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What You Don't See is What You Don't Get. Problems of Effortless Photorealism in Archaeological Field Documentation

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Abstract

Photorealistic and scientifically precise 3D capturing as a main documentation tool has become a standard already in certain contexts of archaeological fieldwork. Tools and software are increasingly affordable and user-friendly, and simultaneously the public heritage agencies, museums and scientific collections are increasingly capable of processing and storing this data. The future looks promising for SfM photogrammetry, LiDAR and other 3D capture technologies, but some fundamental problems may be hidden beneath the sheen of the visually striking and precise outputs.

This paper examines photorealistic 3D field documentation technologies from a critical perspective. As we can efficiently make precise 360-degree models of the fieldwork project with the click of a button, is there a risk that we are losing the ability to use our own human senses to recognize other relevant features? Using a material of some 2,600 Finnish fieldwork reports between 2013 and 2022, this paper identifies archaeologically significant phenomena that may be getting out of focus due to the ease of '3D-scanning' everything frequently. Ultimately, the paper aims to ask fundamental questions for future discussions on how to effectively instruct and guide archaeological 3D documentation principles.

Keywords: photogrammetry; laser scanning; 3D documentation; digitalization

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1. Introduction

Structure-from-Motion (SfM) photogrammetry, laser scanning and other 3D-documentation methods have become well-established methods for field archaeology during the last two decades. After multiple publications dealing with the precision, reliability and ergonomics of these technologies, it seems self-evident that they have become normalized tools for archaeological work processes (e.g. Bayram *et al.* 2015; Murtiyoso and Grussenmeyer 2021; Nuttens *et al.* 2011; Paukkonen 2023; Teppati Losè *et al.* 2022), while also opening possibilities for new kinds of analyses of sites, structures and artefacts (Emmitt *et al.* 2021; Magnani *et al.* 2020; Marín-Buzón *et al.* 2021).

For the concerns of fieldwork documentation, it seems that the reliability and usability of SfM photogrammetry and LiDAR scanning have been sufficiently proved. But what are some other implications of the adaptation of these technologies? Now that the different methods of 3D-scanning have become easier than ever before, has it also introduced some alterations into the way we archaeologists perceive archaeological sites and processes? If the archaeologists writing the reports focus only on scientific approaches, 3D visualizations and other measurements, it may lead to a tendency just to describe what things were encountered and how, instead of examining the possible interpretations related to past lives and experiences, which would require more creative thinking and subjective approaches.

It is crucial to understand the ways that the ease of applying these methods may change the general way we do and record the archaeological excavation process. One promise related to processes utilizing 3D-scanning of excavated sites was and is the possibility of virtual or digital replication of the whole excavation process: separately measured 3D-versions of stratigraphical units can be composed into one visualization, where the user can visualize various stages of the excavation, make cross-sections, zoom into details or measure phenomena that they are interested in. Representations of excavation results have been done in 3D form before the advent of digital methods of course, but their production was significantly slower and resource-intensive (Huvila 2006; Kockel 2004). One very impressive example of this approach is the Dhaskalio excavation (Campbell *et al.* 2024). This kind of systems allow a new level of precision and flexibility in postprocessing and reporting. However, there is a risk that with increasing focus of attention and resources into this photorealistic and emphatically *visual* documentation some other facets of physical aspects of the sites are being neglected and documented with the same rigor as they would have been one or two decades ago. “Scanning” with digital tools can be considered to be cognitively passive activity compared to drawing and verbal describing, both of which require active interpretation as they are being performed (Morgan *et al.* 2021).

It is a possibility that focus on photorealistic digital reproduction may be leading to omitting qualities which are either more subjective or especially non-visual. For instance, we can now easily document the extent, thickness, volume, colour (to some extent) and general visual appearance of a soil layer just by measuring it into a 3D-dataset, but attributes such as consistency, moisture, smell, taste and other in a sense subjective qualities are difficult or impossible to capture in such a way. As such, it is interesting to find out whether this really is the case – whether the adaptation of SfM photogrammetry or laser scanning have had an effect like this in archaeological field recording. Is a picture – or a photorealistic 3D-version of an archaeological site – worth a thousand words?

