AUTOMATA

REPORT ON THE AUTOMATA SURVEY ON THE USE OF 3D MODELLING, NON-DESTRUCTIVE ARCHAEOMETRY, ARTIFICIAL INTELLIGENCE AND ROBOTICS IN ARCHAEOLOGY

May 2026

AUTOMated enriched digitisation of Archaeological liThics and cerAmics

Report on the AUTOMATA survey on the use of 3d modelling, non-destructive archaeometry, artificial intelligence and robotics in archaeology.

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Executive summary

The following report presents the main results of the survey of international scope developed by the AUTOMATA consortium under the coordination of the *Institut national de recherches archéologiques préventives*[1] (Inrap). It aimed to study the practices and the perceptions of actors working in the archaeological domain regarding the technologies[2] used by the AUTOMATA project, namely: 3D modelling, non-destructive archaeometry, artificial intelligence[3] (AI) and robotics. The survey received 323 submissions from 42 countries between March and May 2025, 64% of which chose to subscribe to the project's newsletter. Dissemination was especially strong in France, representing 46% of the submissions (see Section 12 for further information). Primarily active in academic research and the archaeological field, the respondents appear well acquainted with the surveyed technologies, declaring themselves familiar or very familiar with them in numbers going from 58% for 3D modelling to 12% for robotics.

Used at work by 60% of the respondents, 3D modelling is mostly employed to digitise immovable subjects, such as archaeological sites, features or buildings, and is mainly implemented through photogrammetry. Divided on their access to 3D model creation, the respondents invoked lack of training, cost, limited access to equipment, and digital storage constraints as the main obstacles preventing the extensive use of 3D modelling in archaeological practices. Non-destructive archaeometry, used at work by 38% of the respondents, is for the most part employed for material characterisation and applied to soils and ceramics. Portable X-ray fluorescence, computed tomography and ground penetrating radar are the most popular technologies among the respondents. With access to conducting non-destructive archaeometric analyses considered insufficient at 50%, the respondents principally cited cost, unsatisfactory access to equipment and lack of training as the main obstacles to their extensive use.

With 61% of declared users, artificial intelligence is the most popular technology among the respondents, mainly due to the off-the-shelf (e.g. language translation services) and generative AI tools available online. AI is mainly used for text translation and text correction. Robotics, on the other hand, is unsurprisingly the least popular of the technologies (11% of users among the respondents). Its low number of users (36) prevents us from drawing general conclusions, beyond the fact that robotic tools seem to be chiefly used for data acquisition. If robotics is seen in a more favourable light than AI, both fields divide the respondents between enthusiasthic, ambivalent and hostile groups, seen as technologies opening new realms of possibilities, or new threats to the profession and the environment.

Finally, 57% of the respondents indicated that a system such as the one developed by the AUTOMATA project would likely or very likely improve their work process. Viewing it most beneficially for massive data processing and being mainly concerned by loss of human expertise, the respondents expressed for more than half of them a demand for varied forms of training or resources from the project.

[1] The French National Institute for Preventive Archaeological Research.

[2] The word "technologies" is used throughout the document as an umbrella term, as 3D modelling, non-destructive archaeometry, AI and robotics especially are vast fields of study that encompass many different sub-disciplines.

[3] Article 3 of the EU Artificial Intelligence Act defines an AI system as "a machine-based system that is designed to operate with varying levels of autonomy and that may exhibit adaptiveness after deployment, and that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments".

1. Introduction

The following report presents the results of a survey conducted as part of the Horizon Europe-funded AUTOMATA (AUTOMated enriched digitisation of Archaeological liThics and cerAmics[4]) project (GA n.101158046). AUTOMATA aims to develop an AI-augmented robotic system capable of creating 3D models of archaeological ceramics and lithics and seamlessly enrich them with physicochemical data obtained from archaeometric analyses made on the fly with a hyperspectral imaging camera, a portable X-ray fluorescence spectrometer and a portable Raman spectrometer. The data acquired will be made freely available online, allowing effective knowledge reuse by researchers and citizens.

In order to better understand the AUTOMATA-related community's practices and opinions towards the technologies used in the project, the consortium developed, as part of Task 11.3 and under the coordination of Inrap, a survey focusing on the relationship between archaeologists, 3D modelling, non-destructive archaeometry, artificial intelligence and robotics. Opened from March to May 2025, the survey collected 323 submissions from 42 different countries. The survey also intended to inform the project's first Multiplier Event, which took place in Paris on June 12 2025 and aimed to question the future of archaeologists in the age of AI and automation. More information on the event, including photos and videos, can be found on the project website's dedicated page[5].

2. Methodology

Following the collective design of its questions and answers by the AUTOMATA consortium, the survey was published on the EUSurvey platform[6]. As the European Commission's official surveying tool, EUSurvey ensured data security and European hosting while being free, open-source and highly customisable. The platform allowed for versatile features, such as unlimited questions and submissions, multiple or single-choice answers, and conditional logic to display questions based on previous responses. Although the translation of the survey from English was initially considered, the idea was ultimately abandoned due to time constraints. EUSurvey was also selected for its ease of use, which enabled the effortless uploading of the questionnaire and the secure sharing of its results. Furthermore, the platform's "Anonymous mode" prevented the authors from accessing respondents' connection data, such as IP addresses, thereby guaranteeing a higher level of privacy. Additionally, any potentially identifying elements were anonymised from the answers prior to publication.

The survey was mostly disseminated via mailing lists, social media and blog posts by the project members and by solicited professional networks, both international and national, as well as special interest groups. International networks include the ECHOES European project, the World Archaeological Congress (WAC), the ICOMOS International Scientific Committee on Archaeological Heritage Management (ICAHM), or the ARIADNE Research Infrastructure. The CAA international, the European Association of Archaeologists (EAA), the European Archaeological Council (EAC), the Association of Critical Heritage Studies (ACHS), as well as the European initiatives of MAiA, ATRIUM and TETRARCHs were also contacted. National networks encompass several French research laboratories (UMRs) in archaeology, the French chapter of the international organisation of

[4] https://automata-eccch.eu/
[5] https://automata-eccch.eu/news-events/automata-multiplier-event/
[6] https://ec.europa.eu/eusurvey/

Computer Applications and Quantitative Methods in Archaeology (CAA), the National Centre for Scientific Research's Mission for Transversal and Interdisciplinary Initiatives (CNRS' MITI), the French Schools Abroad Network (or ResEFE, regrouping five institutions of higher education and research), as well as the Italian National Association of Archaeologists (ANA). Special interest groups include the French networks of the Association for the Promotion of Research on the Bronze Age (APRAB), the CNRS' Interdisciplinary Archaeometric Skills - National Network (CAI-RN), and the Very Large Research Infrastructure Huma-Num's consortiums of MASAplus (on archaeological data), Consortium3D (on 3D modelling) and pictorIA (on visual data).

The collected answers were manually analysed prior to their presentation in the following report, written in concertation with members of the consortium. A summary of the results of the survey can be found below. For a retranscription of the survey's questions and answers, please refer to the appendix which follows it.

3. Survey's reach

The survey's 323 submissions come from respondents working from 42 different countries spreading across all continents. However, the overwhelming majority of submissions come from people working in European or European-adjacent countries, with the countries receiving the most answers usually being the ones linked to the project. Dissemination was for instance especially strong in France, representing 46% of the respondents[7], as Inrap's position enabled it to quickly contact a large part of the French archaeological community. These numbers illustrate that if AUTOMATA is capable of reaching a rather satisfying number of interested participants, this traffic is mainly restricted to the project partners' own networks and canals – at least at the time of the dissemination of the survey, a few months only after AUTOMATA's launch. To ensure the best dissemination possible of its progress and results, AUTOMATA thus needs to foster a wider network of external communication and develop a stronger interest from the archaeological community.

4. Profile of the respondents

The respondents' age ranges reflect all career stages (with a majority of responses from mid-career individuals) and although the majority of respondents are male (52%), there is no significant imbalance with the feminine gender (45%).

The respondents mainly work in the public sector. Their preferred work environments are universities (n=144) and research institutes (n=147), far ahead of the next most picked answers of museums, other types of public administrations, and private companies (respectively n=41, n=39, and n=29). The participants' fields of activities are largely related to academic research (n=207) and archaeological fieldwork (n=188). Other well represented areas are data management (n=95), teaching (n=77), cultural heritage enhancement and promotion (including communication), picked by 67 respondents, and preventive and development-led archaeology (n=65). The respondents work with similar types of data, even if 2D visual documents proved more popular (with 249 answers), while archaeometric data showed slightly less use (with 119 answers).

[7] For further information on this subject, please refer to Section 12.

Finally, 64% of the respondents wished to be kept informed of the further developments of the AUTOMATA project, leaving their email addresses to be added to the project's newsletter and illustrating a strong interest in the AUTOMATA project within this consultation sample.

5. Familiarity and usage at work

The respondents appear well acquainted with the surveyed technologies, declaring themselves familiar or very familiar with them in numbers going from 58% for 3D modelling, to 12% for robotics (Fig. 1). The familiarity levels of the respondents reflect their usage at work of the technologies, with the exception of artificial intelligence, which is frequently used at work (61% of positive answers, the highest percentage across all four categories) in spite of being familiar or more for only a third of the respondents.

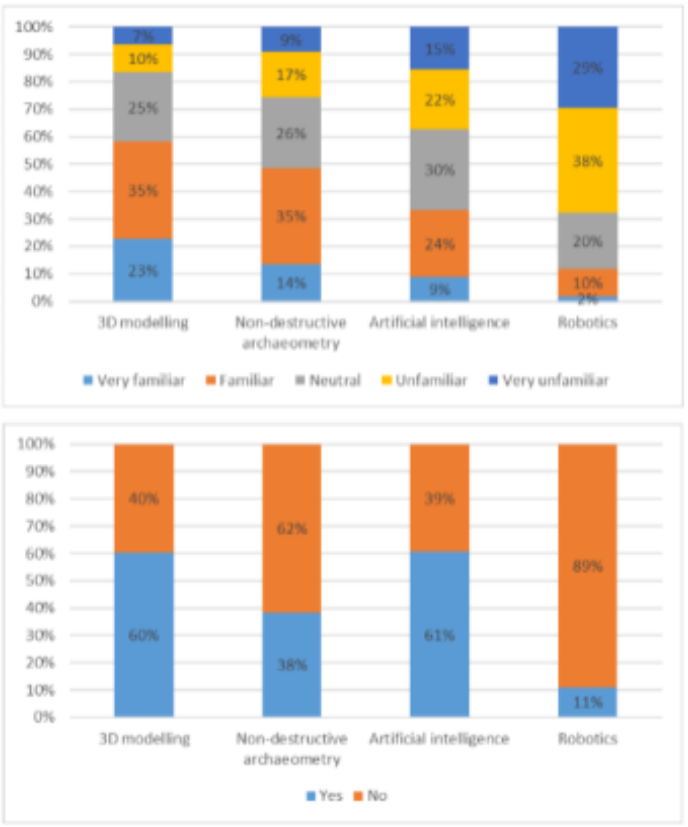

Figure 1: Levels of familiarity (top) and usage at work (down) of the respondents according to the technologies.

3D modelling appears overall as the most popular of the four technologies, with 58% of the respondents declaring themselves familiar or very familiar with it, and used at work by 60% of them. Non-destructive archaeometry also appears as a well integrated discipline, even if less often used at work. Robotics on the contrary, is neither familiar nor used at work for a vast majority of the respondents, illustrating a niche status in archaeology.

6. 3D modelling

Used at work by 60% of the respondents, 3D modelling is a technology widely adopted by the sampled community. Applied mainly on immovable subjects (archaeological features, sites, buildings and stratigraphic layers), 3D modelling is also used for digitising ceramics for more than a third of the users. Photogrammetry is by far the preferred method for creating the 3D models, with 172 answers, followed by lasergrammetry, with 78 answers, and manual modelling, with 50 answers. The respondents also reported using other techniques, namely CT Scan (including µCT) and structured light. 3D modelling is primarily used as a proof to support a scientific demonstration and for research and preservation purposes, and secondarily for outreach and educational activities. Part of the respondents also mentioned how it was used for analysis (e.g. for measurement) and documentation.

When used at work, 3D modelling is usually often or sometimes integrated to work protocols. 3D model generation is an in-house task for a large majority of the respondents, but delegation to third parties can sometimes happen depending on the complexity of the work (bigger models are more prone to be commissioned to contractors), the technique used (with variation among the respondents), and the availability of the equipment. The budget allocated for the creation of the models is often unknown by the participants, but falls most of the time within the lowest range (€0-10k annually).

The evaluation of the access to 3D model creation divides the respondents, with 44% of them declaring it insufficient and 39%, sufficient (17% of the participants abstained to answer). When crossing the answers with the participants' declaring of using or not 3D modelling at work (Fig. 2), it appears that although a significant portion of 3D modelling users (38%) declare an insufficient access to model creation, proportionally, most of dissatisfaction comes from respondents not employing the technology at work. A non-negligable portion of the consultation sample thus seems potentially willing to develop 3D modelling at work but is limited in doing so due to constraints in accessing the technology.

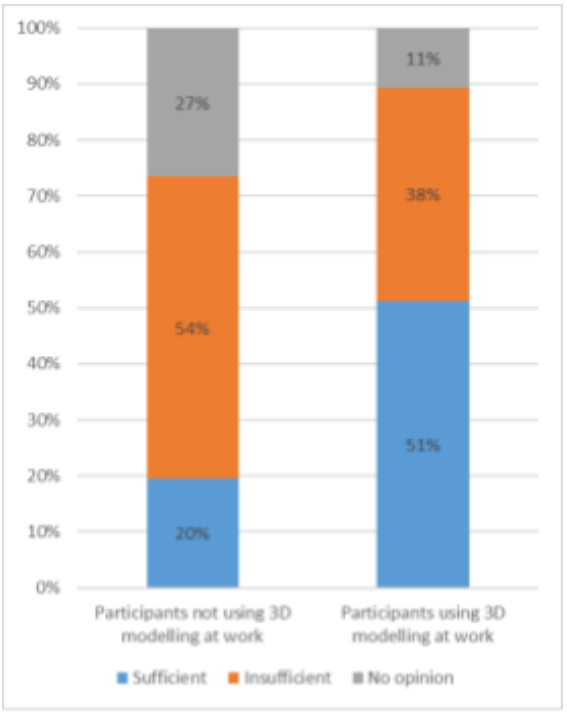

Figure 2: Evaluation of access to 3D model creation according to the respondents not using (left) and using (right) 3D modelling at work.

The main obstacles preventing the extensive use of 3D modelling in archaeological practices are related to a lack of training or expertise, cost, a limited access to equipment, and digital storage constraints. Some of the respondents also noted an absence of standardised practices for integrating 3D modelling into archaeological workflows (e.g. regarding traditional publication), while others reported a certain lack of interest in the technology, viewing it more like a gimmick or a gadget.

