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AARGnews is the newsletter of the Aerial Archaeology Research Group

Published twice yearly in March and September

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[Cover photo. Stansted to Ljubljana, 25 August 2016. Rog Palmer c20160825_053-2]

Ljubljana to Stansted, 27 August 2016. Photo, Rog Palmer: c20160827_062-1
Editorial

Unusually, I haven’t written a continuum of notes as comprise my usual editorials. Perhaps little has happened or no thoughts have occurred. Unusually too – or perhaps it’s a sign of real retirement – in the last several months I have interpreted no photographs, drawn no maps and done no archaeological flying. There has, however, been background activity that has included a few thoughts, meetings with other aerial people, and a little writing.

Brexit, British aerial archaeologists and European networks

Prior to “Brexit”, the UK’s referendum on 23 June 2016 which recommended that the country leave the European Union, AARG and aerial people had benefitted from several EU grants, of which the most recent was for the five-year ArcLand project. These and other grants had enabled us to teach and promote aerial survey throughout Europe (and a bit beyond the EU) for the past 15+ years. With the current uncertainty about access to these EU sources of support for UK-European exchange, it is worth reflecting on the role that EU grants have played in the history of AARG and the creation of an active aerial archaeology community, spanning Europe.

The meeting that began this was in Klein Machnow in 1994 and was either unfunded or run with very limited money. Similarly, the first two training schools were financed by an amalgamation of small grants. But after that, perhaps from 2000, almost continually until ArcLand ended in 2015 the aerial world has been lucky to have been awarded three (I think) fairly hefty EU grants for teaching and, with ArcLand, research. The teaching aspect has initiated or helped aerial survey in many countries – Lithuania, Iceland, Finland, Poland, Germany, Spain, Italy, Croatia, Serbia, Slovenia, Hungary, Romania and France (the latter mainly Rachel’s ALS courses which may not have been EU-funded). ArcLand research was also funded in those and a few more countries. This hasn’t just given us paid holidays (and me a handful of ‘daughters’) but has created a network through which ideas and collaborations continue even though there is no current EU funding. The projects, the resulting collaborations and the EU funding, have helped the development and spread of aerial survey from its fairly Brittocentric origins to at least a Euro-wide scatter of practitioners. We now do much more than just aerial photography or interpretation of images and have found and developed new technical skills thanks to (for example) Michael’s photogrammetric background, Geert’s technical ability, Ziga and Ralph’s (and others) methods of analysing ALS data. All this and more has been fairly comprehensively absorbed and is now being used, or anticipated, by archaeologists in most EU countries. Along with our EU grants, there have been many archaeology students who have benefited from Erasmus, Leonardo and other grants to move and study within the EU. ArcLand also paid for six or so people to come to Cambridge for 3-4 weeks of one-to-one teaching with me. Given these benefits, repeated through much of the present-day scientific and research worlds, the scale of the loss if support for exchanges were to disappear is clear.

We in Britain still have our European colleagues and contacts and have been discussing future workshops, etc and ways of funding them. However, there have been stories that some forthcoming international science projects have asked Brits to withdraw as major partners in

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case having a non-EU member may affect the success of an application. Is this a sign of things to come? If so, how do we proceed?

Equally of relevance to the aerial world is the cessation of EU subsidies to farmers which, despite vague promises, the UK government seems unlikely to be able to match in future years. Lower subsidies may lead to crop changes which, along with climate change, may result in reduced areas of ‘suitable’ crops for aerial prospection – something that Dave Cowley has already noted for parts of Scotland (pers comm). These factors along with the prospect of fewer ‘immigrant’ agricultural workers may result in massive changes to the agricultural landscapes that we now know and rely on to provide our data. Aerial prospection, especially that undertaken by an airborne observer, may thus become a thing of the past as we pursue off-ground techniques and wavelengths that may record buried sites that leave no visible signal on or above the surface.

Uses of computers
While reading the AARG 2016 ‘homework’ on computer vision’ (see elsewhere this issue) I realised that 2016 is the 40th anniversary of OBLIQUE, the program I wrote to transform interpretations so that I could map 4000 sq km of Wessex (Palmer 1997). Others, namely John Haigh and Irwin Scollar, took things further (and Irwin had started the whole thing off by transforming single points a few years earlier – Scollar 1975), culminating in AERIAL 5 and AirPhoto 3 that enabled images to be transformed. Both programs in their later variations are still in use and perform their tasks adequately (and AirPhoto SE is now a free download) but, at the risk of getting an annoyed Skype from Irwin, it has to be said that these are perhaps antiquated methods that use concepts and algorithms of the 1960s. Technology has changed beyond our dreams of 40 years ago (eg, I was recently told that some mobile phones are able to transform photographs – but perhaps not to the accuracy that we require) and with the new technology has come new ways of doing the same things. For example, the automated location and transformation scheme outlined by Michael Doneus at AARG 2015 and 2016 (see also Doneus, et al. 2016) and the now-commonplace creation of accurate geolocated 3D models using Structure from Motion methods. This is great stuff, and something that we can anticipate using in the future especially as Michael and Co are developing methods to deal with the masses of analogue photos that may be the only record of many archaeological features. It’s not just the technology but the abilities and interests of people who understand things beyond the knowledge of many of us and are using this stuff to develop processes that will push archaeology in new directions. Which brings us back to computer vision and the inclusion in this issue of the several pages of General Reading List which attempts to consolidate relevant publications for anyone wanting to find out more or develop different approaches. I am grateful to Karsten Lambers and Arianna Travigia for compiling this and allowing its publication and to those authors and Dave Cowley for the comprehensive review of computer vision that was the ‘homework’ for AARG 2016 and, slightly modified, appears in this issue. I see this as an important comment on ‘where we are now’ in the quest to help us manage our data. Similarly, it was good that Iris Kramer, one of the students working on this topic, came along to AARG this year. Did AARG offer her anything? Will she be back? Were we a useful contact? Some of us hope so.

Aerial art
The first session at AARG this year was Art and included papers dealing with topics from the First World War to Lidar. Who would have thought that some aerial photographs could be
seen as a form of Cubism? This confirms the suspicion that we all see the same object slightly differently. We are lucky to work with or take aerial images that can include scenes of beauty, that can mix an archaeological (or other) subject with interesting weather conditions and lighting, or can just be plain amusing. Even if ‘work’ is peering at air photos or looking at the ground from a Cessna, many of us also want a window seat on commercial flights and I always chose mine on the basis of the direction of the sun. Often we are plagued by haze or boring clouds but occasionally persistence pays off as it did on a recent flight to Ljubljana when even the pilot was raving about the views we were going to have crossing the Austrian Alps. The light and clarity was excellent, but was even better on the way back (with the same enthusiastic pilot) and had some lumpy clouds waiting over much of Europe. By chance, Easyjet emailed me a few days later and asked if I had enjoyed my flight. “Yes, the light was beautiful” was my reply. This was not necessarily what they wanted to know, but much more important to me than whether the cabin crew offered me refreshments.

Are the resulting photos art? Does it matter? I photograph these landscapes and cloudscapes because there are rare chances to see them and often the results, after a bit of manipulation, please me. On the basis that someone else may like this kind of aerial image, I have included a couple in this issue and faded another to make a background for the cover. For anyone interested, these were taken with my ‘toy camera’, a fairly ancient little Canon G12, usually set at 100 ISO and using shutter priority.

This issue
The computer vision contributions have been mentioned above and this topic is one that I hope will be updated at intervals. By now, Martin Fowler should be in retirement and ready to expand his work on satellite images and archaeology. His note on the KH-9 HEXAGON photographs is tantalising because of their current unavailability beyond USA. We include a plea from Rebecca Bennett asking us not to abuse ALS data – and reminding us that there are several ways to – to borrow from her text – kill a cat. And there are two review articles, one for a book about Nadar, the other arising from two ArcLand meetings on ‘archive photographs’. My thanks to all contributors and to Armin Schmidt (ISAP) for giving permission for us to reproduce Rebecca’s article.

References


AARG Chair Piece

September 2016 – Rachel Opitz

At our recent conference in Pilsen, AARG was described as the group where, “we teach you what they don’t teach you in school”. I think that does about sum it up. Listening to papers and panels, you hear about practice and successful or not so successful projects. Conversations at coffee breaks will teach you about what actually happens in the field or the office. If you come enough years in a row, the mess of iterative methodological development and the sometimes slow uptake of new ideas and methods will reveal itself. This year’s conference saw automation take a firm seat at the table as an aerial archaeology method. After several years of tentative efforts and some resistance or at least hesitation, the community is by and large on board with this as an important direction. The recurrent reflections on identity and staying relevant can be traced through AARGnews. I’ve just gone back to some of the 2011 editions to find Włodek saying much what we have said this year in our discussion session on the definition and mission statement of AARG: time for a new name, new brand and new mission statement that reflects what we do now. Trawling through the archive, I’ve come across the 2011 discussion about “AARG’s Definition” which I think it is useful to reproduce here, in light of our conversation at the Pilsen conference, and the quest to stay relevant and attract new practitioners to our craft.

New definition 1, 2011 vintage, reads:

“Aerial photographs, images from satellites and multi- and hyper-spectral sources, plus other non-visual techniques such as Airborne Laser Scanning allow an increasingly informative understanding of the past. Membership of AARG provides a platform for the exchange of ideas and information for those involved in collecting or analysis of these remotely-sensed data, whether studied by itself or in collaboration with other investigations.”

While new definition 2, 2011 vintage, reads:

“The Aerial Archaeology Research Group (or whatever name is) provides a platform for the exchange of ideas and information for those involved in the collecting or analysis of aerial photographs, satellites and multi- and hyper-spectral imagery and Airborne Laser Scanning data. (aerial photographs and remote sensing data?).”