On a larger scale, this kind of notion – that technological innovations influence the way we think and how we focus our attention – is not new. There are many earlier theories and concepts that can be applied for this kind of inquiry. The old theory of *technological determinism,* originally coined over a hundred years ago by Thorstein Veblen, is a well-known model that society and culture are shaped by technological development (Brette 2003; Papageorgiou and Michaelides 2016; Veblen 1906). In context of archaeology this would mean that advances in documenting certain phenomena leads us to be especially focused in studying these phenomena for our interpretations, possibly at the expense of those that are more difficult to study. Or, to put it simply, having a nice laser scanner at hand, the archaeologist will want to scan everything, instead of stopping to ponder their subjective experiences on the smell and consistency of the soil, for example. This may also be seen as an application of communication theorist Marshall McLuhan's dichotomy of extensions and amputations to our senses and bodies (McLuhan 1964): by adopting various methodologies of highly automated 3D-data production through scanning, the archaeologists are "amputating" their sensitivity to phenomena that these methodologies are not suitable for.

The concept of *cognitive offloading* has also become really prevalent due to the recent advance of AI technology, but can also be applied here: people tend to instinctively try to offload cognitively complex tasks for automated systems (e.g. Dunn and Risko 2016), and as such, if we imagine that the complexities of describing stratigraphy, for instance, can be automated through digitalization, we will then try to do it, without realising that the data generated by the new tools does not fully correspond with that generated by older methods. This is also connected to the social psychology concept of *automation bias,* where people tend to sometimes favour decisions made by automated systems and ignore contradictory information from non-automated sources (Cummings 2004; Mosier and Skitka 1999). We may even consider the sort-of dystopia described by Neil Postman in his *Technopoly* (Postman 1993) or Ivan Illich's concepts related to *technocratic disaster* (Illich 1973; Samerski 2018). Some ideas from Jacques Ellul's *technique* and its implications can be also interesting in this context: modern digital recording methods have been lauded especially for their efficiency, in addition to which they can be seen as monistic and universal in his terminology, but these qualities may then lead to devaluation of older methods that cannot compete on their terms (Caraher 2019; Ellul 1964).

Many scholars in archaeology have engaged critically with the effects of technological advancements and digitalization in archaeological theory and methodology before (e.g. Heyd 2023; Huggett 2004; Lock 2003; Tanasi 2020). Illich's concept of conviviality in the context of archaeology has been examined in greater detail by e.g. Given and Caraher (Caraher 2019; Given 2017, 2018). Caraher has been explicitly critical about the industrialization of archaeology and called for attention to the place of digital tools in field practices and methodology (Caraher 2016, 2019). However, the specific question of 'Is something being neglected when we move to digital 3D-scanning' has not been asked earlier as such.

From a cognitive and pedagogical perspective, there is a difference whether a kinetic hand-drawing approach is used, compared to automated digital recording and scanning. Many studies on professional designer emphasize the dissimilarity in the behaviours of sketchers doing sketching by hand and those who use computers – for example, computer-aided design is limited by the toolkits available (Won 2001), and does not seem to support creativity as much as manual environment (Pan *et al.* 2013). There is arguably some pedagogical and cognitive functions that traditional

documentation methods, such as drawing, fill, and which new digital methods do not sufficiently replicate (Morgan *et al.* 2021; Morgan and Wright 2018).

To study the effects of the adoption of 3D scanning on other kinds of documentation, a dataset of some 2,600 Finnish fieldwork reports was studied. The studied reports are dated between the years 2013 and 2022 and coincide with a time of systemic increase of both SfM photogrammetry and laser scanning use. The contents of these reports were analysed by a series of keyword queries to see if there was a correlation between the increase of the use of SfM photogrammetry and laser scanning and the suspected decrease of verbal subjective descriptions of archaeological phenomena.

