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Leonhard Euler as an apologist

One of the greatest scientists of the eighteenth century was Leonhard Euler, known today primarily as a mathematician, although the range of topics competently addressed in his books, pamphlets, articles, and letters is stunningly wide and his contribution to science is inestimable.¹ Much less frequently, Euler addressed problems of philosophy and religion in his writings, and if he did, he expressed his inadequacy in grappling with philosophical issues.² However, philosophical problems were sometimes very closely associated with the problems of physics, and thus physics led him to philosophy. Religious problems, on the other hand, were important for him as a devout Christian.

A religious life

His father, Paulus Euler, was keenly interested in mathematics³ but studied theology and became a pastor⁴ and was the first to have instructed Leonhard in mathematics.⁵ In school in Basel he was privately tutored in humanities and mathematics by Johannes Burckhardt, a student of theology who became a

¹ The following abbreviations will be used in this article:

Defense: Defense of the divine revelation against the objections of the freethinkers.
Letters: Letters to a princess in Germany on different subjects in physics and philosophy.

OO: Leonhard Euler, Opera omnia, published since 1911 by the Euler Committee of the Swiss Academy of Science.

² «I sense my incapacity to be willing to enter [any deeper] into this important question», i.e., the question of the existence of evil (*Letters* 60). On the other hand, he was not shy to scold philosophers to be ready to accept any absurdity and proudly pronouncing about himself «as for me, I am too little of a Philosopher to embrace this sentiment» (*Letters* 17).

³ He defended under the supervision of Jakob Bernoulli and published in 1688 fifty propositions *Positiones mathematicae de rationibus et proportionibus* with his name and the name of Jakob Bernoulli as a supervisor appearing on the title page. In Jakob Bernoulli's *Opera*, Geneva 1744, vol. 1, the *Positiones* are republished with the name of Euler being omitted. Interestingly, Jakob Bernoulli once also studied theology.

⁴ M. Raith: Der Vater Paulus Euler. Beiträge zum Verständnis der geistigen Herkunft Leonhard Eulers, in: M. Jenni (ed.): Leonhard Euler 1707–1783, Basel 1983, 463.

⁵ Leonhard Euler: Autobiography, in: E.A. Fellmann: Leonhard Euler, Basel 2007, 5.

pastor.⁶ Euler received a master's degree from the University of Basel for his comparison of the philosophy of Newton and Descartes. Afterwards, at the urging of his father, he briefly studied theology and classical languages under Johannes L. Frey⁷ being at the same time tutored in mathematics by Johannes Bernoulli.⁸ This great mathematician was also a pious man who in his autobiography frequently thanked God and expressed his submission to God's will.⁹ It is important to notice that in his early years, Euler was under the influence of people who were not only interested and even devoted to mathematics and theology, but who also represented the common attitude in those days in Basel that «the symbolic pregnancy of mathematics allowed [one] to sense the proximity of God.»¹⁰

Euler soon switched to mathematics, and after he received a degree in this field, he moved in 1727 to St. Petersburg where he became a member of the St. Petersburg Academy of Sciences. In 1741, he moved to Berlin to become a member of the Berlin Academy of Sciences. In Berlin, he was also an elder in a French-reformed church in which he participated in the work of some committees and where he proposed certain changes, some of them based on his father's church.¹¹ Euler was disliked by the king of Prussia, Frederick II, and was repulsed by the antireligious atmosphere in the city, which prompted his return in 1766 to the St. Petersburg Academy where he remained for the rest of his life.

In his eulogy, Nicholas Fuß, who was Euler's personal secretary, the closest associate for the last ten years of his life, and a husband of Euler's granddaughter, summarized Euler's religious life thus:

«His piety was sincere and his prayers fervent and heartfelt. He fulfilled with great attention all the duties of Christianity without bigotry and pomp, was friendly to people and patient in high degree, but the latter with the exception of enemies of religion, in particular, the enlightened apostles of freethinkers, against whom he already in 1747 openly defended the revelation.»¹²

Religion was integrated into his daily life as testified by the fact that every evening he had devotions in his home with his family.¹³ The religious beliefs and

⁶ Raith: Paulus Euler (fn. 4), 463.469, note 16.

⁷ N. Fuß: Lobrede auf Herrn Leonhard Euler, Basel 1786 [1783], 14.

⁸ Euler: Autobiography (fn. 5), 5.

⁹ O. Spiess: Leonhard Euler. Ein Beitrag zur Geistesgeschichte des XVIII. Jahrhunderts, Frauenfeld 1929, 100.

¹⁰ Raith: Paulus Euler (fn. 4), 459.

¹¹ F.G. Hartweg: Leonhard Eulers Tätigkeit in der französisch-reformierten Kirche von Berlin, Die Hugenottenkirche 32 (1979) 15; «Euler's proposals are characterized by their sober character and by a strongly marked pedagogical aspect of their execution» (18).

¹² Fuß: Lobrede (fn. 7), 116.

devotion of the young Euler remained constant throughout his life. «Euler is not a man who one day would reject the ideas of his youth. His development has no turning points; from the beginning his spiritual growth progresses in a straight line.»¹⁴

In his prodigious output, only one slim pamphlet, *Defense of the divine revelation against the objections of freethinkers*,¹⁵ was solely devoted to religious issues. The pamphlet was published during his tenure in Berlin as a reaction to the rationalistic, antireligious atmosphere in the Berlin Academy and in the court of Frederick II, who was a sponsor of the Academy. Religious issues were also addressed in the *Letters to a princess in Germany on different subjects in physics and philosophy*.¹⁶ The *Letters* were written in the years 1760–1762 to a teenage princess primarily as a popular introduction to physics. They were published for the first time by Euler during his second tenure in St. Petersburg and have been widely popular.¹⁷ Out of 234 letters, some sixty letters discuss philosophy, and only a few among them include some discussion of religious issues. Religious topics sometimes appear as occasional paragraphs or sentences in the *Letters*, as is the case in other writings of Euler.

Dualism

In philosophy, Euler espoused a dualist ontology by following Descartes in distinguishing very strongly the physical world from the spiritual world. Bodies in the physical world are characterized by three essential characteristics:

¹³ Spiess: Leonhard Euler (fn. 9), 120; G. du Pasquier: Léonard Euler et ses amis, Paris 1927, 90.

