
Light and Void. The Philosophical Background of Valerian Magni's Vacuum Experiments¹

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*The subject of the article is the interpretation of a series of experiments proving the existence of vacuum. This was performed by the Capuchin Valerian Magni in 1647 and described in the treatise *Demonstratio ocularis*, which is the first printed text referring to successful experiments with vacuum. The work generated great controversy at the time, not only with opponents of void, but also with French scholars, who accused Magni of plagiarism. The article reconstructs both the situation around the work's publication and the reaction to it, with an aim of presenting the philosophical background behind Magni's experiments. Magni understood the experiments as confirmation of his anti-Aristotelianism, and placed them among his metaphysics and natural philosophy, in which he attributes the key epistemological and ontological function to light.*

In July 1647, Valerian Magni, a member of the Capuchin order, ecclesiastical politician and a legate of the congregation for the Propagation of the Faith (*Sacra Congregatio de Propaganda Fide*),² published in Warsaw a description of his experiment proving the existence of vacuum. His treatise entitled *Demonstratio ocularis loci sine locato, corporis successive moti in vacuo, luminis nulli corpori inhaerentis* (Magni 1647a) is interesting with respect

1. This study is a result of the research funded by the Czech Science Foundation as the project GA ČR 14-37038G "Between Renaissance and Baroque: Philosophy and Knowledge in the Czech Lands within the Wider European Context." The study is based on my Czech article (Nejeschleba 2015b), which was updated, extended and significantly rewritten.

2. Magni's activities in the field of ecclesiastical policy can be analyzed from the point of view of the organization of the church in Bohemia (see Agbottspon 1939), having features of religious tolerance (Catalano 2012; Sousedík 1995) or with respect to his theological polemics (da Novara 1937; Louthan 2004) or in the context of his irenic efforts (Müller 2004). See also general biographical sketches (Sousedík 2009; Nejeschleba 2015).

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to at least two points. First, the publication generated a huge polemic, not only with the opponents of void but also concerning the authorship of the experiment. The extension of the polemics indicates both the importance the issue of void played in the mid seventeenth century and the role of Valerian Magni within it (Fanton D'Andon 1978; Dear 1995, pp. 187–90).³ Second, one can raise the question of the purpose of Magni's experiment. Since Magni was a keen opponent of Peripatetic philosophy,⁴ the aim of the experiment could have been to only demonstrate the fallacy of Aristotelian natural philosophy and prove the validity of his Anti-Aristotelianism (Shea 2003, p. 85). It seems, however, that there is an inner connection between the experiment, on the one hand and Magni's philosophical system, on the other. This connection is often neglected, however, in the literature dealing with the history of science. It was only sketched out by several historians of philosophy (Blum 1998, p. 108; Blum 2017; Vasoli 1980). The goal of my article is, therefore, to analyze the philosophical meaning of the experiment which Magni gives to it as concerns its philosophical background and show how it is bound with his metaphysics of light in particular.

In the first part of my study I will briefly sketch the circumstances of Magni's experiment and the polemics around it to demonstrate the importance of Magni's activities in this field. Second, I will move on to Magni's philosophy and question how his experiment proving the existence of void is in accord with his philosophical thought being grounded in the Medieval Platonic tradition.

1. Historical Narration—*Facti Historia*

Valerian Magni performed his vacuum experiment in Warsaw in the presence of the King and Queen of Poland on 12 July 1647. He published a description of the experiment in the form of a historical narration—*facti historia* (Dear 1995, pp. 187–90) followed by an explanatory part.⁵ Magni stated at the beginning of the treatise that he was attracted in his experiments with vacuum by a passage from a certain work of Galileo Galilei where Galileo narrates that it is impossible to move water by means of a mechanical tool, i.e., a pump, at a height of more than 18 cubits (Galileo 1638, p. 63).⁶ Following this information, Magni concluded in his own words that mercury,

3. Despite the huge extension of the polemics, Magni's case is hardly mentioned in the basic referential literature, being completely neglected, for instance by Grant (E. Grant 1981).

4. Magni attacked Aristotle's philosophy and Aristotelianism as atheism (Martin 2014, p. 145).

5. Vasoli's description (Vasoli 1980) however contains a number of errors. See also the German (Magni 1995) and Polish translations (Magni 1959) for the entire Magni treatise. List of Magni's works was prepared by Jerzy Cygan (Cygan 1972a; Cygan 1972b; Cygan 1989).

