time t. (Schmidhuber 2010, p. 232) (Italics in the original)

Where the *action selector* is another term for the generator, while the *world* model denotes the GAN's discriminator, here.

Thus, a cognitive agent comprised by two GAN modules, discriminator/understanding and generator/imagination that is continuously engaged in curious interaction with the challenges of the world is permanently improving its prediction and classification capability and seldom becomes bored (Kenett et al. 2023). This is, of course, also of particular significance for the scientific endeavor when the *eureka effect* emotionally rewards the scientist for the rational unification of diverse empirical laws (Stangneth 2019, Mizraji 2023):

Hence, as if it were a lucky chance favouring our design, we are rejoiced (properly speaking, relieved of a want), if we meet with such systematic unity under merely empirical laws; although we

¹⁸Note that my reconstruction crucially deviates in this point from the terminology of Schmidhuber (2010):

The subjective simplicity or compressibility or regularity or beauty [...] The observer-dependent and time-dependent subjective interestingness or surprise or aesthetic value is the first derivative of subjective simplicity [...] (Schmidhuber 2010, p. 234)

Therefore, Schmidhuber's notion of beauty corresponds to my (and Kant's) concept of prettiness, namely prototypicality as measured by compressibility; while his notion of subjective interestingness better corresponds with my (and Kant's) concept of beauty (cf. also the discussion in Collins (2012)).

must necessarily assume that there is such a unity without our comprehending it or being able to prove it. (Kant 1914, §V, p. 24)

The latter quotation provides the connection of Kant's aesthetics with his theory of teleology that is required as a regulative principle for the unification of science (Kant 1914, Primas 1990).

3 Discussion

In this study, I have presented a reconstruction of Kant's theory of art reception in terms of artificial intelligence (AI) (Goodfellow et al. 2014, Schmidhuber 2010, 2012). More specifically, I have used the theory of generative adversarial networks (GANT) for demonstrating an isomorphism between both frameworks in case of art reception. The central pillar of my approach is the analogy between the discriminator module of a GAN, capturing the lawfulness of its perceptions with Kant's understanding as the faculty of rules (Kant 1999, B171) on one side, and the GAN generator module with Kant's productive imagination (Kant (1999, B181), Kant (1914, §49, p. 198)) as the faculty of intuition (Kant 1914, §39, p. 168). During network training, both neural modules are engaged in a free adversarial game, with the generator attempting to fool the discriminator, which, in turn, is constantly improving its discrimination performance. The interaction of both modules is harmonious approaching convergence, which is felt as subjective pleasure in Kant's account (Kant 1914, §12, p. 71). Referring to an idea of Huron (2006, p. 138), this pleasure becomes missattributed from its source to its stimulus, i.e. the beautiful object in a judgement of taste (Kant 1914, §38, p. 166).

In order to probe the suggested reconstruction, I discuss a recent experiment of Cheung et al. (2019) on empirical music aesthetics. They reported high ratings of aesthetic appreciation for both, either predictable closures in rather uncertain contexts, and for surprising closures in relatively certain contexts. These findings are essentially consistent with my GANT approach for the following reasons. First, consider the case of an uncertain context. In this setting, the discriminator has not sufficiently been trained to capture all the regularities of the natural data pool. However, if the discriminator is yet able to successfully classify an unexpected creation produced by the generator, the discriminator wins its match against the generator, thus being rewarded by the second term of the utility function Eq. (10). Secondly, in the other case of a relatively certain context, the discriminator is close to its optimum Eq. (13) for a given generator distribution. If now the generator is able to successfully hocus the discriminator, the latter becomes surprised by a novel creation of the former, that consequently wins this match against the discriminator. Then, this outcome is rewarding for the generator. Hence, in both cases, the GAN modules are in an harmonious interplay, as described by the minimax algorithm Eq. (12), resulting in high aesthetic appreciation. To summarize this argument, a listener who is familiar with a particular musical style could easily predict the temporal patterns of an unknown piece conforming to that given style. In such a situation of certainty, an unpredictable musical event is surprising and signals that the discriminator has not yet approached its optimum. Thus, there is a need for cognitive improvement. In the contrasting uncertain situation, the listener is not sufficiently experienced to make appropriate predictions. Though, when she is yet able to systematically predict musical events beyond change level, her generator has also not reached its optimum for it could be further improved to fool the discriminator. In both cases, the demand to further improve the mental faculties for aesthetic reception is felt as pleasure.