¹⁴ Spiess: Leonhard Euler (fn. 9), 51. Cf. E. Wölfel: Leonhard Euler und die Freigeister. Zum Thema einer «vernünftigen Orthodoxie», in: W.E. Müller, H.H.R. Schulz (eds.): Theologie und Aufklärung, Würzburg 1992, 57.

¹⁵ [Leonhard Euler:] Rettung der göttlichen Offenbarung gegen die Einwürfe der Freygeister, Berlin 1747, in: *OO*, vol. 3.12, 265–286.

¹⁶ [Leonhard Euler:] Lettres à une princesse d'Allemagne sur divers sujets de physique et de philosophie, Saint Petersburg: Imprimerie de l'Académie Impériale des Sciences, vol. 1–2, 1768, vol. 3, 1772, in: *OO*, vols. 3.11–12. The *Letters* have been translated into several languages and had multiple editions. Some editors felt uncomfortable with the religious content of the *Letters*. For example, in the English translation of David Brewster, several religious fragments are excised. The second French edition, prepared by Condorcet, excised even more of them. Condorcet's excisions are listed by an anonymous editor (Jacques A. Emery) in a long appendix to the French translation of the *Defense*, *Défence de la révélation contre les objections des esprits-forts*, Paris 1805.

¹⁷ The list of Euler's publications prepared by Gustaf Eneström lists 111 different editions of the *Letters*.

extension, impenetrability, and inertia (*Letters* 80, 92, 121). That is, unlike Descartes, he did not find sufficient for extension by itself to be the only essential property of physical bodies, but followed Newton.¹⁸ On the other hand, spirits or souls (Euler used the two terms interchangeably) are without extension, impenetrability, and inertia. «Each spirit is a thinking, reflecting, reasoning, deliberating being that acts freely», in a word, a living being; «in physical bodies there is no intelligence, no will, no freedom» (*Letters* 93, 80).

Physical beings are passive; the source of any action is in the spiritual realm.¹⁹ Euler agreed with Newton's law that a body at rest remains at rest and a body moving with the uniform velocity continues this motion. This motion, however, can be stopped, and a body at rest can start moving when struck by another body, the change of state being due to the impenetrability of bodies. However, an ultimate source of motion is outside the physical world, but the explanation of how exactly a spirit can affect a body surpasses the domain of natural philosophy. According to Euler, «this power that each soul has over its body is a gift of God who established a marvelous connection between souls and bodies» (*Letters* 93), marvelous and unexplainable.

Being unextended, spirits are not divisible and thus «each spirit is a whole without any parts» (*Letters* 92). Also, as unextended beings, spirits exist without existing in a particular place;²⁰ however, when they act on a body, they act in a certain place.

For Christian Wolff, who was a leading philosophical authority in Euler's time, there are only unextended and intemporal «simple beings» or monads. Space is only some relation between monads and thus geometry and mechanics have only phenomenal validity and do not refer to true reality. Euler disagreed since «in this way, Geometry would be speculation completely useless and illusory and it would have no application to things that really exist in the world. Since if nothing is extended, why investigate the properties of extension? But because Geometry is without contradiction one of the most useful

¹⁸ «Force of inertia» or «innate force in matter is the power of resisting whereby each individual body, inasmuch as it is in it to do so, perseveres in its state of resting or of moving uniformly straight on» (Newton: *Principia*, df. 3). Inertia, extension, hardness, impenetrability and mobility are the universal qualities of matter (*Principia*, rule 3 of philosophizing); P.M. Harman: Force and inertia. Euler and Kant's *Metaphysical foundations of natural science*, in: W.R. Shea (ed.): *Nature mathematized*, Dordrecht 1983, vol. 1, 237.

¹⁹ [Leonhard Euler:] *Gedanken von den Elementen der Körper*, Berlin 1746, 2.52, in: *OO*, vol. 3.2, 347–366. The work was anonymously submitted in 1747 for competition on the monadic theory.

²⁰ A. Krause: Euler über die Teilbarkeit der Körper und die Ortlosigkeit der geistigen Substanzen, *PhN* 45 (2008) 54–60.

sciences, it should be that its object is not a pure chimera» (*Letters* 125).²¹ The reality of the material world is most natural and indestructible conviction of men and also of animals: a dog barks at an approaching person convinced that the person exists. «This dog is not an Idealist» (*Letters* 97). «If a peasant wanted to be a Philosopher and [wanted to] claim that a Bailiff is but a phantom and fools are the ones who take him for something real and listen to him, this sublime Philosophy would be soon destroyed and the head of this sect would very soon feel the force of the proofs of the reality of the existence which the Bailiff would give him» (*Letters* 118). Thus mathematics does not investigate a world different from the physical world; it investigates the physical world from a higher and more abstract point of view. Therefore, when extension is infinitely divisible then so is the body.²² In this, Euler too hastily and too straightforwardly transferred properties of geometrical bodies to physical bodies.²³

By saying that the basic entity is a simple being or a monad, the Wolffians created a monistic ontology by abolishing the difference between the physical and the natural worlds (*Gedancken von den Elementen der Körper*, 2.43). In their view, not only perceptible bodies are composed of monads, but spirits are also monads and even God. Euler could not accept the contention that his soul is «similar to the last particles of a body» and even less the fact that «several souls taken and joined together could form a body, a piece of paper, for instance, with which one can light tobacco in a pipe» (*Letters* 92). In this way, everything that exists would be a subject of the same laws and this for Euler is simply an offence to God²⁴ and to the grandeur of the spiritual world. It apparently matters little to Euler that monads which are not extended have spiritual characteristics and that the physical world is but a phenomenal side of the world of monads. To Euler, monism is not acceptable since the nature of physical bodies and spirits must be different.

²¹ The usefulness of geometry and arithmetic has already been expressed in the *Declamatio de arithmetica et geometria*, a speech that Euler gave in Latin as a fourteen year old youth, P. Schafheitlin: Eine bisher unbekannte Rede von Leonhard Euler, *Sitzungsberichte der Berliner Mathematischen Gesellschaft* 24 (1925) 10–13.

