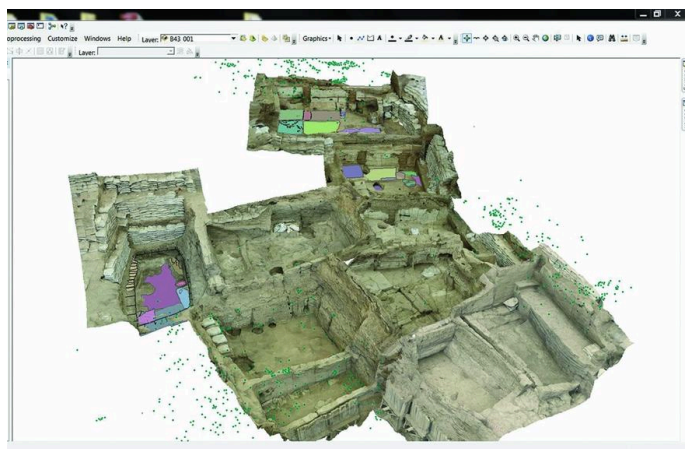
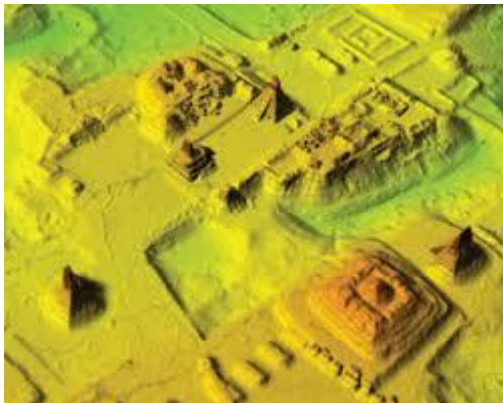


A summary of the application and usage of 3D visualisation technology in an archaeological context

In the current times, technological advancement has starkly transformed and evolved understanding within many fields of study with one said discipline undoubtedly being Archaeology, this has also most certainly led to many points of debates cropping up within this field. An example of growing technological advancement having its application within the field debated is the application of 3D visualisation contributing towards the collection of data in archaeological fieldwork. This includes the use of LiDAR/TLS (Light Detection and ranging) and GIS(Geographical information system) as examples of 3D visualisation technology utilised within the field of archaeology to acquire data. Despite its obvious usage within archaeological research many debates and issues around its usage have risen since its early introduction in the late 1980s.



An Example of GIS imaging (Beggren et al), Newcastle University.



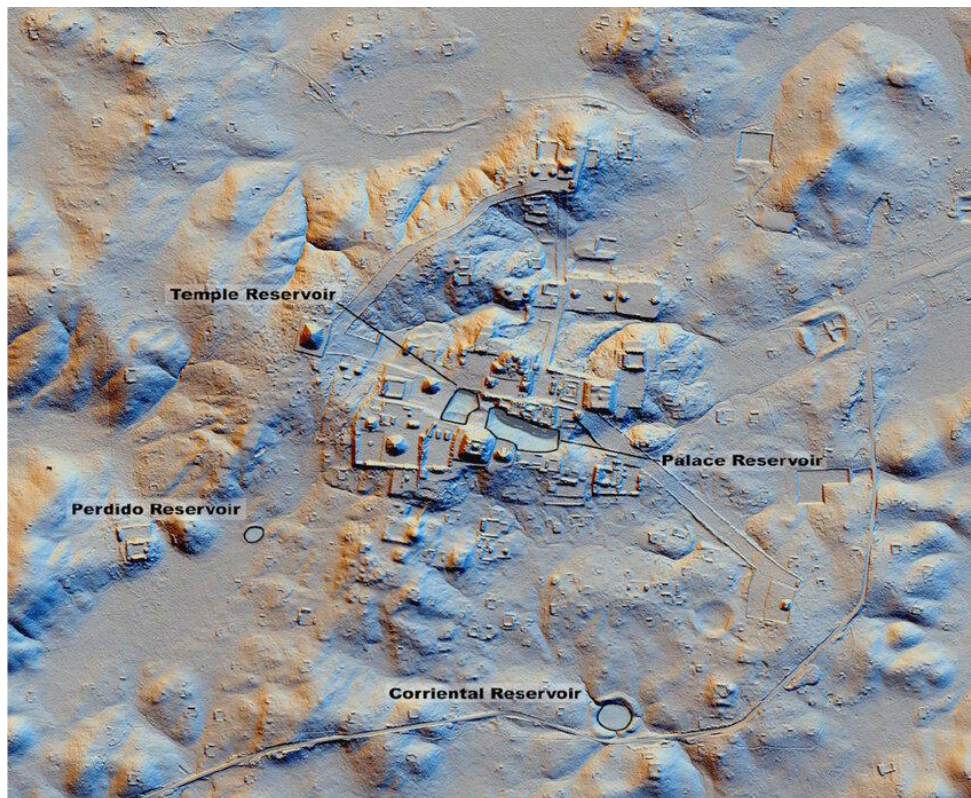
An Example of LiDAR imaging of the Mayan settlement of Tikal from researchers with the National Center for Airborne Laser Mapping (NCALM).

