C.R.AIPS 2

Proceedings of *the Académie Internationale de Philosophie des Sciences*

Comptes Rendus de l'Académie Internationale de Philosophie des Sciences

Tome II

Justification, Creativity, and Discoverability in Science

Éditeur
Lorenzo Magnani

The concept of creativity in the sciences
Reflections on some problems

Hans-Peter Grosshans

Seminar für systematische Theologie, Evangelisch-Theologische Fakultät, Westfälische Wilhelms-Universität Münster, Universitätsstraße 13–17, 48143 Münster, Germany

Creativity is a much sought-after skill in many areas of society. In business, creative people are needed in product design, marketing and advertising. On the other hand, creativity is not so much in demand in the field of accounting and financial management, where solid accuracy is required—unless the finances look very bad. In football, creative players are needed in the attacking midfield, while in defence it is quite uncreative to obstruct and disrupt the play of others. The broad field of culture is very much the social field that is about creativity: in music, visual arts, theatre, dance, etc.

Lorenzo Magnani referred in his recent book "Discoverability. The Urgent Need of an Ecology of Human Creativity" even to Pope Francis, who repeatedly underlined the great importance of human creativity in his Encyclical *Laudato Si*, published in 2015. "Creativity is seen as a fundamental tool that is necessary to remedy the failures of our societies and our lives," summarises Lorenzo Magnani.[1] Following in the footsteps of Pope Francis, Lorenzo Magnani also believes that creativity is essential to solving the great problems of our time. He writes: "I am convinced that without creativity and human skills, all the other ecologies envisaged and invoked, and sustainability in general, will sadly fail".[2] Consequently, he includes human creativity among the deontological commitments: Be creative!

There is no doubt that creativity is often needed in life. But is this also the case in science?

I often see too much creativity in some sciences, such as social sciences or educational studies. There, new concepts and theories about social realities and about the education of young people are constantly being creatively designed, causing a lot of confusion in society and in education. So, the question arises: where is creativity necessary in the sciences, and where is it not? And what kind of creativity is useful in science?

In this paper, I will first follow some approaches to defining the concept of creativity in more detail, also considering its use in my field, philosophy of religion and theology. Then, in a shorter second part, I will explore the question of where and how creativity is necessary in the sciences.

[1] Lorenzo Magnani, Discoverability. The Urgent Need of an Ecology of Human Creativity, Cham (Springer Nature) 2022, X.

[2] Ibid.

Justification, Creativity, and Discoverability in Science, edited by Lorenzo Magnani.
Comptes Rendus de l'Académie Internationale de Philosophie des Sciences 2 (2024).
H.-P. Grosshans, The concept of creativity in the sciences, pp. 103–113.

1 What is creativity?

1.1 Creativity in psychological research

Of all the scientific disciplines, it is probably psychology that has been most concerned with creativity in recent decades. From a psychological point of view, creativity is the ability to find novel solutions to open problems or to previous solutions to problems. In this approach, creativity can be understood as an "at least six-digit relationship [...]: the action H of the individual I leading to the product P within the framework R is classified as creative by the evaluator B with regard to a system S of expectations and purposes".[3]

Products or actions are then considered creative "which are new with respect to the system of expectations of the group evaluating them and which modify this system of expectations".[4] On the one hand, creativity is understood here as a personality trait (in differential psychology), on the other hand, psychology studies the cognitive or mental processes involved in creativity (in general psychology). Four stages can easily be distinguished: preparation (gathering information), incubation (mental processing), illumination (insight), verification (checking the solution). Methodologically, creativity research in psychology is mainly conducted through biographical studies and test-oriented investigations. E. P. Torrance developed such tests (named after him) in his book "Torrance Tests of Creative Thinking" (1974). In contrast to the convergent thinking of a classical intelligence test, his tests aim to measure a person's so-called divergent thinking.

In psychological terms, the subjective dispositions of creativity include "perceptiveness, curiosity, relative independence from expectations, and imagination".[5] In the system of expectations and demands, creative people—under the condition of creative freedom—"respond with unusual and further ideas".[6] This creativity is necessary for self-preservation and for solving problems (which Pope Francis also emphasises), but it also goes beyond this and detaches itself from this practical function, as, e.g., in art.

