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# Radioactive futures of environmental aesthetics

Abstract
*One extreme example of intergenerational environmental change is given by nuclear waste. The radiation from a typical nuclear waste assembly will remain fatal for humans for millennia, creating the problem of communicating a warning about hazardous repositories to people so far in the future that we cannot assume any common ground with them in terms of languages and cultural contexts. This poses limitations to solutions proposed in the context of semiotics. The need for communicating danger and for keeping future people away from certain sites may be tackled from a more sensorial and aesthetic perspective. Given the size of nuclear waste repositories, and the problem of keeping people at a distance, the dimension at which the problem must be tackled is environmental. This work argues for an exploration of what environmental aesthetics, despite and perhaps thanks to all the ongoing definitional and conceptual debates in the discipline, has to offer.*

Keywords
*Environmental aesthetics, Nuclear waste, Semiotics*

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## 1. *Introduction: the problem of nuclear waste*

One extreme example of intergenerational environmental change is given by nuclear waste. The material that comes out as inevitable byproduct of energy production in nuclear power plants or of nuclear weapons production is radioactive and harmful for humans. Such harm is scientifically proven to extend over a time scale that transcends generations and is rather comparable to geological eras. Eventually, radioactive materials decay, that is, they disintegrate to harmless and inert mass, but some of them, like Plutonium-239, have a so-called "half-life" of more than 24,000 years. This means that it takes at least 24,000 years for their radioactivity to reduce to half of its initial value. The danger is proportional to the quantity of nuclear waste to which a human gets exposed. However, even 10 years after removal from a reactor, the radiation dose from a typical nuclear waste assembly is around 20 times the fatal level for humans. Moreover, if nuclear waste gets into groundwater or rivers, it may enter the food chain and, even if indirect exposure entails smaller quantities of radiation, a much larger population could be exposed (USNRC 2019).

This is not meant to be a warning against future use of nuclear materials: whatever will be decided in future energy policies or defense strategies around the world, there is already a nuclear waste problem due to the production of radioactive material in nuclear power plants and in nuclear weapons manufacturing facilities during the 20$^{th}$ century.

There are ongoing projects for the safe storage of nuclear waste, and the one that has been in operation for the longest time so far is the WIPP (Waste Isolation Pilot Plant), located in New Mexico, United States. The WIPP is considered the US's only "deep geologic long-lived" radioactive waste repository. It is located 2,150 feet underground in an ancient salt formation. The location was selected because deep salt beds are geologically stable formations, impermeable, free of fresh flowing water, and salt rock seals all fractures and naturally closes all openings, which makes salt beds "an ideal medium for permanently isolating long-lived radioactive wastes from the environment." The first batch of nuclear waste arrived at WIPP from Los Alamos National Laboratory in 1999 and, according to the site's operators, "sound environmental practices and strict regulations" are required to protect human health and the environment in the years to come (WIPP n.d.).

A nuclear waste repository implies a very particular kind of environmental change: it renders the relevant site life-threatening but since radiation is not perceivable by means of sight, hearing, touch nor smell, the

change is an invisible one, which makes it even more dangerous, and imposes a number of safety issues. Moreover, radioactivity remains life-threatening for tens of thousands of years, which makes the hazards of nuclear wastes permanent, not only from the perspective of a human lifetime, but possibly of humanity itself for as long as it will exist.

This means firstly that the environmental change introduced by such a repository must somehow marked so that people will stay away or at least will not tamper with the repository thus avoiding radiation exposure, and secondly but no less importantly, that such marking must hold for as long as the material keeps being harmful, that is, for tens of thousands of years. Is it possible to provide tens of thousands of years of public warning? If so, what is the best way to achieve such goal?

## 2. *The limits of semiotics*

When framed in the context of semiotics, the issue is about the creation of some sort of warning sign whose meaning should hold for millennia to come (Danesi 2021).

However, in this very particular context of a threat that lasts for such a long time, many fundamental components necessary for a semiotic analysis of the task may fizzle out over the centuries. For instance, will languages stay the same? Communicating danger with textual signs will undoubtedly work for the generations with which we can anticipate a common, or at least similar enough, cultural context. One of the assumptions that the relevant Task Force in the US made in 2015 was that since scholars today are still able to read and understand texts in Old English from 1000 years ago, we can assume that what we write today will be understandable at least for 1000 years more (EPA 1998). But what about in 10000, or 20000 years?

