



Documentation and conservation of contemporary heritage. Daniel Buren's installation at Centre Pompidou Málaga (Spain)

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Abstract

In this communication, we present the work done where the use of photogrammetry has been the protagonist to virtualise the heritage in a 3D model of the installation work Incubé (2015), an installation of the artist Daniel Buren at the Centre Pompidou Malaga. On this occasion, by means of various glass panels in primary colours projected on the architecture, the work generated a play of interspersed stripes of light. Photogrammetry gives us the opportunity to produce accurate models of two-dimensional images, which allows the documentation and conservation of heritage elements, especially those that are endowed with a certain materiality that does not rely on the projection of light or sound reproduction, thus allowing the documentation and conservation of the work.

Keywords: *photogrammetry, heritage, installation work, preventive conservation, 3D model.*

1. Introduction

Talking about the work of contemporary art forces us to dwell on the multiple options and variables offered by its means of creation, to describe the diversity of materials that can be susceptible to be part of it and even beyond its materiality, the volume of the space they inhabit. Sometimes, the architecture of the museum itself becomes part of that work of art; this happens when we find an artistic intervention of an installation nature. Here, we find that the format of the work can be very variable. Its ephemeral nature and the use of sometimes also sensitive materials make it necessary to document the work in the process of creation and installation.

Referring to the work of Llamas Pacheco (Llamas Pacheco, 2012) and the different articles related to this work on three-dimensional contemporary work written by the author, we can define, following her own words, the fundamental role of the conservator restorer of contemporary art is fundamentally preventive. Thus, the criteria that guide the interventions are directed towards preventive conservation. This is a constant attention that we cannot lose when we face the intervention of contemporary work in all the steps we take from the moment the work arrives. Thus, we will consider the first phase of contact and preliminary diagnosis to know how to intervene, and we must think about what we introduce in the work and decide what type of materials we will use depending on the work, the nature of the materials and its history. In this sense, it is important for the contemporary art conservator not to lose sight of the need to have very good previous documentation, if possible, with the artist's intention and the intervention processes, where everything that has been done is specified. This documentation work is usually done using two-dimensional images. Still, photogrammetry offers the possibility of virtualising the work in 3 dimensions, with greater capacity for geometric resolution and higher quality textures, information that can be very useful to check the passage of time in the work's materiality.

2. The use of new technologies applied to heritage: documenting, preserving and disseminating

The use of digital heritage, intended not only for the processes of digitisation, collection or dissemination of data but also as a tool to involve different actors in the processes of protection and re-signification, ultimately leads to a democratisation of heritage itself. Currently, the presentation spaces of cultural heritage should focus on interactivity and user experience as the main axis on which the storyline revolves to provide value above aspects such as aesthetics or beauty.

It is here where the use of Information and Communication Technologies (ICT) plays a leading role, tools with which to work on the heritage project (Figure 1) and in the construction of measures with which to design and the conditions of accessibility and dissemination for the sake of sustainable tourism. A process of no return for which different administrations are betting with greater or lesser success in an effort to increase the benefits by reducing the depletion of the resources of the Cultural Heritage immersed in the tourist circuits of the XXI century.

In recent years, the impact of ICTs on the cultural sector has grown exponentially. New technologies offer innovative alternatives to create new experiences for a constantly evolving public. Virtual Reality (VR) and Augmented Reality (AR) are positioned as two of the main ingredients in this recipe we call 'culture + technology'. The potential of ICT, social networks and digital tools related to heritage has been at the centre of the studies of many researchers since their origin, mainly related to their possibility of creating a virtual "showcase" or "showcase" for the public. In these cases, the effects of ICTs are considered highly positive in strengthening cultural identity.

Augmented reality (AR) technology is an interactive virtual environment that enriches the user experience. It consists of inserting virtual graphics into our physical space so that the real and the virtual blend, offering an enriched or augmented image of reality. Since the term Augmented Reality was coined in 1992 (Cárdenas Ruiz, Yesid Mesa, Suarez Barón, 2018), there have been numerous works on the subject (Bimber, 2005; Haller, 2007; Hainich, 2010; Torres, 2011).