When asked for their opinion on 3D modelling assistance through AI and robotics, the respondents showed no clear preference, although most of them answered negatively (47%, against 45% of positive answers, while 8% had no opinion on the matter). Respondents who answered negatively mentioned AI's (and, to a lesser extent, robotics') high cost in human and environmental resources, its lack of reliability and transparency, and stressed the importance of human expertise and interpretation. On the other hand, positive respondents underlined AI and robotics' ability to improve the accuracy, cost and time needed to produce 3D models, writing how, when used in the 3D modelling process, AI could help enhance or filter images and point clouds, introduce a standardisation of the procedure and minimise human error, while when used downstream, it could help with analysing and classifying large datasets and detect otherwise invisible trends or connections.

7. Non-destructive archaeometry

Used at work by 38% of the respondents, non-destructive archaeometry appears mainly applied to soils and ceramics, followed by stones and metals. Its users declared primarily turning to portable X-ray fluorescence (p-XRF)[8], computed tomography (CT) scanning and ground penetrating radar (GPR) techniques. Non-destructive archaeometry is mostly used for material characterisation.

Less often integrated into work protocols than 3D modelling, non-destructive archaeometry analyses are evenly conducted between in-house and third-party solutions (39% and 42% respectively). 15% of answers mentioned resorting to both, often depending on the available equipment, time and budget. The budget allocated for the analyses is often unknown by the participants, but, as for 3D modelling, falls most of the time within the lowest range (€0-10k annually)[9].

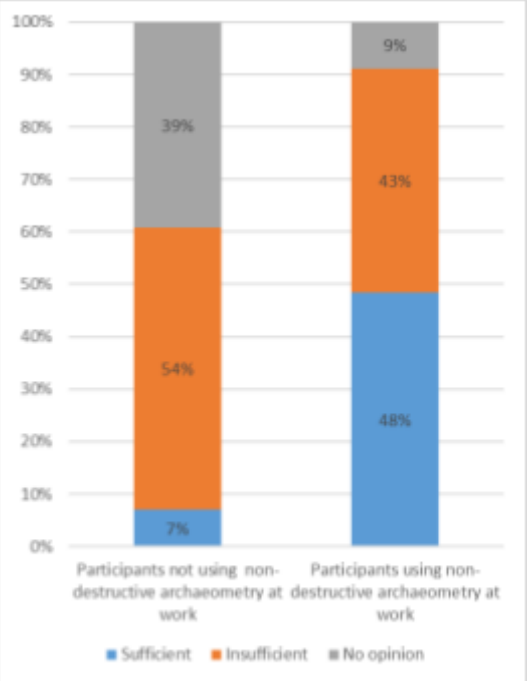

Figure 3: Evaluation of access to conducting non-destructive archaeometric analyses according to the respondents not using (left) and using (right) non-destructive archaeometry at work.

Access to conducting non-destructive archaeometric analyses is considered insufficient for half of the respondents (the remaining half being split between the ones considering it sufficient and the ones with no opinion on the matter). Once more, the participants who do not use the technology at work declared having a proportionally lower access to it (Fig. 3), suggesting the existence of a certain portion of the surveyed community willing to develop non-destructive archaeometry's integration to work protocols, but lacking the means to do so.

Cost appears as the number one factor limiting access to making non-destructive archaeometric analyses, followed closely by insufficient access to equipment and a lack of training or expertise. Some of the respondents also reported limitations linked to regulatory constraints and permits needed for analysis, while others pointed to the limited results of non-destructive archaeometry, restricted to surface analyses.

When asked for their opinion on non-destructive archaeometric analyses assistance through AI and robotics, most respondents had no opinion on the matter (62%). The rest of the respondents were for the most part positive on the topic (representing 34% of all answers, while 4% replied negatively). As before, some of the respondents feared on the one side a deterioration in working conditions and a decline in the quality of information, and on the other praised possibilities of enhancing the data acquisition and recognition process (especially given the data's objective and standardised nature), its precision, regularity, cost and time needed, whilst helping democratise archaeometric analyses to non-specialists. They furthermore underlined how these technologies had already been successfully

[8] One of the types of instruments used in AUTOMATA, alongside a portable Raman spectrometer and a hyperspectral imaging camera.
[9] Although the cost of some of the machines employed in the field can easily render this price range insufficient.

applied in the medical field on similar complex data, while also wishing for a human interpretation or second reading. Finally, reservations towards the high cost needed for large database creation were also expressed.

8. Artificial intelligence

Used at work by 61% of the respondents, artificial intelligence appears as the technology most frequently employed in the survey. These high numbers may in part be explained by the upheaval caused by OpenAI's public release of its conversational assistant ChatGPT in November 2022, paving the way for the democratisation of generative artificial intelligence (GenAI) among the public[10]. As such, more than 75% of the respondents who declared using AI at work reported using GenAI, making it the second most popular tool behind off-the-shelf online services (e.g. language translators), employed by 82% of the users. AI is majoritarily used for text translation and text correction, well ahead of functions like text summarisation, question answering, code generation and correction, or help in finding bibliographic sources.

Easily accessible online, AI tools are frequently employed by their users, with 39% of them using them weekly, and 35% daily. While the majority of users "mostly trust" their results, many of them mention adopting a critical view of them, checking them manually before integrating them into their data. If simpler tasks like text translation (except for technical terms) and code generation seem more easily trusted, academic or scientific queries' results are thoroughly analysed and seldom believed. More than half of AI users are allocating or would allocate a portion of their budget to such tools, to an amount between €0 and €10k per year for 55% of them.

When asked about potential incentives to use AI in their work, a majority of the non-users selected answers related to massive data processing and the ability to delegate tedious, repetitive or time-consuming tasks.

Artificial intelligence's impact on archaeology is generally perceived by the respondents as something ambivalent (48%) or positive (43%), while negative views amount to 9% of the answers. Artificial intelligence is praised for its capacity to assist in documenting and understanding archaeological data, from detecting patterns and sites otherwise invisible, to helping for refittings, classifications and analysis. Some answers also emphasised how AI could be used for processing old data, otherwise forgotten or unused, as well as help for the standardisation and translation of data, hence supporting data reuse. The respondents underlined that when used correctly, AI can lead to greater accuracy (e.g. regarding refittings, or stylistic analysis dating) and, by dealing with tedious, repetitive and time-consuming tasks, free up space for workers to focus on scientific research. However, they also stressed that (Gen)AI is a new tool, and as such called for caution, a critical eye and the development of skills to use it. They pointed out scientific pitfalls, such as GenAI's tendency to hallucinate data, its nonreproducibility (due, in part, to the "black box" effect), and the intellectual theft associated with it. As some respondents pointed out, if training our own models could help reduce or eliminate such

[10] As stated by Bick et al. (2025), "[generative AI's] overall adoption has been faster than either PCs or the internet", while the Project on Workforce at Harvard's Generative AI Adoption Tracker (https://www.genaiadoptiontracker.com/) estimated that by November 2025, 55.9% of the U.S. population aged 18-64 was using the technology, compared to 46.3% a year earlier. We can therefore assume that the results presented in this section might be different if the survey were to be repeated today.

threats, doing so would require important time and open data, often lacking, for uncertain results. The respondents acknowledged that AI could process huge amounts of complex data, but expressed concern about its capabilities of producing reliable and transparent results in an ethical manner, repeatedly underlining AI's environmental impact and threat to human work conditions, as well as to human expertise and skills. While recognising that AI could help with redundant or simple tasks, respondents thus often advocated for an analysis and interpretation of data by humans, instead of one generated by AI.

9. Robotics

Robotics is unsurprisingly[11] the least popular of the surveyed technologies, with 11% of practitioners among the respondents. The results deducted from the answers of the 36 submissions of this pool of users do not allow us to draw generalisable conclusions, but shall nevertheless be briefly presented below.

The tools employed by the survey's robotics users are diverse: no clear trend could be detected among the answers between automated photogrammetry and reflectance transformation imaging (RTI) systems, robotic arms and similar devices, or autonomous vehicles. The purpose for which these tools are used proved on the contrary more unanimous, with 86% of users (31 submissions) declaring using them for data acquisition. The digitisation of archaeological artefacts, structures or sites comes second with 18 votes (50% of users).

Robotics also proves the less frequently used of the surveyed technologies, with a majority of 47% of users declaring employing it "rarely" only. Two thirds of the users nevertheless reported allocating or being willing to allocate part of their budget to acquire such systems, with an amount between €10 and €50k annually for most of them (representing 38% of the answers, or 9 submissions from this subgroup).

Half of robotics non-users declared for their part that the ability to delegate tedious, repetitive or time-consuming tasks, as well as work access or safety in difficult environments, could motivate them to use robotic tools at work.

Robotics' impact on archaeology is seen more favourably by the respondents than AI's. Most of them have indeed a positive (51%) or ambivalent (44%) opinion on it, with only 5% of respondents answering negatively. Seen as "cool" (sic), robots are praised for their ability to safely explore remote or dangerous terrain, such as underwater areas, mines, wells or polluted fields, as well as for preventing physical harm caused by strainful and repetitive work. Respondents also underlined how robots are able to produce precise and consistent data whilst being less invasive, allowing for better documentation of sites or artefacts through photogrammetry and LiDAR (with the device placed on a drone) or RTI, although an answer mentioned how issues arising from an automated system not able

[11] Kim et al. (2025) identified 22 barriers to the adoption and activation of construction robots, including: high initial investment cost for robot adoption, uncertainty in profitability and demand, insufficient R&D investment, limits in workforce transformation and training, non-standardised site environments, lack or robot-oriented design and process integration, absence of legal responsibility and standards, insufficient government support and incentives, undefined human-robot collaboration systems, or hardware limitations unsuitable for narrow and variable work environments.

to detect data errors induced more human work to rectify them. While often considered useful, robots miss a widespread use, with many respondents mentioning being very unfamiliar on the matter and lacking applicability in their practice. Robotics' niche status in archaeology is notably due to a lack of training, a lack of time and above all insufficient funds to produce, use and maintain such systems. The respondents wished for greater technical accessibility and ethical implementation, mentioning how robotics should pursue the benefit of its users (by relieving them of repetitive, difficult or harmful tasks) and not worsen their work conditions (e.g. tighter deadlines) or threaten their occupation. They also expressed concern towards an increased reliability on devices and remote archaeology as well as a potential loss of skills and critical thinking, and advocated for human oversight and thoughtful uses. Finally, doubt was expressed in a few answers in robots' abilities to replace a field archaeologist or to correctly handle objects.

10. The AUTOMATA project

The prototype currently being developed by the AUTOMATA project kindles interest in the surveyed sample, with 57% of the respondents declaring that such a system would "likely" or "very likely" improve their work process.

For more than 60% of the respondents, such a system could enable massive data processing, speed efficiency, and the possibility to delegate tedious, repetitive or time-consuming tasks. The main sources of concern are linked to the loss of human expertise (64%), the lack of training or expertise to use the system (58%), and the lack of transparency in the tool's decision making process (55%), followed by risks of inaccuracy (54%).

Support and training resources from the AUTOMATA project are in demand from the respondents, with over half of them expressing interest in detailed documentation (53%), workshops on good practices (57%), and technical training sessions on using the system (63%).

11. Final thoughts and conclusion

The respondents had the option to leave a comment at the end of the survey to share final thoughts. As seen in previous textual answers of the survey, their responses displayed a wide spectrum of attitudes toward the surveyed technologies, ranging from enthusiasm to scepticism. Indeed, while some respondents view them as capable of opening new types of analyses and new research horizons, others, ambivalent on the issue, see new development opportunities but raise doubts regarding their actual application due to cost, training, feasibility, reliability or transparency. Finally, lack of interest and ethical or environmental concerns are recurring themes among the most critical respondents. The surveyed technologies in general, and (generative) artificial intelligence in particular, induced strong reactions among the respondents, positive and negative alike. Perceived as promising for some and dangerous for others, artificial intelligence and robotics are seen as transformative by the respondents, who alternatively associate them with a new realm of possibilities for archaeology, or with an unsustainable and unreliable threat. Enthusiasm and concern for these technologies are legitimate and raise important questions for the field. It appears therefore essential for AUTOMATA to adopt a reflexive stance on the use of its technologies (as shown in Deliverable 2.4) and actively communicate on the reasons behind using them, their extent in the project, and their associated benefits and drawbacks.

The survey results provide us with concrete guidance for the project's next steps. As mentioned above, the respondents' answers underlined the need for an informative communication strategy, addressing both expectations and concerns. Respondents wish for clarity regarding the transparency and perimeter of the project's automated workflows, which could for example involve a step by step identification of the automated processes. This strengthening in communication should target both the general public, with for instance accessible content on AUTOMATA's social media, and the professionals and experts through technical dissemination, for example via project deliverables, academic publications, and participation in scientific events. This also means providing detailed and accessible documentation for the different elements of the system developed within the project. This documentation should notably cover the development of the algorithms, workflows, and software, while also explaining the system's decisions, biases, and generated data, and providing elements for their critical evaluation. All of these aspects are essential for mitigating the black box effect and ensuring confidence and transparency in the results. The system developed by AUTOMATA will incorporate this approach through the integration of explainable AI (XAI) capabilities, designed to provide understandable feedback about AI decision processes. On the topic of automation, the role of the "human in the loop" emerged as a shared concern among many respondents, with even enthusiastic participants mentioning the importance of keeping a human oversight within automated workflows and wishing for AI and robotics to support, instead of replace, human expertise. As illustrated by the project's intention to notably use continual learning from human feedback for some of its tasks, AUTOMATA thus needs to incorporate human oversight from its users, enabling validation, correction, and confidence in the system. Finally, the submissions reveal uneven familiarity with the surveyed technologies, suggesting that effective adoption of AUTOMATA by the community will necessitate training resources from the project to include as many as possible. Rather than a uniform approach, AUTOMATA would benefit from proposing training material adapted to different levels of expertise, combining introductory sessions with more advanced, practice-oriented workshops. The emphasis placed by respondents on concrete use cases further indicates that training should be closely tied to real research scenarios.

The overall attitude emerging from the survey can be characterised as cautiously receptive, combining interest in the advanced technologies deployed in AUTOMATA with a demand for their transparent and thoughtful use. More broadly, it highlights that their successful integration into the project will depend not only on technical performance, but also on the wider social and professional environment in which they will be implemented.

12. Note on the differences in answers by the French respondents

Respondents working in France[12] account for 46% of the collected answers[13], presumably due to a stronger dissemination in this country. In order not to interrupt the reading with periodic comments on the subject, we decided to gather below a few remarks worth mentioning:

- Members of the public sector for 95% of them (with 8% working for the private sector), the French respondents work for the most part (67%) in research institutes, followed by universities (23%) and other types of public administrations (19%). Respondents from the other countries work for their part in the public sector for 84% of them, and in the private sector for 28%. They primarily work in universities (63%), research institutes (28%) and museums (22%). French respondents' main area of activity is archaeological fieldwork (65%), followed by academic research (46%). On the contrary, non-French respondents' activity consists in academic research first (80%) and archaeological fieldwork second (52%).

- Declaring themselves less familiar with the surveyed technologies than the other respondents, AI and robotics especially, the French answers attest nonetheless of a similar use at work, with the exception of AI (used by 51% of them, compared to 69% among the non-French submissions).

