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How do you talk to a physicist about God?

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Abstract. Three quarters of all Americans without religious affiliation perceive science and religion to be in conflict. On the contrary, most academic theologians see no conflict at all. How can the perception in the general public and among the experts be so different? In a nonreligious worldview, the notion of God is often related to explaining scientific results or properties of nature: it is the 'God of the gaps'. Here, I set this against the biblical concept of God as perceived in human life and history. Thus the foremost question is not whether God exists, but how he is experienced and what the term God means. I argue that religious experiences must be a fundamental element in the dialog between science and theology. Much of today's dialog deals with the question how God could act in a world given by physical laws. Such a question sets out from physics, draws attention to gaps in the physical worldview, and for that very reason misses many contemporaries and particularly physicists. The dialog must move to the question of how we directly perceive reality in general and what is referred to as the Divine in particular. Embodied cognition as discussed in modern psychology may point in the direction of where to proceed.

Keywords: gaps, methodological naturalism, methodology of physics, Notion of God, physicalism, religious experience.

Introduction

'I don't need the God hypothesis to explain the universe and I don't use it', one of my astrophysics colleagues stated recently to open a panel discussion. Here I do not present an apology for the need of the notion of God nor a missionary effort to convince colleagues to use it, but a justification for talking about God in the current worldview and thinking about God myself as a physicist. Is there a need for such a justification? In Isaac Newton's masterpiece, the *Principia* (1687), the word 'God' appears sixty-three times. In this classic work of physics, science and religion are closely related. Today the word 'God' is missing completely in the more than one hundred thousand professional publications on physics per year. Public opinion tends to assume a conflict between science and religion, particularly in the group without religious affiliation (76% in the USA, Pew Research Center 2015). This is in contrast to the theologians I met at the ESSSAT conference in Lyon 2018 and to most contemporary experts in the science-religion dialog (*e.g.*, Losch 2011; Russel and Ferngren 2002: 7), who do not see a conflict. A considerable fraction (40%) of the physicists and chemists at American universities declare themselves as nonbelievers, but three quarters of them are interested in spirituality. Only 10% of all scientists are pure materialists (Ecklund and Scheitle 2018: 56). I suspect that many academic scientists consider themselves as agnostic or incapable of understanding religion. How can this discrepancy between scientists and theologians be relieved?

1. Do not start with gaps in scientific explanations

A scientific explanation uses causality and chance to interpret objective observations or measurements. In physics, mathematical equations link the previous state of a system to a subsequent state, unfolding the development in time. Causality and chance are very successful tools in explaining the observed reality. The explaining model or theory may be disqualified by further observations. Contrary to popular belief, explanations are quickly conjectured and so there is always some scientific explanation. Of course, many phenomena are not 'well explained'. Thus the explanation may be speculative and not tested by further investigation. In public they are often referred to as 'gaps'. Examples of gaps lacking good explanations include, *e.g.*, the formation of earth-like planets, the acceleration of energetic particles in solar flares, the nature of dark matter, cosmic fine tuning, the Big Bang, chaos, quantum uncertainty, etc, etc. There is a plethora of phenomena in physics we do not understand adequately. The rule is that when such a gap is filled, at least one new question pops up. For this reason physics will never come to an end.

Poorly explained results or gaps are the working fields of scientists. It is where further investigations are most promising to yield new science. Scientists generally do not associate gaps with God. Thus gaps are not considered as reservations for God. What a strange idea that God is pushed back – like Indians in North America – to territories which get smaller and smaller with time! From this point of view it is comprehensible that putative gaps are the wrong start for talking to physicists about God. Paradoxically, the science-religion dialog started in the past with scientific questions, such as the center of the universe or the creation of human beings, and it is still focused on gaps.

2. Reject strong physicalism

What is the foundation on which reality is grounded? Neurology applies biological explanations; biology is assumed to be based on molecular chemistry; chemistry is the result of quantum mechanics. Does that mean that all reality is based on physics? Such is the claim of materialism or physicalism. Today the two terms are synonyms, but materialism has a history that goes back to Greek philosophy (Mutschler 2016: 10-13). We will use the new term physicalism here, because it refers to the above chain of assumptions. A third term, naturalism, is also in use. It delimits reality from the supernatural and assumes the absence of God in the real world.