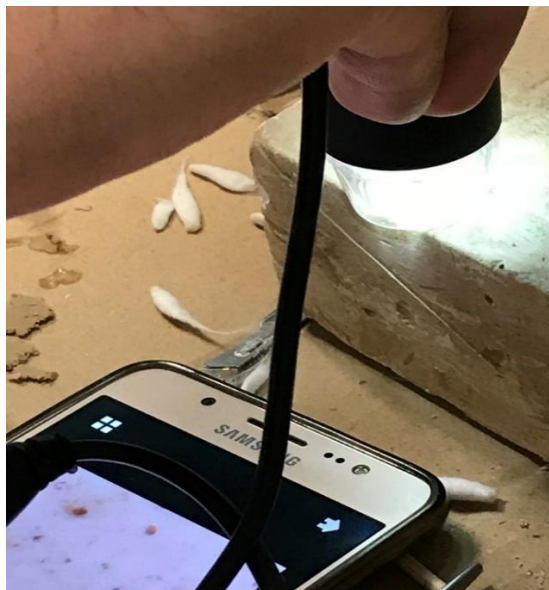


Figure 1. Digitisation process before intervention in movable assets. Degree in Conservation and Restoration of Cultural Heritage. University of Seville. The author of the image is Lourdes Royo (2018).

About intervention work, the incorporation of new technologies plays an increasingly relevant role, being an essential reference in all methodological processes of knowledge, treatment and enhancement of cultural property, given the high degree of technology acquired by conservation and restoration in recent years, both at the level of scientific instrumentation and the increasingly accurate and sophisticated analysis (Bellido Gant, 2008). Using new technologies as a complementary working tool in disseminating and interpreting heritage facilitates access to knowledge to society in general and, therefore, protects and conserves our heritage.

This aspect of guardianship is not only related to the consultation of databases or digital documentation but also to access to all types of information, which in turn allows us not only the visit or direct consultation thanks to the digitisation of documents or databases. In addition to this, the utility as support for heritage research and the dissemination and reconstructions and 3D virtual recreations of the goods has become one of the most important tools for research, conservation and dissemination of cultural heritage, allowing us to understand graphically part of our history in the different spaces enabled for their work: museums, documentaries or information sheets.

3. Daniel Buren's work

Daniel Buren (Boulogne-Billancourt, France, 1938) is one of the most internationally recognised French artists. His conceptual work perfectly reflects his ability to fuse art, architecture, and space through the abstraction of form through line and colour. Creator of the concepts he called "degré zéro" and "outil visual", Daniel Buren radicalised at the end of the 60's the exercise of painting through a series of "Manifestations" that he developed together with other members of the group: B.M.P.T. Group (Oliver Mosset, Michel Parmentier and Niele Toroni) from the deconstruction of the traditional forms of pictorial exhibition to question the institutional devices that give meaning and symbolic value.

From this idea of "degree zero of painting", Buren started in his later works to play with the materials and their relationship with the medium and the structure that give shape to the work of art. At the same time, he would use the line as a "visual tool", which, in its repetitive and regular action, turns the work into a neutral and anti-narrative image. If there is something that defines Buren's work, it is its close relationship with the space that will host it. For the artist, it is vital to know both the place and the context. In this creative exercise, he combines the intention of choosing exhibition contexts in the public space that are marginalised from the official centres, which allows him to develop marginal forms of perception. As a result, pieces seek to be a tool to question how we look and perceive, as well as the way in which space is used and appropriated.

This critical view of the institutionalism of art and the need to move his work from the official exhibition spaces to the social and political terrain of public space is what he has sustained for more than 50 years. His intervention projects are fully conceived and created in the site where they are established, taking into account the context that houses them and a colour palette that allows the establishment of sensations and dynamism between the work and the space.

Buren's work has been presented in museums, public spaces and art institutions in Germany, Belgium, the United States, Spain, France, Italy and Mexico. Many of his works have become references for the cities that host them. An obvious example is the work he presented in 2009 in Nuremberg (Figure 2).



Figure 2. Facade of Neues Museum in Nuremberg coloured by Daniel Buren. Wikimedia Commons (2009).