- Photogrammetry appears as a very popular technique, used in equal measures by the French and the non-French 3D modelling practitioners of the survey (used respectively by 91% and 86% of them). Its widespread use among the French sampled community is further highlighted by the lower percentages achieved by them in lasergrammetry and manual modelling, amounting respectively to 32% and 20%, while reaching 46% and 31% for submissions coming from the other countries. Regarding 3D modelling's purposes, French answers favour in descending order the support of a scientific demonstration (84%), research and preservation (71%) and outreach and educational activities (41%). Non-French users, meanwhile, share evenlier goals for 3D modelling, with percentages rounding up at 70%, 80% and 60% respectively.

- The French respondents' answers on non-destructive archaeometry generally reach lower percentages than their counterparts working in the other countries. A notable exception to this is the French respondents' higher usage of magnetic susceptibility (42%, versus 14% for the rest of the respondents).

- French respondents report greater insufficient access to 3D model creation and non-destructive archaeometric analyses compared to the other countries (50% versus 39% for 3D modelling, 54% versus 46% for non-destructive archaeometry). While all respondents often invoke obstacles related to costs, lack of training and limited access to equipment, French answers notably had higher percentages on reasons linked to time constraints (50% versus 25% for 3D modelling, 37% versus 16% for non-destructive archaeometry). When asked about AI or robotics assistance, the respondents mostly had no opinion on the matter of running non-destructive archaeometric analyses and of processing their results. Regarding

[12] This category will be referred to as "French submissions/respondents/answers" for better readability.
[13] Or 147 submissions. By comparison, the second most represented country is Italy with 29 (or 9%) responses.

their help for the creation and use of 3D models, if a majority of French respondents did not express an opinion on the topic, 55% of the other types of respondents expressed a positive point of view.

- French respondents appear in general more critical and more unfamiliar with artificial intelligence, declaring using it less frequently, using primarily off-the-shelf tools and to a lesser extent GenAI, and trusting less frequently its results. Regarding the type of tasks requested, French users proportionally declared lower activity than their counterparts coming from the other countries, with the exceptions of text translation (used by 84% of French users, against 74% of the others) and assistance for finding bibliographic sources (used by 44% of French users, against 36% of the others). Finally, 36% of French users declared that they were allocating or would like to allocate part of their budget to AI tools to facilitate certain activities, while this number reaches 70% among answers from the other countries. French respondents viewed AI's current and foreseeable impact on archaeology less favourably than the other countries' repliers. While the latters view it positively for the most part (58%), French respondents majoritarily (64%) favoured an ambivalent outlook.

- If the low number of answers collected from robotics users prevents us from drawing generalisable conclusions, their splitting up between the French and non-French respondents furthers this assessment. Remarks on robotics shall thus be limited to the two questions answered by a bigger number of participants. As with AI, French respondents are more critical of robotics, as illustrated by the fact that when non-robotics-users were asked about what benefits could encourage them to use robotic tools in their work, their answers always reached proportionally lower numbers than the ones coming from the other countries. Similarly, French respondents expressed higher percentages of answers qualifying as negative or ambivalent the current and foreseeable impact of robotics on archaeology, and a lower percentage of positive answers.

- Finally, regarding the survey's section dedicated to the AUTOMATA project, the French respondents generally expressed more doubts towards the system developed, and raised higher concern towards the risk of loss of human expertise (picked by 76% of them, versus 53% of the respondents from other countries).

These differences in results can partly be explained by the high number of French answers collected, which could be synonymous with a more representative sample, made of wider opinions and knowledge concerning the surveyed technologies. The relatively high numbers of practitioners gathered in the results may indeed incline us to believe that an important part of the respondents are more familiar than the average archaeologist with these technologies and may thus view them in a more positive light. The French respondents, while also active in academic research for 46% of them (versus 80% for the others), are majoritarily involved in archaeological fieldwork (65%, versus 52%) and preventive/development-led archaeology (37%, versus 6%). The difference in answers can thus also in part illustrate the difference in needs and constraints between these fields.

13. References

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Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence (Artificial Intelligence Act). *Official Journal of the European Union*, L 2024/1689. https://eur-lex.europa.eu/eli/reg/2024/1689/oj/eng

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14. Appendix

In this appendix are presented the questions and answers[14] related to the survey. Further information about the type of questions can be found along the reading.

Nota bene:

Seven of the respondents' email addresses were found twice among the survey submissions, with similar or identical profile information in each corresponding pair, but with varying degrees of difference in the rest of their answers. This seems to indicate that some respondents refined or reconsidered their answers in subsequent submissions. However, given the content of the answers, the survey tool's inability to track submission timestamps, confirm edit histories, or identify duplicates lacking email addresses, it was not possible to determine which version should be retained. It was thus decided to process all submissions without distinction. Given that the seven identified overlapping entries represent 2.2% of the total dataset, their inclusion was considered unlikely to introduce significant bias.

A. Profile of the respondents

A.1. In which country do you work?

Answer[15]	**Number of answers**	**Percentage**	**Answer**	**Number of answers**	**Percentage**
Albania	4	1.2%	Netherlands	3	0.9%
Australia	3	0.9%	Nigeria	1	0.3%
Austria	4	1.2%	North Macedonia	1	0.3%
Azerbaijan	1	0.3%	Norway	3	0.9%
Bangladesh	1	0.3%	Poland	3	0.9%
Belgium	3	0.9%	Portugal	5	1.5%
Bosnia and Herzegovina	1	0.3%	Russian Federation	1	0.3%
Bulgaria	1	0.3%	Serbia	3	0.9%
Canada	2	0.6%	Slovakia	2	0.6%
Colombia	3	0.9%	South Africa	1	0.3%
Croatia	14	4.3%	Spain	7	2.2%

[14] For greater readability, empty answers (e.g. "/") were not transcribed. Textual responses that could potentially reveal the identities of their authors or which contained offensive language have also been removed.
[15] The survey tool allowed respondents to choose among the 193 member states of the United Nations.

Cyprus	3	0.9%	Sri Lanka	1	0.3%
Czechia	3	0.9%	Sudan	1	0.3%
Denmark	4	1.2%	Sweden	1	0.3%
Ecuador	1	0.3%	Switzerland	5	1.5%
Egypt	1	0.3%	Syrian Arab Republic	1	0.3%
Finland	5	1.5%	Turkey	13	4.0%
France	147	4.5%	United Kingdom	19	5.9%
Germany	5	1.5%	United States of America	4	1.2%
Greece	9	2.8%			
Ireland	1	0.3%			
Israel	3	0.9%			
Italy	29	9.0%			

A.2. What is your gender?

Answer	**Number of answers**	**Percentage**
Male	168	52.0%
Female	145	44.9%
Non-binary	3	0.9%
Prefer not to say	7	2.2%

A.3. What is your age group?

Answer	**Number of answers**	**Percentage**
Under 25	3	0.9%
25-34	59	18.3%
35-44	99	30.7%
45-54	99	30.7%

55-64	52	16.1%
Over 64	11	3.4%

A.4. What are your main fields of activity? (Select all that apply)

Answer	**Number of answers**	**Percentage**[16]
Academic research	207	64.1%
Archaeological fieldwork	188	58.2%
Archaeometry	53	16.4%
Conservation and preservation	34	10.5%
Cultural heritage enhancement and promotion, communication	67	20.7%
Cultural heritage management	41	12.7%
Data management	95	29.4%
Documentation	58	18.0%
Engineering (including robotics, AI, etc.)	30	9.3%
Imaging	50	15.5%
Other specialised archaeological studies (palynology, zooarchaeology, geomorphology, etc.)	53	16.4%
Preventive/Development-led archaeology	65	20.1%
Restoration	5	1.6%
Teaching	77	23.8%
Other (please specify)	10	3.1%

The respondents who picked "Other" answered:

"Anthropology"

"Architecture, documentation of architectural remains in archaeological contexts"

[16] Since this question allowed multiple answers, each percentage displays the proportion of respondents who picked its associated answer in relation to the number of respondents who answered the question. The different percentages are not related and their sum is thus higher than 100. A question allowing multiple answers can be identified by the words "(Select all that apply)" added after its statement.

"ceramic petrography, material characterisation, neolithisation"
"Ceramic studies"
"*céramologie antique et protohistorique*" (ancient and protohistoric ceramology)
"*céramologue*" (ceramologist)
"ECCCH"
"*relevé et étude blocs architecturaux en pierre*" (measured plans and study of architectural stone blocks)
"remote sensing"
"Technology of material culture (lithics, pottery)"

A.5. What is your profession?

"3D Artist & Teacher/Archeologist"
"a lecturer and a PhD student"
"Academic researcher, Archaeologist"
"Academician" (twice)
"Anthropologist" (twice)
"archaeobotanist"
"Archaeological geomatics manager"
"archaeological operations manager"
"archaeological site manager"
"Archaeological technologist"
"Archaeologist" (60 times)
"Archaeologist - Fieldwork manager"
"Archaeologist - research fellow"
"Archaeologist" (archaeometry)
"Archaeologist (focused on GIS & information systems used in heritage management)"
"Archaeologist (Primary Investigator)"
"archaeologist / research infrastructure manager"
"Archaeologist / Senior Associate Professor"
"archaeologist and museum curator"
"archaeologist and physical anthropologist"
"archaeologist specialist of ceramics studies"
"Archaeologist specialized in Physical Anthropology"
"archaeologist, art historian, Digital Humanities and Cultural Heritage specialist"
"Archaeologist, Curator"
"Archaeologist, I have a scholarship with CNR-ISCP and occasionally I work in some contract archaeology service"
"Archaeologist, PhD"
"Archaeologist, prehistorian"
"archaeologist, researcher, museum staff"
"archaeologist, specialist in neolithic ceramics"
"Archaeologist, surveyor"
"archaeologist, teacher, researcher"
"Archaeologist/Curator"
"Archaeologist/PhD candidate in media studies"
"Archaeologist-curator"
"Archaeology" (5 times)
"archaeometallurgist"
"Archaeometallurgy"
"Archeolog" (Archaeologist)
"Archeologa e Insegnante scolastica" (Archaeologist and School Teacher)
"Archeological studenti (*Scuola di Specializzazione*) and fiscali anthropologist student"
"Archeologist" (8 times)
"Archeologo" (Archaeologist) (3 times)
"Archéologue" (Archaeologist) (16 times)
"archéologue céramologue" (Archaeologist ceramologist)
"archéologue céramologue gestionnaire de collection" (Archaeologist ceramologist collection manager)
"Archéologue CNRS" (CNRS archaeologist)
"archéologue et archéothanatologue" (archaeologist and archaeothanatologist)
"Archéologue et céramologue spécialiste du Néolithique à l'INRAP" (Archaeologist and ceramologist specialising in the Neolithic period at INRAP)

"Archéologue Numismate (INRAP)" (Archaeologist numismatist (INRAP))
"Archéologue responsable d'opération" (3 times) (Field director archaeologist)
"archéologue, adjoint au responsable d'opération" (archaeologist, deputy to the field director)
"Archéologue, Ingénieur de recherche à l'université" (Archaeologist, research engineer at the university)
"Archéologue-céramologue" (Archaeologist-ceramologist)
"Architect"
"Architect and architectural historian"
"architecte archéologue" (architect archaeologist)
"architecte-archaeologist"
"Architecture"
"Arkeolog-proje yöneticisi" (Archaeologist-project manager)
"Assist. Prof. Dr." (3 times)
"Assistant de conservation du patrimoine" (Heritage assistant curator)
"Assistant professor"
"Associate professor" (4 times)
"Associate Professor in AI, ML, Algorithm and Data Structure"
"Asst. Prof. Dr."
"Buildings archaeologist"
"Capture et analyse de données spatiales" (Spatial data capture and analysis)
"Ceramologist" (twice)
"Céramologue" (ceramologist) (twice)
"chargée de recherche cnrs" (CNRS research fellow)
"Chargée d'études et de recherches" (Research fellow)
"Chemical technician"
"Chief intendant"
"Conservator" (3 times)
"Curator"
"Curator at an archaeological museum"
"Database engineer"
"Digital Archaeologist"
"Digitisation Technician"
"Doctoral student in Archaeology"
"*DR*" (CNRS research director)
"Emeritus research director at the CNRS"
"Engineer"
"Enseignant chercheur" (University lecturer and researcher)
"expert associate"
"field bioarchaeologist"
"Field manager"
"Field project manager"
"Field Technician"
"First, I'm physicist, with a master degree in archaeology and I am ending my PhD in Anthropology"
"Full professor"
"Full-time CNRS researcher"
"geoarcheologist"
"Geologist" (3 times)
"geomatician archeologist"
"Geophysicist"
"Gestionnaire de collections" (Collection manager)
"Heritage Advisor"
"Heritage Information professional" (twice)
"heritage/material scientist"
"historical archaeologist"
"Hon. Associate Professor"
"I am PhD archaeologist, assistant professor and museum advisor"
"I work in academia."
"Independent archaeologist"
"Ingeneer"
"Ingénieur de recherche architecte archéologue" (Research engineer architect archaeologist)
"ingénieur en archéologie" (archaeological engineer)
"IT Coordinator"
"IT Expert"
"Land and underwater surveyor, cartographer and historical gis researcher"
"Lecturer" (4 times)
"Lecturer and Postdoc researcher"
"Lecturer in Archaeology"
"Lecturer in Prehistoric Archaeology"
"lithic archaeologist"

"Msc. Mining Engineer. Software engineering"
"Museum curator and documentalist"
"Objects conservator"
"PhD Candidate" (4 times)
"PhD Researcher" (twice)
"PhD student" (10 times)
"PhD student in archaeometry"
"PhD student working with ADS and Historic England (but soon also Heritage Data Scientist for Historic Royal Palaces)"
"Physical anthropologist"
"Post doctoral fellow"
"Post doctoral research associate"
"post-doc"
"Postdoc in Biological Anthropology"
"Post-doc researcher" (twice)
"Postdoctoral fellow at a private university"
"Postdoctoral research fellow"
"Postdoctoral researcher" (5 times)
"Postdoctoral Researcher in Archaeological Science"
"Pottery Specialist"
"preventive archaeological center director"
"preventive archaeologist and ceramologist, late prehistory"
"Professeur des Universités" (University professor)
"Professor" (5 times)
"Professor of archaeology"
"professor of university"
"project manager"
"Project manager in archaeology"
"Project officer"
"Research engineer" (3 times)
"Research Engineer at the CNRS"
"research technician"
"Researcher" (9 times)
"Researcher at CNRS"
"Researcher specialised on faunal studies (zooarchaeology)"
"Researcher, cultural heritage professional"
"Responsable de recherche archéologique" (4 times) (Field director)
"Responsable de recherche archéologique - Responsable d'opération" (Field director)
"Responsable de recherches archéologiques préventives" (Preventive archaeology field director)
"Responsable d'opération expert en archéologie préventive" (Field director expert in preventive archaeology)
"Retraité" (pensioner)
"Scientific and field director in Roman Archaeology"
"Scientific director"
"Silicate materials engineer & Building materials' researcher"
"Software Engineer"
"Specialist archaeologist in ceramology"
"Study engineer"
"Surveyor"
"Technicienne" (technician)
"Telecommunication Engineer"
"topographic, geomatic, 3D and imaging "scientist"
"University lecturer" (twice)
"University prof and research associate"
"University professor" (7 times)
"University professor in Archaeology"
"Urban archeologist in the preventive archeology field in France."

