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DEVELOPING A COMPUTER BASED MANAGEMENT SYSTEM FOR MONITORING CHANGE TO *INSIDE AUSTRALIA* (ANTONY GORMLEY, 2003)

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ABSTRACT

This paper describes an electronic conservation management system commissioned to document change and predict failure mechanisms for the sculptural installation *Inside Australia* by British artist Antony Gormley. The work consists of a series of 51 life-size cast stainless steel sculptures set across a salt lake in remote Western Australia. The work was installed in 2003 and put in the care of the Art Gallery of Western Australia (AGWA) which commissioned the management system as a first step in executing its custodial responsibility. The severe environmental conditions demand careful decisions for the most appropriate documentation technologies used on the lake, coupled with the need to implement a system that can be handed on to conservators undertaking future in situ surveys.

RÉSUMÉ

Cet article décrit un système électronique de gestion de la conservation commandé pour documenter les changements et prévoir les mécanismes de défaillance liés à l'installation sculpturale *Inside Australia* de l'artiste britannique Antony Gormley. Cette œuvre comprend une série de 51 sculptures moulées en acier inoxydable, de grandeur nature, disposées dans un lac salé reculé de l'Australie occidentale. Installée en 2003, l'œuvre a été placée sous les soins de l'Art Gallery of Western Australia (AGWA), qui a commandé ce système de gestion comme première étape dans le cadre de ses responsabilités de conservation. Les conditions environnementales extrêmes nécessitent de prendre des décisions réfléchies quant aux technologies de documentation les plus pertinentes uti-

INTRODUCTION

In 2002, UK artist Antony Gormley was commissioned by the University of Western Australia, Perth International Arts Festival (PIAF) to create an installation piece for the 2003 festival. Gormley developed the plan for *Inside Australia*, a large scale site specific sculptural installation, to be located in outback Western Australia. Consisting of a number of human sized figurative sculptures scattered across a salt lake, it is one of the most remote works of its kind in the world (Figure 1).

After extensive aerial surveys, a section of Lake Ballard located near the small town of Menzies, 730 km east of Perth, was chosen as the location and PIAF staff installed the works under the direction of Antony Gormley over nine days in early December 2002 (Gormley 2005).

In 2007, Antony Gormley gifted *Inside Australia* to the Western Australia state government. In an arrangement with the government, the Art Gallery of Western Australia (AGWA) took responsibility for the long term conservation management of the work, including remedial treatment, preventative maintenance and advice to stakeholders on site management issues.

As a necessary first step it was determined that a thorough survey of all the components of the work should be undertaken. In 2008, Cummins and Thorn were commissioned to establish a complete digital system for documenting *Inside Australia* and to undertake the first survey.

DESCRIPTION OF THE WORK

Inside Australia comprises 51 sculptures taken from full body scans of local residents. Each sculpture has been cast in stainless steel 316, using the lost wax process, from digitally manipulated three dimensional computer scans of local residents (Figure 2). The sculptures were finished with a short heat treatment to blacken the steel.

The individual sculptures are scattered over 4 km^2 of the salt lake with distances between individual Insiders varying from 90 to 800 meters. The total distance to walk between all is around 14 km.

lisées sur le lac, sans oublier que le système mis en place doit pouvoir être transmis aux restaurateurs qui devront mener des études ultérieures sur le site.

RESUMEN

Este artículo describe un sistema electrónico de gestión de la conservación, que fue encargado para documentar los cambios y predecir los mecanismos de deterioro de la instalación escultórica *Inside Australia,* del artista británico Antony Gormley. La obra consiste en una serie de 51 esculturas de tamaño natural de acero inoxidable, situadas en un lago salado en un área remota de Australia Occidental. El trabajo se instaló en 2003 y se dejó al cuidado de la *Art Gallery of Western Australia* (AGWA, o Galería de Arte del Oeste de Australia) que, como primer paso tras aceptar la responsabilidad del cuidado de la obra, encargó este sistema de gestión. Las duras condiciones ambientales exigen decisiones cuidadosas para elegir las mejores tecnologías para la documentación en el lago, aunado a la necesidad de instrumentar un sistema que pueda transmitirse a otros conservadores que ejecuten supervisiones in situ en el futuro.

Figure 1
Insider on flooded lake with shore in background

CONDITIONS AND ENVIRONMENTAL IMPACTS

Lake Ballard is a remote salt lake in the arid centre of Western Australia. The lake bed is dense red sedimented clay, evident near the shore, with a thin crust of salt overlying this across the lake bed where the sculptures are positioned. Sporadic rainfall converts the salt crust to a saline solution lapping at the ankles of the sculptures.

