Del Rio, Aurora

Archetypes and the Dream of the Radioactive Nucleus: Artistic Research on Belief and Contamination

Published in:
Politics of the Machines: Lifelikeness & beyond, Aachen 2024 (POM 2024) proceedings

DOI:
10.14236/ewic/POM24.22

Published: 01/09/2025

Document Version
Publisher's PDF, also known as Version of record

http://dx.doi.org/10.14236/ewic/POM24.22

Archetypes and the Dream of the Radioactive Nucleus: Artistic Research on Belief and Contamination

Aurora Del Rio
Aalto University
Vaasankatu 15, 00500 Helsinki
aurora.delrio@aalto.fi

This paper explores the concept of archetype in relation to the author's artistic research, which engages with "myth" and "dream" as an expression of archetypal content. The notion of the archetype is followed as it has developed from the dialogue between psychiatrist Carl G. Jung and physicist Wolfgang Pauli, a pioneer of quantum physics, with an interest in the conjoined intention to find a new conception of reality that could overcome the boundaries between physics and philosophy. The archetype is further analysed within the context of 'Nuclear Natures'; the term is introduced following Professor Anna Storm (2018) to describe how nature, as imaginary, entangles with human-created radioactive contaminants.

Finally, the paper elaborates on the concept of archetype in artistic research, as seen through the lens of new materialism; the author considers that new materialist philosophies follow a path opened by Pauli in acknowledging that something has been lost in the understanding of matter. In a time of ecological crisis this can become relevant: a shift in understanding may relate to different actions regarding human-created contaminants. The authors' artistic research, in particular, aims to reflect on how an embodied understanding of radioactive contamination can open up societal questions on the nature of reality and the boundaries of human knowledge.

Keywords: archetype, artistic research, belief, radioactive agency, radioactive contamination

1. INTRODUCTION: THE ARCHETYPE

This article addresses specific kinds of interaction between belief and contamination through the concept of archetype, and in artistic research. The author uses the word "belief" to define how implicit theoretical stands, or worldviews, guide human actions with a tendency to remain unquestioned. Another way of defining belief is through the notion of paradigm, which describes a set of basic concepts that underlie ways of thinking. Following analytical psychology, the concept of archetype is used in this research with the hypothesis that it stays at the core of myths and symbols, which are entangled with belief systems. When applied to radioactive contamination, the question of whether the concept of archetype could be related to it may not immediately appear as relevant. However, in this research archetypes are looked at, together with belief, as part of the experience of reality with the hypothesis that archetypes may function as ordering factors or underlying structures of reality production and of learning processes, the activation of which may occur at different levels of human understanding. The archetype is thus seen as both a generator of mythical and symbolic content, as well as a metaphor for a conception of a unified reality; in this context, human understanding becomes particularly relevant when considering radioactive contamination.

In everyday use, the term archetype represents a model or a reference: Neoplatonic philosophers such as Plotinus used 'archetype' to refer to a first form, an original pattern from which copies are made (Plotinus, 1991, p.406). A mention of the term also appears in the Corpus Hermeticum, a collection of Greek writings that were originally attributed to the mythical figure of Hermes Trismegistus. In this context, God as a cause principle is called 'Archetypal Light', or 'the Archetype of the Soul' (n.d., 2001, p.32). Before the 17th century a separate boundary between the disciplines of science and religion had not yet emerged; the idea of archetype as a model, even in mathematics, was

a way to understand the unfolding of recurring patterns in the natural world: a transcendent generating cause of reality, also represented through the name of God. To understand the laws of the universe was, therefore, a way of understanding a theological and philosophical cause-principle.

A moment of transition or paradigm shift from this worldview saw its beginning, according to physicist Wolfgang Pauli, in the turn from the sixteenth to the seventeenth century. Specifically, the dispute between astronomer and mathematician Johannes Kepler, recognised as the father of modern science, and mathematician and physician-alchemist Robert Fludd, represents this turn (Pauli, 1994, pp.222–223). The dispute regarded Kepler's mathematical observations, which represent the emerging new scientific method, in contrast to the old alchemical tradition defended by Fludd. However, Pauli highlights how a complete separation between what is today considered science and the so-called nonscientific theories was, at the time, not yet clearly defined. Instead, the two positions were based on two different belief systems that contained both rational and non-rational elements: Fludd's alchemical theories sought empirical evidence through experiments with the invented weather glass, a precursor of the modern barometer, used for measuring atmospheric pressure; on the other hand Kepler believed that the universe embodied divine principles: his research was based on the Christian doctrine of the Trinity and presented religious meditations as a foreground to scientific observations (Pauli, 1994, pp. 253–257).

