Gonçalves, Clara Germana Ramalho Moutinho

"A thing of beauty is a joy forever" : a transdisciplinary reading on creativity

Metadados

Data de Publicação 2022

Resumo Art and science, and emotion and reason, are two sides of a common discussion in academic circles and are frequently swapped out, one for the other. The discussion also includes the concepts of creativity and the beautiful. The concept of the sublime, which is closely linked to that of beauty, is also proposed here as part of the debate. This paper aims to contribute to the reflection on how these concepts are interconnected in separate disciplines and how, at the same time, they are elements of...

Tipo bookPart

“A thing of beauty is a joy forever”: A transdisciplinary reading on creativity

Clara Germana Gonçalves
CITAD, Lusíada University, Portugal
ORCID: 0000-0002-1236-5803

ABSTRACT: Art and science, and emotion and reason, are two sides of a common discussion in academic circles and are frequently swapped out, one for the other. The discussion also includes the concepts of creativity and the beautiful. The concept of the sublime, which is closely linked to that of beauty, is also proposed here as part of the debate.

This paper aims to contribute to the reflection on how these concepts are interconnected in separate disciplines and how, at the same time, they are elements of interdisciplinary connection. And how, in reality, they are transdisciplinary concepts.

Keywords: Art and science, Reason and emotion, Creativity, Beauty, Sublime

1 INTRODUCTION

Many authors have advocated a much more holistic view of knowledge and, consequently, of education than that which exists today. Two of the aspects frequently brought up are specialization and the realm of reason-based activity. In the former, the appeal for inter and transdisciplinary study and research is increasingly being made. In the latter case, the appeal is for greater proximity between art and science. These two realities are, of course, interrelated and feed off each other.

As Doucet and Janssens (2011, p.2), there is currently a lack of relational and hybrid knowledge. Transdisciplinarity means, according to Nicolescu (2002), “to celebrate the transgression of disciplinary boundaries” (p. 1). Another idea, also proposed by Nicolescu, is that if, on the one hand, transdisciplinarity is fed by disciplinary research, on the other hand, disciplinary research is clarified by transdisciplinary knowledge (p. 45). Tanya Augsburg (2014, p. 233) explains the broad aims of transdisciplinarity: it presupposes an individual ethic, a desire to improve society and contribute to the common good. Alternatively, as Nicolescu (2002) states: transdisciplinarity means a “new vision of the world” (p. 39).

Two statements can be mentioned here as examples. While citing the Charter of Transdisciplinarity[1], Sue L. T. McGregor (1994) states that “education must come to revalue the role of intuition, imagination, emotional sensibility, and body in the transmission and creation of knowledge.” In Parallax, Steven Holl (2006) uses the expression “thought-to-feeling bridge” to illustrate the now distant but still desired proximity between the different areas of knowledge. He argues:

> Three hundred years ago scientific ideas, perceptual phenomena, and their aesthetic and mystical effects could be discussed together. For example, Johannes Kepler's *Mysterium Cosmographicum* united art, science, and cosmology. Today, specialization segregates the fields; yawning gaps prohibit potential cross-fertilization. (p. 144)

For Holl, the model proposed by Kepler (1571-1630) emerges as a paradigm of the intelligence-sensibility connection and the unity of thought-free of specialization (p. 144). One can say that Holl makes an apologia for a 21st-century holistic approach.

In the context of these proposals, two concepts prove to be paradigmatic: creativity and beauty.

The link proposed here between creativity and beauty does not concern the aesthetic emotion provoked in those who contemplate the work (artistic or scientific). Nor is it about the aesthetic emotion that each one transposes to his or her work. In reality, the aesthetic emotion we are talking about refers to the presence of beauty, almost as an instrument of work, and its weight in decisions and the strength of one’s soul and, eventually, of the search for it. It is, in fact, about the encounter with beauty.

1. Adopted at the First World Congress of Trandisciplinarity, Convento da Arrábida, Portugal, November 2-6, 1994 and signed by Lima de Freitas (1927-1998), Edgar Morin (b.1921) and Basarab Nicolescu (b.1942).

