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Visions of nuclear landscapes: seeing from the perspectives of art, cultural heritage and archaeology

Rosemary A. Joyce *

** Department of Anthropology, University of California, Berkeley, 232 Kroeber Hall
Berkeley, CA 94720-3710, USA (Email: rajoyce@berkeley.edu)*

For three decades the global nuclear industry has drawn on sites such as Stonehenge as warrants for the expected endurance and effectiveness of markers of nuclear waste repositories over long periods of time. In the specific context of the United States (US), where these projects are exceptionally well documented in publically accessible planning documents, the result has been a proposal to build a pre-formed archaeological site, a ruin that, based on its close modelling on specific analogues, would qualify for listing as a World Heritage site. Alternative proposals, some from the same planning process, others from activist initiatives developed in opposition to the nuclear industry, present art projects as alternative ways of marking these contaminated landscapes.

Triangulating between the proposals that use archaeology as their basis, rooted in what I argue is a cultural heritage logic, and those from art worlds, I argue that an archaeological sensibility should question these visualisations as overly static and deterministic, outgrowths of unexamined concepts of human agency as singularly effective over spans of thousands of years, transmitted through passive materials with predictable characteristics that can be maximised by design. The archaeological perspective calls us to question the intelligibility of landscape-scale installations conceived of as simple visual markers, and instead demands that we think about a multi-sensorial perception of differences that might be as simple as variation in the textures of sediments, and how such differences would be narrated, retold and remembered over time.

Designing a ruinous landscape

The project of creating nuclear waste repositories concerns the disposal of the ultimate in long-lived trash: nuclear waste with an expected persistence of dangerous levels of radioactivity of around 10 000 years. The first stage in US planning for the disposal of such waste began with the

design and implementation of something called the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico, as a “research and development facility to demonstrate the safe disposal of radioactive wastes resulting from the defense activities and programs of the U.S. exempted from regulation by the Nuclear Regulatory Commission” (Hora *et al.* 1991: i–5). The US Department of Energy (DOE), the government office that developed WIPP, provided much of the documentation I cite, as part of applications by the DOE for approval of licences to operate a successor facility at Yucca Mountain, Nevada, that did require approval by the Nuclear Regulatory Commission (DOE 1996a & b). Many of those documents actually began their life as part of proposals to mark the WIPP facility in New Mexico (Hora *et al.* 1991; Trauth *et al.* 1993). While Yucca Mountain has yet to be approved, the WIPP facility is in operation, and has already experienced its first failure of containment due to the unexpected behavior of assemblages of people and things (Joyce 2016). Work proceeds on implementing a marker system at the WIPP site (Hart & Associates 2000a & b, 2004).

Drilling for the WIPP project in New Mexico, proposed in the 1970s, began in 1981 (WIPP 2007a). In 1985, the Environmental Protection Agency (EPA) issued guidelines for the disposal of trans-uranic waste that were intended to guide safe use of the WIPP facility. By 1989, the DOE completed its construction of the WIPP storage facility. Shortly thereafter, in 1991, the DOE proposed to begin using the WIPP facility as a ‘test’. This led to lawsuits and court injunctions, and by 1993 the ‘test’ phase was cancelled. Eventually, the EPA certified WIPP for use in 1998. In 1999, shipments of radioactive waste began to arrive. By 2006, half of the planned segments of underground storage had been completed and more than 5000 shipments of radioactive waste were in place at the site.

In 2008, the DOE began the process of applying for a license from the Nuclear Regulatory Commission (NRC) to create a second nuclear waste repository, this one at Yucca Mountain, Nevada (NRC 2015). Yucca Mountain would be used for high-level radioactive waste resulting from civilian activities, the spent fuel from nuclear reactors and waste produced from reprocessing reactor fuel. In 1982, the US Congress had passed the Nuclear Waste Policy Act, amended in 1987 to designate Yucca Mountain as the sole candidate in the US for an underground disposal facility for this kind of nuclear waste. The act designated the EPA as responsible for defining standards for the environmental safety of the site, the DOE as

responsible for designing and operating the facility, and the NRC for employing the EPA standards when reviewing licensing requests for the DOE-operated facility.

The NRC review of the DOE licence application, including refusal of a DOE request in 2010 to withdraw its application, lasted through 2015, when the NRC issued a five-volume ‘Safety Evaluation Report’ (NRC 2015). Between 2008 and 2015, Congress and the US executive branch engaged in a series of exchanges about the feasibility of different options for implementing or replacing Yucca Mountain as the site of this repository. Substantial resistance developed among the citizens of the state of Nevada to being the national nuclear waste dump. A Blue Ribbon Commission report to the US Secretary of Energy, completed in 2012, proposed that legislation be passed or amended to allow for potential sites for waste disposal to be negotiated with willing hosts, rather than insisting on the pre-determined disposal site designated in the 1980s.

As of January, 2015, the NRC recommended against licensing Yucca Mountain, pending the production of a supplement to the project’s environmental impact statement, and resolution of land and water rights issues (NRC 2015). The congressional delegation from Nevada opposes the plan to locate a nuclear waste repository at Yucca Mountain. Indigenous groups in the area are fiercely opposed as well. It seems unlikely that the project will ever be built. Yet even as a failed project, planning for the Yucca Mountain site provided a rich body of information for my purposes because the DOE was required to justify its proposed method to mark these sites in ways that would last for very long periods of time, and that would warn people away from the danger of exposure to radiation by excavation.

The EPA created the criteria that both proposed repositories need to meet. The EPA regulations that the DOE faced when it began to plan the WIPP facility in the early 1990s included the design of a marker system to be in place once the repository was closed (Hora *et al.* 1991: i–8). EPA reviews of the DOE applications provide a layer of commentary on the concepts involved that help reveal what assumptions were taken as self-evident, and which were more debatable (EPA 1996).