Doing semiotics following the path of Saussure (1983), with a focus on linguistics, and the claim that signs only make sense as part of a formal, generalized, and abstract system is problematic in this case, since we are not able to imagine what kind of linguistic system, if any, will be in use in the distant future. May non-textual signs work better?

Peirce's taxonomy of signs may be of help. He categorized signs into three main types: icons, which visually resemble their referent (e.g., a road sign indicating falling rocks); indexes, which are associated with their referents by established correlations or causal links (e.g., smoke means

that there is fire); and, finally, symbols, which are connected to their referents by means of convention (e.g., a green light means "go") (Peirce 1931). How would icons, indexes, and symbols hold through the millennia?

A symbol relies on a convention, so it could work only for as long as the relevant convention is transmitted from generation to generation, which seems impossible on the timescale of radioactive decay. After all, what symbols have we, as humanity, inherited from the people of the distant path? There is no consensus, for instance, on the original meaning of the Nazca lines in Peru (Aveni 2000). This is not a fully legitimate question to ask since we have no knowledge of an attempt by the humans of that era to create long-lasting meaningful symbols. Perhaps there was no intention of transmitting any meaning to the future generations. Nevertheless, the task for the future is challenging to say the least.

An index, as intended by Peirce, is also not viable; actually, it defeats the very purpose of a nuclear waste repository warning sign, because correlates and consequences of radioactive materials are exactly what we are trying to prevent future humans from experiencing. If smoke is an index of fire, one might wonder what an index of radioactive material is. If future humans will use tools similar to a Geiger counter, then they might be able to interpret the measurements of the tool as an index of dangerous material to stay away from. However, should humans without a Geiger counter get exposed to radiation, the only perceivable correlate would unfortunately be the sickness and subsequent death of the affected individuals. These people might learn the danger of the site at the cost of many lives instead of being warned about it by a sign and thus avoiding preventable deaths.

One last Peircean category of signs remains to stand the test of radioactive decay time, that of icons, based on visual resemblance, which is problematic with submicroscopic, invisible radiation. What should an icon resemble visually, in order to keep people away from a nuclear waste repository?

This is where the semiotic discourse of transmitting a message to future generations by means of special signs may be interpreted from an aesthetic perspective, in which the focus shifts to figurative visual entities created with the goal of directing people's actions. If we think of a distant future where no assumptions on signs, languages, and meanings can be made, more basic, instinctual ways to ward off humans from a radioactive site might be needed. This is where a more sensorial, perceptual, and

possibly aesthetic discourse might be initiated. It can be argued that environmental aesthetics (Carlson 2013) might provide an interesting framework for the task.

## 3. *From semiotics to environments to aesthetics*

The shift from warning signs to environments is a shift in scale, which is called for by the issue of distance. If the goal is for people to stay away from a nuclear waste repository, then in a scenario where a person is close enough to a warning sign to perceive it and try to interpret it, we have already failed because that person may already be too close to the repository. This is not an immediate health issue: if the repository is properly sealed, as it would be thanks to the abovementioned physical properties of salt rocks, the person would not be exposed to harmful quantities of radiation. However, this may become a health issue if the person failed at interpreting the warning sign and spent more time in the surroundings of the repository or, worse, brought other people along, perhaps to explore the site and to make some drillings to check what is on the other side of that ancient, clearly man-made wall.

A remedy to this distance issue would be to put the warning sign far from the repository, but then another problem emerges with the possibility for people to reach the site without bumping into the warning sign. To avoid such an event, the simplest solution would be to put a sign in every possible direction from which a person might reach the site. In other words, the site should be surrounded by a fence. We may call a fence made of warning signs a semiotic fence, an alternative to a physical fence that is meant to physically prevent people from entering a certain area. Neither kind of fence is guaranteed to work. The semiotic fence is affected by the abovementioned problems of a lack of continuity in cultural contexts over long timescales. On the other hand, we have several modern (e.g., Berlin) and contemporary (e.g., the US-Mexico border in Texas) examples of physical fences or walls that cannot prevent people from climbing over them or excavate under them, unless a very tight manned and armed surveillance system is put in place, which cannot be guaranteed at all through centuries and millennia, also considering that there might be a significant number of changes in the governments responsible for the territory surrounding the site (Hora et al. 1991).