Kepler used the term 'archetypus' to describe geometry as a model. Interested in the concept of the archetype, Wolfgang Pauli engaged in a year-long discussion with psychiatrist Carl G. Jung, who was developing his own understanding of this term in relation to his theory of a collective consciousness.[1] In developing this theory, Jung considers archetypes as repeating patterns potentially shared by all of humanity. However, Jung's definition has been controversial from the beginning: especially during the last decades, an intense debate in the field of analytical psychology has concerned what was exactly intended for archetypes, and whether proof of their existence could be found through the new scientific discoveries that occurred since this theorisation was formulated (Hogenson, 2019, p.682). The most contested points are their universality and possible transmission through genetics. According to psychologist Christian Roesler, even though Jung's definition appears inconsistent, its coherent use in analytical psychology considers archetypes as 'universal patterns producing meaning and guiding development' (Roesler, 2012, p.224). Roesler, following Knox, identified how four different conceptualisations of the archetype keep emerging in the debate: archetypes as a 'biological concept', as an 'empirical or statistical definition', as a 'cultural approach', or as a 'transcendental concept' (Roesler, 2012, pp.226–228).

The author's artistic research looks at myths and beliefs in relation to the concept of archetype, focusing on how the archetype relates to belief systems as a foreground for human-created radioactive contamination. In other words: how systems of belief, rendered manifest through myths, open up possibilities for different conceptions of reality to emerge. With this intent, this research specifically looks at two different directions of this debate: on the one side the biological conception of the archetype, and on the other side the transcendental one which is elaborated on the following section.

2. BIOLOGICAL OR TRANSCENDENTAL CONCEPT?

The biological conception of the archetype seeks an explanation for archetypal metaphors in human genetics, or biology. According to psychiatrist Erik Goodwyn, while Jung's definition was still based on the Cartesian assumption that thinking is disembodied, cognition must always be considered embodied, as no thinking can occur outside bodily boundaries. An archetypal image is, for Goodwyn, a complex embodied metaphor that thus requires the biological dimension: the body (Goodwyn, 2024, p.428). The universality of the archetype is to be understood as the universality of a shared embodied human experience. Archetypes represent, therefore, metaphorical embodiments of situations that are typical for the human species:

> An archetypal image is not something which can be "found", but rather is a phenomenological description of a particular sort of lived experience. Thus, the question is not so much a reifying "does it exist?" but rather, [...] Do at least some of our spontaneous thoughts qualify as innately constrained symbolic embodiments of species-typical situations? (Goodwyn, 2024, p.416)

For Goodwyn, therefore, primary metaphors, or rather the cognitive structures that allow for the metaphor to be created, are shared because of human physiology: they are innate because they originate through the human body. In considering, for instance, darkness and light as physical experiences that produce archetypal metaphors, darkness, and whatever symbol relates to it, such as the forest, the night, etc., is associated with fear because human sight is weak at night; perception of light takes on the opposite value. Archetypes, thus intended as embodied metaphors, generate symbols and myths as a response. An archetype is, therefore, a model in the sense that it shapes a process; it structures and organises symbolic images that find resonances across different

expressions. Dreams, mythical production, and archetypal images (not the archetypes but the images that stem from them) are, therefore, to be considered spontaneous responses to life; their function is that of reorganising reflections.

When considering the archetype as a model for understanding, such a process produces an experience that is linked to something ungraspable. This experience can be perceived as transcendental or overwhelming, which Jung referred to as a 'numinous' quality of archetypes.[2] Goodwyn explains this experience as stemming from the metaphorical character of the archetypes, considering the 'ineffable core of meaning' that is common to all metaphors (Goodwyn, 2024, p.420).

Goodwyn's definition of how a specific correspondence between an experience of the archetypes as metaphors and the perceived bodily boundaries relates to mythical production is valuable; however, it does not fully explain the transcendental quality of the experience of archetypes. Specifically, this research considers that the relation of the archetype to phenomena that transcend current scientific and logical explanations, such as Jung's theory of synchronicity, is not fully addressed by Goodwyn's biological perspective.

The theory of synchronicity was developed along with Jung's research on the concept of archetype, which was carried out in a dialogue with physicist Wolfgang Pauli from 1932 to 1958. Because Pauli was a pioneer of quantum theory, his contribution sought to ground the theory in this emerging field. Pauli was also known for the so-called 'Pauli Effect': his mere presence in a laboratory would cause the sudden break or malfunction of technical equipment. This uncommon circumstance, inexplicable through the laws of physics, has been one of the reasons that sparked Pauli's interest in Jung's research on exceptional experiences. In Pauli and Jung's conception of it, synchronicity refers to particular correspondences between phenomena with a shared underlying significance, or quality: phenomena that would otherwise be labelled as "chance". Psychologist Suzanne Gieser highlights how for Jung, who reported having experienced premonitory dreams and strong intuitions, the word 'chance' is commonly used to 'fill in gaps in our knowledge'; in other words, when no other explanation is found (Gieser, 2005, p.275).

However, synchronistic phenomena are not synchronic, in the sense that they do not necessarily happen at the same time. 'Synchronicity' in Pauli and Jung's use of the term refers to how the experience of a specific meaning, or content, of different occurrences overlaps at a given moment in time, in a meaningful way for an observer, without these occurrences presenting an apparent causal connection (Jung, 1973, p.25).