In psychological research, the theme of "creativity" brings together different subjects and areas of research, such as research into "talent, originality, imagination, intuition, inspiration, scientific-technical invention, artistic cre-

[3]Wolfhart Matthäus (1976): Kreativität, in: J. Ritter/K. Gründer (Hg.): Historisches Wörterbuch der Philosophie, Basel: Schwabe Verlag. DOI: 10.24894/HWPh.2099; first published: 1976 (my translation).

[4]Ibid (my translation).

[5]Philipp Stoellger, Art. Kreativität I. Religionsphilosophisch, RGG4, vol. 4, 1738f., 1739; English edition: Philipp Stoellger, Gerhard Marcel Martin, and Josef Lukas, Art. Creativity, in: *Religion Past and Present*. Consulted online on 20 September 2022, DOI: 10.1163/1877-5888_rpp_COM_12283; first published online: 2011.

[6]Ibid.

ation".[7] Especially with regard to the last topic, artistic creation, creativity research has a long tradition in psychology—in the evaluation of biographies of famous people or in genius research. For a long time, the aim was to analyse and understand the creative achievements of exceptional people, i.e., those that went far beyond the normal distribution of characteristics such as intelligence, diligence or work capacity. Studies on the relationship between intelligence and creativity are also part of this. Getzels and Jackson tried to prove that creativity is independent of the intelligence quotient of people.[8] Other psychological studies seem to confirm this: Creativity and intelligence are independent.

I would like to highlight this finding from psychological studies of creativity: Creativity does not seem to be identical with superior intelligence, but can sometimes even be the result of ignorance on the part of the intelligent. It should be added, however, that the identification of creativity is always subjective. The awareness of a creative deviation from the norm always depends on the fundamental attitudes of the person making such determinations.

In my academic field, theology and philosophy of religion, in such a situation, where the thing that is grasped with a concept like creativity threatens to become blurred—and this precisely also through subjective relativisation—one turns to the definition of the concept (i.e., creativity), which is then also ideally conceived.

1.2 Creativity in the perspective of theology and philosophy of religion

The concept of creativity plays an important role in the philosophy of religion and in theology. This is particularly true in relation to God the Creator. In Christianity it is believed that God has the creativity to create a complete world (universe) out of nothing. It is understood as pure free creativity to begin a new state without reference to anything that already exists. Plato's Demiurge, who orders the existing chaotic matter into a world, a universe, in analogy to his own perfection, or Aristotle's Unmoved Mover, who orders everything as an unsurpassable state of perfection, i.e., towards himself as the ultimate goal, are also creative in a certain way. That their creativity is limited becomes clear in relation to the Christian God, who in a free creative activity creates the world out of nothing.

According to Immanuel Kant, such creativity is synonymous with freedom par excellence. As Kant defines it: Freedom is "the ability to bring about a state of affairs of one's own accord, the causality of which, according to the law of nature, is not in turn subject to any other cause which determines it

[7] Wolfgang Matthäus, Art. Kreativität, fn. 3 (my translation).

[8] Jacob W. Getzels and Philip W. Jackson, Creativity and Intelligence, New York 1962.

according to time".[9] Kant called this a pure transcendental idea—the idea of something outside experience, a kind of limiting concept of all experience. If we take the idea of creativity here out of its specifically Christian background and formulate it more generally in terms of the philosophy of religion, we can profile it by its opposite. "From the point of view of the philosophy of religion, creativity shows various accents in response to its opposites: creativity stands for innovation in contrast to tradition; it is the 'new' in contrast to the 'old'; it stands for the transcendence of mimesis in contrast to nature. Despite all the correlations, creativity cannot be extrapolated from what has gone before".[10]

We find Kant's idea of freedom, which we have just mentioned, originally elaborated in the concept of creativity in Christian theology. This is the idea of the creation of the world (in the sense of the universe) out of nothing. In the doctrines of theology, the concept of creativity is related to God and thus defined in an ideal way. In principle, theological doctrines always proceed in an idealising way—i.e., they do not attempt to determine the objects they deal with in a generalising way on the basis of a lot of data, nor do they attempt to do so experimentally.