Despite the seeming failure of site-wide fences, we need to find a solution at that scale, because smaller partitions of nuclear waste would

only increase the number of sites, and hence increase the chances of failure: there would be more sites to look for with the required characteristics, and more places to keep people away from. Given the extremely difficult nature of nuclear waste as material to store away, governments have no choice but to focus on fewer, larger sites. So, the shift in scale is also due to a matter of size.

To summarize, this is an environmental issue because we are looking for a solution for creating a distance between a sizeable portion of land and future generations. The issue becomes also an aesthetic one when that distance is created by means of aesthetic principles.

Environmental aesthetic principles cannot be applied to the problem of nuclear waste repositories in a straightforward way, first and foremost because of the goal at stake, which may appear to be in complete opposition to the very definition of environmental aesthetics: the field is focused on aesthetic appreciation of environments, whereas we are looking for a timeless, long-lasting, essential way to keep people away from a particularly dangerous environment. This role reversal of environmental aesthetics is undoubtedly the biggest challenge in the task of vouching for this discipline in the context of nuclear waste repositories. What follows is an attempt to show that entities like the WIPP are indeed challenging yet meaningful use cases of environmental aesthetics and that, in turn, the challenges posed by such a daring exercise can inform many definitional and conceptual discussions in the field.

## 4. *Embodiments of negative values*

The enterprise of applying environmental aesthetics to the problem of nuclear waste repositories relies on the seemingly odd assumption that a discipline traditionally specialized in the appreciation of natural landscapes may help us keep people away from a man-made site. The seeming oddity originates from a two-fold opposition between "appreciation" and "distance" on the one side, and between "natural" and "man-made" on the other. The two facets are related, as it will be shown later, after some considerations on the former.

Even before its delineation as a proper subfield of aesthetics, environmental aesthetics has always been rooted in a positive view of nature. Kant is considered a key contributor to the 18$^{th}$-century aesthetic paradigm with landscapes as objects of aesthetic appreciation, which, despite the subsequent rise of art and the artifactual as opposed to nature and

the natural inspired by Hegel's philosophy in the 19th century, survived until the second half of the 20th century, when it was reprised and revived within a cultural effort to give natural beauty a first-class-citizen status inside contemporary aesthetics (Hepburn 1966), which is considered the foundational act of environmental aesthetics.

In complete opposition to this, one approach to keep people away from a site is to make it ugly, scary or, in general, characterized by features that induce a sense of repulsion in the viewer, with the hope that such repulsion encourages the person to keep their distance. If aesthetics is about appreciation of beauty, the study of the opposite, that is, the repulsion of the ugly may be called anti-aesthetics, or negative aesthetics. Nuclear waste sites constitute an interesting case for experts to explore, not only because the significance of negative aesthetic values in an environmental context is still considered an open question (Sepänmaa 2010), but also because the need for creating a distance seems to be at odds with the more general endeavours, i.e., not specifically related to landscapes and environments, in the aesthetics of the repulsive.

The aesthetics of the ugly has a tradition that is even older than environmental aesthetics, with one of its foundational works dating back to the 19th century (Rosenkranz 1853), and initiating a particular line of thought to create a framework in which ugliness has as much dignity as beauty. Within the aim of creating realistic insights into a far from perfect world, ugliness is a needed feature for a salient representation of ugliness itself, which, within an aesthetic framework that values truthfulness, can give something ugly the status of an aesthetically valid, even beautiful work (Pop 2015). The case of the nuclear waste sites shares a common ethical background with this way of conceiving the ugly, in that they both point at dealing with a problematic world. However, the problem of radioactivity lies beyond what can be achieved with emotive depictions: the need to save people from radiation poisoning is far more imperative and calls for far more effective solutions than an ethical reframing of the ugly. There have also been aesthetic theorizations of the more radical concept of "disgust," but they have all been framed in a way that included, among the fundamental features of disgust, an exertion of subconscious attraction that, in some cases, may even become an open fascination (Menninghaus 2003). The life-threatening danger of radiation forces us to go further beyond, imposing physical distance in an absolute way, as in the absolute negative character that the nuclear waste repositories must be given: there is no space for a meaningful contemplation of the ugly, nor for an unspeakable attraction towards the disgusting.