²² V.P. Zubov: Die Begegnung der deutschen und der russischen Naturwissenschaft im 18. Jahrhundert und Euler, in: E. Winter (ed.): *Die deutsch-russische Begegnung und Leonhard Euler*, Berlin 1958, 30.

²³ Cf. Spiess: Leonhard Euler (fn. 9), 118.

²⁴ According to Wolff, Euler wrote, «even the supreme Being – I almost dare not say it – is also such a monad» (*Letters* 92).

The existence of God

It is interesting that in the *Defense*, Euler took the existence of God for granted. Since the *Defense* was aimed against the freethinkers of his time who for the most part were deists rather than atheists, there was no need to offer a proof of the existence of God. Euler was fighting deism rather than atheism, i.e., he wanted to show that God is presently involved in the affairs of the world. However, Euler did address the problem of the existence of God in largely marginal remarks.

He wrote in his *Examen d'une controverse sur la loi de refraction des rayons*, 1753 that «if other arguments for the existence of God make no impression on the spirit of Atheists, just the consideration of the structure of the eye should convince them about the existence of the supremely wise and powerful Being, in comparison with which the highest wisdom of man is reduced to nothing».²⁵ The eye example is also used in the *Letters*. Vision «is without a doubt the most wonderful thing which the human spirit could fathom.» The little that we know about the operation of the eye «is more than sufficient to convince us of the Omnipotence and infinite wisdom of the Creator; and its wonders should enrupture our spirit to more pure adoration of the supreme being. We discover in the structure of eyes perfections which the most intelligent spirit could never thoroughly examine and the most skilful artist could never construct a machine of such a kind» (*Letters* 41). Although Euler raised the issue of God's wisdom, indirectly he also addressed the problem of the existence of God: the eye is a witness of a supremely wise creator who only can be God. Euler was convinced that God «has surely followed in his works the simplest route» and thus the eye cannot be reproduced by a simpler device (*Letters* 43). Today, the intelligent design proponents use the concept of an irreducible complexity which, as it can be seen, would be endorsed by Euler: the eye is complex but it cannot be made any simpler since removing but one element from its construction would render the eye unworkable. Therefore, all the elements of the eye must have been put together at the same time to enable the proper execution of its function. This is the proof of the existence of God from design, which is the first proof used in European philosophy, namely by Socrates, and was a proof frequently used in the age of Euler, frequently under the name of physicotheology.²⁶ The perfection of every creati-

²⁵ *Examen d'une controverse sur la loi de refraction des rayons*, reflection 6, in: *OO*, vol. 3.5, 181. «Marvelous is the structure of all the eyes which represent at the back images of all the objects in the greatest perfection without noticing even the smallest confusion, which would have to be caused by different refraction of the rays of light if the claimed demonstration were founded. Without a doubt, this is here that we have to acknowledge the power of the Creator as well as his infinite wisdom» (*Instruction détaillée pour porter les lunettes* 1774, preface).

on in nature, animate and inanimate, points to the Creator (*Letters* 89). Admiring the wonders of nature not only assured that God exists but also led to an appreciation of God through an appreciation of His work and to such exclamations as made by Euler himself concerning the eye: «What a beautiful subject of our admiration! And the Psalmist had a good reason to lead us to this important question: He who formed the eye, shall he not see? And he who made the ear, shall he not hear?»²⁷ The eye alone being a masterpiece that surpasses human understanding, what a sublime idea must we form of him who has endowed not only man, but also all animals, even the vilest insects with this wonderful gift, and that in the highest level of perfection!»²⁸

The body and soul

The soul occupies no space; therefore, there is no spatial association between particular soul and particular body. The soul thus can be associated with any body, including animal body. Euler mentioned a possibility that «if it pleased God to establish after my death a new connection between my soul and a body on the moon, I would be instantly on the moon without traveling there.» The soul could even be connected at the same time with more than one body (*Letters* 93). It is interesting to see in this context Euler's criticism of the theory of preestablished harmony.

According to this theory, there is no interaction between the soul and the body. All actions that appear to be coordinated are prearranged by God at the moment of creation of the world. Therefore, when I want to raise my arm, my wish does not lead to raising my arm, and yet the arm is raised since God so harmonized all physical events that that particular desire to raise my arm coincides with the actual motion of my arm. In this way, all events in the natural and the spiritual worlds are executed mechanically since they have been predetermined from the beginning (cf. *Letter* 87). Although Euler mentioned that scholastics likened spirits to geometrical points whereby spirits, like points, are in a certain place, and he also mentioned that the Wolffians «are almost of the same opinion» in respect to monads, he assumed in his criticism that they simply equated monads with points. He mocked this theory by saying that the soul can be harmonized with the body of rhinoceros in Africa

²⁶ Cf. R. Thiele: Euler und Maupertuis vor dem Horizont des teleologischen Denkens. Über die Begründung des Prinzips der kleinsten Aktion, in: M. Fontius, H. Kolzkey (eds.): *Schweizer im Berlin des 18. Jahrhunderts*, Berlin 1994, 375.389.

²⁷ The two questions are asked in Psalm 94:10 in the reverse order; Euler must have quoted from memory.

²⁸ *Letter* 43; *Examen d'une controverse sur la loi de refraction des rayons, reflection* 6, in: *OO*, vol. 3.5, 181.

(*Letters* 83), i.e., not only physical proximity of the soul and the body does not matter, but the kind of the body is irrelevant. However if, in Euler's view, the soul can be connected with any body, this can be a body of a rhinoceros, and if it can be connected with a body on the moon, so it can also be connected with a body in Africa. So it would seem that Euler himself can become the victim of his own criticism.

Major difference between Euler and Wolff in respect to the soul-body association is that for Euler there is some connection between the soul and the body. However, the preestablished harmony advocates may say that this connection has been established by making a particular soul tick in unison with a body (Leibniz compared the setting of the soul-body correlation to the setting of two clocks). Such a connection is of nonphysical character, but so is the soul-body connection in Euler's system.