Objectivity in physics means that a measurement can be reproduced by a different person using a similar apparatus. Such data are considered facts. The data alone are not sufficient to explain reality. Physicists explain them by a mathematical model or theory having the form of equations, sometimes known as 'laws of nature'. The theory allows us to infer parameter values between measurements, in the past or the future. Theories can be proven false if the inferred parameters turn out to disagree with subsequent measurements. Thus theories are not true, but may be falsified in the future (Popper 1959: 17-20). Nevertheless, a theory may be accurate enough to be used for building a machine or forecasting a process. Physics has received much recognition for such technical applications. It has been a major driver for technological progress in the past two hundred years.

Sometimes we forget to be astounded how successful physics is. Mathematics has turned out to be 'unreasonably effective' (Wigner 1960: 2) in physics since Galileo

Galilei's first application of it four hundred years ago. A few fundamental equations seem to hold through the entire universe. Students in physics can master them in four years. These equations yield explanations for all observations in astrophysics and in the laboratory.

The limits of physics are where its method can no longer be applied. We will never be able to directly observe the interior of the Sun. However, there are indirect ways to infer the processes taking place there through messengers, such as neutrinos. Thus the Sun is a physically accessible object all through. This is not the case for the time before the Big Bang and the space behind the Schwarzschild radius of black holes, where observations are excluded by physical laws and theories cannot be confirmed. A different limit, more relevant for human beings, is the restriction on objective and reproducible measurements that the method of physics requires for its input data. It excludes phenomena associated with the human consciousness. They are crucial for religious experiences and will be discussed later.

Physicalism claims that reality can be explained by physics. We may distinguish between weak, intermediate, and strong physicalism. By *weak* physicalism I mean the assumption that every physical observation has a physical explanation in terms of causality or chance. Of course, the assumption cannot be proven until all observations are made. Yet, physicists will search for such explanations. Thus the physicalist assumption may be considered part of the method of physics. It is well accepted and successful. *Strong* physicalism aims at all reality, not just the physics part, and claims that all will be explained by current physics. In particular, neurological phenomena, associated with mind and consciousness, are claimed to be reducible to quantum mechanical processes. This is certainly a far reaching assumption considering that today not even biological macromolecules can be modeled physically. More modest is *intermediate* physicalism, believing that future progress in physics will allow the explanation of mental processes. However, it is unconceivable how a subjective self could ever be explained by objective modeling, in other words how the first-person perspective can ever become a third-person perspective (Aus der Au 2011: 15).

Physicalism beyond physics is speculative. In fields like psychology, it drastically reduces reality to the objective part. Physics is certainly a fundamental science, but identifying it with the foundation of reality would be more than physics. The basis on which reality stands remains a mystery.

3. Be prepared for scientific positivism

Observations are basic for modern physics, to the point that physical parameters like time, space, energy etc. are defined by measurements. The question of existence is replaced by the question of how to observe. The unobservable luminous aether, suggested as the medium in which light is propagated, was discarded by Albert Einstein (Schilp, 1949). The success of special relativity strengthened the requirement that physics should deal only with observable entities. The epistemology of other fields of science, in particular biology, changed at about the same time. Philosophical positivism became more and more influential. It claimed that 'positive' (*i.e.*, objective) observations are the only source of all human knowledge. Metaphysical statements that are not based on objective observations are meaningless. Religion in the form of metaphysical constructions is rejected by positivism (Comte and Lenzer 1975: 330).

Individual fields of natural science still operate successfully according to such positivist principles. As our current worldview is significantly influenced by science,

positivism seeps also into the general public where it surfaces particularly with regard to the truth of religion.

Experimental physicists are realists. The real is what has an effect and can be experienced. The question about the experience of reality is more basic for science than a metaphysical ontology. Where would God fit into my worldview if he existed? is meaningless if it is a metaphysical question. 'Epistemology models ontology', Polkinghorne (1973: 440) commented concerning quantum mechanics. For a physicist asking for the reality behind the 'God hypothesis' the question is simply: How is God experienced? For those who experience God, his existence is not a question.

4. There is more than science

The claim that there is more than natural science challenges the worldview of strong physicalism. It is an issue in the recent science-religion dialogue (Losch 2005: 275–290). From what was said above it is clear that for a person with scientific background such a claim cannot be based on ontological arguments but on observations or experience. A claim for 'more than science' must be more than a hypothesis in a scientific worldview. The claim is that 'there is more to be perceived than in science.' Again epistemology and cognition must precede ontology.