The regulations governing WIPP and its successor required the physical containment of waste to be effective for 10 000 years (with allowance for some radioactive releases), and attempts to limit exposure to radiation for 1000 years following the closure of each repository, providing targets for the persistence of any proposed marker system of at least 1000 years, and up to 10

000 years. The method adopted to produce a design for a marker system involved convening groups of specialists with expertise deemed relevant to identifying materials and forms that could persist over the long term and be intelligible as warnings in a variety of futures (Benford *et al.* 1991; Hora *et al.* 1991; Ast *et al.* 1992; Baker *et al.* 1992; Trauth *et al.* 1993).

The design process began with expert ‘Futures Panels’ that provided projections about what social and cultural contexts might be like long after repositories were closed. In this first phase, four ‘expert judgement teams’, each composed of four people, were convened independently to assess the probability of future intrusion on the site over the following 10 000 years (Hora *et al.* 1991). The Futures Panels provided input, characterised in the report as “more qualitative” to the marker experts concerning “the possible future states of society and modes of intrusion” (Hora *et al.* 1991: i–9). Two of the Futures Panels actually recommended that no marker be planned (Hora *et al.* 1991: ES-1). As the EPA regulations required a proposal for a marker system, these opinions were set aside, and the process continued in what the report implies would be a less qualitative step: design of a marker system.

This work fell to a second group of experts, the Marker Development Panel. A report of expert judgement on markers was issued two years after the report by the Futures Panels (Trauth *et al.* 1993). It presented an account of the deliberations of two teams making up the Markers Development Panel. Interdisciplinary composition of the teams was said to be required by ‘the materials and communications aspects of the marker issue’. Anthropologists, linguists, semioticians and “individuals from the astronomy and communications disciplines” were recruited to provide guidance on how to communicate “over long periods of time with unknown beings” (Trauth *et al.* 1993: 1–12). Both teams incorporated cultural anthropologists. One (team A) included an archaeologist. The other (team B) had a materials scientist as a member, who had directed a centre on ancient materials that worked closely with archaeologists.

The archaeologist on team A had developed previous reports concerning archaeological knowledge as a basis to design markers of nuclear waste sites (Kaplan 1982; Kaplan & Adams 1986). The design proposed by team B followed that lead, and was explicitly based on what it called “historical analogues” for the task of building a permanent messaging system (Baker *et al.* 1992). These historical analogues were all cultural heritage sites recorded by and explored by contemporary archaeologists.

The proposed marker system would consist of two lines of granite monoliths, 32 around a perimeter, and 16 around the defined ‘footprint’ of the waste repository itself (Trauth *et al.* 1993; WIPP 2007b). The two concentric lines of standing stones were warranted explicitly by Stonehenge, and were given a ‘life span estimate’ of 4000 years based on the experts’ understanding of the persistence of Stonehenge as a physical monument for a similar span of time.

Team B included a proposal for an earthwork “to help define the perimeter of the surface area directly above the waste repository” (Baker *et al.* 1992: G-10). In the original design, this earthen berm would have contained embedded metal objects encased in concrete. In some versions, the berm would be made of materials that resisted the growth of vegetation: earth mixed with caliche, the naturally formed calcium-rich stone layer that is deposited below the topsoil in arid environments, or salt. Team B provided a minimum estimate of “0–500 years” for this “0.8-kilometer diameter, 30’ high earthwork of patterned shape” (Baker *et al.* 1992: G-37). They compared the berm to mounds of the south-eastern US, naming Cahokia, Illinois, in particular, as having survived for 1000 years. They concluded that “an earthwork on the WIPP site would be likely to survive for 2000 years with its shape intact” because “hundreds of earthen mounds built in the U.S. during the Burial Mound period [...] are easily visible 1300–3000 years later” (Baker *et al.* 1992: G-37). Team B added to its basic recommendation that “the earthwork might be arranged in the shape of a symbol”, which they then specified “could be constructed in a geometric shape, perhaps in the shape of a designated warning symbol” (Baker *et al.* 1992: G-10). Later, the DOE cited Serpent Mound as a warrant for the earthen berm, perhaps because unlike Cahokia’s Monk’s Mound, Serpent Mound is an earthwork with an iconic shape (DOE 1996a: 5-5; Joyce in press).

Within the inner line of stones, an area comprising the footprint of underground waste disposal chambers, the earth would be seeded with thousands of buried objects, made of materials selected for durability. An above-ground information chamber at the center of the project and two below-ground information chambers completed the proposed design (Trauth *et al.* 1993: 5–9, F-102, F-104). The above-ground chamber was originally estimated to have a probable life span of over 10 000 years, based on the assumption that it would improve on precedents including European megalithic chamber tombs such as Newgrange, cited as having endured for 5000–5500 years (Trauth *et al.* 1993: figs 4–4.7 & 4–4.8).

The surfaces of the standing stones, the surfaces of the information chambers and each of the thousands of small buried objects were to be inscribed with texts and images designed to warn people not to dig at the site and release radioactivity. An estimated lifespan of 2400 years was proposed for the chamber considered as a surface marked with inscriptions, based on the Acropolis in Athens (DOE 1996a: 5–16). Comparing them to “fired clay tablets written in cuneiform script”, the DOE argued that the small buried markers could endure and convey their messages for at least 5000 years (DOE 1996a: 5–20).

In effect, carrying out these proposals would entail the creation of an archaeological site, complete with a layer of discarded but materially persistent buried artefacts. Equation of the proposed marker system with heritage sites was made explicit in the 1993 document summarising design proposals, which said that the marker system would “convey the message that the entire area *enclosed by the monument* should not be disturbed” (DOE 1996a: 5–6; emphasis added).

