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ARTICLE

"Philosophy in science" and "science as philosophy". Some selected philosophical views of Małgorzata Głódź

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Abstract

This article attempts to reconstruct and analyze some selected philosophical views of the Polish physicist Małgorzata Głódź, especially within the context of her links with the interdisciplinary milieu in Kraków (known as the "Kraków School of Philosophy in Science"). It emphasizes the significant role that Głódź played in the historical development of this intellectual tradition. The main portion of this article highlights the connections between Głódź's philosophy and the philosophical ideas propagated by Michał Heller, the School's main founder, and his students and other collaborators. The article also indicates elements of her philosophical achievements that deserve attention from the perspective of today's philosophical challenges.

Keywords: philosophy in science, incomplete philosophy, Kraków School of Philosophy in Science, Małgorzata Głódź, Michał Heller

1. Introduction

Małgorzata Głódź (born 1946) is one of a group of physicists who engage in philosophical pursuits alongside their scientific work. She developed her philosophical interests primarily through her interactions with thinkers in Kraków, though she conducted scientific research at institutions in Warsaw. At the beginning of her career, she studied at the University of Warsaw, where she obtained the MSc degree in physics in 1969. She continued to be associated with the Warsaw scientific community in the following years. Głódź was affiliated with the Institute of Physics at the Polish Academy of Sciences in Warsaw (*Instytut Fizyki Polskiej Akademii Nauk*) for a number of decades. She obtained her Ph.D. in physics in 1976 and gained habilitation in 1994. She specialized especially in laser spectroscopy (atom–laser–field interactions). Her achievements in the area of physics are unquestionable, but it seems reasonable to also consider her philosophical achievements. Significantly, Głódź has written papers of a strictly philosophical nature. More precisely, they deal with the border between science and philosophy[1].

This paper is intended as an initial attempt at reconstructing and analyzing selected elements of this philosophical legacy, especially in the light of Głódź's connections with the interdisciplinary milieu in Kraków. By this I refer to the so-called "Kraków School of Philosophy in Science" (KSPS), which has developed over decades through the activities of Michał Heller, his students, and other collaborators[2]. Despite her scientific activity in Warsaw, Głódź regularly appeared in Kraków, where her connections with the local community of philosophers and scientists deepened. She has cooperated with this milieu for many years and become a significant figure in promoting interdisciplinary dialogue between science and philosophy, both through her own publications and other scientific activities undertaken on behalf of the Center for Interdisciplinary Studies (*Ośrodek Badań Interdyscyplinarnych* or OBI)[3]. In this paper I will try to point out the connections between Głódź's philosophy and the philosophical ideas propagated by Heller and his close circle. I will also try to highlight valuable elements of her philosophy—valuable not just from a historical point of view, but also useful within the context of the currently challenges emerging at the nexus between science and philosophy. I will precede the main considerations on the views of Głódź with a historical outline of the OBI, emphasizing in particular the role of Małgorzata Głódź in the development of this research institution[4].

2. Małgorzata Głódź and the Center for Interdisciplinary Studies (OBI)

The OBI was founded as an informal research institution through the initiative of Michał Heller and Józef Życiński[5]. From the late of 1970s, both philosophers had been building an interdisciplinary milieu in Kraków that brought together philosophers and scientists (mainly physicists) with an interest in the relationship between science and philosophy, as well as science and religion (e.g., Sierotowicz 1997). Their endeavors included both scientific and didactic activities, as well as organizational aspects (see Heller 2006, p.49). During the OBI's initial activities, so-called interdisciplinary seminars (monthly meetings of philosophers and scientists) and publications (books and the journal *Zagadnienia Filozoficzne w Nauce*[6], which was founded by Heller and Życiński) were especially important for developing philosophy within the context of science among the Kraków milieu. Głódź was a significant figure in the OBI, with her participating in the initiatives undertaken of Heller's circle.