The realm of physics and science in general is limited by the requirement of objective observations. What is perceived beyond this limit contains a subjective element. Such perceptions are not reproducible and not quantitative. Are they real? They may concern a real object, like a piece of art, but the experience includes a human being that reacts to the object. The reaction may be a sentiment, a feeling or anticipation. The human mind gets into resonance with the object; it participates in the perception. Such participatory perceptions (Benz 2016: 100-104) are not forcing and – since subjective – are different for each person. Yet, they may be similar for many people. This is why some paintings get higher prices on the market than others. Initially, a participatory perception is pre-rational. It is direct without being scrutinized by reason. At first sight, a piece of art may be overwhelming, but it may turn out at second sight to be factitious or kitsch. Critical reasoning is necessary to avoid subjectivism. To be taken serious, participatory perception must be more than the purely subjective experience. The real is what has a lasting effect and does not turn out in the long run to be an illusion.

What are the sensors for perceptions that are more than science? Human perception is different from scientific measurement. The first interfaces to reality are the sense organs that have similarities to physical sensors. Human cognition, however, differs widely from scientific data analysis. Cognition includes not only brain activity, but neurons all over the body, the mood of the person, emotional tensions, feelings, the prehistory and the environment of the perception. It is 'embodied cognition', a subject of recent psychology (e.g. Varela *et al*. 1991; Wilson and Folia 2016). Embodied cognition helps individuals to orient themselves in the outside world, where it is important to anticipate the imminent future (Clark 2015).

Participatory perceptions of the kind of embodied cognition operate already in the animal world (Thomas 2018). In fact, it was the archaic way of perceiving and has developed through evolution. Scientific forecast and rational analysis may be far superior in many incidences, but humans have not lost the ancient capability to perceive reality. It shows up for instance in the expression to have a 'gut feeling' in a rationally unclear situation. In many cases, the gut feeling is taken to be more relevant than rational reasoning.

Participatory perceptions enlarge our cognition of reality. The perceptions include interpersonal relations, individual conditions, beauty, and other realities of existence that are unreached by present-day science. They are fundamental to the human condition. As Antoine de Saint-Exupéry (1943: 82) expressed it: 'It is only with one's heart that one sees clearly. What is essential is invisible to the eye.' In fact, most experiences in life are not of the scientific type consisting of objective, quantitative, and repeatable measurements, but are subjective perceptions in which we participate. Beauty, love, grief, hate, empathy, inspiration, fascination, motivation, amazement, and so forth are everyday experiences that shape our life.

Poets and writers do not hesitate to assume that more can be perceived than in science. Non-objective perceptions are essential to human existence. If they all were just illusions, human existence would be an illusion. Most scientists are realistic enough to reject such a statement. Only through physicalism can the question of 'more than science' become an issue in science and religion. It is possible to talk about God only if there is 'more than science'.

5. Religious experiences are participatory perceptions

William James (1902) in his classic treatise *The Varieties of Religious Experience* describes a large number of different religious perceptions: mystical experience, sense of a (divine) presence, spiritual unity with the cosmos, overwhelming happiness, answered prayers, etc. Common to these experiences is that none of them is fully reproducible or objective. In all of them a person participated, who found it a relevant or even transformative event. None of the experiences would objectively prove God. What they unequivocally testify, James (1902: 525) concludes, 'is that we can experience union with *something* larger than ourselves and in that union find our greatest peace.' This experience qualifies as a participatory perception. The interpretation of this 'larger' entity with God is possible, but depends on the cultural background and the belief system of the person. The Bible reports on a large variety of religious experiences. They all have in common that none of them was an objective and reproducible event in view of today's science. However, we are told that they changed people's life and for them they were as real as reality can be.

In public talks I often notice that people are amazed about scientific results. They are astounded about the size, beauty, and dynamic history of the universe, about its functionality and fine tuning, its creativity, about the hospitality of planet Earth, and the mere fact that there is something and not nothing. Amazement is a participatory perception. It is not reported in scientific publications, but it would be a bad scientist who is not amazed now and then. Amazement is a meeting point with religion. A person with religious experience in life will interpret cosmic marvels as works of Creation. Utmost care must be taken that the marvels are not unintendedly turned into putative gaps, which would bring us back to Section 1. Everybody should be amazed; only people of faith based on religious experience in their life, however, may interpret such experiences as signatures of a benevolent Creator. Such an interpretation is not a logic explanation in the way physics explains by causality or pure chance. It is not science and must not explain the astonishment away.

God cannot be perceived directly in the astounding wonders of the universe. Nevertheless, they may be compared to icons venerated in Eastern Orthodox Churches. Icons aim at mediating an emotional and existential relationship to the saint or the scene depicted and, beyond that, to the Divine. Science does not suppose genuinely sacred objects or processes in the universe that are distinct from secular things. No holy

intervention is required for instance for a star to form. Yet it is possible to perceive in such creation the realization of a divine idea. This post-mythical perception of the sacred (Gatta 2004: 242) does not make star formation into something removed from natural processes. It remains an icon, as many other things may become iconic and remind believers of the transcendent foundation of reality. Most importantly: icons require viewers to participate in them.