2 CREATIVITY

In the opening pages of *Explaining Creativity*, R. Keith Sawyer (2012) begins by saying that it is particularly difficult to reach a consensus on what creativity is. In his words, "defining creativity may be one of the most difficult tasks facing the social sciences" (p. 7). And, according to him, there are two fundamental lines in the research on creativity: an individualist approach and a socio-cultural approach.

According to Sawyer (2012), painting, of all the creative domains, best fits in the Western cultural model of creativity. But the idea of the painter working alone, shut off from the outside world, and not taking into account any social conventions is, in reality, a fallacy. The truth is that both approaches – individualist and socio-cultural – are necessary for explaining painting (p. 297).

2.1 *The Romantic stereotype*

It was in the Romantic era that creativity emerged as "a pure expression of inner inspiration, an isolated genius, unconstrained by reason and convention," and the associated myth of "mental illness" was shaped (Sawyer, 2012, p. 175). Sawyer (2012) states:

> The Romantics believed that creativity required a regression to a state of consciousness characterized by emotion and instinct, a fusion between self and world, and freedom from rationality and convention. (p. 24)

A "temporary escape from the conscious ego and a liberation of instinct and emotion" was needed to create (p. 24). As examples thereof, Sawyer quotes Wordsworth (1770-1850), who speaks of "the spontaneous overflow of powerful feelings" (as cited in Sawyer, 2012, p.24); Percy Shelley (1799-1822), who uses the idea of "unpremeditated art" (as cited in Sawyer, 2012, p. 24); and also refers to Coleridge (1772-1834) as an example of a Romantic-era poet who knew he was supposed to conceive his poems "in bursts of spontaneity" while experiencing "mental anguish and bouts of madness" (p. 301).

The Romantics saw the artist as a child; creativity depended upon spontaneous, emotional expression, without any ties to rational judgment (Sawyer, 2012, p. 168); imagination was paramount over mastery traditions of the past (Sawyer, 2012, p.24).

The myth created by the Romantics carried so much weight in Western culture that even psychoanalysts thought there was a connection between schizophrenia and creativity. According to Sass (as cited in Sawyer, 2012, p. 168), schizophrenia provided a regression to a primitive Dionysian state, to infantile forms of irrationality.

And it was indeed within Romanticism that the contemporary idea of creativity emerged. The poet or the artist now had a privileged status and no longer a mere craftsperson (p. 24). In a way, it is paradoxical, in the sense that the more they tried to escape reason (in doing so, losing the status of craftspeople), the more they came closer to the status of men of science.

While emotionality and madness, which contributed to creativity, were characteristics of the Romantic cultural period, by contrast, rationalist conceptions of creativity emphasize conscious deliberation and reasoning. This was the case for modernism and post-modernism in 20th-century art (Sawyer, 2012, p.175).

But the 1950s can be considered a neo-Romantic period (Sawyer, 2012, p. 25). By the 1960s, the New York art scene had become fascinated with the process – rather than the end product – a path the New York action painters had set out on in the preceding decade (Sawyer, 2012, p. 301). This valorization of process and spontaneity has affected our conceptions of creativity. But, of course, Pollock (1912-56) planned his paintings and knew art was not possible without norms and conventions. "The painting process is conscious, intentional, planned hard work, sprinkled with frequent mini-insights, just like the creative process in any other domain" (p. 305). However, the contemporary arts from the 1960s onwards epitomized a return to rationalism. Post-modern art and theory can be regarded, in this sense, as anti-Romantic, in that they reject the ideals of authenticity, spontaneity, and personal engagement (Sawyer, 2012, p. 25). Artists such as Juan Miró (1893-1983) and Paula Rego (b.1935), to name just two, have attested to their huge work discipline (Solé, 2018) (Willing, 2016).