Since the discovery of radioactivity in 1896, researchers have reached the boundaries of the previously universal Newtonian laws of physics when looking at the subatomic level. In particular, the law of causality that characterises classical physics turned out to be unable to define quantum physics, or the behaviour of matter at the microscopic level. Quantum theory was developed to describe such a behaviour. A type of interrelation between elements where a causal connection, or an origin, is not given is represented by the principle of 'acausality' (Jung, 1973, p.8). Quantum theory is indeed characterised by acausal correlations, or correlations unrelated to an identifiable causal or generating principle.

Einstein had famously regarded this newly emerging theory as incomplete, for not covering all aspects of reality. Aware of this limitation, Pauli and Jung discussed the necessity of finding an encompassing theory that could explain macroscopic phenomena as informed by the microscopic level. Such a theory shall function as a bridge between psychological and physical aspects of reality, which they recognise as deeply interlinked. Their study of synchronicity and the transcendental aspects of the archetype was an attempt to move in this direction. The theory of synchronicity aimed at explaining how a relation between circumstances based on their meaning was possible, whereas a causal relation is absent or indemonstrable. Jung himself defined these interrelations as having a 'transcendental' nature (Jung, 1973, p.66).

Synchronistic phenomena, as described by Jung, often involve meaning that is partially conveyed through dreams. In particular, content from a dream can overlap with similar content from waking life, creating synchronistic experiences. This process can take the form, for example, of premonitory dreams.[3] The author looks at the aforementioned phenomena through artistic research, and the following is an example of artworks that deal with the same topics.

Artist and anthropologist Susan Hiller has mapped through her artistic work the overlooked and unacknowledged aspects of reality, that what is culturally repressed or misunderstood, including the so-called paranormal phenomena, which, she notices, are constitutive of human experience. Hiller sometimes described her work as 'exploring the unconscious of culture' (Hiller, 2008, p.67).

'Dream Mapping' was a group experiment that Hiller conducted in 1973, with a focus on dreaming: seven people slept together for three nights inside 'fairy rings', or circles formed by mushrooms, that are common in British folk myths. The dreamers discussed and mapped their experiences the next morning and created a composite 'dream map' of the group. Hiller noticed how the dreams gathered shared features.

'Draw together', from 1972, was a series of experiments in telepathic drawing inspired by the ones carried out by writer Upton Sinclair and his wife Mary Craig (Hiller, 2008, p.215). In 'Mental Radio: Does it Work and How?' from 1930 Sinclair documents the 'almost infallible ability of his wife Mary Craig to produce accurate descriptions of what other people were thinking, feeling or experiencing' (Hiller, 2008, p.242). In her project, Hiller would randomly select a cut-out image from a magazine and stare at it while artist friends around the world tried to reproduce the image at the same time, and successively mail the result to her. After one of these sessions, Hiller reported having had an uncanny experience of automatic writing: her hand started to move and write by itself. 'The problem for me was that I didn't have any belief system that would support this kind of experience' (Hiller, 2008, p.215).

These artworks present examples of phenomena that cannot be easily explained. As Hiller reported, there is still no shared 'belief system' to account for occurrences that cannot be explained through classic Newtonian laws of physics. If these laws are, as we have seen, outdated, a more encompassing theory, possibly based on discoveries in the field of quantum physics, is still to become common knowledge.

3. ARCHETYPES OF CONTAMINATION

'Archetypes of contamination' is the title of the author's research, which looks at radioactive contamination through art. This research conceives the archetype as a way of understanding the underlying driving force that stays at the core of various belief systems of a collectively constructed and inhabited reality. Conceived as an organisational pattern according to which reality unfolds, the archetype could be understood as similar to how genetic instructions are carried by DNA, the latter representing a pattern according to which an organism unfolds. Another metaphor that refers to the archetype is that of the Sun as the driving force that produces reality within the solar system. One representation of it can be found in Kepler's writings, where the Sun is compared to God.[4] The myth of the Sun as a deity exists in numerous cultures; however, the chosen metaphors are nothing but signs of something else which remains unnamed, or described only philosophically: the archetype is, first of all, a way of understanding.

Pauli formulated the question 'What is the nature of the bridge between the sense perception and the concepts? All logical thinkers have arrived at the conclusion that pure logic is fundamentally incapable of constructing such a link.' (Pauli, 1994, p.220). The archetype represents, for Pauli, this bridge. As a reorganisational pattern that guide thinking as well as intuition, the archetype overcomes sole logic.

According to scholar Raya A. Jones, for Jung, archetypes relate to human symbolic production, which includes myths, dreams, fairy tales, and art: 'Archetypes [...] give rise to the motifs that are expressed in concrete symbolic productions, such as actual myths' (Jones, 2003, p.623).

The author's artistic research explores various forms of symbolic production, such as myths and dreams, informed by the concept of the archetype, with the aim of fostering an embodied awareness of radioactive contamination through art. The research method uses artistic practices to create an experience in order to provide space for reflections, and possibly a new understanding of the researched phenomena: in specific, a new materialist understanding of radioactive matter. The concept of the archetype is hereby used as a way of looking at something through something else: a phenomenon through a metaphor or a metaphor through another one. The archetype, as a producer of myths and metaphors, is conceived as a central void that acts as a gravitational force to generate or bring together different symbolic forms. The void in itself remains ungraspable, but the symbolic images that revolve around it point to an inner centre. Archetypes are thus considered ordering factors of a continuous reorganisation of collective realities, acting through myths, symbols and beliefs and looked at, in this research, through art.