Vehicles have illegally entered the lake leaving tyre treads and when bogged used the sculptures to pull themselves out, resulting in mechanical damage and displacement. Marking of the salt lake was an integral part of the installation, as foot tracks developed between sculptures would form a pattern observable from an elevated viewing mound within the lake.

Emus are seen benignly crossing the lake, whereas cattle were suspected of causing damage by rubbing against the sculptures and snapping them off.

STATE OF PRESERVATION

After five years, damage had occurred to some of the works as a result of vandalism but formal reporting or repair procedures were not in place at that time. By 2008, four damaged works had been removed to the AGWA conservation laboratory.

The inaugural survey identified that two further figures were missing, presumably stolen. A foot of one was located and the trampled path around another, permitting an accurate location to be determined for both. Seven sculptures had broken ankles causing these figures to lean. It was clear that the very thin ankles were the weakest part of the sculptures. Through plotting these damaged figures, the impact was seen to be closest to the car park and pedestrian access points to the lake. This mapping was useful in confirming human, rather than bovine damage.

Visitor footprints remain on the lake until the next rain and, as Gormley envisaged, provide visitation patterns across the lake. The most defined paths were those within 1 km of the car park. Works close to shore are also

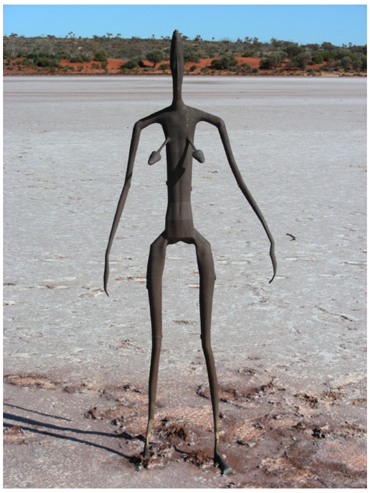

Figure 2
Insider, cast in stainless steel 316

the most accessible for those with poor mobility, so in becoming damaged or absent the visitor experience can be substantially reduced.

Corrosion was the most anticipated damage due to the figures' partial immersion in a saline environment. Surprisingly, the metal surfaces were in good condition. The predominant corrosion was pin point corrosion identified on the lower legs of 13 of the sculptures (Figure 3). This was associated with concentrated salt levels when the lake fills, followed by evaporation leaving salty tide lines up the legs. The saline water tends to wick up the legs to a higher level than the lake level itself.

Defects inherited from casting and manufacture were also documented and measured. These included fissures, open and closed cracks, porosity and shrinkage holes, and incomplete metal flow during casting. The conservators were concerned that, apart from being sites for water ingress and associated deterioration, there was the possibility that some of the cracks may increase through visitor impact.

Almost all the works had a distinguishing hole on the reverse, usually on the upper back measuring up to 3 cm in diameter (Figure 4). These were roughly fettled riser stubs, which the artist retained as part of the industrial manufacturing process. In a later interview with the artist, Gormley said "the in-gates and the risers are cut close to the surface but never at the surface – never lost. The sculptures sing when the wind is in the right direction due to the holes in the back, another reason not to fill the holes..." (Cummins 2009).

Figure 3
Salt crystals on the lower legs and pin point corrosion

Figure 4
Inherent defects from the casting process showing the central hole from fettling the riser stubs and crack on left shoulder

The database adopted a priority rating for each work from 1 to 3, identifying those requiring immediate treatment. The priority rating was as follows:

1. immediate treatment due to structural instability (24%)
2. treatment within 12–18 months to stabilise condition (45%)
3. no immediate treatment required, but monitoring of listed faults during the next survey (31%).

THE CONSERVATION MANAGEMENT SYSTEM

Hardware considerations

The conservation management system needed to provide condition and location data at hand on the salt lake which could be readily transferred to the AGWA computer system. The lake itself imposed limitations. Firstly, the stark brightness of the clear skies and white salt surface rendered all notebook computer screens unreadable. While technologies had been announced, such as transflective and OLED screens, these were not commercially available on notebooks, but available on GPS units and Smartphones. The consultants therefore advised against the use of notebook computers for data collection on site, instead recommending a handheld computer with superior screen visibility, and more importantly of a size that could be shaded by the operators' headwear.

The system needed to be lightweight and readily accessible as only foot traffic was allowed and the sculptures were widely distributed across the salt lake.