An expert elicitation process was initiated by the US Department of Energy, before the opening of the WIPP, to imagine a future in which humans might come to interact with a nuclear waste site, and to propose ways of marking the site in order to prevent such interactions. The experts were archaeologists, materials scientists, anthropologists, astronomists, linguists, and semioticians, with the task of conveying warning messages over tens of thousands of years (Joyce 2020). The perspective of this endeavour was semiotic rather than aesthetic. Indeed, no artist, art historian or aesthetics scholar was involved. When the results were published, they were accompanied by all the above-mentioned caveats relevant to semiotics, with the admission that there is probably little continuity between the present and a distant future of 10,000 years, which makes any projection of continued response to warning signs at nuclear waste repositories highly speculative. There was a significant amount of public commentary, among which the most interesting was a competition organized by an art museum, in which artists were asked to propose alternatives to what put forward by the Department of Energy. This was the first time in which artists and not semioticians wrestled with the task, but the results presented significant commonalities. On the semioticians' side we have a proposal of a landscape covered in large-scale sculptural objects in the shape of spikes and thorns, which are meant to look odious and foreboding, to symbolize danger, and to deter interaction with the site (Trauth *et al*. 1993). On the artists' side, a plan is put forward to surround the site with enormous structures that resemble stylized birds, whose beaks emit piercing sounds when wind blows through them; the structures are designed so that all their edges are razor-sharp (Wong *et al*. 2011). What these proposals have in common is rather clear; it is an all-out assault on the senses: visual, aural, and tactile phenomena are used to provoke repulsion and keep people away. Semiotics is still there: the spikes, the piercing sounds, and the blades refer to something else (in this case, an unspecified hazard), as semiotic entities do, but there is little to no reliance on languages, formalisms, and conventions, since both semioticians and artists focus on the most basic human instincts that are assumed to accompany humanity for the millennia to come.

## 5. *Debates in environmental aesthetics*

When framed in an environmental aesthetic discourse, these proposals intersect many historical and contemporary debates and stimulate further discussion. We have already pointed out that the need for repulsion creates an opposition with traditional aesthetic appreciation. However, since repulsion is needed to create distance, there is also a subversion of the classic role of distance in the 18th-century aesthetics of nature inspired by Kant, whose thesis that judgments of beauty are disinterested paved the way for the prescription that aesthetic experience requires an attitude of distance from the object of appreciation. There are obviously many more levels (e.g., psychic, intellectual) in the idea of distance in the aesthetics of Kant and creating a forced analogy with the physical distance induced by a sense of repulsion may seem to be trivializing the discourse. However, there is a kernel of significance in the role played by the size of physical environments that deserves further analysis to shed light on the relation between environmental aesthetics and aesthetics in general.

This is where the other opposition, the one between natural and man-made comes into play: the view that nature should be contemplated from a distance (physical, intellectual) led to a distinction in modes of appreciation: for nature, a distanced and disinterested contemplation sufficed, whereas art and its man-made artifacts required an engaged contemplation, one that engages the viewer's intellect to appreciate an artifact from many perspectives (e.g., its appearance, its history, its cultural significance, its creator's intentions). A rift was created between natural environments and the artworld (Danto 1964), consolidating the definition of aesthetics as philosophy of art, and excluding appreciation of nature from the realm of aesthetic appreciation. Such rift is helped by a difference in physical distances: art and aesthetics are what happens indoors, inside museums and art galleries, whereas natural environments are the great outdoors, elsewhere. Even an aesthetics of negative values, such as the ugly or the disgusting, requires a contemplation from up close when these values are embodied in the form of artworks (e.g., "Saturn Devouring His Son" by Francisco Goya; "Piss Christ" by Andres Serrano), whereas the embodiment of negative values by means of landscapes and environments is still being investigated.

