Research Article

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Managing the Vague: John Dewey's Aesthetics and the Relation of Fine Art and Mathematics

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Abstract: In philosophical discourse, vagueness is commonly regarded as an undesirable and problematic aspect of human experience. Such standpoints are not unfounded. However, in this article, I argue that vagueness may in certain instances also possess an instrumental role that supports specific modes of human aspiration, including the artistic and the mathematical. In particular, I investigate the ways in which vagueness not only hinders, but also fosters the emergence of an aesthetic quality of experience during the imaginative endeavours of fine art and mathematics. The manner in which the benefit from felt vagueness ties into the formation of artistic and mathematical scenarios helps to illuminate deep and often unnoticed relations between these two domains of human ingenuity. In this article, the overall concept of experience and the particular features of human experience, such as the aesthetic and the vague, are examined in the context of John Dewey's philosophical pragmatism. In Dewey's philosophical framework, the human mind and culture are understood as natural phenomena. As such, the Deweyan approach fits the paradigm of a twenty-first century scientific understanding of the inherent ontological unity of all modes of human existence and activity.

Keywords: philosophical naturalism, philosophical pragmatism, vagueness, imagination, human experience, natural evolution

1 Introduction

In this article, I discourse the aesthetic relationship between fine art and mathematics. Furthermore, John Dewey's philosophical pragmatism provides both the outset and the broad philosophical framework for this inquiry.[1] I begin the discussion with Dewey's remarks on the aesthetic relationship between intellectual thought and artistic engagement. He states that:

> [*A*]*n* experience of thinking has its own esthetic quality. It differs from those experiences that are acknowledged to be esthetic, but only in its materials. The material of the fine arts consists of qualities; that of experience having intellectual conclusion are signs or symbols having no intrinsic quality of their own, but standing for things that may in another experience be qualitatively experienced. The difference is enormous.[2]

1 Since Dewey's time, philosophical pragmatism has developed into many different directions, some of which have become more or less incompatible with Dewey's theorisation. On that account, it is necessary to emphasise that none of these later versions, such as the linguistically oriented neopragmatism for example, are discussed in this article; the framework for this inquiry is strictly Deweyan.

2 Dewey, *The Later Works of John Dewey, 1925–1953. Volume 10: 1934, Art as Experience* (*LW10*), 45 (Italics in the original).

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Thus, on the one hand, the two domains have a common experiential ground as the same psychophysical mechanisms operate in both, bringing about the aesthetic quality in human experience. And on the other, despite the similarities in bodily systems and experiential outcomes, the cognitive strategies – or routes – for arriving at this particular experiential state are markedly different. Dewey calls these differences "enormous." I do not challenge the view that artistic expressions and scientific statements commonly differ in their respective modes of coming about. However, in this article, I investigate the question of whether the enormousness of the difference can be reduced to the point of becoming "miniscule." This approach is not in contradiction to Dewey's argumentation, because Dewey himself contemplates the possibility of overcoming the enormous difference between the artistic and the intellectual. As such, I argue for specific cognitive processes that warrant Dewey's premonitions about a future where the aesthetic and the intellectual increasingly converge.[3]

I posit that the convergence is especially notable in instances in which imagination is the primary domain of activity, as is the case with artistic and mathematical scenarios that oftentimes cannot take place in the surrounding environment. The meaning (as in "experienced consequences") of entities such as dragons of the fantasy genre or higher dimensional solids of extra-dimensional geometry can only be experienced in human imagination.[4] Of course, these imaginative scenarios do not appear out of the a priori blue, but necessitate engagement with concrete materials and objects, such as paints arranged into paintings and abstract symbols arranged into equations. These constructions, in conjunction with various personal traits and sociocultural settings, direct the development of meaningful scenarios in human imagination.

Overall, the purpose of this inquiry is not to reinterpret Dewey, but to expand upon his theorisation, especially in the less explored and developed areas of his work, such as the relationship between fine art and mathematics. To that end, I will first give a general overview of the theoretical basis that ties various aspects of human activity and experience – such as the artistic and the mathematical – together. I will then discuss how this basis gives rise to both the aesthetic and the vague and, consequently, examine certain ways in which the two manifest in the context of fine art. After these points, I move on to discuss the roles of the vague and the aesthetic in the context of mathematics. And in the end, I bring the two approaches together and highlight the similarities between fine art and mathematics as they relate to vagueness within the contexts of instrumentality and imagination.

All of these topics are discussed in the specific framework of Dewey's theorisation on the concept of human experience – a key aspect of his philosophical enterprise, as indicated by book titles such as *Art as Experience* and *Experience and Nature*.[5] In Dewey's philosophical pragmatism – a subsection of the broader framework of philosophical naturalism – life is predominantly deemed as a matter of problem solving; organisms encounter various types of resistances to the desirable courses of living and to the continuity of life itself. This is the struggle of existence that the human psychophysical setup, including the experiential capacity, has evolved to respond to. Our experiential sphere is geared towards managing the process of detecting challenges, discovering the means for taking on these challenges, and evaluating whether the challenge has been overcome with the selected means in a desirable manner. Even in the absence of urgently pressing problems and in times of leisure, the emotionally rich qualities, nonetheless, define the human experiential whole. The embodied structures forged through evolutionary, sociocultural, and

3 Ibid., 154.

4 Notably, in Dewey's art theory, the definition of fine art does not follow any demarcation line of socially introduced labels, such as high culture, popular culture, or folk culture. For him, the defining factor that separates the "fine" from other arts is the intentionally set goal of effectuating exceptionally aesthetic experiences in audiences, which includes the artist herself. In fine art, material objects are constituted for this principal purpose, and it, above all, guides the production of and the engagement with these objects, and their determination as art objects. Accordingly, in this article, too, fine art is viewed as the exceptionally intense aesthetic experiencing that emerges in an interaction with material objects that range from dance to paintings, from movies to sculptures, and from musical performances to fantasy novels.

5 Dewey, *LW10*; Dewey, *The Later Works of John Dewey, 1925–1953. Volume 1: 1925, Experience and Nature* (*LW1*).

personal struggles cannot be "switched off." Consequently, assertive qualities, such as sorrow or satisfaction for example, may occupy the experiential domain in all circumstances and beyond active strife.

It is the qualities of human experience, namely the vague and the aesthetic, that denote the main focus point for this inquiry. More specifically, I examine the aesthetic relationship between fine art and mathematics in the context of vagueness – a quality of the human experiential sphere that predominantly receives negative attention whenever it is discussed. I do not deny the fact that vagueness can be problematic in philosophy, fine art, science, and everyday life. Yet, I posit the view that the human psychophysical setup has evolved not only to manage felt vagueness, but also, in certain instances, to enjoy overcoming such a cognitive challenge. And the aesthetic quality of experience emerges in accordance with the benefit that the management of problematically vague situational specifics brings to the struggle for achieving entertained goals as secured rhythms of activity and life.

Dewey himself does not employ vagueness as an approach to aesthetics. However, he does view the emergence of the aesthetic quality as a matter of consummatory overcoming of challenges.[6] In addition, Dewey deems vagueness as a challenge in the cognitive process of meaning formation.[7] Thus, I think that combining these two points into a stand in which the vague posits a challenge to be aesthetically overcome is not as controversial as it is under investigated.[8] On that account, through this examination of the phenomenon of vagueness and of its role in human experience it is possible to highlight certain neglected aspects of the human cognitive whole. Hence, this study contributes to a better understanding of the deep underlying unity of all human affairs, which comprises a key part of the foundations of Dewey's philosophical project.