Although described as a “monument”, the proposed marker is actually imagined as a ruin (Joyce in press). It is not an analogue of a functioning setting that a group of humans might have constructed and used in daily life, but rather a reproduction of the kind of features in such architectural settings that endure materially after abandonment. Victor Buchli (2013: 158–66) reminds us that abandoned architecture is not constrained by its previous use, but is engaged with in new ways. One goal of the planning process for the nuclear waste marker was to have a system of material signs with which future people’s engagement would be predictable. Implicitly, such prediction is only possible once a human-built landscape stops being used and becomes a ruin. Yet it is not just any kind of ruin that this planning process would produce: it is a vision of a ruin as monument, equivalent to a series of recognised sites of cultural heritage of global significance (Joyce in press).

The version of Stonehenge that underpins the expert panel’s use of it as a model is thus the one inscribed as a UNESCO World Heritage site, a synchronic presentation of visible features that collapses time and the history of the site. The description of the ‘Outstanding Universal Value’ of Stonehenge in its World Heritage listing includes the claim that its “stone and earth monuments retain their original design and materials” (UNESCO 2016). This begs the question: when was the ‘original’ design? Clearly, this does not refer to any of the phases of construction during Neolithic history, still less the possible Mesolithic predecessors of the standing stone

circle (Parker Pearson *et al.* 2007; Jacques *et al.* 2014). Instead, the ‘original’ design here is the design *in ruins*: the ‘known positions in the early and mid-twentieth century’ of the stones that survive.

The UNESCO World Heritage statement draws on a genealogy for Stonehenge created during the period of romanticisation of ruins in Europe:

Since the 12th century when Stonehenge was considered one of the wonders of the world by the chroniclers Henry de Huntington and Geoffrey de Monmouth, the Stonehenge and Avebury sites have excited curiosity and been the subject of study and speculation. Since early investigations by John Aubrey (1626–1697), Inigo Jones (1573–1652), and William Stukeley (1687–1765), they have had an unwavering influence on architects, archaeologists, artists and historians (McFarland 1981).

We can question how ‘unwavering’ the reception of the materials recognised as the World Heritage site actually was. Even the timeline provided raises questions: why is there a five-century gap between the twelfth and seventeenth centuries?

The density of references beginning in the seventeenth century marks the beginning of one way that Stonehenge came to have its modern significance as ruins. Familiar romantic notions of such places emerged when attention to archaeological sites was renewed in eighteenth-century Europe (Huysen 2010; Schönle 2012). This invited emotional reactions such as nostalgia, a longing for a pristine past idealised as fleeting. The past was knowable, but only in abandonment and collapse.

Anthropologists and archaeologists have produced thoughtful critiques addressing how the concepts of ruins and ruination might be refigured to contest the romanticisation of the broken down, and instead explore how things come to be ruined, for example, as an outcome of national and imperial projects (Stoler 2009: 193–98; Dawdy 2010: 769–72). Ruins are not static but dynamic. It is only a romantic sensibility that allows them to be imagined as fixed, and thus eligible to work as permanent markers in a ruinous landscape.

In the mid-twentieth century, just as UNESCO began to play a role in the preservation of such sites, cultural theorists recognised an interplay in European (and thus US) thought between concepts of ruins as “a vehicle to create a romanticizing mood”, as a “document of the past” and as “a means of reviving the original concept of space and proportion” (Zucker 1961: 120). A

combination of the last way of understanding ruins (reviving an *original* concept) with an uninterrogated understanding of the first (a vehicle to create moods) that provides the basis for the WIPP experts' belief that building a ruin from scratch would create a space that could resist future economic motives for excavation due to its inherent capacity to bring about a predictable response. This undercurrent of the romantic invocation of specific sensibilities inherent in ruins was much more evident in the alternative proposal for a marker system developed by the second group of experts, ultimately set aside by the DOE.

Visualising a sense of disaster

In contrast to the proposals from team B that used archaeological sites as models for features of a marker system, the 'expert' team A based its proposal on a concept of universal archetypes embodied in art, relying on "a sense of place [...] based on the concept of human archetypes—that all human beings react similarly to particular physical environments" (Trauth *et al.* 1993: 3-3 & 3-4). Their descriptions of elements of a system of markers owes nothing overt to recognised cultural heritage sites:

Stone from the outer rim of an enormous square is dynamited and then cast into large concrete/stone blocks, dyed black, and each about 25 feet on a side. They are deliberately irregular and distorted cubes. The cubic blocks are set in a grid, defining a square, with 5-foot wide 'streets' running both ways. You can get 'in' it, but the streets lead nowhere, and they are too narrow to live in, farm in, or even meet in. It is a massive effort to deny use. At certain seasons it is very, very hot inside because of the black masonry's absorption of the desert's high sun-heat load. It is an ordered place, but crude in form, forbidding, and uncomfortable.
(Ast *et al.* 1992: F-58–59).

Drawn from an appendix to the main report on the marker design project, this description of *Forbidding Blocks* conveys the ideas developed by team A, drawing in particular on the work of team member Michael Brill, an architectural theorist.

After a false start in engineering, Brill was trained as an architect at the Pratt Institute (Brill 1990). Following a successful career as a practising architect, in 1969 he co-founded a new school of architecture at the State University of New York at Buffalo, with a parallel research institute, the Buffalo Organization for Social and Technological Innovation. He describes

himself as setting off early on a course in which engagements with art and science alternated. Eventually, he focused his attention on what he called “the wonder of places”:

there are places that awe or stun, ones filled with ‘charge’, that nurture reverie and dreams, that center the soul, and that link us to others in especially human ways. I now wanted to find out why or how these places had such effects (Brill 1990: 209; emphasis added).

Brill (1990: 210) attributed his new interest in part to engagement with the arts, including “landscapes, especially those termed sublime, the places marked by megaliths, cave paintings [...] calligraphy from many cultures”. This interest led Brill to read widely across the social sciences, geography and humanities, resulting in his redirection to defining what he called “archetypes of place and mythic consciousness”. He eventually developed what he described as “a set of hierarchical ‘design guidelines’ for sacred places”, which he believed accounted for widely shared, fundamental human place designs (Brill 1990: 215).

