

# Critical Masses: Augmented Virtual Experiences and the Xenoplastic at Australia's Cold War and Nuclear Heritage Sites

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## ABSTRACT

*Critical Masses* is a multidisciplinary pilot project that aims to graphically represent and mediate the histories, spaces and narratives concerning former nuclear installations within central Australia. These include the abandoned British atomic test sites at Emu Field and Maralinga, the Intercontinental Ballistic Missile (ICBM)/Intermediate Range Ballistic Missile (IRBM) rocket launchers at Woomera, and the decommissioned US National Security Agency early warning satellite base at Nurrungar. Significantly, each of these Cold War sites are situated in either hazardous, remote, secure and/or culturally sensitive areas and require sophisticated analysis and negotiation in order to best render their complexity for both online access and on-site tourism. In association with the Maralinga-Pilling Trust and traditional indigenous landowners a multi-tiered approach (re)creating these locations is being modelled across platforms for diverse audiences. Digital materials are being authored and designed for stand-alone DVD, online interactive sites and archives, an immersive/simulated space for interpretation centres, and augmented/enhanced reality interfaces via GPS and mobile/handheld devices used in situ at key sites.

Résumé: Masses Critiques est un projet pilote multidisciplinaire qui vise à représenter graphiquement et arbitrer les histoires, les espaces et les récits concernant les anciennes installations nucléaires de l'Australie centrale. Cela inclus les sites d'essais atomiques Britanniques abandonnés d'Emu Field et Maralinga, le lanceur de fusée ICBM/IRBM de Woomera, et la base du satellite US de première alerte hors service de l'Agence Nationale de Sécurité de Nurrungar. Tous ces sites de la guerre froide sont principalement situés soit dans des zones dangereuses, éloignées, sûres et/ou culturellement sensibles et demandent analyse sophistiquée et tractation de manière à mieux présenter leur complexité à l'accès en ligne et au tourisme

sur site. En association avec le trust Maralinga-Pilling et les propriétaires indigènes traditionnels une approche multi-facettes (re)créant ces sites va être modélisée sur des plateformes pour des audiences diverses. Des supports numériques vont être écrits et conçus pour des DVD autonomes, des sites interactifs en ligne et des archives, un espace d'immersion/simulation pour les centres d'interprétariat, des interfaces accrues et améliorées via GPS et appareils mobiles/portatifs utilisés in situ sur des sites clés.

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Resumen: Critical Masses es un proyecto piloto multidisciplinar que tiene como objetivo representar gráficamente y actuar como mediador en las historias, los espacios y las narrativas relacionadas con las instalaciones nucleares de Australia central. Entre ellas se incluyen los centros abandonados de pruebas atómicas nucleares en Emu Field y Maralinga, las lanzaderas de ICBM/IRBM en Woomera y la base de satélites desmantelada de la Agencia de Seguridad Nacional Estadounidense en Nurrungar. Es significativo el hecho de que estos sitios de la Guerra Fría se encuentran bien en zonas peligrosas, remotas, seguras o con sensibilidad cultural que requieren análisis y negociaciones avanzadas para, a pesar de su complejidad, hacerlos accesibles en línea y permitir turismo en el sitio. En asociación con el Maralinga-Pilling Trust y los terratenientes indígena tradicionales, se está creando un enfoque multinivel para recrear estos lugares en plataformas para diversas audiencias. Asimismo, se están elaborando y diseñando materiales digitales para DVD independientes, sitios interactivos en línea y archivos, un espacio inmersivo y simulado para centros de interpretación y más y mejores interfaces sobre realidad mediante GPS, sin olvidar los dispositivos móviles utilizados in situ en los lugares clave.

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#### KEYWORDS

Cold War, Atomic, Maralinga, Woomera, Nurrungar

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## Introduction

Recent studies of near-contemporary military and conflict archaeology have embraced multi-disciplinary approaches to the recording and communication of material culture and heritage (e.g., Schofield et al. 2006; Schofield and Cocroft 2007). As Hamilakis (2009:5) asserts:

Archaeology no longer makes the distinction between past and present material culture, or even between artefacts and other material traces, be it landscapes, cityscapes or seascapes. All material culture is the concern of archaeology.