6. The reference to *Discorsi e dimonstrazioni matematiche intorno a due nuove scienze* was identified by Jerzy Cygan (Cygan 1969).

which has a higher density, could not exceed a height of 2 cubits. This experiment, as Magni emphasizes, should solve the most important question which has ever been proposed since the creation of the world (Magni 1649, p. 5).⁷ With these words Magni intends to underline the importance of the issue with respect to the fatal consequences which the existence of vacuum has for Aristotelian natural philosophy. In the narrative part of the treatise, Magni writes that he filled a glass tube which was two cubits long and opened at one end with mercury. He then closed it at the opened end with his finger, turned it vertically and placed it into a basin containing mercury. The mercury basin was placed in a larger basin filled with water. After removing his finger, the mercury in the tube descended and steadied itself at a height of one cubit. Magni reports that he saw void at the upper part of the tube, respectively “a place where nothing was placed” (Magni 1649, p. 6).⁸

He consequently continued the experiment with the aim of eliminating objections which could be raised by Aristotelians denying the existence of vacuum. According to Peripatetic natural philosophy, nature should resist void. Air penetrating pores of glass should fill the upper part of the tube. Magni, therefore, closed the end of the tube with his finger again, pulled it into the part of the larger basin containing water and removed his finger again a short while. He observed water flowing rapidly into the upper part of the tube and filling it completely. This would have been impossible, in his view, if the place had been filled with air (Magni 1649, p. 6).

Aiming to disprove the existence of the air in the tube completely, Magni subsequently pulled the tube out of the basin with water, thus, allowing some air to enter. He plugged the open end with his thumb once again and observed how the air in the tube moved through the mercury above the surface of the water like “a shining pearl.” This “pearl” moved up and down the tube depending on how he turned it; he did not observe any other air in the tube, aside from the air he briefly allowed in (Magni 1649, pp. 6–7).

He came to the conclusion that both observations proved the fallacy of Aristotelian natural philosophy. The first fact has already been stated, that is, the confirmation of the existence of vacuum, which Aristotle denies. Magni writes that Aristotle understood the universe as a continuum, completely filled with objects. If there was to be a void among them, they would not be able to have an effect on one another. Magni confesses that he had always

7. I follow the text of the eighth edition of the *Demonstratio*, published in Venice 1649, which also contains the discussion concerning the topic and Magni's responses to his opponents (Cygan 1972a; Cygan 1972b).

8. Magni uses both the terms “locus sine locato” and “vacuum” as synonyms as was already common in the scholastic literature (Grant 1979, p. 238).

had doubts about the doctrine. Aristotle denied a relationship between the forces of “cohesion,”⁹ which conflict with the natural harmony (*concordia*) of parts of the elementary world. Without these forces the elements would move away from each other and not stay together. Aristotle's doctrine also denies the creation of a sublunary substance as a mixture of elements, the assumption of which is the existence of voids that the elementary parts fill.¹⁰ It is here that Magni strongly proclaims atomism, however, he does not see the sensory observation of the vacuum as a confirmation of modern corpuscular theories, but rather predominantly as disproof of the erratic Aristotelian doctrine (Magni 1649, pp. 9–10).¹¹

The second fact that refutes Aristotle is closely tied to the atomistic theory of motion, which assumes voids through which objects can move. Aristotle, in contrast, describes motion as a continuous exchange of positions between individual objects, and thus, void is not necessary for the interpretation of motion. Nevertheless, according to his own words, Magni saw a gradual motion of objects in vacuum (Magni 1649, p. 7).¹² When he flipped the tube in which he had created void, he observed a slow motion of mercury, water, and air. Similarly, motion within the vacuum was observed when mercury and water filled this void. The observations contradict the theses of Aristotle's natural philosophy regarding the doctrine of motion, namely the differentiation between heavy and light objects, where the natural motion of heavy objects is directed downward towards the center of the Earth, whereas light objects are directed upward. Aristotelian physics are unable to describe why mercury, heavy in nature and so directed towards the Earth, rises and tries to fill in void. Furthermore, in an environment where nothing opposes motion—that is, within vacuum—motion should be instant (*motus instantaneus*), which should also mean that one object would be in several places at once. Magni's observation of an object's slow motion in vacuum demonstrates the falsity of Aristotle's theses.

9. Magni calls the power, which forms the globe, a continuative power, a power, by which parts are joined, a contiguous power. In addition, he also distinguishes between a discontinuative power as opposition to a contiguous power, the source of which is the light of the stars (see Blum 2017). Magni elaborates the doctrine about the influence of the light of the Sun and the stars on processes in the elementary world in his *Physics* (*Physica Valeriani Magni*), which he wrote as part of his *Opus philosophicum*, see Magni (1660), but which remained only in manuscript form (see Nejeschleba 2018).

10. Magni later criticized Aristotle's philosophy as ungodly since it did not have the conception of creation and therefore Aristotelian concepts of God and the world are completely erroneous (Nejeschleba 2019a).