According to Euler, there is an actual interaction between the soul and the body. On the one hand, «the soul perceives and feels all that happens in a certain part of the brain» and from sensations it receives, the soul forms ideas concerning the world observed by the senses; on the other hand, the soul can act on «the same portion of the brain and produce certain motions in it» (*Letters* 94). The part of the brain allowing for the soul-body interaction is where all the nerves terminate, which is the *corpus callosum* that can be called the seat of the soul. However, the nature of this interaction is a matter of faith rather than, say, neurology. The soul is not of physical nature, thus, it does not occupy any place, i.e., it does not physically reside in the *corpus callosum*; the latter is just a place from which the soul receives impulses. However, the way these physical impulses are converted into data of spiritual nature is inaccessible to scrutiny by physical sciences. «The connection established by the Creator between our soul and our brain is such a great mystery that we know nothing except that certain impressions made in the brain, where the seat of the soul is, excite in the soul certain ideas or sensations; but the *why* of this influence is absolutely unknown to us» (*Letters* 97). And again, «the union of any soul with its body undoubtedly is and will always remain the greatest mystery of the Divine Omnipotence, [a mystery] that we shall never be able to penetrate» (*Letters* 80). An advocate of the preestablished harmony may see the reference to a mystery in respect of the soul-body interaction to be as convincing – or unconvincing – philosophical proposition as the assumed fact of the preestablished harmony. Euler can, however, always retort that at least the fact of the real interaction must not be denied although its nature is and will remain obscure. This certainly agrees with our intuition that our body is really ours, and this is so not because we are wired in such a fashion that an illusion of being a master of the body is created by the fact that God made the body act in accord to our wishes. In the preestablished harmony framework, these wishes are not causes of actions; they only exist alongside these actions. As

stated by Euler, «it seems to me that my body belongs to me by other reason than such a harmony» (*Letters* 83), i.e., a subjective conviction in respect of mastery of the body cannot be disregarded. Euler could even say that the existence of the conviction of truly influencing the body by one's soul would make God a deceiver. Euler, however, used another argument. «If God, who is a spirit, has a power of acting upon bodies, it is not absolutely impossible that the spirit like our soul can also act upon a body» or «only upon a small particle of matter» (*Letters* 83). Theologically, the argument is convincing since even if providence of God is denied, just as the deists did, the creation of the world by God is not, and thus at least at the moment of creation God acted upon physical bodies. Intelligent spirits, if they are assumed to be created in God's image, may be considered as capable of acting on matter, even if not capable of creating it, if this capability of acting on matter is included in the concept of being God's image.

In spite of Euler's enmity to the theory of preestablished harmony, a form of it is accepted by him in his explanation of prayers. According to Euler, God so arranged the world that prayers are answered. Although humans are free spirits, God knows from eternity what they would do, what prayers they would say. God does not force anyone to do anything, i.e., prayers are not prearranged by God; however, the answers to these prayers, i.e., events in the world pertaining to these prayers are. When creating the world, God established the course of the universe according to «the circumstances which should accompany each event» which includes prayers. God «has already heard a particular prayer from all eternity, and since this merciful father considered it worthy of being answered, He arranged the world expressly in favor of that prayer, so that the fulfillment should be a consequence of the natural course of events. It is thus that God answers the prayers of Believers without performing a miracle» (*Letters* 90). That does not mean that Euler explained all miracles that way. A miracle «is an immediate effect of the Divine Omnipotence, which would not have taken place if God left the machine of the world freely to run its course» (*Letters* 87). Miracles apparently take place for other reasons than a prayer. Euler mentioned miracles performed by Christ (*Letters* 114) and the miracle of Christ's resurrection (*Defense* §36). This raises an unsettling question: why did God fold answers in form of apparent miracles into the structure of the world so that these answers are really results of natural causes, and why did He not do so with other miracles? Maybe miracles of Christ and directly related to Christ (His resurrection) had such a special standing, but what about miracles similar to those performed by Christ? When Christ healed someone miraculously, this would be the direct and immediate result of Christ's healing power on a particular person, even if Christ prayed beforehand for this healing. However, when his disciples healed the sick, was it also such an immediate result or was it really the result of natural

causes built into the natural course of events? With his attempt to explain the mechanism of prayer by removing miraculous elements from them – except for the miracle of creation when future prayers were taken into account – Euler aligned himself with the proponents of preestablished harmony and strict determinism. The religious and psychological importance of miracles is thereby diminished and possibly even becomes a subject of suspicion that they are deceptive devices that can impress only the minds of those not sufficiently knowledgeable in the intricacies of natural causality. Deists, who believed that God created the world and then left it to run its own natural course in accordance to natural causes, would agree with Euler on that point.

Intellect and will

According to Euler, our happiness, that is, the happiness of our soul, consists in perfection of two faculties of the soul: intellect (*Verstand*) and will (*Defense* §1). Perfection of intellect lies in the knowledge of truth whence comes the knowledge of the good. The main object of this knowledge is God – since God is truth – and His works (§2).

The knowledge of God and His works is infinite; thus, human intellect cannot entirely encompass it, and thus only God is perfect (§3), which is a dogmatic statement that was self-evident for Euler and, presumably, also for the deists. People possess such knowledge in various degrees, depending on their efforts. Happiness is proportional to knowledge and thus to the perfection of intellect (§3). By itself, this statement could point to intellectualism biased in favor of scholars and academicians, who should be happiest of all people since they are presumably most knowledgeable of all. Euler clearly would not agree with that since the freethinkers of his age were frequently bright and informed natural philosophers, and yet it would be difficult to claim that their happiness exceeded the happiness of all other people.

God, the most perfect being, the source of all truth, is the supreme good. Also, true knowledge clearly includes the knowledge of evil (§4). Naturally, evil should be avoided in order to reach the state of happiness, and thus from the knowledge of good and evil follow precepts for conduct and hence duties to be fulfilled. These precepts can come only from God as the source of all good; therefore, «the natural law which determines through the light of nature the duties concerning our actions» is considered divine since God inscribed it in the human heart (§5; *Letter* 110). The fulfillment of these duties is necessary for human happiness. Failing to fulfill these duties is a violation of the natural law and ultimately rebellion against God, and it would be blasphemy and folly to think that God would not punish those who violate His law (§6). In this, in the time-honored fashion, Euler assumed the existence of an in-

born natural law (he also could refer to Rom 2:14 for support, but since the authority of the Bible is at issue, this would not convince freethinkers). Striving for happiness in this life has two dimensions. Happy life is, to be sure, desirable; thus it has a positive earthly effect. However, unhappiness is an indication that the natural law is violated and so is the law of God, which is the result of rebellion against God, the sin which may have fatal eternal consequences for the soul after death. The level of earthly happiness could thus be used as a measure of how secure about its fate the soul should feel when it comes to accounting for its deeds after death. The happier the soul is, the more assured of salvation it should be. However, it may be doubtful whether such a simple – even simplistic – proportionality between happiness and salvation would be accepted by Euler in all cases. He would agree that the Christians going through the ordeal of the Coliseum in Nero's times would be saved; however, there may be doubts about a high level of their happiness at that moment and during the imprisonment that preceded it.