In this article, I view vagueness as a problem in the very act of problem solving, a kind of a meta problem that can potentially permeate several phases of the process. Vagueness may disturb the cognitive phase of grasping the nature of a problem and the discovery of the means for overcoming it. Also, it may become an issue in the evaluation of the degree of success produced by an application of specific means to a perceived problem. Vagueness is highly ingrained into the cognitive mechanisms and poses a strong prohibitive factor whenever it emerges in experience. As such, overcoming it – as in achieving clarity of perception and gaining the confidence of asserting accurate meaning to problems, means, and outcomes – can be felt as deeply aesthetic. Connecting this depth and intensity with the similarity of the way in which both artistic and mathematical scenarios incorporate vagueness renders it possible to establish a profound aesthetic link between the two disciplines.

Of course, experiential and aesthetic similarities between the fine arts and mathematical disciplines have been examined in the past. For example, Subrahmanyan Chandrasekhar offers testimonies from various experts as material for relating the aesthetic dimension of mathematical work to that of fine art.[9] However, Chandrasekhar concentrates on the concepts of beauty and elegance, which Deweyan aesthetics covers, but does not position in the core of aesthetic experiencing.[10] Moreover, Chandrasekhar's background assumptions are reminiscent of those of classic philosophy – a broad pre-Darwinian theoretical orientation, the validity of which the founders of philosophical pragmatism in general, and Dewey in particular, challenged.[11] More recently, Angela Breitenbach has examined the relationship between the

6 Dewey, *LW10*, 20–1.

7 Ibid., 198.

8 A closely related discussion on the vague and the aesthetic within philosophical pragmatism can be found in Avcı, "Experience of Absence as the Aesthetic Ground of Sense-Making in James," 177–96. Based on William James, Avcı discusses the aesthetic experience in the context of a felt "absence in relation to which the unity is gained." This correlates with Dewey's views about thinking as oftentimes directed towards things that are not currently present and closures that are yet to be achieved. Moreover, for Dewey, the aesthetic is a matter of a promise of a fulfilment; a compelling prospect marked by a felt consummatory unity even as yet to be obtained and as only imaginatively entertained.

9 Chandrasekhar, *Truth and Beauty*, 59–73.

10 Määttänen, "Emotionally Charged Aesthetic Experience," 97.

11 Dewey questioned the classic notion of "aesthetic" as an independent mental domain separated from other functions of the human mind. For him, aesthetic is a quality of experience that not only coexists with other qualities, but is also partially founded upon them; when concrete activity or an imaginative exercise turns qualities of experience such as frustration and

aesthetic value of science and the cognitive value of art.[12] While not a pragmatist in her philosophical approach either, Breitenbach does acknowledge the importance of imagination and its unified – and unifying – character in various forms of human endeavour, a position that I emphasise as well.

Both fine art and mathematics consist of ventures that take place in the human imagination, but necessitate a catalyst, support, guidance, and distinctiveness from the objects of the external environment.[13] Dewey describes the reciprocal interplay between the imaginative and the concrete as follows:

> There is a stage in which the inner vision seems much richer and finer than any outer manifestation. It has a vast and enticing aura of implications that are lacking in the object of external vision. It seems to grasp much more than the latter conveys. Then there comes a reaction; the matter of the inner vision seems wraith-like compared with the solidity and energy of the presented scene. The object is felt to say something succinctly and forcibly that the inner vision reports vaguely, in diffuse feeling rather than organically.[14]

This quote depicts the cognitive processes taking place in an artistic production. However, it might equally well describe the development of a mathematical idea and its formulation into an equation; replace images painted on a canvas – as the external object – with symbols drawn on a chalkboard and the depiction applies as well. Psychologist Merlin Donald explains in detail this general capacity of material objects to function as constituents of an external memory field – a cognitive strategy without which it would be impossible to bring about, uphold, and develop many of the more complex and abstract mental scenarios. He argues that concrete materials provide stable support and direction for the emergence of imaginative scenarios that embody artistically treated or mathematically formulated ideas: "[t]hrough the external memory field, external symbolic devices create stable, vivid displays of many things that were previously undisplayable. Ideas, theories, strategic plans, even imaginary events are left suspended in the mind, to be processed as we please."[15]

It is precisely this further mental processing and the consequent constitution of a chain of varyingly abstract imaginative scenarios that I examine in this article. An equation or a poem may be printed on paper with ink, but no matter how well executed, the typing does not constitute one or the other. Exquisite typography provides little solace for a mathematician or a poet whose imaginative scenarios are not well received by their reading audiences. In short, I focus primarily on what a particular work "says" and, further, implies. Angela Breitenbach provides an illuminating description of this type of further processing in her personal account of witnessing a dance performance:

> The achievement of the performance, and my experience of it, required an imaginative involvement on my part. It relied on my drawing out ideas that were suggested, but *only* suggested and never made *fully* explicit, by the artwork itself. The show challenged me to think further. It prompted me to engage with ideas I found expressed in the performance, and to offer a variety of representations and interpretations to make sense of what I saw and heard. The beauty of the performance lay in pointing me to ideas of great significance whose content went beyond any particular representation of what was shown by the dance itself.[16]

Arguably, one of the hallmarks of excellence in fine art and science is the ability of a work – regardless of type or topic – to prompt further ideas in the imagination and to keep doing so over long periods of time. That is, in certain instances the imaginative scenarios constituted and experienced in an artistic or a scientific engagement preferably lead to the entertainment of further imaginative scenarios that extend

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desperation into satisfaction and enjoyment, undergoing the process of transformation is felt as aesthetic in experience. In other words, the distinctively aesthetic quality is not in experiencing problems and solutions separately, but in consciously experiencing a desirable way to – sometimes unconsciously – relate the two into a unified consummatory whole of overcoming.

12 Breitenbach, "One Imagination in Experiences of Beauty and Achievements of Understanding," 71–88.

13 Dewey's philosophical pragmatism is founded upon the principles of philosophical naturalism. Hence, instead of a fundamental difference of substances, in Dewey's philosophical framework, the external and the internal denote different points of view from and to the network of relations that constitute the one and only reality of nature.

14 Dewey, *LW10*, 273.

15 Donald, *A Mind So Rare*, 316.

16 Breitenbach, "One Imagination in Experiences of Beauty and Achievements of Understanding," 73 (Italics in the original).

beyond the original context. Importantly, neither the original scenarios nor the further associative scenarios have to be realisable in the concrete environment. And, for Dewey's philosophical pragmatism, these types of counterfactual imaginary constructions – and even fantasy – possess considerable relevance. This claim goes somewhat against views, such as Edward Casey's, according to which Dewey's conception of imagination is "use-bound."[17] Admittedly, Dewey holds that imagination can contribute to "a modification of the objective order" and "the institution of a new object."[18] It is, after all, "an organ of nature."[19] But even as such, Dewey also views imagination as being "often fantastic" and, importantly, not always to the detriment of human aspiration.[20] Indeed, he maintains that:

> I do not think it can be denied that an element of reverie, of approach to a state of dream, enters into the creation of a work of art, nor that the experience of the work when it is intense often throws one into a similar state. Indeed, it is safe to say that "creative" conceptions in philosophy and science come only to persons who are relaxed to the point of reverie. The subconscious fund of meanings stored in our attitudes have no chance of release when we are practically or intellectually strained.[21]

Accordingly, Dewey goes on to argue that "reverie and desire are pertinent for a philosophic theory of the true nature of things; the possibilities present in imagination that are not found in observation, are something to be taken into account."[22] In this article, the imaginatively entertained possibilities – including those known to be untenable in concrete reality – are not only taken into account, but also comprise the main subject matter of the inquiry.