A.6. Do you work for the public or the private sector? (Select all that apply)

Answer	Number of answers	Percentage
Public	287	88.9%
Private	61	18.9%

A.7. Which type of structure are you working for? (Select all that apply)

Answer	Number of answers	Percentage
Archives	17	5.3%
Cultural heritage association	14	4.3%
Library	4	1.2%
Museum	41	12.7%
Other types of public administration	39	12.1%
Private company	29	9.0%
Research institute	147	45.5%
Self-employed	19	5.9%
University	144	44.6%
Other (please specify)	14	4.3%

The respondents who picked "Other" answered:
"Association"
"CNRS" (French National Centre for Scientific Research)
"*Collectivité territoriale (Commune)*" (territorial authority (town))
"*Collectivité territoriale*" (territorial authority)
"Currently unemployed"
"INRAP" (French National Institute for Preventive Archaeological Research) (5 times)
"Non-profit association"
"Research institute"
"Senior member of an archaeological excavation".

A.8. With which type of data do you mainly work? (Select all that apply)

Answer	Number of answers	Percentage
2D visual documents (photographs, diagrams, etc.)	249	77.1%
3D visual documents (3D models, point clouds, etc.)	170	52.6%
Archaeometric data	119	36.8%

Archaeological remains, terrain samples	206	63.8%
Spatial data	180	55.7%
Tabular data (numerical, categorical, etc.)	174	53.9%
Textual data	181	56.0%
Other (please specify)	10	3.1%

The respondents who picked "Other" answered:
"anthropological remains from archaeological sites"
"Archaeological prospection"
"*Archiwalia*" (archives)
"CT-scans"
"Databases"
"Data Communication in VANET"
"Geophysics data"
"identifying species, reconstructing skeletal structures"
"Linked data"
"Technical imaging and spectral data".

A.9. Would you like to be kept informed of further developments of the AUTOMATA project?

Answer	**Number of answers**	**Percentage**
Yes	206	63.8%
No	117	36.2%

The respondents who selected "Yes" were then invited to leave their email address for it to be added to the project's newsletter.

B. 3D modelling

B.1. How familiar are you with the use of 3D modelling in archaeology?

Answer	**Number of answers**	**Percentage**
Very familiar	74	22.9%
Familiar	114	35.3%

Neutral	82	25.4%
Unfamiliar	32	9.9%
Very unfamiliar	21	6.5%

B.2. Do you use 3D modelling in your work?[17]

Answer	**Number of answers**	**Percentage**
Yes	195	60.4%
No	128	39.6%

B.3. (Yes) - On which types of archaeological remains do you use 3D modelling with? (Select all that apply)

Answer	**Number of answers**	**Percentage**[18]
Archaeological features	113	57.9%
Archaeological sites	142	72.8%
Botanical remains	3	1.5%
Buildings	90	46.2%
Ceramics	67	34.4%
Coins	15	7.7%
Epigraphs	13	6.7%
Faunal and human remains	41	21.0%
Figurines	31	15.9%
Frescoes	13	6.7%
Glass	6	3.1%
Lithics	43	22.1%

[17] Each of the technological sections includes these first two questions. The respondent's answer at the second one, related to work usage, determined one of two paths for the remaining questions of the current section. The next questions' belonging to one or the other path are materialised here by the "(Yes)" or "(No)" preceding every question. Thus, the questions without "(Yes)" or "(No)" are the ones submitted to the whole of the respondents.

[18] Since only part of the respondents answered this question (the ones who declared using 3D modelling in their work at the previous question), the percentage is here calculated in regard to this sub-population. The same applies to all questions submitted to a portion of the respondents.

Metal artefacts or metal items	38	19.5%
Sculptures	31	15.9%
Stratigraphic layers	66	33.8%
Other (please specify)	13	6.7%

The respondents who picked "Other" answered:
"architectural remains"
"biological , paleontological and geological collections"
"Computer Graphics"
"Environmental and Geosciences Applications"
"Heritage objects"
"identifying species, reconstructing skeletal structures"
"Landscapes, shipwrecks"
"Organic items, Archaeological finds"
"Rock Art and other material culture"
"Rock art, engravings"
"Rock art"
"Textiles"
"Wrecks"

B.4. (Yes) - How are the 3D models created? (Select all that apply)

Answer	**Number of answers**	**Percentage**
Automated capture (lasergrammetry)	78	40.0%
Computed modelling (photogrammetry)	172	88.2%
Manual modelling	50	25.6%
I do not know / I am not sure	6	3.1%
Other (please specify)	16	8.2%

The respondents who picked "Other" answered:
"3D blue-light scanners"
"3D volume- models of geophysical data"
"Computed modelling from CT scans of bones"
"CT scan" (thrice)
"from µCT or synchrotron scans (semi-automatic segmentation)."
"Geophysical anomaly"

"microscan"
"Micro-tomography"
"*Photogrammétrie*" (photogrammetry)
"structured light and µCT"
"structured light scanner" (twice)
"surface scan"

B.5. (Yes) - How often is 3D modelling integrated into your work protocols?

Answer	**Number of answers**	**Percentage**
Always	44	22.6%
Often	69	35.4%
Sometimes	62	31.8%
Rarely	20	10.3%

B.6. (Yes) - Are the 3D models generated in-house or by third parties?

Answer	**Number of answers**	**Percentage**
In-house	145	74.4%
By third parties	20	10.3%
I do not know / I am not sure	7	3.6%
Both / It depends (please specify)	23	11.8%

The respondents who picked "Both/It depends" answered:
"3D capture (photogrammetry, laser scanning) is done by third parties, and model building (e.g., SketchUp) is done in-house"
"3D models are generated in-house for laser scanning of ceramic fragments"
"Although most of the work is generated in-house, I collaborate with computer science department and audiovisual companies"
"Can be done "in-house" but it is a good way to enhance partnerships and share technical approaches and knowledge"
"Cooperation with different Academic projects and buying services"
"due to the level of complexity, light photogrammetry : in-house, complex site by third party"
"*En interne pour mon institut employeur et par tiers dans le cadre de mon laboratoire (IRAMAT) et de mes collaborations (AOROC)*" (Internally for my employer institute and by third parties within the framework of my laboratory (IRAMAT) and my collaborations (AOROC))

"I can do small scale scanning myself but larger stuff is scanned by colleagues from co-opted institutions"
"I can make simple 3D modelling but as I need more complex actions, I need third parties"
"I make 3D models myself with Reality Capture (mostly dolmens so far), and also use available 3D models online"
"in house, but by contracted post-doc or students"
"It depends from cases"
"It depends if we have the equipments"
"It depends on the complexity and size of the model."
"it depends on the project"
"It depends. If it's 3D models through surface scanning or photogrammetry, then in-house. If CT-scans, through other institutions."
"It depends"
"microscan at the university; laser and photogram by a private"
"*Parfois par des collègues ou des entreprises privées*" (Sometimes by colleagues or private companies)
"Photogrammetry models are made by members of our team, and we are currently taking steps to educate interested colleagues to make 3D models from CT scans, which were so far done by third parties"
"Small-scale projects are generated in-house while large-scale projects can be asked to be generated for third parties."
"Sometimes the operator develops them, sometimes he has them developed by others"
"sometimes we ask privates contractors because they have equipments we don't have (lasergrammetry) in house or not available at that specific time"

B.7. (Yes) - For which purposes are you using 3D modelling? (Select all that apply)

Answer	Number of answers	Percentage
As an illustration to support a scientific demonstration (proof)	149	76.4%
Research/Preservation (e.g. digital twins)	148	75.9%
Outreach, educational activities	101	51.8%
Other (please specify)	20	10.3%

The respondents who picked "Other" answered:
"3D DOCUMENTATION, measurements"
"*analyse des données*" (data analysis)
"archaeological interpretation"
"As a form of primary documentation."

"as a work document to can extract data from, mostly on field work when heavy constraints apply: 3D modelling can be a big help for shaping a general mapping of a work area, without depending to the venue of the topograph"
"calculus, measurement"
"develop new investigation practices"
"Documentation"
"Field excavation documentation"
"Generating orthomosaics"
"It depends from cases, like morphometric and documentation"
"mesure et analyse via QGIS"
"osteology"
"Pottery technology (reconstructions, measures, topography)"
"*Relevés de structures archéologiques*" (measured plans of archaeological structures)
"Sharing"
"Simulation"
"Specific topic in Bim workflow"
"Structural analysis"
"To have the most complete view of my material when I'm not in the country where it's stored"

B.8. (Yes) - What annual budget is typically allocated for the creation of these models?

Answer	Number of answers	Percentage
€ 0–10K	102	52.3%
€ 10–50K	7	3.6%
Over € 50K	6	3.1%
I do not know / No opinion	80	41.0%

B.9. How would you describe your access to 3D model creation?

Answer	Number of answers	Percentage
Sufficient	125	38.7%
Insufficient	143	44.3%
No opinion	55	17.0%

B.10. According to you, what are the main obstacles preventing the extensive use of 3D modelling in archaeological work practices? (Select all that apply)

Answer	Number of answers	Percentage
Cost	166	51.4%
Digital storage constraints	157	48.6%
Lack of training or expertise	211	65.3%
Limited access to equipment	165	51.1%
Shortage of personnel allocated for the task	129	39.9%
Time constraints	118	36.5%
None	4	1.2%
No opinion	12	3.7%
Other (please specify)	22	6.8%

The respondents who picked "Other" answered:

"Because 3d is a gadget most of the time"

"*Dans le cas des objets (céramique, verre...) la normalisation imposée dans les rapports et les publications est en 2D*" (In the case of objects (ceramics, glass..) the standardisation imposed in reports and publications is in 2D)

"Fields/occasions of reuse."

"I'm just not totally sure how they're that much better than what we've been doing for years"

"*il n'y a pas forcément d'intérêt à réaliser des modèles 3D*" (There is not necessarily a reason to create 3D models.)

"I'm not yet convinced of the research gains in relation to the costs in time, equipment and data storage."

"Insufficient data management policies & lack of national level guidelines/standards"

"Interest"

"issues of preservation and presentation of the models"

"Lack of applicability; generally does not surpass traditional analog approaches for use in detailed archaeological analysis and research."

"Lack of consensus around best practice applications."

"Lack of interest by other researchers"

"Lack of precision ; interest in the result scientifically insufficient in relation to the acquisition time"

"*Le rendu final d'une modélisation 3D n'est pas utile, voire non utilisable, pour une publication papier.*" (The final rendering of a 3D model is not useful, or even usable, for a paper publication.)

"Limited diffusion and scientific exploitation possibilities"

"No standards"

"not pertinent for all use and researches"

"Too much 3D data can be simply useless, we do not need to have a 3D model of each artifact from an archaeological site."

"Total lack of consideration as to how to share/disseminate models. I work with human remains. I am appalled by the number of human bones one can find online for people to gawk at, especially

paleopathological specimens, with absolutely no regard to the fact that this represents a person that lived. I am wary of where all these 3D models might end up when the internet allows us to share them so freely."
"Unclear marginal utility over analogue workflows (in some areas)"
"unsufficient need of 3D modelling"
"While some of the listed points are certainly still obstacles (e.g., costs, training, infrastructure), I believe the main challenge lies in the absence of a clear and shared practice for integrating 3D modelling into archaeological workflows. The possibilities offered by 3D data differ significantly from those of traditional methods, and their effective use requires not just technical adaptation but a broader cultural shift within the discipline. Without this shift, 3D modelling remains underused or treated as an add-on rather than as an integrated component of archaeological practice."

B.11. Do you believe that AI or robotics could help with the creation and use of 3D models?

Answer	Number of answers	Percentage
Yes	145	44.9%
No	153	47.4%
No opinion	25	7.7%

B.12. Please explain why.

The respondents who picked "Yes" answered:
"1. process acceleration. 2. lower costs involved. 3. achieve standardised quality through the automated implementation of guidelines"
"A well done automatization should ease the work needed to acquire and create 3d model of object by improving "normalisation" of the process but also reducing time and cost."
"AI could be a tool for data analysis notably helping handling generated big dataset."
"AI and robotics can automate a lot of tasks that would be time consuming for human agents."
"AI and robotics can enhance 3D model creation by automating generation, improving scanning accuracy, optimizing designs, and enabling real-time adaptation."
"AI and robotics can help create and use 3D models because they can automate complex processes like scanning, reconstruction, and simulation. They improve accuracy, save time, and allow for detailed analysis and realistic interaction in fields like medicine, architecture, and cultural heritage."
"AI and robotics can make 3D modeling of archaeological sites way easier and more accurate. AI helps process data faster and improves details, while robotics like drones and scanners can quickly capture high-quality images and measurements."
"AI can be applied in the restitution of DEMs via logarithms, for photointerpretation etc."
"AI can be of specific help when dealing with large datasets. If used properly, it can help in several areas of research, but also provide very powerful and valuable presentational tools for dissemination of archaeological sites and remains for general public. Over the last several years, I start fieldwork each day by scanning the whole excavation area, and additional scanning of all interesting finds,

features etc., as they are discovered, so the progress can be seen, and also used for virtual presentation and even VR games (e.g. virtual excavation of the site). Also, for the last few years, we use photogrammetry and lidar for documenting spatial distribution of finds in 3D."
"AI can generate 3D models from images, text prompts, or sensor data — like text-to-3D systems or AI-driven CAD tools. Robotics use 3D models for navigation, manipulation, and simulation, especially in complex environments."
"AI can help the process to compile them in batch or use specific algorithm to fill gap between data sample. It help manage bigger dataset as well."
"AI can inference and connect the invisible dots. Also, it can learn from similar situations, so it can be a helpful tool (yes, used as a tool, not as a human replacement - that would be catastrophic)."
"Ai can model, put parts together, etc"
"AI can play a valuable role in the creation and interpretation of 3D models. Through AI, we can generate 3D models from images of different types, also can help on predict and reconstruct missing parts of damaged artifacts. Different type of classification and analysis can be performed based on 3D patterns to discover patterns on the data."
"AI could clean up renders, convert files into other formats, help with object analysis like measurements, etc. Robotics could, eventually, probably be given an assemblage of artefacts, and process each one individually with the help of AI removing the need for staffing to process an assemblage of artefacts."
"AI could perform several tasks to save time"
"AI help with batch processing of artefacts and/or integration of meta data to models"
"AI is essential to analyse data and produce models"
"AI is useful for the identification of particular features like, for example, identify a ceramic decoration"
"AI will enable better categorization of the point clouds produced. Thanks to machine learning, stones, for example, can be distinguished and their contours drawn to create plans automatically."
"Analysis of 2d and 3d imaging on a large scale across multiple sources. Adjusting and correcting for human error"
"Anything which automatics or clarifies the process acquisition, can support accuracy and precision and facilitate analysis and classification of models would be useful."
"Artificial intelligence algorithms can automate processes for the creation of simple and complex 3D models, generating detailed models and textures with precision and speed, reducing human manual errors to a minimum."
"Artificial intelligence can be useful in extracting the features of real objects and making 3D modeling by using these features, as well as correctly classifying objects in terms of time and period."
"Automate the procedure of creating a 3D model and limiting the specialized knowledge needed for creating 3D models"
"Automated creation can facilitate the creation and use of models"
"Automation and less time consuming acquisition"
"Automation of modelling tasks"
"AI driven analysis of models (eg segmentation)"
"automation of acquisition and calculation processes"
"Automation of standardized ceramic designs, automated profile recognition"
"Automatisation could speed up the process and help with shortage of highly qualified personnel"
"Automatisation de certaines tâches" (Automation of certain tasks)
"Automatisation des tâches" (Automation of tasks)