2. Method and materials

Studying changes in conceptions of archaeological documentation is a difficult subject. Documenting an excavation process and writing a description of the relevant findings is a fundamentally subjective endeavour, even if various pre-determined forms, sheets and technical measurements bolster an illusion of partial objectivity. The approach of this paper is to examine excavation reports, and the language used in them, with the description of stratigraphical units and their relations used as a fertile example. The interpretative process related to describing stratigraphy is complex and multisensory by its nature and cannot easily be replaced by visual photorealistic documentation. By using the number of stratigraphy related keywords as a metric, it is possible to evaluate diachronic changes in the quality of fieldwork reports.

This work relies on an earlier LiDAR and photogrammetry related paper, which examined the progress of adapting the two aforementioned technologies in Finnish field archaeology (Paukkonen 2024). The study collected all the available digital archaeological fieldwork reports published between 2013 and 2022 in Finland and counted which of them mentioned SfM photogrammetry or LiDAR use in their methodologies. With this achieved, the paper was able to show how and when these technologies had been adapted into Finnish archaeological practice and how common they were (Fig. 1).

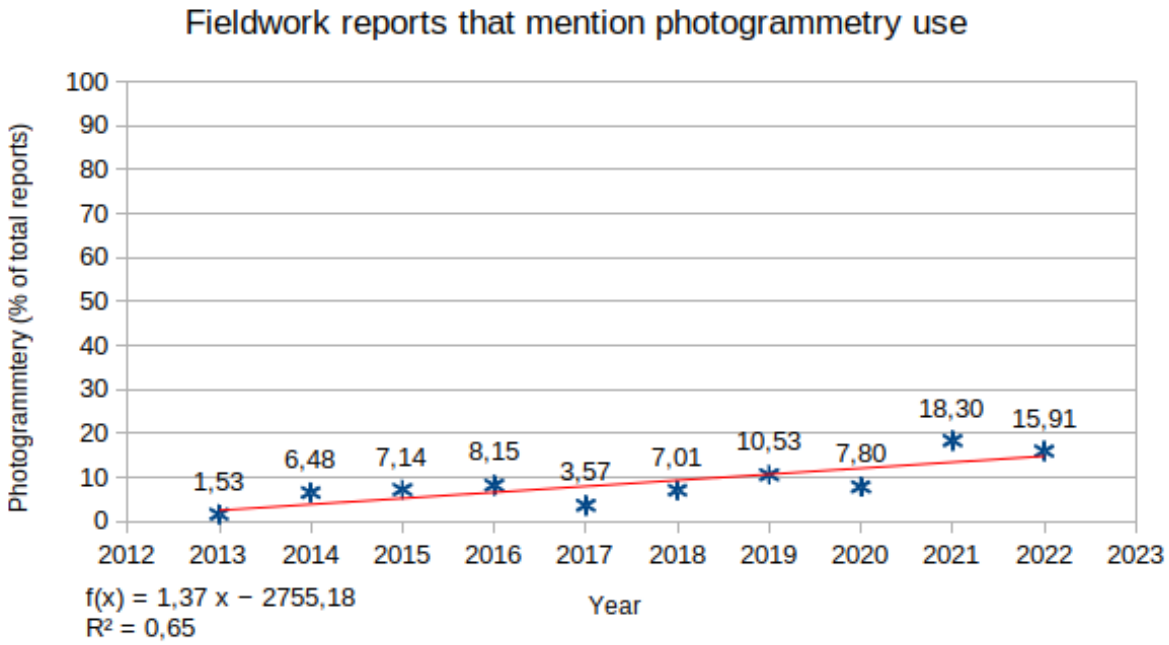

Fig. 1. Increase of photogrammetry use in Finnish archaeological fieldwork reports (Paukkonen 2024).