Understanding the term as a model or reference is not distant from characterising the archetype as an embodied ordering factor or underlying structure of a conceived unified reality, if such a model is placed in the transcendental sphere. The archetype thus becomes what brings together experiences of meaning from different fields, such as physics and psychology. Pauli reported having highly symbolic dreams, in which symbols of nuclear physics entangled with alchemical images. These dreams were interpreted by Jung as symbols of the self. A point that emerged from Pauli and Jung's collaboration was the need to integrate the two domains of physics and psychology into a more holistic conception. Pauli came to understand the whole of modernity as based upon an epistemic split, a sort of dissociative approach towards knowledge. As we have seen, for Pauli, the dispute between Kepler and Fludd marked a paradigm shift: a moment of transition in which the holistic understanding of reality was being put aside in favour of precision. Pauli saw this transition represented by the symbol of the number three, which in Kepler's writing embodied the Christian trinity, substituting the four, which stands for the alchemic doctrine of the four elements. For Pauli, the alchemical doctrine tried to grasp a totality, a holistic conception in which the observer and observed

phenomena represent a fundamental unit; on the other hand, Kepler's trinitarian theory represents, for Pauli, a more precise understanding of single phenomena, representing a different approach to knowledge that emerged along with the development of modern science (Pauli, 1994, p.258).

The described paradigm, unfolding through Kepler's writing and later developing as the principle of observation, representing modern science, was thus based on a separation between an observer and an observed phenomenon, where the observed is deemed as independent from the observer. Even if this worldview is still nowadays represented in common knowledge, remarkably, quantum theory revealed this paradigm as fundamentally faulty (Barad, 2007, p.97). Pauli's philosophical understanding of the emerging field of quantum theory considers how the loss of the previous holistic vision, represented by the alchemical vision of a unified reality, demonstrates that the new technological and scientific advancements had to pay a price to gain precision: a 'quantitative' worldview was lost in favour of the 'qualitative' (Pauli, 1994, p.259). At the time when the collaboration between Pauli and Jung was unfolding, radioactivity had just been discovered (only a few decades earlier), and its application for developing an unprecedented weapon of mass destruction was sought by different countries in the context of the Second World War, which culminated with the dropping of the atomic bomb in 1945. Towards the end of his life, Pauli started to consider the doing of physics as an abuse towards matter:

> Suddenly I had a remarkable *feeling* experience. The observation of microphysics appeared to me to be a kind of *black mass* and I felt remorse. Remorse with regard to matter, which appeared to me to be a maltreated *living thing* (Gieser 2005:323). [5]

From today's perspective, new materialist philosophies move in the same direction of acknowledging what, according to Pauli, has been lost in the understanding of matter. New materialism, with the theorisation of material agency, takes on a philosophical viewpoint that finally re-includes previously unacknowledged agencies.[6]

In a time of ecological crisis, characterised by human-initiated processes that extend beyond a human life's temporality, such as climate change and radioactive contamination, the quest for a holistic vision, represented by the idea of the archetype, can become relevant. What philosopher Timothy Morton described with the term 'hyperobjects' characterises those processes initiated by the impact of humans on the planet, whose magnitude escapes the ability to make sense of them. They are 'not simply mental (or otherwise ideal) constructs, but [...] real entities whose primordial reality is withdrawn from humans' (Morton 2013, p.15). Significantly, Morton highlights the role of art in 'enabling us to cope with hyperobjects' (Morton, 2013, p.171).

Following Morton's definition, this research looks specifically at the 'hyperobject' radioactive contamination, which represents an unprecedented issue to handle for generations to come, for example, concerning the produced waste. The temporalities involved in the decay process of high-level radioactive waste exceed the capability of humankind to predict future scenarios, as this waste is known to remain dangerous to humans for at least the next 100,000 years.

The proposed idea of an entanglement between radioactive contamination, myths and beliefs may seem strange. However, such an entanglement keeps repeating. When radioactivity was discovered, the newly achieved 'transmutation' of one element into another has been repeatedly compared by scientists to alchemical transmutation (Morrisson, 2007, pp.12;105). "Belief" here represents how an already dismissed alchemical worldview was, for a moment, looked at again, as belonging to science. However, the term "belief" can be used to describe any worldview, regardless of whether a specific society considers it true. When considering the issue of finding a way to dispose of radioactive waste, for example, belief comes into question as the underlying assumption that waste can be controlled. The final solution that many countries are currently adopting to dispose of radioactive waste is that of burying the still radioactive material in underground repositories. However, the wish to make nuclear waste disappear into nothing will remain a wish, and information about the related danger may become lost. Unaware future human intruders may harm themselves by digging into the burial site.

