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LEVELS OF THE WORLD. LIMITS AND EXTENSIONS OF NICOLAI HARTMANN'S AND WERNER HEISENBERG'S CONCEPTIONS OF LEVELS*

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The conception that the world can be represented as a system of levels of being can be traced back to the beginnings of European philosophy and has lost little of its plausibility in the meantime. One of the important modern conceptions of levels was developed by Nicolai Hartmann. It exhibits remarkable similarities and contrasts with the classification of the real developed by Werner Heisenberg in his paper *Ordnung der Wirklichkeit (Order of Reality)*. In my contribution I will introduce these two conceptions of levels and compare their salient features. I will discuss them as variants of a scientific worldview that attempts to forge a link to the perspective of the lifeworld. Then I will go on to argue that the shortcomings of these conceptions can be remedied by extending them with the level of the very small and that of the very large. The introduction of these ontologically fundamental levels is based on scientific knowledge that for the most part eludes the intuitively representable character of lifeworld experience. Historical changes in science and the lifeworld could lead to the notion that reality can be represented as a system of levels being challenged in future.

Key words: Nicolai Hartmann, Werner Heisenberg, level, layer, stratum reality, scientific worldview, lifeworld, universe, subatomic.

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УРОВНИ МИРА. ПРЕДЕЛЫ И РАСШИРЕНИЯ ПРЕДСТАВЛЕНИЙ НИКОЛАЯ ГАРТМАНА И ВЕРНЕРА ГЕЙЗЕНБЕРГА ОБ УРОВНЯХ

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Представление о том, что мир может быть представлен как система уровней бытия, восходит к истокам европейской философии и мало утратило за это время своей правдоподобности. Одна из важных современных концепций таких уровней была разработана Николаем Гартманом. Эта концепция демонстрирует замечательные сходства и различия с классификацией реального, разработанной Вернером Гейзенбергом в его статье *Ordnung der Wirklichkeit (Порядок реальности)*. В своей статье я представляю две концепции уровней и сравню их характерные черты. Я буду обсуждать их как варианты научного мировоззрения, которое пытается установить связь с точкой зрения жизненного мира. Далее я покажу, что недостатки этих концепций можно исправить, расширив их до микроуровня и макроуровня. Введение этих онтологически фундаментальных уровней основано на научном знании, которое по большей части ускользает от интуитивно представимого характера жизненного опыта. Исторические изменения в науке и жизненном мире могут привести к тому, что реальность может быть представлена в виде системы уровней, которые будут поставлены под сомнение в будущем.

Ключевые слова: Николай Гартман, Вернер Гейзенберг, уровень, слой, стратова реальность, научное мировоззрение, мир жизни, Вселенная, субатомное.

1. INTRODUCTION

The conception that the world can be represented as a system of levels of being can be traced back to the beginnings of European philosophy and has lost little of its plausibility in the meantime. Democritus's atomism can be seen as an early representative of the idea of levels (Hartmann, 1942, 44). An invisible level of atoms gives rise to the level of visible objects. Here one can speak of levels insofar as atoms and visible objects can be differentiated through different types of properties. Democritus's atoms differ only in size, shape and location; the visible objects have in contrast, even if only apparently, a variety of qualitative properties. In Aristotle we find a non-atomistic conception of levels that distinguishes between inanimate and animate bodies, and subdivides the latter according to the functions of nutrition and procreation, of perception and of thinking (Hartmann, 1943, 180 ff.; Schiemann, 2005, 42 ff.). In this way he explains the difference between lifeless matter, motionless plants, sentient

animals and human beings endowed with mental capabilities. Although Aristotle acknowledges that there are diverse transitions between these four levels, he nevertheless insists on the fundamental qualitative differences between them. René Descartes later turned against Aristotle's classification of reality by contrasting extended bodies with non-extended mind, two substances that can also be understood as ontological levels and continue to influence contemporary thought in the modified form of body-mind dualism.

It was only during the twentieth century that the scientific conceptions of levels began to detach themselves from ones founded on lifeworld experience. Lifeworld-based notions of levels are distinguished by the immediacy of their contents and the taken-for-grantedness with which they understand their objects — that is, by properties that are at odds with the non-intuitive and critical character of modern scientific knowledge. Today, depending on the context, we can draw on a plurality of lifeworld-based conception of levels in the quest for better orientation in the world. Sometimes the Aristotelian division into four parts, at others the Cartesian bipartite division — to mention just two among the examples cited — can be applied better¹. Over the past century, qualitative distinctions were exposed to scientific criticism and traditional conceptions of levels were reformulated accordingly and new approaches developed². Nicolai Hartmann's and Werner Heisenberg's conceptions of levels are prime examples of the interplay of these tendencies. A striking shared feature is that they remain oriented to lifeworld notions to an extent that is no longer justifiable from a contemporary scientific perspective. If one wants to uphold the claim to grasp the world as a whole, one must accept the existence of levels of reality that elude lifeworld — i.e. above all intuitively representable — experience.