With Brill leading the way, expert team A proposed designs that they asserted had universal potential to move human beings in the future in the same way as they would affect people today. These designs, they further argued, created the same effects on people today as they had in the past societies responsible for the examples of ‘sublime’ places that Brill had identified. *Forbidding Blocks* was one of team A’s proposals. They described what is elsewhere clinically labelled the ‘footprint’ of the project—the area at ground level that overlies the actual buried waste containers—with a more evocative term: ‘the Keep’. They saw one of the design challenges as not elevating this central, dangerous place by using markings that would make it seem valued and honoured:

The place should not suggest shelter, protection or nurture [...] it should suggest that it is not a place for dwelling, nor for farming or husbandry. This would be most strongly communicated if the place obviously tries to deny inhabitation and utilization. It might best be designed as a place difficult to be in, and to work in [...] both actually and symbolically. Given this, the center of the place should reject rather than embrace [...] In this project, we want [...] to suggest that the center is not a place of privilege, or honor, or value, but its opposite. In symbolic terms, we suggest that the largest portion of the Keep, its center, be left open, and

few (if any) structures placed there, so that symbolically it is: uninhabited, shunned, a void, a hole, a non-place (Ast et al. 1992: F-52; emphasis added).

Forbidding Blocks may best be thought of as an anti-city: laid out like city streets, the spaces it proposed to enclose were to be too narrow for any useful purpose, and too hot (due to the black color specified) to be comfortable. It is also clearly conceived of as a material agent, capable of acting on people. Through the input of other team members, this material agent was also understood to be capable of communicating with people in relatively unambiguous ways. Team A echoed Brill's ideas about archetypes closely. Yet they merged his ideas with an idea of communicating meanings that goes beyond Brill's emphasis on archetypal places bringing about common sensations. He described his ideas as involving "meanings that flicker into consciousness" (Brill 1990: 215). In contrast, team A talked about using "a universal, 'natural language' of forms" to

communicate meaning through physical form [...] based on an enduring human propensity to experience common and stable meanings in the physical forms of things, including the design of landscapes and built-places (Ast et al. 1992: F-39).

According to team A, there was an intimate congruence between the archetypes required to create the specific sensations that they wanted to rouse and place itself:

The materials best used to manifest the content of place-archetypes must be the very stuff of place itself [...] that which differentiates place from all else [...] Place-design can speak about all the following, and importantly for this project, about their opposites as well: the flight from Chaos to Cosmos, and an ordering of intransigent nature; transformation and ordering of materiality; locating and sheltering; a locus for inhabitation and dwelling; safety and security; stability; an investment of energy; aspiration; nurturance; a focus of care and maintenance; a declaring of value and values; and a way we represent ourselves to ourselves, and others (Ast et al. 1992: F-41–42; emphasis added).

In 1993, *Environmental and Architectural Phenomenology* published an article by Brill titled 'An architecture of peril' in which he commented on why he advocated for a marker system that used forms to convey more directly a sense of place that, he hoped, would discourage future intrusion on radioactive waste. While some of the language is very close to statements in team

A's report, Brill specifies an argument supporting his assertion that certain forms universally convey meanings in a way not included in Team A's deliberations:

place design [...] *is rooted in the enduring human propensity to experience meanings in physical form, including through places. Meaning comes to us through a 'natural language' of form, called 'natural' because we may be born knowing it* (Brill 1993: 8; emphasis added).

For Brill explicitly, and for the expert group whose proposal he shaped, the secret to enduring marking was an expected stability in the behaviors elicited from humans by the built environment. Team A's proposal, had it been accepted, would have led to a very different kind of intervention than that ultimately outlined by the DOE.

Yet the two proposals shared more than would first appear. Not only were both motivated by a sense of predictability about the actions and reactions of people in the past, present and future, but both involved conceiving of landscape-scale installations. I argue that conceptualisation at this scale can be understood in the context of a particular way of thinking about human agency and landscape that developed in the specific context of ideas about the American West.

Landscapes of repulsion

In the summary report for the planning process, the difference between the marker designs proposed by the two expert teams was minimised, described as a debate over “communicating through the feeling evoked by the markers” or “purely through the construction and arrangement of markers and the messages on the markers” (Trauth *et al.* 1993: 5–9). While allowing the DOE to propose a single marker plan, this summary erases the specific character of team A's proposals, which are rooted in the assertion that *only* through the ability of place to evoke predictable sensations would it be possible to ensure success in marking the site. Yet there is a sense in which the DOE's move to equate the two, apparently dissimilar, proposals reflects a deeper identity between these plans.

Both teams A and B proposed designs for markers that would be of exceptional scale. Martin Pasqualetti, a geographer who served on the Futures Panel that preceded the efforts of the markers experts, built on this aspect of the project in an article proposing a third alternative, in which he characterised the challenge not in terms of making a marker or monument, but of creating a landscape (Pasqualetti 1997). He saw the nuclear industry as creating a need for

“landscape adjustments”, the development of “artificial landscapes which, in an odd inversion, we would ask all future generations to avoid” (Pasqualetti 1997: 74).

Pasqualetti (1997: 74) described two conceptions of the resulting “adjustments”: a “silent landscape” that suggests “no hazard and attracts no special attention”, contrasted with a “blatant and permanent landscape, brimming with threat and foreboding that only the senseless could miss”. The ‘silent landscape’ stands for the proposal by the Futures panel, in which he was a participant, to consider a surface marker that would rapidly erode, leaving the buried waste undisturbed, as the panel report said, like King Tut’s unmarked tomb (Benford *et al.* 1991: 37). This proposal was ignored in the subsequent markers planning process. The article Pasqualetti wrote is in essence his revival of his team’s proposal.