An understanding of intergenerational time is not easy to achieve. The possibility of a collapse of the current civilisation, resulting in an interruption in the transmission of knowledge of the site constitutes a real threat. Anthropologist and social archaeologist Rosemary Joyce presented a harsh critique of the use of common-sense assumptions in expert consultants' work for the US Department of Energy in relation to the planning of a storage for the ultimate burial of nuclear waste. Among the quoted research, a proposal by architect Michael Brill was based on the concept of archetypes and presented a design for an 'anti-city', or an architecture that would convey on a visceral level to future human intruders the specific message that the site can pose a physical danger (Joyce, 2020, p.52). For Joyce, similarly to how the archetype debate that followed Jung's concept could not reach a clear outcome, this message will not be clear to future generations.

The author agrees with Joyce in considering that such a use of the concept of archetype in the context of nuclear waste management will fail the task of conveying a univocal message, with the expectation that such a message will be readable through deep time. Furthermore, there are specific pitfalls involved in claiming that the universality of the archetypes may offer a solution to radioactive waste. As an example, Emerita Professor Nicky Gregson (2012) has proposed to consider once more Brill's design plans. Gregson speculatively proposes that a 'ritual gathering: a moment in time to mark radioactivity's absent presence' may be used to transmit transgenerational memory through the 'affective capacities of radioactive waste' (Gregson, 2012, 2018). The problem with this position is that such a solution has been already dismissed as ineffective.

The author's research does not claim to convey a solution regarding radioactive waste management; it proposes, instead, that the concept of archetype may be used today as a representation of a holistic conception of reality, in order to grasp overlooked aspects of human impact on the planet, specifically through its manifestations in beliefs and myths.

As we have seen, for Jung and Pauli, myth is an expression of archetypal content. In its current use, the word myth takes the negative connotation of a false story or belief. However, scholars highlighted precisely the opposite: how a myth is considered a true story by the society that generates it, whereas a myth is a telling of how the universe, or humans, came to be. Such stories are believed to be true at a specific moment in time. [7] Whether one considers a myth as a true or false story, its power over existing beliefs and worldviews remains unquestioned.

The scientific principle of observation, as a modern worldview, can be seen as expressed through the belief in a separation between humans and nature, described by Morton through the negative connotation of a myth:

> Capitalism did away with feudal and prefeudal myths such as the divine hierarchy of classes of people. In so doing, however, it substituted a giant myth of its own: Nature. Nature is precisely the lump that exists prior to the capitalist labor process (Morton, 2013, p.113).

Geographer Max Liboiron further explains how such a "myth" concerns another myth: that of nature's 'assimilative capacity', or the 'theory that environments can handle a specific amount of contaminants before harm occurs' (Liboiron, 2021, pp.39–48). Contamination is thus regarded as the mere presence of a pollutant, whereas pollution is a demonstrable overwhelming presence of contaminants. As a consequence, environments are transformed into 'sites for waste disposal' (Liboiron, 2021, p.40).

In the quoted examples, the concept of "myth" has been used in its current negative understanding of a false story. However, the author's research does not wish to attribute a value judgement to this term, but only to highlight how collective imaginaries are expressed through specific, secular or sacred myths.

Philosopher Kate Soper (2009) has highlighted the various and contrasting definitions of modern conceptions of nature, such as nature as 'otherness', separated from what is human or human-made, which fall into the narrative of what Morton has named the 'myth of nature'. For Soper, an alternative to the existing conception is a definition of nature that acknowledges those processes that are independent of humans, even when initiated by them, and at the same time have the power to act upon human doings: [8]

> This is the 'nature' that cannot be said to be 'ending' whatever we do to planet Earth, since it will persist in its workings even in the midst of nuclear holocaust or destruction by asteroid or solar combustion (Soper, 2009, p.226).

The complex ecosystem revolving around a nuclear power plant, or the scenario of an abandoned nuclear base are both subject to this latter conception of nature: as an entanglement between what is human-made and nature itself as a force or process. This research is informed by the definition of 'Nuclear Natures' following Strom (2018) as a category of environments in which nature as a sheer force interacts with human-created structures and environments. In looking at human imagery represented in beliefs, myths and symbols through the concept of archetype, dreams are looked at as symbolic processes that may guide or inform specific understandings.

Figure 1: *Palkiskuru, Finland, background radiation. Image credits: Aurora Del Rio*

4. DREAM EXPERIMENTS AND THE DREAM OF THE RADIOACTIVE NUCLEUS

> There is a vertical and a horizontal circle, having a common centre. This is the world clock. It is supported by the black bird.
>
> The vertical circle is a blue disc with a white border divided into 4 x 8 = 32 partitions. A pointer rotates upon it.
>
> The horizontal circle consists of four colours. On it stand four little men with pendulums, and round about it is laid the ring that was once dark and is now golden (formerly carried by four children).
>
> The world clock has three rhythms or pulses:
>
> 1. The small pulse: the pointer on the blue vertical disk advances by 1/32.
> 2. The middle pulse: one complete rotation of the pointer. At the same time the horizontal circle advances by 1/32.
> 3. The great pulse: 32 middle pulses are equal to one complete rotation of the golden ring.[9]

