

**Quantum (anti)Anthropology: A Synthetic Research
on Human Nature**

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“Κόσμον τόνδε, τὸν αὐτὸν ἀπάντων, οὔτε τις θεῶν οὔτε ἀνθρώπων ἐποίησεν, ἀλλ’ ἦν
ἀεὶ καὶ ἔστιν καὶ ἔσται πῦρ ἀείζων, ἀπτόμενον μέτρα καὶ ἀποσβεννόμενον μέτρα”

Heraclitus, ancient Greek presocratic philosopher (ca. 6th-5th c. BCE)

[Translation: “*This world order (kosmos), the same for all, none of the gods or humans made it, but it always was and is and will be fire ever-living, kindled in measures and extinguished in measures.*” (Laks & Most, 2016: 178-179)¹]

¹ For more see “Laks, A. & Most, G. (2016). *Early Greek Philosophy, Vol 3: Early Ionian Thinkers, Part 2*. Massachusetts: LOEB, Harvard University Press.”.

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1 Introduction

1.1 Basic concepts

One of the most fundamental and at the same time most puzzling philosophical questions is the one that concerns the inquiry about human beings themselves. As Karl Marx insightfully pointed out, “to be radical is to grasp things by the root; but for man the root is man himself”². Philosophical anthropology is a relatively recent discipline of philosophy that attempts to answer –among other things– the above-mentioned puzzling remark of Marx; that is, philosophical anthropology is the study of human being itself (Ricoeur, 2016: 1; Trajtelová, 2016: 11; Darowski, 2014: 14; Lombo, & Russo, 2014: 18-19; Maini, 2000: 7). This study includes an inquiry on the nature –said differently, the essence or self– of humans. The latter notion describes what is the element that fundamentally constitutes the entity that is called a human being; reiterated, what is the element that distinguishes humans from other more-than-human³ entities and the environment.

In their attempt to understand and define the nature of human beings, the latest movements of philosophical anthropology have turned to the most revolutionary discipline of physics in recent years, i.e., quantum mechanics. To clearly define, quantum mechanics is a theory of physics developed in the early twentieth century and it concerns the very fundamental parts of the cosmos. It is considered to be one of the most fruitful physical theories and yet one of the most ambiguous. To break it down, on one hand quantum mechanics has made a major contribution to physics because its predictions provided an answer to the question of the nature of energy. According to the predictions of quantum mechanics, energy is quantized –hence the name “quantum”– i.e., energy comes in packets (“quanta”). On the other hand, quantum mechanics as a theory is highly ambiguous. This stems from four peculiar phenomena which violate the laws of classical mechanics: wave-particle duality, superposition, the measurement problem, and entanglement (Everth & Gurney, 2022: 5; Faye & Jaksland, 2021: 8236; Ferrando, 2019: 167-168; Vetlesen, 2019: 114).

² A quote from his book “Critique of Hegel’s Philosophy of Right” (1843).

³ Recent researchers of philosophical anthropology and feminist studies have replaced the term “non-human” with the term “more-than-human” when they refer to entities different from human beings.

In short, wave-particle duality brought about by Thomas Young's double-slit experiment describes that fundamental light particles act as both particles and waves – for classical mechanics something can be either an object or wave, never both. That is, light particles basically produce wave patterns but when one attempts to observe them, they behave as particles –known also as the observer's effect. Couple with this, the superposition is the phenomenon which entails that fundamental particles can possibly be in many different states at the same time i.e., they exhibit probabilistic nature –the so-called “Schrödinger equation” calculates exactly these possibilities. On the contrary, in classical mechanics, objects are in only one state at a time. Further, the measurement problem indicates that the attempt to measure a particle's property such as momentum makes impossible the measurement of another property such as position. Again, in classical –or Newtonian– mechanics, every property of an object can be measured simultaneously. Lastly, entanglement is the quantum connection of two particles that makes them behave like being one, regardless of the distance in time and space. In classical mechanics, no such connections are allowed. The above-described non-classical phenomena gave birth to many interpretations of quantum mechanics.

Based on one of these interpretations –Niels Bohr's interpretation of quantum mechanics, which is part of the so-called “Copenhagen interpretation”–, one of the most recent philosophico-anthropological theories attempts to describe human nature. More specifically, Karen Barad's agential realism is one of the latest steps in a series of discussions and controversies regarding human nature. The latter theory is a post-humanist endeavor to overcome humanism's misstep of placing human beings in the center of the cosmos, thus resulting in an anthropocentric definition of human nature. The problematic aspect of anthropocentrism lies exactly in the fact that more-than-human entities (e.g., animals, environment, etc.) are marginalized but also groups of human beings (e.g., non-white, non-European, non-male, etc.) are excluded from humanity's corpus due to dominant group's hegemony. But agential realism is also a counteraction to posthumanism, since it emphasizes –as a new materialist theory– the importance of matter which is highly neglected by posthumanism in favor of culture. Therefore, Karen Barad's agential realism is an effort to overcome humanism and to provide an adequate answer to the question regarding human nature.

The above-mentioned theory having as its basis the interpretation of quantum mechanics by Niels Bohr supports the idea that the measurement problem results in

situated ontologies. To roughly explain, every time a property of a particle is measured, a different ontology is produced. For Barad, the measurement and the use of scientific apparatuses are part of the intra-actions. The prefix “intra-” indicates that the actions are happening inside the world –or again, as Barad calls it, “natureculture” since for new materialists matter, i.e., nature, plays a crucial role. Reiterated, human beings and the cosmos are produced by the intra-actions which result in different ontologies. Nevertheless, Karen Barad’s agential realism –as every theory does– has its shortcomings. This thesis attempts to show exactly that the latter theory fails to overcome humanism’s anthropocentrism and to provide an adequate answer to the question regarding human nature. In response to the latter failure, this thesis counterproposes a different path toward the definition of human nature through David Bohm’s “pilot wave model” interpretation of quantum mechanics.

1.2 Research question and why it is important

In this regard, this thesis poses the question, namely, “how does the holistic ontology of David Bohm’s interpretation of quantum mechanics overcome the anthropocentric remnants found in Karen Barad’s posthumanistic theory of agential realism, thus paving the way for an antihumanistic conceptualization of human nature?”. In short, this thesis argues that Karen Barad’s agential realism does not overcome anthropocentrism since it tries to disperse into the cosmos qualities such as agency that are made only by humans and for humans. To overcome this dead-end this thesis employs a different interpretation of quantum mechanics, i.e., David Bohm’s “pilot-wave model” and advocates that the holistic ontology embedded in the latter theory renders, via the notion of undivided wholeness, the concept of human beings misleading and unnecessary, and thus, on one hand, overcomes anthropocentrism and in the other hand promotes a radical antihumanist stance. In sum, by responding to the above-mentioned research question, three successive tasks are accomplished: first, a respond is provided to the shortcomings of Karen Barad’s theory, second –as a result of the previous– an adequate answer to the long-lasting question of philosophical anthropology –i.e., what is the nature of human beings–, is structured, and, lastly, by employing quantum mechanics in order to answer the latter pervasive question, the

importance of the latter scientific field to humanity's self-determination is highlighted.

Furthermore, to support the argumentation of this thesis the main research question will be divided in three subquestions –and three chapters, respectively. In more detail, in the first chapter of the main part of this thesis an attempt will be made to answer the question, namely, “how does Karen Barad’s posthumanistic theory of agential realism implicitly espouse humanistic remnants?”. In short, the response to this subquestion will justify why it is important to seek for an alternative to Karen Barad’s theory and why this thesis is important in the first place. Moreover, in the second chapter of the main part of this thesis an attempt will be made to answer the question, namely, “how does David Bohm’s interpretation of quantum mechanics lead to a holistic ontology?”. In more detail, the second subquestion –and the second chapter of this thesis, respectively–, indicates an alternative path to avoid the dead-end of the theoretical line of argumentation initiated by Karen Barad. Last, in the third chapter of the main part of this thesis, an effort will be made to answer the question, namely, “how does David Bohm’s holistic ontology by overcoming humanistic and anthropocentric remnants entail an antihumanistic perspective?”. In short, the answer to the last subquestion will prove why David Bohm’s interpretation of quantum mechanics is the optimal path to solve the shortcomings of Karen Barad’s theory.

At this point, it is considered beneficial to delineate the research methods and the theoretical framework that this thesis will employ in order for the desired conclusions to be reached. As far as the research methods are concerned, this thesis will be based on the research method of literature review and analysis. Since the argumentation line and the conclusions of the thesis are for the most part theoretical, then the literature review and analysis is the most appropriate method in this case. On the other hand, the theoretical frameworks employed by this thesis –i.e., the theoretical frameworks of the Philosophy of Quantum Mechanics and of Philosophical Anthropology– are the ones that are used mainly by Karen Barad. This is because the ultimate aim of this master thesis is to provide an alternative to the shortcomings of Barad’s theory of agential realism. Besides, it is not in the scope of this thesis to challenge Barad’s attempt to bring together quantum mechanics and continental philosophy, rather this master thesis aims to improve and extend this pioneer effort.

Given the above, the task initiated by this thesis is crucial for two main reasons. First and foremost, the shortcomings of one of the most recent and most influential philosophical theories, i.e., Karen Barad's agential realism, are revealed. It is exactly the popularity of this theory that makes even more urgent the necessity of a complete and thorough assessment, for misleadings to be avoided by a huge number of philosophy scholars. Second, the response to the above question is crucial since it opens up a whole new philosophical discussion in a highly neglected interpretation of quantum mechanics, namely, David Bohm's "pilot-wave model". As Faye and Jaksland notice:

"Neither Barad nor anyone else have taken up the task to connect agential realism with the vast literature on the various interpretations of quantum mechanics. Such a discussion is of particular importance, since Barad's account of quantum mechanics is closely informed by Niels Bohr's interpretation." (Faye & Jaksland, 2021: 8233)

In this respect, the attempt of this thesis to open up the discussion towards other interpretations of quantum mechanics and the integration of their scientific findings in the philosophical arguments proves its originality.

1.3 Brief delineation of the line of argumentation of the thesis

It will be extremely helpful to roughly sketch the line of argumentation of this thesis. As far as the first chapter of the main body of the thesis is concerned, first and foremost, the theory of humanism will be presented as a theory that designates human beings as uniquely rational and agentive beings. Further, the pitfalls of the latter theory will be pointed out such as anthropocentrism which excluded human and non-human entities, and also the humanistic tension of dualisms which dichotomized entities in opposing poles. Moreover, the movement of posthumanism will be delineated as a movement that decentralizes humans and deprives them of their primal place in an attempt to overcome the pitfalls of its antecedent theory and at the same time regards humanity mainly as a co-evolving cultural product. Next, Karen Barad's theory of agential realism will be discussed. Prior to this, new materialism will be

described as the posthumanistic group of theories in which agential realism is numbered among and which brings back to the anthropological discussion the concept of “matter” that has been neglected by posthumanism in favor of culture. Then follows the elucidation of the theory of agential realism which in a nutshell having as scientific background Niels Bohr’s interpretation of quantum mechanics argues for a realism that emerges from an agential act; or again argues for a kind of situated ontology which depends on the decision that someone or something takes. Last, the anthropocentric remnants of the latter most recent and highly influential theory will be demonstrated. Among them, the failure of agential realism to disperse agency as the inherent quality of everything in the world will be shown, based on the fact that agency is a quality made only by and only for humans.

Next, in regards to the second chapter of the main part of this thesis, first, the famous paper of Einstein, Podolsky, and Rosen will be presented as a stepping-stone that brought forth the phenomenon of quantum entanglement and the principle of non-locality that accompanies. The latter principle is the basis of all types of holisms. Further, the types of holisms will be discussed as consequences of the principle of non-locality and in which Bohm’s ontology is numbered among as an ontological holism. Moreover, Bohmian mechanics will be elucidated as the most technical part of this thesis, where Bohm’s –in quantum mechanics terminology– “hidden variable” of “quantum potential” is introduced. This section is a necessary step for understanding Bohm’s holistic ontology that follows. In this context, the differences between David Bohm and Niels Bohr will be pointed out for the technical part to become more graspable. Next, the holistic ontology of David Bohm will be demonstrated as the core part of this chapter. In short, by introducing first the notions of “subsystem-system-supersystem” and later on in more recent works the notion of “implicate order” Bohm structures his holistic ontology according to which everything in the cosmos is one and the same. Last, the implications of the latter will be presented through Bohm’s discussion of the old mechanistic order contra the new implicate order.

Further, the line of argumentation of the third chapter of the main part of this thesis goes as follows. First, it will be described how Bohm’s holistic ontology is an adequate alternative that can overcome the anthropocentric remnants found in the theory of agential realism. This will be based on the characteristics of Bohm’s theory such as the construction of a refined version of wholeness, the rejection of all

differences, the attribution of the agency directly to undivided wholeness, and, consequently, the rendering of the concept of human beings as misleading and unnecessary. Based on the latter, the conviction that Bohm's ontology leads to an antihumanistic stance will be structured. In short, the antihumanistic theories of Nietzsche and Foucault will be presented as necessary but inadequate steps toward the complete abandonment of the concept of human beings. The last step towards antihumanism is the holistic ontology's consequence that the qualities of all entities are attributed directly to undivided wholeness, thus eradicating once and for all the necessity of the concept of human beings.

Last, this thesis closes with an epilogue. In this respect, a concluding summary of the thesis will be provided. Also, an attempt will be made to rebut some possible objections such as first the idea that the antihumanism movement brings back from the back door dichotomies that it is supposed to overcome, second the doubt on how David Bohm's interpretation of quantum mechanics can reconcile different phenomena occurring from the macroscopic and microscopic world respectively, third the remark that the interpretations of quantum mechanics are just theories not fully proved and thus they are highly speculative to be used in philosophical considerations, and last Jacques Derrida's admonition that "the end of Man is bound to be written in the language of Man"⁴. The epilogue closes with some proposals for future research on topics relevant to this thesis.

⁴ Quoted by Badmington's work "Posthumanism" (2000). For more see "Badmington, N. (2000). Introduction: Approaching Posthumanism. In N. Badmington (Ed.), *Readers in Cultural Criticism: Posthumanism* (pp. 1-10). UK: Macmillan Press Ltd".