Nicolai Hartmann's doctrine that the world exhibits a level structure draws expressly on historical predecessors and seeks to combine them with contemporary knowledge in two ways. On the one hand, he wants to provide orientation for the lifeworld endeavor of "finding one's bearings in the world" (Hartmann, 1946, 63)³. On the other hand, his *New Ontology* wants to take into account the progress in scientific

¹ See Schiemann (2005, 3 ff.), although the operative concept of the life-world there is narrower, so that it only allows for a limited application of Cartesian dualism.

² For criticism, see (Stephan, 1999, 129–155), on notions of levels in the context of theories of emergence, see (Heil, 2005, 17–49); reformulations are presented by Hartmann and Heisenberg; an example of a new approach is the physical concept of the "quasi-autonomous domain," on which see (Robinson, 1992).

³ Hartmann does not speak of the lifeworld, but of the "natural" worldview, by which he means the same thing.

knowledge. Hartmann's aim is to unify knowledge based on lifeworld experience with scientific knowledge. The 'theory of categories,' he writes, "finds its objects in all areas of life and science" (Hartmann, 1940, 15). It does not adopt the conceptions of everyday understanding and science uncritically, but instead subjects them to analysis and evaluation for the purposes of the theory of categories.

Where Hartmann deviates from the assertions of science on specific questions, he feels compelled to provide detailed justifications for his positions. The fact that he repeatedly draws parallels between the structure of his theory of the levels of the real world and the division of the academic scientific disciplines can be interpreted as an indication of how much he takes his orientation from the knowledge of the individual sciences. The theory of levels, the main result of his theory of categories, asserts that the real world is composed of the four superimposed levels of inorganic (*anorganisch*), biological (*organisch*), psychological (*seelisch*) and spiritual (*geistig*). This division of being into "heterogeneous spheres of objects" means that

the sciences, in like manner, split up into interrelated groups of fields according to the same differences. From the fields of exact knowledge of inorganic nature the biological sciences are set off by a clear demarcation line. These are followed by psychology with its various branches, from which in turn the *Geisteswissenschaften* proper distinguish themselves... (Hartmann, 1953, 46; cf. Hartmann, 1942, 38)

When it comes to assessing Hartmann's claim to have captured the system of science and its findings in a theory of categories it may be helpful to compare his theory of levels with approaches that also claim to divide reality into levels, but were formulated by scientists from other disciplines. One such approach, which moreover was developed around the same time and in the same cultural environment, can be found in a manuscript by Werner Heisenberg, which was published posthumously under the title *Ordnung der Wirklichkeit (Order of Reality)*⁴. In this work, Heisenberg develops a model of reality which, in its mode of justification and its classification, exhibits certain affinities with Hartmann's ontology⁵. Heisenberg is also concerned both to establish a connection with a lifeworld-based understanding and to process scientific findings in a critical way. When it comes to its extension, his division of reality coincides for the most part with Hartmann's four levels, as I will show.

⁴ The manuscript was first published in Heisenberg (1984) and is also available as Heisenberg (1989).

⁵ Höfert (1952) also highlights the affinity between Heisenberg's conception of closed theory and Hartmann's theory of categories. Heisenberg's conception of levels can be seen as a generalization of his earlier notion of closed theories; see (Schiemann, 2008, 70 ff., 90).

However, the appeal of the comparison resides less in the similarities than in the differences between and the resulting desiderata of the two conceptions. Unlike Hartmann, Heisenberg does not understand his model of levels as a continuation and summation of previous efforts, but as a break with mainstream philosophical traditions. In the historical development of attempts to determine the structure of the world he sees, not a general tendency leading in the long run to an approach to the truth (Hartmann, 1940, 33), but instead deep discontinuities between the possibilities of thematization in successive epochs (Heisenberg, 1984, 218; cf. Heisenberg, 1984, 277, 295, 304 ff.). Heisenberg's motivation for looking for a structure of the world is therefore in a sense the exact opposite of Hartmann's intentions. He does not inquire into an epoch-spanning orientation, but into an epoch-specific characterization of the world that is unavoidably hypothetical because it may lose its validity in the future. Hartmann's theory of levels has also not been able to avoid a historical change that, in a completely different way than he himself probably assumed, has invalidated the basic structures of his categorical analysis.

Among the differences between the two approaches is in addition the fact that Heisenberg made much less of an effort to justify his approach than Hartmann and that his brief remarks at times remain vague. His slim manuscript of about 140 printed pages was probably written in the early 1940s during the summer holidays that he spent at his house near Urfeld. Heisenberg himself described his text, perhaps also on account of some weaknesses of form and content, as 'private' and 'personal.'⁶ Although not explicitly described as such, the writing has the character of a legacy in which Heisenberg, in case he did not survive the Third Reich, communicates his worldview to posterity. Although the manuscript represents the most coherent elaboration of Heisenberg's philosophical ideas, the scope and depth of its systematic elaboration can hardly be compared with Hartmann's doctrine. Conversely, Hartmann's conceptual precision provides a critical yardstick that can also be applied to Heisenberg's model.