On the second day of the survey, overnight rain filled the lake up to 100 mm depth in the cultural area. This meant that backpacks could not be removed and equipment must be readily accessed from pockets, etc. A typical day's survey required walking 10–15 km.

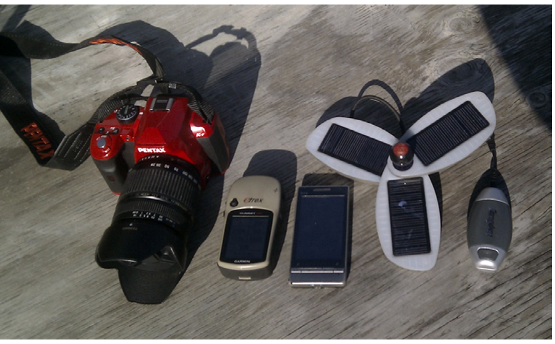

Figure 5
Photo of the equipment used for the survey. From left to right, SLR, GPS PDA, solar charger, battery charger

To survey an individual object required the object to be uniquely recognized. This required both a spatial co-ordinate and an identifiable image. A Garmin Summit mapping GPS was used to locate the sculptures that were, on average, 700 metres apart. The GPS could clearly distinguish points 20 metres apart or less with a spatial resolution of around 3 metres. Additional distinguishing features were also recorded, such as gender, dimensions, and orientation, a feature important to the artist in positioning each work. The brief also required the installation of radio frequency identification tags (RFID), but as these could not be attached to the above ground object, they were buried below ground, often into very wet and muddy conditions.

Ten objects were surveyed each day and the GPS, particularly its on board mapping feature, proved useful in determining whether a sculpture had already been surveyed previously. The map made it clear whether an object was already located when approached to within about 300 metres, a significant advantage when faced with a daily 15 km trudge through salty sludge.

Two cameras were used for the initial survey. Ideally, a compact high resolution camera would work best, but experience with using such cameras in both dark and harshly lit conditions determined that a good quality digital SLR with interchangeable lenses is the best means of capturing reasonable images, and particularly macroscopic details. An SLR is quite cumbersome in sludge conditions, but the larger sensor and adaptable lens configurations compensate for this. Even so, when late afternoon sun shines strongly from the rear of a work, it is very difficult to capture more than a silhouette. This fact is not ignored in the database where one field is devoted to identifying the best time of day to photograph the main front details, allowing follow up surveyors to record better quality images by surveying the sculpture at the documented time.

The three essential acronyms required to undertake the survey are PDA, GPS and SLR (Figure 5). With these a full survey can be done on site with no recourse to existing documents. Storage card compatibility using adaptors between the camera and PDA is useful to ensure that images can be put directly into the PDA for on-site documentation. A PDA with built-in camera is very useful in providing instant registration or condition marked images that can be relabelled at the object with the registration number.

Another acronym is vital to this system – AA. It is essential to be able to run all gadgets for a full day and hence various forms of battery charger are carried. The GPS and SLR camera of choice run on AA batteries, whereas the Smartphone requires charging. A solar charger and AA driven phone charger complete the essential survey kit.

Software considerations

The brief stipulated that the system must be delivered on Microsoft ACCESS. The AGWA were appointed custodians, but the works were not a registered part of the AGWA collection. The consultants supported this software choice knowing that commercial databases, while having limitations for larger collections, avoid the risk of knowledge dilution as trained operators leave the organization. Most government institutions have regular training opportunities on mainstream commercial software and this is seen to be a substantial benefit in maintaining a system in working order. Proprietary systems may be tailored to conservation and give a sense of personalized museum interest, but if they cannot be loaded onto a Smartphone and carried out to the object, their function is limited.

It is therefore essential to choose PDA database software that provides both effective data entry on site and smooth cross platform synchronization. There have been several options in recent years running on compressed Windows formats, but with Microsoft abandoning support for synchronization of compressed formats Handbase by DDH Software was chosen. This program cannot be directly synchronized, but the pathway from hand to desk is reasonably smooth and simple. Handbase has an advantage over competing software in that standardized text entries can be added during the survey, appearing as drop down menus. It was found that each condition could be fully described by one of three or four stock phrases that could then be refined with additional text. There are better individual solutions in other programs, but all in all Handbase has provided effective in situ data collection with minimal retyping of common observations and has been easy to learn for the follow up condition surveyor.

It is necessary to maintain data integrity on PDAs. The preferred system is to work with the database in internal memory and then back it up to a storage card after each object is completed. At the end of each day the PDAs database files are backed up on a tablet computer that also stores daily images and waypoints. This ensures that should the database itself become corrupted, one can step back to the previous day's work and continue.