Finally, I address the question whether and to which extent generations of AI could count as *real art*. In an interview with Christie's auction house, the director of the Art and Artificial Intelligence Lab at Rutgers University, Ahmed Elgammal, said:

Yes, if you look just at the form, and ignore the things that art is about, then the algorithm is just generating visual forms and following aesthetic principles extracted from existing art. But if you consider the whole process, then what you have is something more like conceptual art than traditional painting. There is a human in the loop, asking questions, and the machine is giving answers. That whole thing is the art, not just the picture that comes out at the end. You could say that at this point it is a collaboration between two artists — one human, one a machine. And that leads me to think about the future in which AI will become a new medium for art. (Christie's 2018)

Neglecting some ethical issues about origin, bias, and diversity of AI training data (Bender et al. 2021),¹⁹ AI applications could lead, according to

¹⁹Letter signed by more than 200 artists makes broad ask that tech firms pledge

Elgammal, to new forms of artistic activity that might be called *AI assisted* arts (*AIAA*). What does this imply for my suggested GANT reconstruction? First of all, all mathematical proofs on the convergence of the GAN algorithm require infinite resources such as memory capacity and cardinality of the natural training data (Goodfellow et al. 2014, Schmidhuber 2010, 2012). This is clearly not ensured for contemporary AI systems. Yet this fact has immediate consequences for the understanding of artificial artists. Following Kant:

The mental powers, therefore, whose union (in a certain relation) constitutes genius are Imagination and Understanding [...] Thus genius properly consists in the happy relation [between these faculties], which no science can teach and no industry can learn, by which Ideas are found for a given concept [...] The latter talent is properly speaking what is called spirit [...] (which is even on that account original and discloses a new rule that could not have been inferred from any preceding principles or examples), that can be communicated without any constraint [of rules]. (Kant 1914, §49, p. 201) (My italics)

Here, the crucial idea is that becoming a genius cannot be learned by obeying prescribed artistic rules. By contrast, genius is able to mold new rules. Moreover:

In accordance with these suppositions genius is the exemplary originality of the natural gifts of a subject in the free employment of his cognitive faculties. In this way the product of a genius (as regards what is to be ascribed to genius and not to possible learning or schooling) is an example, not to be imitated (for then that which in it is genius and constitutes the spirit of the work would be lost), but to be followed, by another genius; whom it awakens to a feeling of his own originality and whom it stirs so to exercise his art in freedom from the constraint of rules, that thereby a new rule is gained for art, and thus his talent shows itself to be exemplary. But because a genius is a favourite of nature and must be regarded by us as a rare phenomenon, his example produces for other good

to not develop AI tools to replace human creatives: https://www.theguardian.com/technology/2024/apr/02/musicians-demand-protection-against-ai

heads a school, i.e. a methodical system of teaching according to rules, so far as these can be derived from the peculiarities of the products of his spirit. For such persons beautiful art is so far imitation, to which nature through the medium of a genius supplied the rule. (Kant 1914, §49, p. 203f) (My italics)

Therefore, the power of judgement can only be trained by means of examples; and a genius is able to create examples of art, from which other geniuses may form their artistic productivity. Finally:

Abundance and originality of Ideas are less necessary to beauty than the accordance of the Imagination in its freedom with the conformity to law of the Understanding. For all the abundance of the former produces in lawless freedom nothing but nonsense; [...] (Kant 1914, §50, p. 205) (My italics)

Hence, according to Kant's theory of art generation, contemporary AI artists may not be called *real geniuses* for they are trained by means of finite examples to either reproduce particular styles, or to produce some kind of novelty. In the first case, AI art may be called *manneristic*, in the second merely *random* (Zoeller 2024).

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Appendix

Here, I present the sources of some of the photomosaic details Fig. 2(b): (a) Omega Nebula M17²⁰, (b) Galaxy NGC 7331²¹, (c) Rose Komsomolskij $Ogonek^{22}$, (d) Philosopher Immanuel Kant 1790²³, (e) Author's edited book volume Lectures in Supercomputational Neuroscience²⁴, (f) Umberto Eco's novel Il nome della rosa²⁵, (g) Ring Nebula M57²⁶, (h) Rose Münsterland²⁷, (i) Rose Sacramento²⁸, (j) Horsehead Nebula IC 434²⁹, (k) Italian semiotician and novelist Umberto Eco^{30} , (l) Dan Brown's novel The Da Vinci Code³¹, (m) the same as (c).

²⁴https://link.springer.com/book/10.1007/978-3-540-73159-7

²⁹https://apod.nasa.gov/apod/ap231120.html

³⁰https://de.wikipedia.org/wiki/Umberto_Eco#/media/Datei:Eco,_Umberto-1. jpg ³¹https://danbrown.com/

²⁰https://apod.nasa.gov/apod/ap230908.html

²¹https://apod.nasa.gov/apod/ap230914.html

²²https://commons.wikimedia.org/wiki/File:Rosa_\%27Komsomolskij_Ogonek\ %27_Klimenko_1962.jpg

²³https://commons.wikimedia.org/wiki/File:Immanuel_Kant_portrait_c1790. jpg?uselang=de

²⁵https://it.wikipedia.org/wiki/Il_nome_della_rosa#/media/File: 9788412451207-scaled-e1636366124330.jpg

²⁶https://en.wikipedia.org/wiki/Messier_object#/media/File:M57_The_Ring_ Nebula.JPG

²⁷https://commons.wikimedia.org/wiki/File:Rosa_\%27M\%C3\%BCnsterland\ %27_Noack_1986.jpg

²⁸https://commons.wikimedia.org/wiki/File:Rosa_\%27Sacramento\%27_Anni_ Berger_GPG_Langensalza_1981.jpg