"Automatizácia of *stepi* needed in calculation of 3d model" (Automation of steps needed in calculation of 3d model)
"Autonting post-processing stages or in case of reconstruction modeling making the entire process AI assisted."
"Because AI are tools and, usually, tools help"
"Because AI and robotics automatize the creation of the 3D models"
"because every technical enhancement can help"
"Because it can already generate a wide variety of "imaginary" models based on real-life models and experiences. It would need to be connected/integrated with more specific equipment for 3D modelling."
"because it works better and quickly for technical works"
"Because robots can do such repetitive tasks better than human beings."
"Because the robot can work while I do other task"
"Because they help with everything"
"Better accuracy"
"Both "tools" can automate how to study archaeology data."
"Could add utility in several ways, e.g. speeding up documentation, identification, and classification; allowing for new forms of analysis; creating new forms of dissemination/preservation by record."
"Could do repetitive tasks."
"Could help with: Digital storage constraints, Lack of training or expertise, Limited access to equipment, Shortage of personnel allocated for the task, Time constraints. And, therefore, with cost problematics"
"Depends on several parameters described under The complexity of Data Acquisition for tangible Cultural Heritage assets: https://unescochair-dch.net/EU_Study_quality_in_3D_digitisation_of_tangible_cultural_heritage some examples: Where is the site (100 meters on the ground of the sea, in a cave or on the to of the mountain....)...."
"E.g. robots collecting LiDAR scans across a site"
"Eager to take AI potential to the next level"
"Easier automated capture of data, advanced point cloud filtering, advanced texture manipulation."
"Facilitate the treatment of data"
"faster and optimal data acquirement, standardisation, increasing the number of models generated, not high specialization for running data and model generation"
"Faster recognition on patterns and easier "remontages" in lithic studies, and more effective taxa and anatomical identification of bone remains"
"For AI-generated creation of 3d models"
"gain of accuracy"
"Help for time processing"
"Helping having better match of photography in case of photogrammetry"
"I am looking for a solution that enables scanning multiple objects simultaneously. The primary challenge is the vast number of objects uncovered during archaeological excavations, making comprehensive scanning impractical using traditional methods. My goal is to perform these scans quickly, efficiently, and with maximum precision. Employing a robotic arm is a promising step forward, significantly reducing muscular strain associated with laser scanning. Additionally, I am developing machine learning tools to automate drawing on georeferenced data. By utilizing Detectron2 on multi-channel GeoTIFF files (RGB and elevation data), it becomes possible to

automatically detect stones within archaeological layers, thus substantially saving time during post-excavation processing. So far, artificial intelligence has successfully assisted me in coding these tools for preliminary data. Furthermore, AI has allowed me to develop a tool that directly integrates total station control within QGIS. We can now perform all station and measured point calculations without relying on costly controllers or expensive third-party software like AutoCAD, simply using a tablet PC equipped with QGIS. I am also creating several QGIS extensions with AI tools, enabling ambitious projects despite limited coding expertise (while still understanding the developed scripts). Artificial intelligence can also be utilized for automatic archaeological object recognition, identifying their chronology, typology, and decorative elements. Another promising application of AI is the reconstruction of fragmented ceramic objects. Currently, expensive software solutions are required to digitally assemble fragments; however, AI-driven techniques could perform these assemblies more efficiently and cost-effectively. Moreover, AI has the potential to significantly enhance non-invasive subsoil scanning tools by training models capable of differentiating wave responses based on material type, density, and other characteristics. This capability could help filter out sediments and stones, clearly distinguishing them from archaeological objects. The potential of robotics and artificial intelligence in archaeology is immense, but it necessitates building extensive databases to fully realize this potential."

"I am not very educated about AI, but it seems to be very useful when coming to automated tasks or use of big quantity of data (as for the numerous pictures needed for photogrammetry). So I guess AI could be developed as an aid both for the treatment of the data (pictures, point clouds, ...) and the process of making the 3D model"

"I am working with someone who uses AI to create 3D models from poor quality images"

"I believe that AI assistance is valuable for automating and, when possible accelerating the process of transforming raw data into 3D models"

"I don't think AI can help us in the near future with 3D modeling of new objects using photogrammetry because the images shouldn't be invented but actually taken. However, automating acquisitions using robots should be a goal. In this context, AI can help calculate the optimal trajectory for an acquisition robot and optimize the 3D modeling workflow."

"I have seen preliminary efforts and convinced."

"I imagine that AI will enable us to take the use of 3D models even further and automate certain tasks.

"I suppose that combining AI with photogrammetric algorithms could have a potential in both improving or further streamlining data processing."

"I think there are a range of emerging options in robotics and AI that can automate or semi-automate aspects of the creation process, particularly in initial data capture, e.g. automated/AI guided drone photogrammetry. There are also emerging tools in AI that are improving the accuracy of 3D model creation and its efficacy."

"I think there is a chance that this would work for accuracy/ease, but I'd also be concerned over costs and ownership of the data. So I think there is potential there at least."

"IA peut proposer des schémas types ou abstraits complémentaires à l'utilisation du logiciel." (AI can suggest standard or abstract diagrams to complement the use of the software.)

"If a general pipeline like Automata can do 3D models of all/most objects excavated, and make them freely available, that would be great. I could use those in my digital archaeogames"

"if ease of use and lower cost are achieved: precision and consistency"

"If it is possible to automate certain data acquisition tasks, or their "pre-interpretation" processing, interpretation, etc., this could improve the "efficiency" of implementation and use. But of course,

these tasks should not involve significant additional costs or require specific technical skills (which also involve human costs).”
“Image recognition AI can be used to create models e.g. with photogrammetry”
“Improvement of photogrammetry through AI”
“It could compensate the lack of training, and also my experience with AI so far (for text and images) is positive.”
“It could give more impulse”
“It could help lower the costs because AI works faster”
“It could help with the creation of the model, but interpretation is only possible for the archaeologist, because the AI or robot wont have the full access to all the data on site (ceramic study, fauna and flora studies, ect.), and it might make assumption to fast with only a few details. Where an archaeologist will try to make sur by working with all the specialists.”
“It feels like there are multiple potential use-cases for robotics that are feasible and probably quite cost effective, at least for bigger institutions. I don't really work with this stuff, but things like mass digitization of archaeological finds seem doable. Data management and storage might be a challenge, unless sufficiently resourced.”
“It may depends on the subject, ie useful for extremely intricate subjects and in laboratory context. But introducing more complexity and dependence on technology probably won't facilitate 3D modelling”
“It may enhance the effectiveness of the process”
“It will make the process more efficient”
“it would facilitate the diffusion/establish of standards, speed up production and facilitating the integration of this practice within the discipline”
“It would help to speed up the process, automate many of the phases as well as investigate and discover quicker.”
“It would definitely facilitate the digitisation process.”
“It would shorten the time for image acquisition (robotics) and digital image processing and feature/information extraction (AI)”
“It’s makes the work more efficient”
“Les données recueillies depuis des dizaines d'années doivent être traitées de façon globale pour obtenir des résultats et nous aurons besoin d'outils IA pour parvenir à ces résultats” (Data collected over decades must be processed holistically to obtain results, and we will need AI tools to achieve these results.)
“Making it possible to spare time by automating repetitive tasks”
“Maybe useful to "clean" or prepare the set of images made for photogrammetry. And various uses of IA for 3D would be interesting to find”
“Mesh completion, workflow automation - all tasks that AI prob could assist with.”
“modelling of ancient environment could benefit from ai/robotics to generate procedural modelling. auto 3d generation from generative ai. computer vision”
“More simple and easy to learn, and can be more easily automated”
“much of the process of creating 3D models is repeating labour which could very well be done by AI”
“Much quicker”
“Nerf, automated capture of artefacts, machine learning for object identification”
“NO”
“No idea why but as a gut guess, i think it would work and may help streamline the whole work plan. Cleaning a 3D model is awful too (handscanner experience on fossils remains).”

“Optimizing the IT tool will save time and improve accuracy”
“oui pour les objets archéologiques” (Yes for the archaeological objects)
“par l'automatisation des tâches” (through task automation)
“Pattern recognition and classification”
“Penso che l' intelligenza artificiale possa aiutare. È un buono strumento ma, come tale deve esserci una persona fisica dietro competente” (I think artificial intelligence can help. It is a good tool, but as such, there must be a competent person behind it.)
“Peut-être pas à la création mais à l'usage, L'IA est déjà utilisée dans la reconnaissance des monnaies frappées et dans l'identification des liaisons de coins monétaires” (Perhaps not in its creation but in its use, AI is already being used in the recognition of minted coins and in the identification of monetary coin connections.)
“pour en exploiter le maximum” (to get the maximum out of it)
“Pour garder traces de mobiliers archéologiques sensibles : objets métalliques, objets organiques. Permettre des manipulations des objets sans les touchers pour leur préservation. Permettre mesures, dessins....documents réutilisables.” (To keep track of sensitive archaeological artefacts: metal objects, organic objects. Allow objects to be handled without touching them for preservation purposes. Allow measurements, drawings….reusable documents.)
“*-pour l'analyse des images ou des scans d'objets -pour avoir une vision d'ensemble d'un site -pour gagner du temps et de la précision dans les rendus 3D*” (-for analysing images or scans of objects -to get an overview of a site -to save time and improve accuracy in 3D renderings)
“Pour reconnaître des collages” (To recognise collages)
“rapidité d'exécution” (speed of execution)
“RAS” (Nothing to report)
“Reduce time and cost”
“Reduced acquisition time”
“Robotics can be applied to automatization of photogrammetry and other scanning techniques. AI can be used to improve on object masking and texture improvement on objects meant for exhibits or educational purposes”
“Robotics can be implemented by creating supports in which to insert the findings to be detected and automating the processes. AI can help in the classification of point clouds and in the search for comparisons”
“Robotics could save time. Artificial intelligence could, for example, be used to suggest lithic reassemblies.”
“Robotics means drones, and they are quite useful taking photos of a site or any plane AI may be helping methodologies and training”
“Robots can read the data collected by tools such as laser scanners and can create 3D models.”
“Services such as BlenderMCP (https://blender-mcp.com/) can help or provide insights into creating ideas in 3D, even for non-experts.”
“Since 3D modelling is a product of digital technology, applications such as AI and robotics should be able to develop such models effectively and hopefully at lower cost.”
“Specialized tools of GenAi for problems like space allocation, neural networks for classification, image segmentation, etc.”
“streamlining the process; controlled environment of the recording process (hopefully ;))”
“Surely it can help to make it quicker but I wonder if it is useful to scan hundred of sherds in a site.”
“Surface, shape or pattern recognition”
“Szybsza medoda doklafnosc” (Faster method for accuracy)

“the creation of the 3D models could be eased with the help of the AI, and also the acquisition with robotics that could handle the object”
“The pattern recognition applications and data capture”
“The use of AI and robotics could be useful for the creation and use of 3D models in term of time and cost if the technology is efficient and easy to use.”
“The volume of data in lithic collections is surely subject to AI and robotic assistance.”
“there are too much data to manage in an human brain”
“there exist some generative AI tools used for 3D modelling”
“There is significant potential of automation in the model generation and related data management.”
“they can complete unknown information based on ML”
“They could make 3D representations cheaper and faster to produce without requiring complex “technical knowledge or specialists to operate equipment”
“To improve speed, accuracy and reduce human error.”
“Use data from télédétection and RSCL”
“Use of 3D models. Supervised learning may be useful to help automatically identify features in a model. Thereby helping to avoid potential objects of interest being overlooked and to help with some of the repetitive tasks involved in registration to save time and effort (allocating a unique ID, feature name, copying said data into other tables etc).”
“Well yes and no: Yes) streamline processes allowing teams to make more of their equipment No) 3D data management is prohibitively expensive to share, and equipment is often too expensive to access for all groups”
“What archaeology needs is formalization. Once formalized archaeological explanatory discourse, it is relatively straightforward its computer implementation. In the field, the need for instrumental observation and direct data acquisition non-mediated by archaeologist observation is of topmost relevance. Instrumental data acquisition and reasoning formalization should be related.”
“Whilst vague, AI in the form of deep learning models are already integrated in the vast majority of modern photogrammetric and scanning methodologies. Robotics can assist with automated image capture, this is already the case in automated drone surveys and photogrammetry setups which use apps to control cameras.”
“Yes but we have to be very careful to not generate wrong models”
“Yes, because artificial intelligence and robotics can help create and use 3D models quickly, accurately, and automatically. With image processing, object recognition, and modeling algorithms, they play a key role in developing realistic and functional 3D models in fields like mapping, manufacturing, architecture, and healthcare.”
“Yes, I believe that artificial intelligence and robotics can significantly support the creation and use of 3D models by increasing precision, reducing manual effort, and enabling the reconstruction of fragmented or damaged artifacts. These technologies can also enhance virtual visualization and interactive learning experiences, which are highly valuable in both research and public engagement in archaeology.”

The respondents who picked “No” answered:
“AI is a reductive digital process that has zero ability to replicate the knowledge skills and understanding of human archaeologists. In every test case where AI has been applied to archaeological processes it has either failed to replicate human processes, or if it has done so it has taken longer and cost more. Current AI systems are also limited in intellectual comprehension and have a significantly damaging environmental impact.”