Similarly, Fairclough (2007:19) regards the archaeological study of the Cold War as of great value for its intrinsically “reflexive” nature, “partly because its study so readily transcends the disciplinary barriers between archaeologists, historians, anthropologists, artists and writers (among others), but mainly because it is such a recent past.” This proximity to lived memory, Fairclough maintains, is “still undigested so to speak” and requires a mix of such trans-disciplinary methodological borrowings to comprehend its complexities, since “The very recent past and its legacy is not merely the latest ‘layer’ but is also the still-forming transition from the past to the future” (2007:21).

With the end of the Cold War (1989–1991), a number of previously secure and protected sites of substantial scientific and military infrastructure, though mostly obsolete, have been opened to the public and recognised internationally as important sites for preservation, tourism and education (e.g., AMB batteries and ICMB silos in the USA, and UK command centres).<sup>1</sup> However, successive Australian governments of all political persuasions have been slow to mirror this openness or to publicly promote the heritage value of such grandiose national and international developments (Broderick 2006). The Australian public has long been excluded from information concerning the establishment and operation of Cold War intelligence and nuclear defense-related facilities that function on its home turf. Anecdotally, few Australians today are aware that, in partnership with the British government, Australia was host to a series of atmospheric nuclear explosions at the Monte Bello islands off the north west coast (1952, 1956) and in central Australia at Emu Field and Maralinga (1953–1957) (Wilks 1980; Tame and Robotham 1982; Milliken 1986; Cross 2001). Some might recall the presence of secretive and remotely located US military and/or intelligence facilities, later jointly operated with Australian personnel, established for the US Navy, CIA and NSA, respectively at Exmouth in West Australia, Pine Gap in the Northern Territory and Nurrungar in South Australia (Ball 1980; Mack 1987; Ball 1987) (Figures 1, 2).

Fewer still understand that the Australian government clandestinely pursued the capacity to develop its own independent nuclear weapons capability, if required, from the 1950s to 1980s (Cawte 1993; Reynolds 2000). From the late 1950s, each year Australia produced scores of kilograms of weapons-grade enriched uranium from its research reactor in outer-suburban Sydney, and stockpiled the material on site. In 1967, using a modified US Redstone ballistic missile capable of delivering a nuclear payload,



**Figure 1.** The single geodesic radome remaining at the former NSA early warning facility at Nurrungar, near Woomera. Note the footings of other dismantled radomes at the same site



**Figure 2.** Inside the last-remaining Nurrungar radome. The giant 26-m telemetry dish stands dormant, protected from the harsh desert climate by its exterior Kevlar shell

Australia became only the fourth nation to have successfully launched a satellite into orbit (WRESAT) from its own territory (Morton 1989). It should come as no surprise then that Australia was cited throughout the

1960s in a number of now-declassified CIA estimates and diplomatic cables as a potential 'threshold' nuclear state—along with Israel, South Africa, Sweden, India and Brazil.<sup>2</sup>

At the close of World War II, the combined developments of German V-weapons and the Allied Manhattan project led the Chifley Labor government to partner with the British in order to establish a guided weapons range at Woomera in central Australia, far away from the prying eyes of both enemies and the local populace. The 1949 explosion of the first Soviet atomic device ensured an accelerated arms race between the two post-war superpowers and the British government quickly determined that an independent nuclear deterrent against Soviet aggression was required for Europe.

The first British atomic device to be detonated was inside a decommissioned British frigate, HMS *Plym*, to simulate an attack on a port or naval base. The chosen location was the remote archipelago of the Monte Bello islands, approximately 100 km north of Onslow off Australia's north west coast. Codenamed Operation Hurricane the 20 kt detonation occurred below the waterline and vaporised the 1,300 ton vessel moored 300 m off Trimouille Island on October 3, 1952. A further series of tests occurred at the archipelago in 1956. The two Mosaic blasts on Alpha and Trimouille Islands were tower-mounted detonations to test fission–fusion boosters to enhance atomic explosion into the megaton thermo-nuclear range.