As Sawyer (2021, p. 24) explains, these ideas relating creativity with altered or heightened states of consciousness were not totally new; they were, in fact, thousands of years old. As he exemplifies, in ancient Greece, creativity was associated with demonic possession, and Plato (428/427-348/347BCE) used the term *enthousiasmos*[2] [2] ("divine madness") to describe it. Moreover, that was the reason why Plato was against the so-called musical revolution of the 5th century BC, for he thought music an object of reason, not an object of the senses, and refused music for the delight of the ear. (See Burkholder, Grout, and Palisca, 2014)

According to Sawyer (2012), the fact that Romanticist ideas related to creativity still live on may explain why ordinary people do not like modern art (p. 25). And one could add that that is why they don't see creativity in science as

2. According to the *Cambridge English Dictionary* the definition of the word enthusiasm is as follows: a feeling of energetic interest in a particular subject or activity and an eagerness to be involved in it; a subject or activity that interests you very much. ("enthusiasm", in *Cambridge English Dictionary* [online], https://dictionary.cambridge. org/ dictionary/english/enthusiasm [accessed on 20/04/2021].)

well.[3] Sawyer (2012) explains (after Kasof) that if one wants to be creative or perceived as creative in the West, one must behave in an unconventional, flexible, and open to experience way. For that is the Western cultural conception of creative people (p. 301).

The mindset that is the opposite of Romanticism is probably what Pelletier and Pérez-Gómez (1994) describe as "the glorification of scientific reason during the eighteenth century," which is related to "the reduction of the fine arts to a morally inconsequential aesthetic formalism" which, in turn, "is not an absolute paradigm but rather a historical event" (p. 4).

2.2 *What neuroscience says about creativity*

If the ideas that the artist is more creative than the scientist and that their brains work differently are still current in common sense, this does not seem to be what many academics think at present.

Today, most neuroscientists believe that, as far as creativity is concerned, the brain's hemispheres work together – each contributing a different strength (Sawyer, 2012, p. 160). For there is no evidence of the earlier idea of a specific location in the brain where creativity took place or even that it was in the right hemisphere (not to mention the famous two types of personality depending on the dominant side of the brain). Actually, creativity occurs in different parts of the brain depending on the area of creativity in question. It also varies depending on the individual's abilities and whether he or she is trained or not. Creativity involves the whole brain (p. 163).

Andreasen and Ramchandran (2012) state that, while "there is a general tendency to assume that creativity is more associated with the arts than the sciences" (p. 50), the brains of both groups of individuals function in a similar way (p. 49).

Margaret A. Boden (1996) synthesizes: "Creativity is a puzzle, a paradox, some say a mystery" (p. 75). And she, too, places artists and scientists alongside each other: "Inventors, scientists, and artists rarely know how their original ideas arise" (p. 75). She goes on to point out that the "unpredictability of creativity seems to outlaw any systematic explanation, whether scientific or historical" (p. 75).

3 BEAUTY

More emphasis will be placed on beauty in science, and mathematics in particular, since, in the present context, the discussion of beauty in art becomes redundant since it is its natural territory.

As in other situations, architecture as a hinge discipline (between art and science) can raise a good testimony in inter and transdisciplinary studies. We can, therefore, use here the testimony of an architect on considerations about beauty. In his text titled, not by chance, "Build Beautifully and Practically! Stop Cold Functionality!"[4] (1930), Mies van der Rohe (1886-1969) states: "It is a natural, human characteristic to consider not only the purposeful but also to reach out and love beauty." And raises the question:

> And what finally is beauty? Certainly nothing that can be calculated or measured. It is always something imponderable, something that lies in between things. (1930 as cited in Neumeyer, 1991, p. 307).

3.1 *Attractiveness and beauty*

The feeling of beauty, while also subjective, is, and particularly in the context discussed here, quite different from that of attractiveness.

Don Norman (2004) clearly distinguishes between attractiveness and beauty: the former is a visceral-level phenomenon, while the latter is a reflective one that emerges from conscious reflection and experience, influenced by knowledge, learning, and culture (p. 87). Furthermore, unattractiveness can give pleasure and be beautiful (p. 87). In the same line of thought, Roger Scruton (1979) distinguishes between sensuous pleasures and aesthetic pleasures (or, as he states, those that have "traditionally been described as" aesthetic). Aesthetic pleasure depends upon and is affected by thought processes (unlike the pleasures of the senses) (pp. 71-72). This argument leads one to another reason for the proximity between art and science, and, by way of example, the emergence of beauty in mathematics, given that it does not depend on attractiveness. Even if one does consider how mathematics is written to be beautiful.