2 Posthumanism's humanism

2.1 Introduction

To begin with, during the Dark Ages, the life of human beings as inherent value mattered little. The scholarly research was focused on the study of divinity which was considered the supreme value. This devaluation of human beings was one of the reasons which initiated the humanistic movement. Its main purpose was to raise humanity to its rightful place, i.e., to regard human beings as unique and hegemonical beings in the cosmos. Because of that, many qualities were marked as unique to the human race such as rationality, agency, universal essence, etc. in order for the value of humans to be increased. Nevertheless, the tension to overvalue humanity had its pitfalls. In short, humanism turned into anthropocentrism thus on the one hand it regarded non-human beings as inferior, and on the other hand, it excluded human beings themselves who were not fit in the “proper” picture of humanity (e.g., non-Europeans, non-white, non-male, etc.). Later on, posthumanism movement arose with its central moto, i.e., the deposition of human beings from their primacy and parallelly the recognition of the excluded “others”. Yet, posthumanism and specifically one of its latest versions, i.e., Karen Barad's new materialistic theory of agential realism, did not manage to do away with all anthropocentric remnants.

In this regard, through this chapter, an attempt is made to answer the question, namely, “how does Karen Barad's posthumanistic theory of agential realism implicitly espouse humanistic remnants?”. In short, what is argued is that while trying to disperse human qualities such as agency to everything that resides in the world – thus trying to overcome the humanistic pitfalls–, agential realism neglects the fact that agency is a quality made only by and only for humans. Responding to this question is crucial since on one hand the only way to do away once and for all with humanistic pitfalls is to recognize the humanistic bias residing in the theories that are supposed to counter humanism. Only then excluded and marginalized entities will find their rightful place in the cosmos as integral parts of it. On the other hand, Karen Barad's new materialistic theory of agential realism was chosen among other posthumanist theories by this thesis because it was deemed fruitful to prove the humanistic bias of one of the most recent and most academically cited versions of posthumanism. In

other words, by proving the anthropocentrism of such a theory it would be a first-class proof of posthumanism's inadequacy even in one of its latest versions to overcome its antecedent's dead-ends, and it would be a crucial warning for the pitfalls of a so highly influential theory which shapes the recent academic directions.

At this point, it is considered beneficial to roughly sketch the line of argumentation of this chapter. First and foremost, the theory of humanism will be presented as a theory that designates human beings as uniquely rational and agentic beings. Further, the pitfalls of the latter theory will be pointed out such as anthropocentrism which excluded human and non-human entities, and also the humanistic tension of dualisms which dichotomized entities in opposing poles. Moreover, the movement of posthumanism will be delineated as a movement that decentralizes humans and deprives them of their primal place in an attempt to overcome the pitfalls of its antecedent theory and at the same time regards humanity mainly as a co-evolving cultural product. Next, Karen Barad's theory of agential realism will be discussed. Prior to this, new materialism will be described as the posthumanistic group of theories in which agential realism is numbered among and which brings back to the anthropological discussion the concept of "matter" that has been neglected by posthumanism in favor of culture. Then follows the elucidation of the theory of agential realism which in a nutshell having as scientific background Niels Bohr's interpretation of quantum mechanics argues for a realism that emerges from an agential act; or again argues for a kind of situated ontology which depends on the decision that someone or something takes. Last, the anthropocentric remnants of the latter most recent and highly influential theory will be demonstrated. Among them, the failure of agential realism to disperse agency as the inherent quality of everything in the world will be shown, based on the fact that agency is a quality made only by and only for humans.

2.2 Humanism

In this section, the history and the theory of humanism will be presented along with its pitfalls which led to the rise of the posthumanism movement. This is the first step towards the understanding of why Karen Barad tried to overcome humanism and at the same time why she failed to do so.

2.2.1 Humanism's history and theory

To begin with, humanism is an umbrella term –first used in early-nineteen century Germany and described a broader cultural phenomenon (Norman, 2004: 9)– that includes many different aspects from different time periods and places. In this respect, concepts like “renaissance humanism”, “academic humanism”, “catholic humanism”, etc., can be found in the corresponding academic bibliography. At the risk of oversimplification, one can define humanism as *the theory that puts the human being in the center of the cosmos and conceptualizes it as rational and agential entity with fixed and universal essence* (Kessler, 2019: 44; Abadia, 2018: 170; Nayar, 2014: 15-16; Wolfe, 2010: xi; Norman, 2004: 5-6; Davies, 1997: 21-22; Lamont, 1997: 12). In other words, human beings acquire distinctive and privileged position among other non-human entities because of their seemingly unique rational and agential capabilities which can be found universally in humanity. From the historical period of the Renaissance, humanism acquired the idea of the uniqueness of human beings and their universal characteristics, and from the Enlightenment, it acquired the priority of reasoning as a chief human characteristic.

To break it down, Renaissance was the era of the individual contra the medieval conceptualization of human beings as unselfconscious beings (Lamont, 1997: 21; Davies, 1997: 16-17). It is exactly this individuality that brings forth the self-worthed and self-determining person who rules over nature and becomes the central pivot around which everything revolves; or as Davies quotes:

“The great law of the world . . . is to live, to enlarge and develop our most active and sublime qualities, in such a way that from any sphere we can always strive to reach one that is wider, more airy, more elevated . . . Leave weakness and scruples to the petty minds and the rabble of underlings.”
(Davies, 1997: 17)

But this individuality does not exhaust the universal and fixed traits of human beings because the latter participate as parts in the universal human condition. Reiterated, each unique characteristic of human beings is projected in the universal notion of humanity.

On the other hand, the movement of humanism is enhanced by the ideals of the Enlightenment. In lay terms, Enlightenment is the age of reason in which human beings are the sole and rightful bearers (Kessler, 2019: 44; Wolfe, 2010: xi; Norman, 2004: 11; Davies, 1997: 120-121). Moreover, along with rationality, other consequent qualities arise such as free will, consciousness, agency, etc. Again, all the above are unique to humankind which as sovereign authority exerts its power on the non-rational nature. This is summarized in Denis Diderot's (1713-1784) proclamation:

“If mankind, or the thinking and contemplative beings which comprise it, were banished from the surface of the earth, the moving and sublime spectacle of nature would be nothing more than a scene of desolation and silence. The universe would be mute; stillness and night would take possession of it . . . It is the presence of man which renders other beings interesting, and what better consideration can we bring to bear in dealing with the history of such creatures? Why should we not introduce man into our work, as he has been placed in the universe? Why not make man the central focus?” {Davies, 1997: 123}

From the above extract, it becomes apparent the belief of the scholars of Enlightenment –known as “les lumières”– that human beings are the agents who give purpose and meaning in the universe. On these tenets, humanism structured its fundamental theory regarding human nature.

Moreover, humanism is closely related to science and specifically to materialism –both are regarded as offsprings of Enlightenment– (Norman, 2004: 5, 14; Lamont, 1997: 41). To clearly define, materialism is a philosophy that relies on the scientific method, argues for the atomic structure of things, and believes in the ever-present law of cause and effect. On this basis, humanistic metaphysics is founded; or again, humanism supports pluralism instead of monism. To put it clearly, the cosmos is constituted by atoms that participate in myriad interactions. There is no universal unity, rather there are individuals which are separated from one another. Lastly, is important to note that for humanism the external world exists independently of the human mind.

Until now the historical movements which influenced humanism have been presented along with the main characteristics of the latter anthropological theory. In a

nutshell, humanism drew inspiration from Renaissance and Enlightenment and believed in the central position of humanity in the cosmos, the uniqueness of human beings, the primacy of human rationality and agency, the constitutive role of atoms and their cause-and-effect relations, and lastly the pluralism of an existing independently cosmos. Nevertheless, the above-mentioned tenets of humanism led to problematic outcomes. As far as the role of the atoms and the pluralism of the cosmos are concerned, they will be discussed in another chapter. The rest resulted in the emergence of posthumanism, and hence they will be discussed next.

2.2.2 Humanism's pitfalls

The fundamental declarations of humanism such as the centrality and the uniqueness of humanity, and the primacy of human rationality and agency are of great importance since they constituted a response –among others– to the obscurantism of the Middle Ages. Yet, the same declarations brought about some of the worst aspects of human nature such as mystification, marginalization, exploitation, speciesism, differentiation, etc. (Ferrando, 2019: 103-104; Abadia, 2018: 170; Nayar, 2014: 23; Davies, 1997: 5). This is because the humanistic emphasis on the uniqueness of the human beings promoted the anthropocentrism. The problematic aspect of anthropocentrism lies exactly in the fact that more-than-human entities (e.g., animals, environment, etc.) are marginalized but also groups of human beings (e.g., non-white, non-European, non-male, etc.) are excluded from humanity's corpus due to dominant group's hegemony.

To break it down, first of all, anthropocentrism significantly determined the fate of non-human animals and nature. In short, human beings by believing in their uniqueness and superiority initiated the quest of conquering the earth. This resulted in tremendous damage to the environment and animals, especially in the last two centuries of industrialization. It was exactly the proclamation of human as the regnant of the earth who rightfully can rule over the inferior species that resulted in the degradation of the environment. Thus, in this case, humanism was the smokescreen for anthropocentric speciesism and mystification of the human race.

On the other hand, the above-described anthropocentrism backfired, and its negative consequences affected human beings themselves. In explanation, anthropocentrism normally indicates the central role of all human beings, universally. But, as Davis (1997: 26) insightfully emphasizes, “of course, ‘universality’ is a tricky

notion, and universals may not always be quite as generously inclusive as they would have us suppose”. Therefore, if the choice of who is regarded as part of humanity is completely subjective and serendipitous, then groups of people are excluded from the humanistic ideals and benefits. For this reason, humanism ended up promoting the marginalization and exploitation of human beings. The latter is tightly connected to European colonialism and imperialism.

All the above consequences of humanism’s anthropocentrism can be summarized in the notion of “difference”. In lay terms, anthropocentrism produced a system of differentiation through which a dichotomy –or again, a dualism– between “we” and the “others” emerged. The former included the dominant European, white, man and the latter the marginalized non-European, non-white, women, animal, automata and so on and so forth. The decentralized entities were ignored or even worse exploited indirectly by the humanistic tenets of human uniqueness, centrality, and universality which deeply entailed a dualistic conceptualization of the world and everything in it. It was exactly this tension of dualisms that the posthumanism movement tried to overthrow.

2.3 Posthumanism as a response to humanism

In this section, the theory of posthumanism and its latest version of new materialism will be discussed as the theoretical background of Karen Barad’s theory. In doing so it would be easier to understand Barad’s main ideas, and concepts, but also dead-ends stemming from her posthumanist origins.

2.3.1 Posthumanism’s history and theory

Similar to humanism, the concept of posthumanism is an umbrella term that includes many similar aspects. Thus, in the academic bibliography of philosophical anthropology –and beyond– one comes across many “posthumanisms” such as philosophical, cultural, critical, etc. The posthumanism movement initiated in the late 1960s (Ferrando, 2019: 24; Wolfe, 2010: xii). Above all, posthumanism arose as a counteraction to humanism and its negative consequences of mystification, marginalization, exploitation, speciesism, differentiation, etc. Again, as in the case of

humanism, an all-inclusive definition of posthumanism could be: *posthumanism is the theory of difference that decentralizes human beings and conceptualizes them as a co-evolving instantiation of the assemblage of the interconnections between bodies – human and non-human–, information, and processes* (Ferrando, 2019: 54; Kessler, 2019: 45; Abadia, 2018: 173; Nayar, 2014: 21; Wolfe, 2010: xv). The latter is opposed to the humanistic idea of the unique, fixed, and universal essence of humanity.

To break down the above dense definition of posthumanism, first and foremost one must pay attention to the prefix “post-”. In explanation, by the prefix post, a transcendence of a previous situation is indicated; or again, posthumanism is here to overcome humanism. Obviously, some elements of the theory that is about to be overcome are still present in the new theory as the term “posthumanism” makes apparent. One of these elements is probably the idea that human beings are still present as enactors of the new theory. Nonetheless, it is important to note here that the term “posthumanism” is an open term. That is to say, the term “posthumanism” is an open-ended move beyond humanism without the direction and the destination of this move being defined clearly. Reiterated, “the post by itself eventually dismembers in the openness which it postulates; it becomes a passage from somewhere to everywhere, in other words, a nowhere” (Ferrando, 2019: 66).

Further, as described in the above-given definition, for posthumanism human beings are co-evolving. The latter implies two things: first, human nature is evolving and second its evolution is the outcome of cooperation. As regards the former, posthumanism opposes the humanistic belief of a fixed and universal human nature. On the contrary, posthumanism argues for a dynamic human nature that is subject to change and entails myriad possibilities. On the other hand, the dynamism of human nature comes about through the plethora of interactions between human beings and everything that surrounds them, as opposed to the humanistic belief of the universal human condition. Therefore, human nature is the outcome of cooperation.

Returning back to the above definition, it becomes apparent which things cooperate together with human beings in the formation of the dynamic human essence. Simply stated, human essence is continuously constructed through the interconnections of bodies –human and non-human–, information, and processes. Undoubtedly, on one hand, the participation of information and processes in the evolving human nature indicates its culturally constructed basis. On the other hand,

the idea that non-human beings participate in the construction of the dynamic human essence emphasizes the importance of non-human beings. Also, the non-central role that posthumanism attributes to human beings adds to the latter recognition. Therefore, posthumanist conceptualization exceeds by far the narrow humanistic conception of human nature which proclaims the inferior existence of non-human beings.

Last, this plasticity of human essence allows for the inclusion of even more marginalized others. In this regard, posthumanism paved the way for the inclusion of non-Europeans, non-white, females, etc. in the corpus of humanity by breaking down the humanistic limitations regarding human nature. By discovering even more differences posthumanism is able to expand even further the former list (e.g., the dualism of human/robot). Therefore, posthumanism allows otherness to arise through the study of differences –or again, the dualisms. In recent years, a new posthumanist movement has arisen which has the ambition to integrate science and specifically physics in the discussion about the differences and in general about human nature.

