

Material Intelligence: The Entanglement of Reality in the Making

Dario Amenophi Perfigli

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Supervisor: Bas de Boer

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Abstract

The research aims to discuss the notion of intelligence from a non-human perspective that takes into consideration the complexity of the Anthropocene. The research is part of what Latour (2017) calls the new geo-social question, meaning our conceptual landscape needs to acknowledge the interconnection of humans and non-human entities, advocating for the integration of narratives in which matter is seen as a reactive entity. This is in line with the challenges of the Anthropocene that require new ways of thinking compared to anthropocentric fallacies where the representative models are humans. My argument is that intelligence is one of the concepts that need to be rethought because of its moral implications. The moral aspects of intelligence are inscribed in its hierarchies, where entities with higher levels of intelligence are considered more valuable than lower ones. This understanding offered a justification for human domination over other entities, thus suggesting a connection between the concept and the narratives that led to the Anthropocene.

To respond to this, the objective of the research is to suggest a shift towards a material interpretation of intelligence where human uniqueness is criticised, transforming the concept from being perceived as a property to being understood as a process emerging from the interaction between entities.

The thesis takes three steps to show how such a shift is possible. In section one, I discuss the history of intelligence, focusing on the connection with psychology, assumed to be the field that contributed the most to its development. The section concludes that the three main assumptions from a psychological interpretation are that intelligence is seen as a property that requires cognitive agency and intentionality.

Section two argues that the psychological interpretation is problematic because it is constructed by using humans as the reference model. Thus, the approach leads to a hierarchy understanding when extended to other entities, showing the moral implications. I use Karen Barad's agential realism theory to discuss the notions of agency and intentionality inside intelligence, suggesting an opening toward a material approach to the concept. Agential realism is relevant because discussing the entanglement of phenomena allows me to advocate for a distributed understanding of agency and an emphasis on consequences.

Building on this, section three introduces the idea of material intelligence. The concept is a start toward a non-human interpretation of intelligence, where opposite to dominant views, intelligence is seen as a process rather than a property. I systematise the notion by applying Manuel Delanda's assemblage theory. This theoretical approach studies systems constituted

by external relations, allowing us to view intelligence as a dynamic system emerging from the interaction between heterogeneous entities. From this, I conclude that a material interpretation of intelligence can be understood as the consequences of a whole in terms of reproducible adaptive variations

From the discussion, I believe that an opening towards a more nuanced narrative of intelligence is allowed, passing from an anthropocentric interpretation to one in which the non-human and its relations are taken into consideration. The work engages in answering the new geo-social question, where a discussion is open around human concepts that account for the complexity of reality, aligning with the development of new moral frameworks and political narratives that can better answer the challenges of the Anthropocene.

Introduction

Today, we are in a unique period in the history of planet Earth. For the first time in its billion years of existence, a species is changing Earth's natural systems and configurations at an impressive speed compared to geological time. These changes are not only in the landscape of the ecological niche but on a planetary scale modifying the atmospheric chemical levels, changing the composition of the ocean's water, inscribing geological traces of earth exploitation, producing climate change, and influencing many others of Earth's systems (Halliday, 2022). We, the human species, are causing this through our production systems and daily activities, and the era is the Anthropocene.

The term Anthropocene was used for the first time by chemist Paul Crutzen at the start of the 2000s. It means a new era made by humans (i.e., Anthropos-man; cene-new), since humans' dominating relationship over the planet. The origins of the causes of the Anthropocene are commonly tracked back to the industrial revolution, when, under the colonisation period, globalisation processes began. The causes that led to the Anthropocene are multiple; it is the result of the interaction of millions of individuals in a complex spatio-temporal landscape. What is fascinating about all this is the independent behaviour but, at the same time, synergetic collective production.

Humans are social beings (Fiske, 2019), and when it comes to large groups: the city, the state, and the world, what makes humans collaborative are stories and narratives that have moral meaning. Traces of the collaborative power of stories can be found in all continents and historical periods. From the Egyptian and Babylonian political and religious organisations to Asiatic and Oceanic animistic beliefs, passing from the big monotheistic religions, the Western capitalism ideology, and the communist utopia. All these, and even more, are expressed through narratives. These are formed by ideas: divine power, compassion, the self-realisation. Every idea embeds a narrative. Thus we see that every idea that is transmitted and reaches the Other, creates a narrative, and every narrative, by being interpreted, creates a framework through which humans relate to the world. We see then that there is a direct connection between the narratives that ideas carry with them and how humans relate to the world.

Further, every relation becomes moral, as the narratives establish what is good and evil. Thus, narratives lead to moral behaviour by suggesting how a good and bad relationship should look. We can state that the Anthropocene is a result of how humans related to the world

collectively; thus, it is a result of narratives. Given this, the question to pose is, what type of narratives produced the Anthropocene?

My argument is that narratives and ideas of human superiority produced the Anthropocene. This is because such narratives morally justify human superiority over the planet, creating a hierarchical understanding of the world, whereas humans are at the top of the hierarchy dominating what is below. Therefore, understanding the world from an anthropocentric view justifies actions of humans' self-interest, modifying and affecting the environment according to the dominant narrative in place.

My thesis aims to inquire about intelligence, one of the main ideas that create a narrative of human superiority. Interestingly enough, intelligence as a term in the scientific discourse started to appear during the industrial revolution (Cave,2020). In a broad sense, intelligence can be understood as an agent's capability to accomplish objectives across diverse environments (Legg & Hutter, 2007). This includes specific sets of cognitive abilities like learning, understanding, and actively utilising information. Consequently, intelligence is a characteristic that an agent demonstrates by imposing itself over the environment where the intelligence entity is active and the environment is passive. Among all entities, humans are considered to exhibit this property to a greater extent, leading to their uniqueness, as they are the most proficient in demonstrating intelligent traits. The uniqueness creates a hierarchical view of reality because it carries the narrative that humans have better capacities than other entities, thus, justifying a view of domination as the idea of being better quickly leads to being superior.

Further, we can understand this as the anthropocentric fallacy of intelligence (Pasquinelli, 2015), meaning that humans created the concept based on ourselves, and then we state that we are the best at it. The anthropocentric fallacy suggests that by being the dominators, there is no need for justification. Thus, what needs to be acknowledged is that the narrative that produced the Anthropocene did not consider the responsibility of the actions that were produced. Therefore, if the narrative frames humans as unique in their levels of intelligence, then it collectively justifies the relationship between humans and the world in which humans have a prevalent position.

The Anthropocene is the reaction of Earth to human position, and taking responsibility for this action is a material statement. Latour (2017) calls this the new geo-social question, meaning that in the Anthropocene, we need to integrate a narrative of matter in the political discourse. Nevertheless, the definition of matter needs to be changed; the essentialistic view, seen as a static object from the outside, does not respect the current context; we need a view

of matter as an entity capable of reacting, where the agency is distributed. In this sense, my thesis is part of this new geo-social question, where I attempt to create a narrative of intelligence where matter and its processes play the central role.

Today intelligence refers to the property of an entity² of acting over its environment; as I will show, historically, this understanding developed from interpreting Darwin's evolution theory for political purposes. What is important is to question the relationship between entity and environment; this is because it is the narrative that suggests where to put the attention. Consequently, in the current understanding, the focus primarily lies on the entity. Nevertheless, it is difficult to think of intelligence expressing itself in a vacuum space. This is because intelligence is expressed through actions. It is the action that brings about the phenomenon; without action, nothing occurs.

The narrative of intelligence does not provide much emphasis on the role of action. Arguably, action is not only produced by the intelligent agent but also the result of several interactions, whereas both humans and non-humans play a role. Therefore, I believe that to provide an interpretation of intelligence that is not hierarchical and provides a narrative of inclusion in which all entities are recognised as necessary, we need to have an understanding of intelligence that focuses on the action rather than on the entity, because it is from relations that intelligence expresses itself. Thus, viewing intelligence not as a property but as a particular production process, meaning that thorough interaction consequences are made, is possible to give intelligence a new narrative more in line with the complex social and material landscape that the Anthropocene creates.

In my thesis, I aim to explore the possibility of developing a new understanding of intelligence beyond a human-centric perspective. For this reason, the main question that the thesis poses is how we can understand intelligence from a non-human perspective that includes the complexity of the Anthropocene. In my attempt to answer the question, I use New Materialism as a theoretical framework. New Materialism is a contemporary philosophical movement where various authors emphasise the importance of non-human entities in the making of the world. Moreover, by applying its active understanding of agency inherent in all entities, I seek to reject hierarchical notions of intelligence advocating for a more nuanced perspective.

² For clarity, I referred to and used the notion of entity several times. This is a consistent terminology choice used throughout the thesis when referring to objects, things, beings, and so on because I believe that the word entity better reflects the idea of something existing independently and apart from other entities.

The thesis is divided into three chapters to answer the main research question, each engaging with a related sub-question. Chapter One poses the question of what is today's interpretation of intelligence and to which narrative it is connected. The chapter aims to show the issues of today's interpretation and why we need new ones. To do so, I explore how intelligence is taught and its history and development from a theoretical and practical perspective using the IQ test as a representative case. The chapter's main argument is that today's view can be labelled as a psychological interpretation. Such terms emphasise the connection between intelligence and the field of psychology. The underlining assumptions show that the notion is based on three main assumptions: fixed property, cognitive agency and intentionality. These are in line with the hierarchical view. The chapter shows that if we want to build a concept of intelligence that is non-human-centric, these three assumptions are to be changed. Moreover, the object of inquiry for intelligence should not be the entity but the action.

Chapter Two aims to switch the view, suggesting a new interpretation of agency and intentionality that is non-human-centric. To do so, Karen Barad's agential realism theory is highly relevant as it delves into the material entanglement of reality. Her approach acknowledges entities' intricate connections and interplay, recognising their shared agency. By using agential realism, I show that it is possible to switch the underlining assumptions, proposing a new interpretation based on distributed agency and consequences.

To conclude, Chapter Three introduces the notion of material intelligence. The concept is provided by applying Manuel Delanda's assemblage theory. His framework allows for a systematised understanding of how different entities come together to form interconnected systems and processes, highlighting the dynamic and emergent nature of intelligence within these assemblages.

Combining the thesis's work, the objective is to propose an initial exploration of intelligence emerging from the interaction between heterogeneous entities. I believe that by building up on this preliminary attempt, it is possible to present a narrative of non-hierarchical intelligence that considers the complexity of the material entanglement of the world.

Chapter One: Intelligence Between Yesterday and Today

Introduction

Psychology is a relatively recent field in human knowledge history. The development of psychology as an empirical science as it is today started in Europe during the 19th century. Psychology is a specific approach to studying human behaviour, aiming to measure its activity through scientific methods. Regardless of today's reliability (Yip, 2018; Sheriff, 1998), psychology is problematic because, during the foundation of the field, it was used to justify particular political narratives to validate ethnic and sexual social hierarchies. Intelligence is connected to psychology as it found its entry into scientific research through this field (Cave, 2020), and traces of its original program can still be found in today's use of the concept, what type of narratives promotes, and the assumptions on which it is built.

This chapter argues against the psychological interpretation of intelligence for two reasons. First, it assumes that certain conditions located inside the entity's mind have to be met to be intelligent such as learning, understanding, and reasoning. This condition can be viewed as cognitive agency (Metzinger, 2013), referring to one's control over its cognition. Nonetheless, these conditions are constructed around humans' capacities. Thus, from a psychological perspective, intelligence is a property ontologically fixed within the entity with humans as the reference model. Second, for its politically questionable history traces, which are arguably still present. The political dimension of intelligence is linked to the agency on a moral level. It can be argued that there is confusion regarding agency between cognitive and moral interpretation of the term. To overcome this, I propose a distributed understanding of agency (I develop this aspect in chapter two as one of the main objectives).

My critique does not want to deny that the psychological view can give important suggestions if applied in specific contexts, for instance, to identify children that need educational support. However, they might not be measuring directly intelligence, but rather cognitive processes that take part in intelligence.

This chapter states that having a purely psychological understanding of the view is misleading. The reason is that it not only strongly builds an anthropocentric narrative of intelligence but also does not open for other possible interpretations, neglecting the possibility for new exploration. In this sense, it is not surprising that, still today, there is not an accepted and shared definition of the term; even more, it becomes challenging to apply the concept of intelligence to other non-human entities, both living and non-living. Why does this

difficulty persist in utilising coherently and consistently the concept of intelligence to other entities? It is unrealistic to think that the reason is that humans have something special that other entities do not have. This is not to deny human capabilities and collective achievements. However, in the infinity and multiplicity of the universe, it is just absurd to think that intelligence is an exclusive attribute of humans. Thus, it is absurd to base intelligence only on psychological interpretations, whereas the object of study is human behaviour. Therefore, this approach is insufficient to give a more nuanced account of intelligence that considers even the non-human; by not recognising such limitation, we are just reinforcing the narrative of human exceptionalism.

To criticise the psychological-anthropocentric view, the chapter uses two ways. The first is to look at the genealogy of intelligence. This means looking at how and when the scientific community adopted intelligence as an object of study, the reasons for such use, and which practices developed. As a significant practice, it is taken into consideration the IQ test. This test aims to measure IQ, which is the level of one's intelligence. The popularity of the test, starting from its history and still today, profoundly influences the narrative of intelligence. Two are the aspects on which attention is put: the first is the relation of the IQ test with the social and political context and its consequences. The second is what the IQ test tells us about the assumption built inside intelligence; in other words, how the IQ test understands and interprets intelligence in the first place.

This leads us to the second aspect of our critique. Deconstructing the concept to its building assumptions, we will show that in the current understanding, intelligence is seen as a fixed property based on cognitive agency and intentionality. I show why these three assumptions are problematic, and in Chapter Two, I will propose different ways to view the concept.

The History of Intelligence

The word "intelligence" derives from the Latin word *intelligentia*, referring to the faculty of understanding. Initially used in theological contexts to distinguish humans from animals, it gained scientific attention in the 18th century (Carson, 2015). This section provides a contextualisation of the scientific development of intelligence, unveiling underlying narratives of injustice and discrimination shaped by political and cultural factors. My argument is that traces of this history persist in contemporary conceptions of intelligence. In the following chapters, I advocate for an alternative interpretation beyond the psychological perspective.