In contemporary environmental aesthetics, efforts to close this divide were and are being made in different ways: by reconceptualizing contem-

plation of natural environments, by expanding the concept of environment, and by directly involving the environment in artistic endeavors. The reconceptualization of our engagement with nature aims at putting appreciation of nature on par with appreciation of art by showing that there is a significant cognitive dimension to it. In the same way as history of art and art criticism are supposed to sustain a full-fledged aesthetic experience with artworks, so natural history and natural sciences, e.g., geology (Heringman 2011) or forestry (Gobster 1996), can inform the appreciation of natural environments, which is thus elevated to becoming aesthetic.

An expansion of the concept of environment to include human environments is sustained by this focus on the cognitive aspects of aesthetic appreciation. It is a process of enabling the viewer to abstract away from the most concrete aspects of nature and attend more to the knowledge of the entities involved, their characteristics, their relations with one other, and the underlying causalities, which more and more often leads to a crossing of paths with human activities, since they are exerting an increasing impact on natural processes and environments on all scales (Crutzen 2002). The same result can be reached along a different path, that of an aesthetics of engagement, a stance against the traditional dualism of observer and observed, and the relevant distance in-between, advocating for a more immersive framework in which the observer is inside the observed, which becomes an environment to explore and engage with. Such environment may be nature, art, or the world at large, including man-made sites (Berleant 1997).

As part of an effort to counter the limitations of the more commercial side of the artworld, in the same period in which the conceptual foundations of environmental aesthetics were being laid, the land art movement came to be, as a concrete, practice-based, ultimate convergence between art and nature, where artists create art out of the natural environment itself, sculpting the landscape (e.g. soil, rocks, water) into new forms. Land art enables artists to explore the embodiment of humans in the environment in the era of their overtaking of the planet, attempting to strike a balance, under an artistic light, between respect toward nature and human intervention (Wilke 2013). This kind of artistic effort not only created a cultural space where the distance between art and nature is eliminated but it also helped expand the context of environmental aesthetics to include, besides wild and untouched landscapes, also those en-

vironments like gardens, parks, and cultivated lands, lying between nature and culture, and here interpreted as embodiments of positive relationships between nature and culture (Brady 2016).

These efforts are not part of a unique and consistent manifesto; their entailments and interpretations are often in contrast with each other, and doubts abound: using scientific theories to fill the theoretical vacuum of environment appreciation may bring the effort away from aesthetics, bring it closer to natural sciences, and break it and turn it into fragments of scientific disciplines; if the expansion to include human environments is not characterized by a strong critical stance, the discipline may become an aesthetically informed justification of human intervention on nature, including the highly disruptive instances of pollution, overpopulation, and deforestation, which goes in direct contrast with the ecological interpretations of environmental aesthetics, which link the beauty of nature to its integrity and conservation. At the risk of oversimplifying the complexity of an endeavor like environmental aesthetics, many of its debates can be traced back to the natural versus man-made opposition, an opposition that exists and has been made more and more evident through centuries of scientific and industrial revolution. However, at the same time, the very consequences of such revolution have blurred the lines between nature and humanity in the environment and its landscapes, because in the era of the Anthropocene, hardly any corner of the planet can be considered wild, untouched nature. Environmental aesthetics, whose focus is indeed on those landscapes, has internalized such contradiction, which translates into an array of intradisciplinary and interdisciplinary debates on how to frame the natural and man-made duality. To the traditional spectrum between the sensory/trivial and the informed/serious (Hepburn 1993), environmental aesthetics is now busy adding the dimension spanning between the uncontaminated/natural and the manipulated/human to the analysis and appreciation of landscapes.

## 6. *Radioactive futures*

How do the markers of nuclear waste repositories proposed by semioticians and artists intersect these debated dimensions? How can environmental aesthetics frame these proposals? Does it even make sense to analyze them in the evolving framework of this discipline?