2.3.2 New materialism

One of the most recent movements inside posthumanism is new materialism. The point of departure of this newly formed philosophical tradition is the attempt to reintegrate the notion of “matter” back into the discussion regarding human nature (Ferrando, 2019: 159; Abadia, 2018: 176). In other words, new materialists argue that post-structuralism/constructivism –and perhaps some part of the posthumanists since post-structuralism is the basis of posthumanism– even though declared its opposition to binarism, yet was unable to overcome the culture/nature dichotomy. This is because posthumanism emphasized the importance of culture and language in the construction of reality. This obsession with language almost –as new materialists claim– eliminated the role of matter in the constitution of reality. This radical rejection of objective reality opposes scientific realism. As Karen Barad –one of the leading figures of the new materialism movement– insightfully notices:

“Language matters. Discourse matters. Culture matters. There is an important sense in which the only thing that does not seem to matter anymore is matter” (Barad, 2007: 132)

As becomes apparent, new materialists want to bring back to the discussion the crucial role of matter in the constitution of entities. But, how is matter conceptualized in the context of new materialism?

As described in a previous section humanism was based on the “old” materialism. From the latter scientific perspective, the matter is something static, constituted by spatial and separate atoms. On the contrary, for new materialists matter is regarded as dynamic (Kessler, 2019: 50). To put it differently, the matter is not just something inert waiting for the forces of nature to put it in motion. Rather, matter and forces are in dynamic action. In addition, new materialism claims that in its dynamic role matter also incorporates agency. Thus, this new version of posthumanism once again deprives human beings of their centrality and uniqueness –as attributed to them by humanism– by attributing agency to matter. In this system, humanity does not have priority over other entities.

In this context, the new materialist project stresses the relations between beings, things, and matter (Everth & Gurney, 2022: 4; Abadia, 2018: 177). In other words, matter conceptualized as nature participates actively in materialization along with culture. It is important to note that nature and culture do not inter-act. Instead, for new materialism nature and culture intra-act. The former presupposes that the interacting parts are independent. The latter implies that the intra-acting parts emerge from the relation between them. Therefore, this new materialist description of reality decenters human beings by constituting them as emergent of the relation between natureculture⁵. The notion of “intra-action” is of great importance for Karen Barad’s theory of agential realism which is one of the hallmarks of the argumentation of this thesis.

2.4 Karen Barad’s agential realism

This section is the core part of this chapter’s argumentation. In this respect, Karen Barad’s new materialistic theory of agential realism will be presented as a posthumanism response to humanism’s pitfall. As it will become apparent, this most

⁵ The term “natureculture” is used by new materialists to indicate that nature and culture are so closely related that they become a unity.

recent and most cited theory fails to accomplish its task since humanist remnants regarding agency still reside in it.

2.4.1 The theory of agential realism

In previous sections, the theoretical background of Karen Barad's agential realism was presented. What follows is a detailed elucidation of the latter theory. Karen Barad as a member of the new materialism movement attempts to break the dichotomy between culture and nature. Her attempt is a combination of theoretical physics and feminist theory. The scientific basis for her theory is Niels Bohr's interpretation of quantum mechanics. The latter along with Werner Heisenberg's interpretation form the so-called "Copenhagen" interpretation of quantum mechanics. In a nutshell, the Copenhagen interpretation provides two different solutions to the quantum incompatibility between certain pairs of properties of a particle (e.g., position and momentum) –the so-called, "measurement problem". This means that if one tries to measure the position then one cannot measure the momentum whereas in classical mechanics this is possible; or again, as explained by Karen Barad:

"There is something fundamental about the nature of measurement interactions such that, given a particular measuring apparatus, certain properties become determinate, while others are specifically excluded. Which properties become determinate is not governed by the desires or will of the experimenter but rather by the specificity of the experimental apparatus."
(Barad, 2007: 19)

Therefore, on one hand, there is the uncertainty principle of Heisenberg as one solution to the above-described problem, and on the other hand, there is Bohr's complementarity principle as the alternative solution on which Barad based her theory of agential realism.

First and foremost, Heisenberg's response to the issue was mainly epistemological (Vetlesen, 2019: 120). For Heisenberg, the incompatibility of the properties of a fundamental particle is explained as a limitation to what we can know. Nevertheless, he does not renounce the independent existence of the properties and their values. In other words, just as in classical mechanics, the properties of a particle

are objective and independent. The fact that experimenters are able to know only one property at a time does not mean that the other one does not exist at any given time. Instead, it is just the epistemological and methodological limitations that prevent one from getting the full picture.

On the other hand, Bohr's explanation is basically ontological (Faye & Jaksland, 2021: 8237; Vetlesen, 2019: 115). Differing from Heisenberg, Bohr insisted that particles do not have two determinate properties simultaneously; or again, particles' properties are mutually exclusive –that is complementary. Admittedly, this idea challenges the nature of reality itself. To explain, depending on the apparatus used in the experiment different aspect of reality –i.e., of particles– is revealed. For instance, one apparatus ontologically produces the position of the particle since the former is able to measure the latter, or another apparatus ontologically produces the wave behavior of a photon because it is the one that is able to measure it and so on and so forth.

Most importantly, Bohr's interpretation is a revolutionary change in the classical belief of Newtonian mechanics regarding the relation between the object and the agencies of observation –i.e., the apparatus. That is to say, classical mechanics support the idea that in measurements there is a continuous and determinable interaction between the object and the apparatus. On the contrary, quantum mechanics involve a discontinuous and indeterminable interaction. As Barad puts it:

“Since observations involve an indeterminable discontinuous interaction, as a matter of principle, there is no unambiguous way to differentiate between the object and the agencies of observation. No inherent/Cartesian subject-object distinction exists” (Barad, 1996: 170)

In simple terms, since specific agencies of observation produce ontologically specific properties through measurement there is no distinction between the former and the latter; or again, they are inseparable.

Based on the above-described Bohrian interpretation of quantum mechanics, Karen Barad structured her theory of agential realism. First and foremost, Barad

elucidates the notion of “phenomenon”⁶. In other words, in the Baradian framework, the phenomenon is something objectively real. It is the locus where the object and the agencies of observation emerge. In this respect, Barad emphasizes:

Phenomena are the ontological inseparability of objects and apparatuses ... determinate entities emerge from their intra-action ... a phenomenon is a specific intra-action of an “object” and the “measuring agencies” ... We should understand phenomena not as objects-in-themselves, or as perceived objects (in the Kantian or phenomenological sense), but as specific intra-actions. Because the basis of this ontology is a fundamental separability, it cuts across any Kantian noumena-phenomena distinction: there are no determinately bounded or propertied entities existing “behind” or as the causes of phenomena.” (Barad, 2007: 128)

According to the above extract, objects and apparatuses exist only inside phenomena as they intra-act⁷. To put it differently, phenomena are the intra-action of objects and apparatuses. It is important to note here that phenomena are ontologically primitive (Everth & Gurney, 2022: 6; Faye & Jaksland, 2021: 8238). Object and apparatus do not precede, but rather arise from the intra-action –or again, phenomenon– that produces them. In general terms, everything emerges from the intra-actions.

Furthermore, in more technical terms Barad points out that object and agencies of observation are entangled (Everth & Gurney, 2022: 6; Vetlesen, 2019: 111). By definition, entangled entities are not just separate entities that come together, rather they do not have self-contained existence; or again, they are one, a whole. In other words, object and agencies of observation are the one and the same inseparable entity. Therefore, through their intra-action entangled objects and apparatuses arise. It is worth noting here that the phenomenon of quantum entanglement is one of the cornerstones of quantum mechanics. As it will be described in the next chapter, quantum entanglement is an omnipresent phenomenon the implications of which

⁶ The term “phenomenon” was first used by Bohr in the context of quantum mechanics. Barad uses it in her own interpretation of it. There are many criticisms regarding her appropriation of the term. The presentation of this discussion exceeds the aim of this thesis. For more, see Faye and Jaksland (2021: 8238).

⁷ The meaning of the term “intra-action” has been explained in the section regarding the new materialism movement.

exceed by far its rather limited usage in Niels Bohr and Karen Barad's theoretical framework.

After the above-described notion of the "phenomenon" follows the key point and the core of Karen Barad's argumentation regarding agential realism. To break it down, the most important concept in Barad's theory of agential realism is the "agential cut" (Everth & Gurney, 2022: 6; Vetlesen, 2019: 124; Barad, 2010: 265). In explanation, although –as mentioned above– an inherent/Cartesian subject-object distinction/cut does not exist, another implicit cut exists, namely, the agential one. In Barad's own terms:

"The specification of the conditions necessary for an unambiguous account of quantum phenomena is tantamount to the introduction of a constructed, agentially enacted, materially conditioned and embodied, contingent Bohrian cut between an object and the agencies of observation. That is, although no inherent distinction exists, every measurement involves a particular choice of apparatus, providing the conditions necessary to give meaning to a particular set of variables, at the exclusion of other essential variables, thereby placing a particular embodied cut delineating the object from the agencies of observation." (Barad, 2007: 115)

In other words, intra-actions enact agential cuts which allow for arrangements in the world. This is what Barad calls alternatively "agential separability".

To make it plain, it is fruitful to use an example. In more detail, if an experimenter employs such and such apparatus, then the wave aspect of a photon will emerge. On the contrary, if the experimenter uses another apparatus, then the particle aspect of a photon will come forth. Thus, it depends on what agencies of observation one chooses for what objects one will get. Said differently, different cuts enact different phenomena –since phenomena are the intra-actions of objects and agencies of observations. In slogan form: every time a different apparatus is chosen different object emerges; or again, similar to situated knowledge propagated by post-modernism, there is a kind of "situated ontology", i.e., a realism that emerges from an agential act. It is a kind of situated ontology which depends on the decision that someone or something takes.

Moreover, the latter brings us to the role of human agency in the work of Karen Barad. In general, since Barad is numbered among the posthumanist philosophers, she does not advocate the humanist ideal of human beings seen as privileged bearers of agency. In more detail, for Barad the agency even if it is commonly related to subjectivity and intentionality, yet in her theory of agential realism agency is a bringing-forth and not something fixed in human and/or non-human entities (Vetlesen, 2019: 124; Barad, 2007: 214). Reiterated, if human beings are the outcome of the intra-actions, then also the agency that seems to arise from human beings is also the outcome of intra-actions. In this respect, Barad proclaims:

“The point is as follows: to the extent that concepts, laboratory manipulations, observational interventions, and other human practices have a role to play, it is as part of the larger material configuration of the world. That is, the phenomena produced are not the consequences of human will or intentionality or the effects of the operations of Culture, Language, or Power. Humans do not merely assemble different apparatuses for satisfying particular knowledge projects; they themselves are part of the ongoing reconfiguring of the world.” (Barad, 2007: 171).

From the above excerpt, it becomes apparent the novel conceptualization of human agency and will by Karen Barad. Contra the humanistic beliefs, Barad proposes a type of agency that exists in all matter and is brought forth through the material intra-actions.

In the same context, Barad refers to the role of human responsibility. In explanation, again differing from the humanistic tenet of human supremacy and primacy, Barad claims that the intra-actions bring forth the responsibility as in the case of agency. Humans are responsible inasmuch as they are emerging from the intra-actions –or again, the phenomena– which precede them. In Barad’s own words:

“We are responsible for the cuts that we help enact not because we do the choosing ... but because we are an agential part of the material becoming of the universe. Cuts are agentially enacted not by willful individuals but by the larger material arrangement of which ‘we’ are a ‘part’ ... Cuts cut ‘things’

together and apart. Cuts are not enacted from the outside, nor are they ever enacted once and for all". (Barad, 2007: 178-179)

Once more from the Baradian theory of agential realism, a novel understanding of the concept of responsibility emerges. Everything in the universe has agency and is responsible insofar as everything is part of the ongoing becoming of the universe through the intra-actions. Having said that, the discussion about the humanistic remnants in Barad's theory is what follows.

2.4.2 Agential realism's humanistic remnants

Until now Karen Barad's theoretical background and the theory of agential realism itself were presented. Now, the most crucial part of this chapter is about to be discussed, i.e., the humanistic remnants found in posthumanism in general and in Barad's theory in particular. Generally speaking, Barad's work on agential realism has received plenty of criticism –in part because it is one of the most cited philosophical works in recent years. The plethora of criticisms includes concerns about the transition from small-scale (quantum) to large-scale (social), warnings about the misreading of Niels Bohr's work, doubts about the usage of physics in political matters, etc. (Everth & Gurney, 2022: 9-10). Again, for the purposes of this thesis is important to reveal the humanistic and anthropocentric ideas embedded in Barad's work.

First and foremost, humanism's anthropocentric remnants are found in many posthumanist theories. As a rule, posthumanist scholars attempt to overcome humanism's –and old materialism's, since, as described in a previous section, the latter scientific theory is embedded in humanism's proclamations– tension to privilege human beings by transferring supposedly unique human qualities to matter (Kessler, 2019: 49). Nevertheless, this attempt does not succeed to overcome anthropocentric and old materialism's anachronisms, since the above-mentioned unique qualities go along with human beings; or again, they are built in human "body". That is to say, when someone attributes a quality (e.g., agency) to matter then human beings have a "running start" over everything else that is constituted by matter since this particular quality "was made" for humans in the first place. Also, because is unlikely to find an entity that will fit this particular quality, it is possible to end up again with human

beings' uniqueness and supremacy as the lone bearers of the quality under consideration.

As far as agential realism is concerned, it is logical for such anthropocentric remnants to be found since Barad is numbered among posthumanists, and therefore her theory follows the same tenets more or less. In more detail, the above-presented anthropocentric aspect of posthumanist theories apply also to Karen Barad. Although she renounces the idea that agency is a unique characteristic of human beings by attributing it to all matter, yet she falls into the same pitfall. The quality of agency attributed to all matter goes along with humans. Despite the fact that in agential theory the agency is something that is brought forth by the intra-actions, again until now is only found in human beings. Karen Barad does not make any explicit reference to more-than-human beings which are related to agency.

Only implicitly, Barad brings up the example of the brittlestars. In a nutshell, a brittlestar is a sea animal similar to starfish which has the unique feature that all its body it's a big eye. This is achieved by its skeleton which is covered with crystals that function as a visual system. This visual system is connected directly to the nervous system bypassing the need for a brain. Apart from the previously-mentioned visual system, the brittlestar also has the ability to change its coloration and break off parts in case of visual or physical contact with predators. Barad argues that brittlestar incorporates her theory of agential realism (Vetlesen, 2019: 141-142). First of all, the brittlestar does not have eyes rather it is the eyes thus rendering it a visualizing apparatus; or again, there is no distinction between object and apparatus. Moreover, its bodily materiality is active, an ongoing materialization. This is because brittlestars can adjust their body in accordance with the stimuli of their body-apparatus.