11. Magni admits atomism mostly in his *Physics*, following William Gilbert. His physics is sometimes called “a dynamic atomism” due to the incorporation of the conception of contiguous and discontinuative powers (Gabryl 1915).

12. “corpus successive motum in vacuo”.

In the last part of the description of the experiment, Magni adds that the third fact contradicting Aristotelianism was light which he saw in the upper part of the tube, i.e., he observed light which was not tied to any body (Magni 1649, p. 9).¹³ This is accompanied by several theses: 1. Without light, the eye (*oculus*) cannot see anything; 2. A person looking into darkness thinks he/she sees black; 3. We cannot see the entire surface of an opaque body at a specific point in time; 4. We can see the entire surface of a transparent object at a specific point in time (Magni 1649, p. 7);¹⁴ that is, if a section of the tube was to be void of any body as well as light, we would not be able to see it—we would see only darkness. Magni had seen, however, the upper part of the tube; he saw its entire surface, saw through it, saw colors beyond it, which means that in the part of the tube where there was no body, there was void, there was light that was not tied to any other body.

Demonstrating the existence of light, which is not dependent on any other body, serves to show the fallacy in Aristotelian philosophy. Regarding Aristotelianism, light is dependent on a material subject; ergo, the observation of light in a void space proves that light is not inherent in any material subject. According to Magni, a shining object creates its light from nothing, and thus does not require Aristotelian prime matter (*materia prima*) for its creation, nor does it need an Aristotelian subject (*subiectum*) for change to occur. The visible form, which does not require any matter, is in strict discord with Aristotelian metaphysics, where every substance is comprised of form and matter. Magni demonstrates that this even applies if light is taken as a substantial or accidental form (Magni 1649, pp. 13–14).

2. Controversy of the Times

Magni's demonstration provoked a great deal of controversy (Bucciantini 1994; Gorman 1994). Shortly after this first demonstration, Magni had a disputation with Warsaw theologians, the description of which he had already included in the first edition of his treatise, published in Warsaw in July 1647 (Magni 1649, pp. 15–18).¹⁵ He was subsequently accused of heresy. The Papal Nuncius in Poland was alerted about the experiment

13. "lumen nulli corpori inhaerens."

14. "Superest demonstrare, pariter ad oculum lumen, quod subsistat sine ullo corpore, cuius demonstrationis gratia praemitto nonnulla, posita extra omnem disputationem: 1. Oculus nil videt sine lumine; 2. Videns, qui indendat aciem oculorum in tenebras, putat, se videre nigredinem summam, nam umbrae semper nigrescunt; 3. Oculus non potest uno intuitu videre omnes partes superficiei corporis opaci; 4. Oculus non potest videre uno intuitu superficiem totam, totamque profunditatem corporis diaphani."

15. The section is entitled *Disputatio theologorum Varsaviensium contra vacuum ex nostra fistula illatum*. The German translation of the text is available (Magni 2002, pp. 101–6).

and its interpretation: there was suspicion that the author was attempting to undermine Catholic doctrine concerning the sacrament of the Eucharist. It can be assumed that, specifically, it was the doctrine of transubstantiation, which was tied to Aristotelian substantial metaphysics (Ochman 1978, pp. 103, 196).¹⁶ It therefore seemed that Magni's attack on Aristotle was, at the same time, an attack on one of the focal points of Catholic theology. Magni was summoned for questioning and although he defended himself successfully, he was still afraid, as evidenced from his letters, of being condemned in the similar way as Galileo Galilei had years earlier.¹⁷

It seems peculiar that Magni, as an ecclesiastical politician and a legate of the congregation *De propaganda fide*, referred to Galileo several years after his condemnation. Indeed, Magni was well aware of Galileo's trial as he asked his friend Francesco Buonamici for a transcript of the documents. He was later even involved in the efforts of Giovanni Pieroni to publish *Discorsi* in the printing house of the Olomouc Bishop, Cardinal Dietrichstein, which failed to succeed, partly because of the death of the Cardinal (Catalano 2008, p. 54; Cygan 1969, pp. 144–48). *Discorsi*, which Pieroni finally published in Leyden, was what Magni referred to in his experiment. In his later works, Magni even defended Galileo's heliocentrism and backed it as a doctrine that does not contradict the Christian faith (Cygan 1969, pp. 152–6). In the preface to his writings *Philosophiae Virgini Deiparae dicatae pars prima*, he expressly states that he follows Copernicus and Galileo in astronomy, and Galileo and William Gilbert in physics (Magni 1648b, p. 12).¹⁸

Despite being suspected of heresy, Magni continued with investigating vacuum. In July of the same year, he conducted a demonstration during which the glass tube “miraculously” cracked which is why he was unable to include the description in his publication *Demonstratio ocularis*, before he was able to add a reasonable explanation of the phenomena (Magni 1648a).¹⁹ Furthermore, on September 12, he wrote the so-called second part (*Altera pars*) of the experiment. Here, he demonstrated the existence of vacuum by using a metal tube filled with water, 20 ells long, since the

16. Magni was entered into suspicion by the prelate Woiciech Gniewosc, who sent a letter to the papal nuncio Giovanni de Torres.