A concept acquired in relation to God, such as the concept of creativity, then functions in relation to the less ideal conditions of the empirical world as a borderline concept to which any talk of creativity must ultimately be oriented.

With the assumption of the creation of the world out of nothing, a purely free creativity is attributed to God in order to start a new state without referring to anything that already exists.

In the course of its history, Christian theology soon developed an understanding of nothingness as pure nothing: it was thus understood—in the Greek vocabulary—not as μὴ ὄν but as οὐκ ὄν. To speak of creation from nothing (*creatio ex nihilo*) is to think of nothing. But nothing taken for itself cannot be thought. We can only think nothingness in distinction from what exists.

What is meant by nothingness can then be thought in at least two ways. On the one hand, nothingness can mean the radical opposite of being. In Greek this is expressed by the negation οὐκ ὄν—nothingness as the complete opposite of being.

On the other hand, nothingness can mean the negation of something that exists—that is, what it no longer is or has not yet become. In Greek this is expressed by the negation μὴ ὄν. Nothingness is understood in this sense as a not-yet, which carries with it various possibilities that are not (or not yet)

[9] Immanuel Kant, Kritik der reinen Vernunft, B 561.

[10] Philipp Stoellger, Gerhard Marcel Martin and Josef Lukas, Josef, Art. Creativity, in: *Religion Past and Present*. Consulted online on 20 September 2022, DOI: 10.1163/1877-5888_rpp_COM_12283; first published online: 2011.

realised. If I were to say, as Plato did, that God created the world out of the matter that was present to him, then I would understand "nothing" in this negating sense: it is not (yet) this and that—whereas it could be anything.

When the Christian faith speaks of creation out of nothing, by contrast, nothingness is understood as a complete, fundamental non-being. Such nothingness cannot necessarily be defined. It can be addressed (e.g., in myths), but not thought of in a strict sense.

The attention of theology, in its statement of a creation out of nothing (*creatio ex nihilo*), is then less on the "nothing" than on the Creator. The logic of action, as it were, dominates the understanding of creativity. The emphasis is thus on the fact that in creating out of nothing, the Triune God affirms Himself, and thus His Godhead, and is creative by connecting Himself to nothing other than His own Being.

The "nothing" here is understood as pure nothingness (οὐκ ὄν)—and not as not-yet-being in the sense of not-yet-realised possibilities that are being explored anew in reality, which contains many possibilities. Martin Luther put it very succinctly: "*creare est semper novum facere*: creativity means always creating something new".[11]

So it is said of God that he creates something out of nothing. Not only is something new created, but a completely new beginning is made by God. Creativity, in the strictest sense, is an act of innovation par excellence. God creates something new—something new in relation to himself. What is "new" about it?

The newly created is an Other in relation to God—an Other in which one's own self is not actually realised, but in which one's own self is transcended.

To quote Martin Luther once again: "*haec est natura Dei, [...] ex nihilo creare omnia*: it is God's nature to create everything out of nothing".[12]

In the evaluative perspective of the Christian faith, creation out of nothing expresses that it is love out of which God affirms others than himself and thus allows nothing to become something.

If we generalise this consideration with regard to human creativity, the hallmark of creativity would not only be an innovative, new solution to a problem, but also the transgression of the human being out of himself towards an Other, which, strictly speaking, is actually a stranger. A creative person has to leave—transcend—himself, that is, his previous understanding of things and the familiar ways—and not just vary what is known so far.

God is a subject who begins with himself and only begins with himself. In the model of the divine Trinity, in which some theologians systematised the diversity of Christian talk about God and the diversity of human experience

[11] Martin Luther, Resolutiones disputationum de indulgentiarum virtute. 1518, WA 1, 563,8.