The knowledge of truth is not sufficient for happiness. Knowledge is in that respect a passive element. It is a repository of information concerning what is good and evil and what are the duties derived from them, but there has to be a motive that leads us to the observance of God's law, to the fulfillment of our duties. This is the role of the will which consists in fulfilling these duties. «Man must strive by all his powers to entirely conform his will to the observation of the law prescribed by God» (§7). There is a measure of circularity in this statement. Human will has to be disposed to the observation of the law, but if it is not, it should be forced to do that. How? It would mean that there has to be some will to force the will to observe the law. Should there be another will to force the primary will to properly dispose it, or can the will force itself to will what should be willed? Euler does not provide an answer to this crucial problem.

How can the will go against the fulfillment of the law of God? By submitting itself to passions. Actually, passions can have an adverse effect on the intellect as well. Most people use their intellect poorly in trying to know God mainly because of detrimental influence of desires and passions (§11). Obstacles to an improvement of the will are even greater. It is so difficult to harness passions (§12). There appears thus to be the third faculty of the soul, passions or emotions, in spite of the fact that Euler mentioned only two faculties, intellect and will. However, he also stated that the will finds its greatest pleasure in the observation of God's law (§7). Would that mean that passions are folded into the will?²⁹ If so, the will simply could be incapable to perform its work properly since the passions – if they are really part of the will – would

²⁹ Cf. A. Kowalewski: Leonhard Euler als Apologet, Beweis des Glaubens 34 (1898) 254.

never allow it to do this. Thus, to make it possible, the emotive part of the soul must be differentiated from the will for the will to be able to extricate itself from its influence. Otherwise, passions would have to be annihilated – and Euler mentioned destruction of bad passions and desires and even stated that nothing is more important than harnessing and even destroying desires opposed to duties (§18, cf. §30) – but it is rather difficult to conceive how the will can force itself to the destruction of part of itself, this part being evil passions.

Even if duties are fulfilled against one's will, true happiness is not reached, since resistance of the will is the resistance to the goodness and to the will of God; thus, not only the knowledge of God and His works is needed for happiness, but also perfect submission of one's will to the will of God (§9). There is no other way to be happy in this life and the next for humans and all intelligent creatures that have will (§10). Hence, «it is an indispensable necessity that the will itself perfectly submit itself to the law», i.e., the will has to submit itself to the will of God (§8). The last statement can be interpreted in at least two ways. It is necessary that the will reaches the level of perfect submission to the will of God, which can be viewed as a necessary law and the result of an inevitable development of will.³⁰ Eventually, then, everyone's will would reach the proper level of submission to God's will. However – since Euler considered each intelligent being as endowed with the will – there are evil spirits of devils that are beings who surpass men in knowledge and in corruption (§15; *Letter* 111), and Euler, who adhered to orthodox Christian beliefs, would hardly have considered them as gradually improving their will by bending it to the will of God.³¹ The necessity of submission Euler mentioned is not the necessity of ever reaching the level of submission, but the necessity of such submission as a condition of happiness. The soul may, however, refuse to submit itself to the will of God, and that would have disastrous consequences for the afterlife.

³⁰ This is effectively the claim made by Kowalewski: Leonhard Euler (fn. 29), 255, when he saw Euler as an advocate of the view of «gradual adjustment of the will to the already reached level of higher cognition.» Such «a harmonious interaction of the two faculties of the soul» forms «the original part in all [of Euler's] metaphysico-ethical reflections.»

³¹ Actually, he seems to have left a possibility of salvation to some evil spirits open when he stated that «each spirit addicted to vice is necessarily unhappy and unless it returns to virtue, which could very well be often impossible, their unhappiness will never end» (*Letters* 111). For some spirits breaking with vice is impossible. Would those for which it is possible include devils and demons? Such a possibility was allowed by Origen and Gregory of Nyssa; however, it was condemned by the 543 provincial synod of Constantinople. In modern times, the view was defended by Jürgen Moltmann.

To submit the will to the law of God, some knowledge of this law is needed. With the growth of knowledge grows the number of duties to fulfill (§13). That is, the natural law inscribed in one's heart presumably provides some knowledge of moral and religious obligations but is not sufficient as the source of requisite moral knowledge. In fact, the most essential knowledge is contained in the Scriptures which are God's revelation.

If revelation can contribute to happiness, it should be assumed to exist as God's means to enhance this happiness (§19), and if revelation exists, its purpose would be true human happiness (§20). Those who «work seriously on the improvement of their will», will have no doubt about the divine character of the Scriptures that are «the purest and most abundant source of [the knowledge of] all duties» prescribed by the divine law, this source being the love of God and of one's neighbor (§25; *Letter* 113). In this, Euler obviously referred to the greatest command to love God with all one's heart and another commandment, to love the neighbor as oneself (Mt 22:37–39). Philosophers of old tried in obscure and imperfect ways to provide rules of life, but they spoke about external rules that did not change the heart. The Scriptures are superior to writings of these philosophers in that respect, which points to the divine, i.e., revealed origin of the Scriptures (§26). Moreover, ideas about God presented in the Scriptures are «so pure and suitable to the essence of God» that in comparison with what philosophers said about God, we are «struck by their excellence» and the statements about God's anger, wrath etc. when closely scrutinized in no wise undermine the majesty of God (§27). Also, the purity of doctrine and its agreement with the happiness of man should be sufficient to reject objections against the Scriptures (§35).