Finally, a comparison of the two conceptions of levels also brings to light shortcomings that can be traced back in part to subsequent developments in individual scientific fields and in part to subsequent changes in the self-evident cultural assumptions that shape everyday practice. Some of the weaknesses could be rectified by adapting the conceptions to changed conditions of knowledge. In this context, I will propose that two new levels should be introduced that extend the two conceptions and at the same time reveal their limits. The proposed levels frame the conceptions of Hartmann and Heisenberg, as it were, and thus situate them within a new framework

⁶ References in (Schiemann, 2008, 85).

of meaning. However, one can also formulate fundamental reservations concerning their positions that point toward an order of reality that rejects a level conception.

In my contribution I will first introduce the two conceptions of levels and then offer a more detailed comparison and critical discussion of them. I will thematize the two conceptions as variants of a scientific worldview that attempts to forge a connection with the lifeworld perspective. In the final section, I will return to the relationship between the worldviews of science and of the lifeworld, which Hartmann and Heisenberg assume to be unproblematic.

2. HARTMANN

Hartmann's commitment to the philosophical tradition and his simultaneous recourse to the lifeworld perspective are exemplified by how he introduces the four levels. In everyday practice, he writes, it is evident that the "multiplicity of forms [of the world...] constitutes a realm of steps [*Stufenreich*]" (Hartmann, 1953, 43 (translation amended); cf. Hartmann, 1942, 36)⁷. Moreover, he is not in any doubt that his approach to determining the system of levels, which he borrows from modern philosophy, is for the most part plausible from the perspective of the lifeworld. Appealing to Descartes' metaphysics, he first divides reality into a spatial external world and a non-spatial inner world. While Hartmann assumes that the subsequent division of the external world into inorganic and biological domains is also a matter of common knowledge, he does not think that the spitting of the inner world into the psychological and spiritual domains is equally intelligible. According to Hartmann, the psychological, or that which can only be experienced by the individual, was first brought to light by psychological research together with the demarcation from the spiritual, which refers to all intersubjectively accessible phenomena of conscious life (Hartmann, 1940, 189 ff.; Hartmann, 1942, 37; Hartmann, 1946, 73 ff.). Hartmann subdivides the spiritual into the three component levels of personal (*persönlich*), objective (*objektiv*) and objectified (*objektiviert*) spirit. Personal spirit comprehends the life of consciousness belonging to a person, objective spirit refers to collective achievements that rest on accomplishments of personal spirit (language, law, custom, morality and

⁷ The difference between lifeworld and scientific level conceptions, according to Hartmann, is that the former is 'not fundamental enough,' because it only comprehends 'formations (thing, organism, human being, etc.);' but not levels of being (Hartmann, 1953, 44; cf. Hartmann 1940, 188 ff.; Heisenberg, 1984, 232 ff.), makes a comparable distinction between a 'classification of things (in the most general sense)' and a scientific 'system of law-governed connections.' The term *Stufe* (step), which Hartmann and Heisenberg use synonymously with *Schicht* (level, stratum), is more suggestive than the latter term of a hierarchical structure, which can usually be justified only with qualifications.

science) (Hartmann, 1942, 64), and by objectified spirit is meant “the formation that [...] personal or objective [...] spirit has created in the world of sense” (buildings, infrastructures, works of art, books, and so forth) (Bollnow, 1982, 72).

In his further reflections, Hartmann in no way questions the general plausibility of dividing up the world along categorial lines. The scope of the sections of his works in which he presents this classification as an established fact is negligible compared to his detailed descriptions of the individual levels and the relationships between them. With the exception of the psychological level, Hartmann devoted separate monographs both to the systems of categories of individual and several levels and to the relationships between them (Hartmann, 1933; Hartmann, 1940; Hartmann, 1950) (cf. Fig. 1).

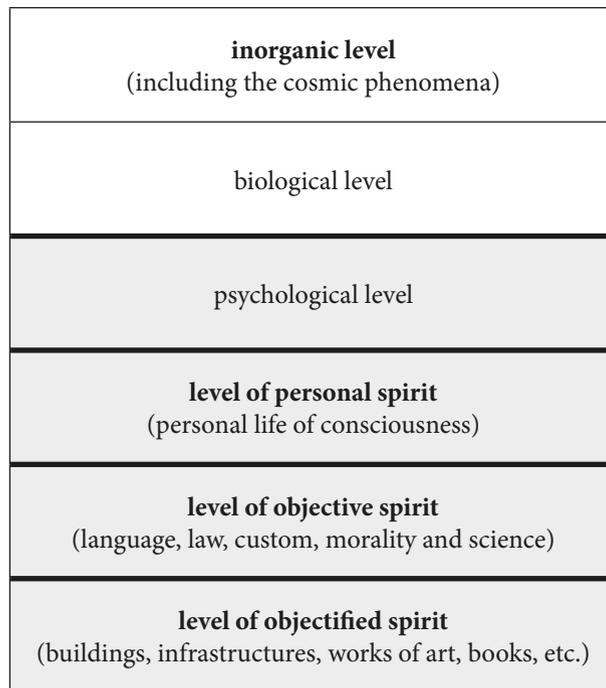


Fig. 1: Hartmann’s division of the real world. The natural domain has a white, the non-natural domain a grey background. The thin line symbolizes a relation of super-formation (*Überformungsverhältnis*), the thick lines stand for a relation of super-position (*Überbauungsverhältnis*) between two levels. Terms in brackets are for explanatory purposes only.