In addition, Dewey describes imagination broadly as "a way of seeing and feeling things as they compose an integral whole."[23] More specifically, he notes that:

> When old and familiar things are made new in experience, there is imagination. When the new is created, the far and strange become the most natural inevitable things in the world. There is always some measure of adventure in the meeting of mind and universe, and this adventure is, in its measure, imagination.[24]

This process is oftentimes highly dependent on subconscious mechanisms and applies to human thought and efforts generally. Of course, a similar point of view – perhaps without the emphasis on the subconscious – can be derived from other philosophical premises, including some that contradict Dewey's philosophical naturalism. For example, Mary Warnock arrives at a description of imagination reminiscent of Dewey's, but bases her account on Kantian theorisation. She emphasises the ability to see, for instance, a "chest as a ship," as children often do.[25] Overall, instead of a "special faculty" Dewey views imagination as "that which holds all other elements in solution."[26]

It is also important to note that Dewey acknowledges the inherent inexactitude of imaginatively contemplated matters – an imprecision that may effectuate felt vagueness under the specific conditions explored in this study. He asserts the following:

> It is important for philosophic theory to be aware that the distinct and evident are prized and why they are. But it is equally important to note that the dark and twilight abound. For in any object of primary experience there are always potentialities which are not explicit; [...].[27]

17 Casey, *Imagining*, 195–6.
18 Dewey, *LW1*, 171.
19 Ibid., 57.
20 Ibid.
21 Dewey, *LW10*, 279.
22 Dewey, *LW1*, 27.
23 Dewey, *LW10*, 271.
24 Ibid., 271–2.
25 Warnock, "1980 Imagination," 266.
26 Dewey, *LW10*, 278–9.
27 Dewey, *LW1*, 27–8.

In this particular excerpt, Dewey speaks about objects of primary experience, which means the objects of the surrounding environment as they are sensorily interacted with. The non-existential objects of secondary – as in reflective – experience emerged for the purpose of rendering the sensorily channelled objects of primary experience more intelligible in presupposition and consequence; language, theorisation, and conceptualisation all clarify, complete, and solidify the meaning of objects.[28] In other words, reflective analysis of material relations commonly dispels – in varying degrees – the vagueness obfuscating the usefulness of concrete objects necessary for the goal-oriented activity of human life. For example, general theories of aerodynamics, and particular ideas such as lift and flow, assist the pursuit for more effective wings in aviation.

However, in addition to material objects of primary experience, the objects constituted in reflective thought also possess hidden consequences. This is already suggested above, in Dewey's note regarding imaginative scenarios that possess "a vast and enticing aura of implications."[29] Moreover, the extent of the applicability of an imaginative idea is not always immediately evident or necessarily exhausted in the same context that provoked its emergence. In short, ideas themselves do not – for the most part – come as finished complete wholes. This argument aligns with Dewey's view on ideas, according to which "[a]t first, save in highly familiar matters, they are vague."[30] Through cognitive effort, the vagueness of an unprecedented initial idea can be dispelled and the resultant clarity usually indicates a further path of usefulness in material affairs, imaginative endeavours, or both. For example, studies of the concept of turbulence in aerodynamics gave rise to improved airplanes, but played a part in the development of mathematical chaos theory as well.[31] These types of connections between the concrete and the abstract emphasise the genuinely Deweyan disposition of this study; divergences are acknowledged and explored, but the theoretical basis rests upon similarities and couplings. The latter two comprise a central aspect of Dewey's philosophical enterprise, namely the overarching unity of all human affairs. He maintains that:

> The arts of science, of politics, of history, and of painting and poetry all have finally the same material; that which is constituted by the interaction of the live creature with his surroundings. They differ in the media by which they convey and express this material, not in the material itself. Each one transforms some phase of the raw material of experience into new objects according to the purpose, each purpose demands a particular medium for its execution.[32]

2 The Aesthetic, the Vague, and the Artistic

The above quote emphasises the fact that the inherent connection of all modes of human aspiration is operational and experiential. This incorporates the aesthetic, which is a quality of experience that potentially arises in any type of goal-oriented activity – especially during an interpretation of situational specifics as being supportive of obtaining the entertained goals. In Dewey's theory, the aesthetic relates inseparably to the overcoming of challenges, as in experiencing solutions to problems. Importantly, encountered problems, alone, do not stimulate the emergence of the aesthetic quality in experience; a prospective

28 Ibid., 15–6.

29 Dewey, *LW10*, 273.

30 Dewey, *The Later Works of John Dewey, 1925–1953. Volume 12: 1938, Logic: The Theory of Inquiry* (*LW12*), 113.

31 Li, "Major Open Problems in Chaos Theory, Turbulence and Nonlinear Dynamics," 379.

32 Dewey, *LW10*, 323; In this quote "the arts" are understood in the broadest sense of the term and incorporate a diversity of areas with specific refined skills. The key takeaway is that the mediums of expression commonly applied in the context of fine art are not necessarily well suited for furthering the achievement of the goals upheld in the various other arts mentioned. For instance, a politician is better-off resorting to the art of human relations – including persuasion – in the legislative environment she operates in and wishes to make changes to. Of course, it is totally acceptable for an object of fine art, such as a movie for example, to highlight political matters such as social injustice. However, as a direct means for legislative reform a movie, alone, is inadequate and, most of all, inappropriate; if a director holds specific political goals above aesthetic ones (not necessarily in her life, but in the context of a particular film), her mode of operation shifts from that of fine art to the art of propaganda.

solution is, also, needed. Dewey explicates the cognitive origins of the aesthetic structure by stating that "resistance that calls out thought generates curiosity and solicitous care, and, when it is overcome and utilised, eventuates in elation."[33]

More specifically, the aesthetic quality emerges in the process of restoration of balances disrupted by events that obstruct the ongoing activity. Accordingly, Dewey notes that "[f]or only when an organism shares in the ordered relations of its environment does it secure the stability essential to living. And when the participation comes after a phase of disruption and conflict, it bears within itself the germs of a consummation akin to the esthetic."[34] For example, opening a door with keys is a mode of rhythmic accommodation to environmental conditions that support the stability of living; the problem of entering a house is solved with the use of the appropriate keys. However, this type of problem-solution dynamic is not disruptive itself, but comprises a stabile rhythm that is subject to disruptions. For instance, upon entering a house, a person might notice that the keys necessary for opening the door appear to have been lost. This is an emotionally felt disruption to the presumed and desirable course of ongoing activity.

Finding the lost keys restores the emotional balance, and the reinstated tranquil sentiment indicates that, again, life proceeds in a desirable manner. However, the restoration is a process with rhythms of its own and phases varying in aesthetic quality. The aesthetic quality of experience is most emphatic in two particular phases: first, during the recall of a probable location of the keys, perhaps preceded by a phase of having no idea of their whereabouts. Second, the aesthetic is especially pronounced in experience during the steps that further the verification of the fact that the keys are in the location they are imaginatively presumed to be. Notably, the aesthetic quality is less prominent in the phases of actually finding the keys – as in coming into physical contact with them – and finally opening the door. Of course, the contact and the unlocking may both be highly satisfactory because of the prior disruption. However, at these later stages of the process, the disruptive problem is already solved.

In short, the aesthetic is most prominent as the balance *is being restored*, not as the balance *is already restored*, as in the balance being affirmatively obtained. This description fits Dewey's view according to which "[e]sthetic experience is imaginative."[35] In particular, because the aesthetic quality tends to become most pronounced in experience when situational specifics warrant increasingly favourable imaginative prospects for overcoming the encountered challenge. As Pentti Määttänen summarises the Deweyan definition, "an aesthetic experience is a promise of consummation, and this promise is enjoyable in itself."[36] On that account, the adages according to which "the journey is more important than the destination" and "the chase is better than the catch" are apt in the context of aesthetic experiencing. However, none of the examples above are meant to say that a closure is totally irrelevant. They merely denote a phase during which the aesthetic quality clearly dominates, as in defining, the experience. For instance, in a movie, the aesthetic quality peaks in the experiences of audiences during the heightened tension of the climax of the story, not as the main characters are affirmed to "live happily ever after." Moreover, the climax builds in accordance with perceived factors that give rise to imaginative – but initially vague – estimates of a desirable way to overcome the main challenge encountered by the protagonists. Also, each step that incrementally dispels the vagueness of an imaginative scenario concerning a desirable outcome, and ushers in a more distinct version of that scenario, may be felt as consummatory as in aesthetic. As Dewey maintains, "perception will be serial in order to grasp the whole and each sequential act builds up and reenforces what went before."[37] Furthermore, the sequential acts may extend into the hypothetical realm and comprise wholes that do not – and oftentimes cannot – exist in the concrete surrounding environment. Accordingly, in this article, imaginative perception is viewed as the primary domain where artistic and mathematical activities align and, also, become subject to similar disruptions introduced by vagueness.

