

# The Idea of Creativity in Whitehead's Writings of Mathematics

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**Abstract:** The question that will interested me in the present paper is, first, when the idea of creativity appears in Whitehead's writings on mathematics and, second, how this idea works in mathematics itself and in philosophy of mathematics? So, I shall follow chronologically the appearance of the idea of creativity in Whitehead's writings on mathematics and the evolution of his intellectual development with regard to the function and role of creativity in mathematics. The key role of creativity in Whitehead's metaphysics is emphasized in his last publication *Immortality* (1941). The connection of creativity with mathematics is emphasized by Whitehead in his last publication on mathematics *Mathematics and The Good* (1941). The conclusion of my paper is that Whitehead's views concerning the idea of creativity in mathematics was formed in his last mature period of intellectual development after 1920ties and he has supported firmly these views till the end of his life.

**Keywords:** philosophy of mathematics, creativity, A.N. Whitehead.

## 1. Introduction

It is widely accepted in Whiteheadian literature that Whitehead's own intellectual evolution has passed three main stages: "he has contemplated the logico-mathematical field *sub specie totalitatis* in Cambridge, geometry as a physical science in London, and metaphysics under the category of creativity in Harvard"<sup>1</sup>. It is also widely accepted that one of the central categories of Whitehead's metaphysics is the category of creativity. As Whitehead himself has put it in his mature metaphysical magnum opus *Process and Reality*, "creativity is the ultimate behind all forms, inexplicable by forms, and conditioned by its creatures"<sup>2</sup>. However, pointing to the central role of creativity did not happen at once. The concept of creativity as such does not emerge before Whitehead's *Religion in the Making* (1926). As Michel Weber points, prior to *Religion in the Making* "the steady leitmotiv is more the "creative advance – or creative activity – of nature"<sup>3</sup>. Namely, Whitehead points in his *The Concept of Nature* (1920) that "... this creative advance, which we experience and know as the perpetual transition of nature into novelty"<sup>4</sup>. And Weber continues: "Previously [before the *Gifford Lectures*] creativity was just

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<sup>1</sup> Weber, Michel (2006). *Whitehead's Pancreativism. The Basics*, Frankfurt: Ontos Verlag, p. xvi.

<sup>2</sup> Whitehead, A.N. (1978). *Process and Reality*. Corrected edition. New York: The Free Press, p. 20.

<sup>3</sup> Weber, Michel (2006). *Whitehead's Pancreativism. The Basics*, Frankfurt: Ontos Verlag, p. 186.

<sup>4</sup> Whitehead, A. N. (1959). *The Concept of Nature*. University of Michigan Press (first published by the Cambridge Univ. Press, 1920), p. 178.

one of the formative elements whose togetherness conditioned the coming into existence of any occasion”.<sup>5</sup> According to him “the irruption of the concept of “creative advance” in the *Principles of Natural Knowledge* of 1919 signals the start of the real processual slant of his research program”<sup>6</sup>. With this book it begins to matter for Whitehead “the intelligence of the ontological conditions of the possibility of the “creative advance of nature””<sup>7</sup>. Creativity in *Science and the Modern World* (1925) is implicit, it is rather a substantial activity, and is made explicit as creativity namely in *Religion in the Making* (1926).<sup>8</sup>

The question that will interested me in the present exposition is, first, when the idea of creativity appears in Whitehead’s writings on mathematics and, second, how this idea works in mathematics itself and in philosophy of mathematics? So, I shall follow chronologically the appearance of the idea of creativity in Whitehead’s writings on mathematics and the evolution of his intellectual development with regard to the function and role of creativity in mathematics.