[Credit and thanks to Włodek Rączkowski for keeping these notes.]

Placing these side by side with our current definition, and in light of this year’s discussion, it seems clear - even obvious - that what ties our community together is our set of data sources which provide a particular way of engaging with and creating the archaeological record. We do seem to be stuck on what to call it. Listing specific technologies doesn’t seem to be the way, as we have to update every few years as new things come into play. At the same time, we wish to acknowledge that our core data sources predispose us to a certain perspective (zoomed out) and scale (large areas) and to an interest in landscape and the long term. We

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might take a page from Helen Wickstead and Martyn Barber’s article (2011), and refer to ourselves as “Spectacular Survey by Flying Machine!” Research Group but I am afraid this might seem unserious to some, and too focused on the data collection to others.

But what about the analysis and interpretation? Is the ability to read landscapes from above implicit for the ‘google earth generation’? The devil, as usual, is in the details. Anyone can read an easy landscape, and therefore projects looking to crowd source the identification of Tells and Kites out in the desert will likely succeed, in the broad strokes. (On the same grounds we have reason to be optimistic about machine learning to improve results under some circumstances.) A complex landscape, full of subtle cues is another matter. Still, how do we convince a generation who have never questioned their ability to read a map or a satellite image that this actually is a skill and one they need to be trained in and practice? From this point of view we are the “deep reading of remotely sensed data” Research Group. I want to run with this idea of “deep reading” for a moment, together with its sister concept “deep mapping”. Deep mapping, according to the blurb for Deep Maps and Spatial Narratives (Bodenhamer, Corrigan, and Harris 2015), is “is a way to engage evidence within its spatio-temporal context and to provide a platform for a spatially-embedded argument”. While deep reading, or slow reading (Miedema 2009), has been described as a reading process in which people take time to reflect critically and understand the text. This involves slowing or stopping at various points, as the reader considers the text and the author’s intentions. A high level of cognitive engagement and concentration is implicit. Depending on where we are in our usual interpretive cycle, I would argue we are practicing something variant on these. We are attempting to read a landscape, or an image, or a data set, carefully - slowing down to consider what it is really telling us. At the same time, we are continually trying to consider spatial and temporal context, and to bear these dimensions in mind at all points while thinking through a landscape. Key to both deep mapping and deep reading is that they are learned behaviours and techniques to get more out of activities amateurs and casual readers or mappers tend to take for granted. There has been a spate of “Grand Challenges” recently (Kintigh et al. 2014; Huggett 2015) and defining, promoting and teaching a “deep reading and mapping” approach to aerial data is one of ours.

So if I may try my hand at a New Definition of AARG, 2016 vintage, I would suggest:

“AARG sees aerial approaches as essential to the pursuit of key questions in archaeology and heritage, including landscape character, long term landscape change, human ecodynamics, and the experience of place. We are a community of heritage professionals, researchers, students and independent scholars dedicated to research, education and outreach initiatives about aerial approaches in archaeology. AARG provides opportunities for networking, mentorship, and exchanges of ideas on theories, methods and technologies related to aerial archaeology. The organization supports an annual conference, workshops, training schools, and publications.”

Comments on a postcard addressed to your Chair.

Rachel
STUDENT/YOUNG RESEARCHERS’ SCHOLARSHIPS FOR AARG 2017.
These scholarships are intended to support bona fide students and young researchers who are interested in aerial archaeology and wish to attend the conference. There is no application form. Please provide the following information in an emailed headed with “Student/Young Researcher Scholarship”: Your interests in archaeology and aerial archaeology; place of study; the name and contact details of a supervisor or employer (email) who can provide a reference; why you would benefit from attending the conference; and an estimate of travel costs to attend. Furthermore, you should also be willing to provide a poster, or for exceptional work provide an abstract for a paper (20 mins) under one of the conference session themes listed above.

Applications should be addressed to Rachel Opitz at aargchair@gmail.com. In addition, there will be a competition for the best Student/Young researcher poster or paper, judged by the Chairman and Vice-Chairman. The prize will be a free 2018 conference package (registration fee, dinner and field trip). All entries for the competition must apply for the Student/Young Researchers Scholarships to be eligible. The closing date for applications is the 1st June 2017.

More information may be found at the Aerial Archaeology Research Group website: http://www.univie.ac.at/aarg/
AARG notices

The Derrick Riley Bursary

The Derrick Riley Bursary still exists. It is £500 a year, usually a single award, but sometimes is split and given to two people.

There should be an application form on the Sheffield Archaeology Department website and a Riley Bursary page on the Sheffield website where potential applicants will be able to find information and download the application form.

Finding the relevant page represents the first challenge, but if you can’t please contact Bob Johnston (r.johnston@sheffield.ac.uk) who administers the bursary.

Please apply for this even though it is not used only for conference attendance. AARG has limited funding and access to the Riley Bursary extends this amount to something more useful. No whinging about lack of money if you don’t apply.

ISAP Fund

In August 2015, ISAP announced establishment of a fund to provide support of up to £1000 to assist with members’ projects [membership costs less per year than AARG does] that ‘further the objectives of the Society’.

Info and application form from the ISAP web site: http://www.archprospection.org/isap-fund

Information for AARGnews contributors

AARGnews is published at six-monthly intervals. Copy for AARGnews 54 (March 2017) needs to be with me by February 14, 2017. Editorial policy (for want of a better word) tends to be that if I am sent interesting contributions they go in unless there’s a danger of an issue overflowing. Instructions for contributors are no longer on the AARG website, but this issue and a page that can be sent on request may guide.

Please do not use any ‘clever’ formatting and avoid footnotes.

Good-quality jpegs are suitable for illustrations. Tiffs are for archives.

Address for contributions: rog.palmer@ntlworld.com
Finding common ground: human and computer vision in archaeological prospection

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Keywords: remote sensing, computer vision, automated object detection

1. Introduction

The (slow) emergence of semi-automated or supervised detection techniques to identify anthropogenic objects in archaeological prospection using remote sensing data has received a mixed reception during the past decade. Critics have stressed the superiority of human vision and the irreplaceability of human judgement in recognising archaeological traces, perceiving a threat that will undermine professional expertise and that archaeological experience and knowledge could be written out of the interpretative process (e.g. Hanson 2008, 2010; Palmer & Cowley 2010; Parcak 2009). Uneasiness amongst some archaeologists of losing control, even partially, of the interpretation process certainly seems to be a significant factor in criticisms, citing the undeniable fact that archaeological remains (or proxies for those remains) can assume a near-unlimited assortment of shapes, sizes and spectral properties. It is argued that only the human observer can deal with such complexity. Thus, while increasingly automated and supervised procedures for object detection and recognition and processing are flourishing in a variety of fields (e.g. medical imaging, facial recognition, cartography, navigation, surveillance; Szeliski 2011), their application to archaeological and, more generally, cultural landscapes is still in its infancy. However, as a number of published works (see References and General Reading List) and ongoing research demonstrate there are major benefits in developing this broad agenda.

This paper provides a general review of the issues from a synergistic rather than competitive perspective, highlighting opportunities and discussing challenges. It also summarises a session on Computer vision vs human perception in remote sensing image analysis: time to move on held at the 44th Computer Applications and Quantitative Methods in Archaeology Conference (CAA 2016 Oslo ‘Exploring Oceans of Data’) that had a similar objective.

1.1 Some background

Aspects of image processing and ‘automated’ object detection were mainly introduced to aerial and remote sensing archaeology by satellite specialists (e.g. Shennan & Donoghue 1992), who draw on a long history of heavy image processing (e.g. Vegetation Indices, Tasselled-cap transformation, Pan Sharpening etc.). It is fair to say that sometimes archaeologically naïve applications or interpretations fostered a hostile reception by some archaeologists, perhaps contributing to the often slow development towards mutual understanding. The archaeological naivety of some applications fed concerns that archaeological experience and knowledge, and the cognitive/perceptual ability of the archaeologist, were not being valued. Palmer and Cowley (2010) articulated some of these
fears, writing that ‘...interpretation of aerial images is a specialist skill, improved by experience and ... methods of auto-extraction .... are a poor substitute for this.’ These types of concerns are further expressed in Parcak’s book on *Satellite Remote Sensing for Archaeology*, in which she states that ‘… computers simply do not have the same ability as human eyes to pick out subtleties...’ and that ‘… only the viewer will know what he or she is looking for.’ She also asks the question ‘Why does there even need to be an automated process for satellite archaeology?’ (Parcak 2009, 110-1).

These concerns and questions are addressed below, but in general it is fair to say that the debate has gradually moved on, underpinned by growing mutual understanding between different specialists and supported by the increasing ubiquity and power of computer vision techniques in complex fields such as medical imaging. While that is the case, such developments will not, by themselves, guarantee progress in aerial and remote sensing archaeology. There remain tensions and suspicion amongst some traditional practitioners, in part at least driven by a tendency to over-simplify issues, often from misunderstandings of workflows and processes. So, ‘automation’, as a rather ambiguous concept, can be still perceived as a threat to traditional practice. This may be reinforced by an unwillingness on the part of some archaeological practitioners to reflect critically on how they ‘look and see’ and to critique how appropriate established means of observation are to large complex datasets such as large area Airborne Laser Scanning (ALS) coverage or multispectral data (Cowley 2012).

This reflection can be assisted by a review of current research on (semi-)automated archaeological object detection as provided below, as this may at the same time shed light on some aspects of traditional practice. There are bigger questions too, such as how to create datasets that can inform heritage management in parts of the world that are either inaccessible (e.g. war zones), for which base data such as maps or aerial images is difficult to acquire (e.g. due to legal restrictions), or that have no tradition of creating archaeological inventories. At the heart of all these issues is the question of how well routine practice developed during the 20th century is equipped to address the complexity and scale of emergent data now available in the 21st century.