The connection between psychology and politics, referring to social hierarchies justified by mental faculties, can be traced back to Plato's Republic and the figure of the "philosopher king" (Cave, 2020). Further, Aristotle shares a view on sociopolitical hierarchies based on mental justification. He writes: "What marks out the rulers is possession of reason; while one who lacks it is a slave by nature (Aristotle, 2010, p. 3). By using Plato and Aristotle as a representative, we see that the idea of mental capacities as a moral value is a belief at the root of Western thinking. Nevertheless, it is worth mentioning that during the medieval period, characterised by Christianity, other values, such as piety and the inheritance by divine right, took place. However, in the 17th century, the moral landscape changed again due to rapid intellectual development given by the new geographic and scientific discoveries. These developments, such as rationalism, empiricism, and scientific methodologies, posing once again the attention to mental capacities, revitalising them as values. Locating mental aptitude at the centre of the narrative, as Cave (2020) noticed, had significant political consequences. The belief in mental capacities, reflected in scientific and technological superiority, was used to keep hierarchical distinctions between different members of the human species. Similarly, this narrative was embedded to make today's distinction of moral superiority between humans and other entities.

The era of colonialism was characterised by the political discourse of race, where the white was seen as superior. Such discourse found intellectual support and searching for biological justification, pushed by an erroneous interpretation of Darwin's evolutionary theory, as it was politically attractive as making white innately superior. Consequently, scientific theories and methods were used for questionable political objectives during this period. For instance, craniometry (i.e., measuring the size of the skull) was used until the middle of the 18th century to research white mental superiority. Craniometry collapsed under the facts.

Nevertheless, because it was one of the first types of anthropometric measurements connected to intelligence, it left traces, giving a view that intelligence is a singular, tangible, measurable, physical entity (Cave, 2020). Nonetheless, most philosophers focused on other concepts such as "reason", "talents", "virtue", and "faculties" to find a justification for human and white uniqueness (Carson, 2015). Intelligence entered the landscape when it started the development of systematic comparison between humans, especially under Francis Galton (1822-1911). Galton is a key figure in the history of intelligence. Moved by Darwin's ideas (they were cousins), Galton carried out an extensive program using systematic anthropometrics testing, qualifying human mental and physical characteristics, aiming to identify the hereditary for superior human characteristics (Carson, 2015; Cave, 2020).

Furthermore, in the middle of the positivist period, enriched by the empirical tradition to gain credibility, psychology needed to be founded on experiments and measurements. By associating intelligence with psychology and gaining credibility in the scientific community to establish a research agenda, intelligence passed from being a debate about qualities to quantities (Sternberg, 2020). Further, Galton also invented the term “eugenics” (Cave, 2020). Moreover, arguably, nothing is more appealing to the eugenics belief that understanding what makes humans “superior” is a hereditary characteristic. Such ideas can be found in his best-known work, the 1869 book *Hereditary Genius*, where he displays his ideas of intelligence as a hereditary trait and a birth control program to pass the traits. Such ideas were positively received in the US, giving rise to the American eugenic movement, with notorious American psychologists among them.

The idea that intelligence can be quantifiable and measured leads in a short amount of time to the development of standardised tests to measure intelligence. This resulted from the Galtonian program based on anthropometrics measurements that led to the possibility of large-scale statistical analysis. This approach assumes that the phenomena can be studied based on average, thus looking at similarities between humans rather than differences. This means that Galton adopted statistical correlation within his measurements and elevated them in the realm of reality through testing (Ariew, 2008). The result is a statistical construction of what intelligence should look like. This is in line with typology thinking which is the view of representing objects based on similarities. The issue of the statistical construction is that humans were used as samples for statistical modelling. However, the modelling is applied or used as a base for measuring intelligence in non-human entities, thus returning to an anthropocentric reinforcement narrative. In this sense, I agree with Danziger (1994), who criticised the typological approach by advocating for an understanding of intelligence on the variability of individual differences. In Chapter Three of this thesis, I follow a similar path by suggesting a population rather than a typological approach to intelligence.

The theoretical idea of intelligence as a priori property is found in the most famous intelligence test, the IQ (Dowe & Hernandez-Orallo, 2011). The development of the IQ test is associated with the French psychologist Alfred Binet, who, in 1905, designed it to identify children that needed educational support (White & Hall, 1980). The test led to the idea of “mental age”, which, based on statistical averages, measures what mental capacities a child should have at every year of development. Arguably, Binet’s test aimed to identify children needing education support but not to create a hierarchical view of intelligence. Nevertheless, this changed when the IQ test reached the US (Carson, 2006). Here, the original Binet test

was revised, and in 1916, Stanford psychologist Lewis Terman published the Stanford-Binet IQ test, which updated version is still used today (Cave, 2020). The IQ test reinforced the idea that intelligence is an innate quantifiable mental ability (Carson, 2006); thus, the idea is an ontological locate property rather than distributed. The starting history of the IQ test is also connected to the military and large-scale applications. During the first world war, in the US, the Army Alpha test was deployed to evaluate and recruit 1.75 million soldiers. Immediately later, similar standardised systems were used to assess school attitudes toward children. However, contrary to the original French version, the US IQ counterpart was used not to identify children that needed assistance in education but rather to identify children with higher capacities, thus making intelligence hierarchical and socially valued. Group IQ tests developed out of the need to screen large numbers of individuals for the benefit of an institution (White & Hall, 1980). However, what benefit means is up to debate. Cave (2020) argues that IQ large-scale testing was adopted to ensure that Ivy League Universities remained predominantly white in the light of increasing immigration. The suggestion of such views is found in what Carl Brigham, one of the leaders in developing such test, writes in his highly influential book (1923) *A Study of American Intelligence* “It is also possible to make a picture of the elements now entering into American intelligence. At one extreme, we have the distribution of the Nordic race group. At the other extreme, we have the American negro. Between the Nordic and the negro, but closer to the negro than the Nordic, we find the Alpine and Mediterranean type” (Brigham, 1923, p. 196).

To conclude, it is appropriate to use the words of Gould (1981), which summarises the history of the science of intelligence as “the abstraction of a single entity, its location within the brain, its quantification as one number for each individual, and the use of these numbers to rank people in a single series of worthiness, invariability to find that oppressed and disadvantages groups are innately inferior and deserve their status” (Gould, 1981, p. 25).

The critique presented here does not dismiss the entirety of the psychometric enterprise. Instead, it seeks to highlight the significant role of narratives. The prevailing view of intelligence as an unchangeable and inherent property, fixed in its ontology, is rooted in a complex and questionable socio-political history. This history reveals that science has been employed for purposes that can be argued to be non-scientific. Consequently, this view was not driven by an objective understanding of the concept but rather by a desire to establish a hierarchical framework for intelligence. This framework aimed to justify the dominance of specific social groups.

During the decays, the theories of intelligence became more open to include differences. In this sense, a popular theory today is Gardner's (1983) theory of multiple intelligence, where different cognitive abilities, from logic to linguistic to motor coordination, are considered. However, even though such views take into account, individual differences are still part of the same framing that interprets intelligence as a property of the single entity that is ontologically located. Such views imply a connection between the entity, intelligence, and behaviour (i.e., action), implying cognitive agency and intentionality.

The Current Understanding of Intelligence

This section aims to describe today's understanding of intelligence. To do so, I am considering where intelligence is taught from undergraduate and graduate textbooks. The methodological choice of using textbooks is because the way intelligence is described shares assumptions with the interpretation given in the previous section from historical analysis, thus revealing a continuation of ideas in the discussion about intelligence from the beginning of its history to today's understanding.

As a representative example, I am considering the recent *The Cambridge Handbook of Intelligence*, edited by Robert J. Sternberg, one of the significant researchers in the field, and published in 2020. The book description states that the foremost experts in human intelligence write it, and it represents an ideal resource for students and professionals looking to enter the field. Given the recent publication, the recognised institution that published it, and the credibility of the people that worked on the volume, I will assume that what is written in it can be a good sample to understand intelligence today.

The book divides the current views on intelligence into seven major understandings, each related to the mind. Sternberg (2020) calls these understanding metaphors because they give an intuitive understanding of the different interpretations. The seven metaphors are the following:

The Geographical metaphor

Locates intelligence in the mind. It suggests that theories of intelligence should address a representational map of the mind. The metaphor includes theories that share a hierarchal view of intelligence, whereas cognitive processes are matched to specific brain areas, tending to focus on the structure of these cognitive areas and how differences can affect functioning. While these theories help inquire about the structure of intelligence, they assume a precise fixed location, thus making them weak in dealing with dynamic changes.

The Computational metaphor

Provides an understanding of intelligence by conceptualising the mind as a computing device, where mental processes can be understood in terms of computational operations, similar to how software drives computer processes. The metaphor emphasises the role of algorithms, information processing, and problem-solving strategies in intelligence. It focuses on the processing of information and the systematic manipulation of symbols and data. The metaphor is narrow by focusing primarily on information processing, allowing limited space for broader considerations.

The Biological metaphor

Offers an understanding of intelligence by examining its underlying biological mechanisms. It aims to uncover how the central nervous system and the brain contribute to the development, organisation, and execution of cognitive abilities. By studying genetic and molecular factors, brain structures and functions, brain damage and its effects on intelligence, head or brain size correlations, and electrophysiological patterns, these theories provide insights into the biological basis of intelligence. The biological perspective contributes to a deeper understanding of the complexity of intelligence within animal organisms; nevertheless, it offers limited insights into other types of entities.

The epistemological metaphor

The father of this view is psychologist Jean Piaget. Intelligence is a developmental process involving the dynamic equilibrium between assimilation and accommodation. It emphasises the role of cognitive structures and stages in acquiring knowledge and the importance of logical expressions. This view is not considered today because recent findings led to outdated theoretical aspects. However, for the case of the thesis, it is relevant because it suggests an ontology of intelligence, the cognitive structures, thus making it ontologically fixed.

Social metaphor

As proposed by Lev Vygotsky, the sociological metaphor offers an understanding of intelligence as a socially constructed and culturally influenced phenomenon. It emphasises the role of social interactions, cultural norms, and socio-emotional processes in intelligence development. According to this perspective, intelligence is shaped through socialisation and learning from more knowledgeable individuals within a particular social and cultural context.

The focus is on how external social factors contribute to developing cognitive abilities and intellectual growth. Social contexts are the main factors that, together with experience, influence intelligence, therefore understanding it primarily as a human collective phenomenon.

Cultural metaphor

The anthropological metaphor offers an understanding of intelligence as a culturally influenced phenomenon. Intelligence can vary across cultures due to the different knowledge and skills needed for adaptation. It highlights the importance of studying intelligence within specific cultural contexts and cautions against generalisations from one culture to another. It emphasises the role of external factors and cultural manifestations of intelligence rather than solely focusing on internal cognitive processes. In this sense, a review study by Sternberg and Grigorenko (2006) investigates the notion of intelligence through culture; while in Western cultures, intelligence strongly emphasises cognitive skills and speed of the mental process, in Asian and African views, it is not. In Asian culture, there is still a presence of the importance of cognitive skills, but such skills are also applied to benevolence use. Looking instead at African culture, taking, for example, Kenya's interpretation, the focus on understanding intelligence is on social-competence skills and the community. Nevertheless, even though such a comparison is interesting, all three views share the understanding that intelligence is a property located within the individual, without saying much about the role that other entities play in the concept.

System metaphor

The systems metaphor explains intelligence as a complex interplay of multiple intelligence systems. Intelligence is not a singular entity but a collection of diverse cognitive abilities that interact and function together. The system metaphor emphasises the interconnectedness and interdependence of these cognitive systems in shaping intelligence. It seeks to move beyond a single-dimensional view of intelligence and explore the dimensions or components contributing to intellectual functioning. Thinking systematically about intelligence is in line with the view of this thesis. However, the ontological understanding of this metaphor is on the cognitive processes, which are indeed a part of but might not be the only possible location.

Given psychology's strong influence, the main point of each perspective is that there is a strong connection between intelligence and the mind, both on an individual or collective level. This relationship is a typical pattern that connects each metaphor. Such connection is emphasised by the resulting behaviour that is assumed that intelligence produces. From this understanding, it is assumed that the mind is the location of intelligence that is ontologically fixed, and even where other external elements are considered, the mind is the gravitational centre of attraction in which everything goes, and intelligence is produced. Thus, intelligence is viewed as an inherent property of the entity in which it is located and fixed. Hence, narrating a view on intelligence assumes the mind as its locus, with the human mind serving as the reference model.

The seven metaphors leave open the possibility of interaction. Nevertheless, it seems that they do not consider the role of the relations between different entities. In other words, there is a barrier between them. However, such a barrier is more conceptual than material in the sense that the realm of reality is a continuum of matter with different shapes and forms. However, conceptually there is no such continuum. Such critique is in line with Deleuze's (1968) statement, "the continuum is not part of the idea" (Deleuze, 1968, p. 223), whereas the author criticises mental categories as not being able to represent the continuity of reality. It is possible to apply this perspective by opposing it to the view of intelligence as ontologically fixed, as being fixed is more conceptual than material. Chapter Three expands further on this point; however, it is important to state as Deleuze's thought is in the background in the interpretation that the thesis develops.

Another source that I want to use for discussing the current understanding of intelligence is to look at how the concept is used in the field of artificial intelligence. This is because AI is one of the most discussed fields attracting huge investment today. Moreover, it promises to develop an intelligent machine and reach an artificial superintelligence whose speculative narrative state would be outside humans' capacities. Thus, the field must deeply understand intelligence if these are the research goals. The proposal of the term Artificial Intelligence is to be traced back to 1956, and the concept was developed with the premise that every aspect of learning or any other feature of intelligence can be so precisely described that a machine can be made to simulate it (McCarthy et al., 1956). Nevertheless, the term artificial intelligence only says a little about what intelligence is, it implies learning and feedback, but not much more is added. In their textbook *Artificial Intelligence: a modern approach* (2022), dedicated to students, Russell and Norvig describe intelligence as a rational, goal-oriented agent that can perceive its environment and act on it rationally by making the right choice.

Such understanding can be one of the interpretations. However, it resembles the same issue that psychological understanding has: a clear focus on the agent, the entity as the protagonist, but neglecting the materiality continuum surrounding it³. Thus, similarly to psychology, the field of Artificial Intelligence understands intelligence as an ontologically fixed property, neglecting the activity of what is around it. Moreover, it assumes a particular type of rational intention, focusing on the single rather than the multiplicity.

So far, we have discussed the history and today's use of intelligence. This helped highlight the hidden socio-political connections to the term and the reasons why it was used and developed. In the following two sections, I critique the psychological notion and discuss the anthropocentric assumption implied in the concept.