Euler raised the possibility that the scriptural ideas of God are judged by their adherence to the ideas of God man already possesses. Humans presumably know already what is the essence of the divine and what attributes can suitably be added to this essence. That is, it is assumed that the natural mind, the mind unaided by revelation, is able to have some knowledge of God. The Scriptures themselves confirm that some aspects of the essence of God are visible to the natural mind (Rom 1:20). However, Euler appears to have advocated the view that the natural mind by itself cannot discover and adhere to the greatest command of loving God and the neighbor. This is a contentious issue in Christian theology. For example, Aquinas stated that the principle of loving God and the principle of loving neighbor «are the first general principles of the natural law and are self-evident to human reason, either through nature or through faith» (*Summa theologiae* 1–2.100.3 *ad* 1). If natural knowledge of God based on the recognition of His work in nature is possible, then an admiration and even love for God may follow. But what about the love of the neighbor, even the love of enemy as a natural inclination of the human soul? Maybe that would be a natural tendency of the soul before

the fall, but since then – hardly. As Euler himself stated, «when we say that God wants that people love one another ... this is a commandment which people should obey, but it hardly happens that way» (*Letters* 88). And this is where the Scriptures play the pivotal role. Euler stated that Christ's disciples by living with Christ and following Him were filled with «the most ardent love and the highest veneration for God» (*Letters* 114). Although not stated explicitly by Euler, disciples of Christ were also filled with the love of their neighbor. In this way, the Scriptures become an indispensable starting point for reaching a requisite level of love, since they describe the life and teachings of Christ who is the source of this love and *the* example of its application.

Causality and imputability

In Euler's view, the doctrine of providence provides the best motives to fulfill our duties; according to this doctrine, «we will never find ourselves in a situation which God did not explicitly regulate on our account according to his infinite wisdom and goodness.» By considering seriously this doctrine, we in all circumstances would submit our will to the will of God and would do that with pleasure (§28). «This concept of God's providence perfectly closes the source of all vices and so it is also the strongest motive to [bring us to] all of virtue.» We love God more realizing that what happens to us was determined by God and we are thus in constant relation with God. This allows us to love even our enemies (§31). Most believers would agree that God in His divine omniscience knows everything that was, is, and will be, and thus He knows what bad things can happen in anyone's life. But Euler has a stronger statement when saying that God «explicitly regulated» what will happen to every person, that He determined what happens to us. This is simply an expression of predestination. Euler required his readers to believe that the greatest evil should be taken with a smile since it was predestined by God that it happens and that fact should be considered an expression of God's love. Since the deeds of enemies were also predetermined by God, enemies should be loved because their deeds were predetermined, and they act on account of the divine fate and thus, as it were, in spite of themselves or even against their own will. Although Euler wanted the readers to believe that the will has a predominant role in determining one's present and future happiness and salvation, the predestination diminishes the role of the will to naught if the events have already been predetermined by God from eternity. In the *Letters* he softened the severity of such predestination theology with his concept of human freedom.

In his criticism of Wolff, Euler distinguished between causality of bodies where the current state of the body is determined by what precedes, and freedom of spirits which is an ability «to commit, to admit, or to suspend an ac-

tion, which is directly opposed to all that happens in bodies» (*Letters* 85). That is, the reasons that prompt the soul to an action are motives that are of different nature than causes or forces that act on physical bodies: a natural cause produces its effect necessarily, a motive produces an effect voluntarily, and thus causality should be distinguished from what Euler called imputability. The freedom of the soul means that the act of its will depends solely on the soul itself. Freedom constitutes the nature of spirits just as extension and impenetrability constitute the nature of bodies, and «just as it were impossible, even to the Divine Omnipotence to remove these attributes from bodies, it is equally impossible for Him to remove freedom from spirits since a spirit without freedom would not be a spirit any longer» (*Letters* 85, 91). «The act of will cannot be stopped by any exterior force, not even by that of God» (*Letters* 91). Freedom is so important that it imposes a limit on God's omnipotence so that no one can be forced to be happy by accepting virtuous life, and thus «it would be impossible for God to make a vicious spirit happy» (*Letters* 111, 114). In this way, by not violating human freedom, God does not contradict Himself and leaves free acts of will to be truly free. That is why God does not save anyone by directly manipulating their will, although this would appear to be a quite efficient way to accomplish universal salvation. Since freedom entails the possibility of sinning, the creation of spirits introduced the possibility of a sin in the world «and it would be impossible to prevent the sin without destroying the essence of spirits, i.e., without annihilating them.» With this explanation, «the Goodness of God does not suffer any harm» (*Letters* 85).

The fact that God does not impose His will on anyone's will does not mean that God relinquishes any influence at all and that He loses control over the spiritual universe. If the will cannot, in fact, must not, be affected directly, it can and is influenced indirectly, namely through persuasion by suggesting proper motives for one's actions. Thus, «all the encounters in which we find ourselves are by design so adjusted to our state by the providence that the greatest villains could draw from them strong motives for their conversion if they wanted to obey by them» (*Letters* 91). Therefore, God's providential «regulation in advance» is limited to the physical world and to some aspects of the spiritual world but not to regulating freedom itself. There is no accident in the world and there is only one goal in everything that happens, human salvation: «all the circumstances are managed by God according to his highest wisdom to lead to happiness and salvation each intelligent being» (*Letters* 91). «It is always God who provides men at every instant the most suitable circumstances from which they may derive with the most powerful motives that can bring them to their conversion; so that men are always indebted to God for circumstances which led them to their salvation» (*Letters* 114). God «foresaw from all eternity all the thoughts, plans and voluntary actions of men and he

so arranged the corporeal world that at all times it leads to circumstances which allow these [men's] enterprises to succeed or to fail according to what his infinite wisdom found appropriate. God thus remains an absolute master of all events in the world, notwithstanding the freedom of men, so that all the free actions have already entered at the beginning into the Plan that God wanted to execute by creating this world» (*Letters* 87).

Some critics say that if God foresaw all my actions, my actions are no longer free. But my actions are still free; they are not undertaken *because* God foresaw them. It is the opposite: God foresaw my actions because I decided to undertake them and thus «the Prescience of God does not deprive me in the least of my freedom» (*Letters* 86). Our freedom does not undermine God's omniscience, since even we are sometimes able to predict someone's motives and thus actions, so much more so the infinite God can predict motives of the spirits He created.