## **2. Whitehead’s writings on mathematics from his early and middle periods of intellectual development**

Whitehead’s first big work on mathematics is his book *A Treatise on Universal Algebra* (1898). In this book Whitehead considers what mathematics according to him is: “Mathematics in its widest signification is the development of all types of formal, necessary, deductive reasoning”.<sup>9</sup> He explains in more details every one of the last mentioned types of reasoning: “The reasoning is formal in the sense that the meaning of propositions forms no part of the investigation. The sole concern of mathematics is the inference of proposition from proposition. The justification of the rules of inference in any branch of mathematics is not properly part of mathematics: it is the business of experience or of philosophy. The business of mathematics is simply to follow the rule. In this sense all mathematical reasoning is necessary, namely, it has followed the rule. Mathematical reasoning is deductive in the sense that it is based upon definitions which, as far as the validity of the reasoning is concerned (apart from any existential import), need only the test of self-consistency.”<sup>10</sup> And he continues: “... all serious thought which is not philosophy, or inductive reasoning, or imaginative literature, shall be mathematics developed by means of a calculus”.<sup>11</sup> We see that no mention of creativity or creative advance

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<sup>5</sup> Weber, Michel (2006). Op. cit., p. 188.

<sup>6</sup> Ibid, p. 5.

<sup>7</sup> Ibid, p. 8.

<sup>8</sup> Ibid, p. 10.

<sup>9</sup> Whitehead, A.N. (1898). *A Treatise on Universal Algebra*. Cambridge: At the Univ. Press, p. vi.

<sup>10</sup> Ibid, pp. vi-vii.

<sup>11</sup> Ibid, p. viii.

is present here. The role of creation is not yet realized by Whitehead here.

In his next famous work “On Mathematical Concepts of the Material World” (1906) Whitehead writes: “The object of this memoir is to initiate the mathematical investigation of various possible ways of conceiving the nature of the material world. ... The general problem is here discussed purely for the sake of its logical (i.e., mathematical) interest. It has aim indirect bearing on philosophy by disentangling the essentials of the idea of a material world from the accidents of one particular concept.”<sup>12</sup> Again no mention of creativity is present here. Neither is it mentioned in the book “An Introduction in Mathematics” (1911) where he says: “we write down as the leading characteristic of mathematics that it deals with properties and ideas which are applicable to things just because they are things, and apart from any particular feelings, or emotions, or sensations, in any way connected with them. This is what is meant by calling mathematics an abstract science.”<sup>13</sup>

This situation can be explained with the words of some investigators of Whitehead’s philosophy of mathematics who say that “Most of Whitehead’s publications prior to 1911 were intended exclusively for the world of professional mathematicians.”<sup>14</sup> However, the same authors continue: “This, however, changed in 1911 with the publication of *An Introduction to Mathematics*. Here we find him for the first time writing for a larger public.”<sup>15</sup> And what such change consist in? “We rather find him [Whitehead] in *IM* dealing anew and in depth with three areas: philosophical, historical, and applied mathematics. He touches these questions anew, insofar as they had already delivered important problems in his earlier works on pure mathematics ... [there is a great] amount of space allotted in *IM* to the treatment of the three basic problems that had occupied Whitehead in his work up to that point. They are the question about the nature of mathematics, its unity and internal structure, and *its applicability to nature*.”<sup>16</sup> The claim of the author is that the basic insights of Whitehead’s works on pure mathematics “can be regarded as prefigurations of basic concepts in his later philosophy of organism”.<sup>17</sup> Namely the investigation of the applicability of mathematics to nature is the necessary step to Whitehead’s later prefigurations of basic concepts in his philosophy of organism.

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<sup>12</sup> Whitehead, A.N. (1906). “On Mathematical Concepts of the Material World”, *Philosophical Transactions of the Royal Society of London. Series A, Containing Papers of a Mathematical or Physical Character*, Vol. 205. (1906), pp. 465-525, p. 465.

<sup>13</sup> Whitehead, A.N. (1911). *An Introduction to Mathematics*. London. Williams and Norgate, p. 9.

<sup>14</sup> Wassermann, Christoph (1988). “The Relevance of *An Introduction to Mathematics* to Whitehead’s Philosophy”, *Process Studies*, Vol. 17, No 3 (Fall 1988), p. 181.

<sup>15</sup> *Ibid*, p. 181.

<sup>16</sup> *Ibid*. Italics mine – V.P.

<sup>17</sup> *Ibid*, p. 182.