In psychology the technique of dream analysis was used to get a glimpse into the unconscious. Starting during therapy but continuing after, Pauli recorded his dreams and offered them for interpretation. After noticing the recurrence of specific images that referred to physical concepts, Pauli became obsessed with understanding the meaning of those symbolic representations of nuclear physics in his dreams. Psychotherapist Suzanne Gieser reports that Pauli noticed how the same symbols appeared in a similar way to scientifically untrained individuals who, through analogical thinking, happened to use terminology from physics to describe something else (Gieser, 2005, p.205). Similar symbolic representations could also be found in old scientific writings, such as those from Kepler. In the unpublished essay 'Modern Examples of Background Physics' Pauli came to the conclusion that what he called the 'abuse' of physical concepts in his dreams could point to a possible archetypal basis of these concepts (Jung and Pauli, 2001, p.179):

> This seems to me today ample proof of the fact that the kind of imagination I call "background physics" is of an archetypal nature (Jung and Pauli, 2001, p.180). [10]

Dreams have been looked at in analytical psychology as a representation of archetypes, however, the practice of deciphering dreams originated long before. In ancient Greece, for example, the cult of Asclepius, dated around the sixth century BC was based on the practice of sleeping in a temple, with the expectation of being visited by Asclepius himself or one of his children, to receive advice through a dream. In case a deity did not directly appear in the dream, a priest would later help the dreamer find an interpretation and prescribe a cure. [11]

The author's 'Dreamwork project' is an experimental project that took place in Kilpisjärvi biological station, Lapland, in September 2023 during the Field Notes artist residency offered by the Finnish Bioart Society. The work was developed as an experiment of a thematic group in connection to a visit to the natural uranium site of Palkiskuru.[12] The author's research interest looks at the 'Nuclear Natures' that emerge from human-created structures apt at conveying and containing radioactivity, and contaminated sites. The site's bedrock in Palkiskuru is naturally radioactive, however, the site has been prospected as a future possible mining location. The idea proposed by the author was to develop a collective dreaming experiment to facilitate an embodied perception of natural radioactivity. The aim was to open reflections, both in the group and in the context of a possible exhibition of the work, on whether an interference between the group's dreams and further elaboration of these dreams may reveal something that was previously unacknowledged regarding human-created contaminants.

Pollution in relation to the production of radioactive energy happens all along the chain of production, starting from the very extraction of uranium from the ore. Currently, Finland is the only country in Europe that still mines uranium. The mining company active in the process, Terrafame, uses an innovative technique to separate uranium from the ore called 'bioleaching'.[13] This technique is considered ecological in relation to other techniques, especially for producing a lower carbon footprint. However, the mining process produces toxic residues that may pollute the groundwater (Bomberg *et al.* 2023, p.12) and require decommissioning after closure (Kaksonen, Lakaniemi and Tuovinen, 2020, p.17).

In preparation for the visit, the group was instructed to attune to radioactivity, specifically focusing on understanding how radioactivity could be thought of in terms of lifelikeness; a possible significant insight was to be found through a dream. The "dreamwork" was to be carried out as a collective sharing and modifying of dream images: the author was interested in generating interference between personal dreams and spontaneous thoughts and associations emerging through collective interaction, with the aim of re-creating a dream as a collective outcome.

The instruction given to achieve this was to interfere with each other's memory of a dream by asking questions about something that had not been narrated by the dreamer, or how some dream element could be or become other things, therefore introducing new images and possibilities into the narration. Dreams should be thus reinvented collectively, transforming dream memories into an entanglement between the dream state, the group's

wake experiences and spontaneous associations, as if in a collective quasi-lucid dreaming. The experiment did not work out as expected: even if agreed in advance, in the moment of sharing, dreamers often opposed the received suggestions to modify their memories, thus interrupting the flow. From the point of view of the author, the experiment failed. However, the author considers failure as a valid outcome, as the potential result of such an experiment may be different from the initial expectations. In this case, some dream images were strangely entangled with places visited the following day. Moreover, during the two weeks spent together, the group developed its particular way of using associative narratives to create wake visions: the dreamwork was happening all along. The final visit to the uranium site brought about a strong emotional response from the group, and the author's memory of it is similar to a transcendental experience: as if a mysterious force was attempting to make contact.