A Critical View of the Psychological Notion of Intelligence

In this section, I attempt to critically review recent intelligence narratives after reviewing historical and recent understandings. My intuition is that besides the attempt to scientifically legitimise the notion of intelligence through several scientific fields such as psychology, cognitive science, neuroscience, computer science, and AI, and their related projects, traces of the origin of the terms are still deeply rooted and present in today's narrative. Not only this, it seems that intelligence's psychological projects, based on cognitive agency, are the only possible. Even today, all research and investigation derive and follow this path without taking a clear cut and looking to new possible explorations. A clear example of the limitation in the discourse is given by simply visiting the *Center for the Future of Intelligence* website of Cambridge University. By viewing their research projects, besides a few that critically question the history of the concept, most are reinforcements of the psychological view, thus, making them part of the same thinking paradigm (in the Kuhnian sense). This means that the research that the centre is carrying out shares a unique and limited understanding of intelligence; thus, they take it as a property that is fixed and ontologically located on an entity, which poses a hierarchy between the entity and its environment. In brief, because it has the property to be intelligent, the entity acts towards the environment. Such an understanding is misleading because it neglects an interdependency of reality; further, it clearly distinguishes what is intelligence (as an active entity) and what is not (as a passive component).

³ This might not be surprising since, starting from the 1960s with the exploration to apply neural networks architectures to computers, Artificial Intelligence started to emerge from psychology as a separate field. For further insight on the relationship between the two fields, the reader can consult Flasiński (2018) *Introduction to artificial intelligence*, chapter 1.

For example, by reading the description of the project *Kind of Intelligence* is possible to notice that the research focus is on agent-orienting tasks but takes little into consideration all the elements that make the task an action, or the *Creative Intelligence* project in which the goal, as stated in the description, is to answer whether AI can be creative. However, by assuming that creativity is connected to intelligence, the view that the project suggests is that creativity is a property of the entity. It does not take into account the agency of the material elements involved in the process. Thus, following the psychological narrative, describing intelligence as ontologically fixed within the entity.

Morally such distinction matters, as it legitimises an understanding of interactions in which intelligence is morally more valuable than non-intelligence. This shifts the discourse towards a moral interpretation of agency. Of course, one might argue that mine is a simplified and limited description. This is true; much more nuanced and grey areas are present in each theory of intelligence with a psychological origin. Nevertheless, the overall narrative, takeaways, and the consequences of such a view reflect my simplification. To prove this is sufficient to see the relationship between human society and the environment that lead to the Anthropocene and its profound ecological consequences and injustices. Arguably, the unquestionable dominance of humans over nature was justified by the view of human superiority. As it is intuitively, human superiority was given by the justification of human intelligence. Thus, what is intelligence is active, and what is not intelligence is to be dominated. To put it differently, intelligence is the root of everything civilisation offers (Cave, 2020). Strangely enough, such views are also present in the concerns of AI development and the techno-apocalypse future, where AI will dominate humans because of more intelligence. In this sense, Bostrom's 2016 *Superintelligence* book, or the *Open letter of the Future of Life Institute*, are examples of where to find such ideas. Saying this, of course, is not to neglect the risk and concerns of AI technology, but rather, is to show how much the narrow understanding of intelligence as a property that is ontologically embedded within an entity and the neglect of the relations that the entity has and forms, is strongly present.

Agency and Intentions: Anthropocentric Assumptions within Intelligence

In section two of this chapter, seven metaphors about intelligence were presented as representative samples of today's understanding of intelligence. In my view, the common denominators are three: intelligence as a property, cognitive agency, and intentionality. The first refers to the perspective that intelligence is a property of a being; the second assumes a connection between intelligence and cognition; and the third refers to the property used to

achieve a specific goal. Assumptions one and two are related because of the space where intelligence is located. Most of the metaphors share the view that intelligence is in the mind. For the sake of the argument, the mind per se is unimportant. What counts is that for the seven metaphors, there is clearly a particular space, identified as an entity, with the property of intelligence. Even though with different interpretations, all seven believe that intelligence is a property that makes something. If something makes something, it means it has agency. Arguably, intelligence is viewed as a property that has cognitive agency because located in the mind. Thus, it is possible to state that the seven metaphors view intelligence as a property of a being with specific cognitive agencies, making it ontologically fixed on the being.

On the other side, intentionality is viewed as the property of orienting actions towards goals. Further, intentionality is connected to decisions, as decisions are based on intentions. What is important is the direction; with this, I mean that intentions are directed toward the future. This aligns with the AI interpretation of intelligence presented in section one, whereas intelligence is a rational, goal-oriented agent. However, how can something be intelligent before it happens? Intentionality creates the illusion that decisions in the future will exhibit intelligence, implying the expectation of intelligent outcomes. Such interpretation is supported by the idea that intelligence is a property since, if the entity has the property of being intelligent also, its future behaviour will be intelligent; therefore, also its intentions have to be intelligent. Intelligence as a property implies the idea that intelligence is reproducible over time. However, this is a hypothetical assumption, as there is no information available of absolute certainty about the future. This assumption is supported and justified in the psychological interpretation as it aligns with an anthropocentric perspective on intelligence. It is derived from our everyday experiences where we make decisions believing they are driven by intentional intelligence. Intentionally supports the idea of intelligence as property because the intelligent entity will exercise the property through intentions. Therefore, intentionally is problematic because it gives an anthropocentric narrative of the concept and further supports the idea of intelligence as an ontologically fixed property. Contrary, my argument is that intelligence is not about the entity but about the action, where actions are composed of a multiplicity of beings.

The three assumptions reinforce the idea of intelligence as hierarchies. In this view, the entity shows the property through intentions. However, this is an erroneous simplification. Intelligence is not within the intentions but within the action. Is the action the space of application of intelligence, not the entity.

Nevertheless, from the psychological perspective, this relationship is not considered; the assumption is that the entity causes the action because of intentions, and it follows that the entity is intelligent. However, this connection needs to be unpacked. This is not to say that the entities do not play a role, but rather that actions are the result of the composition of different entities that, by interacting, make the phenomena. What I am arguing for is an interpretation of intelligence that takes into account the multiplicity of the entities; further, in such view, action is composed of multiple entities, making agency distributed. Hence, intelligence can be conceived as a specific type of action, or better, as a process that unfolds outside the single entity in the space of interaction and considers specific configurations, conditions, variables, and parameters.

Conclusion

The chapter's objective was to explore today's intelligence narrative and show why new perspectives on the term are needed. The chapter reviewed intelligence's history and related practices, such as the IQ test. Arguing that intelligence is a psychological concept became evident that the research agenda surrounding intelligence has been intertwined with the eugenics movement and the propagation of racist narratives. These connections were employed to justify a political hierarchy and reinforce notions of superiority and inferiority. In the second section of the chapter, we explored how the concept is taught by using as representative sources the *Cambridge Handbook of Intelligence* (2020) and *Artificial Intelligence: a modern approach* (2022). We showed that intelligence is understood as a fixed property that assumes cognitive agency and intentionality.

Moreover, I have shown that even though the dark history of intelligence has been acknowledged today, there are still traces of continuity, which is in the narrative of intelligence as morally valuable and hierarchical because it is viewed as property. In the last part of the section, I argued that agency and intentionality are problematic in understanding intelligence because they offer a reductionist and human-centric view of the concept. Contrary, I advocate for an interpretation of intelligence as a productive process that emerges from the interactions of different entities and is located outside of the single. This is the project that goes through the thesis. The next chapter focuses on the issue of how to understand agency and intentionality in-depth, and a different interpretation is proposed by using Karen Barad's agential realism theory. The aim is to suggest new possible interpretations of this ambiguous term which is intelligence.

Chapter Two: Rethinking Agency and Intentionality from a New Materialism Perspective

Introduction

Chapter One discussed the psychological view of intelligence, using it as a representative case of today's understanding. I showed that this perspective on intelligence is based on three main assumptions: fixed property, cognitive agency, and intentionality. The argument was that this is problematic because it gives an understanding as a priori and ontologically fixed with humans as the reference model, thus, leading to an anthropocentric interpretation. This chapter aims to discuss and rethink the assumptions of cognitive agency and intentionality, advocating for a distributed understanding of agency and focusing on the consequences rather than the intentions. The reason to do so is not only to go beyond the anthropocentric fallacy of intelligence, meaning a discrepancy between object and concept but also to deliver a narrative where intelligence accounts for a morality of the Other, aligning it with the current challenges of the Anthropocene.

The link between agency and intentionality is rooted in action. This connection within intelligence transforms agency from cognitive to moral. Action can be interpreted as a moral concept because the action is towards something, referring to the relations between entities, thus, ascribing distinct values to entities. The problem with action is that it focuses only on an individual entity, therefore not counting for a narrative of multiplicity.

Further, the moral becomes political, where the latest is understood as the administration of space for the collective. The issue here is that the narratives of the moral and the political are the ones that decide which relations are worth being called actions and which are not. Therefore, by not accounting for the multiplicity inside the narrative of action, the agency becomes hierarchical towards other non-human entities. This is an anthropocentric construction of the world (Seth, 2021) given by constructing world narratives and categories using humans as reference points. As chapter one showed, intelligence falls under such narratives in which humans' superiority and uniqueness find justification.

What we need is to give a material understanding of intelligence that is non-human-centred, an understanding that considers multiple entities simultaneously in the production of the making. Therefore, providing a narrative that does not focus only on the single entity and human category but that takes into account the complex entanglement of reality. The chapter aims to suggest a possible way to do so, and it does it by adopting Barad's (2007) agential

realism theory. The chapter is structured as follows: first, it presents agential realism and discusses the distinctive characteristics. Second, I compare other accounts of agency that have historically moral implications on our narratives. I do this to show where the current agency narrative comes from and highlight the differences with Barad's interpretation. Third, I apply agential realism for analysing the IQ test, again showing the anthropocentric fallacy inside this practice, advocating the need to understand intelligence as a process in the material dimension.

Agential Realism

The theory was developed by Karan Barad, a physicist and feminist scholar, to break down the dichotomy between subject and object, between observer and phenomena. This makes agential realism anti-cartesian and post-humanistic, meaning that it thinks of things without presuming human exceptionality but making humans accountable for the role of the mutual constitution in the phenomena in which they take part (Barad, 2007).

Agential realism aims to break and rethink how we see the world; it is helpful to use what it says for the scope of this research, helping us to rethink agency and intentionality, promoting a relational account of them.

It starts with a reinterpretation of Bohr's philosophy-physics⁴ and his notion of complementarity together with the quantum view of entanglement. These two terms as starting points represent a significant shift because they do not presuppose the existence of pre-given independent entities as classical metaphysics (Barad, 2007), but rather complementary refers to the not fixed separation between subject and object. There are no pre-given entities with defined properties and ontologies; instead, they will be funded by the consequences.

Further, agential realism embeds elements of Foucauldian philosophy by recognising the power of measurements of material-discursive as acts of observation and playing with power asymmetries under generative dynamics and their embodied materialisations. This means that materiality is the only significant aspect, as the only actual thing. Thus the actuality is material and semantic; it constitutes generative discourses with real consequences. Thus consequences are entangled and distributed within systems of power that generate how to see specific measurements. However, every measurement is a story; it says what to consider and what not and which characters the story should we focus on and which not.

⁴ The two terms are attached because accordingly, to Bohr, there is the same practice not two distinguish one

Having briefly located agential realism in these two traditions, we see that the theory has a realistic account of the world, but where the semantic aspects are co-constitutive by the interaction between subject and object. Further, like most new materialism perspectives, agential realism is anti-essentialist; it sees the world as imminent and contingent rather than transcendent and constituted by essences.

The complexity of this theory is given by the change of perspective that the reader has to adopt. Agential realism can be seen as a text in which conclusions are known, and what is to be unfolded are single words.

Contrary to most theories, agential realism does not understand objects as *priori*. Instead, it focuses on the concept of entanglement. Five main features constitute the theory; these are the phenomenon defined as the ontological unit; the intra-activity as the origin of the unit; apparatus and agential cut are the two operators that make an entity emerge from the material continuation producing all its features; and objectivity that is what separates phenomena between each other. All the features are connected to entanglement. Taking into consideration the phenomenon as an ontological unit, we see that ontological, in the context of Barad's theory, has a more extended implication compared to normalised use. According to agential realism, ontology involves the examination of existence as a unity, where phenomena are seen as ethno-onto-epistem-ological unity. Moreover, unity means inseparable (Barad, 2007); thus, a phenomenon shows the inseparability of existence with the material expression.

As Weber (2020) points out, phenomena in this sense are not “things” or “entities” with defined properties; instead, they are entanglements reconfigurations of the world. Entanglements are virtual configurations of matter that come to be phenomena under intra-activity. Looking at Barad's (2007) own definition of phenomena, the entangled intra-activity reveals its importance.

Barad describes phenomena as “physical-conceptual intra-actions whose unambiguous account requires a description of all the relevant features of the experimental arrangements” (Barad, 2007, p.197). Let us zoom into such a definition. Intra-actions are the concept to be analysed. Intra-actions constitute the phenomenon, but contrary to other ontological theories, intra-actions are not a *priori*. There are no independent objects with established agency, properties, and relations that constitute the phenomena. Rather the opposite, intra-action, is the continuum of matter in the process of becoming, where the entangled agency leads to the emergence of phenomena. Thus, intra-actions are primary movements without meaning outside the intelligibility of the observer. Physical and conceptual aspects are inseparable within agential realism, as everything existing possesses structure and meaning. Agential

realism rejects transcendence in favour of immanence, considering everything to be composed of matter. Consequently, the existence of all entities is unequivocal, existing alongside everything else. For instance, the material presence of a chair in the kitchen exists within the material reality for all entities, regardless of whether an individual is in the kitchen.

Under this perspective, agency is an ongoing dynamic reconfiguration of the world. Dynamisms in this context mean generative (Barad, 2007); thus, it creates the becoming, a continuous reconfiguration of the world. Further, Barad writes that “agency is a matter of intra-acting; it is an enactment, not something that someone or something has” (p.178). Phenomena are not primordial states: there are boundaries and bodies, relations and objects⁵. In the ethno-onto-epistm-ological actualisation of matter, the physical and the conceptual are entangled and inseparable; however, why exactly that actualisation, that is to say, why precisely that boundary and body, why those relations and that object, this is explained through the apparatus in which such phenomena is read through.