Most importantly, Barad emphasizes in regard to the agential nature of brittlestars:

“Brittlestars are phenomena intra-actively produced and entangled with other phenomena. They are agentic beings, lively configurations of the world, with more entanglements than arms. They are not merely objects of our knowledge-making and product-making projects. "Humans" and "brittlestars" learn about and co-constitute each other through a variety of brittle star-human intra-actions. Biomimesis may be the goal of certain research projects that seek to appropriate the ingenuity of the brittlestar's lens system, but this practice

cannot be understood as a process of copying the other ... These echinoderms don't reflect on the world; they are engaged in making a difference in the world as part of the world in its differential becoming, and so are we. The specific nature of our intra-actions with brittlestars matters.” (Barad, 2007: 381-382)

In explanation, Karen Barad argues that brittlestar through biomimesis intra-act with the human being and –as Barad seems to argue– the former as agent brings forth arrangements in the latter through the agential cut. But, as Vetlesen (2019: 144) points out insightfully, this correlation between human beings and more-than-human beings is not as “reciprocal” and “symmetrical” as it seems. In fact, since reciprocal communication is impossible –brittlestars cannot reflect on the world–, human beings are unable to know if brittlestars truly want to co-constitute with them. On the contrary, human beings have the larger burden of argument for their actions. Again, human beings have a “running start” in regard to brittlestars and consequently, the anthropocentric remnants arise once more because agency is of the “human world”.

Last, it is important to note that Niels Bohr was a proponent of the humanistic tenet that humans are separately determined from the entities that they investigate (ibid: 130). Although Karen Barad was aware of this and tried to bypass it through her theory of agential cuts, again the humanistic remnants that seem to reside in Bohr’s interpretation of quantum mechanics are a dead-end for her posthumanistic attempt to overcome humanism. This is because human primacy in the context of experiments resides in the very foundation of Bohr’s theory. Therefore, since Barad structures her theory based on Bohr’s it is inevitable that she will end up facing humanistic dead-ends. In this regard, in the next chapter another interpretation of quantum mechanics will be presented as a response to agential realism’s inadequacy to overcome the humanistic pitfalls⁸.

⁸ The word restrictions imposed on this thesis do not allow for a detailed analysis of Niels Bohr’s humanistic tensions. Such a task would require a whole new thesis in order to be justified. For more about Bohr’s humanism see the work of Vetlesen which is used in this context by this thesis.

2.5 Conclusion

All things considered, in this chapter, an attempt was made to answer the question, namely, “how does Karen Barad’s posthumanistic theory of agential realism implicitly espouse humanistic remnants?”. In short, it was argued that while trying to disperse human qualities such as agency to everything that resides in the world –thus trying to overcome the humanistic pitfalls–, agential realism neglects the fact that agency is a quality made only by and only for humans. To support the latter conclusion first the theory of humanism was presented as a theory that designates human beings as uniquely rational and agential beings. Further, the pitfalls of the latter theory were pointed out such as the anthropocentrism which excluded human and non-human entities, and also the humanistic tension of dualisms which dichotomized entities in opposing poles. Moreover, the movement of posthumanism was delineated as a movement that decentralizes humans and deprives them of their primal place in an attempt to overcome the pitfalls of its antecedent theory and at the same regards humanity mainly as a co-evolving cultural product. Next, Karen Barad’s theory of agential realism was discussed. Prior to this, new materialism was described as the posthumanistic group of theories in which agential realism is numbered among and which brings back to the anthropological discussion the concept of “matter” that has been neglected by posthumanism in favor of culture. Then the elucidation of the theory of agential realism followed which in a nutshell having as scientific background Niels Bohr’s interpretation of quantum mechanics argues for a realism that emerges from an agential act; or again argues for a kind of situated ontology which depends on the decision that someone or something takes.

3 David Bohm's interpretation of quantum mechanics

3.1 Introduction

As became apparent in the previous chapter, Karen Barad's agential realism espouse indirectly humanist and anthropocentric ideas which they are supposed to overcome. In a nutshell, it was argued that while trying to disperse human qualities such as agency to everything that resides in the world –thus trying to overcome the humanistic pitfalls–, agential realism neglects the fact that agency is a quality made only by and only for humans. In this regard, another approach needs to be found that will deal with the inadequacies of agential realism in going beyond the humanistic pitfalls. For this purpose, David Bohm's interpretation of quantum mechanics is deemed as the optimum choice for this purpose for a number of reasons: first and foremost, David Bohm is not a proponent of humanistic ideals, while Niels Bohr is a proponent of the humanistic tenet that humans are separately determined from the entities that they investigate –as became apparent in the previous chapter. Moreover, in the writings of David Bohm, there is an implicit discussion of the ideas of Niels Bohr. This is extremely useful since the previous chapter was related to the philosophy of Bohr via Karen Barad's reflections thus creating a fruitful debate between the two physicists along the lines of this academic work. Last, David Bohm develops an insightful philosophical framework around his interpretation of quantum mechanics –as it will become apparent in the current chapter– which is extremely helpful for this thesis's line of argumentation.

With these in mind, this chapter poses the question, namely, “how does David Bohm's interpretation of quantum mechanics lead to a holistic ontology?”. In more detail, via this chapter, it will be argued that Bohm based on quantum entanglement's non-local implications, structures an ontological holism which he expands on the cosmic scale, thus resulting in a holistic ontology, or again –what he calls– the “implicate order”. It is considered as important to answer the above query since by using Bohm's idea of implicate order, it is possible to overcome the humanistic pitfalls and provide an alternative conceptualization of human nature and its place in the cosmos.

It is deemed fruitful to delineate at this point the line of argumentation of this chapter. First, the famous paper of Einstein, Podolsky, and Rosen will be presented as a stepping-stone that brought forth the phenomenon of quantum entanglement and the principle of non-locality that accompanies. The latter principle is the basis of all types of holisms. Further, the types of holisms will be discussed as consequences of the principle of non-locality and in which Bohm's ontology is numbered among as an ontological holism. Moreover, Bohmian mechanics will be elucidated as the most technical part of this thesis, where Bohm's –in quantum mechanics terminology– “hidden variable” of “quantum potential” is introduced. This section is a necessary step for understanding Bohm's holistic ontology that follows. In this context, the differences between David Bohm and Niels Bohr will be pointed out for the technical part to become more graspable. Next, the holistic ontology of David Bohm will be demonstrated as the core part of this chapter. In short, by introducing first the notions of “subsystem-system-supersystem” and later on in more recent works the notion of “implicate order” Bohm structures his holistic ontology according to which everything in the cosmos is one and the same. Last, the implications of the latter will be presented through Bohm's discussion of the old mechanistic order contra the new implicate order.

3.2 Prerequisites for Bohm's holistic ontology

In this section, the prerequisites for Bohm's holistic ontology will be discussed such as the phenomenon of quantum entanglement and its consequence, i.e., the principle of non-locality which paves the way for holistic theoretical schemas like the ontological holism of Bohm.

3.2.1 EPR argument, quantum entanglement, and non-locality

Quantum entanglement was one of the first phenomena of quantum mechanics to be studied and at the same time one of the most contentious. It was in 1935 when Albert Einstein, Boris Podolsky, and Nathan Rosen brought to light for the first time the above-mentioned phenomenon via their paper known as “EPR paper” (1935) and the consequent “EPR argument” (Ismael & Schaffer, 2020: 4141). Nevertheless, the

scientist who gave the phenomenon of entanglement its name was Erwin Schrödinger, who shortly after the publication of the EPR paper published his comments on the phenomenon and simplified its formulation. Also, Schrödinger developed the very first systematic definition of quantum entanglement. Haley (2017: 40) quotes it as follows:

“When two systems, of which we know the states by their respective representatives, enter into temporary physical interaction due to known forces between them, and when after a time of mutual influence the systems separate again, then they can no longer be described in the same way as before, viz. by endowing each of them with a representative of its own. I would not call that one but rather the characteristic trait of quantum mechanics, the one that enforces its entire departure from classical lines of thought. By the interaction the two representatives (or ψ -functions) have become entangled.”

In a nutshell, quantum entanglement is the connection of two particles which is established when an initial particle is split in two. The derivative particles share some properties such as position, momentum, spin angular momentum, etc. in what Esfeld (2004: 604) calls a “joint probability distribution” –since the probability is one of the core characteristics of every quantum phenomenon. This connection is independent of spatiotemporal restrictions. Therefore, if one particle (particle “A”) is at the edge of the universe and another one (particle “B”) is at the opposite edge and they are entangled, then the measurement of the properties of the A particle will have an immediate effect –since measurement can modify the state of the quantum particles– in the properties of the B particle.

The above-described “peculiar” correlation of the entangled particles has been of great philosophical importance for nearly a century. In recent years the interest in quantum entanglement has increased exponentially (Darby, 2015: 387; Ainsworth, 2007: 145-146). Many scientific areas and applications have been developed on the basis of the principles of entanglement such as quantum information theory, quantum computation, quantum cryptography, quantum dense coding, quantum teleportation, etc.). Moreover, one of the most interesting philosophical implications of quantum entanglement is the idea of holism. But how quantum entanglement entails a holistic perspective of the universe? To answer this query, one must trace back to the period

when the EPR paper was written and the first problematization regarding the phenomenon under consideration came up.

As mentioned above, Einstein, Podolsky, and Rosen were the first who described the phenomenon of quantum entanglement. Before that, a discussion was in progress between Einstein and Niels Bohr (1885-1962) regarding the newly formed quantum theory and its results, known as “Bohr-Einstein debates” (Näger & Stöckler, 2018: 105-106). Einstein could not accept that reality is not objective⁹ and that it is based on probabilities. There must be elements that correspond to reality. The EPR paper and the consequent argument were an attempt to debunk the completeness of the quantum theory. The core of the contestation was the recently discovered phenomenon of quantum entanglement. The three physicists based on their observations structured their argument on three interconnected pillars: the locality principle, the reality criterion, and the completeness condition.

First and foremost, the EPR argument presupposes locality as a key principle of the theory of relativity. By definition, locality implies that the states of two separated systems can only be altered by effects that are propagated with finite and subluminal velocities (Näger & Stöckler, 2018: 107; Howard, 1985: 179). Simplified, two separate objects cannot influence one another instantaneously if they are separated by a great distance. An object can only influence instantaneously its immediate surroundings. This is because nothing can travel faster than the speed of light; and if does so, it will violate the theory of relativity with unexpected consequences (e.g., a break of causality, travel backward in time, etc.). For the EPR this must be the case also for the phenomenon of quantum entanglement; or else, as Einstein indicates, we have “a spooky action from a distance” (Healey, 2017: 54).

Further, the EPR argument calls for the reality criterion. That is, if a physical quantity is predicted in a system with certainty, without disturbing this system, then there must be a physical element that corresponds to this quantity (Healey, 2017: 45-46; Näger & Stöckler, 2018: 112; Bohm & Hiley, 1993: 111-112). Otherwise stated, one is constrained to accept that there must be something there where a physical quantity is predicted with certainty, given that the system where the quantity is predicted is not affected in any way. However, according to EPR in the case of

⁹ Einstein on this matter proclaimed: “If one renounces the assumption that what is present in different parts of space has an independent, real existence, then I do not at all see what physics is supposed to describe” (Barad, 2007: 319).

quantum entanglement first, the measurement of the quantity on one object allows the prediction of the quantity on the other, second, the measurement on the first object does not affect the measurement on the second –based on the locality principle–, and third the quantity measured on the second object corresponds to a physical element of reality. Yet, –as argued by EPR– quantum theory states that the element of reality on the second object is undetermined before the measurement on the first object.

This leads us to the third pillar of the EPR argument; or again, the completeness condition. As a rule, according to the latter condition for every element of the physical reality, there must be a corresponding one in the theory (Bohm & Hiley, 1993: 110; Albert, 1992: 61). Expressed simply, it is necessary for the theory that it is created to explain the quantum world to be able to describe every element of reality thus being coherent ontologically. Based on its results, the EPR paper concludes that the quantum theory does not meet the completeness condition because of the above-mentioned not determined character of the element of reality on the second object, despite the prediction about the physical quantity on that object with certainty drawn out by the measurement on the first object.

Given that, Einstein, Rosen, and Podolsky concluded that the quantum theory is incomplete. Although they believed that the calculations and the results are correct, they maintained that still, something is missing. As mentioned before, Einstein could not accept that there is no objective reality or that it is possible for the locality principle to be violated. For that reason, the authors of the EPR paper proposed the solution of “hidden variables” (Näger & Stöckler, 2018: 105-106; Bohm, 1980: 92-93). In other words, possibly there are some variables not yet described in the theory which could explain the not determined character of the element of reality on the second object even if its quantity is predicted by the first object.

Ironically, the attempt of the EPR paper to prove the incompleteness of the quantum theory led to the discovery of its most important characteristic; or again, the non-locality that accompanies the phenomenon of quantum entanglement. To break it down, many years later (1964) the physicist John Bell proved¹⁰ after a series of experiments with entangled states that an object A can influence another, distant object B faster than by speed of light (Näger & Stöckler, 2018: 115-116; Albert, 1992:

¹⁰ The explanation of how Bell managed to prove the non-locality is extremely complex and does not add to the overall argument of this thesis. Therefore, for coherence and comprehension reasons it will be omitted. For more, see the presentation of Bell’s argument by Näger and Stöckler (2018: 120-141).

70). To put it differently, regardless of the existence of hidden variables, the correlations between two entangled particles are non-local, i.e., two separate objects can influence one another instantaneously even if they are separated by a great distance. It is important to note here that Bell's demonstration does not indicate that quantum theory is complete; it only refutes the first premise of the EPR argument. On the contrary, the quest for the completion of the quantum theory is a desideratum that gave birth to a myriad of interpretations.

3.2.2 Types of holisms

As delineated above, the EPR argument indirectly established the non-locality of the quantum world as a scientific fact. Furthermore, this non-locality principle provoked many directions of argumentation that advocate cosmic holism as an outcome of non-locality. Each direction follows its own line of thought. Ontological holism is numbered among them. This thesis will employ the ontological holism of David Bohm as a sequent of the non-local nature of quantum entanglement.