At first glance, in science – or mathematics – one can only speak of beauty because there is no place for attractiveness, given that mathematics is already a human construction that is the fruit of knowledge, learning, and culture. Although, for some, the mathematical language itself, in itself, and regardless of the ideas it conveys, like an unorganized set of sounds, is pleasant.

3. This aspect leads to another argument. In reality, both the non-Romantic view of art and the view that favours the important role of creativity in science derive from a holistic view of knowledge that does not appear to be generally current today. There is a predominance of inductive thought over deductive thinking; and if one is to question this paradigm, deductive thinking would be essential.

4. Published originaly as "Schön und praktisch bauen! Schluß mit der kalten Zweckmässigkeit", in the newspaper *Duisburger General Anzeiger*, 26 January, p.2. He adds: "*Beauty in architecture, just as necessary and just as desired as in former times, can only be attained if in building we have more than the immediate purpose in mind* [sic emphasis]. (1930 as cited in Neumeyer, 1991, p. 307)."

3.2 *Beauty in science*

Although, as mentioned, in common sense, the idea of creativity is linked (still under the realms of the romantic stereotype and the "glorification of scientific reason" (Pelletier and Pérez-Gómez, 1994, p. 4)) to the artist and, consequently, to art, the academic world strongly diverges from this common sense.

Many authors find strong links and similarities between the arts and sciences – whom I think are very much in line with what transdisciplinarity means. Examples I have referred to in a previous article (Gonçalves, 2020): Ortega y Gasset (1883-1955), Federico Mayor (b. 1934), Graham Farmelo (b. 1953), and Siân Ede.

The presence and role of beauty in science are not new, although its discussion may be. According to Bronovski and Mazlisch (1988), it is fundamentally important to understand that aesthetic judgment was an underlying aspect during the Scientific Revolution. This was the case, for instance, in the work of Copernicus (1473-1543) and Kepler (p. 129).

Again a romantic. "[L]ife of the gods is mathematics," and "[p]ure mathematics is religion," said Novalis (cited in Worringer, 2007, p. 19). It is a very eloquent quotation Worringer chooses, in the early 20th century, on *Abstraction and Empathy* (1908) while calling into question the idea of mathematics being the highest art form according to modern art theoreticians. He points out that paradoxically, and contrary to the usual idea about art, the Romantics first call this idea into question (p. 19).

Today, and once again, not about creativity, but the idea of beauty in science, and perhaps, apparently, paradoxically, Ian Stewart (2007) cites a Romantic author as well in his book *Why Beauty is Truth: A History of Symmetry*. An excerpt from the poem *On a Grecian Urn* (1819) by John Keats (1795-1821) is the epigraph to the work:

> When old age shall this generation waste,
> Thou shalt remain, in midst of other woe
> Than ours, a friend to man, to whom thou say'st,
> "Beauty is truth, truth beauty," – that is all
> Ye know on earth, and all ye need to know.
> (Keats as cited In Stewart, 2007, epigraph)

Interestingly, Stewart (2007) differentiates between mathematics and science based o the idea that mathematics depends on logic and science on experiment (p. 275).

Ian Stewart (2007) advances the idea and gives examples thereof, that no matter how distant the resolution of new problems presented in mathematics may seem, they will always prove useful in the future. "Good mathematics is more valuable than gold, and where it comes from is mostly irrelevant. What counts is where it leads" (p. 276). On this question, Poincaré (1854-1912) was unequivocal. In one of his essays, he stated:

> The Scientist does not study nature because it is useful to do so. He studies it because he takes pleasure in it; and he takes pleasure in it because it is beautiful. If nature were not beautiful, it would not be worth knowing and life would not be worth living… . I mean the intimate beauty which comes from the harmonious order of its parts and which a pure intelligence can grasp. (Cited in Chandrasekhar, 1990, pp. 59-60).