Barad defines apparatus as material-discursive practices (Barad, 2007, p.170) where practices are defined as “causal intra-actions through which matter is iteratively and differentially articulated, reconfiguring the material-discursive field of possibilities and impossibilities in the ongoing dynamics of intra-activity that is agency” (Barad, 2007, p.170). In this context, Barad uses causal to mean that the intra-actions have material effects. The results of the practices through intra-activity do not have virtual effects but are actual and imminent. Causality is real every time that the practice is repeated. However, every time is a new phenomenon with the shape and causes of the first one. This is what Barad means by iteratively and differentially. To understand better, let us use the example of singing a song: singing (i.e., the practice) and the song (i.e., the effect) are the same but different every time. The practice and the effects always pass inside the possible and the impossible of the material-discursive. That is to say, every phenomenon allows for a particular set of possibilities and impossibilities within the difference of the similarities. Thus, singing “Where is my mind” could be done by the Pixies in front of thousands of fans, using expensive musical devices to increase the sound quality, or by me in my room while drying my laundry and using the low-quality speakers of my computer. In both cases, the practices in their material-discursive aspects create a different iteratively and differentially articulation of

⁵ Following Barad’s terminology, bodies are objects without relations

the possible and impossible that leads to causal effects of intra-actions that create the dynamic reconfiguration of the agency of the phenomena.

Thus, apparatuses enact a resolution (Barad, 2007, p.148), a performance, meaning reproducing the same but with differences.

As Weber (2020) points out, the process that connects, in an immanent and entangled sense, the intra-activity to the apparatus leading to the actualisation of the phenomena is called agential cut. Agential cuts actualise what matters, shifting matter from being ontologically indeterminate to the ethno-onto-epistem-ological conditions. Agential cuts are a determined set of relata that make the indeterminate matter of intra-actions become embodied phenomena within the material and the semantic.

Using Barad's (2007) terminology, this material and semantic constitution refers to the physical and the conceptual. Agential cuts allow for exteriority, resulting from the intra-activity under the apparatus as material-discourse. The exteriority is the emerged body, with propriety and boundaries within the phenomena but without relata. The body is still part of the phenomena but in its actualisation. The specific actualisation is given because of the material apparatus and discourse. Exteriority explains the last point of agential realism, which is objectivity within the entangled phenomena.

The starting point of Barad's (2007) for objectivity is Einstein's understanding of spatial separation and his view that this is the condition for objectivity. Spatial separation refers to exteriority, creating surfaces and boundaries within phenomena, an ontological distinction. Thus, a distance is created within the phenomena making the object ontologically evident for the observer, leading to external visibility with boundaries and properties for all observers given a specific material apparatus. Barad (2007) names this agential separability, which is the apparatus that has the role of ontological determinacy. Thus the apparatus enacts the agential material conditions of exteriority-within-phenomena, providing the condition for the possibility of objectivity (Barad, 2007).

Following what has been said on agential realism and using it for the discussion of this chapter on the notion of agency, essential insights are shown. The theory understands agency as an enactment rather than a property something or someone has. According to agential realism, agency is a dynamic, ongoing reconfiguration embodied in the material. The agency is entangled in the phenomena, not constitutive. Thus, if we change perspective by not viewing agency as *priori* but as *posteriori* within the phenomena, assuming that phenomena are consequences, not intentions, we see that the noise becomes a voice in its materiality, showing the entanglement of entities. Thus, there is a shift from the ontological fixation of

agency to an ontological distribution, in which the multiplicity of being and meaning are co-constituted and enfolded in the ongoing actualisation of the world.

A Genealogy of Agency

Agential Realism locates agency to everything that exists; according to it, everything has a physical material dimension. Further, the agency is part of the intra-activity of matter that, by being entangled, creates the making. We can label such understanding as a material agency, where the agency is an influence created by interaction designed within the universe and independent from the human observer. Nevertheless, such understanding could seem erroneous compared to daily bases use. This is because agency is inconsistent (Seth, 2021); thus, the term can assume different and opposite understandings. Following Barad's ideas, we can give an understanding of agency that is materially distributed. Contrary, we can find a cognitive and moral agency. The former is a perception synchronised and produced by the human sensory and neural apparatus (Seth, 2021). The latter is a distinction between agents regarding political values and goodness. Both perspectives make agency human focus. These views of agency are dominant because they strongly rely on human categories and references. In this section, I aim to critique the prevailing human-centred notions of agency, which also influence how agency is linked to intelligence in the psychological interpretation. My intuition suggests that cognitive and moral agency play a role in the dominant intelligence narrative. In chapter one, we observed that cognitive interpretation is prevalent because it emphasises the role of the mind. On the other hand, moral agency involves recognising whose actions are significant, making it a political statement tied to the Anthropocene.

To support my point, I will delve into the field of ethics and examine three major ethical theories, virtue ethics; deontology; and utilitarianism; which have significantly impacted Western thinking. By analysing agency in these theories, we can infer its connection to politics and discern which actions hold importance. This genealogy of agency aims to demonstrate its human-centric features, therefore showing the need to rethink agency if we aim to suggest a narrative of intelligence that is not human-centred. It is essential to acknowledge that the discussion of these ethical theories is not exhaustive due to limited space.

Virtue Ethics

Virtue Ethics is a moral doctrine developed by Aristotle and outlined in the *Nicomachean Ethics*. According to the theory, the biggest good is *Eudaimona*, which can be reached by

individual flourishing through virtuous cultivation. A virtue is a disposition to act embodied in the moral subject (Hursthouse & Pettigrove, 2022). Virtue ethics believes in cultivating one's character and attitudes towards situations; by embodying these virtues, the subject can flourish.

Moral is what is virtuous that finds expression within the subject, making them inseparable. Looking at the notion of agency from a virtue ethics perspective, it is possible to derive an interpretation in which what is recognised as action is what is moral, meaning what is virtuous. Therefore, the agency is embedded in what acts morally, thus capable of following virtues. This gives an understanding of ontologically fixed agency and where intentions play a role because the subject follows the virtue. Therefore, allowing for a perception view of the agency that aligns with the psychological view of intelligence.

Deontology

The central figure in Deontology is Immanuel Kant. He believed that ethics is an *a priori* system of moral principles deducible by reason, called categorical imperative according to Kant's language (Johnson & Cureton, 2022). The idea of the categorical imperative implies autonomous will, and the moral subject is what follows the principles of the categorical imperative. Morality, according to Kant, thus, presupposes that agents can make things happen by their own free choice (Johnson & Cureton, 2022). Reason guides the moral, assuming that rational agents are bound by moral requirements that would necessarily comply with them (Johnson & Cureton, 2022).

Moreover, one of the most famous deontological moral formulas is treating subjects not as mere means but as ends in themselves (O'Neil, 2014). What is noticeable is the focus on the intentionality of action. This refers to a perspective of the *priori* of action, thus, what is significant morally is what stands before action, and by reflex, we see that agency stands before action, making it ontologically fixed. There is a connection between agency and rationality based on the recognition of moral duties, and similarly to virtue ethics, what is essential is the centrality of intentions of these duties.

Comparing deontology and virtue ethics, the difference is in the location of virtues and duties; while deontology believes duties are a pre-given principle of judgment universally applicable, virtue ethics sees virtues as embodied inside the moral subject. Because the moral duty is pre-given, deontology understands the subject as physically separate from it, consequently making agency subordinated to the separation.

However, what is vital for the research is that both deontology and virtue ethics locate agency in the intention of the action. There is a subject-object separation because the agency is indirectly located as part of the virtual and not of the actual since the agency comes before the action, not within the action. The interpretation of agency provided aligns with the cognitive view because seeing agency before action is compatible with a human-centred interpretation of agency; there is a separation between subject-object, thus seeing agency as a distinctive fixed property.

Utilitarianism

The two central figures in utilitarianism are Jeremy Bentham and John Stuart Mill; the theory states that the morally right action is the one that produces the most good, whereas with most good is generally understood in terms of maximising pleasure or happiness for the most (Driver, 2014). Agency is seen as having the ability to make decisions to maximise goods. Contrary to virtue ethics and deontology, utilitarianism shifts the focus from the intention of action to the consequences of action. This is an essential conceptual turn because the moral emphasis is no anymore on the intention of the action but on its consequence. However, as utilitarianism understands it, the consequences are the end part of the action, thus where agency ends rather than the start, shifting the perspective but not the cause. This is to say that an agent will act towards a decision with the virtual consequences of maximising good. However, the consequences are still in the virtual of possibilities rather than in its actuality. From these views, agency pre-exist action, and action pre-exist consequences. Thus, the agency is before consequences, making a time-linear understanding in which causes are irreversible to consequences. Utilitarianism's linear understanding of agency aligns with the epistemological and ontological nature of human experience. However, it fails to consider that agency revolves around material relations entangled in reality. Therefore, from a realist account, the material reality in which agency occurs is independent of human experience. Thus, if the agency is independent of experience, there is no reason why it should follow the linearity of the epistemological and ontological nature of human experience. In this linear interpretation, utilitarianism fails to understand agency for the thesis's scope, although it focuses on consequences rather than intentions.

The above three theories highlighted the moral interpretation of agency, where the value systems create a political narrative in which the psychological view of intelligence is rooted. From this genealogy of agency, we see that the term is moral because it is grounded in

relations, implying the capacity to influence by action. The theories share that agency is prior to action and consequences; further, what makes an agent moral is part of a bigger political narrative. We can contextualise this into an example: let us consider a person pouring water into a glass and a rock falling from a cliff. According to the three theories, we can state that the first example implies agency, and the second one does not because the cause and effect do not imply intentions⁶. Analysing the rock example through virtue ethics, it is clear that rocks lack intentionality. Despite Aristotle's view that rocks tend to fall, this is not intentional or morally significant; thus, no agency is involved. A similar argument can be presented from a deontological understanding of agency. From a deontological perspective, agency involves the capacity to judge and act based on the categorical imperative. This capacity distinguishes agency from simple causation since intention precedes action. Therefore, a rock falling from a cliff does not imply agency since, clearly, there is no action based on the rock's judgment. Also, from a utilitarian view, no agency is implied as the rock is seen as incapable of making decisions towards good maximisation.

Looking at the first example, the person pouring water, we see that instead, there is agency according to all three theories. Virtue ethics and deontology would say that the person's action is guided by the will to drink, which is part of the biological need to stay alive. There would be a discrepancy in how the will is acquired through experience and cultivation of the fact that staying alive is morally significant (virtue ethics) or by the fact that staying alive is a categorical principle *a priori* of the subject and the person should just follow it (deontology). Also, utilitarianism would agree that agency is present, as the person maximises the action for their own good.

We see that agency is an *a priori* element, where the emphasis of the interpretation is on the entity that shows the more significant degree of intentional behaviour. Further, it is plausible to state that such views would locate humans as the entity with a higher degree of agency because they would show a higher degree of intentional behaviour.

I do not want to deny such an interpretation, which views the agency as ontologically fixed on the entity and intrinsically linked to intentionality. If we consider agency as an inherent property existing prior to action, such a view is indeed a reasonable conclusion. Further, I do not want to be misunderstood, and even if it is reasonable to state that such theory developed their understanding of agency based on humans, such understanding could most probably,

⁶ True is that looking at Aristotle four former cause one might argue differently. Nevertheless, the four causes are not necessarily moral, and in this discussion moral is an important element because it is what form the hierarchical relation.

and are, reinterpreted and expanded to include non-humans animals and other living systems as well. Even more, given the last technological developments, such understanding of agency and moral subjects are discussed to be applied to advanced technological systems and forms of advanced AI⁷. However, even with these new developments, the understanding of agency as ontologically fixed and prior to action is not changed. Instead, the discourse is reinforced, thus making agency still an ontological hierarchical concept even though the application is expanded.

Therefore, as shown by using agential realism, to create a narrative of intelligence that is non-hierarchical, we need to think of agency in a different way ontologically. Thus, instead of focusing on the intentions of action that lead to consequences, the starting point should be the consequences as such. Starting from the consequence embedded inside the phenomena and trying to understand a posteriori what actions and interactions create such phenomena, it is possible to have a more precise view of the agency involved and an ontological distribution of it. Consequences are real because material and intentions are virtual prior to action. By tracing back all the entities that took part in the production of consequences, there is a narrative where the agency is entangled, taking into account the multiple and simultaneous. Such narrative aligns with a material view of intelligence where processes and multiplicity constitute it. Therefore, shifting to consequences is the starting point for breaking a hierarchical understanding of agency.

Further, in this view, the resulting underlined assumption is to focus on differences. Consequences are material multiplicities because matter is not divided per se; rather, the division results from the interpretation. Nevertheless, matter makes different things; we must acknowledge differences in understanding agency. Because consequences are material and only material, the assumption states that we must focus on the material aspects because they are the only ones that matter.

Reading the IQ Test using Agential Realism

Chapter One argued that the IQ test is problematic and does not reflect a fair and morally justifiable concept of intelligence. The issue is that the IQ test needs to be revised to capture the complexity of the diversity of human experience, thus reinforcing a stereotypical and misleading idea of the normal, preferring to focus on similarities rather than differences.

⁷ For further discussion the reader can examine Nyholm (2021) “*The Ethics of Human–Robot Interaction and Traditional Moral Theories*”; or Gunkel (2013) “A Vindication of the Rights of Machines”

This section aims to further criticise the IQ test by reading it through agential realism. From this, we can show a different story that considers its apparatus and material discourse, showing that it is possible to give a view of the test in which subject and object are not separated but rather co-produced. In its dominant interpretation, the IQ test follows the psychological interpretation of intelligence, understanding it as a property with human-centred agency that presupposes intentionality. On the contrary, by applying agential realism, I believe there are reasonable reasons to show why it is allowed to use a non-hierarchical agency in a material view of intelligence. This is to say that instead of viewing agency as a defined property of an entity that is characterised by intention and ontological fixed, it is allowed to look backwards, viewing the consequences (i.e., the phenomena), and from this, tracking all the different intra-action that led to such material-discursive configurations. In this sense, the agency is an entangled enactment of matter ontologically distributed.

The IQ measures pre-given agency and intentions toward the tasks. However, this focuses only on the linearity of action, neglecting the multiplicity of elements in place. In a certain sense, intelligence as a property opens the possibility of the essence, a transcendent pre-giveness of agency and intentions, as this understanding of agency presupposes action, yet it still has to come; there is no intra-action activity to be observed. Nevertheless, if instead, the focus is on the phenomena, that is, the result of the action, the virtual that becomes actual, then by looking at it retroactively, what we obtain is a different picture than the starting. Metaphorically, the noise that surrounds action starts to speak.

The agency depends on where you are looking from; thus, causality needs to be interpreted towards the origins rather than the end. We have to focus on the phenomena by reasoning on the meaning and constitution. By changing the perspective, we see that the subject is not detached from the object. Instead of the subject acting towards the object, the two, by maintaining their own externality, are entangled within the phenomena.