With the success of Operation Hurricane at the Monte Bello islands, the British government quickly asked Prime Minister Menzies to approve an Australian site for a series of continental atomic tests. After surveying several remote and underpopulated central Australian locations Emu Field and its claypan airstrip was chosen to stage the tower-mounted detonations of Totem 1 (10 kt) and Totem 2 (8 kt) in mid-to-late October 1953. Despite significant capital works at the site, including Nissan huts, a tent city and bitumen roads, with an overall service personnel of 3,000, the British scientists required a more permanent location for ongoing nuclear trials (Beadell 1967). In May 1955 Maralinga was announced as the 'permanent' site after it was surveyed and suggested by Len Beadell, who had been commissioned by the Australian government to create a network of roads across the central deserts. Although Maralinga was only sparsely populated by nomadic Aboriginal peoples, the site had significant spiritual meaning for the indigenous nations who were forcibly and permanently removed to locations such as Yalata, Ceduna and elsewhere, many hundreds of kilometres from their traditional lands.

The site surrounding Maralinga staged two major series of detonations, Operation Buffalo commencing in September 1956 (incorporating the code-named nuclear devices One Tree, Marcoo, Kite and Breakaway) and Operation Antler a year later in September 1957 (incorporating the codenamed

nuclear devices Tadge, Biak and Taranaki). At the Buffalo tests, soldiers (called the 'Indoctrination Force') were ordered to enter contaminated areas as 'guinea-pigs' (Rabbit-Roff 2001; Cross and Hudson 2005), including the area of the Marcoo ground-burst. Hundreds of minor trials (codenamed Kittens, Tims, Rats and Vixen) were also conducted at Maralinga and Emu from 1955 to 1963 in total secrecy. Unlike the much publicised atomic detonations, these secret experiments deliberately contaminated large areas while burning, crashing, exploding and dispersing various radioactive elements including plutonium, uranium, beryllium and polonium (McClelland 1985). The surrounding locales were left toxic until 1967 when the British government reluctantly and only partially remediated the sites by, at best, burying the most hazardous material into pits capped with concrete, or at worst, simply ploughing much of the radioactive contaminants into the topsoil (McClelland 1985). Controversy still lingers over the effectiveness of the most recent and comprehensive clean-up yet conducted in 2002 (MARTAC 2003; Parkinson 2007).

The British nuclear tests at the Monte Bellos, Emu and Maralinga used a range of media and methods for calibrating the effectiveness of the atomic devices (ship, tower, surface, air drop, and balloon). However, an equally significant and parallel development was taking place at nearby Woomera with guided missile and rocket experimentation (Morton 1989). While British scientists were perfecting the fissile and fusion techniques for nuclear weapons, their colleagues at Woomera were developing the means of delivering the warheads on short-range cruise missiles and longer-range IRBMs and ICBMs. Missiles test fired across the Australian continent with dummy warheads included Blue Steel, Black Knight and Blue Streak. Many failed and fell back to Earth or were deliberately exploded mid-flight, with various rocket stages and component parts raining down along the desert range. The material legacy can be encountered, either purposefully or accidentally, along a number of outback roads and tracks.

### **Cold War Heritage and Nuclear Tourism**

Tourists today face a vast array of possible places to visit and 'things to do'. Travel is more than moving from one physical location to another; it is also about a journey, or series of 'journeys' through which each traveller experiences the world of being a tourist. Some of these micro-journeys are about self-discovery while others concern the discovery of the 'other'. Official tourism is frequently promoted by government as enhancing national identity and history (Fiske et al. 1987; Craik 2001). In the context of this research, the 'other' is both historical and contemporary and it is the interaction between the other(s) and the self-discovery that we aim to explore,

in part, by enabling visitors to share their experiences of Australia's Cold War atomic history. Increasingly, retirees, backpackers and empty-nester baby-boomers are criss-crossing the continent, often in four-wheel drives, enabling easy access to even the remotest of Australia's nuclear heritage infrastructure.

But how do tourists currently engage with this history? How might they engage with it in future? What communities are involved in these ventures and with whom will the tourists interact? Who are the stakeholders for this emerging digital industry as it grows and develops? In conjunction with the Maralinga-Tjarutja traditional owners, *Critical Masses* will deploy new and developing digital technologies along with the online social tagging and networking to find another means to enrich outback tourists experience of the Maralinga Village and associated atomic sites (Maralinga Tjarutja Inc 2003).