Prior to the presentation of the above-mentioned type of holism, it would be fruitful to briefly delineate first what the term "holism" stands for in general terms and which are distinct types of holism besides the ontological one. This will create a framework in order for the holism of David Bohm to be better understood. In more detail, by definition holism means that the whole is fundamental, or again, it is more than the sum of its parts (Healey, 2022: 655; Seager, 2018: 6). That is to say, holism is in oversimplified sense the opposite of reductionism. According to the latter, in order to understand something complex is better to examine it on the lowest level of its parts. Nevertheless, holism implies that the comprehension of the parts will not provide the complete description of the whole since the latter includes something more than what the parts include together. Furthermore, there are many types of holism (Healey & Gomes, 2022). To break it down, many authors advocate property holism. In explanation, property holism entails that the properties of some objects are not determined by the properties of the parts. Moreover, another type of holism is nomological holism. Simply stated, some objects obey laws that are not determined by the laws of their parts. In addition, some researchers have developed the relational type of holism; in slogan form, the relations between some objects do not supervene on their properties. Common ground for all these types of holism is the idea that the

whole is not reduced to its parts. On the contrary, the whole entails something more than the total of its parts.

On this basis, ontological holism is another type of holism. To clearly define, ontological holism “is the thesis that there are physical objects that are not wholly composed of basic physical parts” (Healey, 2022: 656). The burden of proof is not on whether the parts are physical or not. Rather, the emphasis is on whether the entity taken as a whole is after all composed of parts or not. In other words, it seems as if the parts that compose an entity are “homogenized” leaving behind a whole without parts. Bohm’s reflection on quantum mechanics can be regarded as a type of ontological holism. Given these points, David Bohm’s holistic ontology will now be presented.

3.3 David Bohm’s holistic ontology

In this section, which is the core section of this chapter, the Bohmian ontology will be presented to be used later as an optimum choice for the overcoming of the humanistic remnants found in other interpretations of quantum mechanics which – unsuccessfully– were used as solutions to humanism’s pitfalls. First, Bohmian mechanics’ technicalities will be explained which are the basis for the Bohmian holistic ontology, the delineation of which follows along with its implications as indicated by Bohm himself.

3.3.1 The Bohmian mechanics

Bohm’s David Bohm was one of the most significant theoretical physicists who developed his own interpretation of quantum mechanics. In short, the Bohmian mechanics –known differently as the “Broglie-Bohm theory”, the “pilot-wave model”, or the “causal interpretation of quantum mechanics”– entails that the quantum world is operating under a pilot-wave model. In the context of the latter interpretation, the particles “evolve according to a guiding equation, which expresses the velocities of the particles in terms of the wave function” (Goldstein, 2021). Simply expressed, in Bohm’s interpretation the course of particles is predetermined by their wave function. Ultimately, the interpretation of David Bohm is numbered among the so-called

“hidden variables interpretations” initiated by the conclusions of the EPR paper as demonstrated in the previous section of this thesis. In this regard, Bohm states:

“It is generally acknowledged that quantum theory has many strikingly novel features, including discreteness of energy and momentum, discrete jumps in quantum processes, wave-particle duality, barrier penetration, etc. However, there has been too little emphasis on what is, in our view, the most fundamentally different new feature of all; i.e., the intimate interconnection of different systems that are not in spatial contact. This has been especially clearly revealed through the by now well-known experiment of Einstein, Podolsky, and Rosen (EPR).” (Bohm & Hiley, 1974: 93-94)

From the above-quoted extract, it becomes apparent the importance of the by-Bohm-called “interconnection” –i.e., entanglement– of distant systems. Undoubtedly, the value of other quantum features such as the discreteness of energy and momentum, the wave-particle duality, etc. is recognized, but the interconnection between the particles is regarded as the keystone of the Bohmian holistic program.

Furthermore, Bohm structures his argument –mostly mathematically– about the universal holism that arises from the non-locality of entangled states. The crucial element that makes the interconnectedness between particles possible is the “quantum potential” (Nichol, 2003: 184; Bohm & Hiley, 1974: 97). In more detail, quantum potential –or, alternatively, information potential, or potential energy– is the coefficient that Bohm adds to the Schrödinger equation –the equation that describes the wave function of a particle. Expressed differently, the quantum potential is the transmitter of the information contained in the wave function of the particles about the particles’ movement. Ultimately, the quantum potential acts to guide the particles. To clarify the latter peculiar concept Bohm uses the metaphor of the ship and the radar waves. The ships (i.e., particles) on automatic pilot¹¹ (i.e., determinacy) are guided by the radar waves (i.e., wave function) via the transmitter of radar’s information¹² (i.e., quantum potential) on a specific movement in the sea (i.e., quantum world). At this point it is important to stress two things: first, the difference between the quantum

¹¹ My addition to the example.

¹² Ibid.

potential and the wave function is that the former constitutes the active aspect of the information and the latter the passive one, and second, the crucial element of the wave function seen from the perspective of quantum potential is the form, not the intensity since the form is what guides the particle.

Moreover, the above description of the quantum potential concerns the one-particle isolated system. On the contrary, in the many-particle system of non-local entangled particles is where the true effect of the quantum potential becomes apparent. To break it down, the mathematical equations of the Bohmian causal interpretation of quantum mechanics indicate that the particles are guided in a correlated way (Nichol, 2003: 184; Bohm & Hiley, 1993: 45; Bohm & Hiley, 1974: 99). In a nutshell, this means that there are not any more separate parts, rather there is a many-body wave function and a shared quantum potential. It is important to stress here that for the Bohmian interpretation, the wave-function has objective existence similar to the particles (Nichol, 2003: 183). This seems to explain why Bohmian holism is an ontological holism –as noted previously, ontological holism is the thesis that there are physical objects that are not wholly composed of basic physical parts. Therefore, the wave functions of two particles merge into a many-body wave function with its distinctive quantum potential. Most importantly, as the systems of particles interconnect this leads to more and more interconnected systems, probably reaching universal scale.

In addition, again from Bohm's mathematical equations turns out that the interaction between the particles does not decrease as the distance increases (Bohm & Hiley, 1993: 45-46); or again, the non-local interaction arises. In a frugal verbalized description of his equation Bohm explains that this happens because whatever value may one adds to the equation, the value of quantum potential remains equally high. Seemingly this means that the theory of relativity is violated since the interaction is acted at superluminal speeds¹³. Apart from this, the fact that the interaction does not decrease based on the distance maybe indicates that very distant systems of particles are still connected. The latter conclusion amplifies, even more, the holistic aspect of

¹³ Bohm supports the idea that it is possible to compromise the non-locality with the theory of relativity in the context of his interpretation. The explanation of this statement exceeds the research question of this chapter therefore is omitted for the future research. For the explanation see Bohm and Hiley (1993: 130).

Bohm's theory. In other words, this results in a "network" of interconnected systems across the universe.

As mentioned earlier, one of the reasons why the Bohmian type of holism was chosen is that David Bohm establishes a fruitful comparison of his ideas with those of Niels Bohr. Therefore, it is beneficial to juxtapose the ideas of David Bohm and Niels Bohr –via Karen Barad's interpretation– regarding quantum mechanics in general and wholeness in particular. This debate will enhance the comprehension of the complex scientific matters in question. More specifically, there are some major differences between the latter two interpretations of quantum mechanics. These differences concern both the fundamental conceptualization of quantum mechanics and also the holistic implications of this conceptualization.

First and foremost, one major difference between Bohm and Bohr is the deterministic character of the theory of the former (Faye & Jaksland, 2021: 8248). In a nutshell, the Bohmian pilot-wave model indicates that particles are deterministic in nature. This is because the wave function through the quantum potential directs the trajectory of the particle deterministically. On the other side, Niels Bohr's theory is fundamentally indeterministic –as is the case for the whole set of Copenhagen interpretations. In more detail, supports the idea that the nature of the particles is highly uncertain and indeterministic. Add to that, on the basis of the complementarity principle is impossible to measure every aspect of the particles at the same time which intensifies, even more, their indeterministic character.

Coupled with that, a second difference is related to the existence of both the particles and the wave functions. Simply stated, for Bohm both the particles and the wave functions have objective existence (Nichol, 2003: 183). On the contrary, Bohr stresses that on one hand the particle has potential existence until it is observed and then collapses into objective existence, and on the other hand the wave function is simply a mathematical formulation and nothing more. This is a major difference that allows Bohm to develop his ontological holism based on the quantum potential of the many-body wave function. Chiefly, this gives the opportunity to Bohm to eradicate the importance of the observer since particles and wave-function exist objectively and simultaneously.

This brings us to the third difference between the two physicists which is tightly connected to the notion of wholeness. In explanation, as became apparent earlier David Bohm propagates the universal wholeness that includes everything since

systems of particles are interconnected across the universe thus creating a cosmic wholeness. Instead, as mentioned in the previous chapter Niels Bohr emphasizes the wholeness of the observing apparatus and the object (Bohm & Hiley, 1974: 94, 103). Again, for Bohr, this form of wholeness is a phenomenon and there is no way to comprehend the wholeness in its objective and full-scale form.

Last, Bohr's view is a type of relational holism in contrast with Bohm's ontological holism (Everth & Gurney, 2022: 6; Faye & Jaksland, 2021: 8244). In more detail, as noted previously relational holism entails that the relations between some objects do not supervene on their properties. In this regard, in the previous chapter it became apparent that the intra-actions –or again, the phenomena– precede the object and the agencies of observation; or again, relations are before entities. On the other hand, as this chapter made clear, Bohm supports an ontological holism since the wave-function is something more than its parts, i.e., the two particles that come together. Having said that, the Bohmian holistic ontology will be discussed next.

3.3.2 The Bohmian holistic ontology

In one of his papers, namely, “On the intuitive understanding of nonlocality as implied by quantum theory” (1974) written along with Basil Hiley (1935-), Bohm structures a preliminary systematic theory of wholeness which is based on his interpretation of quantum mechanics and its holistic implications. In more detail, the notions of “supersystem”, “system”, “subsystem” are constitutive of the Bohmian ontological holism. As the authors of the paper proclaim:

“The one form of supersystem, system, and subsystem is valid for the whole field of physics, large-scale and small-scale. Subsystems will then generally depend intimately on the systems in which they participate, which will in turn depend on supersystems, etc., ultimately merging with the unknown totality of the whole universe, with no sharply delineated cuts or boundaries. In principle, this includes even the observer.” (Bohm & Hiley, 1974: 104)

The above-mentioned distinction of types of systems is just a convenient abstraction since everything is interconnected and wholeness is formed; or again, this abstraction enhances the importance of the unbroken wholeness. To schematize: two particles

having combined wave function and consequently combined quantum potential form a subsystem. This subsystem's quantum potential can be combined with another subsystem to form a system. Then this system's quantum potential combined with other systems forms a supersystem and so on and so forth. Most importantly, on the other way around, the supersystem is more than the sum of its systems and the system is more than the sum of its subsystems and so on, which explains the holistic structure. Again, this is just an abstraction since in the end everything is connected through the above-described procedure; or again, a holistic ontology comes forth.

Furthermore, there is another important element that Bohm notes. In particular, Bohm indicates that this theory is applicable also in fields outside physics (ibid: 106). In this regard, two examples are provided. First, the "systems" theory can be applied to sociology. In more detail, one can support the idea that human beings are the subsystems of a social group conceptualized as a system. Then the latter is one of the systems of a supersystem (e.g., a country, or a nation, etc.). A second example is related to the human body. Thus, two cells depend on the whole organ which in turn depends on the organism as an undivided wholeness. In both cases, the parts depend on the state of the whole, or again the whole is more than the sum of its parts. Nevertheless, the above-presented idea of Bohm for the expansion of his theory to fields outside physics is part of his first works and seems to be in a preliminary stage.

Nevertheless, in his later writings, Bohm puts aside the latter systematic formulation of wholeness. On the contrary, in his book "Wholeness and the Implicate Order" (1980) he follows a slightly different path to holistic ontology. First of all, he summarizes the three most important features that lead to wholeness and parallelly they constitute the keystones of the quantum theory: the action is constituted of indivisible quanta, the entities exhibit particle-wave duality, and the non-causal relationship of entangled particles (Bohm, 1951: 144; Bohm, 1980: 221-222). So far, so good. He does not emphasize something new here except the idea of discontinuous movement. As regards the latter, in a nutshell, the quantum theory demonstrates that the movement of particles is not continuous –the same hold for the energy–, rather it comes about in quanta, i.e., in indivisible quantities, an idea that demonstrates the underlying wholeness of indivisible movement.

However, the most important feature that Bohm adds in his theoretical interpretation of quantum mechanics is the concept of "implicate order". In this respect Bohm stresses:

“In terms of the implicate order one may say that everything is enfolded into everything. This contrasts with the explicate order now dominant in physics in which things are unfolded in the sense that each thing lies only in its own particular region of space (and time) and outside the regions belonging to other things.” (Bohm, 1980: 225)

In short, in this later version of Bohmian holistic ontology the real quantum world as unified wholeness orderly unfolds in the form of explicate structures such as particles and then enfolds back. Bohm employs the example of the cake egg which enfolds to the whole of the cake (with the exception that the egg cannot unfold back). Further, the explicate structures are of great importance since they render the everyday world possible and reachable to human beings. In addition, Bohm introduces the concept of the super-implicate order to explain how the real world unfolds into structures (Nichol, 2003: 139). In simple terms, the super-implicate order is the super-information field of the whole universe which carries the information and infuses it to the implicate order for the explicate order to arise.

Finally, it is important to emphasize that in the context of the implicate order, the concept of interaction receives a whole different meaning. To break it down, the implicate order is the common ground for everything that explicates –or again, unfolds (Griffin, 1986: 128). Because of that, there is no direct interaction between the explicate structures. On the contrary, since the implicate order is immanent –that is, one thing exists in the other and vice versa– in each of them thus they are immanent in each other and this allows them to interact indirectly. This creates a “vertical causation” (ibid.: 129) that emerges from the common ground instead of a “horizontal” one. All entities are immanent to the undivided wholeness and themselves; or again, in slogan form: in a deeper level they are not parts of the cosmos, they are the cosmos. Based on all the above, Bohm formed his pure philosophical conceptualization of the new order that arises. In the next section, the latter theory will be presented.