3.3 *Beauty in mathematics*

In the case of mathematics, as Roger Scruton (2014) argues, in his argumentation on the idea that "we pursue the true, the good and the beautiful": "our thinking 'latches on' to a realm of necessary truth, reaching infinitely beyond the puzzles that need to solve" (p.14).

For Breitenbach (2013), the idea that "[m]athematics can be not only true but also beautiful" is a common thought, and aesthetic merit has been a decisive element for many great mathematicians concerning their theorems, proofs, and theories (p. 955). For Breitenbach, there are two fundamental conceptions with respect o the experience of mathematical beauty: on the one hand, the Platonist conception, which consists of an intellectual insight into the fundamental structures of the universe; on the other, the Kantian conception, which is grounded in our felt awareness of the imaginative processes that leads to mathematical knowledge. Breitenbach proposes a relationship between elements of aesthetic reflection, creative imagination, and mathematical cognition.

In "The Study of Mathematics" (1902), Bertrand Russell (2008) strongly argues: "Mathematics, rightly viewed, possesses not only truth, but supreme beauty" (p. 45). And he goes on to say that this is

> a beauty cold and austere, like that of sculpture, without appeal to any part of our weaker nature, without the gorgeous trappings of painting or music, yet sublimely pure, and capable of a stern perfection such as only the greatest art can show. (p. 45)

And (again similar to the authors cited above), he compares mathematics to poetry, arguing that

> [t]he true spirit of delight, the exaltation, the sense of being more than man, which is the touchstone of the highest excellence, is to be found in mathematics as surely as in poetry. (p. 45)

Of course, here, one recalls Novalis' words. And, of course, one recalls the subsequent ideas of Paul Valéry (1871-1945), who, in addition to being a poet, was a mathematician as well.

Without wishing to be redundant, I will cite here Bertrand Russell's description of the freedom he finds where common sense finds only rules, logic, and rationality. His words are as wise as they are eloquent:

> [T]he world of pure reason knows no compromise, no practical limitations, no barrier to the creative activity embodying in splendid edifices the passionate aspiration after the perfect from which all great work springs. Remote from human passions, remote even from the pitiful facts of nature, the generations have gradually created an ordered cosmos, where pure thought can dwell as in its natural home, and where one, at least, of our nobler impulses can escape from the dreary exile of the actual world. (2008, p. 45)

The question must be asked whether it is emotions and passions, as opposed to Romantic beliefs, that hinder us and take away our freedom?

Bertrand Russell compares mathematics to architecture, alluding both to logic and structure: "the rules of logic are to mathematics what those of structure are to architecture" (p. 45). Is there a rule that supports beauty?

Unfortunately, the idea of beauty in mathematics, or the aesthetic emotion one feels when studying mathematics, will not be a unanimous subject, at least in common sense. In fact, if one searches scientific databases, one will find numerous articles (particularly in psychology, pedagogy, etc.) precisely about the difficulty that many students have in studying mathematics and sticking to it with enthusiasm.

3.4 *Beauty and truth*

As already pointed out, beauty as a decisive factor in scientific theories in general, and mathematics in particular, has already been dealt with before (Gonçalves, 2020). For this reason, the examples given here are to be considered complementary to those referred. Hermann Weyl (1885-1955), whose research included the theory of groups and physics, writes: "My work has always tried to unite the true with the beautiful and when I had to choose one or the other, I usually chose the beautiful" (as cited in Stewart, 2007, p. 278). According to Ian Stewart (2007), Paul Dirac (1902-84) argues that natural laws and being mathematical were also beautiful, with beauty and truth being two sides of the same coin and beauty being decisive for physical truth. As Stewart informs (p. 277), Dirac also makes the remarkable argument that he preferred a beautiful theory to a correct one.

One of the lines in the epigraph of referred Ian Stewart's (2007) book that functions as a kind of leitmotif for the work is "'Beauty is truth, truth beauty'" (p. v). He advances the idea that our minds react similarly to both, and that is, in his opinion, the reason why beauty and truth appear so closely connected (p. 275).

Mies van der Rohe cites a medieval sentence: "'Beauty is the radiance of truth!'" (1930 as cited in Neumeyer, 1991, p. 307).