An urban scale project designed under environmental and social concepts that seek to expand public spaces and promote social interaction. His design was conceived and produced for the central fountain of the ARTZ Pedregal complex, in which the artist created a dialogue with the space and the environment through the combination of simple materials, geometric figures and solid colours that coexist with water and natural light.

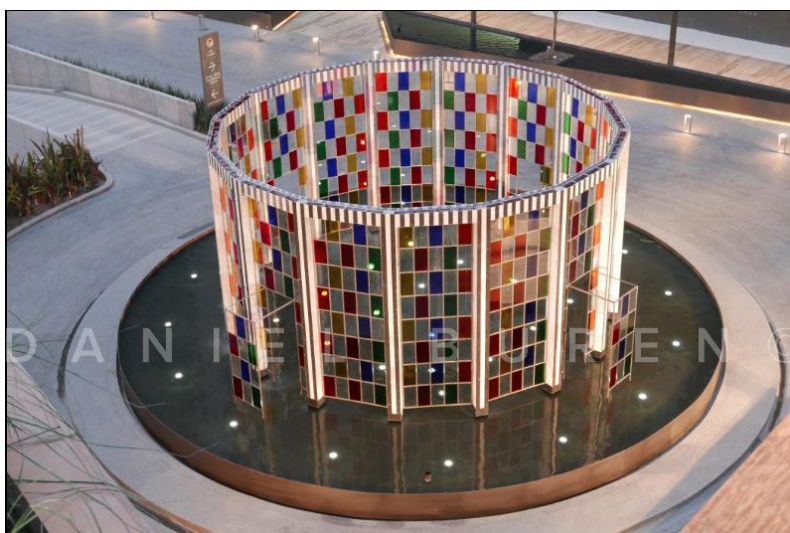


Figure 3. From the Rotonda to the fountain. 5 coors for Mexico. Homage to architect Manuel Tolsá, travail in situ permanent, mars 2018, in "[Inauguration d'Artz Pedregal]", Plaza Comercial Artz Pedregal, Mexico, Mexique, à partir du 9 mars 2018. © Daniel Buren/ADAGP, Paris. Détail.

4. Daniel Burén's installation at Centre Pompidou Málaga

The Centre Pompidou in Malaga is an adapted building designed in 2013 by Javier Pérez de la Fuente and Juan Antonio Marín Malavé, architects of the city's Urban Planning Department, organised on two levels, outside, with 12 meters. High, the image that takes plastic force is a cube built of glass and steel, a transparent element that allows skylight access to natural light but also constitutes a full urban design and a void inside the museum. It is precisely this structure with which it is identified today.

In 2015, the Frenchman Daniel Buren was commissioned to carry out an intervention in the building, choosing this minimalist piece he titled *Incubé*, i.e. incubated inside the cube. Here again, Daniel Buren created a work conceived specifically for the context in which he was working.

The coloured cube of the Pompidou in Malaga is developed inside the "Cube" on the promenade along the harbour basin. With a rhythmic sense (36 on each side), the cube's glass plates are covered with sheets of self-adhesive vinyl in plain colours, triggering chromatic and luminous pulsations that affect not only the exterior but also the interior of this skylight. With this "cladding", the Cube is the only visible part of the Centre Pompidou Malaga. It imposes itself as the symbol of the institution's presence in the urban landscape of the city, becoming one of the most photographed places, a meeting point for its inhabitants and the most representative image of the museum.



Figure 4. *Incubé*, Centre Pompidou Málaga. The author of the image is Royo-Naranjo (2015).

5. Objectives

The main goal of this digitisation was to see and test how translucent and transparent surfaces are recognised by the software Agisoft Metashape Pro. We knew that this kind of surface could inherit some difficulties, and we wanted to check how the object is recognised and how material and textures are translated into the 3D model.

For this purpose, we ran two different digitisations with two sets (chunks) of images, the first one without markers and the second one with designated markers; by the end of the processing, we couldn't tell any differences between the two groups, if so the second one was translated into the 3D model much worse than the first one. As shown in Figure 6, the software wasn't able to establish a concrete area where you can reminisce about the object of our study.