One problematic informing Maralinga tourism is that visitors may be unable or unwilling to visit certain sites because of the large distances involved or because of their personal circumstances, including age, health and wealth. Former and current restrictions formally placed on access to Cold War/atomic sites may still provoke fear, or actual danger, along with concerns about ownership and the long-term conservation of the locale. New digital technologies, however, may provide pathways through these restrictions or barriers to travel. These same technologies will provide for a more democratic interpretive process that permits visitors to take away digital 'souvenirs' while encouraging them to leave behind artefacts they create themselves, to share with a growing community of visitors, such as some form of digital recorded memory, whether voice, video, photo or text. Hence, tourists become participants in an organic interpretation of the site, who do not merely remain the passive recipient of an official, monolithic narrative.

## **Augmented Reality, Virtual Heritage and The Xenoplastic**

the Museum of the Third Kind, the museum of emergence, is a platform of operations, a seedbed, a planetary resource, a site of cultural negotiation, interaction and collaborative creativity, before it is in any sense a showcase, a stage set or repository. It will make history rather than record it (Ascott 1996).

Prior to Ascott's assertion, above, Paul Ricoeur defined the discipline and methodology of hermeneutics by its fundamental capacity to explore *how* we interpret texts (Ricoeur 1971). This is not only because we may learn

something new about the way we consider a text, but because we might also come to understand some of the systems that regulate, and hence influence, our interpretations. The elegance of a hermeneutical approach is that it can equally be applied to objects and spaces (as texts), especially those that are re-interpreted for us by institutions such as museums. For the *Critical Masses* project, which will include the construction of an interpretation centre at Maralinga Village, the question of how to relate particular sites and artefacts used in atomic testing in 1950s Australia to the cultural zeitgeist of today, and into the future, is a salient problem of interpretation. In this way *Critical Masses* recognises that an interpretation centre based at Maralinga will be a connection point or meeting place that intersects with several dynamic and historic relationships (traditional occupation, explorers, settlers, indigenous dispossession, bi-lateral nation-building, military, science, national security, etc.) All of these will be taken into account and as such will be woven into what Giaccardi et al. (2006:13) describe as the

fabric of existing practices and activities inside the local community, identifying social and emotional support mechanisms, and collaborating with local partners and social networks [as] crucial elements for the success of the project.

As a result the information technology systems that are used to support the interpretation centre will be exploited to make the space a permeable network; influenced by its users and outside cultural influences. Therefore a hermeneutic approach is important to understanding the ongoing systems of knowledge and social relations responsible for the interpretation, communication, and renewal of cultural objects as living entities.

Cultural artefacts within the museum context act as the nexus for a whole range of territories, spaces and time. These objects are subject to the paradox of (usually) being physically frozen in a glass display case yet infinitely subjected to the growing number of cultural contexts of the time in which they are viewed. In other words, historical artefacts continue to gather significance not as unique and singular autonomous objects, but rather as a part of a larger cultural picture, outside of itself (Manovich 2002). Traditionally museums try to compress the vast history of an object into a terse narrative, display panel or reconstructed diorama. That which is not considered 'essential' is effectively 'edited out' and with this erasure we are left with the supposed singular truth, or 'essence' of the object. Apart from the problematic of such authorship, the key difficulty for museums, according to Manovich (2002), is really a matter of scale. Hence, the larger the supporting network that generates meaning for an artefact,



then the larger the database of accrued information to be accessed and sustained over a significantly long period of time.

The sheer scale of media data and competing interests embedded in sites like Maralinga (e.g., materials informing the 1984 Royal Commission into the British Nuclear Tests) inevitably requires the reconstitution of information to suit its users, or to be more precise, the delivery and re-contextualisation of historical information as metadata. Metadata is ‘data about data’ and is predominately a computer science term used to describe the information within a computer file (Manovich 2002). But imagine, as does the Viridian Design Movement (<http://www.viridiandesign.org/>), that every object in our everyday life was tagged with a chip (a ‘ThingLink’) which provided metadata (or an ‘infocloud’) on all levels of an object’s physical and virtual makeup. Not only would visitor-users gain a deeper insight into the way they use (and are ‘used by’) any object, but such an ‘Internet of things’, as Sterling (2006) suggests, would allow users to identify and label the object, track its precise GPS position (before and after use), link to powerful search engine functionality with manufacturing and product information, and visualize historical data with 3D or 4D virtual representations of the object incorporating animations of its use. All this information can be augmented or layered with our own ‘raw’ vision of the physical object and delivered by some kind of visual display, embedded in anything from a mobile phone to transparent VR or augmented reality glasses. Such information (oral histories, amateur and official film and photography, maps, reports) is already in accessible archives and converging mobile technology platforms are increasingly available to tourists. By taking advantage of augmented aural and visual or mixed reality technologies, *Critical Masses* aims to reveal that the currently perceived ‘barren’ topographies such as Maralinga and Emu Field are, in fact, information rich, and a convergence point for a socially creative experience.