3.3.3 The old and the new order

David Bohm's holistic ontology, an offspring of his causal interpretation of quantum mechanics in general and the phenomenon of quantum entanglement in particular, paved the way for his philosophical theory and the corresponding newly formed order. In explanation, based on the idea that everything in the universe is a unified wholeness that is more than the sum of its parts, Bohm declared that the old mechanistic order –as he calls it–, initiated in the era of Enlightenment and proclaimed the ontological priority of the parts, is over. On the contrary, the time of a new order has come; or again, the era of the indivisible unity of the universe, the implicate order. What follows is first the presentation of the mechanistic order and second the delineation of the new implicate order.

First and foremost, the mechanistic order, as its name indicates, describes the world as a huge machine. This conception came forth in the 17th century, –of course, similar ideas existed implicitly and in previous eras, e.g., the atomic theory of Democritus in ancient Greece, etc.– the era of the Enlightenment. It is the period when modern science emerged in which the distinguished figures of René Descartes and Isaac Newton reigned over. The mechanistic worldview gives ontological priority to parts and not to the whole; or again, part-to-whole intelligibility and structure. The universe is a machine in which the parts are entities independent, separate, unchangeable, impenetrable, and movable (Seager, 2018: 5; Bohm, 1980: 219). They are independent because they are first-class entities from which everything arises. Moreover, they are separate since it is impossible to merge together in something radically different from the parts. In addition, they are unchangeable because regardless of the forces that are cast on them their essence does not change. Further, they are impenetrable since they are indivisible. Finally, they are movable and their trajectories are continuous. In form of a slogan: they are the building blocks of the entire universe.

The above-described order –the mechanistic order according to Bohm– is inconsistent with the discoveries in quantum mechanics and the discoveries related to the phenomenon of quantum entanglement and its subsequent principle of non-locality. David Bohm was one of the first physicists working on quantum mechanics who advocated the idea of holism that arises from the phenomenon under consideration. Therefore, he claimed that the old order must change. Chiefly, it must

change in the field of science. The main reason for this necessity is that the mechanistic order promotes division. This divides the knowledge and conceals the wide picture of the world.

On the contrary, the Bohmian philosophical considerations call for a new holistic order, i.e., the implicate order. In this regard, David Bohm declares:

“The entire universe must, on a very accurate level, be regarded as a single indivisible unit in which separate parts appear as idealizations permissible only on a classical level of accuracy of description. This means that the view of the world as being analogous to a huge machine, the predominant view from the sixteenth to nineteenth centuries, is now shown to be only approximately correct. The underlying structure of matter, however, is not mechanical¹⁴.” (Bohm, 1951: 167)

Or again, in another passage he emphasizes:

“Ultimately, the entire universe (with all its ‘particles’, including those constituting human beings, their laboratories, observing instruments, etc.) has to be understood as a single undivided whole, in which analysis into separately and independently existent parts has no fundamental status.” (Bohm, 1980: 221)

Given the above, it becomes apparent that in the new order, everything is an undivided whole. The division in individual parts is nothing more than a convention and does not have fundamental status. It is only useful for classical descriptions. Or again, in the scientific language of David Bohm: parts are unfoldings of the undivided whole that make the grasping of the world possible. Given these remarks, in the next chapter, an attempt will be made to show how David Bohm’s philosophical consideration of the implicate order eradicates any remnants of humanistic and anthropocentric conceptualizations found in the posthumanist theories such as the theory of agential realism of Karen Barad.

¹⁴ In a footnote under the text, he remarks that even the term “quantum mechanics” should change and renamed as “quantum nonmechanics”.

3.4 Conclusion

All in all, in this chapter an attempt was made to answer the question, namely, “how does David Bohm’s interpretation of quantum mechanics lead to a holistic ontology?”. In more detail, via this chapter, it was argued that Bohm based on quantum entanglement’s non-local implications, structures an ontological holism which he expands on the cosmic scale, thus resulting in a holistic ontology, or again – what he calls– the “implicate order”. To support the latter conclusion first, the famous paper of Einstein, Podolsky, and Rosen was presented as a stepping-stone that brought forth the phenomenon of quantum entanglement and the principle of non-locality that accompanies it. Further, the types of holisms were discussed as consequences of the principle of non-locality and in which Bohm’s ontology is numbered among as an ontological holism. Moreover, Bohmian mechanics was elucidated as the most technical part of this thesis, where Bohm’s –in quantum mechanics terminology– “hidden variable” of “quantum potential” was introduced. This section was a necessary step for understanding Bohm’s holistic ontology that came next. In this context, the differences between David Bohm and Niels Bohr were pointed out for the technical part to become more graspable. Next, the holistic ontology of David Bohm was demonstrated as the core part of this chapter including the notions of “subsystem-system-supersystem” and later on in more recent works the notion of “implicate order” and its implications.

4 The antihumanism of David Bohm's holistic ontology

4.1 Introduction

In the two previous chapters an attempt was made to first make apparent the humanistic and anthropological remnants found in Karen Barad's theory of agential realism, and second to describe how an alternative interpretation of quantum mechanics –i.e., David Bohm's interpretation– can lead to a holistic ontology. In the first case, it was argued that while trying to disperse human qualities such as agency to everything that resides in the world –thus trying to overcome the humanistic pitfalls–, agential realism neglects the fact that agency is a quality made only by and only for humans. In the second case, it was emphasized that Bohm based on quantum entanglement's non-local implications structures an ontological holism which he expands on the cosmic scale, thus resulting in a holistic ontology, or again –what he calls– the “implicate order”. The findings of these inquiries will be used now synthetically in order for new knowledge in the fields of philosophical anthropology and quantum mechanics to be produced.

In this regard, this chapter poses the question, namely, “how does David Bohm's holistic ontology by overcoming humanistic and anthropocentric remnants entail an antihumanistic perspective?”. In short, via this chapter will be argued that since Bohmian holistic ontology emphasizes the ontological priority of undivided wholeness and attributes the qualities of all entities directly to it, this entails a radical antihumanist stance which renders the concept of human beings misleading and unnecessary and thus eradicates it once and for all. The response to the above question is crucial for two reasons. First, despite the fact that agential realism is one of the most recent and most influential theories, this chapter argues that there are other interpretations –like the one of David Bohm– which, although highly neglected, are capable of overcoming the dead-ends of seemingly successful theories. Second, by answering the above-posed question, the movement of antihumanism is pointed out as an adequate theory that can be employed in order for the humanistic pitfalls to be addressed once and for all.

The line of argumentation of this chapter goes as follows. First, it will be described how Bohm's holistic ontology is an adequate alternative that can overcome

the anthropocentric remnants found in the theory of agential realism. This will be based on the characteristics of Bohm's theory such as the construction of a refined version of wholeness, the rejection of all differences, the attribution of the agency directly to undivided wholeness, and, consequently, the rendering of the concept of human beings as misleading and unnecessary. Based on the latter, the conviction that Bohm's ontology leads to an antihumanistic stance will be structured. In short, the antihumanistic theories of Nietzsche and Foucault will be presented as necessary but inadequate steps toward the complete abandonment of the concept of human beings. The last step towards antihumanism is the holistic ontology's consequence that the qualities of all entities are attributed directly to undivided wholeness, thus eradicating once and for all the necessity of the concept of human beings.

4.2 David Bohm's holistic ontology as an alternative to agential realism

David Bohm's holistic ontology can be used as an alternative to agential realism's inadequacy to overcome humanistic and anthropocentric beliefs. To prove this the analysis of the previous two chapters will be used as premises for a synthetic argumentative conclusion. As became apparent in the first chapter of the main part of this thesis, although Barad attempts to go beyond humanism's pitfalls via her theory of agential realism, humanism is deeply rooted in her scientific and philosophical considerations. Following the paradigm of the movement in which she numbered as a member, i.e., new materialism, she tries to disperse human qualities such as agency to matter. As demonstrated by this thesis, this attempt was misleading since qualities like agency are made by humans and for humans. Therefore, anthropocentrism was dispersed parallelly with the agency in the cosmos.

On the other hand, a deeper level of comprehension comes forth in David Bohm's philosophical conceptualization of the implicate and explicate order. To break it down, for Bohm the implicate order –as described in the previous chapter– is the deeper substratum that espouses the quantum potential –or again, the carrier of quantum information– which guides the unfolding of the entities. On the contrary, the explicate order includes the entities that unfold from the implicate order and make the cosmos graspable. Most importantly, the implicate order constitutes the undivided

wholeness in which every entity is immanent and from which every entity is immanent to each other in vertical causation¹⁵. Reiterated, Bohm argues that everything in the cosmos on a deeper level is an undivided wholeness, and what unfolds as an object of classical physics (e.g., humans, particles, structures, etc.) are just superficial abstractions of the same deeper wholeness.

In this regard, Bohm's theory can be employed as an alternative to agential realism's inadequate attempt to overcome the humanistic pitfalls for a number of reasons¹⁶. First and foremost, the conceptualization of human beings –and everything else– as the undivided wholeness of the cosmos is a far more sophisticated and refined version of wholeness than the one described in agential realism. Simply stated, in the latter theory, wholeness is restricted to the entanglement of the object and the apparatus of the observation. They are the coming-forths of the intra-actions, i.e., the phenomena. On the other hand, Bohm's theory of implicate order includes everything in the undivided wholeness. This is extremely important because in agential realism the cosmos is described in a multitude of intra-actions. The explanation of how exactly one phenomenon affects the other, how one apparatus interrelates to another, etc., is extremely vague in the context of the theory under consideration.

In this respect, the idea that the cosmos is a multitude of phenomena seems to bring from the back door the mechanistic order that Bohm described. In short, it seems that every phenomenon is a distinct part of ontological primacy. This fragmentation disturbs the equilibrium among entities since there is a plethora of different phenomena, each ontologically independent; or again, every part can be attributed a different value. Perhaps this also concerns the phenomena which include human beings. In this context Bohm warned about fragmentation:

“Even earlier, man's first realization that he was not identical with nature was also a crucial step, because it made possible a kind of autonomy in his thinking, which allowed him to go beyond the immediately given limits of nature ... Nevertheless, this sort of ability of man to separate himself from his environment and to divide and apportion things ultimately led to a wide range

¹⁵ See 3.3.2.

¹⁶ Obviously, Bohm never expressed the ideas described in this session. It is an attempt of this thesis to employ the findings of the Bohmian mechanics and its correspondent philosophical considerations of implicate order to the context of philosophical anthropology.

of negative and destructive results ... Being guided by a fragmentary self-world view, man then acts in such a way as to try to break himself and the world up, so that all seems to correspond to his way of thinking.” (Bohm, 1980: 2-3)

In opposition, Bohm’s holistic ontology avoids this pitfall because of notions of the explicate and implicate order. The former explains the existence of the individual entities and structures and the latter justifies their equilibrium since every entity and structure by being immanent to each other –and all together to implicate order– is identified as the undivided wholeness.

Coupled with the restricted version of holism found in agential realism, the second reason why Bohm’s theory is an adequate alternative to agential realism is related to the fact that Niels Bohr’s theory is deeply anthropocentric. As mentioned earlier, Bohr is a proponent of the humanistic tenet that humans are separately determined from the entities that they investigate. Therefore, even if Barad makes the effort to overcome humanistic pitfalls, humanism is deeply rooted in her theory. On the contrary, Bohm’s opposition to mechanistic order and the idea of undivided wholeness of implicate order do not allow for any suspected anthropocentrism. From the very beginning Bohmian theory puts human beings in the backstage.

Furthermore, the third reason is related to the quality of agency per se. As described previously, Barad attempts to disperse agency in matter when striving to overcome humanism. But, this results in the dispersion of anthropocentrism in the matter. On the contrary, Bohmian holistic ontology avoids this pitfall also. In more detail, the latter theory renders the attempt to disperse human qualities in matter unnecessary. In explanation, there is no need to provide the more-than-human entities and matter with the quality of agency found only –as far as it is known– to human beings because, as demonstrated before, everything is immanent in everything else in vertical causation via the implicate order; or again, the quality of agency found in human beings is a quality of undivided wholeness via human beings thus it is a quality of more-than-human beings since they are also the undivided wholeness. Obviously, this idea does not entail –as agential realism did– that human beings have primacy over other entities since the quality of agency that they exhibit is a quality of undivided wholeness.

The above statement becomes apparent by recalling Karen Barad's example of brittlestars described in a previous chapter. In a nutshell, in the latter example, Barad made the effort to prove that brittlestars participate as agents and enact agential cut through biomimesis in their intra-action with human beings. As argued in this context, human beings have the larger burden of argument for their actions in their –not so reciprocal– relation with the brittlestars. Nevertheless, Bohmian holistic ontology can be used to solve the dead-end of this example. To explain, there is no need to find a way to attribute agency to brittlestars. Conversely, Bohm's implicate order allows for conjunction. Human agency and brittlestar body-eye are both qualities of the undivided wholeness therefore they are qualities of both human beings and brittlestars since they are immanent to implicate order and through it immanent to each other.

In addition, the fourth reason why Bohmian holistic ontology is a solution to the issue of anthropocentrism has to do with the differences. In the Bohmian framework, there is no differentiation. This is extremely important because it comes up against the postmodernist idea of differences. As described in a previous chapter, posthumanism made an effort to designate even more different groups and entities in order to end their marginalization. In this attempt, the differentiation and dichotomies were crucial. But, although the exclusion and the marginalization more and more faded, the differentiation remained. To put it in slogan form: the act to overemphasize the differences, makes them more important than the initial reason that led to their emergence. Again, David Bohm's holistic ontology bypasses this side effect. For the latter theory in fact there are no differences. Although entities and structures unfold as explicate order for the world to be graspable, the underlying substratum of implicate order establishes their true undivided unity. Everything and everyone are different as unfoldings but this is only an abstraction since everything and everyone enfolds to the undivided wholeness. Therefore, the importance is shifted from the superficial differences to the deeper unity of all.