The analysed data comprised of PDF reports that had been extracted from the two Finnish Heritage Agency services, Kyppi and Asiat. Almost all the reports are in Finnish – the few reports in the other official language of Finland, Swedish, have been removed from the dataset. Using optical character recognition (OCR), the search for photogrammetry and LiDAR related keywords could be automated. The resulting database contains the keyword search results for each report, organized by year of publication and type. The results section of the paper showed a clear increase in various 3D-scanning technologies during the period of 2013—2022 (Paukkonen 2024).

For the study at hand, the analysis of reports was based on an automated query of common stratigraphical keywords. The keywords include e.g. Finnish names for different soil types, consistencies, granulation and other important vocabulary. The included Python code searches the reports for these keywords and then compiles them into an Excel file. This very basic analysis relies on the idea that the more a report exhibits these keywords, the more the writer of the report has given attention to verbal descriptions of stratigraphy. The number of hits in each document was divided by the number of pages in the document to get a crude but very telling ratio that can be used to visualize the change. Higher the number, higher the attention given to verbal descriptions, and vice versa.

3. Results

Based on these results, there indeed seems to be a decrease in the stratigraphical keywords / number of pages ratio during the studied years 2013-2022 (Fig. 2). It seems that the number of

words to describe stratigraphical units has clearly decreased. When comparing this result with the Paukkonen 2024 study of photogrammetry and LiDAR use, it is obvious that in 2013 to 2022 period photogrammetry and laser scanning use have increased, while words used for stratigraphy descriptions in the same report have decreased. Looking more closely at individual reports, it is evident that despite some high-ratio outliers, the trend is generally decreasing (Fig. 3). Some outliers are explained by specific find categories or appendices generating disproportionate ratios: for example, a report from an excavation at the Iron Age site of Papinkallio contains a list of finds that includes hundreds of separately listed fragments of burnt clay (Näränen 2016). Regardless of such individual anomalies, the general trend is still descending without any doubt.