Each of the levels is characterized by a system of categories, whereby the justification of the selection of the individual categories is not demonstrated in a systematic way and it varies according to context. To each level belong categories whose occurrence is specific to that level alone. Hartmann considers the properties designated by

these categories to be irreducible — that is, they cannot be explained in terms of the properties of the other levels. In that regard, one can specify the necessary (but not sufficient) conditions not identified by Hartman himself for introducing further levels — namely, to demonstrate properties of the world that could not be explained in terms of any of the properties already represented by categories⁸.

Every level shares categories with another level. Levels do not exist in isolation from other levels, but form a system of interrelated levels that is held together as a whole by the so-called fundamental categories, which are the only ones shared by all levels. The relationships between the individual levels are described by a complex web of categorial laws that ensure the hierarchical connection and structure of the levels. From the variety of determinations, I would like to select just the law of indifference. It states that only the lower ontological levels can exist independently of the higher ones. This means at the same time that the existence of every higher level presupposes the existence of all of the levels that are lower relative to it (Hartmann, 1940, 520, 529 ff.; Hartmann, 1942, 69, 73, 83). This law does not seem infallible to me. Although biological entities cannot exist without inorganic realities, it is questionable whether the existence of spiritual or psychological phenomena depends with the same kind of necessity on the existence of biological entities (Hartmann, 1942, 69; different wording in Hartmann 1940, 520, 529 ff.)⁹. When Hartmann emphasizes that the determinations of his doctrine of levels are merely hypothetical, he is thinking of individual categories or categorial laws, and does not entertain such far-reaching corrections as a partial invalidation of the law of indifference (Hartmann, 1940, 29 ff.; Hartmann, 1950, 411 ff.)¹⁰.

3. HEISENBERG

The hypothetical character of Heisenberg's conception extends as far as questioning the basic structure of its internal classification¹¹. As already mentioned, Heisenberg's model of levels sees itself as a countermodel to a previous conception of order, just as it allows for the possibility that it will be replaced by future, incommen-

⁸ The criterion does not have to be sufficient if the properties in question are situated on the boundaries of an already existing level.

⁹ Creating spiritual entities independent of organic reality can be regarded as the goal of the artificial intelligence research that I will discuss below.

¹⁰ Feyerabend (1963) shows that Hartmann (1950) does not justify his claim that his theory has a hypothetical character, but affirms it dogmatically.

¹¹ On Heisenberg's hypothetical view of science, see (Schiemann, 2009).

surable conceptions of reality. Descartes' division of the world into two parts also serves Heisenberg as the central philosophical point of reference for the introduction of his model. In contrast to Hartmann, however, he does not want to uphold the split between object and subject, but instead to overcome it. Eliminating this ontological separation is the guiding idea of his entire conception, which conceives of all levels as combinations of subjective and objective elements. The model for this is an idea of order developed by Johann Wolfgang von Goethe that classifies the "effects observed in experience [...] in ascending order from the lower to the higher" in terms of nine properties: "accidental, mechanical, physical, chemical, organic, psychological, ethical, religious, genial" (Heisenberg, 1984, 159, 232; Goethe, 1989, 788). This classification draws directly on lifeworld experience and serves Heisenberg to refute the assertion that pure objectivity or subjectivity can exist in isolation¹².

By 'objective' Heisenberg means the "representation of a [...] state of affairs" in which "the state of affairs in question [...] can be detached from us and from its representation" (Heisenberg, 1984, 229). By 'subjective,' on the other hand, he means those descriptions where this is not possible to varying degrees (Heisenberg, 1984, 235). His model of levels is spanned between an objective and a subjective pole. Starting from the objective pole, the objectivity of the levels decreases 'by increments' in relation to their subjectivity (Heisenberg, 1984, 231).

As a physicist, Heisenberg has in mind here the paradigm of the object domains of certain theories from his own discipline. The epitome of a theory that raises a claim to objectivity is, for Heisenberg, classical physics (mechanics, electrodynamics, phenomenological thermodynamics, special and general relativity), in which the describing subject does not feature in the descriptions of their objects. However, the price to be paid for this objectivity, according to Heisenberg, is subjectivity in the form of idealizations that "through the intervention of our thought [...] detach certain processes, phenomena, laws" from the reality under consideration (Heisenberg, 1984, 235 ff.). Since idealizations, which occur in all theories of reality, are comparatively speaking least important in classical physics, their object domain is the lowest, i.e. "most objective" level (Heisenberg, 1984, 236). The absolute belief in objectivity traditionally associated with its description, Heisenberg argues, has been shaken by modern atomic physics, in which no assertion is any longer independent of the measuring interven-

¹² In fact, the lifeworld experience with which Goethe's scheme can be correlated cannot be clearly divided into subjective and objective components. It is subjective insofar as it is arranged concentrically around the subjects from whose sensory perspective it proceeds; it is objective insofar as its subjectivity does not become thematic, whereby the general limits on the thematizability of the lifeworld also set limits to its objectivity.