Likewise, the application of these ‘thinglinks’ and ‘infoclouds’ could support what is aptly called “iridescence” by Giaccardi et al. (2006:4) and described as a

form of virtuality that—rather than focusing on duplicating pieces of reality, recombining digital contents, or interconnecting different museums—empowers creative interaction among the physical, cultural, and virtual components of cultural objects, and allows attributing to these components different functions and degrees of importance according to the need.

The beauty of using technology in this framework is that it physically preserves the artefact whilst expanding the visitor’s perceptions. Archaeology already demonstrates that ordinary physical objects have a shifting techno-social substrate, only in the case of *Critical Masses* we won’t require shovels, trowels or brushes to uncover it.

Like many cultural histories, the extant materials concerning the Australian atomic test sites and former Joint Intelligence facilities are far from complete. They are continually contested and still subject to official secrecy. Just as the central Australian bush struggles to reassert itself over ‘ground zero’—from the atomic blasts to multiple attempts at clean-up—there are experiences and stories still in the making, still being negotiated. How would an interpretation centre take these active relations between community and territory, physicality and virtuality into account yet still preserve a coherent and possibly unified overall experience? In Ascott’s (1996) description of museums of the future augmented by technology, the experience is,

no longer a one-sided encounter with official taste, nor a secondary encounter of personal interpretation, but a close encounter of the third kind, involving transformation and interactivity, where the observer becomes an integral part of the creative system.

For Ascott the museum (of the third kind) must account for the interpretations of the past yet allow for the dynamics of community and territory, both physical virtual and cultural; no matter how ‘xenoplastic’. The digital, non-linear capacity of such user/site interfaces promotes xenoplasticity: “in the emergent culture the principal focus of the Art Museum shifts from the plastic arts to the xenoplastic arts, the arts of connectivity and interaction” (Ascott 1996).

Having a vast range of accessible and editable metadata about an object or place is one way of accounting for this shifting cultural dynamic. Another is to allow users to generate ‘social tags’ (e.g., Steve Museum 2007) which adds a kind of social creativity or meta-design to the existing knowledge archive. Put simply, meta-design “supports users as active contributors who can transcend the functionality and content of existing systems” (Fischer 2007) (Figure 3).

An unlikely example of social creativity and ‘analogue’ meta-design was discovered on a 2007 research trip to the atomic test sites in South Australia. Our research team spent the night at William Creek, a small town located between Alice Springs and Adelaide. On visiting the local pub we were surprised to see a perfect example of social tagging in action. Each visitor is asked to staple a piece of memorabilia of themselves to the walls or bar of the hotel. As a result the interior of the bar is quite literally laminated in business cards, photos and items of clothing—a mix between anthropological *bricolage* and artistic *decoupage*. The process is a perfect example of meta-design in action whereby an aggregate cultural picture is added to a space by the people who use/occupy/visit the location. The outcome is a culturally diverse, historically rich and a creative social space,



**Figure 3.** Social tagging bricolage at the William Creek Hotel and Bar

continually growing, that reveals the interaction between patrons and the bar. This ‘accidental design’ of interior accretion is mirrored externally by the deposit of 19th century settler/pioneer cultural and engineering artefacts outside the William Creek Hotel, as a testament to the ‘opening up’ of the central desert interior to European exploration. The same jumble of objects is juxtaposed in a beguilingly random display against an array of mid-20th century missiles fired from the rocket range—an assortment at odds with the official Missile Park in the centre of the Woomera township (Figures 4, 5).