33 Dewey, *LW10*, 66.
34 Ibid., 20.
35 Ibid., 276.
36 Määttänen, "Emotionally Charged Aesthetic Experience," 97.
37 Dewey, *LW10*, 141.

The various schools of thought in classic philosophy disagree on many things, but usually share a common desire for the utmost univocality and almost never embrace vagueness. As Dewey points out, "whenever the habit of identifying reality with the object of knowledge as such prevails, the obscure and vague are explained away."[38] This orientation has persisted in numerous incarnations throughout the millennia. Over the last century, philosophical discussions about the problematic nature of vagueness have been especially prominent in the context of linguistic propositions. For example, in his article entitled "Vagueness," the pioneer of analytical philosophy Bertrand Russell asserts that all language is vague, because all possible use cases for a particular word are not known in advance.[39] The framework of philosophical pragmatism, within which this article is positioned, remains in stark contrast to accounts derived from classic philosophy, including the analytical represented by Russell. Yet, a somewhat similar – as in linguistic – approach to vagueness as a philosophical issue appears in the pragmatist framework as well. Namely, the founder of philosophical pragmatism Charles Peirce defines vagueness as follows:

> A proposition is vague when there are possible states of things concerning which it is intrinsically uncertain whether, had they been contemplated by the speaker, he would have regarded them as excluded or allowed by the proposition. By intrinsically uncertain we mean not uncertain in consequence of any ignorance of the interpreter, but because the speaker's habits of language were indeterminate; [...].[40]

In this article, however, the linguistic aspects of vagueness commonly discussed by the likes of Russell – and even by pragmatists such as Peirce – do not comprise the main focus point. That is, I do not discuss the removal of vagueness in the sense of developing new and increasingly exclusive definitions for a particular term or a concept. Rather, I discourse vagueness as *felt* – as a part of the human experiential whole. Overall, felt vagueness may emerge in the human experiential sphere in any problematic situation in which the available means and materials point to a range of consequences that is too wide for being comfortably relied upon in the efforts to secure desirable outcomes. And as such, the experienced vagueness is phased out through activity that reorganises available resources – including the embodied human capabilities – into constellations that are perceived to narrow the range and, thus, increase the probability of reaching the ends-in-view.

The above definition of the phenomenon of vagueness is not exactly concise and explicit in Dewey's philosophical pragmatism, but spread out through his writings. For example, in one instance, Dewey discusses vagueness by stating that "[a]t twilight, dusk is a delightful quality of the whole world. It is its appropriate manifestation. It becomes a specialised and obnoxious trait only when it prevents distinct perception of some particular thing we desire to discern."[41] Evidently, Dewey steps outside the compartmentalisation of formal and natural languages, in the context of which Peirce discusses vagueness. For Dewey, vagueness is an obstacle in the general process of meaning formation; a cognitive procedure of interaction with the environment which establishes meanings as the experienced effects that objects and acts produce in the structures of the world, including our embodied selves. Importantly, according to this view not only linguistic meanings, but, also, the entertained meaning of any object, including the imagined, incorporates varying degrees of indefiniteness.[42]

However, as the above quote regarding "dusk" implies, it is crucial to note that an inability to capture or project all the details of an object or a scenario does not always amount to experiential vagueness. The resolution of sensory stimulation may not be arbitrarily high, but, nonetheless, it may suffice for the task at hand. For example, most of the time, taste is successfully applied in determining the suitability of food items, even if taste oftentimes cannot distinguish all the exact ingredients that went into a dish. Vagueness, on the other hand, is usually felt when the obtained data are not deemed sufficient for a successful

38 Dewey, *LW1*, 27.

39 Russell, "Vagueness," 84–92.

40 Peirce, "Vague," 748; A further examination of both Peirce and Russell in the context of vagueness can be found in the book *Vagueness* (1996) by Williamson.

41 Dewey, *LW10*, 198.

42 Dewey, *LW1*, 27–8.

overcoming of the challenges presented by the given circumstances. For example, for a person with a food allergy, an inability to discern potentially dangerous ingredients through smell or taste may constitute vagueness in the assessment of whether a presented dish supports or hinders life. In other words, vagueness obscures the experienced meaning of objects and puts in doubt the rationality of relying upon them in further thought and outward activity. Overall, human beings commonly experience vagueness when indistinctness interferes with the held belief that the ongoing path of activity is appropriate for achieving desirable outcomes.

As a felt disturbance, vagueness usually calls for measures that remove either it or the disturbing quality from the experiential whole. That is, vagueness needs to be managed in one way or the another, so that the perception of causal relations can be comfortably relied upon in planning and executing activity. The most obvious way to achieve mental stability and operational security is through empirical confirmation. However, such a reassuring verification is not always possible to obtain. And when conditions do not allow the use of empirical evidence as a basis for decision making, imagination is usually applied in bridging the irritating gaps that vagueness introduces into the chains of causal reasoning.

Depending on the situation, a varying proportion of the sensorily channelled affirmative events can be replaced with imaginatively conceived hypothetical scenarios. Oftentimes the substitution can be accomplished without excessive mental discomfort – at least in everyday life and apart from the requirements of strictly empirical sciences. Of course, this type of psychological flexibility does not do away with vagueness in a strict epistemic sense. Yet, it dispels the accompanying emotional disturbance that may induce paralysing confusion, which is – and during natural evolution has been – a potentially life-threatening state of being. Assigning some imaginatively determinate meaning – rather than nothing at all – to that which is felt as vague is more beneficial for survival; that something may prove adequate – even if not wholly accurate – for resolving the problematic situation. Notably, this type of a resolution of the problem of felt vagueness and, especially, the accompanying removal of emotional disturbance effectuates a restoration of mental balance. And as previously discussed, the restoration of mental equilibrium denotes the main part of the process that culminates in the consummatory aesthetic experience. Taken together, it is possible to establish a connection between the vague and the aesthetic quality of experience; the latter emerges through the dissipation of the former. In short, the vague can become a problem, the overcoming of which can, in turn, result in aesthetic experiencing.

Notably, arranging materials in formations that increase the probability of producing anticipated outcomes can take place both in concrete surrounding environment and in abstract imaginative thought. This relates to a general human tendency to include a degree of imaginative conjecture in inductive reasoning; a continuous self-correcting series of acts, of which Peirce notes that, "in the long run they approximate to the truth."[43] From an evolutionary standpoint, either the fruits of imaginative guesswork were frequently harvested or they were so exceptionally advantageous – even if rare – that the imaginative procedure itself became enjoyed and, consequently, sought after. As Dewey summarises, "[t]he striving of man for objects of imagination is a continuation of natural processes; it is something man has learned from the world in which he occurs, not something which he arbitrarily injects into that world."[44] This cognitive setup plays an important part in the following examination of the aesthetic enjoyment that emerges during the dispelling of vagueness in the context of fine art and later on in the discussion of the role of vagueness in mathematics.