“AI is a tool that costs water and energy, both in shortage globally. Using it in rich countries is selfish and reckless.”
“Answer depends too much on what you mean by AI” (twice)
“As of now, AI cannot correctly replicate models without serious human input and corrections, and uses significantly more computational resources and energy.”
“Automated algorithms that do not depend upon generative AI can be used, but they are not reliable yet.”
“Creating a 3d model requires an expertise in the related fields (osteology, geology…) that can’t (or shouldn’t ?) be delegated to a computer.”
“Every case is very specific and it can not thus be inferred from existing results.”
“I am not sure about the usefulness of 3D models in archaeology, especially small finds.”
“I do not believe robotics would be very helpful with helping the creation and use of 3D models due to their very high cost and need of specialized personnel and maintenance.”
“In archaeology, the interpretation is necessary”
“It's indifferent to me, helping or not it depends on the case”
“Je préfère échanger avec mon topographe à ce sujet plutôt qu'avec un énième logiciel” (I prefer to discuss this with my topographer rather than with yet another software)
“La démarche scientifique impose une démonstration de causalité et une argumentation à différents niveaux qui supportent l'hypothèse qui sont propres au chercheur. Les mêmes données ne donnent pas forcément la même analyse suivant l'opérateur. Le caractère systémique et normalisé de l'IA ou de la robotique conduirait à une normalisation de sapproches et donc un affaiblissement des savoirs.” (The scientific approach requires a demonstration of causality and arguments at different levels that support the researcher's hypothesis. The same data does not necessarily yield the same analysis depending on the operator. The systemic and standardised nature of AI or robotics would lead to a standardisation of approaches and thus a weakening of knowledge.)
“Lack of expertise in the archaeological field to make it work.”
“L'IA est trop mal utilisée et les produits (logiciels) comportent trop d'erreur. Le jugement, l'expertise scientifique provenant de la déduction propre à l'intelligence humaine n'est pas remplaçable par un algorithme aussi poussé soit-il.” (AI is too poorly used and the products (software) contain too many errors. Judgement and scientific expertise derived from human intelligence cannot be replaced by an algorithm, however sophisticated it may be.)
“loss of skills for humans, and of contact with the raw data, need critical mind, training and experience to check and assess what AI is doing... risk for young colleagues who would only use AI without knowing more in depth how to do the work more "traditionnally"...”
“Normalisation des process sans savoir ce qu'il se passe en arrière-plan des outils. Perte de contrôle sur les données et leur traitement” (Standardisation of processes without knowing what is happening behind the scenes with the tools. Loss of control over data and its processing)
“Only humans can determine archaeological remains.”
“Precision is essential in archaeology. AI is not capable of precision. Robotics can hardly help at the moment with non standardized artifacts. While supervision is possible, it is more difficult to spot an error or inconsistency than doing the job manually. “
“Robotics are a part of the enrichment of 3D modeling, but AI is not helpful in the domain of archaeology for me, especially in the domain of 3D modeling : the interpretation of archaeologist are the most important.”
“The primary obstacle to the successful application of AI is training issues on published data. leaving aside the huge moral issue of training AI on published works for which such a purpose was not

intended, or given permission for, many published catalogues (as well as unpublished archives) have a large number of in-built errors (i.e. 1) photographs: issues of perspective; 2) drawings: are typically schematic, not life-like; scaling inaccuracies, etc.). I have seen little indication that poorly informed project directors have the will or interest in directing poorly trained student research assistants, lacking in experience, to address these major issues, which would require major investment in in-person archival work. These built-in errors in our records will heavily bias AI training."
"The question is about believing, so I do not believe."
"What do you mean by AI ? Generative AI ? Algorithm ? Machine Learning ? This question is like asking "Do you believe maths could help". Yes. But it's so generic it doesn't make sense."
"While AI and robotics have shown potential in 3D modeling, I am skeptical that their application in archaeology will expand significantly in the coming years, as they remain highly specialized and resource-dependent. Due to high costs and technical barriers, I fear these will remain niche applications for a long time."
"While I think AI can help automate some tasks, 3D reconstruction is a process that is intrinsically subjective. I would worry that excessive AI use would be a detriment to overall reliability."

C. Non-destructive archaeometry

C.1. How familiar are you with non-destructive archaeometry?

Answer	Number of answers	Percentage
Very familiar	44	13.6%
Familiar	113	35.0%
Neutral	83	25.7%
Unfamiliar	54	16.7%
Very unfamiliar	29	9.0%

C.2. Do you use non-destructive archaeometric techniques in your work?

Answer	Number of answers	Percentage
Yes	124	38.4%
No	199	61.6%

C.3. (Yes) - With which non-destructive archaeometric techniques[19] do you mainly work? (Select all that apply)

Answer	Number of answers	Percentage
Computed Tomography (CT) Scanning	47	37.9%
Fourier Transform Infrared Spectroscopy (FTIR)	26	21.0%
Ground Penetrating Radar (GPR)	47	37.9%
Hyperspectral Imaging (HSI)	12	9.7%
Infrared Reflectography	10	8.1%
Magnetic Susceptibility	34	27.4%
Magnetometry	37	29.8%
Microscale X-ray Fluorescence (μ-XRF)	17	13.7%
Multi-Spectral Imaging	24	19.4%
Portable X-Ray Fluorescence (p-XRF)	50	40.3%
Raman Spectroscopy	29	23.4%
Scanning Electron Microscopy (SEM)	37	29.8%
Ultraviolet (UV) Imaging	7	5.6%
X-ray Diffraction (XRD)	25	20.2%
X-ray Fluorescence (XRF)	42	33.9%
Other (please specify)	17	13.7%

The respondents who picked “Other” answered:

“All geophysics technique”
“ALS”
“computer-aided design of geometric patterns by extraction of archeological objects”
“Confocal microscopy”
“Ecognition”
“Electromagnetic tomography in geophysics”

[19] Similarly to the other sections, the possible responses may extend beyond the scope of the AUTOMATA Project alone. Here, for instance, GPR and magnetometry are used for applied geophysics.

"Fiber Optics Reflectance Spectra (FORS)"
"Homemade techniques"
"I mainly apply some of these techniques in remote sensing (landscape) for what concerns artefacts (among the techniques listed) CT scanning is the method I have been engaging in the most"
"LIDAR"
"LM ICP MS"
"Micromorphology"
"Moosbauer Spectroscopy"
"My eyes and such technologies"
"resistivimetry, thermography"
"stereomicroscopy on non prepared archaeological remains"
"Synchrotron phase contrast µCT"

C.4. (Yes) - On which types of materials do you conduct non-destructive archaeometric analyses? (Select all that apply)

Answer	Number of answers	Percentage
Botanical remains	13	10.5%
Ceramics	53	42.7%
Faunal and human remains	25	20.2%
Glass	16	12.9%
Metals	40	32.3%
Parchments and manuscripts	8	6.5%
Pigments and related	26	21.0%
Soils	54	43.5%
Stones	43	34.7%
Textiles	13	10.5%
Other (please specify)	15	12.1%

The respondents who picked "Other" answered:
"Archaeological features"
"archaeological sites"
"Archeaological remains"
"Building mortars"
"Corroded metals."
"Cremated bones"
"Inorganic building materials (lime plasters, stuccos, concretes)"
"Lithics"

“Neanderthalian footprints.”
“ornated caves”
“Rock pigments"
“roman sites”
“Sediments”
“*sols : sondages géophysiques*” (soils: geophysical surveys)
“*vestiges archéologiques*” (archaeological remains)

C.5. (Yes) - How often are non-destructive archaeometric analyses integrated into your research protocols?

Answer	Number of answers	Percentage
Always	26	21.0%
Often	35	28.2%
Sometimes	46	37.1%
Rarely	17	13.7%

C.6. (Yes) - Are the analyses conducted in-house or are they outsourced to specialised laboratories?

Answer	Number of answers	Percentage
In-house	48	38.7%
By third parties	52	41.9%
I do not know / I am not sure	5	4.0%
Both / It depends (please specify)	19	15.3%

The respondents who picked “Other” answered:
“Again, depends on the techniques used. CT - scans are off-house”
“Depends on type of analysis.”
“If we don't have the equipment in place then we collaborate with several other institutions around the world…”
“In house first but with limited equipment resources sometimes specialised consultants are used.”
“In house we háve online pXRF”
“In-house for magnetic; collaboration with other laboratories for pigments”
“It depends from many variables: projects, budgets, cooperations, topics…”
“It depends if we have the capacity to make them by ourselves.”
“It depends on the needs, budget and time”

"Our Lab lacks the equipment, so we include colleagues who have the equipment and then we work together."
"*Prospections géophysiques en interne. Tomographie labo externe*" (Geophysical surveys in-house. Tomography external lab)
"SEM is not conducted in house"
"Typically, I have done all the sample preparation myself (powdering of samples, creating glass beads for XRF, etc.) and then the prepared samples have been given to the lab at the institution where I am located and the analysis is performed by technicians who share the results."
"We have limited means to conduct analyses."
"We have some equipment (microscopes) in house, but most analyses are done through outsourcing."
"We have some specialists in house able to carry the analysis, in some case we contact third party labs"
"Within University but paid for in different department"
"XRD & XRF - 3rd party laboratories"
"XRF were made in third party laboratory"

C.7. (Yes) - How do you use the results of non-destructive archaeometric analyses in your work? (Select all that apply)

Answer	Number of answers	Percentage
Material characterisation	82	66.1%
Provenance studies	52	41.9%
Remote sensing for archaeological surveys	57	46.0%
Technological analysis	62	50.0%
Other (please specify)	11	8.9%

The respondents who picked "Other" answered:
"Anthropological analysis of bones and lesions"
"Appearance"
"Biological and/or taphonomic changes on bones/teeth"
"Condition assessment"
"*observation de contenant (céramique, boîtes...)*" (observation of containers (ceramic, boxes..))
"Pattern recognition"
"Preservation and investigations into pathology and morphology (done by another individual)"
"Sediments sources"
"Spatial analysis within archaeological sites (sediment chemistry/soil chemistry)"
"study of dental tissue microstructure"
"various bioarchaeological analyses (e.g. bone structure, pathologies, morphology, 3d geometric morphometric analyses)"

C.8. (Yes) - What annual budget is typically allocated for these analyses?

Answer	Number of answers	Percentage
€ 0–10K	57	46.0%
€ 10–50K	19	15.3%
Over € 50K	5	4.0%
I do not know / No opinion	43	34.7%

C.9. How would you describe your access to conducting non-destructive archaeometric analyses?

Answer	Number of answers	Percentage
Sufficient	74	22.9%
Insufficient	160	49.5%
No opinion	89	27.6%

C.10. According to you, what are the main obstacles preventing the extensive use of non-destructive archaeometric analyses? (Select all that apply)

Answer	Number of answers	Percentage
Cost	195	60.4%
Lack of training or expertise	172	53.3%
Limited access to equipment	175	54.2%
Shortage of personnel allocated for the task	126	39.0%
Time constraints	83	25.7%
None	2	0.6%
No opinion	55	17.0%
Other (please specify)	16	5.0%

The respondents who picked “Other” answered:

“Again, the lack of comprehension that non-destructive analysis are not necessarily "non-destructive". There have been debates on whether repeated high-intensity CT-scans might damage archaeological DNA in human bones, hindering future paleogenetics studies. Every manipulation of a bone is potentially destructive, so if it's just to have a "prettier model to look at", not a good investment of money.”
“Analysis permits”
“Conservative archaeologists. Lack of support from government agencies to implement methods in cultural heritage management. Lack of competence among archaeologists.”
“does not allow the detection of all remains”
“I do stable isotope analyses, which can be considered part of archaeometry, although I usually associate that more with dating. The closest you get to non-destructive SIA in archaeology is laser ablation (LA-ICP-MS), and as far as I'm aware, this approach cannot efficiently distinguish diagenesis to be reliable. So, I'd say we lack the research to develop these methods.”
“Impossibility of accessing such analysis in certain countries (e.g. Egypt).”
“In metal analysis non destructive analysis give only results about the partina”
“Knowledge about this topics for other archaeologists”
“Lack of contact in specific archaeometric analyses”
“layers and soil not compatible”
“Little interest by project leaders”
“No permits”
“NO”
“Regulatory constraints in the specific oversea territory where we work : we can't send artefacts to laboratories, specialists must come with their "mobile" labs.”
“the type of information acquired : surface analysis of ceramics whom surface might be contaminated. Not a true analysis of the material.”
“What is it? I mean I guess I think I know from context but I’m not sure”

C.11. Do you believe that AI or robotics could help run non-destructive archaeometric analyses and process their results?

Answer	Number of answers	Percentage
Yes	110	34.1%
No	14	4.3%
No opinion	199	61.6%

C.12. Please explain why.

The respondents who picked “Yes” answered:
“1. for issues of complexity (as before), 2. for cost reduction 3. high quality of results”
“Accessibility and processing of results and help with interpretation”
“Again, if these tools can facilitate the implementation of measurements and contribute to the manipulation and interpretation of data, they are desirable. But it is difficult to produce "all-purpose"

tools, or "standard procedures", when in the field of archaeology the artefact often has a unique dimension, requiring adaptation. The development of tools, their maintenance and even their implementation may require significant resources (human and technical), or specific technical skills on the part of operators that are not easy to generalise (notably for data interpretation)."
"Again, if well trained AI and robotics can facilitate many processes and speed up the analysis and data collection."
"AI and robotics could enhance non-destructive archaeometric analyses by automating complex tasks, improving accuracy, and processing large datasets efficiently. They can help analyze archaeological materials without damaging them, providing valuable insights faster and more precisely."
"AI and robotics could help reduce analysis costs and create new automatic and/or semi-automatic production protocols"
"AI and robotics significantly enhance non-destructive archaeometric analyses by automating precise data collection, rapidly processing complex datasets, and creating predictive models for artifact characterization. These technologies improve accuracy, efficiency, and interpretation while preserving artifact integrity, provided they're supported by robust, well-annotated training datasets."
"AI based analysis is used for automated data interpretation in ground based remote sensing (geophysical data), classification or object detection in remote sensing data such as LIDAR and satellite imagery."
"AI can help process a great variety of results"
"AI can help us better understand the complex information gathered through non-destructive methods like X-rays, spectroscopy, or ground-penetrating radar by sorting through the data and revealing patterns or details that might otherwise go unnoticed."
"AI could help process results"
"AI could make processing and interpretation easier. Robotics can make field surveys autonomous, thus cheaper and better."
"AI I can improve upon classification and perhaps on provenience by using mass data to see patterns in trace elements of rare earth metals and such."
"AI in particular can help with large data sets."
"AI methods can probably help identify patterns in the results obtained from analyses and in some statistical analyses."
"AI will make it possible to establish an initial automatic analysis of the various results, as with the petrology of ceramics or geophysical prospecting. However, a human evaluation of this first analysis is mandatory."
"Already used in medical fields. Could be applicated in an archaeological context."
"analyse plus rapide des données" (quicker data analysis)
"Archaeometry is an instrumental task, and it is easily implemented in computers. The difficulty of interpreting results (spectrograms) can be enhanced using AI methods"
"As with 3D, means better use of time, but the time only is beneficial if coupled with more access to equipment"
"Assistance in initial data acquisition and efficacy in processing data."
"Automatic anomaly detection to avoid potential objects of interest being overlooked. Should still always be accompanied by a control stage operated by a person."
"Automatisation"
"automatisation des tâches et rapidité j'imagine" (task automation and speed I imagine)
"Automatisation of workflow"
"automatization of surveying process"