To manage the transfer of data back and forth from desk top to salt lake, two data tables are established. The first table contains all condition data imported back and forth from the PDA, while the second exists only in ACCESS on the desktop and houses all of the linked images, files, reports and maps. This ACCESS only table contains links to an image folder for each object and to its location on Google Earth. The two tables are merged during the query building stage within ACCESS and have been structured to facilitate the simplest expansion into the future. For example each image folder has been set up with five empty folders for future surveys. Each survey simply pastes images into each of these folders and adjusts the title to suit the year. The new images are immediately connected to the database as all links are already in place.

The Handbase program cannot accommodate embedded images, so these are stored on the PDA in a folder of registration images gathered through the on board camera. The same reduced size images serve as the reference images in ACCESS and so are kept in a separate folder that is improved as better quality images become available. Accessing a folder of numbered images for verification works just as quickly in a stand-alone image viewing program or hyperlinked within the database, and is the best solution for the limited processing power of PDAs.

The Garmin GPS comes with the desktop mapping software MapSource, allowing further waypoint management. One of the strong features of MapSource is its ability to directly load and display waypoints in Google Earth, which is the best readily available source of aerial photographs, providing the ability to permanently save waypoints and projects. One aspect of Gormley's original concept anticipated that walking tracks between objects would mark the lake bed and become a visual component of the work. It was richly satisfying to load the sculpture waypoints into Google Earth and see these trails in the salt from the aerial images (Figure 6).

The camera requires no software but, as previously mentioned, there is a great benefit in being able to transfer images to the PDA for editing. The PDA is loaded with image editing software, in this instance Pocket

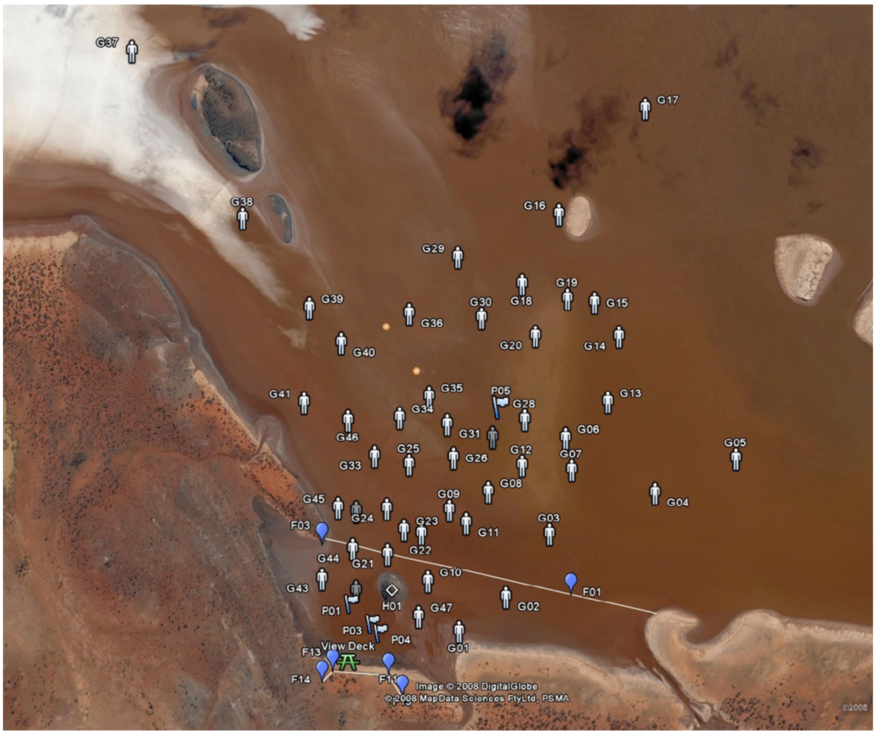

Figure 6
The GPS survey of the installation overlaid onto the Google Earth satellite image

Artist by Conduits. This program resides in the PDA but was not called upon in the initial survey. By having in situ image, editing it allows details that cannot be illustrated solely by photograph to be documented quite accurately. The compression required to open and edit images on the PDA usually renders them too compressed for final use, but the key here is that the conservator is equipped with all the tools to fully document conditions without prior base images on hand. This is a particularly significant issue when surveying in remote places where the cost of travelling to site is very high and the ability to achieve full documentation in one visit is an advantage.