Dewey states that "[t]he real work of an artist is to build up an experience that is coherent in perception while moving with constant change in its development."[45] Both the building up and the constant change may involve the type of problem–solution dynamics that generate exceptionally high degrees of aesthetic quality in experience. As Dewey further explicates, "[s]ince the artist cares in a peculiar way for the phase of experience in which union is achieved, he does not shun moments of resistance and tension. He rather cultivates them, not for their own sake but because of their potentialities, [...]."[46] As described earlier, in

43 Peirce and Hartshorne, *The Collected Papers of Charles Sanders Peirce, Volume 5: Pragmatism and Pragmaticism*, 350.
44 Dewey, *LW1*, 315.
45 Dewey, *LW10*, 57.
46 Ibid., 21.

order for the aesthetic potential to actualise in experience, relevant aspects of the problem must hang in the balance for the time being. And felt vagueness, in particular, is an indication of the fact that things have not yet been resolved into sufficiently distinct outcomes that are necessary for planning and executing further activity in a mentally comfortable manner. As such, vagueness can tie into the building up of basal coherence and to the dynamic of further developments in imaginative perception; vague issues call for imaginative estimates about the way things actually are (the nature of the present problem) and, also, about the way things could potentially turn out to be (a reasonable future solution).

An example of an artwork that relies on a combination of the two is the feature film *Alien* (1979), in which the structure, the capabilities, and the intentions of the antagonist are only slowly revealed. These aspects remain rather vague for a considerable part of the film, which allows the audience to engage in the emotionally rewarding activity of constituting imaginative assessments about the extent of the danger. That is, even if the worst fears seem to be coming true, correctly inferring this to be the case plays enjoyably into the formation of the aesthetic dynamism of tension and release. The sequels to the original film do display the threat more explicitly and in higher sensory detail. Yet, in comparison to personal imaginative visions, the improved special effects comprise a less rewarding way to dispel the vagueness regarding the nature of the obstacle – if any remains after the first instalment. In brief, only the first *Alien* film upholds two simultaneous – albeit intertwined – layers of imaginative prognosis: the survival of the protagonists *and* the essence of the antagonist. The sequels tend to focus merely on the survival of the main characters, which reduces their imaginative scope and limits their aesthetic potential.

The emotionalised dissipation of vagueness through the formation of feasible scenarios in imagination is grounded in multilevel evolutionary developments. First, the fate of another person matters to a member of an audience because human self-preservation has been highly dependent on the social group for a considerable part of human evolution. As Dewey maintains, "destructive enemies must be kept away; the help of others must be availed of. Meanings and ideas connected with these organic-environmental adjustments are substantially sound as far as adjustments are successfully made – and within limits they are ordinarily so made, or life ceases."[47] In addition, Jerome Popp further elaborates on Dewey's thinking about this social function by stating that "[i]f an interest is consciously shared by a sizable number of people, then as they put their minds to various problems, they are aware that their solutions and reconstructions have meaning that goes well beyond their personal well-being or even that of their extended family."[48] On the whole, sympathising with another person – even a fictional one – compels audiences to imaginatively entertain possible ways in which the presented difficult situation might be resolved in a satisfactory manner for that person.

Second, from a broader evolutionary point of view, it is highly beneficial for survival to form initial threat estimates *in general* and continuously improve upon them through further iterations. Moreover, the way that natural evolution has encouraged organisms to engage in such an advantageous predictive activity is through emotional incentives. Although fallible and subject to being consciously ignored and overridden, in their original primal function "[e]motions help us make decisions about what to do."[49] And, importantly, emotional consummatory satisfaction is felt not only in a life-enabling closure, but also during – and because of – the imaginative formation of increasingly probable and decreasingly vague estimates about past, present, and future states of affairs. In the context of fine art, the emotional guidance for the further activity of constituting imaginative scenarios in thought is oftentimes based – in significant part – upon tacit meanings. Pentti Määttänen explains the background of this process. "Most of the workings of tacit meanings (habits) are subconscious but the outcome of this subconscious cognition become conscious as emotions as signs of the value of anticipated experiences."[50] I add that the valued aesthetic quality of experience is exceptionally emphatic in situations in which the increased probability of a prediction reveals

47 Dewey, *LW1*, 260.
48 Popp, *Evolution's First Philosopher*, 102.
49 Määttänen, *Mind in Action*, 72.
50 Ibid.

increased odds for overcoming potentially life-altering challenges and a clear(er) path towards desirable goals. This viewpoint defines the specific way that the cognitive act of dispelling vagueness examined in this article fits Dewey's notion according to which "[a]rt is a mode of prediction not found in charts and statistics, and it insinuates possibilities of human relations not to be found in rule and precept, admonition and administration."[51]

Of course, in fine art vagueness may, also, sometimes be unintentional, ill-advised, and counterproductive. For example, in the discussion of expression of character in literature, Dewey points out that "whenever situations are left inchoate and wavering, characters are found to be vague and indefinite – something to be guessed at, not embodied, in short are uncharactered."[52] However, as previously described, felt vagueness *can* function as an intentional and enjoyable part of an artwork; carefully applied vagueness may, for example, entice audiences to connect the dots imaginatively and to the effect of aesthetic enjoyment instead of distracting incoherence. Moreover, as the gist of Dewey's main work on art theory – namely *Art as Experience* – suggests, all forms of fine art function temporally in the sphere of human experience.[53] On that account, in any mode of fine art – from painting to instrumental music – phases of experienced vagueness can be implemented according to the requirements of the aesthetic ebb and flow of tension and release.

3 The Vague and the Aesthetic in Mathematics

In colloquial language, mathematics is often described as the most exact of sciences, and vagueness, in particular, is not commonly associated with the discipline in such discourse. Admittedly, the rules of mathematical formalism are very strict and unforgiving. However, as Dewey notes, mathematics comprises "a canon of liberation rather than of restriction," because "all developments are welcome as long as they do not conflict with one another."[54] In addition, "[o]nce the idea of possible operations, indicated by symbols and performed only by means of symbols, is discovered, the road is opened to operations of ever increasing definiteness and comprehensiveness."[55] Naturally, human engagement with such an open – but nonetheless precise – field of imaginative endeavours is neither predetermined in path nor easily exhausted in scope. And that which is indeterminate, but actively presumed, tends to be more or less vague until actually confirmed in the concrete or in logical proof.

In order to constitute the unfettered mental domain of mathematics, certain cognitive peculiarities need to take place. Most importantly, the axiomatic base and the consequent exactness are both achieved by intentionally loosening various aspects of the correspondence between mathematical symbolisation and the elements of tangible reality. Dewey describes this cognitive approach as "a temporary neglect – an abstracted gaze."[56] It enables perception of relations that play a role in the coming about of individual phenomena, but which the uniqueness of a particular phenomenon tends to obscure prior to symbolic generalisation. For example, the differences between individual fingers of a hand need to be ignored in order to count them as units of measurement and use them in operations such as summing and dividing. In addition, the general concept of "finger" needs to be abstracted further into a general symbolic unit or a number for the purpose of performing these operations among even more heterogeneous objects, such as fingers and rocks for example. As Dewey further posits, symbols "afford the only way of escape from submergence in existence."[57]

51 Dewey, *LW10*, 352.
52 Ibid., 248.
53 See Dewey, *LW10*.
54 Dewey, *The Later Works of John Dewey, 1925–1953. Volume 4: 1929, The Quest for Certainty* (*LW4*), 128.
55 Ibid., 126.
56 Dewey, *LW1*, 118.
57 Dewey, *LW4*, 129.