Figure 2: The dreamwork project in Palkiskuru, Finland. Image credits: Aurora Del Rio

5. CONCLUSIONS

This paper has explored the interconnectedness of belief and contamination through an analysis of the concept of archetype in relation to myth and dream, looking at Pauli and Jung's theorisation, and artistic research with an emphasis on a transition from the holistic to the scientific worldview. The archetype represents a possible point of connection or bridge between apparently opposite belief systems. When considering radioactive contamination in the context of 'Nuclear Natures' the 'Pauli-Jung conjecture' becomes relevant: their sought-after bridge between physics and psychology, and not only confined to these disciplines, is still a problem of today. Cross-disciplinary knowledge remains underrepresented, and issues that are evident in one field of knowledge disappear in another. Belief, for example, is barely a matter of science. However, belief constantly interferes with the creation of collective realities. For example, a form of belief can be seen in the Western paradigm that is represented by the (almost) unquestioned faith in the power of technology and scientific progress, which are expected to provide "magical" solutions to the environmental issues they have created. As professor in Human Geography Anna Storm (2020) has pointed out, operations of nuclear decommissioning that are aimed at erasing the traces of nuclear activities often use existing myths or other forms of symbolic representations to act upon collective imaginaries through belief. In such generated collective imaginaries nuclear waste is rendered invisible, and nonhumans appear to be finally taking over the responsibility of humans:

> The nonhuman and the mythological both seem to provide a reliable route into ancient pasts as well as into elusive distant futures, and thus may persist even when we have finally left the nuclear territories (Storm, 2020, p.340).

At the same time, myths and symbolic images take on different forms through art practices. In Hiller's words: 'I believe that art can function as a critique of existing culture, and as a locus where futures not otherwise possible can begin to shape themselves'.

Throughout the author's research, the archetype has taken two complementary conceptualisations: on the one hand, it is considered a producer of belief systems, including mythological production and worldviews. On the other hand, the archetype can be used as a tool for understanding how different narratives may relate to each other. This can be the case of synchronicity occurrences and dream content. The author's artistic research has looked at dreams through a group experiment, considering that dreams could represent entryways to archetypal content. Interestingly, philosopher René Descartes, who is considered the father of rational empiricism and one of the main precursors of the scientific worldview, was inspired by three vivid dreams. Following reflections on the outcome of the dreamwork in Kilpisjärvi, the author repeated the experiment in a different context, in an intensive dream workshop conducted in 2025 at Aalto University, Finland.

In the context of this workshop dreams have been looked at from different theoretical perspectives and disciplines, and through different kinds of experiments with a focus on the production of an artistic outcome; one of these sessions has tackled the dreamwork. This followed no initial focused meditation, but was a test aimed at developing the method itself.

In this context, the author noticed how the dreamwork method finally developed into a collective outcome. The reason for this result was that, in this case, a preliminary moment was dedicated to narrating the dream as it was remembered by the dreamer, and only afterwards the dream was modified by the group. This methodological finding will be elaborated through future experiments.

As a concluding remark, the archetype as an ordering factor, and looked at through art, may remind us of the need to think holistically, since bridging together different aspects of knowledge production can bring about a more encompassing understanding of human-created contamination.

6. REFERENCES

Del Rio, A. (2023–) *Dreamwork project* [Art project].

Barad, K. (2007) *Meeting the universe halfway: Quantum physics and the entanglement of matter and meaning.* London: Duke University Press.

Bomberg, M., Miettinen, A., Hajdu-Rahkama, R., Lakaniemi, A. M., Anacki, W., Witecki, K., Puhakka, J. A., Ineich, T., Slabbert, W., Kinnunen, P. (2023) Indirect in situ bioleaching is an emerging tool for accessing deeply buried metal reserves, but can the process be managed? – A case study of copper leaching at 1 km depth. *Environmental Technology & Innovation.* 32 (103375). 1–16.

Coole, D. and Frost, S. (eds) (2010) *New materialism: Ontology, agency and politics.* London: Duke University Press.

Gieser, S. (2005) *The innermost kernel: depth psychology and quantum physics*. *Wolfgang Pauli's dialogue with C.G. Jung*. Berlin: Springer.

Goodwyn, E. (2024) The Human Body is the Collective Unconscious: Archetypal Images as Innate Embodied Metaphors. *Journal of Analytical Psychology*, 69 (3). 411–433.

Gregson, N. (2012) Projected futures: the political matter of UK higher activity radioactive waste. *Environment and Planning A: Economy and Space,* 44 (8). 2006–2022.

Hiller, S. (1972) *Draw Together* [Postal art project].

Hiller, S. (1973) *Dream Mapping* [Art event].

Hiller, S. (2008) *The provisional texture of reality. Selected talks and texts, 1977-2007.* Edited by Kokoli, A. Zurich: JRP Editions.

Hogenson, G. B. (2019) The controversy around the concept of archetypes. *Journal of Analytical Psychology*, 64(5). 682–700.

Jones, R. A. (2003) Jung's view on myth and post-modern psychology. *Journal of Analytical Psychology*, 48 (5). 619–628.

Joyce, R. A. (2020) *The future of nuclear waste: What art and archaeology can tell us about securing the world's most hazardous material.* New York: Oxford University Press.

Jung, C. J. (1973) *Synchronicity: An acausal connecting principle*. Trans. Hull, R. F. C. Princeton: Princeton University Press.

Jung, C. J. (1958–1995) *The Collected Works of C. J. Jung volume 11 Psychology and Religion: West and East.* Trans. Hull, R.F.C. New York: Bollingen Foundation.

Jung, C. J. and Pauli, W. (2001) *Atom and archetype: The Pauli/Jung Letters 1932-1958.* Trans. Roscoe, D. Princeton: Princeton University Press.