17. In his letter from 3 August 1647, he confided to his protector in Rome, Giovanni Battista Barsotti, about his fears. Magni was worried that the case could be heard at the inquisitorial tribunal in Rome, and asked Barsotti for help from Cardinal Harrach. See the transcription of the letter in Cygan (1969, pp. 163–65).

18. “Ego suscipio in astrologia Ioannem [sic] Copernicum, in eadem facultate et nonnullis quaestionibus physicis Galileum de Galileis, in revelata occulta natura Magnetis, quae rite cognita, aperit viam perscrutanti structuram machinae mundanae, Gulielmum Rhobertum Anglum.”

19. After the first edition in 1648, Magni included the treatise into his book *Principia et specimen philosophiae* (Magni 1652), which was also published in 1661.

density of water is about 13 times smaller than the density of mercury. When he immersed the tube into a bowl of water, whose volume he knew precisely, he was able to determine how much water was added after releasing the bottom end of the tube, and how large the vacuum column in the tube had become—more than two ells (Magni 1649, pp. 19–24).

After describing the experiment and the interpretation in the intentions of the first part of *Demonstratio*, Magni, surely after experiencing the immediate reactions to the first experiment, added a justification for his anti-Aristotelism. The Capuchin saw no reason why a Christian should rely on Aristotle's authority and why he should trust his natural philosophy. From the point of view of Christian theology, Aristotle is fallible since he does not consider God as the effective cause of everything (Magni 1649, p. 23). It can be argued that thanks to his writings about vacuum, Magni explicitly opened up a systematic campaign against Aristotelism, not only against a controversial philosophy, but also against a school of thought which is not suitable for Christians—but rather harmful to them.

A systematic attack on his demonstrations, from the point of view of Aristotelianism, came from the Krakowian philosopher Jan Brożek, who on 22 October 1647 wrote a treatise entitled *Peripateticus Cracoviensis* (Brożek 1647).²⁰ Brożek considered Magni's experiments and interpretations to be an unfounded, naïve belief, and referred to older and newer authors with the aim of encumbering sensory observation as an untrustworthy source of knowledge, as shown by optical illusions, etc. According to Brożek, philosophy is inclined to Aristotle's interpretation, not because of Aristotle's authority, but rather for the rational reasons presented by Aristotle. Brożek even takes the Capuchin Anton Maria Schyrleus of Rheita (1604–1660)—Magni's friend—as a witness, and takes the approach of “Capuchin versus Capuchin.” Several years before Magni's experiment, at the request of Count Wilhelm of Neuenburg, who inquired about the possibility of the existence of vacuum, Schyrleus replied in a letter (August 1645, dated in Antwerp) where he considers the doctrine of void as monstrous, contradicting the logical arrangement of the cosmos, and explains the supposed vacuum by way of Aristotle through the theory of densification and dilution. Brożek adds that talking about void, which is nothing, makes no sense: void—this is nothing, it can have no purpose and, therefore, it cannot come from nature or be created by artificial forces (Cygan 2002).

Magni published Brożek's critique in the fourth edition of his *Demonstratio* in November 1647 and supplemented it with a response advocating his anti-Aristotelianism. He is surprised that Brożek's argument is based

20. At the time, Jan Brożek (1585–1652) was a priest in Międzyrzec Podlaski. Before this time as well as after 1648, he served at Jagiellonian University.

on a reference to Schyrleus, since the letter of his fellow brother was not a reaction to Magni's experiment. He also radically opposed Brožek's questioning the experiment as simply sensorial and, thus, burned with error and not supported by reason. Magni is convinced, in contrast that he had raised a rational argument (Magni 1649, pp. 25–30). I will return to the root of Magni's argumentation later.