[12] Martin Luther, WA 40/III, 154,11f; cf. WA 1, 183,39f.

of God, this is expressed in the figurative but actually modelling talk about God the Father. In fact, the model of the divine Trinity is a product of theological creativity. As Father, God is par excellence the one who begins, the one who acts on his own initiative. In the Trinitarian model, God the Father stands for the fact that God is pure activity and inexhaustible possibility in one. This is nothing less than absolute freedom. As Father, God is the free and therefore the creative par excellence.

Whereas we, in the context of our world, can only begin in such a way that something is already given, God the Father can make an absolute beginning—that is, a beginning without any specification; a creative beginning out of nothing.

While for us the rule is: nothing comes from nothing, for God it is true that he can make everything out of nothing.

Such ontological creativity only became conceivable "in the expansion of the horizon of possibility, when the concept of infinity was transferred to God [...] with a 'turn' from the primacy of reality to that of possibility".[13] This can already be seen in Gregory of Nyssa and is then developed, above all, by Duns Scotus and William of Ockham.

In the early modern period, at the latest, the idea of the perfection of nature dissolved into an awareness of a contingent constellation that "no longer had to be imitated, but artistically and technically transcended".[14] Georg Wilhelm Leibniz took this broadening of horizons even further. For a long time, only God's creativity was regarded as essential and human creativity as non-essential (since it was ultimately understood only as imitation [*mimesis*]). When the latter became independent in art, but also in technology and science, the legitimacy of human creativity could no longer be denied.

At the same time, however, its ambiguity became apparent. From a theological perspective, human creativity is always seen as ambiguous. It becomes particularly problematic when it is equated and confused with God's creativity. In any case, the creative energy of the human spirit is always judged critically, despite the appreciation of successful creations. From a theological perspective, the results of human creativity are always ambiguous and to be used in different ways. However, this critical view of human creativity is itself misguided if it defames human creativity.

The capacity for creativity is theologically given to human beings by being created in the image of God, and it is part of human beings' God-given freedom to be creative themselves. Therefore, a non-use of creativity and an inertia of the spirit would also be contrary to this gift of God. This is especially true with regard to the creativity made possible by the gift of

[13] Philipp Stoellger, Art. Creativity, fn. 9.
[14] Ibid.

language, through which man can also deal with problems by inventing new metaphors and models and thus open up new perspectives.

In order to structure the reflections on the theological concept of creativity systematically, we can specify the analysis of creativity in theology and philosophy of religion in at least four ways: according to a logic of origins, a logic of action, a structural logic and a semiotic logic.

If we look at creativity according to the logic of origins, creativity belongs "to the essence of all that is"—which in the world of religions leads us to myth, in which this origin and creativity is expressed narratively.

If we look at creativity from the logic of action, we must conclude that creativity is an action that presupposes a creative subject. It is only since the Renaissance that this has also been attributed to human beings—whether in competition with God's creativity or as a consequence of human beings being made in the image of God. Interestingly, human creativity has been more often theologically criticised than positively appreciated. But philosophically, too, the emphatically creative human subject has been criticised, especially when it has been linked to the cult of genius.

Looking at creativity in terms of structural logic, creativity is understood "as the purpose of a process in which something new is created. The advantage (but also the limitation) of these perspectives is that they do not rely on a creative subject. Moreover, attention is drawn to the emergence of ontological innovation [...]. Signs are not only interpretations, but also existing relations".[15]

Finally, creativity can be explained semiotically "as a quality inherent to a subject or process, in that both the process of signification and the user of signs are capable of being creative". Here we can refer to Charles Sanders Peirce's concept of "abduction". "Signs are not only interpretations but also stand for real relations. The use of signs is therefore an act by which real things are created"—as in speech acts. "In relation to a natural language, the specific manifestations of creativity are metaphors and allegories".[16]

2 Creativity in the sciences

Human creativity cannot create something out of nothing. Under the conditions of finiteness, however, a "*creatio ex aliquo*", a creation out of something, is possible. "Creative processes do not start from nothing, they do not begin with nothing, but they presuppose something, they are connected to something that they transform, reform or even radically revolutionise. [...] But the something to which creativity is linked cannot be determined and constructed on the basis of predetermined rules. [...] If creativity and what is designed, built, [...] formed with the claim of being creative could