Further, by looking backwards, the specific material arrangements of the concept of intelligence are shown; thus, not only an individual narrative of the phenomena in which location is inherent to the individual and only the individual, in contrast, for instance of collective understanding, but also the assumption of particular practices and cultural knowledge of certain material disposition such as the object required for the test and the processes of the test: internal metabolic processes and energy for making the body of the people involved act, and the evidence of just a specific set of skills at work of all the possibility of the body schema.

Viewing IQ as a property shown by a test rather than a phenomenon makes it counterintuitive because it neglects dynamic expressions. Ironically, an agency under the view of intention has difficulties dealing with a continuous change given by generative dynamic interactions. On the contrary, an agential realism account of agency can help in this sense, as agency is understood as entangled within the generative change. It shows that difference matters, so we must account for such differences to understand intelligence from a non-human perspective. The agency is not fixed inside the subject that overcomes the object. Instead, the two are entangled inside phenomena in continuous and ongoing sets of intra-activity and reconfigurations. Viewing phenomena as a dynamic reconfiguration, we observe that subjects and phenomena emerge within themselves, originating a new phenomenon.

Intelligence starts with a definition (Sternberg, 2020). However, this is not focusing on what is happening but on the abstract idea of the story according to the dominant interpretation. IQ is measuring, and as it was argued, measuring is a way of seeing, is a story, and stories highlight and neglect characters. Arguably, IQ does not measure intelligence; it shapes and constructs the term and how it should be seen. Therefore, IQ constructs and reinforces certain discourses on intelligence.

According to intra-activity, the IQ test does not reflect the understanding of categorical pre-existing phenomena. It is involved in producing and constituting the understanding, highlighting particular capacities over others, and showing how scientific and social material discourse come together, interconnecting meaning and knowledge in their normalised understanding. Therefore, IQ test cannot be examined individually, rather is part of a broader and more complex research project aimed at measuring the uniqueness of humans over other entities. As the history of the development of the test shows, the search for measurement was to find the seed of superiority rather than for a practice of humility.

The IQ test suggests that agency, as Barad (2007) proposed, can be viewed as an entanglement between human and non-human entities and apparatuses. We see that the agency does not belong to the subject taking the IQ test, and from there, an outcome is given. The IQ test is not just a tool that reflects the subject's agency; it is an agent, shaping and defining the understanding of intelligence and producing normalised knowledge of it. Moreover, we see with the IQ test an entangled agency embedded and distributed within the apparatus and material discourses in which it is part.

Simplifying, the IQ test can be viewed as the actualisation of social constructions. However, this has arguably less to do with the entanglement of the process that is taking place. Therefore, what IQ tests measure is a social construction of the idea of intelligence. This is

not to say that IQ lacks scientific methods but rather the contrary. The IQ test is empirical; it uses a certain number of observations to state and standardise claims inductively. By this method, the IQ test is a scientific practice. However, it is possible to argue that scientific practices are social practices (Fourez, 1997). This means that over the promise of universal objectivity, scientific methods are linked to the intelligibility of humans, and they are practices of humans. Thus, scientific practice is not ontological primordial; it is not neutral but shaped by the social system it embeds.

Intelligence, as developed, is a cut on a mirror on which we reflect how we want to be seen rather than that for what we are. We are not sincere, creating a deceitful image of what humans want to see. It is the desirable rather than the actual.

Making an example, the IQ test proposed by Binet was developed arguably with good intentions, as identifying children that needed external educational support; however, the consequences went beyond intention as having biases and were used for social discrimination, thus, shifting the focus from intention to consequences we recognise the complex and entangled nature of agency.

It follows that the IQ test can be understood as a product of material discourse and social practices, therefore, embedded and contributing to the biases and beliefs that exist in society. The IQ test is not just a tool but is an agent that shapes and generates the understanding of intelligence, reinforcing and eliminating discourses in the physical-conceptual materiality.

Arguably, the agency involved in the IQ traditional model does not capture the complex entanglement of nature, its interdependent systems and feedback loops within variations that underlines the spaces which man is embedded into (i.e., consequences that matter).

The IQ test is about searching for similarities, but phenomena, as was shown, are generated from differences. Further, by searching for similarities, possibilities of actualisation are destroyed. Reading the IQ test through agential realism, it is possible to state that it is a product of the political agenda with the effects of creating hierarchies, valuing humans over other entities, and leading to the Anthropocene. This was shown by analysing the connection between agency, intentionality, and morality, which is what counts and what does not.

Under the Copernican revolution, we learned new positions and new ways of seeing the universe, similarity, to face the Anthropocene, a Copernican revolution in which humans relocate themselves under new systems of coordinates that understand them not in nature but within nature is needed (Latour, 2017). This is a political matter, and seeing what counts as action and what does not, is the first act of humility we are called to face. In this sense, I follow Haraway's statement: "We need to think on how to think" (Haraway, 2016, p.7).

With this, Harraway means to enquire about the assumptions covered in our concept deeply. In this chapter, this was done by discussing the notion of agency implied inside the narrative of intelligence. Agential realism opens the possibility of viewing intelligence beyond the anthropocentric fallacy. It does so by suggesting that intelligence can be viewed from a material perspective passing from being property to a process where the agency is distributed non-hierarchically and by emphasising the consequences that the process creates.

Conclusion

The chapter aimed to show that it is possible to think of intelligence differently. The main discussion of the chapter was on the two assumptions on which the psychological view of intelligence is grounded, respectively, human-centred agency and intentionality. By linking the two terms to the moral and political dimension, we showed how hierarchical narratives can be created, therefore, arguing for a need to reinterpret these two assumptions in the context of intelligence. Regarding the agency, we argued in favour of a material distributed interpretation, while for intentions, the suggestion is to adopt an approach *a posteriori* and focus on the consequences. To theoretically understand this shift and the implications for the concept of intelligence, we used Barad's (2007) agential realism theory. Agential realism provided us with a framework that considers the complexity of reality's entanglement, overcoming the dualistic notion of subject-object, and it does so by adopting a distributed view of agency. This means that reality is produced from the heterogeneous interaction of matter, which forms the phenomenon, which is iteratively and differentially articulated since agential realism views every phenomenon as an individual. Therefore, by using Barad's theory to discuss the notion of agency and intentionality, we see that it is possible to build a concept of intelligence that considers the complexity of material relations, and its dynamic, ongoing reconfiguration, allowing a shift in intelligence from property to process.

To conclude, the chapter applied agential realism to analyse the IQ test. The use of agential realism shows the need to consider in the intelligence narrative all the elements that take part in the action, thus advocating for a system and process view of intelligence where differences matter. This contrasts with more classic views that see intelligence as a property. In the next chapter, I build upon these findings. By using Delanda's assemblage theory, I attempt to present a view of intelligence that aligns with new materialism thinking, providing a narrative that, in the political dimension, is non-hierarchical or human-centred.

Chapter Three: Introducing Material Intelligence

Introduction

In the previous chapter, a critique was made towards the elements that compose the psychological interpretation of intelligence. It was argued that we need to rethink human-centricity to develop an understanding of intelligence that acknowledges the Anthropocene. In this sense, three main assumptions must be discussed respectively: intelligence as property, human-centred agency, and intentionality. In the previous chapter, we advocated for an understanding of intelligence as a process where the agency is distributed between the network of entities involved, and the focus should be on the resulting consequences. To do so, the chapter used Karen Barad's agential realism theory.

Barad's work helped criticise and rethink the assumptions underlined inside the psychological view of intelligence, suggesting an opening for a material conceptualisation. However, to suggest a systematic interpretation of intelligence that is in line with new materialist views, agential realism is not sufficient. This is because agential realism aims to attack anthropocentrism, making justice to the role of matter and emphasising favour of an entangled ontology. Nevertheless, the mechanistic description of the apparatus is focused on the effects of discourses and asymmetries of power that do not reflect the aim of this thesis. This is because Barad's theory focuses on the inseparability between phenomena but is limited in analysing the dynamic interactions taking place.

Agential realism helped show where to start, but other theoretical frameworks are needed to complete the work. To do so, this chapter uses another theory generally associated with the new materialist movement: Delanda's assemblage theory. This is because the notion of assemblage helps to systematise the interaction of dynamic material systems. Moreover, the understanding of agency and consequences is coherent with agential realism, adding a description that shows how entities interact to form emerging wholes, thus helping to conceptualise and read material intelligence as a dynamic process. This is in line with the non-human-centred narrative of intelligence that the thesis is proposing.

To show how such understanding is possible, the chapter is structured as follows: at first, assemblage theory is present; second, I present how to think of assemblage; and third, a new materialistic understanding of intelligence is present based on what was said.

Assemblage Theory

Assemblage refers to a process of fitting things together: assemblages are wholes of components that mesh together. A first attempt to go beyond this simple definition and theorise the concept systematically can be traced back to Deleuzian philosophy. Deleuze understands assemblages as a multiplicity of heterogeneous terms that establish relations between them; moreover, the assemblage becomes unity only through co-functioning its components (Deleuze & Guattari, 1987). Examples of assembles are cities, ecosystems, social institutions, the human body, a computer, and a colony of ants. This is because heterogeneous entities come together and form something more significant.

Locating assemblage theory in today's theoretical landscape, the theory is broadly understood as part of the new materialism movement, with Manuel Delanda as the key figure. The theory implies a realist and material ontology, and as agential realism, it sees reality as a distribution of material relations embedded in anti-essentialist views. Assemblages view reality as immanent and contingent, constituted by individuals. This means that every entity composing reality is unique; it has its history, origin, and extinction. An individual in this context does not refer to a particular individual of a species, for example, a particular human with its contingent characteristics (Delanda, 2016), but to all assemblages, as the continuous production of a dynamic world that is immanent. Therefore, emphasising the historical trajectory of the individuation processes. Individuation refers to everything being unique because it results from different historically accidentally bounded relations. For example, if we consider an assemblage that produces a clone of a Giant Panda, it would not be a Giant Panda because of the different relations that produced it. The same is the case between biologically made Giant Pandas; each is unique as having its own historical relations. Therefore, even with a high degree of similarities, every individuation process is different from another, showing that, according to the theory, history matters⁸.

Assemblages are constituted by heterogeneous entities bounded by material immanence and contingency. Heterogeneity is a crucial aspect of assemblage theory, part of its definition: assemblages are heterogeneous wholes with emergent properties.

Assemblages and emergence

⁸ This is part of a bigger discussion within assemblage theory and new materialism, that argue against universalism and essentialists views. The key point of Delanda is that there is not such things as transcendent essences, however, expanding on this view would be out of the research scope. If the reader is interested in further discussion, they can consult part two of Delanda (1998) *A Thousand Years of Non-Linear History*.

If the assemblage, the process of fitting things together, were made of homogeneity, it would still be a whole but characterised by the unity of totality, an aggregate sum of parts (Delanda, 2016). Therefore, heterogeneity is in the function of the emergent properties of the assemblage; heterogeneity constitutes the emergence. Emergence means creating something new that is more than the sum of the parts. Moreover, emergent properties are properties of wholes irreducible to single components. The unity of a sum is a quantitative change but not a qualitative one: adding or subtracting components does not modify the properties of the unity. Contrary, emergence is a qualitative change in the assemblage; therefore, by reducing the components, there is an alteration of the properties.

One classic example of an emergent system is a flock of migratory birds. The flock has emergence behaviours that are irreducible to the single birds. The interaction of the different components constitutes the new properties of the whole and only of the whole. This understanding of emergence is in line with causation, as, for assemblage theory, every causation that gives rise to new properties and is irreducible is an emergent causation. Therefore, according to assemblage theory, all emerging properties are causal properties. Nevertheless, causation is not only emerging but exhibiting new properties. It can also be within the assemblage showing changes in relations but not showing the new characteristics. Delanda (2016) notes two other reasons why emergence is compelling to the assemblage theory. The first one, as was already sketched, is the irreducibility of the property of the assemblage and its part. The second is that considering the property of wholes depends on the interaction of the part entails that these properties are not to be either necessary or transcendence but somewhat historically contingent. Thus, emergence shows the connection between the whole and its components. In other words, emergence is a bottom-up process with top-down effects. This means that the components maintain their original identities; however, the relationship established inside the assemblage produces new properties that affect the single components. Recalling the example of the flock of birds, the single bird is a bird within and without the assemblage; however, the independent behaviour that the flock acquires by the assemblage of the different individual birds affects all the birds (i.e., components) of the flock.

As noted, the bottom-up processes and top-down effects within the assemblage's components produce the property of the whole. This means that if the interactions cease to occur, the properties cease to exist (Delanda, 2016), making the assemblage's emergent properties

contingent. The contingency of properties is in line with the individuation process described previously, emphasising the history and continuity of an assemblage⁹.

Tracking the origins of its philosophy, Deleuze (and Guattari) identifies two types of relations: interior and external (Deleuze & Guattari, 1972). Interior relations constitute the identity of the relations (Delanda, 2016); for example, teachers and students, because they define and give identity to the relation, they constitute the relation themselves. However, interior relations do not apply to assemblages because interior relations are mutually constitutive (Delanda, 2012).

The second type of relations are external ones, which occur inside assemblages. Relations of exteriority mean that the relationship may change without the terms changing (Delanda, 2012). Elaborating, relations of exteriority stay on the surface; they do not change the identity of the single terms. In the flock of birds, every bird is externally related to the others. Interacting the birds form a whole that is irreducible to the single parts. However, the birds interacting with each other do not change their identity. A single bird remains itself with its properties and identity with and without interacting with the others. As Delanda (2012) noticed, the relations between every bird are not explained by their necessary mutual constitution as in the teacher-student case but by the contingent co-evolution, referring to the dynamic change within the whole.

External relations make the assemblage suitable for conceptualising material intelligence because of its interchangeability of elements with no-fixed boundaries. I showed that assemblages are immanent and contingent entities, thus subjected to processes of individuation. This applies to all assemblages; therefore, all assemblages share the same ontological status (Delanda, 2016). Sharing the same ontological status implies that there is no hierarchy between assemblages. The size, dimension, and number of components do not matter for the ontology. The reason is that what counts for the ontological status is the history and continuity of the assemblage, which are the immanence and contingency of the production process.

Assemblages and parameters

⁹ Viewing assemblages under the view of history and continuity leads to different ethical questions, this is because existence and extinction in this view are real in the biggest sense. The individuation process of a particular assemblage is disappear forever once is ended, it cannot be reproduced, because as noted with the example of the Giant Panda, the histories and contingent factors that led to the started individuation would be different. The possibility of extinction and the mechanistic description of the interactive relations required an ethical contextualization, therefore, we must ask ourselves what type of relations take place inside assemblages. However, due to limited space, such discussion is out of the scope of this thesis.