A number of other treatises, criticizing Magni's demonstrations, appeared within a year. Following Brožek, Magni's writings were gradually criticized anonymously by Niccolò Zucchi, a Roman Jesuit from the Collegium Romanum (Zucchi 1648; Gorman 1994), Wojciech Kojalowicz—a Jesuit from Vilnius (Wijuk Kojalowicz 1648), the French scholastic philosopher Jacques Pierius (Pierius 1648) and a Parisian Jesuit from the Collège de Clermont, Descartes' teacher Étienne Noël (Noël 1648), both of whom were famous for their controversies with Blaise Pascal (Dear 1995, p. 190; Jouslin 2006),²¹ as well as the Bolognese philosopher Joannes Elephantutius - Giovanni Battista Fantuzzi (Elephantutius 1648). Several years later, Magni's experiments were also criticized by the Dominican Dominik Aurnhammer (Leinsle 2012). Each case presented objections based on Aristotelian views and Magni did not explicitly react to them, but only re-edited his response to Brožek as he considered it a general reply to any Peripatetic critique.²²

Another polemic arose on the part of scholars who admitted the existence of void. Pierre Desnoyers, the Secretary to the Polish queen, was present in the audience at Magni's first demonstration. He immediately informed Gilles Persone de Roberval and Marin Mersenne about the experiment (Mersenne 1983, 15 (1647), pp. 311–14, 318–21),²³ to whom he sent copies of Magni's treatise. During his visit to Mersenne in Paris, Blaise Pascal learned about the publication and immediately denied "Father Valerian's claims." Magni's description was subsequently republished in France in the autumn of 1647 (dated October 16), together with an earlier letter from Pierre Petit to Pierre Chanut from the year 1646 (Petit 1647). In the aforementioned letter dated 19 November 1646, Petit briefly described how, at Marin Mersenne's suggestion, he was present at Pascal's Rouen experiment in the autumn of 1646 with a glass tube filled with mercury, which, following Torricelli's barometer experiments, proved the existence of vacuum. The anonymous editor of the foreword "Au lecteur"

21. In 1646 Pierius was present at Pascal's vacuum experiments in Rouen and published a pamphlet against vacuum *An detur vacuum natura* in October 1646. Noël had an important correspondence with Pascal before his pamphlet against vacuum.

22. Magni did not include Brožek's treatise in the following publications of the *Demonstratio ocularis* writings, and only left his response to an "anonymous" Peripatetic from Warsaw as an answer to Aristotelian philosophers in general.

23. Desnoyers' letter to Roberval is dated July 17 and his letter to Mersenne July 24.

therefore pointed out that Magni's *Demonstratio ocularis* was not original since Torricelli and Blaise Pascal conducted the experiments earlier. Magni's treatise provoked Blaise Pascal to publish his celebrated *Expériences nouvelles touchant le vide* in haste, in order to demonstrate the priority of his experiments against Magni's activity as soon as possible; he refers to his work as an abstract to a larger work in progress (Fouke 2003, pp. 77–8).

Magni was also attacked by the mathematician Gilles Personne de Roberval, who addressed a letter to Pierre Desnoyers dated 12 October 1647 (Magni 1649, pp. 31–42),²⁴ in which he similarly accused Magni of plagiarism, for experiments with vacuums had been performed by Torricelli and Pascal first. Roberval described how awareness of Torricelli's experiments spread to France in 1644 through Marin Mersenne. He goes on to claim that Magni, who knew Mersenne very well with evidence that they had met in Rome in 1645, also must have known about the experiments that Torricelli performed in Florence in 1643, and yet published them as his own.

Magni was deeply affected by this accusation and published Roberval's letter together with his own response entitled *Inventione artis exhibendi vacuum. Narratio apologetica Valeriani Magni Fratris Capuccini. Ad Nobilem et Clarissimum Virum AE. P. De Roberval* (Magni 1649, pp. 43–7) in November 1647. He defended himself by introducing his personal history and writing that he had not known or heard about Torricelli and the others before his experiment. He wrote that he had performed his vacuum demonstration only on the basis of his reading of Galileo's book *Discorsi e dimostrazioni matematiche intorno a due nuove scienze*, as he had already mentioned in the first edition of his *Demonstratio ocularis*.

The question of Magni's alleged plagiarism is difficult to resolve to a satisfactory level. In any case, the controversy on this side ended in late 1647. It seems that Mersenne, who actually knew Magni personally and had sympathy for the Capuchin (Mersenne 1647, Praef.),²⁵ never commented on the case. Pascal's indignation also subsided when, in February 1648, he admitted that Noël's writings countering the vacuum were not a personal attack on him, but rather on Magni (Pascal 1970, 2:572).²⁶ The Capuchin, although hurt initially, never condemned his French colleagues. On the contrary, in his response to Brožek, he presented a group of scholars, who were

24. Magni published Roberval's letter *De vacuo narratio AE. P. de Roberval ad Nob. virum D. Des Noyers* already in the fourth edition of his *Demonstratio ocularis* (Magni 1647b, pp. 75–90).