It is worth noting here that Głódź had been interested in Heller's views since the early 1970s, being one of the first person who notice Heller's scientific potential. In 1972, the journal *Znak* published fragments of Głódź's correspondence with Heller at the time. The correspondence concerned Heller's first book *Wobec Wszechświata*. The discussion, or rather polemic, between Głódź and Heller concerned certain aspects of the philosophy of science, with these being related to, among others, the nature of scientific research in the context of the relationship between experimental and theoretical physics (Głódź and Heller 1972)[7]. In the following years, Głódź and Heller continued their collaboration[8], and when the OBI became active, Głódź worked closely with the Kraków interdisciplinary milieu, co-creating it to some extent. Over time, the KSPS was built on the foundation of this activity of the OBI (Polak and Trombik 2022). The term "philosophy in science" refers to a specific style of practicing philosophy proposed by Heller. One of Heller's students and collaborators, Paweł Polak, characterized it as follows: „This philosophy was developed in an interdisciplinary dialogue between philosophy and science. The concept of «philosophy in science» had its

origins in Heller's broad understanding of the philosophy of nature. Heller described it as a new philosophy for the philosophical interpretation of science" (Polak 2019, pp.266–267). For more about philosophy in science, see Section 3.

Głódź actively participated in the works of the OBI. She participated in events organized by this institution and was also known as the author of philosophical papers that were published on behalf of the OBI. Her publications included strictly philosophical works (Głódź 1992c, 1996a, 2006), reports from events organized by the OBI (Głódź 1987, 1992b, 1996c), and memoirs on various forms of Heller's and OBI's activities (Głódź 1999, 2012). Her papers were mainlny published in journal *Zagadnienia Filozoficzne w Nauce* and collective monographs devoted to Heller (in connection with his milestone birthdays, multi-author monographs were published that comprised papers by his students and colleagues: (Głódź 1996b, 2006). Some of Głódź's articles were also published in books signed by Heller and Życiński (Głódź 1988)[9]. It is also worth noting that she co-authored paper with Heller (Głódź and Heller 1983).

An important element of the OBI's activity in the 1980s was the translation and publication of important works (papers or fragments of books) by Western scholars that were often unavailable in the political realities of Poland at that time. These translations were published in *Zagadnienia Filozoficzne w Nauce*, as well as in other OBI publications. Głódź's contribution should also be appreciated here, because she translated, among others, works by Erwin Schrödinger, Pierre Teilhard de Chrdin, Charles Misner, and later—Polish astronomer and philosopher Andrzej Pacholczyk, who collaborated with the OBI (Teilhard de Chardin 1982; Misner 1983; Schrödinger 1983; Pacholczyk 1996)[10].

Głódź was deeply involved in the activities of the OBI and was keen to develop an interdisciplinary milieu that would focus on investigating the overlap berween science and philosophy[11]. She not only saw the potential of the OBI in this regard, but also identified with the philosophical program of Heller and his students, and openly expressed her affiliation with this movement. Głódź was also one of the first to notice the process of development of the School (although she did not use this word herself), pointing to the continuity of a certain tradition initiated by Heller and Życiński:

> This first group of enthusiasts, organizers and participants of the seminar[12], led by Michał Heller and Józek Życiński, called by Włodek [Włodzimierz] Skoczny the „undisputed pillars of the OBI", was supplemented over time by subsequent „generations" of their students from the Faculty of Philosophy of the Pontficial Academy of Theology [PAT], and later also students of students. Apart from the strict hardcore of the OBI, there was always a milieu of its more or less faithful supporters and co-workers from the academic milieu outside PAT (especially from the Jagiellonian University) and church circles (especially during the communist era, the publishing activity of the group was possible mainly thanks to Catholic editorial offices, also „church-related").[13]

Głódź's very valuable comments show how the KSPS was formed and how important it is to take into account a wide range of influence in the description of the phenomenon of this School: students of Heller and Życiński, the subsequent generation (i.e., the students of students), collaborators, supporters[14]. It should be noted that she herself also identified with the OBI group. The approach to practicing philosophy in the context of science, something

that had formed in the Kraków milieu, was close to her: „The name «philosophy in science» is very relevant and close to my heart" she admitted in 1999, very positively assessing the activities of the OBI as „service to two masters: philosophy in science and cooperation between disciplines" (Głódź 1999, pp.16–17).

Declarations of this type are of great importance when discussing the history of the KSPS, because they prove that there were philosophers among Heller's collaborators who openly admitted being inspired by his philosophy and openly demonstrated their belonging to his circle. I will discuss this issue in more detail in Section 4, meanwhile, in the next part of the paper I will present Głódź's philosophical views against the backdrop of the views of Heller and the OBI circle.

3. Selected philosophical ideas of Głódź in relation to philosophy practiced within the KSPS

The project known as "philosophy in science", outlined by Heller in the 1980s (Heller 1986a)[15], was an important reference point for Głódź in her own philosophical papers. Before I delve further into this, I will give a few remarks on the concept of "philosophy in science", the roots of which lie in the 1970s (as exposed, e.g., by the name of the journal *Zagadnienia Filozoficzne w Nauce* [„Philosophical Problems in Science"], published on the basis of seminars organized by Heller and Zycinski since 1978).