**Figure 4.** A Skylark missile fuselage beside a wooden cart sits atop decaying hard-wood railway sleepers at William Creek



**Figure 5.** Blue Streak 2nd stage rocket fuselage next to a felled Skylark set amongst William Creek's 19th century pioneer heritage objects

There are now multiple online projects that attempt to link individual perspectives with historical objects through social tagging and meta-design. At the *Steve Museum* website (<http://www.steve.museum>), visitors are encouraged to describe works of art in their own way and:

See art you haven't seen before. Look in a new way [...] Exchange your ideas with the community of art lovers. Lead others to artworks they wouldn't normally see. Create a personal relationship to works. Let museums know what you see. The more you tag, the richer the experience for all (2007).

This kind of social creativity is reflected to some extent in Wikis, open source software and MMOG (massively multiplayer online games) which more-or-less allow users to participate in the living organism that is 'every-day archaeology'. While not necessarily narrative in outcome, these projects highlight the possibilities in empowering the role of the user as an active agent in mapping the links between the community and the artefacts which represent them. The *Critical Masses* team is also designing interactive games for use at these locations, playable on-site/in situ, to enable new ways of exploring history and place. In this way the same type of augmented data can be represented by virtual avatars, and in-game puzzles which might reward players for their skills in forming associations or making discoveries.

By using our experiences of the William Creek Hotel as a possible prototype for social creativity, *Critical Masses* hopes to expand the interplay between the social and the historical elements of Maralinga by taking advantage of augmented or mixed reality technologies. There is nothing

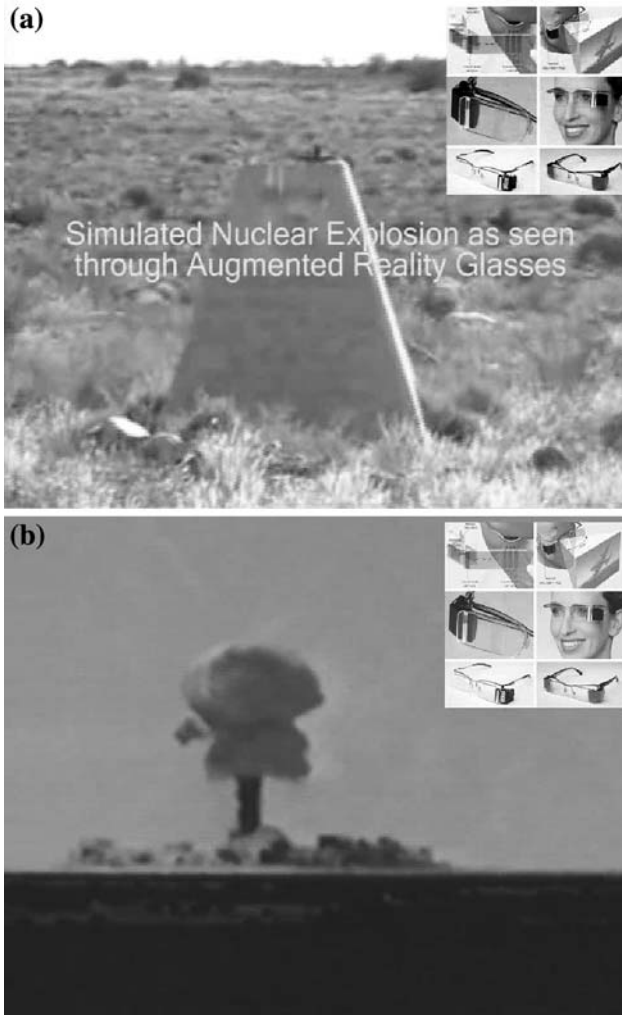


**Figure 6.** Murdoch team co-authors (from left to right): Mark Cypher, Mick Broderick and Jim Macbeth at the 20 kt Taranaki atomic blast site, ground zero commemorative plinth, Maralinga, South Australia

like the experience of physically standing at a ground zero nuclear explosion point. Indeed, the implications of being in the exact same spot as an atomic detonation adds a kind of compelling ‘iridescence’ all on its own. According to popular mythologies, sites such as Maralinga and Emu are often considered barren, if not hazardous, and ‘spoilt’ by contaminants. Yet they are simultaneously steeped in historical and current spatio-temporal knowledges. The ‘infocloud’ available is immense, ranging from service veterans’ accounts to local indigenous experiences, previous visitors’ remarks, scientific data, archival footage, equipment analysis, through to ‘official’ cultural and political interpretations (Figure 6).