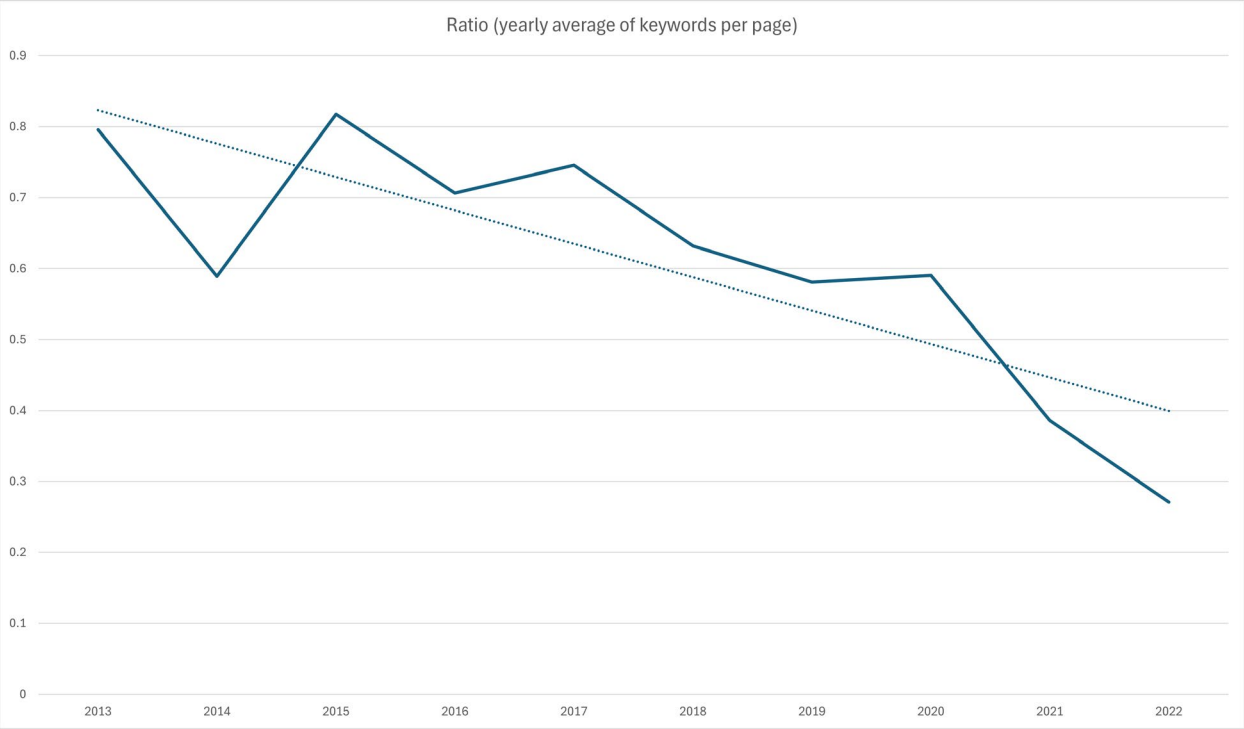

Fig. 2. The yearly averages of stratigraphical keywords per page in the studied Finnish excavation reports.

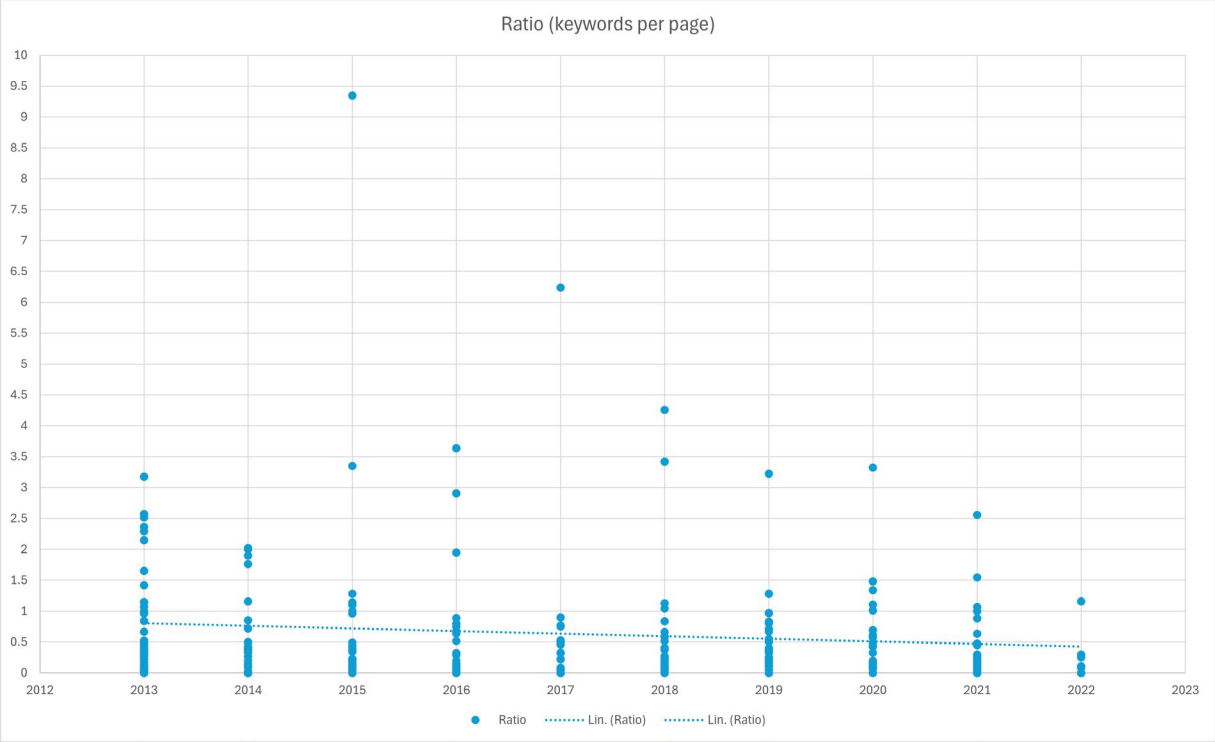

Fig. 3. Plotted individual report ratios of stratigraphical keywords per page.