### 1.2 Defining some terms of reference

It may be unnecessary to state that no one advocates ‘automatic archaeology’, but it is worth asserting here because the study of the human past through material remains is not something that can be automated – it is an endeavour made up of many processes and approaches in which the emotions and intellect of the archaeologist play a central role (Barceló 2008). Amongst these processes is the examination of material remains directly, and through various proxies (e.g. aerial photographs), in order to identify attributes, features and objects that may be fed into interpretative frameworks. Aerial and remote sensing archaeology draws heavily on imagery (photographs, spectral imaging) and digital topographic data (ALS, radar) for the identification of attributes, features and objects. In a traditional or manual approach this may involve the examination of photographs of a field, identifying a variation in the crop that is interpreted as a ditch and further as the ploughed down buried remains of the perimeter of a Roman Marching Camp (Fig. 1). There are a number of processes at work here – in the examination of imagery, the identification of features or objects that are of interest, and their interpretation and mapping as material remains of the past, and it is the processing and examination of imagery, and the detection/recognition of features or objects that are of potential interest that we think is the most productive area for the development of
‘automated’, semi-automated or computational approaches. The interpretation and validation of objects extracted from imagery or other data remains the prerogative of the archaeologist.

In practice, especially in manual workflows, the components (i.e. detection, recognition and mapping, classification and interpretation) of workflows are often intermixed, but, regardless of whether or not this is best practice, it helps clarity to compartmentalise them (Fig. 2).
There is probably a general consensus amongst advocates of increasingly computational approaches drawing on computer vision and – in time – artificial intelligence, that one of their strengths lies in the examination of imagery/data to identify elements that conform to a defined set of characteristics (i.e. a model) and to extract those objects or patterns. Another area of consensus is that quick, systematic and consistent processing of large and complex image datasets is absolutely vital to facilitate exploration of the data and assist interpretation. What is not being claimed is any particular role in the subsequent archaeological interpretation – which is where the experience, knowledge and imagination of the archaeologist are paramount.

1.3 Defining some terminology

The topic under discussion here is cross-disciplinary and that brings with it a need to ensure terminology is used explicitly so that dialogue is constructive and mutually understood. In this paper we will use terminology from computer vision as this benefits from explicit definition, in a way that equivalent archaeological usage often does not. Firstly, we aim to avoid the use of ‘archaeological feature’. Although it is a common term in archaeology, it is often used, like ‘anomaly’, in a vague and ambiguous way for things we do not specify further – sometimes because we cannot, but often because we are lazy. Such a use of the term is not common in computer vision, where ‘features’ are first of all image properties that may have real-world correlates, but very often do not. In computer vision, feature detection usually happens in an early stage of image processing, for example in finding suitable points for image matching. When it comes to real-world entities – and that is what we as archaeologists want to find in remote sensing data – computer vision refers to them as ‘objects’ and we will be using this definition forthwith. Object detection is a much later step in the workflow than feature detection (Szeliski 2011), and this is the step that is a central focus of archaeological applications and potential.

1.4 Towards common ground

It will come as no surprise to the reader that the authors of this paper are advocates of exploring the applications of supervised and increasingly automated object detection in archaeology. They have incorporated such approaches in their own work (Lambers & Zingman 2013, Zingman et al. 2016), given papers, organised conference sessions and written about issues and interfaces with other fields of archaeological practice (Cowley 2012, 2013; Opitz & Cowley 2013; Bennett et al. 2014). In this, they share the views of a growing number of practitioners who increasingly see the power of fields like computer vision and other methods for object detection (e.g. Trier et al. 2015; Sevara et al. 2016). Crucially they see this as a world of opportunity, not a threat, recognising that there is an interesting future in developing thoughtful approaches, and addressing challenges to workflows and routine practice. In particular, this applies to tackling large area and complex data for which traditional observer-based ‘looking’ is slow, and probably not especially suited to seeing differently (cf. the issues of confirmation bias). The many (new) ways of seeing that are offered by computer vision or analysis of topographic data have the potential to create a strong iterative relationship with traditional techniques, and for the experienced observer, of aerial photographs for example, should represent a world of opportunity for self-exploration that extends beyond simply relying on the eye and cognitive powers. Such issues lie at the core of developing 21st century solutions to 21st century problems, rather than uncritically
taking techniques developed in the 20th century and insisting they will maintain a currency for evermore. We believe that this basic position is strongly borne out by the papers presented at the CAA 2016 session that is summarised below by way of illustration.

2. Finding common ground – CAA 2016 session summary

The CAA 2016 session 'Computer vision vs human perception in remote sensing image analysis: Time to move on' organised by Arianna Traviglia and Karsten Lambers was underpinned by a basic premise that the time to move on from polarised discussion is well overdue. That is to say that the focus for discussion should now move firmly to ‘how’, rather than ‘if’ computational approaches to detection and extraction are applied in remote sensing archaeology. In many ways the 2016 Oslo session was a follow-up to a similar session held at CAA 2009 in Williamsburg and summarised in AARGnews 39 (De Laet & Lambers 2009). Papers in that session demonstrated the state of the art of remote sensing archaeology and called for increased collaboration and understanding between aerial archaeologists and remote sensing specialists. Even in 2009, while ‘automation’ was still a new topic, the session conveners concluded that the ‘uncooperative’ nature of archaeological remains ‘… does not mean that semi-automated detection approaches are doomed to fail from the outset’ (De Laet & Lambers 2009, 13).

The contributions to the CAA 2016 session certainly confirm that this optimism was justified, with significant progress in many areas over less than a decade. A notable characteristic of the 2016 session is a focus on ALS data, reflecting the proliferation of archaeological applications over the last decade. However, it also became clear that many computational techniques can be applied across a range of different data, from optical images to geophysical measurements and ALS-derived DEMS, or combinations of these data sources.

The CAA session invited presentations on computer vision methods that are being used or developed to automatically identify landscape patterns and/or objects from remote sensing data and imagery. While the organisers were open to papers critiquing the topic, perhaps unsurprisingly for a CAA conference, presentations and the audience broadly shared a basic premise that automation demands to be explored as a basic and routine element of archaeological practice. The brief summaries of papers below illustrate how researchers are trying to automate parts of the workflow for archaeological object detection employing a variety of approaches, from innovative combinations of simple image processing tools to sophisticated handcrafted detection algorithms and further to high-level computational approaches, such as deep learning.¹

The session was opened with a paper by Dave Cowley, Arianna Traviglia and Karsten Lambers, entitled Why, when and how? Context and computer vision in archaeological prospection and interpretation. This introductory presentation provided background to current issues and polarisations around automation in archaeological prospection. A central theme was the lack of explicitness about how archaeological object identification is undertaken and how the processes, whether ‘automated’ or ‘human’, of identifying patterns, shapes and objects interrelate with archaeological interpretation, providing a framework for critical discussion of the relationships between emergent approaches and traditional skills. The paper covered many of the issues presented above, addressing questions related to: how can we

¹ A selection of papers from the CAA conference in Oslo, edited by E. Uleberg and M. Matsumoto, will be published about one year after the event. See the conference website (CAA 2016) for information on the proceedings.
create clarity about why and when automated approaches are desirable; what are the roles of (traditional/manual) archaeological experience and skills in designing algorithms; and how can automated/manual approaches be used iteratively to improve archaeological detection – questions that were, at least partially, addressed by the following papers, summarised here not in the order of presentation but according to the increasing sophistication of tools / decreasing level of user interaction.

Benjamin Stular (Research Centre of the Slovenian Academy of Sciences and Arts, Ljubljana) presented a paper on *Two methods for semi-automated feature extraction from Lidar-derived DEM designed for cairn-fields and burial mounds* that illustrated the potential of simple and easily applied techniques for semi-automated detection of specific monument types that share a basic morphology. In aiming to detect objects that survive in the surface topography as mounds, two methods were applied, both of which were implemented in free GIS software packages. The first used the standard deviation of elevation-based local relief and subsequent classification of 2D shapes, while the second method used a peak (i.e. highest point) finding algorithm. Both methods were tested in two different case studies that provided not only 'ideal' conditions but also a very demanding one. Although decent accuracy of mapping compared to manual interpretation was achieved, the method was recommended as a mapping (vectorising) tool rather than an interpretation tool.

In his paper on *Experiments in the automatic detection of archaeological features in remotely sensed data from Great Plains USA villages*, Kenneth L Kvamme (University of Arkansas) also explored how relatively common GIS tools can be employed for the identification of specific archaeological object types. Using case study survey data of prehistoric villages associated with native farming tribes of the Great Plains (USA), which incorporates ground-based geophysics and aerial remote sensing including ALS, a variety of methods were applied that collectively offer a diverse array of decision-making mechanisms for the identification and classification of complex archaeological objects. Image manipulation tools (e.g. Low- and High-pass filters) were used during pre-processing to simplify noisy data and remove local geological or topographical trends, while Fourier methods isolated and removed elements such as plough marks that may obscure the archaeological signal. Reclassification tools were used to define anomalous or potential anthropogenic objects. Shape indices were applied to allow objects to be characterised and scaled, and the use of ‘distance’ modules supported consideration of context, while custom filters may be designed to recognise complex shapes through pattern matching approaches (Fig. 3).

![Fig. 3 - Automatic classification results derived from the bare earth elevation data at Huff Village. (Image courtesy of K. Kvamme).](image-url)
With the following papers the emphasis shifts to increasingly heavy computational demands, beginning with a paper by **Amandine Robin** and **Karim Sadr** (University of the Witwatersrand) on *Automated detection of stone-walled ruins based on support vector machine and histogram of oriented gradients*. They propose an autonomous approach to detect ruins based on Histograms of Oriented Gradients for object extraction and on a Support Vector Machine in order to classify extracted objects as ‘ruin’ and ‘non-ruin’. The support vector machine uses a training set of previously identified structures to learn to distinguish ruins, and was then applied to a subset of locations within a 9000 km² study area in the southern Gauteng Province of South Africa, to automatically identify pre-colonial stone-walled structures without any *a priori* knowledge. These structures are very subtle and made from locally available material. Shapes are diverse and tend to be occluded by vegetation, and are therefore difficult to differentiate from natural landforms and flora. The study used satellite images (from Google Earth), aerial photos and ALS DTMs and achieved a relatively high level of accuracy and control of false detections.