While the overall experience of standing at ground zero can be affective and sobering, imagine if you were able to witness the actual explosion via authentic actuality footage at the site augmented through your transparent VR glasses whilst standing in the actual place of the blast. Then, immediately after, you could access all the metadata associated with the event. You could also aurally and visually record your personal reflection/interpretation to be uploaded to a visitors’ social tagging database, or else simply use the same mechanism as a digital audio-visual record of your trip, following your eye-movement and seeing/recording what you see. Using this framework *Critical Masses* hopes to cultivate an understanding of cultural objects and spaces by not only bringing together the physical elements, but also the multiple perspectives of the past and active participation of users in the present (Figure 7a, b).

The information technology architecture of *Critical Masses* is specifically designed to support an expanded means of participation. Not just in the



**Figure 7.** Still images from a demonstration video of in situ experiences for visitors to Taranaki and the capacity to access VR or augmented reality overlays in the field (e.g., archival film) on portable eye and ear-wear

sense of social creativity but also as a means to access information on demand and in multiple forms. Combinations of different interaction spaces and media delivery systems offer visitors multiple entry points into an engagement with several interpretation sites (Giaccardi et al. 2006). Before even arriving at Maralinga visitors may be able to login to a website,



**Figure 8.** A mobile phone or PDA using GPS or wireless/Bluetooth is triggered to convey data on-site. Here the device describes the metal rings used to tether a balloon detonation at the Tufi (aka 'Gona') site

gather information and secure tickets to associated events/tours and accommodation. The interpretation centre itself will display artifacts, equipment and ephemera from the time of the atomic testing. Along with each object's associated *thinglink*, a large amount of information in various aural and visual formats can be delivered to either a handheld PDA or VR glasses (Figures 8, 9).

Similarly, the Maralinga interpretation space virtual tour of the atomic test sites will use novel and portable projection environments, which can be up-scaled to meet any size or display environment. This element will not act only as a means to advertise the field tour itself but to provide an alternative perspective or entry point to the experience of being at ground zero. It will enable those visitors that are either 'time poor' (cannot undertake an escorted tour), or cannot afford the expense of that option, or who may be frail and infirm, or who do not like the idea of exposing themselves to the proximity of a former atomic test detonation, with a simulated and immersive 3D experience under temperature controlled conditions (Figure 10a, b).

Visitors would also have the ability to upload personal comments about these artefacts to an existing archive, subject to moderation. Individual video and audio recordings (downloaded from handheld tour guide PDAs or VR glasses) could also be uploaded to a large touch-sensitive screen, enabling visitors to contribute to an ongoing digital social archaeology that



**Figure 9.** The same digital device will access archival photos and video to show how the proposed balloon detonation may have been configured immediately overhead

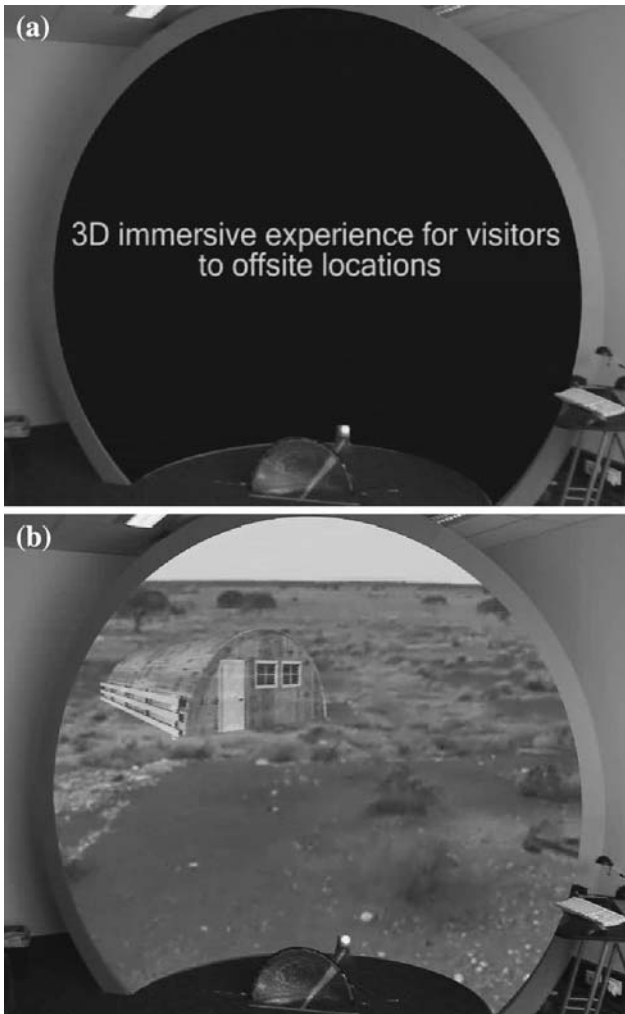
complements existing social practices such as the William Creek Hotel. This same data will also be available to visitors to create their own digital postcard for blogging, or a DVD of images and sounds captured whilst on the tour to take away with them. In this way the connection between the interpretation centre and on site tours is preserved through the integration of data, physical presence and locative media installations.