“Automatization of the processes.”
“Because AI and robotics can help in the acquisition and processing of the data”
“building a reference set of data for analysis, for ex. pigments, materials”
“Bulk data processing, improved feature recognition, workflow streamlining”
“By eg. identifying clay paste inclusions after processing large numbers of thin section micro-photos or traces of construction techniques for inorganic materials (hammering, wheel-throwing etc or ,traces of use ware etc as a human eye would do (much like in medical radiology), but involving considerably larger datasets”
“By making these analyses available, it would help disseminate best practices and familiarize archaeologists with the method.”
“Can help us to identify elements with the aim of photography”
“Carefully programmed AI and robots should be able to understand and undertake the time swallowing tasks invoked in examining each flake for use/non use , etc”
“Cf commentaire précédent” (See previous comment)
“Come sopra. Sono un aiuto. Uno strumento” (Same as above. They're an aid. A tool.)
“Could do repetitive tasks”
“Could help with pre-processing data” (twice)
“Dans le cadre de la détection de sites archéologiques grace aux images satellitaires, la constitution de bases de données de références peut être très intéressante.” (In the context of detecting archaeological sites using satellite imagery, the creation of reference databases can be very useful.)
“Data Acquisition and Processing, interpretation. Interpretible ML models would be effective”
“Define and classify in certain case the peak of the spectral images”
“Facilitate the treatment of data”
“*favorise l'accès au contenu d'un vase, quelle qu'en soit la nature, sans avoir à intervenir sur celui-ci (ex. en contexte funéraire, mais aussi domestique et cultuel).”* (facilitates access to the contents of a vessel, whatever its nature, without having to interfere with it (e.g. in a funerary context, but also in domestic and religious contexts).)
“Faciliter l'imagerie à des fins de publication” (Facilitating imaging for publication purposes)
“For the same reason than before”
“I believe AI and robotics can contribute by automating complex analysis workflows and enhancing pattern recognition in data processing. However, the lack of large, high-quality training datasets may severely limit the effectiveness of the latter, restricting its broader application in archaeometry.”
“I could see how AI could help to analyze large dataset of archaeometric data”
“I do not know exactly how”
“I think there is a possibility in running CT processes, to speed it up and reduce the human time cost (i.e. hours having to construct 3D models from scans). But there would still need to be human involvement”
“I’m not sure but it seems possible”
“If robots could be trained to do it, that would of course help”
“If you prepare the artifacts in a standardized form, robotics might help. AI cannot yet. I haven't seen any real application of robotics yet.”
“image pretreatment and analysis”
“Interpretation of complex data”
robots may be used for exploring delicate or inaccessible areas”
“It can improve the process of data analysis and interpretation of results”

“It could facilitate the identification of chemical components, alterations, reconstruct morphological lacking portion of archaeological objects, identify similar records or supply areas according to available data in geological maps and published literature, etc.”
“It could run the analysis, interpret its results, while the archaeologist would just have to put the material at the right place for that”
“It's possible in medicine than for objects , it's easier.”
“Je n'ai pas d'argument, mais ça me semble possible” (I don't have an example, but it seems possible to me.)
“La quantité de données à traiter devient trop important pour être utilisé de façon classique” (The amount of data to be processed is becoming too large to be handled in the conventional manner.)
“Large data sets processing, comparation and evaluation is one of the easiest tasks for AI.”
“Maybe lower cost and better analysis of the data.”
“Maybe to identify some elements that people can't see even in microscopic scales.”
“Minimalny kosz” (Minimal costs)”
“Much interesting question ! AI might help to better setup XRF data models. It could be interesting.”
“oui dans la mesure il s'agit de réaliser et d'analyser des données brutes et non de leur interprétation” (Yes, insofar as it involves collecting and analysing raw data rather than interpreting it.)
“oui mais en ayant une analyse critique de ces résultats et une bonne conscience des biais possibles en amont” (Yes, but with a critical analysis of these results and a clear understanding of possible biases upstream.)
“Pattern recognition and edge detection”
“permet d'analyser plus rapidement des objets afin de les identifier sans les abîmer” (enables objects to be analysed more quickly in order to identify them without damaging them)
“phenotypic analysis, automated identification analysis”
“Pour faire les premières analyses descriptives” (To perform the initial descriptive analyses)
“probably”
“Probably could speed up data collection and facilitate data analysis”
“Quicker analysis of the data”
“recognition automation from representative data”
“regroupements de données facilités par IA, qui en découle une interprétation ou analyse complémentaire .” (AI-facilitated data aggregation, resulting in additional interpretation or analysis.)
“Researches have shown how it is feasible to neural networks to process quantitative results (in the form of tabular data) from archaeometric analyses, e.g. classification tasks can be performed.”
“Robotics could be used to conduct scans on non-landscape scale projects and AI could be used to recognise patterns in the data”
“Robotics could help in automising the sometimes lengthy data acquisition procedure (spectrometry, diffractometry, imagery). AI could greatly help in the archaeometric analysis results processing.”
“Robotics help already in gathering data with e. g. GPR.”
“Robots are helpful creaturs”
“Robots do not get tired.”
“same thing, technical works”
“Since sample measurements are highly standardized (elemental concentrations, crystal structures, etc.), they should provide a solid learning base for training a DNN model.”
“Some of the analyses, although they require expensive machinery and equipment, are quite simple in the physical sense and could (easily?) be machine run.”

“Spectograms and graphical or tabular results from specific equipment can be processed using deep learning methods”
“Speeding up processes”
“speeding up processes, therefore making them cheaper as well”
“The repetitive activities in geophysics, image interpretation”
“There are some repetitive tasks to be done, and transfer of data could be automated. It might be more effective via IA to prevent mistakes in excel”
“they can improve the results, and lower time and cost”
“They could at least help”
“They probably could execute a CT scan, but would I want them interpreting it ? Not at the current level they are at, woefully untrained in paleopathology.”
“To détect archaeological sites on the surface”
“To explore elements that cannot be dismantled (such as axes in their sheaths, arrowheads in bones, etc.).”
“To make rapid comparisons of large-scale measurements.”
“To interpret data in a standardised way”
“to save time and gain accuracy…”
“Treatment of data and automated data acquisition could help”
“We already experienced IA for the characterization of porosity networks in neolithic pottery”
“Yes — AI and robotics are actually a perfect match for non-destructive archaeometric analyses. Here’s how: AI can process complex data from spectroscopy, 3D scanning, XRF, or CT scans, revealing material composition, age, or production techniques without damaging the artifact. Robotics can perform precision scanning, sampling, or imaging in delicate or hazardous conditions (like ancient tombs, underwater sites, or fragile remains). AI models can detect patterns, classify artifacts, and reconstruct incomplete objects virtually. Combined, they enable real-time analysis and decision-making in the field, improving both speed and accuracy of archaeological investigations.”
“Yes if the technology is easy to use and if the investment in term of founds is affordable.”
“Yes it could be automatic and maybe it will spent a little time”
“Yes, AI and robotics can greatly improve non-destructive archaeometric analysis by automating data collection, artifact classification, and results processing. Robots equipped with tools such as XRF or LiDAR can safely collect data from artifacts and sites without damaging them. Meanwhile, AI can analyze large data sets, recognize patterns, and help with artifact classification, provenance studies, and predictive modeling. These technologies also improve site analysis, site monitoring, and conservation efforts, assisting archeologists to gain insights faster while preserving archeological materials. With human supervision, AI and robotics provide valuable, efficient tools to advance archeological research.”
“Yes, I believe that AI and robotic technologies can greatly assist in conducting non-destructive archaeometric analyses by automating data collection, enhancing pattern recognition, and improving the interpretation of complex datasets. These technologies can help uncover subtle material properties without harming the artifacts, leading to more accurate and efficient scientific outcomes.”
“Yes, I believe that the use of AI, after extensive training, can assist in improving the recognition of compositional elements (not in their interpretation) but in a faster and more efficient manner, thereby accelerating the research process.”

The respondents who picked “No” answered:
“A mon sens c'est juste un gadget” (To me it’s just a gimmick)

"AI : No for the same reason. The cost of creating database is very high. We must first focus on creating data that can be later used for training. Robotics: not suited for field acquisition"
"I don't believe AI or robotics could replace human understanding of the matter and what the analyses were made for."
"I don't want our jobs being replaced by energy-consuming tools that cannot think for themselves."
"I have excellent colleagues who do this, and I want to continue working with them."
"Le traitement robotique enlève l'intérêt du travail réalisé par un humain. Il n'y a plus aucun sens à son travail si on lui enlève sa réflexion. De plus les résultats des sondages géophysiques sont insuffisants. Seule la fouille permet de faire les constats d'évidence." (Robotic processing removes the interest of work done by humans. There is no longer any point to their work if they are deprived of their ability to think. Furthermore, the results of geophysical surveys are insufficient. Only excavation allows for clear observations to be made.)
"Not currently"
"Not enough knowledge to judge"
"same as before, working on archeological materials requires a lot of critical assessment…"
"Same opinion as before for robotics. Yes for AI"
"The above issues of lack of access to equipment and lack of training for personal need to be addressed by greater access to equipment and greater training of personal. Avoidance and addressment of these issues by simply shifting the problem to digital tools, does not solve the personnel problem. It represents a rather simplistic avoidance of the problem. In any real-world scenario, the cost of any digital solution is greater than employing staff and providing adequate training and access to tools. The latter represents a more substantive long-term investment in archaeology."
"The questions are specific and the interpretations depend on the skills of the researcher. No authorization possible."
"What do you mean by AI ? Generative AI ? Algorithm ? Machine Learning ? This question is like asking "Do you believe maths could help". Yes. But it's so generic it doesn't make sense."

D. Artificial intelligence

D.1. How familiar are you with the use of artificial intelligence in archaeology?

Answer	Number of answers	Percentage
Very familiar	29	9.0%
Familiar	78	24.1%
Neutral	96	29.7%
Unfamiliar	70	21.7%
Very unfamiliar	50	15.5%

D.2. Do you use AI tools in your work? (automatic translation, machine learning models, chatbots, etc.)

Answer	Number of answers	Percentage
Yes	196	60.7%
No	127	39.3%

D.3. (Yes) - Which AI tools do you use in your work? (Select all that apply)

Answer	Number of answers	Percentage
Classic digital assistants and chatbots (e.g. Siri)	52	26.5%
Custom-trained models	52	26.5%
Off-the-shelf online tools or softwares (Grammarly, DeepL, Google Translate, etc.)	161	82.1%
Generative AI tools (ChatGPT, Copilot, Gemini, Midjourney, DALL-E..)	148	75.5%
Other (please specify)	16	8.2%

The respondents who picked "Other" answered:

"A PhD student is developing a tool that I intend to use"
"Automatic segmentation"
"Classical optimization techniques that are the first step of AI"
"Data analysis and synthesis. Text to data tools."
"GitHub CoPilot"
"Google lens"
"I work with AI researchers to develop tools and techniques to study ancient games using simulated play."
"NERFs and Gaussian Splatting (if these count)."
"Notebook LLM"
"OpenAI Whisper-1 API speech recognition."
"Semantic technologies such as Natural Language Processing NLP" (twice)
"Tests of platforms and tools for AI applied to images"
"Text analysis; Napkin AI, Claude"
"Transkribus" (twice)

D.4. (Yes) - To which ends do you use them? (Select all that apply)

Answer	Number of answers	Percentage
Code generation or correction	76	38.8%
Data conversion	57	29.1%
Detection of patterns, information or trends in data	64	32.7%
Help in finding bibliographic sources	76	38.8%
Image generation or correction	46	23.5%
Question answering	85	43.4%
Text correction	126	64.3%
Text summarisation	91	46.4%
Text translation	153	78.1%
Other (please specify)	16	8.2%

The respondents who picked "Other" answered:

"As LLM NPCs in Unreal Engine disseminating archaeological topics in my archaeogames, along with the 3D models"
"Automated data processing and description of archival materials (finds, documentation)."
"Automatic segmentation of images"
"checking a translation on which I have doubts, I otherwise write by myself (even though it might contain more mistakes, I prefer to do the efforts by myself to avoid losing my skills)... AI makes people lazy…"
"Data analysis"
"Find comparative objects"
"Lesson planning"
"Monument detection in lidar data"
"*normalisation de données issues de plusieurs sources, création de graphique, analyse des données*" (standardisation of data from multiple sources, graph creation, data analysis)
"novel 3D view creation"
"Pictures' analysis"
"Reasoning"
"*reconnaissance formelle*" (formal recognition)
"Text transcription"
"Transcription, image description and classification, information extraction,..."
"writing emails - so, text generation?"

D.5. (Yes) - How frequently do you use AI tools in your work?

Answer	Number of answers	Percentage
Daily	69	35.2%
Weekly	77	39.3%
Monthly	28	14.3%
Rarely	22	11.2%

D.6. (Yes) - In general, how much do you trust the results given?

Answer	Number of answers	Percentage
I trust the results	7	3.6%
I mostly trust the results	107	54.6%
I rarely trust the results	38	19.4%
I do not trust the results	3	1.5%
It varies (please specify)	41	20.9%

The respondents who picked "It varies" answered:

"All results need to be fact checked by a person who knows the field."
"Code-wise, AI are beasts ! I rarely double check their produces but for translation, it's always best to double check."
"*Dans certains cas, recherche d'informations ou compléments d'informations sur d'autres supports. Parfois vérification des résultats de l'IA*" (In some cases, searching for information or additional information on other media. Sometimes checking the results of AI.)
"Depends on the task and in any case I believe in human supervision and assessment of both process and results"
"Depends on the task"
"Depends what I am doing and what sources I am using."
"Depends what I ask of them, how specific and in-depth my query is"
"For chatBot, I do not trust the answer entirely, but they help me win time on code generation. For my own model I discuss their results in the discussion part of my articles"
"For translation i usually trust, for the rest i rarely trust."
"For translation work I generally trust the results, but e. g. for coding I use it only for small scripts or portions of a larger whole."
"I always check other sources myself"

“I always check the results.”
“I always check, but it can be a good starting point.”
“I always try to contrast the data provided or adjust the answer according to my needs (when I ask for text correction, for example)”
“I always try to double check the results”
“I trust the results but i control them”
“i try to verify the results”
“I use AI as a basis and then go further by my own and double check the information the AI gave to me.”
“I use AI as a tool and evaluate its results at all stages of research. I trust the results when the question and the technique fit each other.”
“If there are sources to a statement, I trust the results more (but there can still be errors so I usually check its sources). When using RAG it also improves, but it's not always100% accurate when GenAI tools. For code, it's easy to test if it works or not.”
“In some cases, it's easy to trust the results, but most of the time it takes time and patience to refine the results.”
“It depend of the kind of data I'm working with”
“it depends how you use the tools, and which tools you use”
“It depends on the process. I trust the results more when I can be involved in the process.”
“It depends on the topic and my level of the knowledge on the mentioned subject”
“It depends on the type of AI i use”
“It depends on what tool I am using and what I am using it for. For example, if I'm using ChatGPT to generate basic scripts I can trust but verify very easily, however, I would not really trust it to answer more specific technical questions. Alternatively, I would not trust image generators to produce accurate depictions of most things.”
“It is highly dependent to specific tool and task.”
“It is just results of a study. As always, I doubt.”
“It really depends. For example, it is very easy to generate code and verify that it actually does what it is supposed to do. With custom trained models it is essential to understand their capabilities and limitations properly, which should involve some for of testing and verification. My experience from custom models is mostly related to object detection / semantic segmentation / computer vision tasks.”
“*je complète par d'autres recherches documentaires pour vérifier*” (I round off with further documentary research to verify)
“Significant improvements, scientific research need to be checked twice, and code generation takes time the usual workflow is : generate, test, crash, regenerate, test, improve, test, and so on, but the results are pretty good, especially in summarisation research for data in papers, graphics generation.”
“specific words of our fields are very often badly translated, we have to check the translation”
“*sur les demandes simples, je fais assez confiance mais je vérifie ponctuellement, pour les demandes complexes je ne fais pas confiance et je vérifie toujours*” (For simple requests, I am fairly confident but I check occasionally. For complex requests, I am not confident and I always check.)
“*termes techniques mal traduits*” (technical termes incorrectly translated)
“The results are a starting point and have to be checked”
“The results are quite good when it comes to creative ideas; however, if I use it to get information in my field, I need to check the given information. The incorrect or nonexistent answers are not rare.”
“the trustworthiness of AI generated answers/data depends on a larger number of parameters (skills of the user, training data, availability of information etc)”

"When using AI for paperwork (mainly preparing bureaucratic reports) or for code writing I usually trust the result, although I check them and possibly modify and adapt the texts. When academic/scientific data is involved I usually do not trust the results and systematically and deeply check or conduct parallel, personal research/writing etc."