The exterior relations constitute the assemblage but not the identity of the assemblage's component; thus, relations of exteriority make the entities of the assemblage not fixed. The components inside the assemblage can change, and the intensity within the relationship can change, making the same relation stronger or weaker at a given time. This change in the degree of the assemblage is due to the adaptive changes to external events. Let us think of a community inhabiting a city as an assemblage. The set of exterior relations in place is subject to change if external events affect the community. For example, let us consider a scenario where a state-centralized government makes a change in the taxation regulations that benefit one sub-community group while negatively affecting another. This external event can affect the assemblage by creating conflict. To answer to this dynamic change Delanda in his work, proposes to add territorialisation and coding as parameters, meaning how the environment can affect the assemblage.

Territorialisation is the parameter measuring the degree to which components of the assemblage have been subjected to a process of homogenisation and the extent to which its defining boundaries have been delineated and made impermeable (Delanda, 2016, p. 3). Given their material ontology, assemblages occupy spaces and have boundaries; territorialisation measures those boundaries. However, boundaries are not fixed; they are subject to change over time. Let us think of a city like London; if we consider it an assemblage, we see that its boundaries have changed during historical periods, starting as a military camp in the Roman occupation in the first century AD, followed by abandonment after the Roman collapse, to then a gradual expansion during the centuries, becoming the global city that is today which boundaries include millions of people.

From this, we see that territorialisation is a parameter that refers to an assemblage's continuous change of boundaries. Has to be noted that such boundaries refer not only to a spatial level but also to integrating new components. Looking at the example of the expansion of the city of London, in its expansion process, London has incorporated other surrounding settlements that today are city neighbourhoods. Thus, boundaries refer not only to the spatial perimeter of the assemblage but also to the degree of impermeability, that is, the resistance to integrating new components in the assemblage.

The two different implication of the notion of boundary in the assemblages leads to the understanding that territorialisation is the parameter that captures the trade-off between homogeneity and heterogeneity within an assemblage. Thus, accepting a new component within the assemblage would imply homogeneity to the assemblage as a whole. Contrarily, the rejection or resistance of the new component would imply heterogeneity to the

assemblage as a whole. This distinction shows an important mechanistic distinction: for its functioning, the assemblage needs to be heterogeneous in its components but homogenous in the wholeness.

The second parameter that Delanda proposes is coding. Coding refers to the role played by particular expressive components in an assemblage in fixing the identity of a whole (Delanda, 2016, p. 22). As the components of the assemblage have their individual identity, the assemblage, as a whole, has a recognisable identity as well. Coding is the parameter through which the identity is expressed. For example, language is a coding parameter that gives a recognisable expression of identity to the members of the linguistic community.

Both the parameters, territorialisation and coding, are parameters of the continuum of the whole. The former refers to the homogeneity of the whole, and the latter to the continuation of its identity.

Assemblages, diagrams, and consistency

The last aspect of assemblage theory that needs consideration is the notion of the diagram and plane of consistency. Every assemblage is contingent and historical; moreover, the productive consequences of the assemblages, defined by their relations, are actual meanings that exist in the here and now (Delanda, 2016). However, consequences might result from only some of the properties of an assemblage, meaning that an assemblage can have different properties and capabilities but not used all at once.

Following Delanda's terminology, the use of a particular property would be its actualisation. For example, a technology such as a smartphone can be considered an assemblage of heterogeneous components creating a bigger whole. A smartphone has different properties: It can take photos, emit signals, access the internet, record sounds, and communicate with other devices. All these subsets of properties, the different combinations, and variations represent possibilities and compose the assemblage's diagram. Delanda (2016) describes the diagram as the possession of disposition, tendencies, and capacity of an assemblage as a whole. The diagrams are all the possible configurations an assemblage has, both in the virtual and actual. On the other side, the plane of consistency refers to the coherence of the world as a continuum according to the laws of reality.

Diagrams and planes of consistencies in assemblage theory are highly abstract. However, they can be understood with Barad's concept of intra-activity since they refer to the virtuality of a phenomenon. While, from a first view, they might resemble Neoplatonic essentialist metaphysics, thus suggesting a contradiction with new materialism views (Kleinherebrik,

2020), they do not imply metaphysical distinctions between the world of essences and the physical one. Instead, the diagram focuses on all the possible interactions and configurations an assemblage can embody. Conversely, the plane of consistency represents the coherence possibilities of the assemblage's diagram within the constraint of reality. The plane of consistency is within our world, capturing all possible degrees of movement and change, aligning with a material view of reality.

Assemblage Theory and Agential Realism

The non-hierarchy between assemblages is similar to the view of the non-hierarchy that Barad sees in the phenomena. However, in agential realism, it is not the historical contingency that makes the phenomena non-hierarchical but the agency distribution. Arguably, this difference does not make the two views mutually exclusive. As Delanda (2016, p.20) writes, “assemblage theory takes into account the material expressivity of matter”, referring to the heterogeneity inside assemblages being formed by external relations between human and non-human elements as well as living and non-living, the natural and the artificial. Matter is viewed as active, and by creating connections, it produces changes. Therefore, assemblage theory takes into account an ontological distribution of agency as well; it takes it as a given fact. A similar point can be made with agential realism and the history of phenomena. Barad (2007) refers to the immanence and contingent fact of phenomena; she refers to it in the process of becoming when matter enters into contact within the apparatus and material discourses, the reason why precisely *that* apparatus and *that* discourse is a result of the arbitrary immanence and contingency of space-time coordinates.

The shared ontology between assemblages not only helped to see the ontological compatibility between Barad's agential realism and Delanda assemblage theory but also shows that because assemblages share the same ontology, they can interact. Thus, the theory opens the possibility to assemblages of assemblages (Delanda, 2016). This possibility opens the view of seeing assemblages as part of a population of assemblages.

To sum up, let us consider an ecosystem as an example of where to apply the above description of assemblage theory. Ecosystems are wholes composed of heterogeneous entities, such as animals, plants, soil, water, air, and microorganism. Every entity is connected through exterior relations, thus keeping its single identity. Ecosystems show stable equilibrium on a nutrient level; this is an emerging property because nutrient equilibria are not reducible to the single entities that form the ecosystem but are produced through

interactions. Looking at the two parameters, territorialisation does not only refer to the physical boundaries of the ecosystem but also to the trade-off between heterogeneity of the components and the homogenisation as a whole, for instance, how the ecosystem, as a whole, would respond by introducing a new species. The second parameter is coding, which is the material identity of the ecosystem. For instance, the distinction between what identifies a desert or an arctic ecosystem. To conclude, a diagram refers to all the possible configurations that an ecosystem can assume, both in its virtual and actual, for instance, population variation, species composition, or relations. Nevertheless, the diagram shows all the possible coherent configurations the ecosystem can assume in line with the physical world that describes nature.

Assemblage Theory and the Three Modes of Thinking

Before applying the views of assemblage theory to propose an understanding of intelligence in line with new materialism perspectives, it is appropriate to give an introduction on how to look at such understanding. This is because more than a description of assemblages is needed to understand the implication of using assemblage theory to view intelligence. What is needed is a way of looking at it, an interpretation of the conceptual processes involved. For this reason, this section presents three modes of thinking about assemblages: population, intensive, and topological. These three modes are derived from three different disciplines, population thinking derives from ecology, and it refers to looking at a system in terms of heterogeneous sets of populations; intensive thinking is based on the field of thermodynamics and, as the name suggests, it means thinking in terms of intensity and dynamic thresholds inside systems, topological thinking is derived by topological geometry, and it looks to the systems in terms of trajectory and tendencies.

These three modes of thinking are relevant to our discussion on intelligence as they provide the foundations for constructing the variables that will enable us to develop the concept of material intelligence in the next section.

*Population thinking*¹⁰

¹⁰ The way Delanda proposes population thinking derives from Darwin's evolution theory and Mendel's genetics. Therefore, Delanda emphasizes the idea of bigger systems formed by bottom-up interactions of different elements. For a bigger discussion on the topic see Ruse, M., & Ariew, A. (2008). Population Thinking. In *The Oxford Handbook of Philosophy of Biology*. essay, Oxford University Press.

Population thinking means thinking about individual variation (Ariew, 2008). For assemblage theory, population thinking is critical because it directs the perspective of the theory toward heterogeneity, looking at local variations that constitute particular assemblages¹¹.

Assemblage theory assumes that every entity that composes the world is an individual; therefore, it is possible to state that an assemblage is an assemblage of individuals. Together, these individuals make a population; thus, assemblages are a population of heterogeneous individuals.

Thinking in terms of population means thinking in terms of bottom-up processes, that is, breaking down the properties of systems to their individual, which is to say that difference counts. This recognises the significance of top-down effects. As shown, top-down effects count as those that make the assemblage a whole. Thus top-down and bottom-up are both necessary components for an assemblage in the individuation process. However, the emphasis on the bottom-up processes that population thinking suggest is connected to the local view of the assemblage. This is because local variation matter for the evolution of systems. The entities within the assemblage interact, and their differences create variations and dynamic changes in the assemblage. In this sense, both the subject of study of ecology and meteorology are goods example. The local variation in the ecosystem or the climate conditions leads to the change in population.

Population thinking is about heterogeneity. What makes the heterogeneous is the variability between the entities, that is, the propagation of the asymmetries inside the assemblage of populations. Therefore, from the above, we see that population thinking aligns with material intelligence because it emphasises the interactions and heterogeneity of entities. Thus, it guides attention to the difference inside the assemblage rather than the similarities.

*Intensive thinking*¹²

¹¹ Interestingly, population thinking is usually opposed to typological thinking, the mode in which the psychological view of intelligence as developed by Galton is based on. Recall that typologist think in terms of abstraction based on a reference model. Of course, typological thinking does not deny variation, the point is rather on what to focus. Typologist thinkers aim in finding similarities and construct an idealized model of an entity (i.e., the classical taxonomic sense). Opposite, population thinkers emphasize the difference between similar entities and what do these difference produce.

¹² Delanda develops intensive thinking from Deleuze, that borrows it form thermodynamics. For the scope of the thesis I'm only exploring the notion of intensity, nevertheless, a second aspect of intensive thinking is morphogenesis, that refers to the spontaneous change inside entities, for instance driven by internal dynamics as energy distribution. However, for this preliminary attempt to develop the notion of material intelligence I believe that intensity is sufficient the basic notion of energy. Nevertheless, I do not exclude that further developments might explore the application of morphogenesis.

Intensive thinking is thinking about energy. Assemblages, being ontologically relational, operate through the interaction between their constituted parts. Therefore, focusing on energy entails considering the fuel the assemblage needs to function. This is because every function is a process, and processes need fuel: energy that makes them happen.

Key to processes is the movement of differences. The distinction between diversity and difference is essential. According to Deleuze (1968), diversity is what is given: the tree, the horse, planet Jupiter. On the other side, the difference is what comes from the relationship between these diverse entities. Therefore, a process is a relation where differences move, and to explain this, we need intensity.

Intensity is what makes the actualisation of virtual forms (Delanda, 2000). In other words, intensity is energy which travels through but is also part of the assemblage's immanent state. Examples of intensities are speed, temperature, pressure, and density. In a certain sense, intensities are embodied in the assemblage. When looking at assemblages, intensities are what keep them together; it is the continuum that connects heterogeneous components. Thus, intensities are connected to what was described as the cosmic plane of consistency (Delanda, 2016), the coherence of the assemblage following the laws of reality. The cosmic plane of consistency has a diagram that is the space shared by the virtual and the actual. What there is between the virtual and the actual is the actualisation. Therefore, actualisation emerges as the solution to the process (Delanda, 2000).

To make an example of how intensities affect an assemblage, let us consider the development of mobility systems and infrastructures in a city. Consider different neighbourhoods characterised by unique social-economical conditions and cultural backgrounds. These neighbourhoods are unique individuals in the large urban population. Now, let us suppose that the mobility infrastructure starts to connect the different neighbourhoods. The difference between the individuals starts to interact and shape each other, thus enabling productive processes. The difference in intensity can be viewed as the flow of people, money, and ideas shifting between the network of neighbourhoods. Further, the increase of interaction may increase the intensity, and when reached certain thresholds, there are emerging transformations, such as the creation of new businesses, communities, infrastructure projects, and subcultures. This example shows the generative role of intensities, the energy that flows and creates.

To summarise, intensive thinking is about differences that produce, embodied in the assemblage, as energy. Thus, by adopting this perspective, we can view material intelligence considering energetic relations and generative processes that shape the assemblage.

*Topological thinking*¹³

Topological thinking is thinking geometrically about the tendencies of an assemblage. Tendencies are real but not actual; thus, thinking topologically means thinking about the system's possibilities (i.e., the virtual) and where the system is going (i.e., the actual). Topological thinking expresses this through spaces, and spaces are about reference and coordinates. From a topological perspective, coordinates are local, and this is because it emphasises the idea that space is the product of networked entities (Paasi, 2011; Harris, 2009) that exhibit global connectivity. The connection between the local and the global is coherent with the ontological status of assemblages, as the local assemblage is connected to the global picture, which maintains its individual characteristics.

Local information is the focus of topological thinking because it forms spaces and gives coherence to them. The coherence is given by the internal configurations of its relations that establish the tendency of the assemblage. Configurations and local information form virtual spaces; the actualisation is produced from the intensity generated by the differences. Delanda (2016) uses the term *enfolding* to refer to this productive difference, as they are part of the becoming. Let us think about the orogeny processes that occur in the production of mountains, where the differences in the convergent plate margin produce the process that gives rise to such generation. Thus, mountains are enfolding; they are becoming. However, these processes can have different speeds. It is crucial to notice this because human phenomenological experience also occurs at a certain *speed*. Thus, while some enfolding processes are imperceptible as the orogenesis of mountains because they are too slow, others are imperceptible because they are too fast as the decay of quantum particles. Others instead are coherent to our perception as the movement of clouds. From these examples, we see that speed and becoming are strictly connected. Moreover, when speeds are multiple, the enfolding process acquires dimensions called a manifold. According to Delanda terminology, a manifold is a field of rapidity and slowness (Delanda, 2016:116.), and in Deleuzian terms (as where Delanda takes it), it is a multiplicity.