The description of a landscape “brimming with threat and foreboding” corresponds to what Pasqualetti (1997: 85–86) later called a “landscape of repulsion”. This is directly equated with the proposal for archetypal installations intended to create a predictable emotional response developed by marker team A. The example Pasqualetti (1997: fig. 7) chose to illustrate had been characterised by Brill (1993) as an “architecture of peril” that he titled *Spikes bursting through grid*, in which “a regular grid, about house-sized, inlaid in a masonry slab that covers the Keep” comes “bursting up from below”:

The spikes/teeth/barbs first ripple in the Keep’s cover, then deform it, then puncture it; finally, the grid’s reliable and human-imposed order is destroyed by a more powerful force—chaos (Brill 1993).

The term ‘foreboding’ was used by the DOE to characterise yet another of the archetype designs, *Menacing Earthworks*:

The area over the waste panels [...] would be outlined by earthen berms. These berms would be jagged in shape and would radiate out from, but not cover, a central area or ‘keep’ even if some are destroyed. The four corner berms would be higher and provide a ‘vantage point’ to see the area as a whole. The jagged nature of the berms is meant to convey a sense of foreboding (not honorific or pleasant) (Trauth *et al.* 1993: 3–4).

Peril, threat, a sense of foreboding: this is what Pasqualetti (1997) characterised as a landscape of repulsion. In his own description of *Menacing Earthworks*, Brill uses language that the DOE did not echo, describing the effect as a “loss of place”:

Immense lightning-shaped earthworks radiating from an open-centered Keep—emanations of danger seen best from the air, or from vantage points on top of the highest, 70-foot earthworks. At ground level, these massive earthworks crowd in, cutting off the horizon and making a loss of place. The square sandy Keep is vast and desolate, except for a walk-on map locating the many other radioactive waste sites in the world (Brill 1993: 9).

Brill, and the team he so profoundly influenced, understood their task as creating *place*. Pasqualetti reframes the kind of place being created as *landscape*. Landscape had a specific meaning for him. He cited the seminal cultural geographer of the American West, J.B. Jackson (1984: 5), who described the ‘natural’ landscape as “a space with a degree of permanence”, a quality Pasqualetti referred to as “immutability” (Pasqualetti 1997: 73). Pasqualetti distinguished this from the ‘artificial landscape’ required by the nuclear industry, implicitly space lacking that quality of immutability and permanence.

Pasqualetti intervened in a process that, as managed by the DOE, was rooted in an insistence on separating a world of humans and things that they intentionally made to convey meanings from the environment in which those markings would be made. Both the landscape-scale of the proposed intervention, and the explicit contemplation of the power of place itself to move humans entering these constructed spaces, resonate with the practices recognised under the term Land Art. Turning to Land Art, we find some of the same sources of inspiration cited for landscape-scale projects that also took the American West as empty and ready for modification. In these expressive projects, however, both the asserted immutability of the given substrate and human ordering of the constructed feature were brought into question.

The entropic landscape

While it was never acknowledged by the DOE, team A actually went further in advocating for the use of art as a means to produce meaning-preserving markers at a landscape-scale. In a brief comment citing a project by James Roden, located in the state adjacent to New Mexico, team A suggested that a Land Art work might be commissioned as an “integral, permanent part” of the marker system (Ast *et al.* 1992: F-135).

Emerging in the 1970s, Land Art projects (alternatively called ‘earthworks’) were produced by a number of artists working at large scale in the open air. Antonia Rigaud (2012: 2) traces the

origin of the Land Art movement in the US to a 1968 exhibition in New York City documenting a group of projects. It is in the American West that the most recognised installations of Land Art actually took place, a contested landscape associated in the American imagination with tropes of discovery and control that Joshua Fisher (2011) argues resonate with some of the major Land Art projects. As stated by English artist Richard Long, whose use of landscape often causes him to be linked to the movement, Land Art was made by “American artists working in their own backyards, using the deserts to make monumental work and only in America” (quoted in Grande 2009: 44). Grande goes on to say:

Informed by the landscapes of John Muir and Edward Abbey, Western artists [...] were all brought together under the rubric of this new art form [...] They moved away from the more pastoral and decorative approach [...] in which the land is used as a backdrop. Instead the earth itself created the art form (Grande 2009: 45).

Leslie Ryan (2007: 95 & 96) goes further, describing Land Art as “land reclamation” in the deserts of the American West, conceived of as “a place that swallows up boundaries, a vast, silent, intimidating and bewitching canvas”.

Rigaud (2012: 36–38) argues that land artists intend to produce a sensation of disorientation, allowing people to become aware of the power of landscape and the limits on human capacity to control land. As with Land Art, the designs for a marker proposed by team A took the form of massive earth moving and stone assemblages intended to produce sensations, but not in themselves assumed to convey meanings. Yet the connection to Land Art is no less relevant to the project team B outlined: to build, in the Western landscape of the US, a cultural heritage site (conceived of as empty space), a ruin modelled on remains left by ‘civilized’ societies.

The description Michael Brill (1993: 9) offered of the experience of “the Keep” as part of the nuclear waste marker system, cited above, bears comparison to discussions of one of the great examples of early Western Land Art, Robert Smithson’s *Spiral Jetty* (Cooke *et al.* 2005). Built in April 1970 at Rozel Point on the shore of Utah’s Great Salt Lake, *Spiral Jetty* extends out from the shore as a low earthen berm that coils into a spiral once away from shore, 1500 feet long, 15 feet wide.

Land Art challenges the guiding intention of the marker projects, which seek to design stable installations that will remain legible in a singular way for thousands of years. Land Art is

understood to be dynamic. Ryan (2007: 101) describes Smithson as “fascinated” by “the inevitability of entropic change, often over vast, geologic time scales”. *Spiral Jetty* famously was submerged when water levels in the Great Salt Lake rose within two years of its creation. Only when water levels fall does it come into view, its surface altered by the effects of the brine. Salt crystals precipitating on the surface, not part of the original design, are now part of the unfolding of the work.