3.5 *Beauty and simplicity*

Stewart (2007) reflects on how Dirac also valued beauty over simplicity (p. 277). Dirac argues:

> The research worker […] should strive mainly for mathematical beauty. He should still take simplicity into consideration in a subordinate way to beauty.[…] the latter must take precedence. (as cited in Stewart, 2007, pp. 277-278)

Stephen Hawking (2002) also describes Galileo's (1564-1642) motives for confirming Copernicus' theories as being based on their "simplicity and elegance, in contrast to the complicated epicycles of the Ptolemaic model" (p. ix).

Also, about Kepler's belief in cosmic harmony, Lippman (1992) argues that: "faith in mathematical simplicity is […] . doubtless intrinsic to the very idea of science", extending the shadow of that belief to Einstein and subsequent authors (p. 15).

3.6 *Beauty and unity*

On Copernicus, Bronovski (1988) also references another concept that is associated with beauty: that of unity (it was because he did not find beauty and unity in Ptolemy's (ca.100-ca.170) theories that Copernicus rejected them) (p. 129). (See also Gonçalves, 2020)

Bertrand Russell links simplicity and unity implicitly, reiterating that "[t]he discovery that all mathematics follows inevitably from a small collection of fundamental laws is one which immeasurably enhances the intellectual beauty of the whole" (p. 45).

3.7 *Sublime*

One wonders if it is not also the case that it is not a search for the sublime per se, but at least for the sublime as well.

In the examples above, one can read some descriptions in the scientists' statements that come very close to those of the sublime, even more so than the beautiful. They even go as far back as Edmund Burke's seminal work, *A Philosophical Enquiry into the Origin of our Ideas of the Sublime and Beautiful* (1757). Among others, vastness, infinity, succession, and uniformity are qualities of the sublime referred to by Burke. It is indeed wonderful to note how the same aspects are also present in the thinking of scientists and how we understand the

feelings of the philosopher (about art and nature) and the scientist (about science, in general, and to mathematics, in particular) as being similar.

Burke (1757/2010) states on infinity: "The ideas of eternity, and infinity, are among the most affecting we have: and yet perhaps there is nothing of which we really understand so little, as of infinity and eternity" (p. 34). Also, on infinity: "Greatness of dimension is a powerful cause of the sublime" (p. 39). And "[f]or division must be infinite as well as addition; because the idea of a perfect unity can no more be arrived at, than that of a complete whole, to which nothing may be added" (p. 40). We immediately imagine the physicist studying the universe with its unchangeable laws and principles, its infinite space, its sense of immortality, emotionally And it is extraordinary how Burke also refers to the infinitely small: "[A]s the great extreme of dimension is sublime, so the last extreme of littleness is in some measure sublime likewise" (p. 40). He shows the same fascination as Poincaré (see below).

And he explains how an "artificial infinite" may be created: "Succession and uniformity of parts are what constitute the artificial infinite" (p. 41). "I believe, we ought to look for the cause why a rotund has such a noble effect. For in a rotund, whether it be a building or a plantation, you can nowhere fix a boundary" (p. 41). It looks like the writing of a mathematician. Or an architect. Alternatively, a painter that depicts a tholos in the landscape.

Poincaré goes further, hand in hand with Burke:

> It is because simplicity and vastness are both beautiful that we seek by preference simple facts and vast facts; that we take delight, now in following the giant courses of the stars, now in scrutinizing with a microscope that prodigious smallness which is also a vastness, and, now in seeking in geological ages the traces of the past that attracts us because of its remoteness (as cited in Chandrasekhar, 1990, pp. 59-60).

In his preface, "Sublime, Neoclassical, Romantic" [My Translation] to the Spanish translation of the works of Burke (Burke, 1757/1985, pp. 7-37), Valeriano Bozal explains how Burke, in his consciousness (which, for this author, was greater than for any other 18th-century writer), was extremely careful not to go outside the boundaries defined by taste. He thus felt the need to explain the sublime based on experience and experience alone (p. 15). It is interesting to note that today empirical aesthetics is very much a thing and that there are institutions such as the Max Planck Institute for Empirical Aesthetics (based in Munich and founded in 2012), which "aims to use scientific methods to explain the psychological, neuronal and socio-cultural basis of aesthetic perceptions and judgements."