Heller understood "philosophy in science" as a sort of philosophical reflection that continued in a sense what was formerly called the philosophy of nature. This "new" philosophy of nature—precisely as philosophy in science—was more innovative in nature than the traditional forms of this discipline that were widespread in Poland at the time of the OBI's foundation. As a type of non-systemic philosophy—in contrast to the neo-Thomistic philosophy of nature, developed within the framework of the Aristotelian-Thomistic system—it was focused on closer contact with the sciences and the latest philosophy of science. The subject of philosophy, when understood in this way, was to include both the historical and contemporary interactions between science and philosophy (including metaphysics), with an emphasis on the following areas[16]: the influence of philosophical ideas on the development and evolution of scientific theories; traditional philosophical problems intertwined with empirical theories; philosophical reflection over some assumptions of the empirical science (the assumption of the mathematicity of nature, the assumption of the idealizability of nature, the assumptions of an elementary character and the unity of nature).

The analysis of Głódź's philosophical achievements reveals that the area of her interests overlapped with the theme of "philosophy in science" as outlined by Heller, and more broadly—it was simply part of the activities of the wider OBI movement (Trombik 2021, pp.221–226). Although Głódź addressed various issues in her papers, they were all closely related to the problems that dominated within the OBI. It is worth adding that Głódź published these papers over several decades, showing that her philosophical interests were not incidental, but accompanied her throughout her entire scientific career.

Głódź's oeuvre includes papers on certain metaphilosophical aspects (i.e., reflection on philosophy and its connections with science, especially the discussion on the project of "philosophy in science"), contemporary philosophy of science (e.g., the factors influencing the development of science[17], the relationship between theory and experience), ontology

(especially the issue of the mathematicity of the world, which was the major issue taken up by the KSPS[18]), the history of science (i.e., selected issues taken from the modern and contemporary history of science[19]). A separate category comprised papers on the border between science and theology, which although not the subject of this article's analysis, touches upon issues discussed by Heller, Życiński and other members of the OBI (Krauze 2008).

Faced with the question of how to practice philosophy in the context of the sciences, Głódź analyzed Heller's "philosophy in science" project several times. Her assessment of Heller's project and what OBI representatives did in practice to develop "philosophy in science" (as understood as a style of practicing philosophy) was positive. Like Heller, she noticed the numerous relationships between science and philosophy (Głódź 1999; 2006, p.370), and just like Heller and the OBI milieu, she did not approve of the rigid methodological isolationism of science and philosophy that was widespread in the views of some philosophers of nature. Głódź also shared the conviction that contemporary philosophizing in the context of the scientific image of the world necessitated rejecting the maximalist ambitions of the old philosophies of nature, which aimed to construct a system of knowledge that encompasses final answers to questions about reality. This was the result of both the fact of temporariness (openness to change and improvement) of the scientific image of the world, as well as more in-depth methodological and historical research, which reveals the nature of the development of knowledge about the world. In this context, Głódź wrote that „OBI philosophizing is not limited to posing problems, but the chances of finding ready-made solutions are assessed realistically. The methodology and history of science, as well as the history of philosophy—treated in the OBI with due attention—allow us to assume that the search for answers is, perhaps, a convergent process, but the result of individual searches will not be a final answer, but, at best, marking one's participation in the chain of human struggles" (Głódź 1999, p.19). Głódź's remarks in this aspect correspond to the declaration and views of Heller and other representatives of the OBI (Heller 1986a, 1998).

Considering the specifics of philosophy, Głódź clearly highlighted a need to consider its tasks and goals in close connection with our scientific image of the world. She therefore posed the question: „What general framework for philosophy is provided by the evolutionary style of thinking imposed by evolving scientific knowledge about evolving reality?" (Głódź 1996a, p.21). In response, she proposes the idea of an "incompleteness philosophy" ("*filozofia niedomknięta*"). Evolution would be inherent in the nature of philosophy understood in this way—in the sense that it would take over certain features of evolution from the process of developing scientific knowledge. Głódź clarified that „evolution excludes closed (final) systems. Evolution postulates «philosophy on the way». There is no reason for philosophy to fear such a state of affairs. The lack of closure in science is a condition for its development. In science, the metaphor of evolution is not indefinite fluidity. It is rather the spreading circles of a wave, encompassing earlier solutions (or perhaps also a metaphor for «evolutionary waste», removed by the logic of new knowledge) […] The history of human thought gives the impression that—whether individual philosophers wanted it or not—philosophy is somehow open anyway. Why shouldn't it be consciously and programmatically unclosed? Science benefits from this" (Głódź 1996a, p.22).