Since it's a metal structure with squared crystals attached to it, in the model, you could see the metal part since they're solid, but transparencies were a complete challenge since it doesn't recognise the surface as such after running the two rounds we assumed that Agisoft Metashape is not capable at the moment of reading a transparent or translucent object/surface and recognising that it could have a solidity to it. Instead, after running

all the improvements at hand, we could still see that the structure is recognised only partially, as you can see in Figure 9.

6. Case Study: Results

To carry out the photogrammetric digitisation of Buren's work at the Pompidou Centre Málaga, several factors specific to the work and the space it occupies had to be considered.

Firstly, the work is located in Plaza Muelle 1, on two levels, with the promenade leading to the museum entrance on one side and the cube on the other. The space of preferential perception of the work is either from the street level, being at the foot of It and rising before us, or It can also be partially enjoyed from the inside of the museum itself.

It should be noted that the space that the cube generates inside the museum is a quadrangular courtyard that rises in height from floor 0, the museum's space where frequent on-site installation development occurs; this space is inaccessible to visitors who can enjoy it from the outside. Likewise, one of the characteristics of the cube is both transparency and its ability to reflect light, therefore becoming difficult in terms of digitisation, as it is of the surfaces that so far seems to be the most difficult to digitise using photogrammetry (Marqués, 2023). For this reason, data was taken in two different environments, on the one hand with more uniform and filtered light during a cloudy day and on the other during the early morning hours of a sunny day, to assess which colour results are more in fine with reality.

It has been considered that the installation of the architecture and the glass pieces are developed from the outside of the cube. Therefore, the digitalisation of the work is directed from this same space, taking the two-dimensional data from outside the museum and placing us on the outer circumference of the cube.

The equipment used to take images of Buren's work was a Canon EOS 600 D digital camera and EF - S18 - 55mm f/3.5 - 5.6 IS II zoom lens; after marking the terrain using targets, we could scale the model later during processing. The software chosen to carry out the processing and photogrammetric survey has been Agisoft Metashape Pro, based on previous experience with this software and because data is also usable in all types of GIS and CAD software.

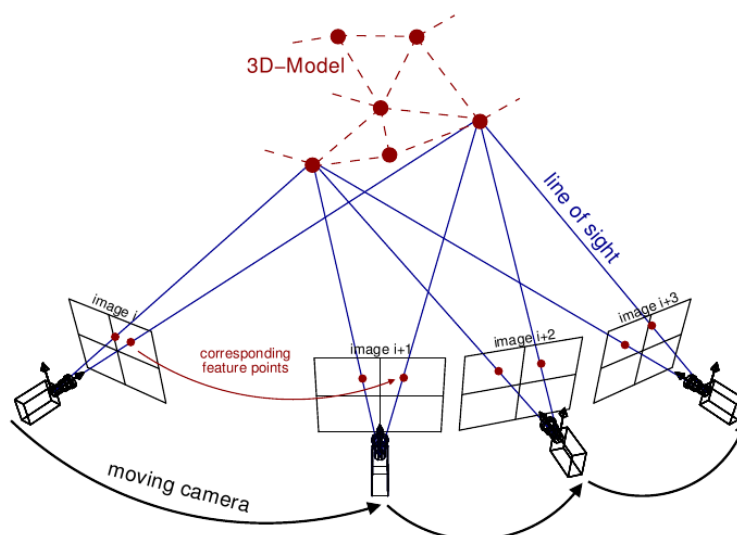


Figure 5. Structure from Motion (SfM) photogrammetric principle. Source: Theia-sfm.org (2016)¹.

¹ Exploring the use of 3D GIS as an analytical tool in archaeological excavation practice - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/figure/Structure-from-Motion-SfM-photogrammetric-principle-Source-Theia-sfmorg-2016_fig3_303824023 [accessed 7 May, 2024].

We align the photos, a simple but essential step in getting a good result, through a sequential reference pre-selection. Points are used in Agisoft Metashape to calculate the relative location of the cameras. First, a sparse “low density” point cloud from the key point is created, the maximum number of points the program will draw from a photo. The key point limit is set to 40000, and the tie point limit is set to 10000, creating a balance between having a great camera alignment performance without increasing too much processing time and having an overall 25 hours of processing data for this sole step.