These basic concepts of the philosophy of organism did not appear in empty space. The basic continuity between Whitehead's earliest mathematics and his final philosophy can be found in his book *An Introduction to Mathematics* (1911) that describes best Whitehead's early philosophy of Mathematics.<sup>18</sup> However, it is not true that Whitehead "never re-examined mathematics from his later philosophical position".<sup>19</sup> We shall see it in the last part of my exposition on the example namely of the idea of creativity.

### **3. Whitehead's vision on mathematics from the point of view of his mature philosophy of organism**

As I pointed in the introduction Whitehead's first mentioned the idea of creativity was in the form of "creative advance" in his book *The Concept of Nature* (1920). Here he mentioned "creation" or rather "creative advance" only once: "The difficulty as to discordant time-systems is partly solved by distinguishing between what I call the creative advance of nature, which is not properly serial at all, and any one time series. We habitually muddle together this creative advance, which we experience and know as the perpetual transition of nature into novelty, with the single-time series which we naturally employ for measurement."<sup>20</sup>

Later, in *Science and the Modern World* (1925) Whitehead also mentioned the concept of "creation" only ones and it happened in connection with mathematics. This mentioning has happened namely in the chapter "Mathematics as an Element in the History of Thought" where he says: "The science of Pure Mathematics, in its modern developments, may claim to be the most original creation of the human spirit"<sup>21</sup> repeating what he has said in his Harvard lecture 81 delivered on 16 May, 1925.<sup>22</sup> In this chapter Whitehead says: "In reviewing this rapid sketch of the influence of mathematics throughout European history, we see that it had two great periods of direct influence upon general thought, both periods lasting for about two hundred years. The first period was that stretching from Pythagoras to Plato, when the possibility of the science, and its general character, first dawned upon the Grecian thinkers. The second period

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<sup>18</sup> Henry, Granville and Valenza, Robert (1993). "Whitehead's Early Philosophy of Mathematics", *Process Studies*, Vol. 22, No 1, 1993, p. 22.

<sup>19</sup> Ibid, p. 24.

<sup>20</sup> Whitehead, A. N. (1959). *The Concept of Nature*. University of Michigan Press (first published by the Cambridge Univ. Press, 1920), p. 178.

<sup>21</sup> Whitehead, A. N. (1967). *Science and the Modern World*. New York: The Free Press (first published in 1925), p. 19.

<sup>22</sup> See *The Harvard Lectures of A.N. Whitehead, 1924-25*, edited by Paul A. Bogaard and Jason Bell. – in: *The Edinburgh Critical Edition of the Complete Works of A.N. Whitehead*, Vol. 1, 2017, Edinburgh Univ. Press, pp. 385-6.

comprised the seventeenth and eighteenth centuries of our modern epoch.”<sup>23</sup>

There is an interesting connection between these two periods which is not explicitly explained in the above passage, but which is made clear in quotation of one private Whitehead’s dialogue much later, in May 1945. Whitehead is quoted to have said: “Stagnation of thought is one of the pitfalls of mankind. It is easier to grasp from the history of mathematics than from theology. *Mathematics is the study of possibilities.* Beyond the immediate practical applications of the multiplication table, say at 12 x 12, mathematics in fifth-century Athens was useless. It was a form of speculation. Plato was immensely excited about the subject. His mind was full of mathematics; he used it as an instrument of thought, and it suggested to him all sorts of hitherto unguessed possibilities. If you had talked to Aristotle about him at that time, no doubt Aristotle would have remarked to you privately, 'Poor old Plato! All bogged down in those useless mathematical ideas.'" (He smiled drolly as he said this.) "Now, as a matter of fact, in Plato's time those mathematical ideas *were* useless, and they remained useless for roughly sixteen or seventeen centuries. Then, *beginning at about the twelfth century A.D. those mathematical ideas which had so excited Plato, made possible the modern world.*"<sup>24</sup>

The last words are very important. The question arises here: how and why those mathematical ideas have made possible the modern world? And what is the role of the idea of creativity in that process? Let me try to answer these questions using Whitehead’s own statements.