**Till Sonnemann** (Leiden University) and his co-authors **Jessie Leigh Pasolic**, **Douglas Comer**, **William Megarry**, **Bryce Davenport**, and **Eduardo Herrera Malatesta** presented a paper titled *Down to the last pixel: Multiband use for direct detection of Caribbean indigenous archaeology*, exploring the utility of satellite imagery and radar data for detecting pre-colonial settlement remains. These comprise slight topographic modifications, house platforms and small mounds predominantly of midden and soil that also include ceramics and lithic assemblages. The altered topography and the surface scatters were used as quantifiable indicators of an archaeological site. Using pixel information from known sample sites and areas with no known archaeological evidence, a combination of multispectral bands (Worldview-2, Aster, LandSAT) and SAR (UAVSAR L-band, TanDEM-X) was used to feed a direct detection algorithm developed at Cultural Site Research and Management (CSRM) and Johns Hopkins University that assesses the probability of the presence of sites comparing means of similar pixel values within each data set. The pre-processed very diverse data sets had to be exactly matched in resolution and location, feeding a semi-automatic process that requires supercomputing. The output maps, combining all data sets through Boolean merge, present quantifiable statistical results of areas with similar pixel values to the known sites, defining areas of high or low probability of archaeological evidence.

**Iris Kramer** (University of Southampton) presented a paper on *Using eCognition to improve feature recognition* inspired by successful applications in Geosciences for dealing with supervised classification of irregular landforms, such as landslides. This approach draws on the image analysis software TRIMBLE eCognition that implements geographical object-based image analysis (GeOBIA), a programme that has been applied to a limited degree in archaeology. This paper highlighted new additions to the array of already available methods to re-evaluate what the potential is for object recognition: for instance, the integration of ALS data and aerial photographs, which has always been sought-after, as well as the ability to transfer rule sets modelling target objects for the detection of common features, a feature that can facilitate data and knowledge-sharing amongst researchers.

The case study presented three different automated detection methods: the well-known eCognition rule set generation based on cognitive reasoning; self-learning algorithms; and adaptive template matching. These techniques were applied to round barrow detection in the Avebury region of southern England, specifically distinguishing between the known variations of barrow, bank and ditch (Fig. 4). The algorithms were intended to prioritise
cognitive aspects of human vision such as elevation, size, shape and texture, using ALS data and aerial photographs.

This paper was the winner of the Nick Ryan Bursary award for best student paper at the CAA conference, and is based on a Masters thesis (Kramer 2015).

Norwegian researchers have been at the forefront in the development of automated detection for many years (Trier et al. 2009), and the paper by Øivind Due Trier, Arnt-Borre Salberg, and Lars Holger Pilo (Norwegian Computing Center, Oslo) on Semi-automatic detection of charcoal kilns from airborne laser scanning data – by using deep learning presented their recent advances. This work demonstrated the potential of new high-end methods for the semi-automatic detection of charcoal kilns in ALS data. The establishment of a number of iron works in Norway during the 17th century required large amounts of charcoal, and past archaeological surveys have pointed to the presence of large numbers of charcoal kilns, but it was not known how many kilns there were, if they showed signs of reuse, and how they were distributed across the landscape. This case study used ALS data for the entire forested valley in Lesja, Oppland County. Initial visual interpretation of the dataset in the central area identified about 1000 possible round charcoal kilns, varying in diameter from 10 to 20 m. Beyond some basic similarities, the kilns exhibited a variety of forms, including the presence of a surrounding ditch and of pits and low mounds. While previous studies by the same authors used sophisticated hand-crafted algorithms for object detection, in this study the authors adapted and applied a generic machine learning approach based on deep
convolutional neural networks (CNN). CNNs are multi-layered networks of artificial neurons that emulate the biological visual cortex and, like humans and animals, learn from training examples. They have recently gained recognition for dramatically improving previous success rates in object detection (Krizhevsky et al. 2012; LeCun et al. 2015) and can be adapted to specific tasks by introducing case-specific classifiers on the deepest layer. In this study the classifier was constructed from image patches of charcoal kilns in ALS data identified by visual interpretation. The yes/no classifier for kiln detection was then applied to the ALS data in a moving window. Initial results over a 3 km by 3 km test area yielded a remarkable 85% rate of true detections (Fig. 5).

Fig. 5 - Result of automatic charcoal kiln detection for a 3 km × 3 km test area. This illustrates the high return of positive identifications, including those that were overlooked during field investigation, set against the false positives from the automatic detection. (Image courtesy of Ø. Trier).

The importance of the Norwegian case study is not just that, along with Zingman et al. (2016), this is the first application of new and highly promising CNN-based machine learning approaches to archaeological prospection, but also its effect on archaeological practice. In a complementary paper by Martin Kermit and Øivind Due Trier, entitled Towards a national infrastructure for semi-automated mapping of cultural heritage in Norway and presented in another CAA session, the authors demonstrated a new web portal for heritage professionals in Norway in which the semi-automated detection tools for different kinds of archaeological remains developed over the last decade are implemented in an intuitive and easy-to-use environment. For the first time, this web portal will make advanced detection tools available for the daily business of heritage management.
While much of the work on automating detection has used satellite data and ALS, the presentation by Sebastian Zambanini, Fabian Hollaus and Robert Sablatnig (TU Wien) on Computer vision applied to historical air photos: The registration and object detection challenge reminded us of the importance of collections of historic aerial photographs. This work forms part of the DeVisOR project (Computer Vision Lab 2016), and addressed the issues of automatically analysing aerial photographs taken during World War II air strikes to locate unexploded ordnance (UXOs) and to detect military objects (e.g. bomb craters or trenches). In an issue shared with the Sonnemann et al. paper, registration of data to common standards is a challenge (Fig. 6), as changes in imagery since printing (e.g. warping) and in the landscape (urban and rural development) make point matching and sample-based transformations difficult, further exacerbated by the generally low quality of the old aerial photographs and variations caused by illumination, for example. These problems are also manifest in the detection stage, which is further impeded by the absence of large training sets. While no solutions were offered, this work in progress identified the potential dividend from tackling these issues with less than ideal datasets, that never-the-less hold unique information.

3 On common ground? Observations on the CAA session

The CAA session brought together a diverse range of papers, presenting work from a wide variety of contexts that make use of a broad range of methods. One key point to emerge is that there is increasing acceptance that supervised and heavily automated detection routines are becoming less contentious in many areas of archaeological practice. Indeed, this point was brought out in a paper by Karl Hjalte Maack Raun and Duncan Paterson presented in another session at CAA on a Systematic Literature Review on Automated Monument Detection - A remote investigation on patterns within the field of automated monument detection. This study documented the proliferation of automated procedures by correlating key terms for ALS and remote sensing data with academic citations of their use. Results were explored using network analysis to investigate the personal, institutional and financial
connections and actors involved in automated monument detection, documenting the evolution of ‘automated monument detection’ for ALS and remote sensing data from 2000 to 2015. Not surprisingly, the study demonstrates that well-known key papers such as those by De Laet et al. (2007) and Menze and Ur (2007) helped to introduce concepts of automation to the archaeological community.

This is an encouraging trend – and a healthy one if the papers presented at CAA 2016 are a good measure. The common ground with fields such as computer vision is clear, while the connections that are being maintained with aspects of field practice are encouraging. The iterative engagement of automated/supervised detection and ‘traditional’ observation should be highly productive – each offering the potential to improve the other without opposition. So too is the increasingly explicit statement of workflow and process that helps practitioners understand where and how particular methods or processes take place. And, while some approaches clearly demand access to expensive resources and specialist input, there are tools available to all (e.g. in Open Source GIS software) that allow the user to think about how they define objects and sites as explicitly as possible – which can only be a good thing – and how they might implement those definitions in routine software.

After all, surely the important point about the detection of objects of interest is not whether it was undertaken by making heavy use of software, or through the services of a human observer, but that the processes and parameters of detection are explicit and systematic. If the detection process is undertaken using an explicit, systematic, automated approach that does not rely on an individual’s perception, ability, attention or any other personal parameter, this only increases the probability of identification of relevant traces, creates an accountable and replicable process and has no reason to invalidate or undervalue the interpretative (human-driven) process that will follow. In addition, the automation of some steps within the object detection process enhances the opportunity for a remote sensing operator to improve their visual detection capabilities by highlighting marks, patterns, and features that might otherwise be overlooked, thus creating learning opportunities.

4 Conclusions and future perspectives

Having already clarified that we firmly believe that by now the matter for discussion is not ‘if’ such approaches are worthwhile, we should now move the discussion on to ‘how’ a variety of approaches now available should be incorporated in the archaeologist’s toolkit. A discussion session held at the AARG annual conference during September 2016 in Plzeň on the topic of ‘automation’ addressed this issue through three papers: Dimitrij Mlekuz speaking on From quantity to a new quality: Big Data and landscape archaeology; Dave Cowley, Arianna Traviglia and Karsten Lambers speaking on Finding common ground: Human and computer vision in archaeological prospection and interpretation; and Toby Driver on Shared goals: Using airborne imagery to develop landscape understanding (however we do it). In all papers the need to develop perspectives that allow us to engage with big data were stressed, identifying the desirability of active engagement in developing applications rather than retrenchment and opposition. These generated an active discussion, with broad agreement that dogmatic opposition was not desirable and a general recognition that such developments are positive.