Smithson linked his work directly to the kinds of monuments archaeologists document: “I like landscapes that suggest prehistory”, the website for *Spiral Jetty* quotes him saying. Where Brill saw his team’s proposal as timeless and universal, Smithson pointed to the past as precedent for his work. Rather than seek a stable and changeless status, Smithson is said to have purposely pursued the effect of ‘entropy’ as he understood it, “the chance operations of nature that lead to a state of transformation”.

Popular coverage of *Spiral Jetty*, however, shares the kind of assumptions team A incorporated in its proposals, under the influence of Brill, which also, if less explicitly, underpin the vision of team B. These popular understandings see monumental works, whether Smithson’s *Spiral Jetty*, or Stonehenge and other ancient works taken as models by the markers teams, as intended to remain the same. In 2011, reporter Glen Warchol wrote an article for the *Salt Lake Tribune* that was headlined ‘*Spiral Jetty*: building an artistic masterpiece for the ages’. The implicit framework referenced is one in which a work should maintain legibility over long periods, ‘for the ages’.

The article is based on interviews with Bob Phillips, a local contractor who assisted in constructing Smithson’s work. It says that Phillips “struggled to understand what Smithson was trying to express through the *Spiral Jetty*”. In particular, Phillips noted his inability to understand what Smithson meant by repeated citation of entropy: “I thought if I could understand what that word meant, I could get into his head and understand what he was trying to do.”

Warchol quoted the chief curator of the Utah Museum of Fine Arts, Jill Dawsey, explaining that Smithson “expected that nature would take its course and things would return to what they had [been] before”.

Ryan characterises Smithson’s view of landscape in terms that reinforce this:

The landscapes of everyday life, a contemporaneousness that didn’t attempt to erase or deny a past (or a future), and an inquiry into process and place that

*'related to change and change in the material order of nature' formed the basis of
Smithson's aesthetic of the entropic landscape (Ryan 2007: 103).*

This is uncannily close to the way an archaeologist might talk today about time, space and materiality. In contrast, the markers project, in both of its designs, was rooted in a denial of the differences between pasts and futures, a requirement for the plans proposed to be considered predictable. While the planning of markers for US nuclear waste repositories laid claim to archaeological authority, it is rather with the producers of Land Art that we can see a shared sensibility that acknowledges the radical contingency of material behavior, even though we engineer or reverse engineer it with our finest tools.

Archaeology/archetypes/art

Intertwined strands that I have only touched on above link the two sources for nuclear marker design proposals, archaeology of cultural heritage sites and place-design based on archetypes of the sacred and awesome, and the landscape-scale practice of art-making that emerged in the late twentieth century. All three take the American Western desert as an empty site for the creation of projects. Where they differ most is in the understanding of the ability to predict or control the future of the works produced.

The nuclear waste marker proposal preferred by the US DOE, based on archaeology, essentially calls for the creation of an archaeological site. By examining the statements from the experts proposing this, and the evolution over time of DOE proposals, I have traced the equation of the marker proposed with UNESCO World Heritage sites, clarifying that what was to be created was not just any archaeological site: it would be a site conforming to standards of Outstanding Universal Value, a cultural heritage monument (Joyce in press). This implication was explicitly drawn out by Frederick Newmeyer (a member of experts team A) in an appendix to the team A report. Newmeyer wrote that "if the collective proposals of team A are carried out, the WIPP site will quickly become known as one of the major architectural and artistic marvels of the modern world" (Ast *et al.* 1992: F-149).

Newmeyer's argument was that the project should explicitly treat the marker as a purpose-built memorial, by building a visitor's center. In support, he argued that while "no building or plot of ground is destruction proof [...] those known to bear religious, memorial, or emotional significance tend to far better than most" (Ast *et al.* 1992: F-150).

At times ambiguous, the conception of the archaeologically warranted marker as something that would last precisely because it shared features universally valued by humans was already evident in the design requirement, that it be based on “historical analogues of structures, media and messages that have withstood the test of time” (EPA 1996: 36). As Sophia Labadi (2013: 114–25) argues, the concept of Outstanding Universal Value that is part of UNESCO World Heritage guidelines equates cultural heritage sites to stable points of reference that maintained fundamental significance from a past to a present. Explicit and inexplicit endorsement of this cultural heritage logic can be found throughout the markers experts’ documents. This allow us to trace a final aspect of the marker proposal: not only would it be a cultural heritage monument of universal value, modelled on an archaeological site; it would deliberately recreate the monument as a ruin.

The proposal by team A, based on the deliberate violation of archetypes understood to create awe and a sense of the sacred, also claimed a power to stop time through monumental scale construction. In another minority comment on the proposal by team A, Ast expressed the romantic notion of what he felt were universal motivations that led to the conservation of cultural heritage monuments, and would in his opinion be more likely to lead to the success of a marker design. “Beauty is conserved, ugliness discarded”, he began, continuing:

To design a marker system that, left alone, will survive for 10 000 years is not a difficult engineering task. It is quite another matter to design a marker system that will for the next 400 generations resist attempts by individuals, organized groups, and societies to destroy or remove the markers (Ast et al. 1992: F-152).

In a remarkable break from his team, he concluded that “a marker system should be chosen that instills awe, pride, and admiration, as it is these feelings that motivate people to maintain ancient markers, monuments, and buildings” (Ast et al. 1992: F-152). Yet while the designs proposed by team A were asserted to violate universal archetypes that created awe, the emotional responses predicted fell along the same spectrum of strong reactions: it would be repulsive, ominous, scary. The repeated claim was made that the markers would evoke awe (Ast et al. 1992).