Following topological insight, we can see all the possible spaces associated with the assemblage. Spaces of possibility are phase spaces. The space of phase refers to studying possible configurations of dynamic systems. The study is possible by identifying the relevant

¹³ Topological thinking derives from topological geometry, which was developed in the XIX century by Riemann and Gauss, and later by Poincaré. Thus, from a theoretical perspective, topological thinking is about non-euclidian spaces, for example trajectories and curves surfaces. Delanda in his work, borrows the idea from Deleuze's (1968) book *Difference and Repetition*, chapter four.

ways of change of a system, which are the degrees of freedom that a system has. The relevant ways of change depend on the system that is considered. A possible example would be a pendulum where the degrees of freedom relevant in the system are the speed and position of the movement. Thus, the manifold that will represent will have many dimensions as the degrees of freedom.

The representation is made of points, and a series of points is a trajectory. Configurations make each representation. Topological thinking looks at the general tendencies of a system in its becoming, allowing representation on the manifold. Tracking the trajectories by considering the relevant degrees of freedom emphasises how things change and relate to each other.

To conclude, the three modes of thinking help to understand the processes inside assemblages. The commonality that the three modes share is the primary position that the difference has. As we saw, the difference in the assemblage is reflected under the perspective of individual variations of its components, the difference in intensity levels and energy, and the difference in possible configurations and trajectories. This pushes us to consider the importance of heterogeneity inside the assemblage as what makes it function and exist. Therefore, utilising these three perspectives as the foundation for constructing variables in a material interpretation of intelligence highlights differences' significant role.

Assemblages, Three Modes of Thinking, and Material Intelligence

Through the thesis, I made several critiques to the IQ test. What we see is that this practice can be read as the consequences of an assemblage where politics, empirical data, institutional design, scientific programs, human heterogeneity, social practices and discourses come together, co-constituting a hierarchical narrative of intelligence. This is one of the significant aspects of the intelligence narrative today. Similarly to others, Delanda (1998) moves a critique to the test as an institutionalised sorting device used for political purposes. This was the adoption of the practice in 1924 in the US for immigration restriction based on the assumption of genes inferiority from immigrants (Gould, 1981). What allowed for such interpretation was the understanding of intelligence as a property based on essences of genetic origin (Delanda, 1998) rather than a multifaceted phenomenon. Contrarily, throughout the thesis, I have advocated for interpreting intelligence as a process characterised by historical contingent factors that consider the phenomenon's complexity. In what follows, I attempt to put together what was said to this point and suggest the concept of material

intelligence that better represents the complexity of intelligence compared to the psychological interpretation. Moreover, contrary to the IQ test, it promotes a politics of inclusion that aligns with the Anthropocene.

Using Barad's agential realism, we saw that it is possible to think of intelligence based on non-human assumptions, proposing to shift the focus on consequences and ontological distributed agency. Delanda's assemblage theory gave us the theoretical bases to build a non-hierarchical interpretation of intelligence. The understanding of intelligence that I am proposing is to understand it as the consequences of a whole in terms of reproducible adaptive variations. In what follows, I will dive into the single elements of such an understanding by describing what they refer to and how they relate. After explaining this view's mechanistic components, I discuss the picture this new interpretation of intelligence allows.

The Ontology of Material Intelligence

The definition of intelligence I am proposing is compatible with assemblage. Recall that assemblages are heterogeneous wholes subjected to individuation, where individuation is a historical origin in a contingent space. Moreover, assemblages are emergence systems, meaning that the properties of the whole are not reducible to the single components. By interacting and relating, the heterogeneous components create a bigger whole than the sum of the single parts.

The conceptualisation of intelligence through assemblage theory differs from the psychological interpretation. We showed that intelligence from a psychological view is based on three main assumptions: it is a property, with human-centred agency, and presupposes intentionality. These assumptions allow for a hierarchal narrative where the intelligent entity is active while the non-intelligence is passive. Contrary, assemblage theory allows us to view intelligence as a process that emerges from the interaction of heterogeneous entities. Chapter two has advocated for distributed agency and the emphasis on producing consequences in developing a material understanding of intelligence. Assemblage theory helps to define further how agency and consequences are conceptualised with the ontology of the process. This is possible because of emergence, as a bottom-up process created by generative differences of the elements; nevertheless, as a whole, it has top-down effects, referring to the consequences. Therefore, contrary to the psychological interpretation, the material view is non-hierarchal because it is not a property that is ontologically fixed but rather a process that is ontologically distributed between its heterogeneous components.

In this context, whole refers to assemblage; this is compatible with the idea of the phenomenon from an agential realism perspective. According to agential realism, phenomena emerge from material intra-activity; this is possible because all matter has agency, thus distributing the agency inside the phenomena; everything has an entangled becoming. However, when matter entangles in its intra-activity, constituting the phenomenon, it is bigger than the single intra-activities. Therefore, treating intelligence as a specific process emerging from heterogeneous wholes is compatible with assemblage and agential realist theory.

We see that, ontologically, the concept of intelligence can be applied to the architecture of assemblage. The understanding proposed from a new materialistic standpoint focuses on the internal characteristic of the assemblage, the connectivity and variability of its heterogeneous components. However, as was described, assemblages have two external parameters that refer to environmental changes. Thus, before discussing the interpretation of intelligence being proposed, it is appropriate to briefly discuss the parameters of territorialisation and coding and their implications within the context of material intelligence.

Territorialisation is the degree of homogenisation between the whole and its components. Moreover, it is associated with the degree of impermeability of the assemblage. This is to say that the assemblage as a whole should look like a single entity, but in which the identity of its components is visible. Taking as an example, the human body, as a whole, is a unique entity; however, the single organs maintain their identity independently from each other. This is because assemblages have relations of exteriority. Relations of exteriority open to the possibility of aggregating new components; however, by doing this, the properties of the whole are not to be changed, or better, the whole still should be a unique entity. Returning to the human body's example, what would happen if a new organ is introduced inside the system? What would happen if, inside the assemblage of the human body, a photophore organ used for bioluminescent properties by certain fish is introduced in the human body? Would the body, as a whole, still be consistent, coherent, and homogeneous, or would the assemblage be disrupted?

Applying such views to the notion of intelligence, the parameter of territorialisation deals with trade-off questions; therefore, it asks if, by introducing new entities or contracting/expanding the assemblage boundaries, the whole can produce intelligent consequences explained by the three variables discussed below.

The second parameter that was discussed is coding. Coding refers to the material expression of the assemblage as a whole. To intuitively understand, as an example, languages were given. Besides the heterogeneity of its components, languages give a continuum of the

expression of identity of the components of the same linguistic community. Therefore, besides the external relations that aggregate the assemblages, coding has an internal nature. Concerning the new materialist understanding of intelligence, the coding parameter refers to the information within the assemblage that produces consequences.

Information is everywhere; arguably, the universe is made of information (Solms, 2022). The continuum passage from one second to the next is a continuous information flow. If this is not the case, the becoming could not unfold. True is that on the quantum scale, time works differently, and modern physics still needs a fully comprehensive understanding of it (Giovanetti et al., 2015). Nevertheless, at the scale in which time is experienced, the universe is a continuum flow of information that connects the past to the present and the present to the future. However, systems, as assemblages, can embody specific types of information circumscribed to their locality. For example, considering language as a coding parameter, where just the members of the same linguistic community can decode the message. Therefore, information can be seen as a coding parameter. Thus, when viewing the material notion of intelligence, information is the coding parameter, referring to codes and signals that make the individual assemblages operate, thus, putting into communication the heterogeneous entities with each other. The materiality and the content of the information differ from assemblage to assemblage. However, the function of communication between the heterogeneous entities towards the production of consequences stays consistent as coding expression.

Once again, let us consider the human body as an intuitive example. Every organ is a single entity; if the same working condition is reproduced outside the body, the organ will continue to function. Nevertheless, the body as a whole ceases to exist. Thus, the coding parameter that expresses the identity of wholeness in the individual organ is the continuous sharing of information that produces, as a consequence, the functioning body.

Material Intelligence and Productive Consequences

Having explained how the two parameters of assemblage theory are interpreted inside the material intelligence concept, let us continue by explaining the proposed interpretation. We have discussed the ontology of intelligence; now, let us see what consequences mean. Chapter Two argued that focusing on consequences rather than intentions is essential because it separates things, breaks down action hierarchies, and shows that every interaction matters to the bigger whole. Such a perspective is essential if we aim to give a new interpretation of

intelligence based on the interaction of heterogenous entangled entities. Therefore, let us ask: How are these consequences?

Consequences follow the ontological characteristic of assemblage theory; thus, they are contingent, immanent, historical, and individual. Contingent and immanent are connected to the diagram, the space of possibility of the virtual and the actual, because they are “here” and “now”. Thus, contingent and immanent emphasise the connectivity and continuity of the assemblage; moreover, they open the possibility to change. Therefore, contingent and immanent underline the importance of interactions, meaning that the interaction of heterogenous elements produces consequences; however, these interactions might actualise as they might not. The dependency between interaction and consequences as a produced phenomenon opens the view that interactions are not given but produced as well; thus, every interaction matters to the production of the consequence; moreover, it shows the individuation process for each consequence. This means that every time consequences are open to variation, however within the production process, variation passes through the parameters of territorialisation and coding; thus, in the field of velocity and slowness, they might result invisible to human experience, and for this, we are tended to say that some consequences are “the same”. In other words, material intelligence takes place at different *speeds*.

Nevertheless, the ontology does not change; consequences are always produced; thus, there is a historical moment of creation and openness toward extinction. Such a view is compatible with Barad’s description of generative matter, where the entangled intra-activity of the matter is a productive process toward the phenomena. Thus, as consequences are produced by the distributed agency of the interaction within the assemblage, phenomena are the consequences of the production of intra-activity. There is no such reason that suggests that such interactions are transcendent and given, thus making them immanent and transcendent. Moreover, the interactions’ interconnectivity is constitutive in actualising the consequences. Consequences are individual processes since every process produces a degree of difference. Nevertheless, the degree of variation given by heterogeneous interaction of the composed is not meant to affect the assemblage as a whole in its production processes. As we have shown, this is reflected by the parameters of territorialisation and coding.

At this point, we have described the ontological structure of intelligence under the form of assemblage, and we said that from a new materialistic understanding of the concept, the area of focus is the productive consequences of the assemblage in terms of individuation, meaning that every consequence difference between each other. Thus, intelligence emerges from an

assemblage, and it can be understood by viewing what the assemblage does. However, the evaluation has to be done after the productive processes have concluded because, in this way, every interaction reveals its importance. Moreover, individuation entails the incompatibility of comparison, meaning that every consequence is contextual-dependent to immanence and contingency because the interaction and historical origins are different between each process. Thus, this shows that material intelligence focuses on differences rather than similarities.

Material Intelligence and the Three Modes of Thinking

Having examined the ontology of intelligence, and the meaning of consequences in such a context, it is now the time to describe what is meant by reproducible adaptive variation. The three terms refer to the three modes of thinking where reproducible is related to intensive thinking, adaptive to topological thinking, and variation to population thinking. To conceptualise material intelligence, I consider the three modes of thinking as necessary variables. Thus, the consequences of an assemblage in its distributed agency need to consider the variables allowed by the exterior relations.

Before discussing the implications of the three variables, I introduce an example to show how they apply to an assemblage. Let us consider one more time a flock of birds; intensive thinking refers to the energy that the flock of birds needs to function distributed throughout the assemblage; topological thinking refers to the tendencies and configurations that the flocks have, for instance as movements and dispositions; and population thinking refers to the single entities, their differences, and identities. Therefore, reproducible refers to the quantity of energy needed to sustain the flock of birds in its consequences; adaptive refers to all the possible movements and configurations that the assemblage can take without changing the consequences; and variation refers to the continuous production of consequences by substituting an entity with one that shares similar identity.

a) Material Intelligence and Intensive Thinking

We saw that intensive thinking is thinking about productive differences and exploring energy's role with an assemblage. Energy is essential as it is the fuel that makes the process. Therefore, considering intelligence as a particular type of productive process, exploring the role of energy in such interpretation is mandatory. In the most direct sense, reproductive means if the assemblage can reproduce the productive processes of its consequences. Thus, associating this view with the moment of extinction links it to individuation. Reproductive is central for distinguishing between arbitrary events and assemblages with emerging causal

properties. In other words, if the assemblage cannot reproduce the consequences, thus the productive consequences drive the assemblage to extinction. Such an assemblage would not meet the interpretation of material intelligence.

Energy reproducibility is vital for the existence of the assemblage. Let us, for example, think of ecosystems or nuclear processes inside stars. Even considering their big difference, both assemblages need to be energetically sustainable as a whole to continue their productive consequences. True is that both ecosystems and stars arrive at moments of extinction. The cause of such extinction might be multiple, and indeed one could be the end of energetic levels given by internal changes. In stars, this is represented by the end of combustible material due to the creation of too heavy elements in the nucleus, whereas in ecosystems might be a deficit in calorie equilibrium between the different heterogeneous components that creates a disequilibrium in the reproductive ratio between its members.

Nevertheless, the opening towards the possibility of extinction does not make the systems not intelligent from an intensive thinking perspective. The factors that lead to energetic disequilibrium and related extinction are multiple and contingent on a single assemblage. Therefore, more than focusing on the intensive aspects of the assemblage is required to create valid reasons for judging an assemblage as intelligent or not. However, it is an indication: How can an assemblage be intelligent if incapable of reproducing its consequences?

Therefore, we see that the importance of thinking in terms of the intensity of the reproducibility of assemblages' consequences is necessary but not sufficient for the concept of intelligence from a new materialist view. Such necessity is justified by drawing the difference between arbitrary events and emerging processes; further, productive consequences are to be repeatable to be associated with the ontological status of assemblage. To conclude, intelligent assemblages operate towards energetic continuation, thus driving them away from extinction.

b) Material Intelligence and Topological Thinking

The second term, adaptive, refers to topological thinking. As we saw, topological thinking focuses on the tendencies of assemblages. Thus, adaptability is about the becoming of assemblage, linking it to the different configurations of relations that produce consequences.

For applying topological thinking to intelligence under new materialist views, what is essential is to understand the relationship between becoming and consequences. Arguably, becoming equals consequences, in the sense that the becoming constituted by the productive processes of the assemblage leads to its consequences. Thus, becoming can be substituted by

the productive process in the previous relation; therefore, a productive process equals productive consequences. In the view that I am presenting, productive processes result from the interaction of the heterogeneous elements of the assemblage. As we saw, in the assemblages' characteristics, there are multiple ways to arrive at consequences. The multiplicity is given by the internal configurations of its relations. In other words, following the productive processes, there are multiple ways to arrive at the consequences.