There remains a necessity for critical reflection on what is being done to ensure that unthinking applications are not developed and that the theoretical and philosophical underpinnings of an evolving application of increasingly heavy computational approaches are
explored. Recognising that archaeology is poorly funded and not well-placed to develop bespoke applications, there is a need to look closely at progress in other disciplines and to critically and carefully select what is relevant to our own field and can be translated into applications that improve our work (which will be the subject of a session at CAA 2017 in Atlanta). To do otherwise is to risk generating unthinking applications that generate poorly understood outputs. There is also a need to recognise that this is a very dynamic field with rapid developments in algorithms and computational power, and that while many first steps may be less productive than might be wished for, there is a bigger picture to keep an eye on: that of moving practice along in a dynamic environment (Opitz 2016).

To facilitate this process, as well as the references cited in the text, a (necessarily incomplete) reading list of papers on applications of automated detection and recognition procedures for a variety of airborne and satellite data is also included in this volume of *AARGnews* (Lambers and Traviglia 2016).

Acknowledgements

We thank the contributors of the CAA 2016 session for allowing us to use their slides and providing additional information for this review.

The work of Arianna Traviglia on automation and computer vision application to archaeological research has received funding from the European Union’s Horizon 2020 Research and Innovation Programme under the Marie Skłodowska-Curie grant agreement No 656337. Karsten Lambers’ work on the same topic was supported by the European Interreg IV programme *Alpenrhein – Bodensee – Hochrhein* and by the *Zukunftskolleg*, University of Konstanz. Dave Cowley has received funding for work on ‘automation’ and interpretation of digital datasets from the Royal Society of Edinburgh.

References


Computer Vision Lab 2016. DeVisOR. http://www.caa.tuwien.ac.at/cvl/project/devisor/ [accessed 15-08-2016].


Opitz R. 2016. (A very brief) Chair(man)’s Piece. AARGnews 52, 8–9.


Automated detection in remote sensing archaeology: a reading list

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The applications of automated object detection in remote sensing archaeology have grown considerably in the last few years. This reading list has been compiled as a contribution to consolidating current perspectives at September 2016, and in support of the preceding paper on the broader issues of human and computer vision in archaeological prospection (Traviglia et al.).


Casana J. 2014. Regional-scale archaeological remote sensing in the age of big data. Advances in Archaeological Practice 3: 222–233. DOI: 10.7183/2326-3768.2.3.222


D’Orazio T, Palumbo F, Cuaragnella C. 2012. Archaeological trace extraction by a local directional active contour approach. Pattern Recognition 45: 3427–3438. DOI: 10.1016/j.patcog.2012.03.003


The archaeological potential of declassified HEXAGON KH-9 panoramic camera satellite photographs

Martin J. F Fowler

Since their declassification over 30 years ago, photographs taken in the 1960s and early 1970s by the CORONA series of photoreconnaissance satellites have proved to be of considerable use to archaeologists (see Fowler (2013) for a recent review). The photographs are readily accessible from the US Geological Survey (USGS) Earth Explorer web site (http://earthexplorer.usgs.gov/), with archive scans available for download over the Internet free of charge, and photographs that have yet to be scanned available for purchase at the relatively modest cost of US $30 per frame. With a relatively high spatial resolution and almost global coverage, CORONA photographs represent a unique and cost-effective resource for landscape studies and for the discovery of archaeological sites that have been destroyed through intensive land use and development.

In 2000, photographs taken by the GAMBIT and HEXAGON satellites were declassified and copies released to the USGS for download and purchase. Whilst the ‘close look’ GAMBIT photographs have a better spatial resolution than CORONA, rather than being used for broad area search they were targeted on strategic and military facilities in the Former Soviet Union and China, and therefore coverage is less global than CORONA. To date they have had limited use in archaeological studies (e.g. Ur 2005), although they are ideal for studies of Cold War material culture (Fowler 2008). Photographs taken by the mapping camera carried on twelve HEXAGON missions are of lower spatial resolution than CORONA; nevertheless, they are capable of revealing landscape features such as pre-Roman rectilinear field systems on the island of Hvar and Soviet-era ‘landscape graffiti’ near Volgograd (Fowler 2004; 2016).

The mapping camera was not the primary camera that was carried on the HEXAGON satellites and three years ago further photographs taken by the satellites’ primary KH-9 panoramic cameras were declassified and released to the US National Archives and Records Administration (NARA) as accession numbers LTI-0537-2013-0010, -0023 and -0035. Each HEXAGON satellite carried two, independently controllable, 60-inch (1.8 m) focal length stereo panoramic cameras producing negatives some 8ft (2.4 m) long and 6.6 inches (0.17 m) wide (Figure 1) and with a ground footprint of the order of 340 by 24 km depending on the altitude of the satellite. Nineteen HEXAGON missions were successfully flown between July 1971 and April 1986 returning up to 60,000-plus frames of black and white, and occasionally colour and infrared, photographs per mission. The total HEXAGON archive is well over 2 million photographs, compared with approximately 800,000 photographs for CORONA, with each photograph covering an area approximately three times that of a CORONA photograph. For a summary of the achievements of the HEXAGON programme see McDonald and Widlake (2012); a more detailed description can be found in The HEXAGON Story (NRO 1992).

In contrast to CORONA, GAMBIT and the HEXAGON mapping camera photographs, only a very small fraction of the declassified KH-9 panoramic photographs has been released to the

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USGS; coverage is largely of North America, although a few images of Antarctica and the Arctic Circle were included in the release.

To investigate the archaeological potential of the KH-9 panoramic photographs, a scan was purchased from the USGS of a photograph taken over Florida by mission 1217-4 on 20 October 1982. The photograph’s footprint covered an area of approximately 200 by 20 km and included the city of St Augustine, the oldest continuously occupied European-established settlement within the borders of the contiguous United States (Figure 2). Compared with the footprints of CORONA photographs which can be displaced vertically by up to a frame’s width in many cases, the KH-9 image footprint appears to be reasonably well registered with the ground. In addition, the browse image available from the EarthExplorer website is of sufficiently high resolution to identify landscape features such as roads and water features in order to assist in determining the degree of cloud cover over a particular location (Figure 3).

Scanned at resolution of 7 micron (3,600 dpi), the KH-9 photograph was provided in the form of seven TIFF images, each of which was 36,967 by 24,481 pixels, giving a total file size of approximately 6 gigabytes for the whole photograph. The high quality of the scanned image can be seen in the extract shown in Figure 4 that covers the airfield north of St Augustine, where considerable detail can be clearly discerned including light aircraft on the apron (inset A) and the runway markings (inset B).
Figure 2. Approximate footprint of a photograph D3C1217-401747A005 acquired on 20 October 1982 by HEXAGON KH-9 mission 1217-4. The location of the city of St Augustine is shown by a red marker. In reality, the ground footprint is ‘bow-tie’ shaped because of the distortion inherent in the KH-9 panoramic camera system.

Figure 3. Browse image of KH-9 photograph D3C1217-401747A005 taken from the EarthExplorer web site together with enlargements showing the degree of detail visible on the image.
Whilst a direct comparison of the scanned HEXAGON photograph with CORONA and GAMBIT photographs of the same area is not possible, when compared with the runway markings of other airfields observed on these products it is apparent that the HEXAGON KH-9 panoramic image (Figure 5D) is of a far superior quality to CORONA (Figure 5B), and similar to the scanned GAMBIT product (Figure 5C).

One of the few remaining structures in St Augustine dating from the early European colonisation is the Castillo de San Marcus fort (Quesada 2010). Designed by the Spanish engineer Ignacio Daza, construction began in 1672, some 107 years after the city’s founding when Florida was part of the Spanish empire, and continued at intervals until 1695. Constructed using a sedimentary rock called coquina that was quarried on the nearby Anastasia Island, the fort can be clearly seen on the HEXAGON photograph (Figure 6) and is broadly similar in quality with a Google Earth image taken some 33 years later (Figure 7).

With a quality comparable to that of GAMBIT photographs, and a global coverage similar to that of CORONA, declassified HEXAGON KH-9 panoramic camera photographs clearly have great archaeological potential. Unfortunately, access to the photograph archive is presently a limiting factor. As noted above, the coverage that is currently available from the USGS is primarily of North America; access to the photographs of other areas requires a visit in person to NARA at College Park, Maryland.
Figure 5. Comparison of Declassified Intelligence Satellite Photographs of airfield runway markings: A. HEXAGON mapping camera (Greenham Common, UK, Mission 1213-5); B. CORONA KH-4B panoramic camera (Farnborough, UK, Mission 1104-2); C. GAMBIT KH-7 strip camera (Swansea, UK, Mission 4036); D. HEXAGON KH-9 panoramic camera (St Augustine FLA, USA, Mission 1217-4). Images available from the USGD EarthExplorer website: http://earthexplorer.usgs.gov/.

Figure 6. The Castillo de San Marcus at St Augustine. KH-9 photograph (entity ID D3C1217-401747A005) available from the USGD EarthExplorer website: http://earthexplorer.usgs.gov/.
Whilst no indication is provided on the NARA website (https://catalog.archives.gov/) of finding aids associated with the archive, a post in a Federation of American Scientists blog (http://fas.org/blogs/secrecy/2013/04/kh9-imagery-declass/) suggests that hard copy footprint overlays may be available giving data on mission, pass and frame number which then need to be translated into reference numbers for the retrieval of the photographs from a cold storage facility at Lexana, Kansas. It is stated that it can take up to a week to retrieve a can of photographs from the facility, and then they are only available at NARA for 3 days before they have to be returned to Lexana. To quote the blog: “Only then can you see if you even have the right can and frame number. If the area is not completely cloud covered, you may actually see your target facility – or not.”