Both of the families of designs for a marker system required belief that either the forms or the emotions embodied in a marker, or both, would be stable over vast stretches of time. The justifications that the two teams used overlapped in their engagement with archaeological sites, differing primarily in whether sites were understood to be effective strictly as evidence of

material endurance, or of constructions that evoked similar emotional reactions across time and space.

In contrast to the panels of the nuclear waste experts, Land Art creators accepted, indeed embraced, the inevitability of physical decay as a productive force for the future experience of the large-scale works that they designed and carried out in the landscape of the American West. Even when they proposed the inclusion of a Land Art work, the nuclear waste markers experts ignored or denied the reality that materials inevitably change, including in unpredictable ways. Rigaud (2012: 20–21) argues that in his identification of Land Art works as “new monuments”, Smithson recapitulates the action of marking that defines historical monuments, while doing it in a way that subverts classical notions of monumentality as verticality and that rather monumentalises what is traditionally anti-monumental, or even non-material.

The proposals for a nuclear waste marker system by team A, based on presumed archetypes, also self-consciously juxtaposed the monumentalising act of marking while rejecting verticality for the ‘anti-monumental’. These experts argued that the proposed design could produce effects *opposite* to those expected from historically attested place archetypes, leading to the opposite of sensations of “locating and sheltering”, “safety and security” (Ast *et al.* 1992: F-42). Team A explicitly rejected the use of vertical monuments unless they were made in forms that were “more like jagged teeth and thorns than ideals embodied” (Ast *et al.* 1992: F-39 & F-41). Rigaud (2012: 7) cited analysts of Land Art who suggest that these anti-monumental landscape-scale works can be thought of either as like labyrinths or observatories. As with labyrinths, the ‘streets’ of *Forbidding blocks* were intended as a disorienting space. Rigaud (2012: 7–8) describes moving through labyrinthine Land Art works as “ritualistic”, promoting an experience of the place “as a mysterious object which plays on our sense of orientation through the sense of loss”. *Menacing earthworks* incorporated aspects of the observatory, with four corners built to provide a ‘vantage point’ to see the whole.

While the DOE never mentions the proposal by team A for the marker system to include a commissioned work of art, a broader community in the region, skeptical of the immutability and effectiveness of the designs proposed through the experts process, looked to art as an alternative source of ideas about how such a landscape could be marked. In 2002, the director of the Desert Space Foundation in Nevada, Joshua Abbey, issued a call for artists to submit their own ideas for

a marker that might meet the requirements of material persistence and communication of warning, a call that was received ironically by many of those who responded (Auer 2002). Where the expert markers teams drew on archaeology to support their certainty about the persistence of marker elements, and the survival of a capacity to relay a message, archaeology appears in a discussion of this art competition as evidence for the inevitable failure of a monumental marker system. Citing the Egyptian pyramids, Abbey is quoted as saying that “markers ultimately are provocations for human curiosity” (Auer 2002: 7).

The concept selected by judges of this art competition as the most effective was a serious attempt to engage with the challenge. Called ‘Blue Yucca Ridge’, the winning design was described by artist Ashok Sukumaran as “not just a giant aesthetic splotch in the desert”, but rather what he called a “living system” dependent on change for its continuing capacity to communicate danger:

yucca plants, genetically engineered to be blue, would be thickly planted on top of the mountain. The idea is that upon seeing the stretch of mutated yucca, viewers would instinctively comprehend the dangers of what lies beneath (Auer 2002: 7).

Sukumaran offered his own assessment of how the marker system designs proposed by the experts panel would fail: “they are not likely to deter future ‘Indiana Joneses’” (Auer 2002: 7). In subsequent interviews, Sukumaran explicitly rejected “conventional graphic design”, arguing that “the language with which we perceive the world now is going to change, so how can we impose a visual sign that might not remain valid 10 000 years from now?” (Hart 2003). For artists, whether those engaged in the Land Art movement or those responding to the challenge to transform a nuclear landscape into a meaning-generating place, change was inherent, unavoidable. Only through the adoption of a logic that denied change could the markers panels propose designs that they claimed would remain intelligible. That logic, whether expressed as a story of human archetypes of place or of universal values that monumentality expresses, draws on the materials that archaeologists engage with while ignoring what archaeological knowing tells us: things change in unpredictable ways. Only the romantic views that persist in the cultural heritage logic that colonises archaeological spaces without engaging with archaeological knowledge could authorise projects as quixotic as those involved in purporting to design a monument ‘for the ages’ that would last and communicate a message encoded today for the next 10 000 years.