And one must not forget that, after Kant (1724-1804), who, according to Ginsborg (2019), shows the influence of Burke, the very definition of sublime contains, in itself, this mystique of mathematics, for Kant proposes two notions of the sublime: one of them is the mathematically sublime and the other the dynamically sublime. The mathematically sublime is related to infinity and vastness.

One could rightfully ask if science does not, in reality, seek the sublime more than beauty?

4 TOWARDS A HOLISTIC VIEW AND THE FEELING OF BEAUTY

Again we recall the desire, and also the need, to put inter and transdisciplinarity into practice today, as well as the idea so eloquently expressed by Steven Holl (2006) of the "thought-to-feeling bridge" (p. 144).

Knowledge must not be separated from emotion; their common root is amazement about the world, expressed through the harmonious integration of all those intellectual and creative faculties that we use to respond to the wonder of things, both immense and minute (Luminet, 2009, p. 272).

As Albert Einstein said:

> [M]an tries to make for himself in the fashion that suits him best a simplified and intelligible picture of the world; he then tries to some extent to substitute this cosmos of his for the world of experience, and thus to overcome it. This is what the painter, the poet, the speculative philosopher, and the natural scientists do, each in his own fashion (Einstein, 1954, as cited in Luminet, 2009, p. 273).

5 CONCLUSIONS

The inter and transdisciplinary debate opens up new perspectives both on the relationships between the various disciplines and on how each discipline sees things. Inter and transdisciplinarity prove to be a useful exercise which, depending on the intuits resulting from its genesis, enriches itself with disciplinary knowledge and reciprocally enriches the individual disciplines through said exercise.

We are definitely thinking with emotion: through an encounter with beauty, the sublime, the real.

When one discusses the question of rules vs. taste, in reality, one is not discussing the rules of mathematics vs. taste, but just rules – in the broadest sense – given that mathematics itself seems to be dependent on that taste, the presence of (and the quest for) the beautiful.

Could it be that the quest for beauty and the sublime are walking, not independent of each other, but side by side and even simultaneously?

In the end run, the creative processes are similar, and beauty indeed exists in these two forms traditionally distanced from one another. One can advance here the hypothesis that the sublime is also present in science.

If there is unanimity regarding the conviction that creativity is so essential in both art and science, it also seems to be unanimous that, after all, the search for beauty and its use as a decision-making criterion also seems to be common to both areas of thought.

There is a need for a holistic view – both synchronic and diachronic; transdisciplinarity and transtemporality. For beauty is ever everywhere. Felted everywhere. Needed everywhere.

As Keats very well understood, "[a] thing of beauty is a joy forever" (John Keats, Endymion, 1818).

ACKNOWLEDGMENT

This paper was funded by National Funds through the FCT – Foundation for Science and Technology, under Project UIDB/04026/2020.

REFERENCES

Andreasen, N. C. & Ramchandran, K. (2012). Creativity in art and science: are there two cultures? *Dialogues in Clinical Neuroscience*, 14(1), 49–54.

Augsburg, T. (2014). Becoming transdisciplinary: The emergence of the transdisciplinary individual. *World Futures: The Journal of New Paradigm Research*, 70 (3-4), 233–247. doi: 10.1080/02604027.2014.934639

Boden, M. A. (1996). What is creativity? In M. A. Boden (Ed.), *Dimensions of creativity* (pp. 75–117). Cambridge, MA: MIT Press.

Breitenbach, A. (2015). Beauty in proofs: Kant on aesthetics in mathematics. *European Journal of Philosophy*, 23 (4) December 2015, 955–977. https://doi.org/10.1111/ejop.12021

Bronovski, J., & Mazlisch, B. (1988). *A tradição intelectual do Ocidente* (J. J. B. C. Rosa, Trans.). Lisboa, Portugal: Edições 70. (Original work published as *Western intellectual tradition* in 1960)

Burke, E. (1985). *Indagación filosófica sobre el origen de nuestras ideas acerca de lo sublime y lo belo* (J. de la Dehesa, Trans.). Murcia, Spain: Colegio Oficial de Aparejadores y Arquitectos Técnicos de Murcia. (Original work published as *A Philosophical Inquiry into the Origin of Our Ideas of the Sublime and Beautiful* in 1757)

_____. (2010) *A Philosophical Inquiry into the Origin of Our Ideas of the Sublime and Beautiful* [Kindle version]. Digireads.com. (Original work published in 1757)

Burkholder, J. P., Grout, D. J. & Palisca, C. V. (2014). *A history of western music*. New York, NY: W. W. Norton.