Defense of the Bible

To use the Bible as an authority of the divine provenance, people have to be convinced that it really came from God, but not everyone is. Freethinkers say that revelation should be performed in a more extraordinary and thus more convincing fashion (*Defense* §20). But, responded Euler, although a more extraordinary way of revealing the Scripture would affect intellect, it would not affect will; thus, more duties would be known which would not be fulfilled, and thereby man would be more sinful (§21). Revelation made by the infinitely good God should have as its goal primarily the improvement of our will by providing the most efficient motives for our actions. It should also reveal infinite perfections of God as much as we can comprehend them without making us more sinful in the present state of depravation of our will (§22). Then we will see that the Scriptures give not only the better means to those who seriously want to reform their heart, but also advance knowledge about God and do not expose to great danger those who do not want to conform to their precepts (§23). Thus, the fact that the divine origin of the Scriptures «does not strike the eyes of everyone equally clearly» is really a mark of their divine provenance since their goal is salvation of man, not an increase of unhappiness (§24). This is a very interesting twist: if the Bible were revealed with too extraordinarily a fashion, that would be a sign of its supranatural origin, but, at the same time, that would not stem from the goodness of God. God has human wellbeing in His mind – here on earth and in the hereafter – and He loves even the sinners. The more sinners know about God's commandments, and yet violate them, the more sinful and thus more liable to punishment they become. By making His revelation not too obvious, God gives man a chance

to improve his moral level gradually by submitting his will to the will of God and thus to the possibility of maximum happiness in the whole process. But it seems that, ultimately, only those who «work sincerely on the improvement of their will» will believe in the revealed character of the Bible. Where would the starting point of this work be? There should be the will to perform the work on the improvement of the will and thus, again, we see circularity involved in the problem of the improvement of the will.

In his defense of the Bible, Euler stated that if we see in it descriptions of incredible things, it is unjustified to simply reject them. This concerns miracles (*Defense* §33) including the miracle of resurrection. The witnesses of the resurrection of Christ can hardly be undermined by stating that they tried to deceive others or that they were deceived by their own imagination (§34). The resurrection of Christ is an incontestable fact. It could be only a work of God, and thus the divine mission of Christ should not be doubted, and we should trust in promises of the Gospel (§36). The doctrine of the Scripture is criticized by trickery and by misinterpretation (§37). This points to the hidden malice of critics since «the divine truths can never agree with clouded intellect of spiteful people.» In fact, «the divinity of the holy Scripture would suffer a more severe blow when we would find in it greater agreement with the opinions of freethinkers» (§38). As to apparent contradictions in the Bible, «there is no science, regardless how firmly it is founded, against which such strong or even stronger objections cannot be made.» Such apparent contradictions should be confronted with the first principles to resolve them (§39). Very intelligent people found difficulties in geometry, thereby apparently casting doubt on its certainty. Geometry does not lose any of its luster in the eyes of people of common sense even if not all of its difficulties are resolved. Why should the Bible be treated differently? (§40). Even some rigorously proven theorems of geometry appear to some people contradictory with other theorems (§41). Other sciences are even more prone to such problems. No one doubts in the existence of bodies. Bodies are simple or composed of parts, and it is equally difficult to prove either of the two claims, but the existence of the bodies will not be thereby denied, although «some fantasts» did just that (§42). Also, in spite of the problems arising in analyzing the nature of motion, the reality of motion is commonly accepted (§43). The critics of the Scripture will not criticize geometry or reject the reality of motion, and yet they dwell on apparent scriptural contradictions and reject their revelation. This means that their motivation does not come from the love of truth but from some «impure source» (§44). It is important to stress that the Bible reveals things which could not be discovered by reason alone, or at least it would be very difficult to do so. But if what is accessible to reason has contradictions, how much more so reason sees contradictions in the revealed doctrine that rests on suprarational principles (§45). Because the critics are

not motivated by the love of truth, no refutation of their criticisms can be effective, and they only repeat over and over again «the weakest and most absurd objections» (§46). Thus, regardless of the strength of arguments, free-thinkers and libertines will not be convinced. However, the hope is that those who are not too far gone will be convinced, after all (§53).

Theodicy

Very briefly, Euler addressed the theologically daunting problem of the existence of evil. Since «God is supremely good and holy» (*Letters* 89) can anything less than a perfect creation be expected from Him? Is our world really the best that can be? If so, how can that be reconciled with the ubiquity of evil in the world? As in many other cases before, he, basically, referred to a mystery. Euler proposed a distinction between a world purely corporeal and a world in which also a spiritual dimension exists (*Letters* 60). It is easy for God to create a corporeal world in which no evil occurs. In fact, «as to bodies and material productions, their arrangement and their structure is such that certainly it cannot be at all [made] any better» (*Letters* 89). However, the existence of spirits means the existence of free agents and this freedom is the source of all evil. «At the moment of creation, spirits were all good since bad inclinations require some time for their formation.» Spirits are free agents and «freedom could not exist without a possibility or ability of sinning.» Spirits violated God's commands, abused their liberty and thus are responsible for their sin and deserve punishment. Spirits could not have been created to avoid evil and we do not know whether the world would subsist without them.

An evil is a fact, but «wickedness of some people often contributes to the correction of others» which «suffices to justify the existence of evil spirits» (*Letters* 89), that is, «the wickedness itself of free beings may contribute to the perfection of the world in an inconceivable manner» (*Letters* 60). Therefore, an argument should not be used that God should not have created at least the spirits that He knew they would contribute to most egregious evils since «perhaps the plan of the universe required the existence of all possible spirits» (*Letters* 110). Everything that happens, happens for our benefit and «so many good people would not have arrived at virtue, if they had not been oppressed and tormented by injustice of others.» Everything takes place according to God's design. «The wicked may very well commit injustice, but we cannot suffer from it; ... in everything that happens to us, we should always acknowledge God, as if it were He who directly commanded that this happens to us» (*Letters* 112). Also, we should resist a temptation of questioning the divine wisdom that lies behind many events (*Letters* 111) remembering that «the

judgment of what is best infinitely surpasses our capacity» of comprehension (*Letters* 60). We should always take into account the eternal perspective, the perspective of the afterlife.