All the above lead to the last reason why Bohmian holistic ontology is an alternative to agential realism's inadequacy to overcome humanistic pitfalls. To break it down, this reason has to do with the concept of the "human being" itself. In simple terms, since human beings are identified with undivided wholeness, the concept of the human being is misleading and unnecessary. Everything is immanent to implicate order and to each other through it. The attribution of distinct status to human beings is misleading. It creates the problems this thesis described. Problems related to

humanism's pitfalls but also problems related to the attempts of overcoming humanism anthropocentrism. Therefore, human beings are not different at all from everything else in the cosmos and consequently, the attribution of a unique meaning to the concept of human beings is misleading. The latter is an antihumanist stance. In the next section, an attempt will be made to support this statement.

Prior to this, it is fruitful to make a last note. All the philosophical and anthropological implications of Bohmian holistic ontology arising from the above-delineated reasons may seem odd or peculiar or even alien at first glance. For instance, it is extremely difficult to accept the idea that the body-eye quality of brittlestars is a quality of human beings also. Here, Bohm could possibly say that it is the deeply rooted fragmentation attitude of human beings that renders them unable to grasp the idea of undivided wholeness which justifies the idea that the body-eye quality is a human quality also. This difficulty can be overcome if the qualities found in the cosmos here and there are added up to the sum of the qualities of the undivided wholeness. Of course, here and now human beings do not have the quality of a body-eye as brittlestars do. But in the cosmic context the latter quality is a quality of the undivided wholeness therefore a quality of human beings. Let's now return to how the misleadingness and the unnecessary of the concept of human beings lead to an antihumanistic stance.

4.3 Antihumanism

In this section, the antihumanistic implications of Bohm's holistic ontology are presented. Prior to this, the steps of an ongoing theoretical procedure are described from Nietzsche's first establishment of the antihumanistic theory until its expanding and radicalization by Foucault.

4.3.1 History and theory of antihumanism

Antihumanism is the alter ego of posthumanism. Nevertheless, the two theories are not identical, and they should not be confused (Ferrando, 2019: 45). There are some similarities and some differences between the two. As far as the similarities are concerned, posthumanism and antihumanism challenge the unique, central, and

universal idea of human nature. The overcoming of the pitfalls that the above idea brings forth is the ultimate task of the theories in question. Moreover, posthumanism and antihumanism share a common ground in postmodernity. Therefore, the importance of differentiation is embedded in both movements.

On the other hand, posthumanism and antihumanism differ in many ways. First and foremost, their difference arises in their morphology, i.e., the prefixes “post-” and “anti-”. As explained in a previous chapter, by the prefix “post-”, a transcendence of a previous situation is indicated. But, at the same time, this transcendence is not defined; or again, it is an open-ended move beyond humanism without the direction and the destination of this move being defined clearly. Differing from the latter, the prefix “anti-” indicates a strict opposition to the anterior movement of humanism. Therefore, the theory of antihumanism is an effort to cut off any relations with the past.

This reveals the second difference between posthumanism and antihumanism. In other words, antihumanism is far more radical than posthumanism. On one hand, posthumanism seeks to move forward without denying completely the notion of human beings. Humans are still there in the creation of their new identity. On the other hand, antihumanism propagates the “death” of human. Obviously, this is not a biological death but rather a conceptual one. It is the eradication of the notion of human beings per se and its seemingly unique and essential nature. This dismantling procedure was not instant, on the contrary, it lasts nearly two centuries and as it will be argued shortly after still it has not reached its end.

4.3.2 Friedrich Nietzsche

Nietzsche is one of the most prominent Western philosophers and he is regarded by many scholars as the founder of the antihumanism movement. In his works, he conducts the gargantuan and meticulous task of reevaluating all the fundamental constituents of humanity (Schacht, 2006: 115; Sluga, 2005: 228; Davies, 1997: 36). In more detail, Nietzsche seeks to reevaluate religion, morality, art, science, social and political institutions, truth, knowledge, psychological phenomena, and last human beings themselves. The Nietzschean task of reevaluating all fundamental constituents was an attempt to show that nothing is stable and fixed. Posthumanist and antihumanist movements were based exactly on this tenet.

From the constituents that Nietzsche reevaluated, two are of great importance for the argumentation of this chapter and for this thesis in total. The reevaluation of religion –i.e., the idea of God– and the reevaluation of the idea of human beings. This is because, as it will become apparent next, the reevaluation of God is a prerequisite for the reevaluation of human beings which constitutes the dawning of antihumanism. As far as the reevaluation of the religion is concerned, Nietzsche propagated in his work “Thus Spoke Zarathustra” (1883) the death of God:

“But when Zarathustra was alone he spoke thus to his heart: “Could it be possible! This old saint in his woods has not yet heard the news that God is dead!” (Nietzsche 1883, 2006: 5)

To break it down, for Nietzsche the death of God meant the conceptual death of religion and of the transcendental imposition of absolute truth (Ferrando, 2019: 51; Davies, 1997: 36, 38). That is to say, the death of God brought about the demise of the imposed truth guaranteed by divinity and, conversely, gave importance to the individual truth. This transition after the demise of God paved the way for the rise of the individual, which Nietzsche calls “Übermensch” (“overhuman”).

The latter comes forth from the second devaluation, i.e., the devaluation of the concept of human beings. To break it down, Nietzsche questioned the hegemony and the unity of the notion of human beings by regarding them as metaphysical errors (Abadia, 2018: 170-171). That is, Nietzsche denounced the dominant version of static human nature and advocated the dynamic one. There is not one type of human nature, on the contrary, the concept of human beings varies over time and changes accordingly; or again, human beings are beings in the making.

On this basis, Nietzsche elaborated the idea of “overhuman”. The overhuman is the incarnation of the overcoming of the old version of human. After the death of God, the death of the old human came in order for the new human to take God’s place. In this respect Nietzsche declares:

“I teach you the overman. Human being is something that must be overcome. What have you done to overcome him?” (Nietzsche 1883, 2006: 5).

For Nietzschean philosophy, the overhuman is its cornerstone. Nietzsche believes that human beings are contradictory entities (Schacht, 2006: 126). Simply put, human beings are the only animals on the earth that are never satisfied, and they always try to overcome themselves. It is an inner contradiction that forces human beings to turn against themselves. Nevertheless, this unsatisfied nature of humans gives rise to a never-ending future; or again, it is overhuman's constant self-overcoming that enables an infinitum of possibilities. Through self-overcoming human nature continuously changes and along with it the earth itself due to human activity.

As indicated before, Nietzsche's philosophy initiated the antihumanist movement. Yet, it was not as radical as seemed at first. Of course, Nietzsche was the first to denounce the immutable and ahistorical human nature which overcome humanism and paved the way for posthumanism and antihumanism. But, in fact, it never reached the radical antihumanist ideology. This is because, to the empty seat of the old human, Nietzsche placed the overhuman. The latter is nothing more than a new version of human beings. Instead of the humanistic version of humans who are the sole bearers of qualities such as rationality, agency, consciousness, etc., Nietzschean theory offers a new version of humans that bears again the unique quality of self-overcoming. Reiterated, human beings are still in the center of the scene with a dynamic nature this time.

4.3.3 Michel Foucault

The Nietzschean philosophical work was highly influential. Almost a century later Nietzsche inspired deeply the philosophical considerations of Foucault (Miernowski, 2016: 10; Davies, 1997: 71; Ferry & Renaut, 1985: 98). In this context, Foucault continued the antihumanist task initiated by Nietzsche and expanded it in a more radical and thorough way. Thus, he made an effort to debunk the humanistic ideals of the centrality and sovereignty of human beings. Alongside the revaluation of the concept of human beings, he focused on the revaluation of knowledge which was a prerequisite for the accomplishment of the former. In order to understand the relation between the two one has to first comprehend the Foucauldian theory that underlies them.

In a nutshell, a central notion of Foucault's philosophy is the "discourse". The latter concept delineates the dominant social power relations which as narrative

control, manipulate, and monitor everything in society (Abadia, 2018: 171; Nayar, 2014: 25; Canguilhem, 2005: 79; Davies, 1997: 70). Obviously, language has a crucial role in the discourse. It is now used not as a marker of things, but rather as a tool for power relations to be exercised. Like language, discourse is deeply rooted in the everyday life of human beings. They are unable to realize that their life is fully controlled by power relations. Those relations determine the boundaries of what human beings are allowed to be said or even think.

The above-described power relations define also what is knowledge and truth, and what constitutes the “episteme”. In explanation, for Foucault episteme is the power-constructed knowledge and truth. In other words, the meaning and the content of natural sciences, history, law, and even human sciences are socially manufactured by power relations (Canguilhem, 2005: 88-89). Because of that, the concept of human beings is also socially constructed through the episteme of human sciences (e.g., anthropology, psychology, etc.). Thus, this is the reason why through reevaluation of knowledge Foucault reevaluates the notion of human beings. Most importantly, episteme changes as the power relations change. For instance, what is regarded as historical fact today by the given power relations, tomorrow maybe will change. There is nothing stable or immutable, not even knowledge and truth. Of course, this is the case also for human beings. Therefore, Foucault gives the final blow to humanism.

Based on that, Foucault similarly to the Nietzschean death of God, proclaims the “death of man” (Ferrando, 2019: 48; Abadia, 2018: 172; Canguilhem, 2005: 75; Davies, 1997: 70) –this is exactly the reason why he is numbered among the antihumanists. Simply stated, the humanist notion of unchangeable, universal, and unique humanity is erroneous. Human beings are structured socially from power relations and this structure changes over time. As Foucault propagates:

“One thing in any case is certain: man is neither the oldest nor the most constant problem that has been posed for human knowledge. Taking a relatively short chronological sample within a restricted geographical area – European culture since the sixteenth century – one can be certain that man is a recent invention within it . . . As the archaeology of our thought easily shows, man is an invention of recent date. And one perhaps nearing its end.” (Foucault 1966, 2005: 421-422)

Obviously, Foucault does not mean literally that human beings will die biologically. On the contrary, he believes that the concept of human as defined in this era will become extinct. In fact, Foucault proclaims the death of the humanistic conceptualization of human.

Having said that, it is considered fruitful to outline how far has Foucault exceeded the antihumanistic task that Nietzsche initiated but never managed to purify it from the humanistic and anthropocentric remnants. In this regard, whereas Nietzsche advocated a self-overcoming and self-willed subject, Foucault argued for a human being that is directed by exogenous powers. Otherwise stated, human beings are neither sovereign nor self-regulated. Humans conceptually are offsprings of the ever-changing social power relations. The dynamic human nature is imposed by powers exterior to human beings. For Foucault –and postmodernists in general– there is a clear priority of culture over nature. As mentioned in a previous chapter, posthumanists overemphasized the importance of culture to such a degree that nearly ignored matter itself as ontologically sequent to culture.

But how far did Foucault go? Did he manage to overcome humanism and establish a complete antihumanism? If one considers the theory of power relations that Foucault developed, it seems that he neither went too far nor he overcame the humanistic pitfalls. To explain, it seems that Foucault relocated anthropocentrism from the conceptualization of human beings themselves to the conceptualization of social power relations. In Karen Barad's terms:

“Also problematic is the antihumanist view that encourages, or does not sufficiently discourage, the mistaken belief that human bodies and subjectivities are the effects of human-based discursive practices. Like their humanist counterparts these accounts reinscribe the nature-culture, human-nonhuman, animate-inanimate binaries and other Enlightenment values and stakes that antihumanism seeks to destabilize.” (Barad, 2007: 171).

As the above extract confirms, discursive practices are human-based. Admittedly, while growing in magnitude and power these power relations are becoming more and more invisible to human understanding. It is like they become autonomous and operate behind the scene of the world. Nevertheless, human beings chiefly initiate

these relations, in one way or another. Therefore, Foucault arguably does not overcome the humanistic pitfalls he proclaims to overthrow.

4.3.4 The completion of an unfinished task

From the above-presented discussion regarding antihumanism two conclusions can be drawn. First, the antihumanism theory initiated by Nietzsche is an ongoing movement which has recognized the dead-ends of humanism and tries to overcome them with more and more radical attempts. Second, as it has been argued via this thesis, all the aforementioned philosophical attempts did not manage to overcome the deep-rooted humanistic and anthropocentric remnants regardless of how radical these attempts were. In this regard, this thesis claims that David Bohm's holistic ontology is the final step towards the completion of the antihumanistic movement.

As described in the previous section, Nietzsche was the first who put an end to the humanistic conception of human by propagating the rise of the overhuman, a self-overcoming human being. Yet, in his conceptualizations human beings were still there possessing a newly found unique quality. Moreover, Foucault nearly one century later prophesized the death of man, i.e., the change of the power relations which brought about the humanistic conception of human beings in the first place. Again, the Foucauldian theory espoused implicitly anthropocentric ideals since human beings chiefly initiate the social power relations, one way or another. Consequently, another step is needed that will eradicate once and for all the humanistic and anthropocentric pitfalls of humanism.

In this respect, the Bohmian holistic ontology and more specifically the notion of implicate order can be employed for the above-posed task. To break it down, the implicate order indicates that everything in the cosmos is an undivided wholeness. This includes also human beings. Therefore, there is no need to attribute to them unique status or unique qualities. The notion of "human being" is unnecessary and, even more, misleading. To clearly define, human beings –and every other entity– are unfoldings –or again, the explicate order– that make the world graspable. But on a deeper level, they are abstractions of the underlying implicate order to which they enfold back eventually. This includes the qualities of the entities. Since the entities are immanent to implicate order and, through it, to each other all qualities are qualities of all entities; or again, of the undivided wholeness. Perhaps, it is preferable to say that

there are no human beings or Barad's brittlestars at all. Although they objectively exist as unfoldings it is better to regard them as abstractions in order to overcome the confusion that they cause to the comprehension of the undivided wholeness. The only things that exist are the fundamental particles which as unfoldings bring forth qualities such as agency, consciousness, the body-eye, telepathy of some alien species, etc., conceptualized as inherent qualities of the undivided wholeness. The combinations of those particles in even bigger and more complex forms bring forth different qualities. But in the end of day, they are just particles brought together as unfoldings of the implicate order.

The above-described conceptualization is the most radical antihumanistic stance that can possibly be. It exceeds the antihumanistic attempts of both Nietzsche and Foucault. Obviously, overcomes the humanistic pitfall of anthropocentrism. Admittedly, goes beyond posthumanism's and new materialism's inadequacy to get over with humanism. And lastly reveals and confronts the dispersed anthropocentrism found in Karen Barad's theory of agential realism. All in all, this thesis supports a radical antihumanist stance based on the findings of quantum mechanics by eradicating the concept of human beings thus giving rise to a cosmic undivided wholeness and all its qualities dispersed here and there in the cosmos; or again, it is an antianthropology born from the quantum world.