[15] Ibid.
[16] Ibid.

be reduced to a rule-based, learnable and reproducible knowledge, it would be superfluous to speak of creativity as the creation of something new. [...] In this respect, creativity is more and different than mere technical problem solving. By referring to something that has gone before, it refers to unfinished, inexhaustible possibilities. And sometimes it is necessary to think the impossible in order to make the possible real and to sharpen the sense of the possible. [...] Thinking creatively and promoting creativity in scientific, artistic and organisational contexts would therefore mean giving space and time to thinking in the subjunctive and in the potentialis".[17]

This means that creativity always includes the possibility of failure and lack of success. In science in particular, the failure or non-success of scientific projects is not seen as a good thing. If experiments do not produce useful results, they are usually not published, even though they may provide insight. And also: Many new hypotheses or theories have met with incomprehension among contemporaries. Failure can therefore also mean that the time was not yet ripe for a new insight or observation. But even an error, which in a way is also a failure of a scientific investigation, is not meaningless on the way to truth. You only get to the truth if you risk the error. Nor can efficiency be a criterion of success in science. Researchers who pursue their curiosity are often inefficient, ponderers, collectors or tinkerers obsessed with a question, a problem or an idea. Eagleman and Brandt write: "Creative output typically requires many failed attempts. As a result, across human history, new ideas take root in environments where failure is tolerated. [...] Human culture is littered with ideas that have been rejected by the public and passed into oblivion."[18]

At the beginning of this paper, I raised the question of where creativity is needed in science and where it is not. I added the question of what kind of creativity is useful in science. I have just given an initial answer to these questions. It makes sense for new research questions, approaches and methods to be used in the sciences. "New" here means genuinely innovative, leaving behind previously trodden paths, not just varying previous research. For young researchers, this is very risky, because the result of such research can also be that the research question is unproductive, the research approach does not lead to results, or the method is not really helpful. This usually means that a scientific career ends before it begins. In this respect, it is more important for established researchers to be creative in this sense and to go beyond their own successful research profile to really pursue new questions and develop new methods.

[17] Andreas Großmann, Kreativität als Denken und Praxis des Möglichen. Zur Einführung, in: Andreas Großmann, Kreativität denken, Tübingen 2020, 1–7, 3f. (my translation).

[18] David Eagleman and Anthony Brandt, The Runaway Species: How Human Creativity Remakes the World, Edinburgh 2017, 176, 180.

A second response: With regard to the methodisation of new research approaches, the abductive method is particularly interesting in terms of creativity in science.[19] Charles Sanders Peirce reintroduced this method into the philosophy of science. For Peirce, scientific statements are about a context of discovery, not a context of justification (as with the positivists). According to Peirce, it is the logic of discovery that is important, not the logic of inquiry. "Abduction is that kind of argument which proceeds from a surprising experience, that is, from an experience contrary to an active or passive belief. This takes the form of a perceptual judgement or a proposition referring to such a judgement, and a new form of belief becomes necessary to generalise the experience". "Deduction proves that something must be; induction shows that something is actually operative; abduction merely suggests that something might be."[20]

Thus, an explanatory hypothesis is formed abductively on the basis of an experience or observation that surprises or irritates, disturbs or challenges the usual experiences and observations. Predictions are derived from the hypothesis and facts are sought to verify the hypothesis. Abduction is thus the starting point of the actual cognitive process that follows perception.

Peirce also emphasised the creative moment and the originality of the idea that appears like a flash of lightning, while being aware of the ambivalence of this spontaneous event. "The abductive conjecture comes to us in a flash. It is an act of insight, albeit an extraordinarily deceptive insight. It is true that the various elements of the hypothesis were previously in our minds; but the idea of bringing together what we had never dreamed of bringing together before, flashes the new conjecture into our contemplation".[21]

As a theologian, I see an analogy here with a mystical insight, the point of which is also that after a long contemplative preparation—an exercise in concentration—the thing to be known suddenly falls into thought. This is the beginning of thinking, of reflecting on the thing that has thus become present, and thus the actual process of cognition.