To begin with, the primary arguments for 3D visualisation usage over traditional methods of conducting archaeological fieldwork, is its unique ability(in the case of LiDAR imaging) in finding archaeological remains that had become lost to time such as the Mayan settlement of Tikal, in a case where the majority of the settlement was obscured from view by dense Guatemalan rainforest, which could only be stripped away with the use of lasers(courtesy of aerial LiDAR mapping). The benefits of this technology is borderline revolutionary to the field in discovering locations obscured from the view of a normal human eyes survey of land and

even in person with locations such as Tikal located in dense rainforest the hauling of equipment and personnel to these locales can be damaging to the natural biodiversity of a rainforest and even be dangerous for the personnel trying to haul equipment directly to site; LiDAR can negate indirect damage to the rainforest by simply mapping it from above. This has been the primary argument for its application in the field and has even been referred to as "revolutionising archaeology the way the Hubble Space Telescope revolutionised astronomy" by Francisco Estrada-Belli, a research professor at the Tulane University School of Liberal Arts when speaking to National Geographic about the LiDAR mapping in Guatemala in 2018 in the very same breadth, Kathryn Reese-Taylor, a University of Calgary archaeologist and Maya specialist also speaking to National Geographic came forward and said "After decades of combing through the forests, no archaeologist had stumbled across these sites. More importantly, we never had the big picture that this data set gives us. It really pulls back the veil and helps us see the ancient civilisation as the ancient Maya saw it". Furthermore, LiDAR mapping can be of specific benefit to archaeological sites of heritage because of its unique ability to map alterations in topography over time. This is a useful ability of LiDAR because within topographical changes being pinpointed erosion and deposition points of occurrence can be located also. This allows heritage sites' planning and protection to be based with the information of where they are at heavy risk or little at all, allowing planning companies to organise mitigation and or conservation projects accordingly.

However 3D visualisation technology such as LiDAR has its very distinct drawbacks that can limit its usage to certain academic institutions or organisations is not only the cost of the technology but the complex data sets it produces. Despite being an undoubtedly revolutionary technology for the discipline of archaeology it also requires a massive amount of computing power to process the data gathered by the already very expensive mapping technology for the professional level of LiDAR mapping with prices ranging from \$50,000 upwards which does not take into account the costs of a plane, a pilot and airplane fuel for aerial usage which a lot of large archaeological projects, like the ones that have taken places in Guatemala, utilise. Continuing on about the discourse surrounding computing power required to process the archaeological data it generally takes as in industry norm the equivalent to actually gathering the data with on a smaller scale of around 30 hours of processing is required to gather around 3 square miles of data in a professional capacity. As is for most technology LiDAR drones also generate a carbon footprint due to the considerable amounts of energy required to make them operable. This described carbon footprint's impact varies in size and has not fully been understood as to the amount at which its carbon emissions contribute to climate change. Although it must be recognised that no matter what size of the emissions produced by LiDAR drone technology it has to be sustainably managed as if it is not net zero it is still contributing to the worldwide issue of climate change and how it is managed. Further developments in the field of processing information quicker involves the planned use and development of AI for the processing of said LiDAR mapping data quicker which in turn would be a step that would revolutionise the field further but also contribute more to the carbon footprint that LiDAR scanning imprints upon the world as a whole, which is because as an example: Large machine research models consume massive amounts of energy to consistently train responses and thinking, producing around the equivalent of 300,000kg of Carbon dioxide, the same as 125 round trip flights between New York and Beijing.

To conclude this summary of the application and usage of 3D visualisation technology in Archaeology, without doubt its usage has revolutionised and dramatically changed the field of archaeology and how we practise it today in the modern age. As a clear example: many previously held beliefs and supposed established thoughts about a large amount of different ancient civilizations such as the maya, as referenced in the above writings, have been drastically altered and revised giving way to new pathways of discovery and allowing a much better, more learned view of the past through archaeological practise aided crucially by 3D visualisation technology.



An annotated LiDAR mapping image, showing the Mayan settlement of Tikal, created by Francisco Estrada-Belli of the PAQUNAM LiDAR initiative with annotations by Christopher Carr and Nicholas Dunning.

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