25. Mersenne praises Magni's philosophy of the light of minds and compares it with Descartes.

26. Pascal's letter to Le Paieur from February 1648. Pascal later refers to Magni in his *Provincial Letters* as he considers him an intellectual who suffered from the Jesuits, see the letter from 25 November 1656 (Pascal 2010).

fast to stand against Aristotelian dogmata and, apart from himself, included Torricelli, Mersenne, Pascal and Roberval (Magni 1649, p. 29). Otto von Guericke later referred to Magni as one of his predecessors (Guericke 1672, 117) and Georg Wilhelm Leibniz in his correspondence with Guericke cites Torricelli and Magni as inventors of the vacuum experiment, intentionally omitting Pascal's experiments (Leibniz 2006, 1:282).²⁷ In any case, Magni's *Demonstratio ocularis* was the first printed edition of the description of the experiment with void.

In addition to eight editions of *Demonstratio ocularis*, gradually supplemented by polemics and reactions thereto, plus the above-mentioned French translation, Magni also wrote further treatises on the issue of vacuums. The first one is quite significant since the Capuchin had to cope with a phenomenon, which seemed "miraculous" at first glance. The treatise is entitled *De vitro mirabiliter fracto* (Magni 1648a), in which Magni describes the unsuccessful experiment when the glass tube broke. The "miracle" rested in the fact that there was no sensory perceptible external factor, which would cause the tube to break. Magni admitted that the cause could not have been a material object. The cause must have been spiritual in nature (*natura spiritualis*), e.g., a force or energy penetrating the given space where there is no body. Whatever broke the tube, i.e., a spirit, energy, not tied to the body, inherently prevented the creation of the vacuum.

Magni published a short treatise in 1650 on vacuum *Vacuum pleno suppletum* as a supplement to the prior experiments (Magni 1650). Both the publisher and Magni emphasized at the beginning that the experiment's primacy must be attributed to Torricelli, which, however, the author did not know about at the time of publishing *Demonstratio*, just as in the case of Pascal's experiments. Magni now writes about his further experiments without determining the time of execution, supposedly supporting his and Pascal's previous experiments.²⁸

His last summarizing work, *Opus philosophicum*, whose first section was published in 1660 and included a critique of Aristotelianism and Valerian's metaphysics (Magni 1660), also included a treatise on vacuum. It only

27. Leibniz's letter to von Guericke from 17 August 1671. Leibniz also speaks about Magni in this way in letters to Peter Lambeck and Johann Philipp von Schönborn (Subotowicz 1959).

28. Magni, who apparently did not speak French, had Pascal's *Récit de la grande expérience de l'équilibre des liqueurs* from 1648 translated into Italian: *Racconto della grand'esperienza dell'equilibrio de liquor progetto del signor B.P. per lo compimento del trattato, ch'egli ha promesso nel suo compendio toccante il vacuo et fatto dal sig. F. P. in una delle più alte montagne dell'Avernia*. The anonymous translation is housed in the archives of the Capuchin monastery in Vienna (not catalogued).

remained, however, in manuscript, along with the other treatises dealing with natural philosophy (Cygan 1972a).²⁹ The treatise on vacuum is composed of passages from *Demonstratio ocularis* and *De vitro mirabiliter fracto*. Within the structure of the entire work, the vacuum treatise follows the treatise on elements and is followed by the treatise on magnetism. The common denominator is the spiritual nature of powers of continuity, contiguity and discontinuity, which he was introducing as an explanation for natural phenomena already in his treatise *Demonstratio ocularis*.

3. Vacuum and Light Metaphysics

I will now move to the question regarding the purpose of Magni's experiments. In scholarly literature, Magni's *Demonstratio ocularis* is often analyzed either isolated from his other works or only as part of anti-Aristotelianism, therefore as a negative element in his philosophical thought. None of Magni's other vacuum treatises are discussed at all in the literature. My aim here is to consider the connection between these experiments with the positive parts of his philosophy.

Magni did not consider his *Demonstratio ocularis* separately from his philosophical writings. At the very beginning of this treatise, in his dedicatory letter to the Polish king, he referred to his philosophical work *De Luce mentium* (Magni 1649, p. 1) and, at the end of his response, explicitly wrote to Warsaw theologians about his philosophy being the background of his thinking about void (Magni 1649, p. 18). This raises the question, what kind of philosophy did Magni actually profess?

Magni published his work entitled *De Luce mentium* at age 56 as his first philosophical fruit in the year 1642 (Magni 1642);³⁰ this at a time when he was already a well-known ecclesiastical politician, an advisor to the Prague Archbishop, Cardinal Harrach, a legate of the congregation *De propaganda fide* in Central Europe, a keen opponent of Jesuit scholasticism, and a propagator of the certain concept of tolerance with respect to the re-Catholization of the Czech Lands. The book *De Luce mentium* was inspired by the philosophy of St. Bonaventure which he had tried to elaborate into a scholastic system (Boehm 1965; Bérubé 1984). This elaboration, although professing a dependence on medieval sources, has a tendency towards a modern subjectivist approach, as philosophy starting from the philosopher's own mind, from "ego," only to then also reveal traces of Renaissance Platonism (Sousedík 1982).