The afterlife

Euler had no doubt that the soul is immortal. He did not offer or discuss any proof of its immortality, which was a common topic in the European philosophy and theology beginning with Plato's *Phaedo* and was also frequently discussed in Euler's times. The soul is immortal and during the lifetime of an intelligent being inscrutably connected with a body. Death consists of the dissolution of this connection, whereby the body dissipates as being cut off from the soul, the principle of life, and the soul lives on. As an incorporeal being, the soul resides nowhere, and thus it «does not have any need to be transported elsewhere» after death (*Letters* 93). Being cut off from the senses, the soul relies in its cognitive operations on its reason and memory. In this life, such a state is approximated by the state of the soul when the body is asleep, so it can be said that «after death we will find ourselves in the state of the most perfect dreams which nothing will be able to disturb: these will be representations and reasonings perfectly well maintained.» However, in spite of the remark that «this is almost all in my opinion that we could say positively about it» (*Letters* 93), because of the «almost», Euler stated more about the fate of the soul after death.

After death, another life begins «which should last forever. The faculties of our soul and our [cognitive] lights will be without a doubt elevated to a higher level of perfection.» Then we will see clearly infinite perfections of God what we see now vaguely and «they will be the main object of our contemplation, our admiration, and our adoration.» Then, God «will fill us up with his love, with love whose effects will never be interrupted by any reversals. This thus will be a degree of happiness which will infinitely surpass all that we can imagine» (*Letters* 112) and in this state it becomes true that «the true happiness consists in a perfect union with God» (*Letters* 113). This is only possible for those with the proper disposition toward God, for those accepting the rule of virtue in their lives, which is the life founded on loving God and one's neighbor. God does not force us to be virtuous but so arranges the events that we can be motivated to accept His commandments, which may include going through the fire of suffering and becoming a target of evil-doing of others. Therefore, people just should find solace in the belief that all events take place «under the direction of Providence, and finally terminate in the true happiness» (*Letters* 89).

What happens to an unrepented soul? The wicked simply cannot be happy in the next life, just as the deaf cannot enjoy music. «The wicked will be forever excluded from it and that not by an arbitrary decision of God but by the very nature of the thing, a vicious man not being susceptible, by his own nature, of the supreme happiness» (*Letters* 113f.). Eternal separation from God is the supreme punishment. Hell is the separation from God; hell is the turning away from the possibility of the union with God.

Euler spiritualized the afterlife; there is no final judgment and no destruction of the world that would lead to the creation of new heaven and new earth in his theology; there is no resurrection of the body and eternal life of the union of the soul and the body. Apparently, the material world in its present state is eternal. Euler allowed for the possibility that the intelligent life exists on other planets. Now, if all the planets that are inhabited by rational beings are considered, «the number of all the beings endowed with reason, which have existed, which exist, and which shall exist, in the whole universe, must be infinite» (*Letters* 110). This is strictly incorrect by Euler's own principles, unless an infinity of planets with life on them is assumed. As dictated by science of Euler's times, the orbit of the earth decreases and eventually the life on earth will be burned by the proximity to the sun and the earth will crush onto the sun (*Defense* §§50–52). If this happens to the earth, it will also happen to each planet, so the life in the entire universe eventually will extinguish. «When the holy Scripture speaks about an imminent end of the earth and of the current structure of the entire world, this is not in conflict with reason» and with the natural causes established by science (§50). Therefore, unless the act of creation is repeated over and over again, the number of spirits will be finite. The world will come to an end, but the matter constituting it will apparently remain as cosmic waste with which the soul will have no contact. The soul, when released from a connection with the body, lives eternally in its spiritual state, whereby the union with God becomes presumably stronger. There is no return to any association with the body, renewed or otherwise.

Euler the apologist

Euler only infrequently moved in his publications beyond mathematics and natural sciences. He was in a way forced by physics to undertake some philosophical investigations concerning the nature of time, space, and body. Although religion was a very important part of his personal and family life, he very seldom made pronouncements of theological character. The rather standard proof of the existence of God he offered was made on the margins of his scientific investigations. He offered no proof of the immortality of the soul; he resorted to a mystery in the matter of the mind-body interaction. In

the matter of religion he was an apologist. He did not venture to prove the truths of the Christian religion; he assumed them to be true and accepted in his pronouncements as unspoken assumptions. The Bible is God's word, the resurrection of Christ is God's work (*Defense* §36), but is Christ divine? We probably should assume that Euler believed so, but there were many unitarians in his times, Newton being one of them. But in the *Letters* he mentioned Christ only once (*Letters* 114) and he never referred to the Holy Spirit. What conclusion can be drawn about his Trinitarian outlook? In the *Defense*, the emphasis is on the problem of the revealed character of the Bible; thus, the problem of the Trinity may not have arisen. But the *Letters* addressed to an impressionable teenage mind discuss the matter of religion, and it is puzzling why such an important tenet as the problem of the Trinity is not even mentioned.

The problem of eternal punishment is mentioned by Euler very briefly as spiritual isolation from God. Should it be equated with hell? Euler made only one passing reference to hell in mentioning spirits from hell (*Letters* 101). What is this hell, then, this residence of infernal spirits?

Why is Christianity superior to other religions? It is superior, in Euler's view, to philosophers' ideas (§26), but Euler did not concern himself with confronting it with other religions.

Euler did not bring any revolutionary insights to theology, and he never intended to do this. The apologetic *Defense*, the religious remarks in the *Letters*, and religious observations scattered in other writings and letters are just an expression of the need of his heart and importance of belief in life, personal and scientific, even if not always explicitly expressed. And since the best proof of the existence of God is the harmony and beauty of the universe, he could consider his work in investigating this harmony and showing it in his publications as a practical way of expressing his religious convictions.

Abstract

Euler was a devout Christian keenly interested in practical and theoretical issues of the Christian religion. However, in his voluminous writings, only one short pamphlet discussed only religious issues. There are also some theological remarks scattered in other of his writings and letters. The present paper presents his defense of philosophical dualism expressed particularly in his criticism of monadology; his use of proof from design in arguing for the existence of God; his discussion of the problem of the soul; his criticism of the view of the preestablished harmony; his understanding of psychology; his approach to the problem of causality in the dualistic world; his view on theodicy; and his defense of the Bible.

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