In *Adventures of Ideas* Whitehead has pointed to the grasping of nature as a process and as creativity in Ancient Greek worldview and to the role and place of mathematics in that worldview in the following way: “In respect to Harmony, the Greeks made a discovery which is a landmark in the history of thought. They found out that exact Mathematical Relationships, as they exist in Geometry and in the numerical proportions of measurements, are realized in various outstanding examples of beautiful composition. ... Plato drew the conclusion that the key to the understanding of the natural world, and in particular of the physical elements, was the study of mathematics. There is a good reason to believe that the greater part of the studies of his Academy was devoted to mathematics. The mathematicians of the succeeding generation, and indeed of the next two hundred years, ending with the astronomers Ptolemy and Hipparchus, are the product of the systematic tradition shaped by the example and the doctrine of Plato. Of course the Academy inherited the Pythagorean tradition in Mathematics. Thus with

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<sup>23</sup> Whitehead, A. N. (1967). *Science and the Modern World*. New York: The Free Press (first published in 1925), p. 33.

<sup>24</sup> Price, Lucien (1954). *Dialogues of Alfred North Whitehead*. Boston: Little Brown, p. 309. Italics mine – V.P.

Plato and Aristotle, a new epoch commences. Science acquires the cleansing of logical and mathematical lucidity. Aristotle established the importance of scientific classification into species and genera: Plato divined the future scope of applied mathematics. ... The notions of Harmony and of Mathematical Relations are only special exemplifications of a yet more general philosophic concept, namely, that of the general interconnectedness of things, which transforms the manifoldness of the many into the unity of the one. We speak in the singular of *The Universe*, of Nature, of *φύσις* which can be translated as Process.”<sup>25</sup> Whitehead continues on the next pages that “The general science of mathematics is concerned with the investigation of patterns of connectedness, in abstraction from the particular relata and the particular modes of connection. It is only in some special branches of mathematics that notions of quantity and number are dominant themes. The real point is that the essential connectedness of things can never be safely omitted.”<sup>26</sup>

What is the connection here with the idea of creativity? Whitehead says in the same book that “There are two current doctrines as to this process. One is that of the external Creator, eliciting this final togetherness out of nothing. The other doctrine is that it is a metaphysical principle belonging to the nature of things, that there is nothing in the Universe other than instances of this passage and components of these instances. Let this latter doctrine be adopted. Then the word Creativity expresses the notion that each event is a process issuing in novelty.”<sup>27</sup> And at another place of the book he explains: “*Creativity*. ... The initial situation includes a factor of activity which is the reason for the origin of that occasion of experience. This factor of activity is what I have called ‘Creativity’. The initial situation with its creativity can be termed the initial phase of the new occasion. It can equally well be termed the ‘actual world’ relative to that occasion. ... This basic situation, this actual world, this primary phase, this real potentiality – however you characterize it – as a whole is active with its inherent creativity, but in its details it provides the passive objects which derive their activity from the creativity of the whole. *The creativity is the actualization of potentiality*, and the process of actualization is an occasion of experiencing. Thus viewed in abstraction objects are passive, but viewed in conjunction they carry the creativity which drives the world. The process of creation is the form of unity of the Universe.”<sup>28</sup>

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<sup>25</sup> Whitehead, A.N. (1967). *Adventures of Ideas*. New York: The Free Press (first published in 1933), pp. 149-150.

<sup>26</sup> Ibid, p. 153.

<sup>27</sup> Ibid, p. 236.

<sup>28</sup> Whitehead, A.N. (1967). *Adventures of Ideas*. New York: The Free Press (first published in 1933), p. 179. Italics mine – V.P.

Let me repeat the phrase that is stressed on above: “creativity is the actualization of potentiality”. And let us compare it with Whitehead’s later thought from 1945 that “Mathematics is the study of possibilities”. Possibilities are something potential. So, we see that there is a connection between subject of mathematical studies and creativity and that creativity has a key role in the way of functioning of mathematics.