However, the vagueness potentially arising from the diversity of existences in the process of forming basic mathematical axioms is no longer a major concern; the foundations of mathematics are predominantly fully established and only rarely questioned.[58] In the modern epoch, vagueness in the relationship between mathematical symbolisation and features of concrete reality tends to emerge in increasingly further abstractions and more complex phenomena of nature. For example, Einstein struggled for well over a decade to combine his unique ideas about gravity with mathematical ones. Supposedly, he did not arrive at the mathematical formulation for the general theory of relativity by chance, but was led by some – perhaps a vague – imaginative foresight.[59] This hypothesis finds support in Merlin Donald's notion, according to which "[w]e can recognise the value of ideas whose mere possibility we suspect, and whose reality still eludes us completely, to the point of pursuing them passionately for a lifetime."[60] I posit that maintaining such passionate drive owes in part to the aesthetic quality of experience, which arises through specific acts that gradually remove vagueness from the focus point of imaginative perception and give the entertained idea a distinct communicable form. That is to say, the emotional incentive takes the form of an aesthetic enjoyment, which keeps the agent engaged in activity deemed as highly worthwhile; every increment suggesting an increased probability of reaching a goal – partial or conclusive – can be experienced as consummatory as in aesthetic. This aligns with Dewey's view on aesthetic quality as comprising "a significant motive in undertaking intellectual inquiry and in keeping it honest."[61] Dewey also notes that the "esthetic cannot be sharply marked off from intellectual experience since the latter must bear an esthetic stamp to be itself complete."[62]

According to Dewey's definition, mathematics "is intrinsically free from the *necessity* of existential reference while at the same time it provides the *possibility* of indefinitely extensive existential reference."[63] As described above, developing a particular, explicit, and functioning realisation of such a *possibility* caused Einstein to flounder. However, Einstein was a physicist – not a mathematician. The latter do not – for the most part – concern themselves with this particular aspect of their discipline; as long as the axiomatic base holds, it is implicitly presumed that further abstractions – if not contradictory to one another – are sound as well. On that account, mathematicians tend to emphasise their freedom from "the *necessity* of existential reference."[64]

Acts performed in symbols bear results that are composed of symbols, not of concrete existential matters. Of course, this symbolic mode "to act without acting" was initially motivated by the fact that it rendered possible planning and predicting overt outcomes without being subjected to potentially hazardous material consequences.[65] However, such a useful cognitive tool warranted its own development independent of any particular application. Notably, this progression led to the discovery of various abstract phenomena that bear no direct resemblance to tangible aspects of physical nature. For example, the diagonalisation argument presented by Georg Cantor demonstrates the counterintuitive fact that some infinite sets of numbers contain more numbers than other infinite sets.[66] In other words, Cantor showed that not all infinities are equal in size. It is possible to arrive at such a conclusion because, instead of individual transformations between the material and the symbolic, mathematics proper focuses on *transformability* in general.[67] The abstract transformability of mathematics concerns only the relations between symbolic operations and it is, also, itself described in symbols.

58 For an example of this kind of questioning, see Hintikka, *The Principles of Mathematics Revisited*.
59 Hadamard, *An Essay on The Psychology of Invention in the Mathematical Field*, 142–3.
60 Donald, *A Mind So Rare*, 278.
61 Dewey, *LW10*, 45.
62 Ibid.
63 Dewey, *LW12*, 391. (Italics in the original).
64 Ibid.
65 Määttänen, *Mind in Action*, 8.
66 Cantor, "Ueber Eine Elementare Frage der Mannigfaltigketislehre," 75–8; Ewald, *From Kant to Hilbert Volume II*, 920–2.
67 Dewey, *LW12*, 394.

Nonetheless, cognitive operations in mathematical fields of interest are not fundamentally different from those performed in other areas of human activity. Dewey maintains that "[j]ust as we overtly manipulate things, making new separations and combinations, thereby introducing things into new contexts and environments, so we bring together logical universals in discourse, where they copulate and breed new meanings."[68] And, "[i]n trying new combinations of meanings, satisfactory consequences of new meanings are hit upon; then they may be arranged in a system."[69] In other words, new mathematical phenomena may be consciously developed or encountered more or less accidentally. However, prior to any kind of establishment of new meanings and systems of meanings, the reformative phenomena – even if wholly symbolic – can initially be felt to be shrouded in vagueness. This disturbance is gradually abated during the activity that gives rise to a prospective mathematical formulation and, in the end, disposed of with the assertion of the exact final articulation as an equation.

Commonly, the former stage of *increasing* mathematical clarity holds the most potential for engendering the aesthetic quality of experience, because the majority of vagueness yields to the emerging distinctness during this particular phase. Most of the time, the latter – more static – phase of clarity *as obtained* merely confirms that which the promising materials have already suggested in imagination. And confirmation is a less imaginative cognitive process leaning more towards plain satisfaction than aesthetic enjoyment, especially if the confirmation is neither related to the means for achieving further goals nor of a surprising type enticing further exciting associations. As Dewey aptly points out, "[a] consummatory object that is not also instrumental turns in time to the dust and ashes of boredom."[70] This type of instrumentality applies to both concrete objects and objects constituted in imagination, such as the mathematical and the artistic.

4 Vagueness, Instrumentality, and Imagination in Fine Art and Mathematics

Paints applied on a canvas or symbols drawn on a chalkboard may be instrumental in pushing the mind towards the entertainment of a specific type of hypothetical scenario. Dewey explicitly states that "a painter converts pigment into means of expressing an imaginative experience."[71] Yet, in fine art and mathematics, the full experiential potential of the discipline is only undergone insofar as the constituted mental scenario, too, is instrumental in pushing the mind further towards new imaginative grounds. This extension beyond the original context impregnates the experience with felt depth, especially if the further inspired associations suggest an existence of unprecedented connections to other interests not explicitly present in the ongoing situation, but, nonetheless, held by the audiences.

However, prior to an establishment, these unprecedented connections remain presumed and, thus, more or less vague. In such an instance the vague does irritate, but it also intrigues – as long as the annoyance functions as a sign of a novel ground for inquiry and as an invite to embark upon it. For a curious mind, it is a delight to come across even vague hints of unprecedented phenomena or faint cues for novel approaches into known matters. They imply potentially advantageous and, consequently, enjoyable forms of activity in expanding present understanding through recontextualisation of obtained ends into means for attaining increasingly further ends. For instance, anomalies in particle accelerator experiments are lauded because they mark the unknown beyond current knowledge and stir the imagination of theorists and experimentalists alike.

68 Dewey, *LW1*, 152.
69 Ibid.
70 Ibid., 274.
71 Dewey, *LW10*, 69.

From a technical point of view, a felt vagueness can potentially reposition human awareness within the rhythmic alteration of tension and release to a phase where the aesthetic quality of experience is on the rise rather than yields to other qualities. That is, vagueness can denote the beginning of a new cycle in the ever-ongoing problem–solution dynamic of life. And, for an optimistic mind, the satisfaction from concrete achievement is built upon, and augmented with, the satisfaction of imaginatively perceived future potential. If this potential was not initially vague, but wholly resolved, then instrumentality – as experienced – would be stuck in conclusive satisfactions devoid of the aesthetic potential of promising, imaginative scenarios.

In this respect, as a part of instrumentality, vagueness does not need to be dissipated always and entirely. The presumed meanings – as imagined consequences – of a scenario may be clarified in one area and simultaneously remain vague in others as a sign of potentially uncovered affordances. Hence, persistent – but always partially receding – vagueness can play a part in rendering scenarios into catalysts for long-lasting aesthetic enjoyment. This does not mean that ideas can be inexhaustible in the absolute sense. Yet, certain scenarios of fine art, and those of mathematics, may be deemed to imaginatively conjoin multiple areas of a particular human being's interests. In such a case – and for the individuals in question – these types of scenarios can potentially last for a lifetime as sources for continuous excitement and aesthetic enjoyment as they encourage experimentation and even play.