Głódź's reflections on philosophy can be viewed as part of the project of philosophy practiced within the OBI circle, and fit very well with the idea of "philosophy in science" as an anti-foundationalism proposal for practicing philosophy, or more precisely: as an attempt

to practice philosophy without indisputable philosophical foundations that constitute the basis of the theoretical system which is exhaustive and entirety of knowledge. Foundationalism can be understood as a conviction that „a philosophical system that is supposed to provide certainty knowledge and must be built on indisputable foundations" (Heller 1999b, p.84). "Philosophy in science" was intended as a philosophical project based on the results of science, a proposal constituting „a modern equivalent of the traditional philosophy of nature" (Heller 1998, pp.12–13). This modernity was to manifest, among other things, in a programmatic openness to changes triggered by the developing scientific image of the world. Głódź shares this view of philosophy and accepts, just like Heller, the necessity of an interdisciplinary approach to philosophical problems involved in science (Głódź 1999). "Incomplete philosophy" understood this way can, on the one hand, address traditional, great philosophical problems currently entangled in scientific theories while, on the other hand, follow the example of the sciences and focus on certain aspects of reality, ultimately contributing through detailed research to a deeper understanding of certain phenomena. Głódź considered this second aspect of philosophy and posed questions that could be treated as an encouragement to think through the foundations of philosophy when understood as philosophy in science: „philosophy that ignores a series of questions and analyzes only a fragment of reality is contemptuously considered as contributory. Is the contempt justified? Perhaps, at least in some cases, contributory philosophy is a good path to truth? Why is a philosopher afraid to admit: I am programmatically exploring this fragment, and I will probably never know about the other?" (Głódź 1996a, p.22).

An important element of the analyses conducted by Głódź on the philosophy practiced within Krakow's interdisciplinary milieu was the question of referring to the slogan "science as philosophy", which sort of complemented the idea of "philosophy in science" (Głódź 2006, p.370; Heller 1998; 2007, pp.189–191). At this point, Głódź also referred closely to Heller's ideas, proposing the foundations of her own view, which fits into the understanding of "science as philosophy"[20]. The slogan "science as philosophy" is understood in such a way that the sciences, by taking over an important part of the old functions of philosophy, carry information about what reality is like, and the process of interpreting this information has a philosophical value in the end. In the case of Głódź, it should be clarified that she means precisely physics as "science"; physics is the model of science for her (Głódź 2006, p.372). By "philosophy" she refers to ontology here, along with its important epistemological references.

In the case of epistemological issues, especially the problem of the relationship between scientific descriptions and reality itself, her position is close to realism (i.e., scientific realism). She is convinced by the "miracle argument" by John Worrall (Głódź 2006, p.372)[21]. The mathematical–empirical method of investigating the world is an effective procedure that allows us to discover certain properties of the world. It is worth highlighting here some of Głódź's remarks that are important from the perspective of the philosophy of science. Głódź has repeatedly emphasized the close interdependence of theory and experiment (experience). She considers the division into "theoretical physics" and "experimental physics", something that is apparent even in the organizational structures of research institutes, as being invalid and harmful (Głódź and Heller 1972, p.739). She justifies her own position on this matter with research practice itself: experimental physics requires a theoretical foundation, because an experiment cannot be described without referring to the theoretical layer[22]. According to Głódź, this is an expression of the fact that „reality is significantly richer than our common

ideas about it. Understanding a number of its properties consists of «reading into» the description made in the language of mathematized theory" (Głódź 1992c, p.107).

The effectiveness of investigating the world using mathematical and empirical methods prompted Głódź to put forward an ontological view. Inspired by Heller's analyses of the ontological aspects of physics (Heller 1986b), she states that physical theory itself—as mathematical structure confirmed empirically—can be considered as „a specific ontological interpretation of the world" (Głódź 2006, p.371). A physical theory carries information about what the world is like, and therefore—as Głódź concludes—it actually carries information of an ontological nature, i.e. about the nature of being (Głódź 2006, p.376). In this sense, physical theory becomes philosophy and the slogan "science as philosophy" becomes legitimate (Głódź 2006, p.371).