This kind of simple correlation does not necessarily imply causation. Many other factors may have had an effect in this change of report quality: the decrease could be caused for instance by the increase of financial pressure to finalize reports as quickly and efficiently as possible. This period has also seen an increase in the amount of fieldwork conducted by private contractor companies, which may have further caused pressure to finish reports quickly (Rahtola 2020). There might also be some change in the way archaeologists are educated in universities, but at least when it comes to vocabulary of teaching and curricula in general, there does not seem to be clear changes that could explain this change. Nevertheless, these results work now as a basis for further study and more complicated inquiries – a decrease in verbal descriptions is visible, and it may be caused by an increase in accessible photorealistic documentation methods.

4. Discussion

Regardless of the open problems related to proving any causality in this study, the question itself is interesting and will need further study so we can understand how the quality and focus of archaeological fieldwork may be changing. A more sophisticated use of natural language processing (NLP), (Brandsen 2022) or a large language model (LLM) based approach, or even a look into sentiment analysis with this dataset might give us some more insight into this phenomenon, as would looking at other data from other countries and contexts. A well-designed questionnaire for working field-archaeologists might also prove useful in determining the significance of this process.

Other phenomena than stratigraphy might also be interesting to examine through this type of approach and with a suitable number of archaeological reports, such as descriptions of find assemblages, or the number of interpretations.

These concerns should not be interpreted as a fully negative attitude towards the advance of photorealistic 3D-documentation of excavations. Photogrammetry and laser scanning have become established technologies in ordinary archaeology usage, replacing many traditional documentation methods. It is reasonable to pay attention to what facets of the reporting process may be inadvertently neglected through this process. Further research may show if the results presented in this paper are part of a larger trend, and what the stakeholders can do to ensure that the standards and requirements are maintained, so that the fieldwork reports current archaeologists write are sufficient for the use of future generations. For example, the concerns voiced by Wright and Morgan about the pedagogical worth of archaeological drawing and conversely its supposed lack in digital documentation is definitely worth further research (Morgan and Wright 2018, 11–13).

Despite this, it needs to be remembered that in many countries, the majority of contemporary field archaeology is conducted by private companies with strict financial interests and limitations. “Slow archaeology”, advocated by William Caraher is partially still an impractical and privileged philosophy (Caraher 2019, 2), and the competitive and efficiency-driven commercial projects cannot go back to traditional documentation methods, despite their cognitive and pedagogic benefits. However, university curricula and archaeological field schools do not need to follow these constraints, and the people in charge of arranging and developing them should take these concerns seriously.

5. Conclusions

This analysis of public Finnish archaeological field work reports between the years 2013 and 2022 shows a clear decrease in the use of keywords related to stratigraphical descriptions. During the same period there has been clear increase in the use of SfM photogrammetry and laser scanning in field documentation. While no direct causal link can be proven, the timing suggests that shifts in documentation technology may be influencing how archaeologists describe and interpret excavated contexts.

The benefits of these tools are evident. They improve efficiency, produce highly detailed records, and enable forms of analysis that were previously impractical or impossible. Yet the findings highlight a need for reflection. If high-resolution 3D models increasingly substitute for close, embodied observation in the field, key elements of stratigraphic interpretation may be weakened. Photorealistic accuracy does not automatically translate into interpretative insight. Rather than replacing traditional descriptive practices, digital methods should be integrated with them. Maintaining rigorous stratigraphic reasoning during excavation remains essential, even as documentation technologies evolve.

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Conflicts of interests

The author declares that they have no financial conflicts of interest in relation to the content of the article.

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