An example of an abstract mathematical idea that has had such a profound impact on peoples' lives is the Pythagorean theorem, which played a role in the formation of something of a religious cult at the time of its discovery in antiquity. Undoubtedly, other factors, too, contributed to the establishment of the Pythagorean sect, but the allure of mathematical elegance cannot be understated. The Pythagorean theorem posits a scenario regarding relations between the sides of a triangle, but it has – time and again – proven to possess considerable relevance outside its relatively simple geometrical origins. For example, the theorem has been generalised to non-Euclidean spaces and higher dimensional solids.[72] In addition, and within the realm of applied mathematics, the Pythagorean theorem is integral to, for example, the Born rule, which is used to calculate quantum probabilities.[73] Overall, the discovery of the extent of the instrumentality of the Pythagorean theorem – partly through removal of vagueness regarding its applicability – has been a long and, perhaps for some also, an aesthetic intellectual journey.

In the context of fine art, the criteria for an enduring capacity for aesthetic quality usually incorporate more personal factors and preferences from the audiences. This is because, unlike in mathematics, in fine art the furtherance of thought and experience does not commonly gravitate towards any specific inquiry, but to life more broadly. Dewey reflects on this difference, "[t]he work of esthetic art satisfies many ends, none of which is laid down in advance. It serves life rather than prescribing a defined and limited mode of living."[74] On that account, the works of art that maintain the potential to bring about aesthetic experiences of art in audiences over long periods of time are more diverse – as are the life paths of human beings in comparison to mathematical advancements. Of course, popular artworks that appeal to the masses do exist, but these are not necessarily those that the individual members of audiences find the most potent in constantly evoking the aesthetic quality in experience. Accordingly, Dewey notes that:

> Some esthetic products have an immediate vogue; they are the "best sellers" of their day. They are "easy" and thus make a quick appeal; their popularity calls out imitators, and they set the fashion in plays or novels or songs for a time. But their very ready assimilation into experience exhausts them quickly; no new stimulus is derived from them. They have their day – and only a day.[75]

Moreover, the longevity of an artwork is not always based on the type of instrumentality discussed above. It is, for example, also possible to turn to familiar art objects for solace or nostalgia. Furthermore, many of the

72 Pambuccian, "Maria Teresa Calapso's Hyperbolic Pythagorean Theorem," 2; Conant and Beyer, "Generalised Pythagorean Theorem," 262–5.

73 Mandolesi, "Quantum Fractionalism," 126725.

74 Dewey, *LW10*, 140.

75 Ibid., 172.

most famous pieces of art, especially from the distant past, are continuously admired for their cultural prestige or exquisite craftmanship, instead of the imaginative impact of their subject matter on a modern mind. The Mona Lisa is a prime example of an art object that is often revered because of the position it holds in the western cultural heritage. However, the actual content of the painting is unlikely to be experienced as imaginatively extraordinary by the majority of audiences that have grown up in the constant hyperstimulating audiovisual bombardment of the twenty-first century media outlets.

Nonetheless, contemporary art objects that continuously bring about recontextualised or recontextualising imaginative scenarios do, also, exist. Especially with such works, the type of – often conscious – effort highlighted by Dewey is required. "The perceiver, as much as the creator, needs a rich and developed background which, whether it be painting, in the field of poetry, or music, cannot be achieved except by consistent nurture of interest."[76] But even so, the full depth of the work is not necessarily immediately apparent. Indeed, Dewey notes that:

> Indifference to response of the immediate audience is a necessary trait of all artists that have something new to say. But they are animated by a deep conviction that since they can only say what they have to say, the trouble is not with their work but those who, having eyes, see not, and having ears, hear not. Communicability has nothing to do with popularity.[77]

Of course, even the most novel works of art may incorporate materials from – and references to – past objects and events. In such instances, the combination of various elements usually reflects a contemporary viewpoint or highlights issues relevant in the present society. I do not suggest that what is relevant for human life today is entirely different from the relevancies of the past. Yet, nuances matter in fine art, especially in what audiences of our time deem as forward looking and experience as intriguingly vague. Accordingly, museums of contemporary art commonly – even if not always – exhibit art objects that emphasise this type of future-oriented aesthetic.

Overall, neither in fine art nor in mathematics does the experiencing of scenarios incorporate a closing affirmation from the surrounding sensory environment. The same does not hold true of physicists or artisans, whose ideas can usually be experienced and, consequently, evaluated through direct sensory engagement with concrete material outcomes. For example, lasers may be reflected from mirrors and chairs may be sat in. In both instances, the direct sensory experience of physical properties is usually highly effective in dispelling the vagueness of imaginative estimates that anticipatorily precede and guide the active testing of a planned scenario. As Dewey explicitly states, "the natural sciences not only draw their material from primary experience, but they refer it back again for test."[78] Such a concrete removal of vagueness regarding an idea is available neither to advanced mathematicians nor practitioners of fine art, both of whom produce scenarios that are carried out in the imaginative thought of audiences instead of the surrounding physical environment.[79] In his definition of a work of art Dewey states that it "is not only the outcome of imagination, but operates imaginatively rather than in the realm of physical existences," and the same can be said of mathematics proper.[80] This procedural similarity aligns mathematics and fine art more with one another than with disciplines they are commonly associated with – such as experimental physics and craft arts, respectively.

Of course, it is entirely possible for a contemporary artist to put together an art installation that consists of, for example, an actual chair and the overt act of an audience sitting on it. In fact, Estonian sculptor Villu Jaanisoo has done just that; the aptly entitled sculpture "Chair" (2001) is built from rubber tires and allows audiences to try it in practice. However, in such a special contextual setting – which necessitates other

76 Ibid., 271.
77 Ibid., 110.
78 Dewey, *LW1*, 15.
79 Alongside this argument, it is worth reiterating the Deweyan definition of a work of art as an experience. Art objects can be put on display for others to evaluate, but works of art – as experiences – cannot. In other words, it is possible to hang a painting on a wall, but as Pentti Määttänen notes, "[e]xperiences cannot hang anywhere." Määttänen, "Emotions, Values, and Aesthetic Perception," 94.
80 Dewey, *LW10*, 277.

situational factors as well – the psychophysical experience of sitting on a chair arouses new imaginative scenarios rather than terminates existing ones. It is precisely the former that constitutes a work of art, as the emergent imaginary scenario – more than the sensory feel of the chair – is experientially undergone and emotionally evaluated by the audience. In other words, the rubber tires used in Jaanisoo's work do affect the audience sensorily, but they are not judged merely according to their material function for supporting a human body. Rather, the rubber – as felt – is primarily and often unconsciously evaluated in its role as supporting the associative emergence of imaginative scenarios that may escape any concrete realisation.

On the whole, in fine art and in mathematics, the evaluation of success is only loosely tied to the exigencies of the physical environment. This is in contrast to the more concretely oriented frameworks, which of necessity incorporate solidifying aspects from the physical domain into the held criteria. For example, even as prospective, a medicinal treatment is consummatory only insofar as it is assumed to cure patients in actuality instead of merely in imaginative visions. Whereas in fine art and mathematics neither dragons nor complex numbers, for example, are expected to embody a concrete material form and affect physical reality through direct interactions. Naturally, both include familiar components, such as wings and fire or, in the case of complex numbers, symbolised forms of established abstract operations. Nonetheless, the general structure of dragons and that of complex numbers requires a degree of modification to factual limitations, a type of adjustment which is possible only in imagination.[81] And this adjustment also concerns the basis for interpretation, evaluation, and experiencing of such objects.