Ontological considerations conducted in the OBI circle often led to discussions about the mathematicity of nature (Heller and Życiński 1990). Many scholars who descended from Heller's milieu have followed their inspirator in treating mathematicity as a property or feature of nature, precisely in the ontological sense (Życiński 1987). The problem of the relationship between mathematics and the world itself is also a key element of Głódź's philosophical considerations. This represents an interesting example of the practical implementation of the "philosophy in science" project. It is significant that her position on the issue of mathematicity of nature is also similar to the positions shared by Heller, Życiński and other members of OBI.

Głódź believes that the mathematizability of nature (i.e., the possibility of describing nature through mathematics) is a fundamental methodological assumption of science (Głódź 1996b, p.56). Nevertheless, she did not stop at this obvious fact but rather tried to address the philosophical question about the property of nature itself, which is described mathematically. She sees the possibility of moving from epistemology (i.e., a mathematical description of nature within the context of its investigation) to ontology (mathematicity as a property of nature that is investigated). Głódź seems to have rejected ideas close to phenomenalism, writing that „the discovered regularities actually concern the structure of the world, not our mental states" (Głódź 1996b, p.57). She directly suggests that mathematical structures fit the world, thus raising the legitimate question of whether they are some kind of reflection of the structure of nature.

The correspondence between the structures of mathematics and the physical world is not "pure", i.e. mathematical theory does not describe fragments of reality in all its complexity, but, due to idealization, it only provides an approximate image of a fragment of reality. It is worth emphasizing that Głódź, following the ideas of Heller's project of "philosophy in science", treated the idealizability of nature as a basic assumption of science that one should reflect upon. Heller directly pointed to the idealizability of nature as a key assumption of science that requires philosophical reflection (Heller 1986a, pp.17–18). Głódź conducted such reflection, showing that the possibility of applying idealization in the description of nature allows for approximating its ontological structure through the structures of mathematics used in sciences. At this point, Głódź returns to the interdependence of theory and experience, emphasizing that „in the preparation of a piece of the world so that it is subjected to the research procedure, i.e. idealization, both experience and theory participate, because everything happens [...] in a network of interdependencies" (Głódź 1996b, p.53). It is also worth noting Głódź's remarks on what she called the "mathematicity of experience". In assuming the mathematicity of

nature, „we also assume the mathematicality of that part of it which constitutes experience in physics" (Głódź 1996b, p.57). Experience is a part of reality, and its course is subordinated to "Mathematics-Structure" (Głódź 1996b, p.48).

In this case, Głódź adopts the Heller's distinction between mathematics with a small „m" (i.e., mathematics as applied in science) and Mathematics with a capital „M" (i.e, as a property of nature itself). In some fragments of her papers, Głódź seems very close to Platonism in its structuralist version, which Heller also approved of. According to her, scientific practice itself (or rather the successes of mathematized sciences) testify to the fact that the world has a certain property that allows for the reconstruction of its structure. The laws of nature discovered by scientists concern the very structure of the world; mathematical structures correspond to these structures of the world (i.e., its ontology).

In these ontological considerations, Głódź revealed herself as a scientist keenly interested in certain philosophical consequences of scientific discoveries. According to Głódź, practicing science is something that essentially opens one up to metaphysical issues and even further, theological issues (Głódź 1993, p.36) in the sense that awareness of the possibilities (but also certain limitations) of science creates a framework for reflection of a theological nature (e.g., on the nature of God). In relation to religion, science—as a key element of contemporary culture—should serve as an important source of theological inspiration. Głódź openness to issues on the border between science and religion is another significant feature of intellectual formation related to KSPS[23], characteristic also of the "philosophizing scientists" associated with the School, such as Andrzej Fuliński or Leszek Sokołowski (Sokołowski 2011).

The above examples show how closely Głódź's philosophical position dovetailed with the idea of "philosophy in science" and how closely it fit with the philosophical profile of the OBI. Głódź's views should be discussed in more detail—which may happen in a more extensive work—to further cosider these similarities. I assume that the fragments of her papers presented here are representative of her greater philosophical output—in the sense that they highlight certain threads that are common to her and the KSPS, thus allowing to considered her as an prominent member of this School.