tion of the observer. Heisenberg correlates the subatomic and atomic processes with the so-called chemical level, since according to his conception all chemical processes can be explained in terms of subatomic and atomic processes. In the case of the modes of knowledge typical of the higher levels, the subject of knowledge can be less and less ignored. Similarly to Hartmann, Heisenberg first distinguishes between the biological and the inorganic levels, situates a level of consciousness above them and rounds off his model with levels that transcend individual consciousness (with increasing subjectivity). The highest step is constituted by the level of creativity, in which the objects are pure products of subjectivity (Heisenberg, 1984, 246 ff.) (cf. Fig. 2).

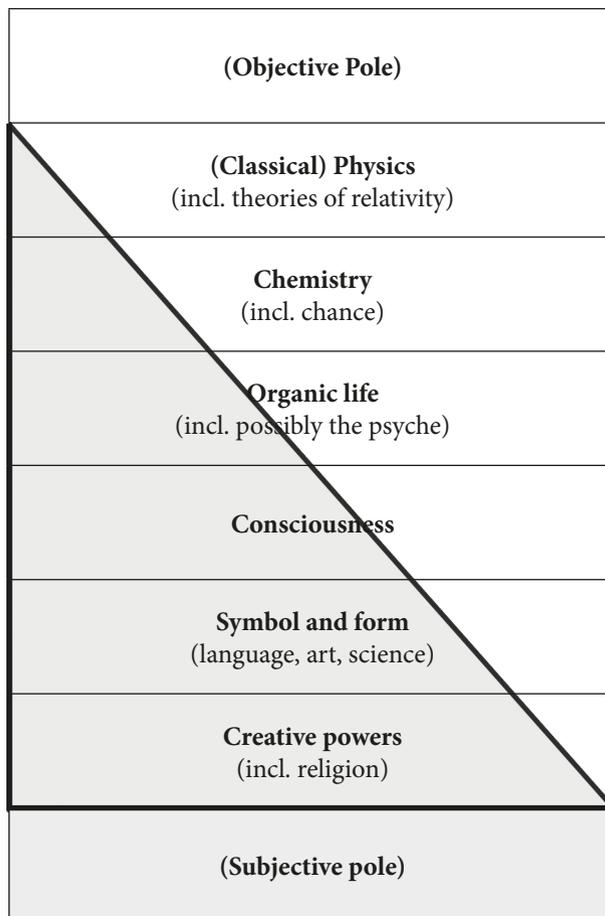


Fig. 2: The classification of reality according to Heisenberg. The white background symbolizes proportions of objectivity, the gray background proportions of subjectivity of the levels of reality. Terms in brackets are for explanatory purposes only.

Although the claim of the levels to overcome the object-subject split is connected with a continuous construction principle, the transition between them is not continuous. With each level are correlated one or several notions corresponding to specific experiences associated with its scientific investigation (Heisenberg, 1984, 234). Like Hartmann, Heisenberg associates an anti-reductionist basic attitude with his model of levels, although this can no longer be demonstrated in his later writings¹³.

One point about his conception that Heisenberg does not discuss is that it can be read in an inverse way and thus is compatible with an opposite interpretation of the world. This possibility is rooted in the fact that his model is not independent of how it is presented. He describes his chosen determination of the levels, which starts from the objective pole and ascends to progressively more subjective levels, as “scientific” (Heisenberg, 1984, 228 ff.). This conception of the world aims at objectivity comparable to a realistic representation, but it gradually loses its explanatory power as it progresses to the less objective levels. Conversely, an alternative, equally valid conception would descend from the subjective pole to the increasingly objective levels and, as it progressed, would be less and less able to explain the phenomena. Heisenberg describes this conception as ‘religious,’ and one can assume that he considers that its influence has waned in modern times. For the religious conception, the domains of scientific objectivity stand under the spell of the infinitely distant, forever incomprehensible opposite pole.

It is not altogether clear from Heisenberg’s manuscript whether he considered his own scientific conception to be typical of the present or saw it as an anticipation of a new ordering structure that was only beginning to emerge. Among the indications of an epochal shift in the “foundations of thought” (Heisenberg, 1984, 304) he counts, in addition to the revolution in modern physics, also the social and cultural changes in Germany before 1933 and the totalitarian regime of the ‘Third Reich’ (Heisenberg, 1984, 218, 304)¹⁴. In the post-war years, the technologization of the world acquired greater importance as an event that could bring about fundamental changes in conditions of existence (Heisenberg, 1984, 411; cf. Schiemann, 2008, 86, 118 ff.).

¹³ Thus Heisenberg does not rule out in principle that holistic structures of life and its symbolic capabilities could be explained in terms of physically unmeasurable forces (Heisenberg, 1984, 260 ff.). This is also indicated by his talk of the “creative forces” (Heisenberg, 1984, 294 ff.).

¹⁴ Heisenberg does not use this term.