## 6.1. *The radioactive death of environmental aesthetics*

The markers constitute a very challenging case study: they are a permanent modification of the environment aimed at creating a sensorial experience that is primordial and intense. From the perspective of their conception and realization, the markers touch on all the above-mentioned aspects and debates in environmental aesthetics or, rather, they take them to extremes. We are at the antipodes of classic, detached appreciation of uncontaminated natural landscapes: we must create gigantic objects to scare people away from man-made containers of highly contaminated and life-threatening industrial remnants. Every facet of environmental aesthetics is disrupted: the sensorial experience must be negative, the science that should inform the appreciation of the environment is the same science that caused its permanent and deadly modification, uncontaminated nature is lost forever, and we now need more human intervention to counter the effects of human intervention. What happens when an entity has only negative answers to all the questions that a discipline poses? Should the experts in the discipline ignore the entity? Is it the end of the discipline? Here is an oversimplifying, almost apocalyptic yet coherent, possible interpretation of what the nuclear waste repository markers may mean for environmental aesthetics. The distinction between natural and man-made is real, it has been made more and more intense by the development of nuclear technology, whose byproducts are the ultimate undoing of nature. Natural environments no longer exist, at least without significant disruption by human activities. Aesthetics focused on an ecological ideal of uncontaminated nature is a thing of the past, and now its objects of appreciation can only be large-scale artificial spaces, possibly populated by gigantic artifacts used as markers. The only aesthetics that has a connection to reality is the aesthetics of the artificial (Holt 2017). Land art is a subfield of this aesthetics, focused on artistic further manipulation of an environment already manipulated by technology. This would be the end of environmental aesthetics as we know it.

## 6.2. *The radioactive life of environmental aesthetics*

A future in which the artificial and the artifactual have completely taken over the environment is just one scenario among many and possibly not even the most effective in tackling the issue of nuclear waste. We must

remember that the ultimate goal is not to modify the landscape, not to make anti-art nor to elaborate negative aesthetic principles, but to keep people away from radioactive material. The aesthetic of repulsion embodied by the proposed markers is put forward as an alternative to semiotic warnings whose effectiveness might fade through the millennia, but is repulsion the only way to create distance? Some experts argue that this kind of aesthetics might actually be counterproductive, because, while successfully warding off many, it might have an undesired effect of piquing the curiosity of a few. There are no examples of repulsion aesthetics from the past, but there is abundant archaeological testimony of attempts at scaring people in early non-pyramid tombs in Giza, where walls were inscribed with curses against those who would raid the place (Ikram 2009). Clearly, these semiotic attempts have failed. Will aesthetic attempts succeed in the distant future? Future tomb raiders or archaeologists may interpret the visual, aural, and tactile assaults of the senses by the markers as a way of protecting a treasure from thieves, instead of protecting people from radiation poisoning. There is an intrinsic risk associated with marking a site: the marker attracts attention. The strategy so far has been that of creating negative attention, whether by semiotic or aesthetic means. An alternative strategy would be to avoid attracting any attention at all, by not marking the site, relying on the hypothesis that marking the site increases the chance of voluntary interaction with the site more than not marking the site increases the chance of involuntary interaction. The new, non-marking strategy makes us switch from landscapes of repulsion to landscapes of reclamation: the site, in a sense, gets reclaimed by the surrounding environment, it is allowed to go back to the appearance it had before the construction of the nuclear waste repository site (Pasqualetti 1997). Such reclamation is not a completely natural and spontaneous process, considering the amount of work in terms of excavation, securing, shielding, sealing, etc. that goes into a place like the WIPP. Landscapes of reclamation are landscape architecture and engineering projects, in which environmental aesthetics makes a comeback (from that dystopian future of purely artefactual landscapes) to inform the architects and the engineers on what kind of make-over to give the site they are working on. Yet, the application of the discipline is not straightforward, because once again we are not dealing with a simple appreciation of natural landscapes. In changing from repulsive markers to no markers at all, we are moving from a negative aesthetics to an aesthetics that is neither positive, nor negative. Calling it neutral may work,

as long as neutrality is not interpreted as a golden mean dictated by common sense and decency. Here, what we are aiming for is indifference: the site must blend in an environment that is isolated from people and keeps on being isolated because it has no feature that attracts them. Landscapes of reclamation are landscapes that, in appearance, just are, and they are let be, while at the same time they hide a hazardous secret inside.