4. Some summary remarks about Głódź's philosophical activity

Głódź's philosophical works are not well known within the philosophical community. If we tried to measure her philosophical impact merely by citations, we could say that it is moderate. References to Głódź's works appear mainly within the Kraków milieu (Heller and Życiński 1990, p.121; Heller 1992, p.51; Wszołek 1994, pp.82–83; 1996, p.224; Rodzeń 2007, p.92; Stolarczyk 2018, p.271). On the other hand, the number of citations (especially at the current stage, when Głódź's achievements are only just being exposed) does not necessarily say anything about the quality of these achievements. The history of philosophy includes many examples where the value of a philosophical work was only appreciated years later. One of the goals of this paper was to show that Głódź's articles contain serious philosophical potential worthy of attention in our current reality. Any assessment of her achievement should be nuanced, however. For example, it is debatable as to what extent Głódź's ontological remarks contribute anything new to old disputes about the properties of the world. Nevertheless, certain issues related to the philosophy of science (such as the issue of the theory–experience relationship or the related issue of the "mathematicity of experience") deserve close attention,

because Głódź's suggestions in this respect seem relatively original[24]. I believe that in this context, it is also worth emphasizing the fact that Głódź, as a scientist, emphasizes the value of philosophical reflections conducted under the light of scientific knowledge. In her works, one can find many valuable remarks on the understanding of philosophy and the relationship between philosophy and science. These were not just empty declarations, because—as her own achievements show—she put into practice the idea of "philosophy in science".

Głódź was a promoter of interdisciplinary research, within which philosophy plays an important role. She herself participated in such a dialogue between science and philosophy for many years, working within the OBI, where the postulate of interdisciplinarity was put into practice: „I understand interdisciplinary research as the cooperation of specialists of various specialties. However, from the point of view of one specialist, each specialist from a different field is placed in an external position. How can philosophy in science be practiced interdisciplinarily? Probably only in the sense that a scientist must be practiced «interdisciplinary» in at least two fields: he must be suspended between his scientific specialization and philosophy, i.e. in addition to the «scientific sense», he should have «a sense of philosophical perception of problems», as well as philosophical education. It seems, however, that philosophical issues in science cannot be studied in an interdisciplinary way—understood broadly. Meanwhile, the many years of achievements of the OBI contradict this statement" (Głódź 1999, pp.16–17). Głódź is convinced that if philosophers are not ignorant of science, and if scientists do not treat philosophy as a set of meaningless statements, they can meet in creative discussions. According to her, the OBI was an example of such a milieu, one in which interdisciplinary dialogue took place in a creative and fruitful way.

I believe that these remarks regarding the need for interdisciplinarity in philosophy are so currently pressing that they are worth recalling. It is undoubtedly worth emphasizing, for historical reasons, that they are not entirely innovative, however. Even when only considering the OBI milieu, they are actually repetitions of what Heller had been expressing since the 1970s. On the other hand, Głódź's reflections on the so-called "contributory philosophy" seem very promising. In the OBI milieu, the value of philosophical research on certain detailed issues entangled in scientific theories (or from a slightly different perspective, on fragments of reality that were philosophically "penetrated" in attemps to understand them a little better) was eagerly emphasized. If such contributory research is not an end in itself, but simultaneously constitutes an essential basis for reflection on the so-called great questions of philosophy, then it can significantly enrich the traditinal branches of philosophy, and protect philosophers from naive generalizations and excessive speculation. The history of philosophy confirms that such a threat has lingered at various stages. The Kraków School attempted to remedy these threats, and Głódź's position on this matter could have been one of the important voices pointing to the value of such a "contributory" approach, which, after all, does not exclude metaphysical problems from the area of philosophical reflection.

These examples show that in terms of the approach to practicing philosophy, the ideas of Heller and the entire OBI community were very close to those of Głódź. The project of practicing philosophy in science, as an interdisciplinary project in principle, was intended to constitute a new form of philosophy of nature. According to Heller and his collaborators, philosophy in science should not be limited solely to the analyzing the language of science or scientific methods, nor should it merely generalize the results of science. Heller tried to go beyond the relatively narrow understanding of philosophy that was characteristic

of, for example, certain forms of positivism. In this respect, the OBI milieu preferred a more maximalist approach, and an expression of this maximalist attitude was openness to metaphysical problems. In other words, philosophy in science was in practice a project of anti-naturalistic philosophy. Heller's metaphysical interests were also shared by his students and colleagues, including Głódź (e.g., her ontological considerations on the properties of nature, which can be interpreted as a manifestation of "science as philosophy"). These interests sometimes even led them to take up issues on the nexus of science, philosophy, and theology. On the other hand, the project of philosophy in science, despite these maximalist tendencies, also had its minimalist profile—in the sense that it was a non-systemic philosophy, not pretending to construct a holistic image of the world (this was, for example, a frequent ambition of systemic philosophies, especially in the Thomistic style, something that Heller's milieu widely polemicized[25]). It was a philosophy conceived as an open project, or—as Głódź used to say—a philosophy that was programmatically open, "incomplete", a "philosophy on the way", the development of which was conditioned by the development of scientific knowledge. Głódź's philosophical achievements show that this balance between minimalist tendencies (in the sense of non-systemic philosophy) and maximalist tendencies (in the sense of a certain anti-naturalism, or at least anti-scientism[26]) was apparent in her papers, and dovetailed with what was generally characteristic of the OBI milieu.