Until this limitation is overcome, the archive of HEXAGON KH-9 panoramic photographs will unfortunately remain a largely inaccessible resource for archaeologists investigating landscapes outside of North America. However, it is understood that the USGS is currently working to open-up the EarthExplorer website to include further HEXAGON photographs. Plans are at early stages and it will take time and a significant effort to create browse imagery for the 2 million photographs that were delivered to NARA.

Whilst there is no time frame for this to be achieved, it is possible to set up a Standing Request on EarthExplorer to provide notification when data for an area of interest become available. This can be done by logging into the website, selecting an area of interest and the DECLASS 3 dataset, and then selecting ‘Submit Standing Request’ in the Results tab. Once data become available, an email notification will be provided by the USGS. By setting up a number of these requests, some indication of the demand for coverage of particular areas could be provided to the USGS and thus help in prioritising the release of further photographs. Hopefully, it will not be too long before further photographs are released, at which point the full archaeological potential of the HEXAGON KH-9 panoramic photographs can be realised.
References


Fowler, M. J. F. 2008, The application of declassified KH-7 GAMBIT satellite photographs to studies of Cold War material culture: a case study from the former Soviet Union. *Antiquity* 82: 714-731.


Hillshades and High Drama

Rebecca Bennett¹

[Reproduced, with permission and slightly modified, from its original publication in ISAP News 47, 12-13. See also, Roger Ainslie & Armin Schmidt, 2016. Free LiDAR data in the UK. ISAP News 46, 5-6 which noted that the UK Environment Agency had made available a large amount of lidar data: http://environment.data.gov.uk/ds/survey/index.jsp#/survey but I think we know about that.]

Firstly, a confession – I am on a mission, a mission to curb the terrible misuse and abuse of lidar data. It’s not a terribly exciting one but it keeps me busy and so to follow on from the introductory piece on lidar in ISAP News 46 I’d like to share with you my three top tips for getting more out of your data, especially if it comes from the Environment Agency (EA).

1) Everytime you make a single direction hillshade a kitten dies
I know they are everyone’s favourite, quick to make, easy on the eye and exactly how you and everyone else expects lidar survey to look. But when it comes to identifying microtopography they have so many problems that I’ll run out of words here if I explain them all in detail. We can talk about feature mis-location, mis-representation, inverted topography, shadows, infinite duplication of effort and pointless profiles some other time (or you can check out the references below), but trust me the sum of the last decade of work into this topic (yes it has been that long) is that there are better techniques than hillshades for accurate visualisation and detailed mapping of microtopographic features.

Fortunately, people far cleverer than I have published devious ways to get more out of your model without ever making another hillshade. Each visualisation has in common an unappealing name, such as sky-view factor, openness or local relief, and a complex mathematical formula but by Gods do they work wonders on your microtopography. And you don’t just have to take my word for it (see refs again), though I have included some darling shots to whet your appetite [Figure 1, right].

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Best of all making these visualisations is a doddle thanks to the incredible folks at the Institute of Anthropological and Spatial Studies, ZRCSAZU Slovenia. You can download their stand-alone processing genie, the Relief Visualisation Toolbox, along with a detailed manual and even a powerpoint presentation about the visualisation techniques from this link (RVT – http://iaps.zrc-sazu.si/en/rvt#v). With the click of a button you’ll be on your way to a better lidar day.

One final and important word of caution: as ever with data processing, an understanding of the processing you are doing, along with its advantages and disadvantages is a must, otherwise we are just making a selection of pretty pictures! (By the way the title of this section isn’t true but if it makes you stop and think twice about your options for visualising lidar then that’s OK by me.)

2) Not all the data from the Environment Agency are the same

No doubt you all saw the headlines ‘England Makes 3D Data of the Entire Country Free After Minecrafters Ask For It’ (entirely untrue by the way but why let that get in the way of a good story?). The data they are referring to here is the EA composite coverage, a neat little product that combines data from multiple surveys into a surface and terrain model for each resolution model. Very useful for minecraft and 3D visualisation but due to lack of date / resolution information and the way in which they must ‘blend’ the data from surveys of different dates to account for inter-survey error, this layer is not suitable for prospection of microtopography. I’ve stolen a diagram from EA’s metadata file to demonstrate [Figure 2, right].

Don’t panic the single dated surveys that you need are still available but you need to scroll down in the downloader to view them as the composite layers are shown first [Figure 3, below].
3) Downloading Drama
The EA downloader is rubbish so if you want to try before you ‘buy’ (or at least spend a while faffing around) why not link in to the highly-underpublicised WMS service in your GIS? You’ll need to search for ‘lidar’ here http://environment.data.gov.uk/ds/catalogue/index.jsp#/catalogue to get the links, then you can check out the coverage of each resolution for your site of interest. Easy like a Sunday morning. [Figure 4, below]

4) Where did the Welsh data go?
I know I said three tips but if you are wondering where the Environment Agency for England and Wales’ data for Wales went take a look here: http://lle.gov.wales/Catalogue/Item/LidarCompositeDataset/?lang=en

5) Got stuck? Ask!
(Sorry I just couldn’t help myself – this will be the last point I promise!) As lidar is definitely not a new idea, we have some whizz kids around in the heritage sector who can and will help you if you get stuck or don’t understand. Don’t feel like you are alone with your model mayhem!

Selected references


Cropmarks
Harvested by Rog Palmer

(web links were accessed on various dates between March and September 2016)

Early aerial photographs
A collection of photographs taken by Shadbolt in and over London, plus a lot of hand-drawn and coloured views from the ground and from the air. For more information on Shadbolt, see selected outpourings of Martyn Barber.

[hyperlink to website]

A ‘new’ Maya city..?
News of a clever piece of detective work that enabled a 15-year old to identify a previously-unknown ‘Maya city’ via ancient star charts and newer satellite data.

[hyperlink to website]

Or perhaps not..?
A slightly-more academic breakdown of the above that stresses the need to call in suitably-qualified experts to validate such claims.

[hyperlink to website]

North to the top?
It’s nice to have a friend…. A short contribution based on Jerry Brotton’s A History of the World in Twelve Maps, that suggests that north to the top is a peculiar custom.

[hyperlink to website]

UAV in USA
Any of you in, or likely to be in, USA flying UAVs should be aware of the FAA’s new ruling regarding flying the things. All 624 pages of it….

[hyperlink to website]

Automated drones
Not really for archaeological work, but an insight into just how far drone technology has advanced in this autonomous, multi-purpose kit made by Airobotics. Payloads can be automatically changed and include a DSLR high-res (4K) camera for mapping and surveying. Combo RGB and IR video camera for and a HD video camera (4k). Coming soon will be sensors for LiDAR, Hyperspectral and Multispectral. Links below are to a YouTube demo and to the company website.

[hyperlink to website]
[hyperlink to website]

(thanks to Geert Verhoeven)

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1 rog.palmer@ntlworld.com
ALS-v-SfM
A fairly wordy piece that ends up comparing costs and benefits of generating accurate survey
data using ALS and SfM.

http://www.outsideonline.com/2099481/fodar-future-maps

Mini thermal camera
TeAx Technology make a range of very small thermal cameras (with expectedly small image
sizes) that may be of interest to any of you wanting to add thermal capacity to your drone’s
armoury.

http://thermalcapture.com/worlds-smallest-commercial-lwir-thermal-drone/

(thanks to Geert Verhoeven)

Free USGS maps
National Geographic have recently added downloadable PDFs of 1:24,000 scale map cover of
USA to their web site. These carry coordinate information using NAD83 and WGS84 for
those who want to try and geolocate the maps.

http://www.natgeomaps.com/trail-maps/pdf-quads

Chasing sites from satellites
Having solved all our problems in Egypt, the Roman Empire and tracking down the bloke
who discovered America, Sarah Parcak is next to turn her attention to finding all the unknown
archaeological sites in Peru. And if you want to help, just follow the link at:


Open source ALS software
The link below takes you to part of the Dielmo 3D website, a Spanish company that offer
‘Lidar and geospatial services’ to clients. Their open source software includes tools for
visualisation, analysis, profiling and a viewer for point clouds.


(thanks to Geert Verhoeven)

Camera technology
A nine-minute video showing a range of ‘extreme’ cameras, from satellite and high-resolution
aerial surveillance to astronomy and a miniature camera (plus light, battery and transmitter)
that you can swallow to see what’s going on inside.

https://www.youtube.com/watch?v=cm0KJC3b3UQ

CUCAP closed again
On 31 August 2016, CUCAP again closed for consultation with apparently little idea about
the future of the collection. The website states: ‘The CUCAP collection is currently not
available for consultation, while arrangements for its ongoing status are put in place.’

http://www.cambridgeairphotos.com/
Lidar sensors for UAVs
Probably the next ‘must have’ for UAV operators, this site lists its ‘top 10’ in an article dated 17 September 2016. I give the date because these things will change so rapidly and we must hope that the web site keeps updating its information. After a brief ‘How Lidar works’ and a list of its uses, the top 10 sensors are described along with some of their technical specifications. In reality, this is a list of the ‘top 9’ as the Leica sensors are too heavy (37 and 37 kg) and are identified as for ‘manned aircraft’ use (spotted by Nina Heiska). Links are given to the host web pages.

(thanks to Ioana Oltean)

And processing UAV-collected ALS data?
The above link makes no mention of how a user is expected to process the collected data, nor really does another article titled, *Introduction to UAV photogrammetry and Lidar mapping basics*, which is more about hardware than software. However, the mother website (DroneZon) may be of interest to droners and detailed searching may reveal more than I found in 10 minutes.


Technology and maize mazes (or maize art)
How changing technology has led to the use of a GPS-guided mower and drone videos to make precision artwork in maize fields. The web link includes photographs of a succession of these artworks – don’t miss them. OK, this is 2016 kit but it still leaves unanswered the question of how ‘aliens’ made some of the precision crop circles some 20+ years ago.