Analogies can also be found in Aristotle, for whom philosophy begins with astonishment, surprise and wonder. He had in mind above all the irritating astonishment, e.g., that something is not in its usual place, which triggers thinking and makes one ask about the preconditions that led to the irritation, but also about the preconditions of the usual order.

In Christian theology, too, amazement (surprise and wonder) has a cognitive meaning. But while philosophy seeks to overcome the surprise and wonder that go hand in hand with ignorance, amazement remains

[19] Cf. Lorenzo Magnani, The Abductive Structure of Scientific Creativity. An Essay on the Ecology of Cognition, Cham (Springer Nature) 2017.

[20] Charles Sanders Peirce, Collected Papers, Vol. 5, ed. by Charles Hartshorne, Cambridge 1934, 171.

[21] Ibid., 181.

permanently present in faith. There, too, people are astonished because they hear and see something. Here, too, amazement is provoked by something unknown and leads to knowledge. But this unfamiliarity does not become ordinary and normal. Rather, the following applies: "The more you recognise the amazing, the more amazing it becomes".[22] This, of course, has to do with the mysterious character of faith and thus with the amazing God. For this reason, theological knowledge does not come to a standstill in the end, but is always set in motion anew by this amazement. In view of this, I would conclude that creativity in science presupposes a sense of amazement, a sense of surprise and wonder—be it frightening or joyful—and thus being intellectually moved and taken in.

A third answer to the question of where creativity is needed in the sciences, and what kind of creativity is useful, can be given in relation to the evaluation of observations, experiences and data. Semiotically, creativity is needed to find a new language for new knowledge. This is particularly evident in the creation of new metaphors and new models.

My subject, theology, offers many examples of this. They can already be found in the Hebrew Bible, where the understanding of God was creatively developed again and again with new metaphors and models. Such examples can then be found especially in the New Testament, already in Jesus and the evangelists who portrayed him, and then even more conceptually in Paul. Paul, in particular, had to recognise that the old metaphors, images, narratives and models could only inadequately capture and express what happened with the incarnation of the Logos in Jesus Christ. New metaphors, images, narratives and models had to be formulated and accompanied by a new religious practice. You cannot put new wine in old wineskins, but in new wineskins (Mt 9:17).

This creative new way of thinking about God, documented in the New Testament, also required new models of God. The doctrine of the Trinity of God is basically a simple, complex model of God in which the many different ways of talking about God in the New Testament have been brought together and thus been modelled in the contexts of life with a variety of experiences of God. The Trinitarian model of God is an excellent example of creative intellectual innovation because it allows for a whole new understanding of God (for example, that God's unity does not exclude plurality). At the same time, this model works back to the interpretation of the diversity of life in the horizon of God. The Trinitarian model of God has a hermeneutical function in relation to the human situation. For it makes our own life situation understandable to us in such a way "that we find ourselves created by God and fallen with him, that as such we are found by God through Jesus Christ, and that we are guided by the Holy Spirit to find the right way to the goal

[22]Eberhard Jüngel, Zum Staunen geboren. Predigten 6, Stuttgart 2004, 10.

and end of life".[23] The trinitarian model is complex because it not only models a diversity of discourses of God in the Bible, but also preserves rather than harmonises the diversity of God's relation to human beings. A new creative innovation in thinking about God would have to at least match the capacity of the Trinitarian model. Anything else would be neither creative nor innovative.

From this I would like to draw a general conclusion for the topic of "creativity in science": Creativity in science not only cannot be prescribed, it cannot even be demanded. If creativity is lacking in science, this is not a fundamental deficiency. Uncreative science can be very sound. We cannot, for the sake of research creativity, constantly replace models and theories that have proved their worth with new ones—and certainly not if they do less than the previous ones.

Nevertheless, science must remain open to new creative models, metaphors, theories and the like—for the sake of a better understanding of the problems and issues being researched.

[23] Gerhard Ebeling, Dogmatik des christlichen Glaubens, Vol. 1, Tübingen 1979, 545.