4. COMPARISON AND EXTENSION OF THE CONCEPTIONS OF LEVELS

I have already mentioned some similarities and differences between the two conceptions. If we make a schematic comparison between the two systems, the first thing that strikes us is the similarity between their respective sequences of levels. The main reason for this commonality is that both authors reproduce elements of a worldview rooted in the lifeworld that is generally taken for granted in Western culture¹⁵.

In both authors, the inorganic also includes the domain of the cosmic dimensions. However, this commonality goes hand-in-hand with profound differences. Whereas for Heisenberg the special and general theory of relativity, as part of classical physics, provides the basis for assertions about “very distant spaces [...] and times,” (Heisenberg, 1984, 244) Hartmann refuses to take the consequences of relativity theories into account in his theory of levels. The conceptions also deviate from each other in the inorganic domain as a result of differences in their respective descriptions of the very small. For Heisenberg, the specific limits of the objectivity of the subatomic level support the introduction of a separate level, whereas Hartmann subsumes atomic and subatomic reality under the level of the inorganic.

For the organic level, it is striking that neither author provides any concepts for distinguishing between plants and animals. Heisenberg could have made this differentiation in terms of his broad notion of consciousness, since it allows for the possibility that animals, but not plants, participate in consciousness¹⁶. Hartmann’s psychological level would allow for such an extension if its orientation to Descartes’ dualism were loosened¹⁷. Today, one could appeal to the bioethical notions of sensation and suffering as a basis for distinguishing additional levels within organic reality. Recent findings in astrobiology also tend to support a subdivision of the organic. They suggest that, whereas simple forms of life may exist almost everywhere in the universe,

¹⁵ In the European cultural tradition, the distinction between the inorganic and the organic and the division of organic reality into plants, animals and humans formulated by Plato and Aristotle has shaped the ontology of the lifeworld since antiquity. Ingensiep (2001, 27, 59, 258) and Jahn (1985, 63, 219 ff., 235) point to the connection to the doctrine of the ‘three natural spheres’ of minerals, plants and animals. For the historical development, see (Hartmann, 1943) and for the contemporary lifeworld relevance, see (Schiemann, 2005, 43 ff., 118 ff., 130 ff.).

¹⁶ “It may be that the realm of reality that encompasses all organic life cannot be distinguished from that wider realm that, in its parts accessible to ordinary language, includes the knowledge of the human mind” (Heisenberg, 1984, 259).

¹⁷ Hartmann only attributes a ‘non-spiritual’ or ‘spiritless’ consciousness to animals: (Hartmann, 1933, 48; Hartmann, 1942, 38).

complex living beings may be very rare because their existence presupposes an extremely improbable concurrence of a large number of independent conditions (Ward, Brownlee, 1999).

Finally, in the case of the higher levels it is worth mentioning that for Hartmann, as already indicated by his terms 'objective' and 'objectified' spirit, the main factor is objectivity, whereas for Heisenberg it is subjectivity. In Hartmann, the higher levels are more strongly differentiated. Above the level of consciousness, he distinguishes three levels, Heisenberg only two.

In what follows, I will confine myself to the problem of the classification of the properties of the very small and the very large.

4a) Properties of the very small

Both authors discuss whether the constitutive principles of the very small are different from those of other domains of reality. The central question is that of chance. Hartmann counts the causal nexus among the eleven categories of the inorganic level (Hartmann, 1950, 251 ff.), so that there cannot be any uncaused or random events at this level (Hartmann, 1950, 348, 370 ff.). Whereas Heisenberg assumes that quantum theory necessitates the "recognition of chance," Hartmann argues that one cannot speak of chance without falling into a contradiction (Heisenberg, 1984, 257). Even where chance is asserted, one must assume causality insofar as one expects events (Hartmann, 1950, 375).

However, this notion of chance as relative to consciousness does not do justice to the current state of scientific knowledge. According to contemporary standard physical theories, the chance occurrence of individual events is independent of the subjective expectations of observers. The theories proposed thus far to explain quantized individual events through causal mechanisms have proven to be extremely problematic. They are forced to make assumptions that cannot be empirically verified and, compared to standard theories, are unconvincing in their structure, scope and predictive power. Above all, these approaches do not deny the irregularity of the quantized individual events¹⁸.

The lack of evidence of a causal nexus is not the only feature that distinguishes the very small from the larger dimensions. At this point I would like to supplement Heisenberg's approach with further arguments for introducing a separate level of the very small. Properties such as spin and parity violation do not have any analog in other inorganic domains. The correlations between spatially distant quantum objects,

¹⁸ See the relevant accounts in (Rae, 1996) and (Albert, 1992).

which have also received good experimental confirmation for very small dimensions, and the simultaneous existence of different states of a quantum object occur at the macroscopic level, if at all, only in the transitional region to smaller dimensions and under special conditions¹⁹. In recent decades, research into the relationship between the strange states of the very small and the phenomena of the higher dimensions has shown that the transition between the two is reduced to a narrow time window²⁰. All things considered, the properties of the very small seem to be irreducible and so delimitable as regards their properties that there are good reasons to consider the introduction of a separate level²¹.