Kaksonen, A. H., Lakaniemi, A. and Tuovinen, O. H. (2020) Acid and ferric sulfate bioleaching of uranium ores: A review #. *Journal of Cleaner Production,* 264, (121586). 1–25.

Liboiron, Max. (2021) *Pollution is colonialism*. London: Duke University Press.

Malinowski, B. (1984) 'The Role of Myth in Life'. In: Dundes, A. (ed), *Sacred Narrative. Readings in the Theory of Myth*. London: University of California Press.

Morrisson, M. S. (2007) *Modern alchemy: Occultism and the emergence of atomic theory.* New York: Oxford University Press.

Morton, T. (2013) Hyperobjects: *Philosophy and ecology after the end of the world*. London: University of Minnesota Press.

N.d. *The corpus hermeticum*. (2001) Trans. Mead, G. R. S. Online: Blackmask.

Pauli, W. (1994) *Writings on physics and philosophy*. Trans. Schlapp, R. Berlin: Springer.

Plotinus. (1991) *The enneads.* London: Penguin.

Roesler, C. (2012) Are archetypes transmitted more by culture than biology? Questions arising from conceptualizations of the archetype. *Journal of Analytical Psychology*, 57 (2). 223–246.

Soper, K. (2009) Unnatural times? The social imaginary and the future of nature. *The Sociological Review*, 57 (2). 222–235.

Storm, A. (2018) Atomic fish: Sublime and non-sublime nuclear nature imaginaries. *Azimuth*, 6 (12). 59–75.

Storm, A. (2020) When we have left the nuclear territories. In: Harrison, R. and Sterling, C. (eds). *Deterritorializing the Future: Heritage in, of and after the Anthropocene*. London: Open Humanities Press.

7. ENDNOTES

[1]Pauli's engagement with archetype theories and his relationship with Jung become known to the wider public thanks to Finnish physicist Kalervo Vihtori Laurikainen who first wrote about the correspondence between Pauli and his colleague Markus Fierz, which is deposited at CERN, contrary to the will of Pauli's wife. Psychologist Suzanne Gieser has successively engaged in extensive research on the figure of Wolfgang Pauli and his relationship with Jung, which culminated in the monograph 'The Innermost Kernel: Depth Psychology and Quantum Physics. Wolfgang Pauli's dialogue with C. G. Jung'.

[2]Jung borrowed the concept of the "numinosum" from Rudolf Otto. The Latin meaning of the word 'numen', 'nod of the head', refers to the animistic ancient Roman idea of a divine force that could operate in inanimate objects and eventually consent to human actions. Eventually, the word took the meaning of 'divine will or power'. https://www.merriam-webster.com/dictionary/numen

[3]Jung presents some examples of synchronicity in relation to dreams (Jung, 1973, pp.22–29).

[4]For Pauli, Kepler's belief on the heliocentric system is of a religious nature, as it stems from the doctrine of the Trinity, where the image of the Sun is compared to that of the God the Father (Pauli, 1994, pp.232–233).

[5]The quote is a translation from Suzanne Gieser of Pauli's letter (postcard) to Aniela Jaffè (1865 from ca.10 August 1954). The original German quote: 'Plötzlich hatte ich ein merkwürdiges *Gefühl*serlebnis. Die "Beobachtung" der Mikrophysik erschien mir wie eine Art schwarzer Messe und ich empfand *Reue.* Reue gegenüber der Materie, die mir dabei wie ein malträtiertes Lebewesen erschien.' In: "Wolfgang PauliWissenschaftlicher Briefwechsel mit Bohr, Einstein, Heisenberg u.a.' Volume IV, Part II: 1953-1954 p. 747

[6]See for ex. Coole, D. and Frost, S. (eds) (2010); Barad, K. (2007).

[7]Mythological stories are '*aetiological* because their purpose is to explain why something exists or happens' (Malinowski, 1984, p.205).

[8]'For there is *one* sense in which nature does always have its say in human activities, and this is the sense in which all our interventions, whether environmental or biological in respect of ourselves or other beings, are dependent on the workings of physical laws and process, and have their outcomes determined by them' (Soper, 2009, p.226).

[9]Pauli's 'Dream of the world clock' as reported in Jung 'Psychology and Religion' (1958–1995, p.66).

[10]Pauli's definition of background physics: 'What I understand by "background physics" is the appearance of quantitative terms and concepts from physics in spontaneous fantasies in a qualitative and figurative—i.e., symbolic—sense' (Jung and Pauli 2001:179).

[11]https://www.britannica.com/topic/dream-sleep-experience/Dreams-as-a-source-of-divination#ref984709

[12]The group was 'TALE: Soft and messy transtemporal explorations', with a focus on different temporalities. The group was facilitated by artist Erich Berger. https://bioartsociety.fi/projects/field-notes-the-north-escaping/posts/the-north-escaping-by-tale

[13]https://www.terrafame.com/offering/our-product-journey.html#:~:text=Air%20is%20blown%20into%20ore,secondary%20heap%20for%20final%20leaching.