This way of conceiving environments is yet another challenge, because if conceptualizing and embodying negative aesthetic values is complex, what does it even mean to do so with neutral values? This approach seems to go against some of the core principles that have guided aesthetics from the very beginning: Plato's stern position against the arts that distract people from the real truth (Gaut and Lopes 2013) or Kant's warnings against the arts used as tools of persuasion (Kant 1987) are some of the oldest examples of the strong connection between aesthetics and the concept of truth, not interpreted from a logical or epistemic perspective, but as an ethical and moral obligation. The mental experiment of explaining the issue of nuclear waste and the possible advantages of hiding its repository to those philosophers amounts to little more than an exercise in rhetoric. Nevertheless, the mission of creating landscapes of reclamation has complex ethical nuances and implications that deserve attention from ethicists and aestheticists with a strong penchant for ethics.

The aesthetics of indifference seems also to go against the aesthetics of engagement that argues for an elimination of any distance between the subject and the object. At least the negative values of the landscapes of repulsion entailed some engagement, although negative and hopefully brief. The landscapes of reclamation, instead, call for a complete rethinking of this aspect of the discipline, an aesthetics of disengagement of sorts.

Landscapes that are so banal they end up being ignored are conceptualized as blandscapes (Porteous 2013) and fought against by contemporary environmental aesthetics. To propose that the discipline should contribute to an active pursuit of blandscapes might look like a provocation.

Despite all these apparent contradictions, there is an ethical core specific to environmental aesthetics that makes the experts in this discipline an invaluable resource for the task at stake. Such core dates back to the early years of the discipline in its modern form when the classic paradigm of distanced contemplation started being questioned. In particular, doubt was expressed about its application to landscape management, where a

fixation on natural beauty from afar could have directed too much attention and thus resources to preserving scenic landscapes, while excluding other environments, like swamps and wetlands, that may not embody romantic ideals of idyllic peace, but surely play a more important role in the ecological balance of the environment (Leopold 1966). Rather than the nonetheless important attention for ecology, what matters here is the inclusiveness that characterizes this stance that accompanied the beginning of modern environmental aesthetics. This attention to all kind of landscapes, independently of their conformity to a single standard of beauty, should guide environmental aestheticists in their support of the process of reclaiming nuclear waste repositories, in the pursuit of a blandscape, whether natural, man-made, or both.

## 7. *Conclusions: the radioactive present*

All these considerations must be accompanied by a warning, similar to the warning signs conceived for the WIPP. Everything that has been said about the future management of nuclear waste, with semiotics and with environmental aesthetics, is speculative. These are future imaginings, some of which are not even possible at the current state of legislation in the US: the legal duty to warn people about the presence of radioactive material, for instance, makes the landscapes of reclamation impossible at the moment. Unfortunately, nuclear waste is real, here, and here to stay for a time that is much longer than any civilization ever created by humans. At a first glance, it may appear like a technological problem, but it is also, and perhaps even more, a cultural problem. We can envisage technological advancements that will enable humans to stop producing new nuclear waste (either thanks to discoveries in nuclear power production or in alternative forms of energy sourcing) and to perfect secure transport and storage of the existing nuclear waste. Even if these almost utopian technological goals are one day reached, we are left with a Pandora box that must remain sealed for eons to come, and with the cultural problem of communicating future generations the need for keeping the box closed. We have seen that semiotics, especially if based on languages, does not stand the test of time. We have championed environmental aesthetics, which can provide great support in a solution that may be framed as landscape camouflage, ethically dubious and currently legally impossible. Despite all these perplexities and doubts about the future, we hope

that this work has shown that environmental aesthetics, with its interdisciplinarity and openness, has an enormous potential for a significant contribution to the task at stake. All the official expert groups that have tackled the issue so far have focused on semiotics exclusively, and their proposals have been integrated by interesting unsolicited works by environmentally conscious artists. Now is the time to invite wholeheartedly aestheticists, whether environmental or not, to join the discourse. The problem is extreme, and it will undoubtedly put all the definitions, concepts, and frameworks of the discipline to an unprecedented test, but even if there won't be immediate results, carrying the discussion further on, in terms of fresh ideas and increased awareness, is already part of the solution.

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