4b) Properties of the very large

Hartmann distinguishes within the inorganic level between “two closed series of dynamic structures separated by a gap” (Hartmann, 1950, 483). One of these series is formed by the ‘microsystems’ of atomic and subatomic dimensions, the other by the ‘macrosystems’ that begin with the “agglomerations of matter that form the stellar bodies and [...] end with the great spiral galaxies [...] or even with whole ‘swarms’ of such galaxies” (Hartmann, 1950, 484)²². In the gap between these two domains, according to Hartman, are located fragments of the macrosystems and organic nature, which as it were “falls out” of the inorganic ladder (*Stufenleiter*) (Hartmann, 1950, 485).

Hartmann combines both series in one level because he is convinced that they are uniformly determined by the dimensional categories that also apply to organic reality and by the specific system of categories of inorganic reality. In order to generate unity, he thinks that his theory of levels must reject not only the specific characteristics of the submicroscopic level, but also the determinations of space and time that follow from physical theories of relativity. According to Hartman, space and time cannot arise in the cosmos, space itself cannot be curved and an absolute simultaneity of events must be possible (Hartmann, 1950, 216 ff., 236 ff.). Hartmann thus adopts the

¹⁹ These conditions are not only technically realizable, but could also be based on biological processes; see (Vedral, 2011).

²⁰ The transition from the very small to the larger phenomena is described in theories of ‘decoherence.’ For an introduction, see for example (Joos, 2002).

²¹ With regard to the spatial order of magnitude of its objects, but not to the scope of its interactions beyond this, the level of the very small would extend from the immeasurably small (10–18 meters) to the dimensions of the atomic or the nanometer range (10–9 meters), which means that it would be situated beneath Heisenberg’s chemical level.

²² On Hartmann’s special interest in astronomy, see (Harich, 2004, 78 ff.).

standpoint of Newtonian physics, which treats the intuitive understanding of space and time of the lifeworld as absolute²³.

However, such a generalization can no longer be regarded as straightforwardly compatible with the physical facts and the theories that deal with them. No directly perceivable relativistic effects occur on earth simply because of the comparatively short distances between events and of the low velocities and small sizes of the moving masses (Schiemann, 2015, 219)²⁴. Although these effects start to occur continuously in the transition to the dimensions of the very large, their corporeal effectiveness, which only begins with high energies or strong fields, can be regarded as a reason for introducing a separate cosmic level²⁵. Worlds in which relativistic changes in measurements of time and distance acquired relevance for sensory perception (e.g. a fast moving space ship) would be qualitatively different from worlds in which this is not the case²⁶. However, it is questionable whether the future technical possibilities will be sufficient to generate the amounts of energy per unit of time necessary for this (e.g. accelerating a space ship). The cosmic level, which in spatial terms only begins at an order of magnitude of interstellar distances, could remain inaccessible to humans (Schiemann, 2018)²⁷.

The introduction of a cosmic level also suggests itself from the perspective of basic concepts. While the description of very small phenomena and those of intermediate size always presupposes the existence of space and time, the description of the world of the very large can include the emergence of space and time. The so-called Big Bang hypothesis asserts the beginning of space and time. Insofar as time is dependent on the gravitational field that exercises effects in very large dimensions, it loses its status as a basic concept for the construction of theories (Schiemann, 2015, 220 ff.).

²³ Feyerabend (1963, 86) notes in general that “Hartmann’s approach [in his *Philosophy of Nature*]” leads him “to uphold the categories of classical physics.” On the relationship between the Newtonian understanding of space and time and that of the lifeworld, see (Schiemann, 2006, 126 ff.) and (Schiemann, 2015, 214 ff.).

²⁴ The special theory of relativity has to be taken into account when it comes to understanding the processes in the regions of the subatomic that cannot be intuitively represented.

²⁵ This reason belongs the philosophy of nature which deals with human beings’ relationship to nature and includes lifeworld experience such as corporeal effectiveness. It differs from natural science, and from a theory of science that is primarily interested in the conceptual foundations and formal structures of scientific theories, in virtue of its reference to human beings.

²⁶ An example of the categorial difference between non-relativistic and relativistic worlds is ‘time travel,’ which is only possible in the latter. For an introduction, see (Wüthrich, 2007).

²⁷ The closest star is around four light years distant from the earth.

In the last decade, findings in astronomy and cosmological theories have lent additional support to the assumption that there may exist a level of the very large. Measurements of phenomena interpreted as an expression of the accelerated expansion of the universe²⁸ have led physicists to infer the existence of a form of energy whose properties and causes cannot be derived from known physical laws. This so-called 'dark energy' makes up around 70 % of the total amounts of matter and energy present in the universe (Börner, 2008). It determines the future fate of the universe. Assuming that it remains constant, it will lead in the distant future of perhaps 10^{100} years from now to the dissolution of all bodies and hence to the destruction of all life and its detectable traces (Schiemann, 2018). The universe confronts us not only with spatial extension and emptiness of a magnitude that is scarcely imaginable, but also with a hostility to life destined to increase in the long run that demonstrates the limits of every form of anthropocentrism.