The "philosophy in science" project was implemented in practice by Głódź, and in addition she openly admitted to being inspired by Heller's ideas and demonstrated her awareness of belonging to the Kraków interdisciplinary community (i.e., the OBI). These various factors, i.e., firstly—involvement in the activities of the OBI; secondly—the convergence of Głódź's interests with the research interests of Heller and his other collaborators; and thirdly—a similar (convergent with the project of "philosophy in science", which Głódź herself declared was close to her) way of philosophizing, allow us to consider Głódź as a representative of the Kraków School of Philosophy in Science.

Głódź's philosophical achievements are one of the examples of Heller's idea of "philosophy in science" finding fertile ground among representatives of science. In the context of post-war, 20th-century Polish philosophy, this was a phenomenon—i.e., the visible influence of philosophical ideas among scientists—unseen anywhere else on such a scale. Indeed, Głódź was not an unique figure from the OBI environment in co-creating a specific philosophical School while being active in science. There were many such philosophizing scientists in Heller's circle (e.g. Leszek Sokołowski, Andrzej Fuliński, Alicja Michalik, Andrzej Staruszkiewicz), which leads to the guess that the approach to practicing philosophy in the context of science, proposed by Heller, turned out to be very effective. Philosophical research is still needed to highlight (or deny) the deeper connections between the ideas of scholars such as Głódź and the ideas of Heller and the entire OBI milieu. Further historical research is also undoubtedly needed to shed light on other, possibly even sociological, factors in the development of the School, with an emphasis on the role played by representatives of the sciences in this process.

Importantly, some of Głódź's work holds importance for historical research, because it illustrates the historical development of the intellectual formation known as the KSPS. Głódź not only participated in this milieu as a philosophizing scientist, but she was also a keen observer of it. She was one of the first to clearly emphasize certain unifying factors that emerged among Heller's students and collaborators, which formed this philosophical milieu. Głódź wrote about certain factors as early as the late 1990s (Głódź 1999). This shows

that identification with Heller's ideas and the OBI milieu appeared in some—as in Głódź's case—already over 25 years ago. In the context of further research, especially in relation to the discussion on the historical factors involved in the formation of the School (Polak and Trombik 2022), this seems to be of great importance.

Notes

1 At this point, it should be noted that Głódź has also published papers about the relationship between science and religion (e.g., Głódź 1982b, 1992a, 1993, 1994, 1997). Certain aspects of this issue in Głódź's works will therefore also be considered here. Nevertheless, due to the purpose of this paper (the emphasis on the relationship between science and philosophy in Głódź's works with the desire to compare her views with those of Heller and his collaborators), I will leave the subject of the relationship between science and religion in Głódź's works for another occasion.
2 For more information on KSPS, (see e.g., Polak and Trombik 2022).
3 For more on the OBI from a historical and philosophical perspective, see: (Heller 1999a; Heller et al. 1999; Heller 2006; Trombik 2019).
4 The quoted fragments of Głódź's works are translations by the author of this article.
5 Heller and Życiński were academics at the Pontifical Academy of Theology in Kraków (PAT). From the 1970s, they collaborated both on an institutional level (contributing to the creation of the Faculty of Philosophy at the PAT and organizing a local community of philosophers interested in the sciences) and on a philosophical level (initiating and developing the project of philosophy practiced in the context of the sciences). For more information on certain aspects of this cooperation, (see Trombik 2019).
6 The journal is currently called "Philosophical Problems in Science".
7 Głódź's comment on this discussion is significant: "I believe that the misunderstanding between us stemmed, at least in part, from slightly different «sources of admiration» in each of us. For me, the point of discussion about research was closer to the research itself. I like that humans have an effective method for penetrating reality. I didn't actually explicitly ask why this method is effective. For you, the beauty of physics lies one level lower – in the structure of the world itself, in the conviction that it is constructed in such a way that we can investigate it. For me, the beauty of physics lies in the fact that we can investigate the world, that we can decipher the code of its structure, and that when we apply it to reality, we find that it fits quite well. After all, no one said that enthusiasm must necessarily be aroused by causes, not effects" (Głódź and Heller 1972, p.741).
8 Głódź also followed Heller's publications and even wrote reviews of some of his books, in which she discussed various philosophical issues (Głódź 1982a, 2010).
9 Part of this chapter was previously published in the journal *Przegląd Powszechny* (Głódź 1984a, 1984b).
10 Teilhard de Chardin's text (translated by Głódź) was later also published in Heller and Życiński's book *Drogi myślących.*
11 It is worth adding that Głódź was a keen observer of the changes in Polish scientific culture that occurred in connection with the collapse of the so-called Eastern Bloc. For example, she noted with some concern that after 1989, interest in the relations between science and philosophy in Poland was decreasing (Głódź 1992b).
12 Głódź means here the interdisciplinary seminars that I wrote about above. See also: (Liana and Mączka 1999).
13 (Głódź 2012, p.5).
14 It is worth noting that Głódź treated the OBI not so much as a scientific institution, but rather as a group of enthusiasts deeply involved in conducting a dialogue at the interface of science and philosophy: „calling OBI a research and didactic institution, even when the Centre [OBI] was affiliated with PAT [the Pontifical Academy of Theology in Kraków], was, in my opinion, a slight exaggeration. What was happening there intensively was of a «pure» character, precisely outside the institution,