29. Treatise no. 36 entitled *Vacuum suppletum* is housed in the archives of the Capuchin monastery in Vienna (not catalogued).

30. The book was reedited in 1643 and 1645, modern Latin critical edition was published recently (Magni 2016).

Magni followed in his thought the rules of his order which prescribed St. Bonaventure as the highest theological authority within the order (Elpert 2008). Magni's views, presented already in his first book *De Luce mentium*, therefore did not deviate from St. Bonaventure, although the Capuchin wanted to proceed in his own way. Finally, in the following book dealing with the same topic, his goal was to demonstrate that his thinking can be completely derived from sentences by St. Bonaventure and St. Augustine (Magni 1645). The main features of his dependence on Augustinian Medieval Platonism lie: 1. in the theory of introspection referring to St. Augustine's claim to enter our mind; 2. in the distinction between the realm of corporeal things and the intelligible, unchangeable realm of eternal art, i. e. the realm of ideas; 3. in the theory of illumination, distinguishing illumination by a corporeal light and intellective illumination, both stemming from God the creator (Nejeschleba 2019b).

The concept of light actually plays the central point in his philosophy. Light has a crucial epistemological function in Magni's philosophy as a condition of visual perception and analogically in rational cognition, which is impossible without the aid of mental light. By means of mental light, the human mind compares images of objects acquired through sensual perception with an image previously impressed upon the human mind, and then assesses the veracity of a sensible image (Nejeschleba 2017). Light also has an ontological function in Magni's philosophy. The human mind flows through two realms. The first one is the realm of "existing objects"; the second is the eternal realm of the ideas of all things. These are the exemplars according to which all things were created and what Magni called this second realm of mental light and perfect being. Every existing being of the first realm is dependent upon its being in this mental light. Due to this ontological dependency, we can assume the existence of all beings only in the light of this mental light (Blum 1998, pp. 102–16).

I would like to return to Magni's treatise on the void. First, it should be emphasized that he did not call it an experiment, but *Demonstratio ocularis* which means a demonstration that is accessible through the sight of the corporeal eye. Magni also stated in this treatise that light is a condition of all sensible cognition. There is consequently no chance that his *Demonstratio ocularis* culminates, not with the proof of the existence of void, but with the consideration of light. The last section of his treatise is not only an element of his anti-Aristotelianism demonstrating the indefensibility of Aristotelian natural philosophy; the demonstration of the existence of void is the precondition for his notion of light. Corporeal vision is the central and only faculty of human cognitive activities to grasp the existence of bodies, argued Magni in the *De Luce mentium* (Magni 2016, p. 46). Thus, already in his philosophical first fruit, light seems to be independent from

bodies, but Magni does not go far in this direction. Only his demonstration of the existence of the visible void provided him with the crucial means for the proof of the essentiality of light as a principle of reality.

If light is visible at the place where a body is absent, light is not dependent on any material subject, thus the priority of light in all of creation is demonstrated. Simultaneously it is evident, according to Magni, that light is indeed the fundamental principle of human cognition, for only through vision can we come to this conclusion.

Finally, on the theological level, it was evident to Magni that modern physics did not contradict Christianity. Galileian physics could be harmonized with theology with the help of the metaphysics of light, contrary to atheist Aristotelian philosophy. When considering the metaphysics of light, Magni did not proceed in the similar way his medieval predecessors did, such as St. Bonaventure. His references to the beginning of the Gospel of St. John on light are not the starting point of his thought, but retrospectively affirm the orthodoxy of modern Galileian physics, which is compatible with theology thanks to the metaphysics of light.

Moreover, Magni's responses to the objections of Aristotelian philosophers can be put into the context of his treatise *De Luce mentium*. Jan Brožek, a Krakowian Peripatetic, objected to Magni's demonstration of the void in that sensual cognition is not a source of perfect knowledge for it is erring. When we compare the senses and reason, we should prefer the latter, which proves the impossibility of the existence of vacuum. Thus, Magni's sensual demonstrations are not reliable, for reason proves the opposite. Magni answered with words which can, at first sight, be considered a concession to Aristotelianism. He argued that the existence of void is of course not attainable through the senses, through corporeal sight, but per reason and per mental light: "vacuum is not attainable by means of the corporeal eye, but who observes the tube, he or she can grasp the vacuum by means of the mental eye" (Magni 1649, p. 26).³¹

The real sense of these words can only be comprehended with respect to Magni's philosophy. In *De Luce mentium* he maintained that the human mind is able to come to necessary conclusions in a syllogistic manner only with the aid of mental light. Every true syllogism depends on a general proposition which is not derived from sensual perception, which is to say, from experience. A general proposition in every syllogism is achievable only via mental light (Magni 2016, c. pp. 11, 70–77).³² Therefore, only mental light can come to the conclusion that void is in the upper part of

31. "Fateor, inquam, vacuum non esse visibile oculo corporali, ac visibile est oculo mentis hominis illius, qui oculo corporis intuetur meam fistulam."