Chandrasekhar, S. (1990). *Truth and Beauty: Aesthetics and Motivations in science* [Kindle version].

Doucet, I., & Janssens, N. (Eds.). (2011). *Transdisciplinary knowledge production in architecture and urbanism: Towards hybrid modes of inquiry*. Dordrecht, Netherlands: Springer.

Ginsborg, H. (2019). Kant's aesthetics and teleology. In E. N. Zalta (Ed.), *The Stanford Encyclopedia of Philosophy* (Winter 2019 Edition), (ed.), URL = <https://plato.stanford.edu/archives/win2019/entries/kant-aesthetics/>.

Gonçalves, C. G. (2020). Creativity and beauty in art and science today: a basis for discussion of a possible future architecture. In M. S. M. Kong, M. R. Monteiro, & M. J. P. Neto (Eds.), *Intelligence, creativity and fantasy. Proceedings of the 5th International Multidisciplinary Congress* (pp. 47–52). Leiden, Netherlands: CRC Press. https://doi.org/10.1201/9780429297755

Hawking, S. Introduction. (2002). In J. Kepler, *Harmonies of the World: Book Five* (pp.ix–x). Philadelphia, PA: Running Press.

Holl, S. (2006). *Parallax*. New York, NY: Princeton Architectural Press.

Lippman, E. (1992). *A history of western musical aesthetics*. Lincoln, NE: University of Nebraska Press.

Luminet. J.-P. (2009). Science, art and geometrical imagination. In D. Valls-Gabaud & A. Boksenberg (Eds.), *Proceedings IAU Symposium: No. 260. The Role of Astronomy in Society and Culture* (pp. 248–273). Paris: France: International Astronomical Union 2011. doi:10.1017/S1743921311002377

McGregor, S. L. T. (2004). The nature of transdisciplinary research and practice. Retrieved June 28, 2019, from https://www.kon.org/hswp/archive/transdiscipl.pdf [Google Scholar]

Neumeyer, F. (1991). *The artless world: Mies van der Rohe on the art of building* (M. Jarzombek, Trans.). Cambridge, Mass.: MIT Press.

Nicolescu, B. (2002). *Manifesto of transdisciplinarity*. New York, NY: SUNY Press.

Norman, D. (2004). *Emotional Design: Why We Love (or Hate) Everyday Things* [Kindle version]. Retrieved from Amazon.com

Pelletier, L., & A. Pérez-Gómez. (1994). *Architecture, Ethics and Technology*. Ottawa, Canada: Carleton University Press.

Russell, B. (2008). *Mysticism and logic and other essays* [EBook #25447]. Release Date: May 12, 2008

Sawyer. R. K. (2012). *Explaining creativity: The science of human innovation*. 2nd Edition. Oxford, England: Oxford University Press.

Scruton, R. (1979). *The aesthetics of architecture*. London, England: Methuen.

_____. (2014). *The soul of the world*. Princeton, NJ: Princeton University Press.

Solé, A. (Director) & ARTE France, Rmn-Grand Palais, Compagnie Des Phares Et Balises, Minimal Films (Producers). (2018). *Joan Miró: The inner fire*. [Documentary film].

Stewart, I. (2007). *Why beauty is truth: a history of symmetry*. New York, NY: Basic Books.

Willing, N. (Director) & Kismet Film Company (Producer). (2016). *Paula Rego: Histórias e segredos*. [Documentary film].

Worringer, W. (2007). *Abstraction and empathy: A contribution to the psychology of style*. Chicago, IL: Ivan R. Dee.