The multiple ways processes interact and produce are compatible with the idea of the diagram that was previously discussed. Therefore, to be closer to assemblages' terminology, we can refer to the becoming, the multiple ways of producing, as the degree of freedom of an assemblage to produce consequences. Looking at the starting point of the section, considering the relations enfolding into consequences is vital to apply topological thinking to intelligence. Taking this into consideration, from what was said, it follows that the degree of freedom of an assemblage must be consistent with the productive consequences of the assemblage to view the assemblage as intelligence. Moreover, applying topological views, consequences can be translated as the tendencies of an assemblage. This is allowed because viewing consequences as reproducible (as discussed by applying intensive thinking) means that consequences of assemblages in relation to the concept of intelligence are the general inclination of what the assemblage produces as a whole.

Let us give a simple example of intelligence as a process to make the above visually more concrete. Consider the assemblage that gives as a consequence the cutting of bread. The heterogeneous entities, by interacting, produce consequences (i.e., the knife, the bread, the human, the surface of cutting, the air that sustains life, the metabolic processes, the atomic disposition of the materials, the light that directs the action) in which we can see that the adaptability, that is the degree of freedom of the assemblage, refers to all the possible configurations that the relations can assume. However, all these configurations of relations give (if effective) a productive consequence, as a tendency, the cutting of the bread. Therefore, by combing this example and the above, we can state that from a topological perspective, intelligence is the degree of freedom of an assemblage as a whole that must result in the overall reproductive tendencies of the assemblage. Such a view considers the individuation of each process by linking them with the overall consequences of the whole. Thus, topological thinking can be viewed as the coherence between the adaptation between single interactions and what the whole produces.

c) Material Intelligence and Population Thinking

The last term we need to explore is variation, which is connected to population thinking. Recall that assemblages were defined as a population of heterogeneous individuals, different entities with different properties that come together.

These heterogeneous elements are connected within the assemblage by relations of exteriority, meaning that the elements maintain their identity. This allows for independence of the components towards the assemblage as a whole and the assemblage to substitute the single heterogeneous components. Hence, variation concerning the understanding of intelligence this text offers refers to substituting individual heterogeneous components with new ones by maintaining productive consequences. Drawing from the previous example of cutting the bread, for viewing the assemblage under the concept of intelligence, does not matter if the subject cutting the bread is me, my neighbour, Julius Caesar, or a robot coming from Andromeda, as it is not essential is what is cutting the bread is paring knife, a knife for meat, or a sword, same goes for the type of bread, or the surface on which the action is taking place. What is important is how all these entities are related to produce the consequences as a whole. True, depending on individual characteristics and the specific relationship that such characteristics would create, some components would support cutting better than others; however, this would not make the assemblage invalid. Thus, by maintaining the productive consequence as a tendency of the assemblage, the single individual components do not matter. Therefore, it is not the entity that matters but the degree to which the assemblage can respond to the variation of the entities by not changing the emerging properties of the whole in the productive process. Such an understanding emphasises the interchangeability of the components inside the assemblage and further shows the connection between consequences and the two parameters.

Assemblages are contingent, historical, and immanent. Further, this view makes intelligence contextual; it cannot be used hierarchically. This is because different productive consequences cannot be compared as the energy, the degrees of freedom, and the single components are different for every assemblage resulting in different consequences. Making an example does not make sense what is more “intelligent” between the assemblage that, as a consequence, produces the migration of a flock of birds directed towards the southern hemisphere or the one that gives, as a consequence, the cutting of bread, or the assemblage that produces the winning of the world cup of football. Every assemblage produces different consequences making them incomparable. One might argue that such examples are trivial, as the difference between the assemblages is too big in its characteristics or identity to make

them comparable, and one has to look at the same type of assemblage to make the comparison. This objection has a significant problem; the argument is framed under a typological understanding. It would pose the incomparability of the argument that there are differences between being a flock of birds or a football team, as there is a stereotypical model connected to the flock of birds and the football team; thus, going back to essentialist approaches. Through this thesis, I have already argued against essentialistic views; I do not think I further need to respond to this critique. The central point is that entities and processes emerge from historical, contingent relations that may not conform to human concepts. Instead, our concepts should acknowledge the dynamic entanglement of reality if we aim to create narratives that account for the agency of non-human entities. Thus, rather than considering the single entity, what is important is the relations and configuration between entities, all elements that exist in the immanence of the material world.

Once again, this shows that individuation is crucial, as it determines the conditions of an assemblage and its components. Thus even by comparing assemblages that have similarities under a common understanding, the examples are still valid because although they share characteristics, differences still show the uniqueness of each assemblage. As the productive consequences of an amateur football club differ from a professional one, given the differences in their heterogeneous components, the productive consequences are contextual to each assemblage. Moreover, by comparing the two, what is created is a transcendent consequence, that is, the idea of intelligence reflected in a particular standard or quality of the game, but this goes back to the issues of typology thinking; it does not reflect the individuation process of each assemblage, does not take into account the heterogeneous reality of the material components. Once again, such a view is incompatible from a new materialistic perspective and similar to the IQ test; it opens a politics of exclusion that is not in line with the current context of the Anthropocene.

Conclusion

To summarise, this chapter opened by introducing Delanda's assemblage theory. The description took space, but it was needed to clarify the theoretical and mechanistic aspects, together with the relevance of this theory for the thesis's aim. In brief, assemblage theory can view the world as a population of emergent wholes composed of heterogeneous elements that relate to producing material consequences. In the second section, the text discussed the three modes of thinking. These are important as they provide ways to read and understand

assemblages. Respectively, the three modes of thinking are population, intensive, and topological.

To conclude the chapter, section three applies what was said to build an understanding of intelligence from a new materialist perspective. This was done using the considerations drawn from agential realism and assemblage theory. Thus, we have concluded that material intelligence can be understood as the consequences of a whole in terms of reproducible adaptive variations. This is a shift in the interpretation of the concept of intelligence because opposed to the psychological view that understood intelligence as property, the material interpretation sees it as a process.

Further, viewing intelligence as a particular type of assemblage, we acknowledge the agency of all the different entities that participate in the production of consequences. Such understanding aligns with a narrative that considers the multiplicity of reality, thus promoting a non-human-centre interpretation of the term in which every entity is entangled with the Other. Therefore, in line with a new conceptual landscape attempting to answer the complexity of the Anthropocene.

Conclusion

With this thesis, I wanted to suggest a new interpretation of intelligence that is not human-centred. I adopted an approach that viewed intelligence under material aspects, and by doing so, it suggested an interpretation that criticised the anthropocentric fallacy and the underlined hierarchy. We started the thesis by contextualising and offering spatio-temporal coordinates for the discussion. Today we live in the Anthropocene, an era deeply influenced by the domination of human activity over the planet. This is problematic because the historical process that produced the Anthropocene did not take into consideration the Earth as a reactive system with its own agency, thus resulting in the disruption of Earth's systems leading to climate change, the disruption of ecosystems, the exploitation of the planet, and many others. We have emphasised the importance that narratives played in producing such consequences. Narratives are essential not only because they shape and bond humans on a collective level but also for the moral values that are embedded within them. Thus, narratives collectively shape how humans should relate to the environment. The claim is that the Anthropocene arises from a narrative highlighting human superiority, constructing reality from a human-centric perspective and justifying human domination over the environment. Recognising that narratives are intricately intertwined with concepts is vital, shaping our understanding and engagement with the world. In this context, I align with Donna Haraway's viewpoint that we have to criticise the origins and foundations of our thinking (Haraway, 2016). Within these narratives, intelligence assumes a central role as being one feature that distinguishes humans from other entities.

The thesis's main assumption is that the concept of intelligence is part of the narrative that led to the Anthropocene because of the justification of human uniqueness; therefore, the main question that we have explored is how to understand intelligence from a non-human perspective, thus, taking into account the current historical period. I used New Materialist perspectives as the primary approach. The choice was motivated by the movement's emphasis on non-human entities and the central role that matter as a reactive entity plays in the theories.

I used agential realism and assemblage theory as the two main working frameworks throughout the thesis. From the combination of the two, it was possible to offer an interpretation of intelligence, defining it as the productive consequences of a whole in terms of reproducible adaptive variations. Such a definition can answer the main research question because viewing intelligence as a process rather than a property moves the narrative away from a human-centred understanding. In contrast, it takes into account the complexity and

entanglement of reality, thus providing a non-hierarchical narrative where every element contributes to the emergence of intelligence through interaction.

To arrive at this conclusion, we took three main steps, each represented by a chapter that answered a sub-question.

The first sub-question asked how intelligence is understood today and its history. We found that the history of intelligence is closely connected to the one of psychology; thus, we named today interpretation the psychological view of intelligence. Moreover, we found that the history of intelligence is strictly embedded within the historical and political context of the end of the 19th century and the beginning of the 20th. Nevertheless, the main finding of the chapter was to go behind the concept and find the hidden assumptions, namely intelligence as a fixed property, human-centred agency, and that it assumes intentionality.

The second sub-question asked how to think of intelligence differently from the psychological interpretation. To answer the question, I adopted Barad's agential realism that allowed us to engage with the material entanglement of reality, thus, putting the basis of viewing intelligence not as a property but as a process. The chapter showed three main aspects: (i) In order to understand intelligence as a process, we need to adopt narratives that start from the consequences of phenomena and go back by tracing the distributions of interactions; (ii) ideas and practices are connected on a material level, showing how discourses and meaning are produced, and this is the case with the notion of intelligence; (iii) there is a connection between agency and morality that affects the psychological view, thus, problematising the narrative of intelligence in the Anthropocene.

To conclude, Chapter Three poses the sub-question of how a material interpretation of intelligence should look. I used Delanda's assemblage theory to answer the question because, contrary to agential realism, it systematises the internal material relations of emerging systems. The conclusion presented by the chapter is also the answer that the thesis provides. Therefore, material intelligence presents a narrative where intelligence is looked at retroactively as the consequences produced by emerging processes of a whole and is composed of three variables, respectively: reproducibility, adaptability, and variations.

As I see it, the implications of this conclusion are the following. First, the material notion of intelligence that I introduce moves away from the anthropocentric fallacy, and rather than considering intelligence as a property based on humans' features, it takes into account aspects that are part of the material world, thus including humans and non-humans. Second, it shows that the relationship between agency and intelligence deserves more attention because of the political narratives that lead to the Anthropocene. The thesis showed that the notion of

agency in the psychological view of intelligence referred to cognitive agency; nevertheless, intelligence in the political narrative interpreted agency as moral. Therefore, showing how agency in the psychological view justifies human uniqueness. Contrary, the proposed material notion argues for a distributed view of agency; thus, all the entities that take part in the intelligence process are equally important, therefore, advocating for a non-hierarchical narrative of the concept. Third, material intelligence focuses on the relations between entities and what these relations produce rather than on cognitive capabilities and properties as the psychological view. I believe this is the most crucial implication because it suggests the opening for new perspectives and discussions around intelligence.

These implications are fascinating; nevertheless, the work is just a sketch of a more significant project. Therefore, limitations and space for further research are present. Here I present five possible directions to expand the work; each tackles one limitation.

As mentioned, the thesis assumes a correlation between cognitive agency and moral agency, forming a crucial link between human-centred agency and narratives of the Anthropocene. While Chapter Two delves into this relationship, its current state needs a solid foundation. Therefore, the primary suggestion is to elaborate extensively on the connection between these two types of agencies to strengthen the thesis.

Second, in the thesis, I provide a definition and systematic interpretation of material intelligence. Nevertheless, only a little is said about the conditions of applications. A possible way to expand on this is to explore the notion of operationalisation (Bridgman, 1927) as understood in the philosophy of measurements. Simply put, operationalisation means that we only know the meaning of a concept if we have a method of measuring it (Chang, 2019). This suggestion may contradict the work proposed by the thesis, given my strong criticism against the IQ test.

Nevertheless, my critique was not about measuring but how and what to measure. The concept of operationalisation is based on two assumptions: the first is that concepts, to stay valid, need to extend beyond the domain defined initially; the second is that concepts cannot be treated simply with phenomena, as there is not a direct relationship between the two. These two assumptions show a possible preliminary connection between material intelligence and operationalisation. Therefore, operationalisation might be a helpful methodological principle for inquiring about the condition of applying material intelligence and the relationship between its variables and parameters.

A third limitation is the role of information in the material notion of intelligence. We have argued that information plays the role of coding parameter in the assemblage; nevertheless,

we did not expand on understanding and defining information due to limited space. Therefore, the suggestion for further research is to explore how Shannon's (1948) information theory can play a role in material intelligence. Shannon's notion explores the process between the sending and reception of the information to entropy which is the uncertainty present in the process. As Piccinini and Scarantino (2010) notice, Shannon's view of information does not assume semantic connotations but rather is interested in the only transmission of the digital or analogue signal.

It needs to be clarified if information as a coding parameter in the assemblage needs to include a semantic or non-semantic understanding or the implications of both options. Therefore, to open a discussion around information as the coding parameter in intelligence, Shannon's information theory is a possible point of departure.

The fourth limitation regards the variable of reproducibility. As stated, reproducibility is about the energy and entropic levels within the assemblage, making the process possible to reproduce. Therefore, to expand on this point, a possible path can be to explore the application of the free energy principle (Friston, 2013) in the material notion of intelligence. As several authors stated (Seth, 2021; Friston, 2013; Solms, 2022), the free energy principle might be more related to the notion of life and consciousness rather than intelligence. This is because the idea behind it is that all self-organising systems have the fundamental task of keeping existing, thus connecting the principle to homeostasis and trade-off between entropic levels. Nevertheless, the free energy principle might show exciting aspects of the reproducible variable in material intelligence.

Fifth, my critique of intelligence was towards the psychological interpretation; nevertheless, in my historical analysis, I do not say much about research in intelligence in other fields, such as physiology and brain science. Therefore, a possible suggestion to expand the historical critique and the related narratives is to explore the connection between my notion of material intelligence and Malabou's (2019) notion of morphic intelligence. Malabou's narrative of intelligence reviews the historical framework and development of paradigms such as epigenetic and neural plasticity, together with the idea of replication in the artificial application of the notion. Therefore, by integrating Malabou's views, a more accurate description of the historical research agenda of intelligence can be delivered, thus better understanding the related narratives.

My hope is that the work present in this thesis will continue together with the development of the material notion of intelligence. I see this thesis as the starting point for engaging in the new geo-social questions, where a discussion is open around human concepts by taking into

account and acknowledging the complexity of reality, offering a Copernican revolution to our moral framework that aligns with the challenges of the Anthropocene.

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