(thanks to Nina Heiska)
“A set of old wives’ tales”: When Nadar was a photographer

Review article by Martyn Barber


Well over a century since it first appeared, what might loosely be called Nadar’s ‘memoir’ of his photographic life and times has finally appeared in an English translation. Despite ongoing fascination with his portrait photography and, to a lesser extent, his aerial photography, remarkably little of Nadar’s literary output has been thus transcribed beyond the odd (and often familiar) passage, perhaps the most recent and noteworthy example being Julian Barnes’ (2013) remarkable essay “Levels of Life” – “You put together two things that have not been put together before. And the world is changed. People may not notice at the time, but that doesn’t matter. The world has changed nonetheless.” Nadar’s first – the world’s first – aerial photograph is the product of one of those moments of change touched upon in a book that is ultimately concerned with the death of Barnes’ wife Pat Kavanagh a few years earlier. The apparent veracity of a perspective offered by distance is one of the touchstones in Barnes’ account of Nadar, the ability “to look at ourselves from afar, to make the subjective suddenly objective”. Of course for Nadar, the ‘objective’ potential of aerial photography turned out to be illusory.

Firm facts about Nadar himself are hard to come by even without the added complication of his own writings. For instance, he struck everyone, it seems, as being remarkably tall, although estimates of his height (that I’ve come across, anyway) range from 5ft 10in to 7ft. Without recourse to actual measurement, I guess a lot depends on the perspective of the observer. As for his appearance, obviously we have a number of black and white portraits, generally self-portraits, but there are plenty of concise pen-portraits as well. One, among the mass of material collected in the 1920s by Walter Benjamin for his Arcades Project, tells us that:

“His hair has the reddish glow of a setting sun; its reflection spreads across his face, where bouquets of curly and contentious locks spill this way and that, unruly as fireworks. Extremely dilated, his eyeball rolls, testifying to a truly unappeasable curiosity and a perpetual astonishment. The voice is strident; the gestures are those of a Nuremberg doll with a fever” (Benjamin 2002, 681).

Benjamin’s notes offer only a secondary source for the quote, although it appears to originate with writer and critic Theodore de Banville, which makes one wonder if the ‘Nuremberg doll’ reference is an allusion to the comic opera of that name. From the same source Benjamin also quotes Nadar himself – “…nearsighted to the point of blindness and consequently liable to the most insulting amnesia in the presence of any face which he has not seen more than twenty-five times at a distance of fifteen centimetres from his nose…” (ibid.). Can we trust Nadar’s claim to near-blindness? Probably not. In her detailed and enlightening account of the early decades of commercial photography in Paris, Elizabeth McCauley highlighted some of the problems with Nadar’s own version(s) of his life – he “transformed himself into a myth

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during his lifetime” (McCauley 1994, 7), and emphasized the need for a “non-hagiographic reappraisal of his career”, something still still awaited.

Richard Holmes has written about Nadar on several occasions, recalling how it had once seemed to him “that Nadar would provide a wonderful opportunity for a biographical ensemble, the study of a whole Romantic generation, something extraverted and flashlit, full of melodrama, gaiety and humour” (Holmes 2005, 53). There was a problem though. Nadar didn’t fit the ‘Romantic’, bohemian template. He didn’t conform to Holmes’ ideas of the age – “there was something in the buoyant optimism of Nadar’s temperament, the endlessly cheery egoism, the very naivety which so appealed to Verne, which curiously denied the reflective, questioning mood which I found in his photographs, and which seemed to me essential to the 1850s” (Holmes 2010, 209). Even worse, he was interested in progress, in technological advance; he championed powered flight over the balloons he is more often associated with. Worse still, he failed to die young, outliving most of his contemporaries by decades (in some biographical accounts, Nadar’s later years seem to comprise a sequence of death-bed scenes). The most recent (English language) biography is, therefore, Nigel Gosling’s Nadar (1976), which is more an introduction to Nadar than a detailed life.

Among the fourteen essays contained in When I Was A Photographer is Nadar’s account of the taking of his first successful aerial photograph – that moment when the world changed forever. It is typical of the other essays, managing to combine considerable detail with an absence of firm fact, offering a first-person, eye-witness account of adventure, exhilaration, frustration and triumph that will probably disappoint anyone seeking a reliable report of what actually happened and why. Rosalind Krauss (1978, 29) famously observed that the essays in this book were “structured like a set of old wives’ tales, as though a community had entrusted its archives to the local gossip...[An] almost maddening array of peculiarly personal reminiscences, some of which bear a relationship to the presumed subject that is tangential at best”. It was perhaps, she felt, “this quality of rambling anecdote, or arbitrary elaboration of what seem like irrelevant details, of a constant wondering away from what would seem to be the point, that accounts for the book’s relative obscurity”. This may be so – it is a memoir – although one wonders whether ‘obscurity’ here refers mainly to the lack of an English version. However, it is most certainly not history or autobiography. It is instead a collection of personal reminiscences, containing much that is unreliable, each essay directly or indirectly related to the developing art and practice of photography in 19th century France. In keeping with Nadar’s original publication, there are no photographs to accompany the text, although unlike Nadar, the authors (or perhaps the publishers) have placed photographs (of Nadar) on the front cover and the title page.

Outside France (and probably inside too?) Nadar remains best known, if at all, as a pioneering portrait photographer, his ability to inject subjectivity and uncertainty into a technological practice evident in an enduring fascination with his likenesses of Sarah Bernhardt, Victor Hugo, Charles Baudelaire and the many other contemporaries who sat in front of his lens (although the identities of those sitters obviously plays a part too). The many discussions of those portraits, including the numerous exhibition catalogues from both sides of the Atlantic, tend to treat his aerial photographic experiments (and his often disastrous ballooning exploits), along with his descents into the Paris catacombs and sewers, as something rather different. Nadar himself stressed the importance of the creative input of the photographer into what was widely seen as a purely mechanical process (although this was connected with
arguments over whether a photographer could claim copyright over the image the camera captured), while seeing his airborne photographs in a rather different light:

“No more preliminary triangulation, painfully built up on a stack of trigonometric formulas; no more dubious instruments, plane tables, compasses, alidades, graphometers; no more chains of convicts to drag through the valleys, hills, plowed fields, vineyards, swamps; we do not have to bother people at home anymore. No more of these uncertain works, prepared without uniformity, pursued and completed by approximation, without cohesion, without control or guarantee, by unsupervised personnel who sometimes can be made to forget their hours of work by the billiards hall in the next town” (p60 in the volume under review).

The vertical aerial photograph was a map, or rather, the basis of a map, a virtual representation of the earth below from which a map could be created without recourse to algebra or prisoners. It didn’t work, of course. Well – up to a point, it did. That first photograph, taken late in 1858 (Nadar, typically and erroneously, perhaps deliberately and mischievously, implies that it was taken in 1855), “affirmed...despite its imperfection, the practical possibility of aerostatic photography... As for its cadastral application, my very eminent friend, Colonel Laussedat, explained to me that it was impossible” (p71 in the volume under review).

Laussedat, of course, was French military engineer Aimé Laussedat, who had been experimenting with mapping from photographic images for some time. Beginning with efforts to produce measured drawings from the image projected by a Camera Lucida, by the 1840s he was experimenting (unsuccessfully) with kite photography before making Nadar’s acquaintance. Laussedat went on to become a key figure in the development of what eventually became known as photogrammetry, responsible for devising both instruments and geometrical techniques for deriving measurements from photographs. Nadar does not elaborate on why a ‘cadastral application’ for his balloon photographs was ‘impossible’, something not chased up by the translators of this volume (some of the reasons are discussed in Barber and Wickstead 2010 & Wickstead and Barber 2011). Laussedat, I believe, is the only person mentioned in the entire book who has not been provided with a biographical footnote. I suspect the reason is not that he is so well known as to make it unnecessary. It is a remarkable oversight, but far from unusual in literature about Nadar the photographer.

So – is it worth reading? Undoubtedly, so long as you are not expecting fact-based reminiscence or a straightforward source for the history of photography, aerial or otherwise. I would, however, strongly recommend that anyone who can read French get hold of a French edition – there are clear signs that Nadar’s somewhat literary, elliptical and allusive approach has occasionally defeated the translators. On the matter of linguistic issues, however, it is worth recalling Henry Murger’s account of a trip across the English Channel (yes, I know – La Manche) with Nadar in 1858, during which, intriguingly, they claimed that “in London, morality goes to bed at nine o’clock”: “Nadar’s English is not current in London” (Baldick 1961, 168).

References


Barnes, J (2013) *Levels of Life* (Jonathon Cape, London)


Recovering lost landscapes

Review article by Ioana Oltean


ArchaeoLandscapes Europe (ArcLand) may not have been about research, but the successful series of core publications showcasing its achievements speaks for what specialists can do once they get together: they talk about their research, of course! As explained by the editors in the introduction, this volume publishes 14 papers presented in two separate events which were organised as part of the training and dissemination activities of the Working Party 5 of ArcLand which worked towards securing a better exploitation of existing air-photo archives across Europe. The first event was a seminar and subsequent workshop held in Belgrade, Serbia between 19/20 November 2013 looking at the archaeological application of historic aerial images (*Recovering Lost Landscapes*; Institute of Archaeology, Belgrade and the Research Centre of the Slovenian Academy of Sciences and Arts, Ljubljana); the second, *Patterns, Processes & Understanding: historic aerial photographs for landscape studies*, a conference in Bedlewo, Poland (24/25 April 2014).