untainted by subordination and bureaucracy, supported on the shoulders of consistent and systematic enthusiasm. On the other hand, what kind of institution is it that has no headquarters, no stable income, no paid employees. But despite this, or maybe, as I thought, thanks to the lack of bureaucratic burdens, it works brilliantly" (Głódź 2012, p.6).

15 English version: (Heller 2019). For more on the historical context of the origin of the idea of "philosophy in science", along with a discussion of this concept of practicing philosophy, e.g., (Polak 2019; Pabjan 2019).

16 "Philosophy in Science" initially primarily covered various philosophical issues arising in physics and cosmology. Over time, it also began to touch upon problematic issues of other disciplines: on the border of philosophy and chemistry, philosophy and biology, and in recent decades it has been used as a proposal for pursuing reflection on traditional epistemological and anthropological problems entangled in neuroscience (Dębiec 2006). The project of the so-called "philosophy in informatics" (or "philosophy in technology"), which focuses on the philosophical aspects of new technologies, has also proven innovative (Rodzeń 2007; Polak 2017, 2023; Krzanowski 2023).

17 For example, she took a position in the context of the classical problem of the philosophy of science, namely the issue of scientific development and the factors conditioning this development. Głódź shared the belief about the rationality of the development of knowledge (at least in physics), but she also emphasized the importance of sociological factors (Głódź 1996b, p.50).

18 See e.g., (Heller et al. 1999; Trombik 2025).

19 See e.g., (Mączka et al. 2012).

20 Although Głódź referred to the idea of "science as philosophy", she understood it somewhat differently than Heller's declarations in some of his works (Heller 2007), emphasizing the informational content of scientific theories themselves rather than their philosophical interpretations. In this sense, one could say that her understanding of "science as philosophy" is somewhat narrower than in some of Heller's works, although consistent with the content of his other works (Heller 2006).

21 It is worth noting that the "miracle argument" in support of scientific realism has been a subject of interest for OBI scholars, especially Jacek Rodzeń (Rodzeń 2005, 2006).

22 Compare with: (Życiński 1993, pp.75–93).

23 For a historical perspective see e.g., (Obolevitch 2012; Polak and Rodzeń 2021; Polak 2023).

24 This originality is also noticeable in the context of the views of Heller himself and his close associates, such as Życiński. Some subtle differences can be seen here as a result of slightly different research emphases, which Głódź signalled already in the 1970s (see footnote 7 on the "sources of admiration" in the context of physics' successes). In the case of Głódź, one can speak of a slightly greater emphasis on experimental physics than in Heller's case, and therefore a slightly different view of science. Her reflections on the "mathematicity of experience" can be considered an important supplement to Heller's analyses about the mathematicity of the world.

25 See e.g., (Heller 1996). An example of Głódź's position on Thomism: (Głódź 1996b, p.54). More information about the criticism of Thomism from representatives of the OBI milieu: (Trombik 2021).

26 See e.g., (Głódź 1988, p.141).

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