4.4 Conclusion

Via this chapter an effort was made to answer the question, namely, "how does David Bohm's holistic ontology by overcoming humanistic and anthropocentric remnants entail an antihumanistic perspective?". In short, it was argued that since Bohmian holistic ontology emphasizes the ontological priority of undivided wholeness and attributes the qualities of all entities directly to it, this entails a radical antihumanist stance which renders the concept of human beings misleading and unnecessary, and thus eradicates it once and for all. To prove the above conclusion first, it was described how Bohm's holistic ontology is an adequate alternative that can overcome the anthropocentric remnants found in the theory of agential realism. This was based on the characteristics of Bohm's theory such as the construction of a refined version of wholeness, the rejection of all differences, the attribution of the agency directly to

undivided wholeness, and, consequently, the rendering of the concept of human beings as misleading and unnecessary. Based on the latter, the conviction that Bohm's ontology leads to an antihumanistic stance was structured. In short, the antihumanistic theories of Nietzsche and Foucault were presented as necessary but inadequate steps toward the complete abandonment of the concept of human beings. The last step towards antihumanism was the holistic ontology's consequence that the qualities of all entities attributed directly to undivided wholeness, thus eradicating once and for all the necessity of the concept of human beings.

5 Epilogue

5.1 Concluding summary of the thesis

Through the lines of this work, a task was undertaken to prove that humanistic remnants are present in the most recent posthumanist theories such as Karen Barad's agential realism. More than that, an alternative to the latter shortcoming was proposed, more radical than its predecessors, i.e., an antihumanistic response to the question regarding human nature, established on David Bohm's interpretation of quantum mechanics. The first part of this task proves its importance since it attempts to reveal the flaws of one of the most influential philosophical theories in recent years. The second part of this task proves its originality because it is perhaps the first time that David Bohm's theory is used in the context of philosophical anthropology. The conclusion that this thesis reached –i.e., that the concept of human beings is unnecessary since everything is an undivided wholeness– is truly a bold statement. For some, maybe it is provocative or even reckless. Yet, I firmly believe that it is the outcome of a steady, coherent, and well-established in bibliography argument. Surely, the unprecedented endeavor to bring together such dense and sophisticated theories from philosophical anthropology –Karen Barad's agential realism– and from the philosophy of quantum mechanics –i.e., David Bohm's interpretation– made the dedication to such an argument extremely difficult. Not to mention, the delineation of Friedrich Nietzsche and Michel Foucault's philosophical considerations. All in all, this thesis is a philosophical and scientific amalgam that brings together so many different ideas and aimed in accomplishing three successive tasks: first, to provide a response to the shortcomings of Karen Barad's theory, second –as a result of the previous– to structure an adequate answer to the long-lasting question of philosophical anthropology –i.e., what is the nature of human beings–, and, lastly, –by employing quantum mechanics in order to answer the latter pervasive question– to highlight the importance of the scientific field of Quantum Mechanics to humanity's self-determination.

At this point, it is considered beneficial to re-summarize the whole line of argumentation of this thesis. First of all, an attempt was made to answer the question, namely, “how does the holistic ontology of David Bohm's interpretation of quantum

mechanics overcome the anthropocentric remnants found in Karen Barad's posthumanistic theory of agential realism, thus paving the way for an antihumanistic conceptualization of human nature?". In short, this thesis argued that Karen Barad's agential realism does not overcome anthropocentrism since it tries to disperse into the cosmos qualities such as agency that are made only by humans and for humans. To overcome this dead-end this thesis employed a different interpretation of quantum mechanics, i.e., David Bohm's "pilot-wave model" and advocated that the holistic ontology embedded in the latter theory renders, via the notion of undivided wholeness, the concept of human beings unnecessary, and thus, on one hand, overcomes anthropocentrism and in the other hand promotes a radical antihumanist stance.

To support the latter conclusion this thesis broke down the main research question in three subquestions and three chapters, respectively. In more detail, in the first chapter of the main part of this thesis an attempt was made to answer the question, namely, "how does Karen Barad's posthumanistic theory of agential realism implicitly espouse humanistic remnants?". In short, it was argued that while trying to disperse human qualities such as agency to everything that resides in the world –thus trying to overcome the humanistic pitfalls–, agential realism neglects the fact that agency is a quality made only by and only for humans. To reach the latter conclusion, first the theory of humanism was presented as a theory that designates human beings as uniquely rational and agential beings. Further, the pitfalls of the latter theory were pointed out such as the anthropocentrism which excluded human and non-human entities, and also the humanistic tension of dualisms which dichotomized entities in opposing poles. Moreover, the movement of posthumanism was delineated as a movement that decentralizes humans and deprives them of their primal place in an attempt to overcome the pitfalls of its antecedent theory and at the same regards humanity mainly as a co-evolving cultural product. Next, Karen Barad's theory of agential realism was discussed. Prior to this, new materialism was described as the posthumanistic group of theories in which agential realism is numbered among and which brings back to the anthropological discussion the concept of "matter" that has been neglected by posthumanism in favor of culture. Then the elucidation of the theory of agential realism followed which in a nutshell having as scientific background Niels Bohr's interpretation of quantum mechanics argues for a realism

that emerges from an agential act; or again argues for a kind of situated ontology which depends on the decision that someone or something takes.

Moreover, in the second chapter of the main part of this thesis an attempt was made to answer the question, namely, “how does David Bohm’s interpretation of quantum mechanics lead to a holistic ontology?”. In more detail, via this chapter, it was argued that Bohm based on quantum entanglement’s non-local implications, structures an ontological holism which he expands on the cosmic scale, thus resulting in a holistic ontology, or again –what he calls– the “implicate order”. To support the latter conclusion first, the famous paper of Einstein, Podolsky, and Rosen was presented as a stepping-stone that brought forth the phenomenon of quantum entanglement and the principle of non-locality that accompanies it. Further, the types of holisms were discussed as consequences of the principle of non-locality and in which Bohm’s ontology is numbered among as an ontological holism. Moreover, Bohmian mechanics was elucidated as the most technical part of this thesis, where Bohm’s –in quantum mechanics terminology– “hidden variable” of “quantum potential” was introduced. This section was a necessary step for understanding Bohm’s holistic ontology that came next. In this context, the differences between David Bohm and Niels Bohr were pointed out for the technical part to become more graspable. Next, the holistic ontology of David Bohm was demonstrated as the core part of this chapter including the notions of “subsystem-system-supersystem” and later on in more recent works the notion of “implicate order” and its implications.

Last, in the third chapter of the main part of this thesis, an effort was made to answer the question, namely, “how does David Bohm’s holistic ontology by overcoming humanistic and anthropocentric remnants entail an antihumanistic perspective?”. In short, it was argued that since Bohmian holistic ontology emphasizes the ontological priority of undivided wholeness and attributes the qualities of all entities directly to it, this entails a radical antihumanist stance which renders the concept of human beings misleading and unnecessary and thus eradicates it once and for all. To prove the above conclusion first, it was described how Bohm’s holistic ontology is an adequate alternative that can overcome the anthropocentric remnants found in the theory of agential realism. This was based on the characteristics of Bohm’s theory such as the construction of a refined version of wholeness, the rejection of all differences, the attribution of the agency directly to undivided wholeness, and, consequently, the rendering of the concept of human beings as

misleading and unnecessary. Based on the latter, the conviction that Bohm's ontology leads to an antihumanistic stance was structured. In short, the antihumanistic theories of Nietzsche and Foucault were presented as necessary but inadequate steps toward the complete abandonment of the concept of human beings. The last step towards antihumanism was the holistic ontology's consequence that the qualities of all entities attributed directly to undivided wholeness, thus eradicating once and for all the necessity of the concept of human beings.

5.2 Possible objections and their rebuttal

It is considered beneficial to make an effort to rebut some possible objections to this thesis' argumentation. First and foremost, one possible objection can be related to the idea that the antihumanism movement brings back from the back door dichotomies that it is supposed to overcome. Admittedly, posthumanist and antihumanist theories focus on the eradication of dualisms. Also, the prefix "anti-" maybe indicates the emergence of a new dichotomy between humanists and their opponents since the prefix anti provokes some sort of antithesis. Nevertheless, as argued via this thesis, the antihumanism that emerges from David Bohm's holistic ontology is radically inclusive. Although it eradicates the concept of human beings as unnecessary, human beings rise up to a cosmic level since they are –alongside everything else in the cosmos– the undivided wholeness. The prefix "anti-" mainly aims at the pitfalls of humanism which created the dichotomies in the first place. Humanism's effort to give value is not refused, on the contrary, is amplified; or again, it is better to be the cosmos rather than to be the ruler of the earth.

Furthermore, another possible objection has to do with the doubt about how David Bohm's interpretation of quantum mechanics can reconcile different phenomena occurring from the macroscopic and microscopic world respectively. In lay terms, Bohm explains how this is possible with his theory of implicate and explicate order. This dual-structured theory enables both the macroscopic and microscopic worlds to exist but also to be identical. As this thesis has demonstrated, the explicate order is just an unfolding that makes the classical world graspable. But, it is just a superficial abstraction of the underlying implicate order. As Bohm

emphasizes human beings prefer to see the world in its division since this renders it more comprehensible; it is not a delusion to do so, but they miss the whole picture.

Moreover, the remark that the interpretations of quantum mechanics are just theories not fully proved and thus they are highly speculative to be used in philosophical considerations can provoke a possible objection to this thesis. On a first level, this objection is easily rebutted. Obviously, all the interpretations of quantum mechanics are theories. A theory is not fully proven but it has a great percentage of success through experimental results. Truly, the interpretations that are now available provide more or less adequate explanations with regard to quantum phenomena. Therefore, although this thesis' argumentation is based on a scientific theory that is not fully proven, this does not prevent a philosophical inquiry from being based on its experimentally recognized soundness. Apart from this, the philosophical inquiry needs to reach the most peripheral and marginalized human endeavors and recast them philosophically refined back to society.

Nevertheless, on a deeper level, the latter objection seems to beg the question, namely, if the theories of quantum mechanics can be used to answer problems arising from philosophical anthropology and other similar disciplines of philosophy. Truly, this is a puzzling issue. Yet, at least as far as this thesis is concerned, an effort was made to use David Bohm's scientific theories already filtered by the bibliography of the philosophy of quantum mechanics. Also, David Bohm already filtered his ideas through his remarkably sophisticated philosophical considerations. Therefore, it can be argued that this thesis does not make the leap from quantum mechanics' mathematical formulations straight to the philosophico-anthropological theories and conclusions. There are multiple layers of processing the mathematical equations to philosophical arguments.

The last objection is connected to Jacques Derrida's admonition that the end of Man is bound to be written in the language of Man¹⁷. In short, this objection points out the possible antinomy of human beings attempting to erase themselves conceptually. This is related to Marx's insightful remark quoted in the introduction of this thesis, i.e., "to be radical is to grasp things by the root; but for man the root is man himself". The answer to this objection is complicated and simple at the same time. If one considers human beings to be just human beings then surely an antinomy

¹⁷ For the quotation see the general introduction of this thesis.

arises when (s)he tries to render the concept of human beings as misleading and unnecessary; but if one considers human beings to be the undivided wholeness alongside everything else in the universe then the undivided wholeness comprehends itself in the uttermost clarity¹⁸. Or again, according to Descombes' interpretation on one of the most remarkable thoughts of Jean-Paul Sartre:

“Sartre can envisage only one philosophical possibility (the very one he desires to avoid) that of a metaphysical pantheism which would describe the birth of humanity on the planet Earth as the means employed by the Universe in order to perceive itself; in the human species it creates the mirror (speculum) of its own reflections.” (Descombes, 1980: 53)¹⁹

5.3 Future research

Before closing this master thesis it is regarded as beneficial to present some possible extensions of the ideas presented here for which the word limitations of this project did not allow further development. First, the antihumanism that the argumentation of this thesis inferred from David Bohm's scientific and philosophical considerations could possibly lead to new Ethics. In other words, the idea that the concept of human beings is unnecessary and everything in the cosmos is an undivided wholeness, alters the point of view about human beings, more-than-human beings, entities, objects, and the cosmos as a whole. Human beings should treat everything as they would treat themselves since they are one and the same thing. This axiom changes the ethical perspective towards other human beings, animals, and the environment itself –the latter is extremely important in the context of the environmental catastrophe of planet Earth or in the context of terraforming other planets. Obviously, a lot of research can be conducted in this area.

¹⁸ It is important to note here that the answer to this objection obviously cannot respond to the whole theory of Derrida about language. This requires a whole new thesis and the word permissions imposed on this thesis does not allow such thing. In this regard, the answer is concentrated exclusively to the main point of Derrida's statement that it is related to this thesis. Besides, as already has been pointed out, posthumanism through new materialism has emphasized that culture –language included– in not the only thing that exists; matter also has a role to play. Therefore, human beings are not solely the language they produced; they are also matter, and this materiality is that renders them in a deeper level the one and the same with the undivided wholeness.

¹⁹ For more see, “Descombes, V. (1980). *Modern French Philosophy* (transl. L. Scott-Fox & J. Harding). Cambridge: Cambridge University Press.”

On the other hand, future research can be done in regard to the notion of undivided wholeness. To break it down, the idea of a unified cosmos is present in the most recent developments of quantum mechanics, i.e., the theories about quantum gravity. In general, there are roughly two main versions: the idea that the cosmos is one unified entity that is stable and unmoved –the Parmenidean version– and the idea that the cosmos is one unified entity that is on the move –the Heraclitean version. For instance, the theory of Loop Quantum Gravity (LQG) cast doubt on the dynamic character of the cosmos since it changes the perspective on the nature of time per se, rendering the latter as emergent and thus not fundamental. Therefore, the dynamic nature of the cosmos is deconstructed; or again, via this statement a strict quantum monism arises, similar to the monistic theory of the ancient Greek philosopher Parmenides. It becomes apparent that David Bohm’s theory of undivided wholeness can be developed even more in the context of the most recent scientific developments of quantum gravity.

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