## Conclusion

In its quest for new modes of representation, interpretation, democratisation and end-user production/dissemination, the *Critical Masses* project is acutely aware of its capacity to substitute one representational orthodoxy for another. As Cody points out, virtual technologies can never fully replace the physical dimensions of the museum let alone any architectural, archaeological or natural wonder, because they cannot convey “scale, texture, a sense of place, and other three-dimensional qualities [...] Be it small or large, seeing the real thing is unambiguous. There is often an emotional reaction that accompanies the perception of true size” (Cody 1997:39–40).

The virtual experience of museums may also be a solitary interaction, notes Cody (1997:40), as opposed to physical interactions in the museum





**Figure 10.** Video stills of a demonstration panel displaying an interpretation centre's immersive, virtual space. The central prism at bottom projects a curved image onto a concave screen, giving the impression of a 3D moving image, into which the viewer feels 'immersed' without the need for special eyewear. In this example, as the camera pans from screen left-to-right over the contemporary remnant Emu Field camp footings, a computer generated reconstruction of huts is overlaid to recreate how the camp appeared in 1953

through organised tours, study groups and other informally organised communities. While the virtual experience may improve the sense of concentration and engagement with the object or episode under scrutiny, and

also offers opportunities for discussion and dialogue with other ‘reality’ visitors, it is essentially a “faceless” interaction, according to Cody, that may further a sense of alienation, not just from historical reality but also from contemporary reality.

However, this aspect is precisely what *Critical Masses* aims to challenge: our rendering of the history of nuclear testing in Australia through digital technology, including augmented reality, will be anything but ‘faceless’. Besides providing for a democratic interactive journey, our purpose is to create a complementary array of heritage interactions, from immersive communal spaces through to field trips with augmented meta-data devices, not activities that are isolating and without scale.

Hence, *Critical Masses* follows Hooper-Greenhill’s critique of conventional museological practices by stressing the importance of using hermeneutical approaches for understanding “differences, for change and for rupture” in order to create a methodology that enables a range of interpretations from a single experience, one that traditional teleological accounts of official history might suppress (Hooper-Greenhill 1992:10). As McGlann argues “the digital transformation of our museums and archives” warrants a “rethinking of literary and cultural studies, method as well as theory, by establishing an institutionalised mechanism [...] for new kinds of digitally based analytic and interpretive practices” (McGlann 2005:179).

A creative exploration of the long-ignored, if not suppressed, history of Australia’s Cold War atomic development, we feel, is one such domain worthy of innovative practice in the 21st century.

## Notes

1. For examples see “Nike Missile Site” at <http://www.nps.gov/goga/nike-missile-site.htm>, “Minuteman Missile Historic Site” at <http://www.nps.gov/mimi/index.htm>, and “Hack Green Nuclear Bunker” at <http://www.hackgreen.co.uk/>.
2. See William Burr “National Intelligence Estimates of the Nuclear Proliferation Problem: The First Ten Years, 1957-1967”, National Security Archive Electronic Briefing Book No. 155, June 2005, at <http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB155/index.htm#5>; “Australia’s Prime Minister Wanted ‘Nuclear Option’” in “The Impulse towards a Safer World”, National Security Archive at <http://www.gwu.edu/~nsarchiv/nukevault/ebb253/index.htm>; and Jacques E. C. Hyman, “Isotopes and Identity: Australia and the Nuclear Weapons Option: 1949-1999”, *The Nonproliferation Review*, Spring 2000, at <http://cns.miis.edu/pubs/npr/vol07/71/hym71.pdf>.

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