The various contributions invite the reader to a very broad range of issues, from data access, reliability and manipulation, to examples of successful application in case studies all set within the diverse geographic, chronological and cultural European framework. There is something for everybody: major rivers, from the Danube in the Roman period (Ivanisevic and Bugarski) to the Bug in 1940 (Soszinski et al); from the plains of Poland (Kiarszys; Krolewicz & Zuk) to the uplands of northwest and central Iberia (Curras et al.; Lobato), the Montenegro Karst (Petricvic), Slovenian Alps (Veljanovski, Kokalj) and back again to the Polish Sudetes (Latocha). Landscapes and sites of various periods could all be examined using old aerial photographs, while at the same time giving the opportunity to assess comparatively the benefits of using such early surveys in tried and tested systems of heritage management and protection in England (Winton) and Wales (Musson & Driver).

Thus, the use of Serbian military aerial photographs of unspecified date in conjunction with historical maps from 1726 and 1894 (Ivanisevic and Bugarski) gave considerable insight into the archaeological landscape of the Roman frontier along the Danube, now affected by the waters of the great dam at Djerdap/Portile de Fier 1 built in the 1970s. Rescue investigations prior to its construction were conducted separately both on the Serbian and Romanian sides of the river along a 130km-long stretch, but given that they lacked a unitary bi-national strategy and a landscape focus, these efforts have been patchy at best, even within areas under the same national competence. The result of these early investigations biased our understanding of sites with corresponding structures on the other side of the river (e.g. the Lederata/Nova Lederata sector) which, with the help of aerial photographs pre-dating the dam construction, can now be better understood as a working system spanning both sides of the river.

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Based on some 30 years of experience, and despite their inferior ground resolution, Curras et al. makes a passionate argument in favour of the use of American, Spanish and Portuguese historical aerial photographs in NW Iberia to identify traces of ancient mining above more recent technologies (e.g. ALS). The superiority of conventional aerial photos is seen there especially in view of more recent landscape development affecting archaeological remains, and in their ability to reveal the maximum arable potential of those landscapes prior to the introduction of modern agriculture. This is further (and to some extent better) reinforced by the successful use of historical aerial photographs in conjunction with digital photogrammetry to virtually restore the original topography of the Cero de la Mesa Iron Age site affected by the construction of a dam on the river Tagus in Central Spain (Lobato). Their contributions once again reinforce the view that no single methodology can be fully relied upon, and that the task of the professionals is to use creatively those methods which would best overcome the specific problems they encounter. At the same time, however both Cantoro and Veljanovski & Kokalj successfully argue for a move towards tridimensional reconstructions and analyses of landscapes under study.

As expected, a number of authors provide among other, technical overviews of the international and national data sources accessible for their areas, which are useful to others hoping to follow on their footsteps, but excellent additions to the volume are discussions on data reliability (Kiarszys; Krolewicz & Zuk). To trust or not to trust: maps versus aerial photographs within political discourse is a refreshing contribution to the eternal debates over maps reliability; in this particular case the authors sought to test the reliability of a 1960s set of Stalinist-era Polish maps and for once we see them successfully rescued from the largely unjustified disrepute brought to them in the early 1990s by the undiscerning mass-rejection of the previous regime’s artefacts. Particularly welcome here is the discussion on the use of data (and the access to it) as an instrument of power. This is an issue which comes strongly (as it might) also from Palmer’s experience with UK-based public photo archives. Helping us once more to see these datasets as mere artefacts serving a process, his paper proposes the principle of the precedence of informative content over physicality when assessing the value of photographs and sees their digitisation as a means to increase their usability and user access to collection. On the other hand, his invitation to divorce UK archives from the need to produce money may sadly be less than popular with current government targets.

The volume is generally well presented by the editorial team. A major gap in the coverage of the volume is that it is very prolific in illustrating most the use of aerial photographs, sometimes in combination with old maps and sometimes with ALS coverages, but there is virtually no attempt to use old satellite imagery; given that more than half of the case studies are set in areas beyond the Iron Curtain I would have expected some consideration of the high resolution Corona satellite imagery nowadays easily accessible. Another problem is (somewhat surprisingly given the large format of the publication), the occasional small-scale of illustrations which are less useful even to trained audiences.

The now defunct ArchaeoLandscapes Europe may not have achieved in its lifetime a complete opening of access to historic imagery archives. Nevertheless, there is little doubt that the sheer diversity of examples of their use and of sharing of good practice advice available now in print will increase the pressures from professionals for access to collections which will hopefully prompt substantial changes in the public policy those archives.

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Books of interest?

Rog Palmer¹


Most of the contributors are new names to me, but may be acclaimed in the new world of 3D recording. Among the pages, we may also be told just why and how this way of recording is helping archaeologists understand the past rather than it being done because it can be done (which reminds me of the Detail session at a recent AARG).

Whittles website ([http://www.whittlespublishing.com/3D_Recording_Documentation_and_Management_of_Cultural_Heritage](http://www.whittlespublishing.com/3D_Recording_Documentation_and_Management_of_Cultural_Heritage)) gives the contents as follows:

- Introduction – Current Trends in Cultural Heritage and Documentation (Mario Santana Quintero and Rand Eppich)
- Conservation Techniques in Cultural Heritage (Minna Silver)
- Cultural Heritage Management Tools: The Role of GIS and BIM (Anna Osello and Fulvio Rinaudo)
- Basics of Photography for Cultural Heritage Imaging (Geert Verhoeven)
- Basics of Image-Based Modelling Techniques in Cultural Heritage 3D Recording (Efstratios Stylianidis, Andreas Georgopoulos and Fabio Remondino)
- Basics of Range-Based Modelling Techniques in Cultural Heritage 3D Recording (Pierre Grussenmeyer, Tania Landes, Michael Doneus and José Luis Lerma)
- Cultural Heritage Documentation with RPAS/UAV (Fabio Remondino and Efstratios Stylianidis)


The study of conflict archaeology has developed rapidly over the last decade, fuelled in equal measure by technological advances and creative analytical frameworks. Nowhere is this truer than in the inter-disciplinary fields of archaeological practice that combine traditional sources such as historical photographs and maps with 3D digital topographic data from Airborne Laser Scanning (ALS) and large scale geophysical prospection. For twentieth-century conflict landscapes and their surviving archaeological remains, these developments have encouraged a shift from a site oriented approach towards landscape-scaled research. This volume brings together and wide range of perspectives, setting traditional approaches that draw on historical and contemporary aerial photographs alongside cutting-edge prospection techniques, cross-disciplinary analyses and innovative methods of presenting this material to audiences. Essays from a range of disciplines (archaeology, history, geography, heritage and museum studies) studying conflict landscapes across the globe throughout the twentieth century, all draw on aerial and landscape perspectives to past conflicts and their legacy and the complex issues for

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heritage management. Organized in four parts, the first three sections take a broadly chronological approach, exploring the use of aerial evidence to expand our understanding of the two World Wars and the Cold War. The final section explores ways that the aerial perspective can be utilized to represent historical landscapes to a wide audience. With case studies ranging from the Western Front to the Cold War, Ireland to Russia, this volume demonstrates how an aerial perspective can both support and challenge traditional archaeological and historical analysis, providing an innovative new means of engaging with the material culture of conflict and commemoration.


Thanks to Dave Cowley for sending a link to this paper which documents results of observations recorded over a twelve-month period to determine what the authors call the ‘Theoretically Best Period for Marks Detection’.


Details the flight planning, flight mission and data processing using a ‘basic’ UAV fitted with a GoPro camera. Test sites were in Nepal (2.9 sq km) and Cyprus (1.1 sq km) and the paper notes the numbers of ground control points at each site, processing time and accuracy achieved. Both test areas are World Heritage Sites and the main reasons for undertaking the UAV surveys was to document them to aid further planning and, for Cyprus, to assist excavation and research being carried out by Polish archaeologists at Ancient Paphos.


Survey in 2015 using a helicopter mounted with a Leica ALS70 HP instrument (and a 60 megapixel Leica RCD30 camera) collected full waveform data at a minimum of 16 points per sq m over an area of 1910 sq km. Added to an earlier (2012) survey, this has resulted in ALS data for about 2230 sq km around Angkor and specific targets, plus a large area of urban and agricultural land to its NE. The article discusses elements of the survey – mound fields, quarries, temple cities, water management and unexplained geometrical features – and shows some of the transformation of the landscape undertaken during the Khmer Empire which leads towards greater ‘understanding of the socio-ecological dynamics over large scales of time and space’. This is a vast survey, will provide many years of work for this problem-orientated research programme.
Archaeological Prospection has published several aerial/satellite papers in recent months. Abstracts from http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1099-0763. Among these are:


and related to this:


Jeroen de ReuI, Jan Trachet, Pieter Laloo and Wim de Clercq, 2016 (forthcoming?). From low cost UAV survey to high resolution topographic data: developing our understanding of a medieval outpost of Bruges.
The Aerial Archaeology Research Group

AARG is a lively and friendly international group of young and old researchers. It provides a forum for the exchange of ideas and experience on archaeology and landscape studies using all forms of remote sensing, especially airborne and satellite based techniques.

AARG is actively involved in promoting the collection, interpretation and application of remote sensing data in fostering research, conservation and public understanding. Its members are among those pushing the boundaries of the collection and analysis of air- and space-borne sensors.

Since its foundation in the early 1980s, AARG has vigorously encouraged discussion and cooperation through its annual conferences, workshops, specialist publications and biannual newsletter, AARGnews.

Membership is open to all who have an interest or practical involvement in aerial archaeology, remote sensing and landscape studies.

AARG is a registered charity: number SC 023162.

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Anyone wishing to apply should write to AARG’s Chairman (aargchair@gmail.com) with information about their interests in archaeology and aerial archaeology, as well as their place of study. The annual closing date for applications to the annual AARG conference is 1 June. Other meetings for which scholarships may be available will be advertised on an ad hoc basis.