5. CONCLUSION

My reflections on the levels of the very small and the very large are intended as attempts to take account of the results of historical changes in scientific knowledge for the two conceptions of levels of reality discussed above. In contrast to the other levels, the two newly added levels for the most part elude the intuitive representability of lifeworld experience. While the intermediate dimensions are directly accessible to experience, the very small and the very large dimensions can only be observed and influenced indirectly by means of technical aids. The two levels of the very small and the very large are of fundamental ontological importance. The very small is formed out of the constituents of the entire visible matter in the observable universe; the very large encompasses the total density of matter and energy of the observable universe²⁹. Organic, psychological, conscious and spiritual reality (up to objectified spirit or the creative forces) is framed, as it were, by these two levels. This suggests an overarching tripartite division of all levels into the very small, the intermediate and the very large dimensions.

As examples of a scientific worldview, Hartmann's and Heisenberg's conceptions are open to change that can lead to the idea of levels itself being placed in question. From a theoretical point of view, here we should take note of the improvement

²⁸ The phenomena in question include the velocity of an exploding supernovae, for whose measurement the Nobel Prize in physics was awarded in 2011.

²⁹ The term 'visible matter' refers to the so-called baryonic matter, the term 'observable universe' to the part of the universe accessible to experience from the earth.

in the conditions for realizing the program of a reductionist explanation of the world rejected by Heisenberg in his manuscript and by Hartmann in general. The forms of scientific reductionism currently widespread in science reject level models on the grounds that all phenomena can be explained in physical terms³⁰. They rely heavily on the impressive advances in physical explanations of phenomena in the life sciences. However, as long as this program, notwithstanding the progress that has been made, remains as far from realization as it is today, non-reductionist forms of physicalism also have some justification. They assume that phenomena of one level must be describable in a language that cannot be derived from the properties of the lower level (Beckermann, 1999, 216 ff.). However, this independence does not necessarily imply inexplicability, as Hartmann and Heisenberg claim for some of their specific level concepts.

Also at odds with the notion of levels are the enhanced technical possibilities for manipulating and producing phenomena. The increasing susceptibility of nature to technical control has rendered the boundaries between the levels permeable in new ways. The transitions between the inorganic and the organic have become the focus of laboratory investigations, and techniques for influencing conscious processes through medical interventions has entered the phase of neuroenhancement. As differences have become leveled, the possibility of the multi-realizability of previously unique phenomenal properties has gained in importance. In the future, it may be possible to produce technical systems that have essentially different structural properties from natural organisms and yet resemble them as living beings. Multi-realizability could also imply connecting levels previously separated by an intermediate level and thus could contradict the already mentioned law of indifference according to which an upper level is dependent on all levels lower relative to it. An example would be the much-discussed intention of research on artificial intelligence to build machines that could not be classified as organic, but nevertheless had capabilities equivalent to the cognitive abilities of human consciousness.

If scientifically oriented level conceptions were to be increasingly problematized or abolished by the sciences themselves, this would not necessarily impair the lifeworld plausibilities to which the two authors appeal. If we understand the lifeworld not as a category that comprises culture or nature, but as a limited domain of experience in which the attention of adults is devoted to non-professional dealings with familiar things and persons as they appear intuitively in external perception, then the

³⁰ Esfeld, Sachse (2009, 90) provide an example of physicalist reductionism that rejects “levels of properties in the world” but not “levels of complexity in the configurations of physical properties.”

term can be assigned to a specific form of knowledge with its own ways of understanding the world (Schiemann, 2005, 89 ff.). In contrast to the scientific notions of levels, the typification of the lifeworld starts with things that belong to one or several levels. The above-mentioned division of the world into inorganic reality, plants, animals and human beings can serve as an example of such a classification that stands parallel to the two conceptions of levels³¹. From the perspective of the lifeworld, there is also a categorial difference between classes of phenomena which, remarkably enough, is not thematized as such in the two level conceptions: Natural objects are contrasted with technical objects, with nature being conceived as that which can change without human intervention, while technical objects owe their existence to human production. The fact that Heisenberg and Hartmann did not envisage a technical level or domain can be criticized as an element of their approaches that is at odds with the lifeworld³².

However, the increasing technologization of the lifeworld is one of the factors of social change that has the potential to eliminate intuitive representability as a necessary condition of lifeworld experience, and hence also to undermine the foundation of the non-scientific intelligibility of the intermediate levels. Although the conception of the world as comprising levels may seem plausible at present, its future development must be regarded as uncertain.

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³¹ Cf. (Hartmann, 1943, 180 ff.), (Schiemann, 2005, 42 ff.) and n.16.

³² On the difference between nature and technology from a lifeworld perspective, see (Schiemann, 2005). Heisenberg sees a close connection between science and technology (Schiemann, 2008, 115 ff.), which may be why he did without a separate technical area. Hartmann regards technology as a “spiritual domain ‘devoid of tradition’” whose products he assigns to the level of objectified spirit (Hartmann, 1933, 246 ff., 418). See also the discussion of technology in (Hartmann, 1942, 79 ff.).

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