6. The language of religious experience is metaphorical

Section 4 describes how physics and religion start from different perceptions of reality. Observations selected by the exact sciences are objective and quantitative facts, apt to be modeled by mathematical theories. The measurements correspond to reality within the error margin of the instrument. Theories are falsifiable and may be disproved by new observations. Religious perceptions, like all other participatory perceptions, are not quantitative. They could be illusory and may not even reflect reality. The mathematical language of the exact sciences is not possible and separates religion even farther from physics.

On the other hand, the language that describes participatory perceptions is rich in metaphors, using well-known objects or processes as images to communicate abstract or difficult concepts. Although theology may argue rationally, metaphorical language is necessary to express its experiential basis, using imagination, instinct, or intuition. Describing the experience of God metaphorically has a long tradition in the Bible: God is like a source of water, a mother, light in the dark, etc. What are religious experiences in today's reality and language? A modern example of how metaphors are used to describe a religious experience is the mystical perception Blaise Pascal (1948: 117) describes it in his memorial as feelings of certitude, joy, and peace. He notes it metaphorically as 'fire' and then continues with interpreting the 'fire' as the 'God of Abraham, God of Isaac and God of Jacob'.

Section 4 claims that the reality perceived by humans is larger than what science is based on. The perception of beauty, for example, has a subjective part. It cannot and will never be part of science. Religion goes one step further. Link (2018: 67) notes that beauty shines in the natural world, and where this happens, the view opens up into that depth which is called Creation by its theological name. Link reminds us that participatory perceptions refer to reality in our world. They may also give a hint of an external agent, however. It may be the case when we feel as though we are being addressed by a text; or feel as though we have received a gift, referring us to a giver, or be called to some duty by a caller. As in the case of Pascal, God is not perceived directly but is a subsequent and often rational interpretation. More explicit experiences of God are reported in traditional texts like the Bible often in a language that today is more difficult to understand.

Faith is more than knowing the answer

It is conceivable that participatory perceptions and metaphorical language are felt as slippery ground by people of science; religion then seems to be strange and remote. So why talk about God at all? Because it is where the big questions arise. They concern the meaning of all, orientation towards the goal of life, the origin from where we ultimately come and where we go. These questions cannot be answered by science and must not be shortcut by religious catchphrases. The answers may be left open, but in a religious perspective they become less pressing.

This perspective is known as faith. In everyday language faith is equated with believing something that cannot be proven. In theological terms, faith is more than conceding something to be true; faith means to trust in something that is or may become important in life. It is a pre-understanding of reality that must be confirmed and strengthened through daily experiences and tested in existential crises. It may appear like a rigid belief system for some people, but faith should the opposite: openness toward reality whatever will come to us. Faith should develop in life from a childhood faith into a mature faith.

Hans Weder (1992: 150) remarks: 'With faith, thinking begins anew.' It is the change of perspective that enables talking about God. Faith functions somewhat like a sensor for godly experiences in daily life. In the perspective of faith, the sense of wonder becomes a possible point of contact with science. The nexus does not prove faith in God but can relate faith to objective reality and can make faith understandable for believers as well as nonbelievers (Benz 2000: 54; Rom 1:18, 19).

Science-religion dialog

Physics and religion may be brought into a common view. The two perspectives may meet for instance in our amazement at the magnificent functionality of the universe as revealed by astrophysics. Our physical knowledge of the workings of the cosmos may resonate with the first-person perspective in a starry night and with the notion of grace for the whole world. Even chance and laws of nature are then not simply a matter of course, but a reason for gratitude (Benz 2016: 151).

If the science-religion dialog is to reach physicists, it has to leave the objective plane and insist that religion is more than dogmatic assumptions or unprovable claims. The situation is comparable to the state of theology around 1800, when Schleiermacher objected to the philosophical theology of the Age of Enlightenment. Schleiermacher (1996: 13) asserts that religion cannot be found in cold argumentation but in the depth of the heart ('Gemüt').

It must be clear that the underlying perceptions in physics and religion are different. If not, physicists do not understand it and will not be able to go on to meet religion and to discuss ontology and even ethics. What is needed in the current science-religion dialog is a return to religious perceptions and a new start. The theological side must go back to the plethora of human experiences and, on the other hand, science must not exceed the range given by its limited observational basis. This new dialog may be incomprehensible for some of today's scientific atheists stuck in controversies of the past. However, it is better to be not understood at all than to be misunderstood.

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