Analogous conclusions can be drawn from Whitehead’s thoughts in his last book *Modes of Thought* (1938) where he emphasizes the connection between the categories of creation and process. Here he says: “Consider for example the effect on European thought of the rise of mathematical science, about four centuries before the Christian Era. Mathematics was concerned with notions which at that time introduced no sense either of transition or of creation. Numbers and geometrical forms constituted the sole content of Greek mathematics.”<sup>29</sup> And Whitehead continues on the next page connecting creativity with process: “It is unnecessary to dwell on the importance of the science of these special mathematical forms. It has transformed civilization. But its effect on Greek thought was very mixed. As the Greeks understood that science, the notion of transition was in the background. Each number, each ration, each geometric form exhibited a static attainment. The number *twelve* (in their conception of it) had no reference to creation; neither had the ration *six to two*... The result of this revelation was that Greek philosophy – at least in its most influential school – conceived ultimate reality in the guise of static existences with timeless interrelations. Perfection was unrelated to transition. Creation, with its world in change, was an inferior avocation of a static absolute.”<sup>30</sup> Here he also says: “The effect on subsequent European thought of this impulse from the golden age of Greece has been threefold. In the first place, the static absolute has been passed over to philosophic theology, as a primary presupposition. In the second place, the abstractions of structure, such as mathematical notions and all notions involving ways of composition, have been endowed with an eminent reality, apart from individual compositions in which they occur. In the third place, these abstractions of structure have been conceived as carrying, in their own natures, no reference to creation. The process has been lost. The final outcome has been that philosophy and theology have been saddled with the problem of deriving the historic world of change from a changeless world of ultimate reality.”<sup>31</sup>

The role of process in mathematics is stressed on more clearly in the following passages: “A prevalent modern doctrine is that the phrase “twice-three is six” is a tautology. This means

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<sup>29</sup> Whitehead, A.N. (1968). *Modes of Thought*. New York: The Free Press (first published in 1938), p. 80.

<sup>30</sup> Whitehead, A.N. (1968). *Modes of Thought*. New York: The Free Press (first published in 1938), p. 81.

<sup>31</sup> *Ibid.*

that “twice-three” says the same thing as “six”; so that no new truth is arrived at in the sentence. **My contention is that the sentence considers a process and its issue.** ... If we say that “twice-three is six,” we are saying that the issue of a process is an entity with the character of “six”. If we are saying that “twice-three is equal to the sum of two and four,” we are saying that two distinct processes issue in compositions with the same numerical character. The meaning of *equality* – of the word *is* – differ in each of these cases. **My final point is that mathematics is concerned with certain forms of process issuing into forms which are components for further process.**<sup>32</sup>

On the next page Whitehead has pointed that “[In Antiquity Plato] was apt to identify process with mere appearance, and to conceive of absolute reality as devoid of transition. For him, in this mood, mathematics belonged to changeless eternity. He then has accepted tautology. ... The nature of any type of existence can only be explained by reference to its implication in creative activity, essentially involving three factors: namely, data, process with its form relevant to these data, and issue into datum for further process – data, process, issue.”<sup>33</sup> And also: “All mathematical notions have reference to process of intermingling. The very notion of number refers to the process from the individual units to the compound group. The final number belongs to no one of the units; it characterizes the way in which the group unity has been attained. Thus even the statement “six equals six” need not be construed as a mere tautology. It can be taken to mean that six as dominating a special form of combination issues in six as character of a datum for further process. There is no such entity as a mere static number. There are only numbers playing their parts in various processes conceived in abstraction from the world-process.”<sup>34</sup>

And Whitehead concludes in that book: “In these lectures [i.e. in Whitehead’s lectures which *Modes of Thought* is based on] ... The mathematical modes of fusion, such as “addition,” “multiplication,” “serial form,” and so on, have been construed as forms of process. The very notion of “multiplicity” itself has been construed as abstraction from the form of process whereby data acquire a unity of issue into a novel datum.”<sup>35</sup> Concerning the role of abstraction in connection with the role of process he says that “Pure mathematics is the chief example of success by adherence to such rigid abstraction. Again, the importance of mathematics, as finally disclosed in the sixteenth and seventeenth centuries, illustrates the doctrine that the advance of

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<sup>32</sup> Ibid, p. 92. Bold is mine – V.P.

<sup>33</sup> Ibid, p. 93.

<sup>34</sup> Ibid.