The cloud point has been processed in an extra-high setting and a mild depth filtering map to achieve an accurate depiction since it processes images at its original resolution, creating a cloud point with a total of 29275 tie points. We took all the data from the dense cloud point and started the triangulation, which will then build a mesh to enable the making of the 3D model. It should be noted that since we set the programme to draw colour from the vertex, all the colour information extracted from the dense cloud point has been added to the mesh.

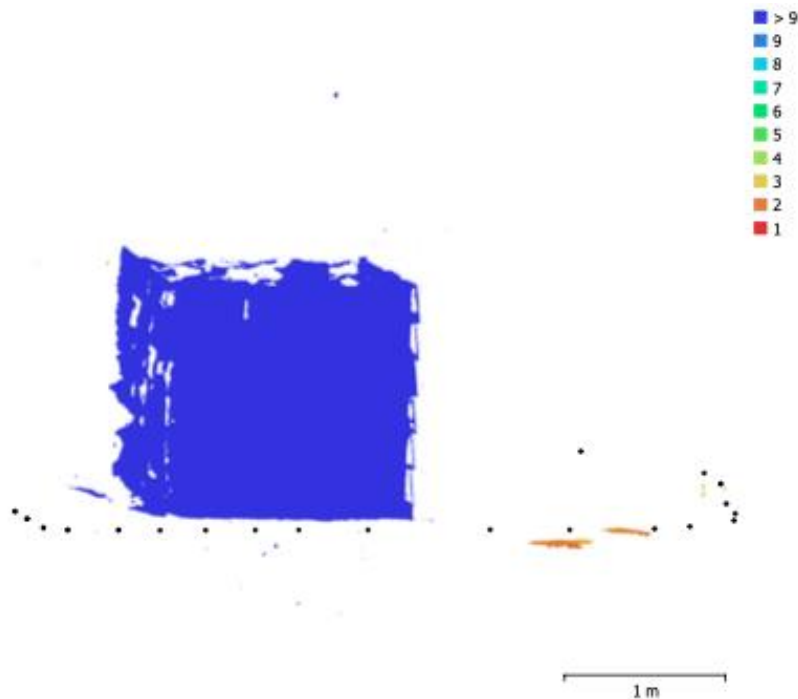


Figure 7. Camera location and overlap, Agisoft Report on Daniel Buren’s cube.
Author of the image: Deborah Fernández León, 2024.



Figure 8. 3D model generated from dense point cloud. Author of the image: Deborah Fernandez León, 2024.

After smoothing the mesh and closing the holes, we still can see how the colour hasn't transferred as it should; then, we created a texture with depth maps extracting data from the base images with a mosaic blending to protect the surface. Results show how complex the base material makes the digitisation of the structure without post-production added to the main 3D model, as there are still some unclosed holes. This raises the question of whether post-produced 3D models are still useful for conservation since they have some features altered to fit reality but do not necessarily show the material state.

7. Conclusions

Although photogrammetry presents a few difficulties depending on the material the architecture is made of, as in Buren's work with reflective and transparent surfaces, it can be fixed to a certain point afterwards in production and surely will be overcome in the future. The capacity to create models that deliver more information than digital elevation models, orthophoto and perspective views is valuable in recording before an intervention or tracking the qualities of a material.

In a large structure, as it is the cube, we would encourage using a drone to capture small details that might not have been caught by a camera set on a tripod from the floor level. Results show how light and transparency affect the creation of a readable surface for the software since there is no colour in some parts. Although the structure is in the middle of the city centre with a close airport and a hospital with a helipad, it's situated in an area where you cannot fly a drone unless you go through a long and costly bureaucratic procedure. Regardless, the outcome might be enhanced by using a drone to capture the cube from the upper structure, allowing it to present a flatter and hopefully solid structure.

Ultimately, digital photogrammetry helps to create records and information about heritage in general and architecture in particular, making the process easier than before, more precise, cost-effective and accessible.

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