32. Magni's logic is formulated as a critique of Aristotelianism (Hubka 1979).

the tube, or that light visible in this part does not depend on any material subject, etc. In his answer to Brožek, Magni even stressed the infallibility of mental light because it is derived from eternal reason. Magni emphasized the theological meaning of experiments with vacuum by the connection of light shining in the void (that means in nothing) with God's creation of light from nothing (Magni 1649, p. 27).

Magni tries to develop a natural philosophy, which would be consistent with the confirmed existence of vacuum. He takes the doctrine on light as a principle of epistemology, ontology and natural philosophy over from Neoplatonist tradition. It seems that he was familiar with the work of Marsilio Ficino, although he never referred to him directly.³³ It is also possible that he was inspired by Francesco Patrizi in his focus on light; at least, his systematic critique of Aristotelianism is reminiscent of Patrizi's critique.³⁴

During the formulation of the principles of natural philosophy, he progressed independently, to a certain extent. As early as in *Demonstratio ocularis*, he determined the power of continuity, contiguity and discontinuity, through which he remodels the previous theory of natural philosophy, which is not sufficient for grasping the concept of vacuum (Blum 2017). He expanded the theory in the *De vitro mirabiliter fracto* treatise. The force exerted on an object can be called different names, e.g. sympathy and antipathy. What is important is that they are forces spiritual in nature and not chimeras (Magni 1648a, p. 15). Continutive power forms and keeps the sphere of the universe together, and it is this force that comes from God the Creator, penetrating the entire universe and is the same throughout, and responsible for rupturing the tube in the attempt to create void.

In the late and unfinished work *Opus philosophicum*, Magni strives to link the theory of cohesive and separation forces with the metaphysics of light. In the *De systemate Solis* treatise, he attributed the separation and mixing of elements to light, as a fundamental principle. In accordance with Medieval and Renaissance Platonic tradition, he differentiated between light with respect to origin (*lux*), which is simple light and composed light called *lumen*. Initial sunlight with respect to origin (*lux*) is the king—the ruler of the solar system. Magni goes on to call sunlight (*lumen*) emitted from the solar body the vice-ruler (*vicarius*), through which elements are separated.³⁵ In the same work, Magni supported Galileo's ideas as well as heliocentrism, which he

33. For instance, Magni's concept of beauty in *De luce mentium* (Magni 2016, c. pp. 6, 54–5), resembles Ficinos's commentary to Plato's *Symposium* (Nejeschleba 2019b).

34. Magni's *Metaphysics* is introduced by the *Synopsis and Critique of Aristotle's Metaphysics*, which resembles Patrizi's *Disputationes peripateticae* (Nejeschleba 2019a).

35. Magni's *Tractatus 19. De systemate Solis* remained only in a manuscript form. It is kept in the archives of the Capuchin monastery in Vienna (not catalogued).

highlighted through the cosmological priority of the Sun as the source of light, located in the centre of the universe (Cygan 1969).³⁶

In conclusion, I again ask the question: what was the real purpose of Magni's experiments with vacuum? Magni did not support experimental science as such. He performed experiments as demonstrations visible through the eyes. This approach is in concordance with the epistemological priority of sight and the demonstration of void helps him confirm the essentiality of light in the realm of natural philosophy in opposition to Aristotelianism. The proof of the existence of void is also deeply connected with Magni's metaphysics of light. The existence of void is only provable by means of mental light. Mental light as an epistemological principle is ontologically dependent on God's light, which is the first being. Thus, Valerian Magni, incorporates, in my view, certain elements of Galilean physics into his scholastic system which was inspired by Medieval, and probably also by the Renaissance Platonic tradition, and saw it as compatible with Catholic theology. The demonstration of the existence of vacuum results in the justification of the essence of light, since its independence is demonstrated on bodies or any kind of material basis. For Magni, this confirms the core of his philosophy based on the metaphysics of light and justifies its priority in the epistemological and ontological sense. His experiments therefore demonstrate a specific philosophical background, which differs from his contemporaries dealing with vacuum.

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36. Also Magni's *Tractatus 31* containing the defence of Galileo and Heliocentrism remained in a manuscript form and is kept in the archives of the Capuchin monastery in Vienna (not catalogued).

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