CONDITION SURVEYING SYSTEM IN PRACTICE

The initial survey was planned over five days with around ten objects studied each day. Each sculpture was located and as the first day's survey progressed, both the database fields and terminology required to describe the works and their condition were developed. Each work was photographed from four angles, together with additional detailed condition shots as required. To index the SLR images the object number was inscribed into the salt lake and photographed, to tag the images relevant to that work. The GPS waypoint and database record were synchronised to this number and each evening the digital photographs were separated into individually numbered folders corresponding to the recently established registration number from the database.

The ACCESS database was constructed to link all these pieces of information. The record screen was split into two main tabbed areas, so that registration fields could be compared to condition fields and these with recommendations, etc. The layout was particularly mindful of the need to be able to have all relevant fields on screen for every possible end use, including ready comparison of changing conditions between surveys. Hyperlinks were created to show a marked map of each work and each record linked directly to a folder of high resolution photographs. This approach, rather than having direct hyperlinks to images, allows for future expansion without requiring rewriting of the database. Subfolders were created for future surveyors to place their images into so they will be immediately visible through the hyperlink. Future ease of use is considered to be the most important mark of successful database construction.

A low resolution front view registration image was created for each object simply as a confirmatory reference. Low resolution images maintain optimal database performance and the same small files are stored on the PDA for in situ verification. It is important to keep the same identifying image uniformly recognizable across platforms.

USING THE SYSTEM IN SUBSEQUENT SURVEYS

A subsequent survey in 2010 and conservation treatments have demonstrated the benefits of the system.

The single most useful aspect of the survey was the GPS location of all the individual works on the lake. This, in combination with a portable database loaded on to a PDA, has resulted in an excellent facility to identify each sculpture on the lake and retrieve data associated with it. A particular Insider can be selected prior to entry to the lake and navigated to for surveying and reporting. Equally, the Insider currently visited can be identified to recall all relevant data with ease. Other systems would be either too unwieldy or slow to be of much use in such a remote environment.

The treatment prioritisation of the works has allowed resources to be targeted towards those needing urgent attention, resulting in completion of all priority 1 treatments in relatively short order. The decision to monitor priority 2 and 3 works has been adopted as both categories involve casting defects considered by the artist to be integral to his work. Most notable of these issues is the decision not to fill the riser holes, as these can make the sculptures sing, an effect the artist did not intend, but one he is very happy with.

By loading the GPS coordinates into a publically available program such as Google Earth, AGWA has been able to share this data with other stakeholders where necessary. This has enabled some surprising benefits when working with partners in areas such as tourism.

One particular incident of note where the system especially proved beneficial was the case of one sculpture disappearing from the lake after the initial survey. Using the database, the missing work could be easily identified and the exact orientation and coordinates it had been taken from confirmed. From the images taken from several aspects, identification of the original computer scan allowed a replacement to be cut and the work recast.

CONCLUSION

This paper outlines the response to a specific brief whereby a remote sculpture collection has been condition surveyed and mapped in digital form, providing ongoing usability both in software and hardware terms. The three authors worked together on refining the brief, particularly in terms of technological capability, and one of the authors has returned to the lake after 18 months to use the system developed by the other two. This adoption by a conservator not involved in the initial development has verified the management system achieves its designed objective.

Frequently, databases and other computer based management systems become redundant through being too user specific to a point that when the initial user has passed on there is no legacy of continued operability. Equally, proprietary systems may require constant support from the developer and cannot readily be sent to portable devices for use at the object. With the chosen software the generated tables can be imported into almost any software package required.

The specification of three devices, GPS, PDA and SLR, has been established after experiencing the short comings of various alternatives. The PDA used has the capability of providing all three data collection functions; however, this capability has been avoided for various reasons. The quality and flexibility of an SLR is warranted, but not essential. GPS points can be collected on the PDA, but at the time of the first survey no suitable mapping software existed that could plot progress of the mapping in situ. The facility of a mapping GPS and its ability to export to Google Earth has proven a significant function. Screen technologies continue to advance, and since the survey some technologies have emerged that can be read in full sun. These have yet to find their way into notebook computers, but it must be considered that a notebook is a cumbersome item on a salt lake in full sun.

Google Earth has proven to be a vital part of this system as it has revealed one of Gormley's key concepts, visualization of the tracks in the salt through people walking from Insider to Insider.

ACKNOWLEDGMENTS

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REFERENCES

CUMMINS, A. Transcript of artist interview with Antony Gormley, personal communication, 14 July 2009.

GORMLEY, A. et al. 2005. *Antony Gormley: inside Australia*. London: Thames and Hudson.