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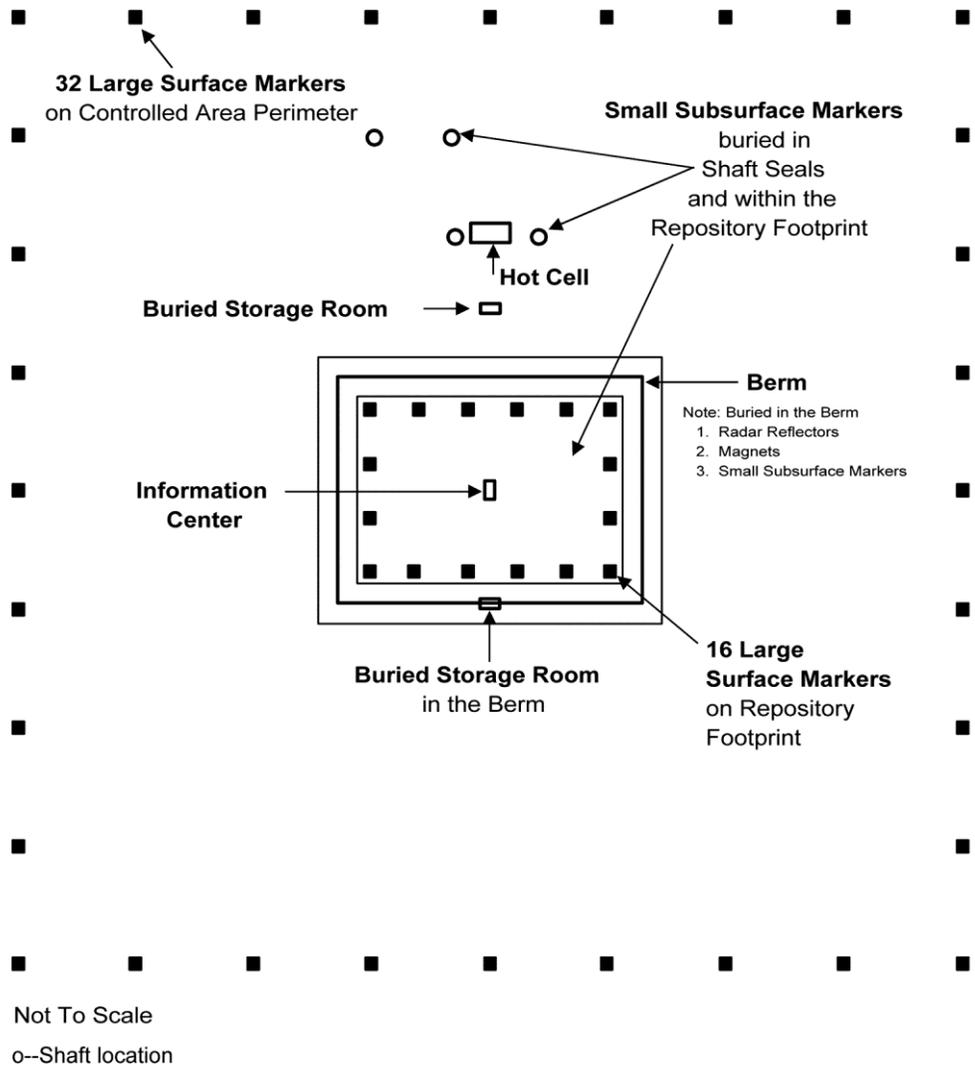


Figure 1. The archaeological marker.

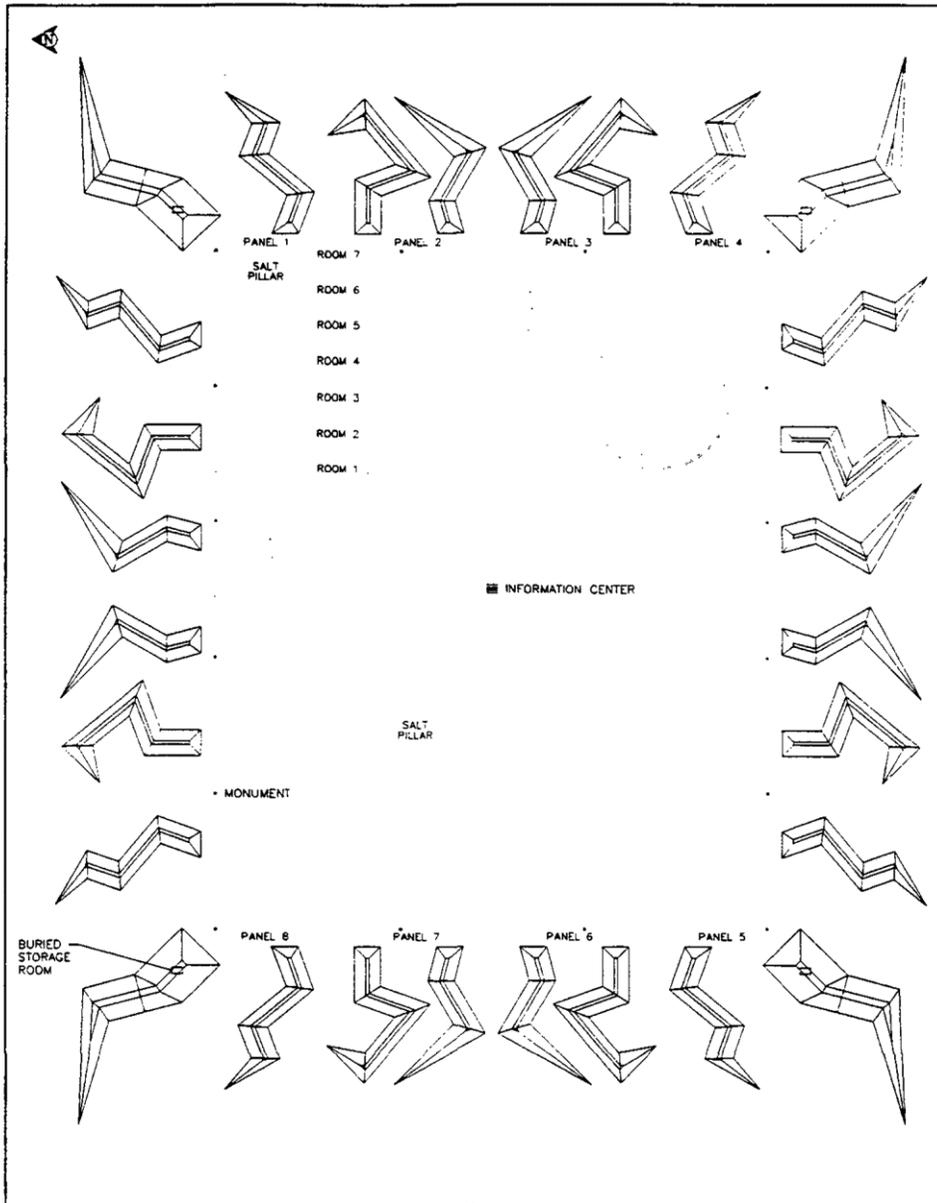


Figure 2. One of the alternative visions for the project.