<sup>35</sup> Ibid, p. 97.

the finite human understanding requires the adherence to some judicious abstraction, and the development of thought within that abstraction.”<sup>36</sup>

#### 4. Conclusion

The key role of creativity in Whitehead’s metaphysics is emphasized in his last publication *Immortality* (1941). Here he says: “The World which emphasizes the multiplicity of mortal things is the World of Activity. It is the World of Origination: It is the Creative World. It creates the Present by transforming the Past, and by anticipating the Future. When we emphasize sheer Active Creation, the emphasis is upon the Present – namely, upon “Creation Now,” where the reference to transition has been omitted.”<sup>37</sup> The connection of creativity with mathematics is emphasized by Whitehead in his last publication on mathematics *Mathematics and The Good* (1941) where he says: “Abstraction involves emphasis, and emphasis vivifies experience, for good, or for evil. All characteristics peculiar to actualities are modes of emphasis whereby finitude vivifies the infinite. In this way Creativity involves the production of value-experience, by the inflow from the infinite into the finite, deriving special character from the details and the totality of the finite pattern.”<sup>38</sup>

So, the conclusion of my paper is that Whitehead’s views concerning the idea of creativity in mathematics was formed in his last mature period of intellectual development after 1920ties and he has supported firmly these views till the end of his life.

#### References

*The Harvard Lectures of A.N. Whitehead, 1924-25*, edited by Paul A. Bogaard and Jason Bell. – in: *The Edinburgh Critical Edition of the Complete Works of A.N. Whitehead*, Vol. 1, 2017, Edinburgh Univ. Press.

Henry, Granville and Valenza, Robert (1993). “Whitehead’s Early Philosophy of Mathematics”, *Process Studies*, Vol. 22, No 1, 1993.

Price, Lucien (1954). *Dialogues of Alfred North Whitehead*. Boston: Little Brown.

Wassermann, Christoph (1988). “The Relevance of *An Introduction to Mathematics* to Whitehead’s Philosophy”, *Process Studies*, Vol. 17, No 3 (Fall 1988).

Weber, Michel (2006). *Whitehead’s Pancreativism. The Basics*, Frankfurt: Ontos Verlag.

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<sup>36</sup> Ibid, p. 55.

<sup>37</sup> Whitehead. A.N. (1941). *Immortality*. – in: *The Philosophy of Alfred North Whitehead. The Library of Living Philosophers*, Vol.. III. Second edition. La Sale: Open Court, 1951, p. 684.

<sup>38</sup> Whitehead. A.N. (1941). *Mathematics and The Good*. – in: *The Philosophy of Alfred North Whitehead. The Library of Living Philosophers*, Vol.. III. Second edition. La Sale: Open Court, 1951, p. 681.

Whitehead, A.N. (1898). *A Treatise on Universal Algebra*. Cambridge: At the Univ. Press.

Whitehead, A.N. (1906). "On Mathematical Concepts of the Material World", *Philosophical Transactions of the Royal Society of London. Series A, Containing Papers of a Mathematical or Physical Character*, Vol. 205. (1906), pp. 465-525.

Whitehead, A.N. (1911). *An Introduction to Mathematics*. London. Williams and Norgate.

Whitehead, A. N. (1959). *The Concept of Nature*. University of Michigan Press (first published by the Cambridge Univ. Press, 1920).

Whitehead, A. N. (1967). *Science and the Modern World*. New York: The Free Press (first published in 1925).

Whitehead, A.N. (1978). *Process and Reality*. Corrected edition. New York: The Free Press. (first published in 1929)

Whitehead, A.N. (1967). *Adventures of Ideas*. New York: The Free Press (first published in 1933).

Whitehead, A.N. (1968). *Modes of Thought*. New York: The Free Press (first published in 1938).

Whitehead. A.N. (1941). Immortality. – in: *The Philosophy of Alfred North Whitehead. The Library of Living Philosophers*, Vol.. III. Second edition. La Sale: Open Court, 1951.

Whitehead. A.N. (1941). Mathematics and The Good. – in: *The Philosophy of Alfred North Whitehead. The Library of Living Philosophers*, Vol.. III. Second edition. La Sale: Open Court, 1951.