Overall, in fine art and in mathematics, it is possible to develop premises, objects, and standards that are imaginatively derived from – instead of outright dictated by – the direct surroundings. In other words, various practical demands imposed by the surrounding physical and cultural settings can be imaginatively modified or ignored, if not always at will, but potentially through effort. The important point is that, in addition to existent particularities, abstractive derivation can discriminate general conditions of physical and sociocultural reality. That is, not only the individualising features that render objects such as fingers or rocks unique, but also the laws of nature and the human condition that produce the known modes of existence can be imaginatively omitted to varying degrees. On that account, the broad frameworks themselves, including aspects of the standards of evaluation, may continue to develop reciprocally with the scenarios, both imaginatively liberated from various existential preconditions. It is important to note, however, that this type of liberation does not amount to a total detachment from reality – neither into transcendent existences nor into unintelligible chaos. Rather, the result is cognitive plasticity and an ever-branching development of abstract thought.

Moreover, this mental flexibility does not lead to a continuous overthrowing of established logical or artistic procedures, but to a holistic bifurcation of frameworks. For example, non-Euclidean geometry does not overturn the preceding Euclidean framework. The former introduces new affordances, structures, and objects that become conceivable and meaningful only in a new context in which certain premises – as in conditions for possibilities – of the prior framework have been imaginatively modified. Furthermore, in this particular instance, the path of derivation from the concrete to the abstract is clearly distinguishable. Evidently, Euclidean geometry is derived from the specific ways in which human beings experience spatial dimensions. And further developments into non-Euclidean geometries retain certain elements of the preceding frameworks in their vocabulary and in the constituent parts. Units and terms, such as "lines" and "directions," are still employed in the formation of novel scenarios of non-Euclidean geometry, unfit for – and perhaps unrealisable in – the prior sensory and theoretical contexts.

Somewhat similar forms of development commonly occur in various areas of fine art as well. For example, the evolution of bebop jazz into fusion jazz did not discard typical jazz instrumentation nor abandon general musical notation. Yet, appreciation of jazz fusion requires changes in the cognitive systems of interpretation and evaluation. The exact type of the necessary changes may be difficult to identify, verbalise, and communicate, because in fine art a considerable proportion of the alterations need to take place below conscious awareness. Hence, it is a challenging task to teach oneself – or others

81 Notably, the structure of complex numbers includes a component that is explicitly called "the imaginary part."

– to enjoy and engage with novel artistic frameworks that introduce cognitively unusual approaches to subject matters and unfamiliar types of imaginative scenarios. However, the potential benefits of such a difficult, but not impossible, undertaking are noted by Dewey: "escape from the familiar environment to a foreign one is often a means of enlarging subsequent experience, because the excursions of art create new sensitivities that in time absorb what was alien and naturalise it within direct experience."[82] Or, as Gregory Minissale phrases the issue, "[s]uch artworks eventually condition us to have appetites for even more bizarre, subtle and improbable combinations of partial objects, a new vocabulary that stutters on the edge of giving form to a new outline of practice."[83] In short, it is oftentimes precisely the more exotic kinds of scenarios and the accompanying associative implications that advance artistic, and mathematical, developments and the personal growth of an individual.

Naturally, an adjustment in – or a removal of – familiar contexts of reference affects the emergence of vagueness in experience. In such instances, the meanings assigned to objects may be indistinct because the most suitable composition of a framework for interpretation and evaluation may be unsettled for the time being. That is, the felt vagueness may concern the foundational structures – as laws or norms – that, first, permit the entertained scenarios and objects to exist, even if only in imagination. For example, factual limitations of animal physiology have to be ignored in the case of fire-breathing dragons of fantasy literature and concrete physical proportions have to be exceeded in the case of higher dimensional mathematical objects. Second, vagueness may be felt in the less-constraining preconditions that render it possible for the scenarios to incorporate interesting processes and outcomes. That is, contemplation of novel fantastical beasts or new abstract mathematical entities usually necessitates accompanying accounts of the imaginative environment that suits them, not only as allowing their existence, but, also, as contributing to their further development. For example, dragons are more at home in the world of magic rather than in the world of modern weapons. And n-dimensional objects call for higher dimensional geometrical spaces in which their properties can be studied and developed. In short, in addition to details of a particular imaginative existence, vagueness may also concern the suitability of an environmental framework – or a "space" – for novel existences in general.

Admittedly, this added layer of indefiniteness renders the alteration of tension and release more complicated and cognitively burdensome – perhaps daunting for the unaccustomed, but possibly enriching for the attuned. For the latter, the enhancement incorporates more than a possibility for a restoration of lost balances. It denotes the potential for a discovery of wholly new ways to achieve states of equilibrium – novel not only as new links in a chain of particular occurrences, but possibly also as new links in the chain of contextual frameworks. As mentioned above, the two are integrally related; the removal of vagueness regarding a particular object may lead to a questioning of the suitability of the current contextual environment. In both fine art and mathematics, surprising features of new objects can evoke vague premonitions regarding more suitable conceptual environments of meaning and evaluation for them. And, also, the other way around: removal of vagueness with regard to an emerging conceptual framework can come to imply a potential for unprecedented objects and scenarios that presumably exceed in properties, and in meaning, the ones that originally prompted the development of the framework in question.

5 Conclusion

Overall, in fine art and in mathematics the imaginatively constructed extensions of possibilities – and the abstract frameworks, scenarios, and objects constituted upon them – comprise ever-evolving multilevel cognitive wholes. The continuous steps of advancement contribute to the longevity and the layers of signification to the depth of the experienced aesthetic dynamic. Vagueness can be viewed as an impetus

82 Dewey, *LW10*, 287.
83 Minissale, *The Psychology of Contemporary Art*, 62.

for both and as an enhancement in the emergence of aesthetic quality of experience. That is, not only does vagueness motivate the type of investigation and engagement that the advancement from known steps and layers towards the unknown commonly benefit from, but it, also, potentially increases the aesthetic quality generated during such efforts. On that account, vagueness is – to a degree – instrumental itself for the type of instrumentality that Dewey deems necessary for rendering experiences of objects and scenarios aesthetic in the full. In Dewey's words, "[t]his occurs when activity is productive of an object that affords continuously renewed delight. This condition requires that the object be, with its successive consequences, indefinitely instrumental to new satisfying events. For otherwise the object is quickly exhausted and satiety sets in."[84] This statement underlines the main argument of this article, which holds that even though vagueness is often deemed somewhat of an opposite to consummation, it is through detection and dispelling of it that consummations are rendered more profound and persistent. This means that the aesthetic quality becomes exceptionally emphatic in experience, as it often does during an attuned and inspired engagement with the imaginative pursuits of fine art and mathematics.

The significance of the above investigation ensues from the clarification of Dewey's thinking and argumentation. His call for the "enormity" of the difference does, indeed, apply to most common types of engagements with fine art and mathematics. For example, calculating your taxes and listening to the latest pop song are markedly different experiences. However, Dewey also notes the cognitive basis for an unity between artistic and intellectual engagements in the following point that he makes about rational thought: "[T]he experience itself has a satisfying emotional quality because it possesses internal integration and fulfillment reached through ordered and organised movement. This artistic structure may be immediately felt. In so far, it is esthetic."[85] A thorough understanding of this procedural similarity, for which Dewey argues for, requires further exploration of more idiosyncratic cases. Hence, in this article, I explore the types of intensive and imaginatively oriented engagements with artistic and mathematical matters that highlight the cognitive flexibility necessary for a procedural overlap in the degree of considerable experiential alignment. Such instances may be less common, but they, nonetheless, can potentially reduce the experiential difference between the artistic and the intellectual from the "enormous" to the rather "minor."

The broad goal of this article is to enhance the understanding of the role that human experience possesses in the processes of perceiving the world and comprehending the possibilities the world offers. In the modern epoch, human perception of environments and affordances commonly extends from the immediate sensory surroundings to the hypothetical and abstract entertained in imagination. And in the present framework of Dewey's philosophical pragmatism, this extension occurs as a natural continuity, which comprises a general axis of advancement for all human activity and pursuance, that is in the evolution of the perceivers and perceptions alike.

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