D.7. (Yes) - Are you allocating or would you allocate part of your budget to AI tools to facilitate certain activities?

Answer	Number of answers	Percentage
Yes	112	57.1%
No	84	42.9%

D.8. (Yes) - If so, how much does or would this amount represent annually?

Answer	Number of answers	Percentage
€ 0–10K	62	55.4%
€ 10–50K	12	10.7%
Over € 50K	7	6.3%
I do not know / No opinion	31	27.7%

D.9. (No) - What could motivate you to use AI tools in your work? (Select all that apply)

Answer	Number of answers	Percentage
Ability to delegate tedious, repetitive or time-consuming tasks	67	52.8%
Cost-efficiency	26	20.5%
Increased speed	43	33.9%
Massive data processing	70	55.1%
None	26	20.5%
Other (please specify)	7	5.5%

The respondents who picked "Other" answered:

"a formation to how use correctly AI"
"Get paid for it"
"I work with scholars and students implementing these methods"
"*je ne sais pas*" (I do not know)
"No specific needs"
"*Per ora non ne sento la necessità.*" (I don't feel the need to at the moment)
"*recherches bibliographiques*" (bibliographic research)

D.10. How would you qualify AI's current and foreseeable impact on archaeology?

Answer	Number of answers	Percentage
Positive	140	43.3%
Negative	28	8.7%
Ambivalent	155	48.0%

D.11. Please specify here your answer to the previous question:

The respondents who picked "Positive" answered:
"a lot of the repetitive task can be assisted by AI."
"AI can bring new methodology to archaeological research"
"Ability to delegate tedious, repetitive or time-consuming tasks, Cost-efficiency, Increased speed, Massive data processing"
"AI can automate repetitive processes and time-consuming, as well as provide help in interpreting data"
"AI can help in many fields and in many situations, since the actual archeologic work till the reporting of results."
"AI can recognise the patterns, help with the processes and automate them so the time saved can be allocated elsewhere. And the digitisation can hugely benefit from the use of AI, from auto image cropping, detecting patterns, as well as facilitating scanning processes and aiding user experience while accessing the collections online."
"AI could be an improvement in our work flow because It could do repetitive tasks faster then us"
"AI could offer new opportunities to archaeologists who do not have access to resources in digital methods and tools"
"AI gives us the possibility to streamline many processes, so we have more time left for the research itself"
"AI has great potential in many fields. In the short term, helping with simple repetitive tasks would save time (money) and effort (potentially reducing stress levels of overworked staff). In the longer term to become the basis for a variety of tools to actively aid investigations. Archaeology was one of the disciplines present in the early history of AI. This illustrates that the potential has long been known. It is only natural that it should be at the forefront of future developments."
"AI has potential but it is still in early stages. In our organisation there is also a lack of skillsets needed to utilise AI properly and using its potential."

“AI is a great chance for archaeology.”
“AI is a tool. As a new tool, it could provide new information like the development of 3D.”
“AI is here to make more efficient the processes”
“AI is starting to have an impact on archaeology, especially in areas like data classification, pattern recognition, and metadata enrichment. However, its full potential is still unfolding. For AI to have a meaningful and sustainable role, we need to critically assess how it interacts with archaeological data and practices. The challenge is not just technical but also methodological and ethical, as its integration requires rethinking workflows and responsibilities in knowledge production.”
“AI looks like a good tool to process data and to gain time for some boring and time consuming tasks, but should be used with precaution of course”
“AI needs to be checked, but it is undoubtedly useful on basic tasks and will only grow its capabilities.”
“AI will allow large amounts of data to be collected, processed and analysed at a speed never seen before by the most powerful computers. The technology will allow archaeologists to collect data more efficiently and accurately, as it has been and still is with the use of GPS technology or remote sensing techniques such as LiDAR. IA will be able to provide archaeologists with a wide range of new technologies that can help them better identify and analyse sites, etc.”
“AI will be useful in data management”
“AI’s current and foreseeable impact on archaeology is overwhelmingly positive. It is transforming the field by enhancing data analysis, improving pattern recognition in large datasets, and supporting more efficient documentation practices. Looking ahead, the integration of AI will continue to support interdisciplinary research, foster new interpretations, and open up innovative avenues for understanding and protecting cultural heritage.”
“AI's current and foreseeable impact on archaeology is significant and transformative. Right now, AI is already enhancing various aspects of archaeological research, including: Data Analysis, Predictive Modeling,Virtual Reconstructions..”
“AI's current and foreseeable impact on archaeology is transformative. It enhances data analysis, automates artifact recognition, supports 3D reconstruction, and assists in predictive modeling of archaeological sites. These capabilities significantly accelerate research processes and open new perspectives in the interpretation of the past.”
“Although AI is not yet concretely useful in archaeology, the numerous avenues of reflection will probably lead to relevant processes”
“although I have not yet participated in AI based studies, several colleagues did and were very positive. AI could save significant amount of time, and also provide much more precise results in, for example, refitting of lithic artefacts - providing important data for technological analyses, but also information on spatial distribution of finds that were produced from the same core. The same method can be applied for fragmentary human remains (e.g. fragmentary Neandertal fossils and so on), providing better refitting and reconstruction, which, when combined with 3D geometric morphometric based reconstruction, can greatly increase our understanding of human evolution and morphological variation in space and time.”
“Any tool that makes work "easier" is positive. But I mean this at a "low level" of the potential impact of AI, rather like computing in general. Because at the moment it's mainly generic tools that I use. The potential of specific tools could be significant for various tasks.”
“Artificial intelligence offers many advantages to the field of archaeology and can help archaeologists discover patterns and insights that might otherwise be missed.”
“As a tool to facilitate and speed up work”

"As long as we treat them as tools and are wary of the outputs (i.e., see to verify them) I think they can only be a positive because of the speed which which they can manipulate and parse very large data sets."
"As with everything to do with AI, the concern is about malicious use and/or the disappearance of certain jobs that would be replaced by this technology, at the risk of no longer having any human control behind it."
"Because of uncertain and vague processes AI can provide some additional information."
"Because archaeology covers different logical relationships and also measures data information, data driven computational models based on intelligence and learning frameworks would be feasible in most cases."
"believe the application of AI is helping researchers to explore research topics in creative ways. Additionally, they can improve the accuracy of the research works while saving time. For proper use, it is advised to use these tools in a wise and not 100% relying on the results."
"Big data analysis and quick processing huge database"
"Bonne aide pour certaines tâches" (Good help for certain tasks)
"Brak możliwości w Pl pracy z Al dla archeologa" (No possibility of working with Al in Poland for an archaeologist)
"Çok gelişiyor" (It's developing rapidly.)
"Computer vision, natural language processing"
"Correct classification of archaeological remains may be useful in terms of modelling."
"Could help to increase the data processing speed and outline important research questions."
"Delegate repetitive or time-consuming to a software could be interesting for research work to liberate time to focus on other aspects."
"Efficiency gains with rote reporting and communications"
"faster and optimal interpretation and data acquisition"
"For Data Analysis and Pattern Recognition tasks specifically for remote sensing data, it provide efficient solutions."
"Gain de temps et travail de meilleure qualité globale, accès à des ressources internationales jusque là inaccessibles (notamment grâce à la traduction)" (Time savings and better overall quality of work, access to previously inaccessible international resources (particularly through translation))
"Gain time and more accuracy"
"Good help for many task"
"good impact"
"help on repetitive tasks; build common database and extract data for meta analysis, cover wide time scale, improve communication between searchers by improving the quality of papers and abstracts languagewise (better translation of ideas)."
"Help to accelerate process"
"I am convinced that photographs and technical drawings (which are outrageously numerous in archaeology) constitute a good training base for automatic classification via AI/ML"
"I assess the impact of AI as highly positive. Naturally, any AI-generated output requires review and validation, but it significantly accelerates workflow, particularly in the field of digital archaeology. Since archaeologists are not necessarily trained as computer scientists, AI can help bridge technical gaps, especially in areas where time constraints make it challenging to develop advanced computational skills."
"I believe AI will significantly transform the way we conduct archaeological research. Archaeology involves many repetitive and tedious tasks, which are well-suited for automation."

“I believe that AI is already changing the way archaeological work is organized, both in the field and in the laboratory; the prospects for improvement and the concretization of results will be perceptible in the next two years”
“I changed my work as much as when efficient photogrammetry came out 10 years ago.”
“I have already applied deep learning and other AI methods with success, and I have a research project to develop its application”
“I lack expertise but I am aware of the increased use of AI in many scientific fields.”
“I previously mentioned that artificial intelligence contributes to 3D modeling processes in a fast, accurate, and automated manner. This has a highly positive impact on fields like archaeology as well. AI greatly facilitates the digital modeling, analysis, and preservation of archaeological remains. Moreover, it plays a significant role in predicting missing parts of historical artifacts and in classifying large datasets.”
“I think AI can help in managing large quantities of data, in enhancing statistical work for example and looking for data necessary to the research subject”
“I think AI is the future but we need to understand the things we are doing (i.e., enhance our AI literacy)”
“I think AI will help archaeologists to understand the past as we have not seen earlier.”
“I think it can advance a lot of the menial tasks involved in archaeological data generation and post processing so that humans can do interpretation and analysis and then science communication.”
“I think it could be a great help in carrying out time-consuming and repetitive tasks”
“I think it general archaeology stands to benefit considerably when it comes to improvements in data processing efficiency and novel ways interrogating data. Furthermore, improvements in prospection of archaeological sites and artefacts with help from AI seems to be a promising field.”
“I think it has great potential for automating data collection (e.g. by writing parsing scripts), it can help with writing, learning new topics/methods faster, explaining errors in coding, creating new apps, and in disseminating archaeology and heritage.”
“I think more time could be given to critical thinking, creative ways of preserving heritage, and engaging with people, and less time focusing on finding information, analysing data, and writing reports.”
“I think of AI as a technologically advanced tool that can facilitate and speed up every day work, the processes of data analysis and research”
“I think there are appropriate ways to use it as a tool that will provide positive developments to the field, as long as archaeologists do not abuse the technology to say it does more than it is able.”
“I think, that AI is likely to become an increasingly valuable tool for archaeologists, helping them make discoveries in places that are hard or even impossible to access, and revealing new insights from data that’s already been collected.”
“I trust that - if we teach users well and make them aware of chances, challenges, problems etc of AI it can be used in a proper way and can take over some of the boring everyday work, leaving more room for creativity, critical thinking etc (hopefully)”
“I would be madness to deny that AI, like the smartphone, will change everything”
“I would describe the current and foreseeable impact of artificial intelligence on archaeology as transformative and promising. AI enhances the efficiency of data analysis, aids in the classification and interpretation of complex archaeological findings, and supports predictive modeling for excavation planning. In the near future, it is expected to play a key role in managing large datasets, identifying patterns invisible to the human eye, and enabling more precise reconstructions of the past.”

“if used correctly it is great!”
“If used correctly, it can help to produce/test archaeological hypotheses.”
“If used reasonably and cautiously AI can certainly improve many stages of research work”
“I'm most familiar with using object detection and sematic segmentation techniques to detect archaeological features from remote sensing data, which is having a huge impact on archaeology and heritage management. It feels like some of the other use-cases are also highly promising, but probably involve some challenges as well. All in all it's definitely net positive.”
“Image recognition, Object classification, Virtual archaeology”
“In my opinion, AI will be used more widely worldwide for most of the works. So, archaeology can not be separated from this. AI will help archaeologists in interpretation, in understanding materials, even in the excavation process.”
“in order to speed up the work”
“increase of Quality and cost reduction”
“Increasing productivity.”
“It can help study as a much faster rate and allow studies and analyses that were too much time consuming in the past. AI is a tool in the same prospect as calculator to make calculus easier”
“It could help improve and speed up different types of analyses and data collection strategies, as well as improve (and possibly decrease the price of) different analyses that require expensive equipment and training. In addition, AI tools are being used in the promotion of, in my case, archaeological heritage (through 3d reconstructive models, augmented reality, etc.).”
“It give more possibilities”
“It gives and enhances the possibilities to do different types of archaeological work”
“It has the potential to revolutionise and democratize archaeological practice and research”
“It helps and can help even more if built wisely.”
“It helps, it is not 100 percent trustworthy but it helps”
“It is reducing time spent on tedious task by simplifying the creation of one-off tools used to do data analysis, and easily create custom software to do image analysis.”
“It will allow to accelerate otherwise very time lengthy tasks, process more objects/information that would otherwise not be processed and just stored.”
“It will speed up data analysis, uncover hidden sites with advanced scanning, and create even more detailed 3D models. It will help preserve artifacts by predicting damage and assisting in restoration.”
“AI will also make sorting and classifying discoveries much faster. While it won’t replace archaeologists, it will make research, conservation, and discoveries more efficient and exciting than ever!”
“It’s a great innovation in preserving and enhancing heritage sites”
“Many repetitive, non-analytical tasks could be entrusted to artificial intelligence. This is the only way to explore large-scale analyses too.”
“May be helping to manage massive data collected or to understood results giving ideas”
“ML models can streamline processing of massive amounts of data in archaeology.”
“More time for investigation”
“My positive comment based on impressions I have is that AI will relieve archaeologists of repetitive demanding time consuming work with lithics and May already do so.”
“Nous pourrions gagner du temps sur des tâches simples, répétitives mais chronophage pour se concentrer sur la réflexion” (We could save time on simple, repetitive but time-consuming tasks in order to focus on thinking.)

“positive — AI’s current and foreseeable impact on archaeology is broadly positive. It speeds up analysis of massive datasets (e.g., satellite imagery, site maps, 3D scans, ancient texts) that would take human researchers years. Enables non-destructive testing and virtual reconstruction of fragile or incomplete artifacts. Assists in predicting potential archaeological site locations using AI-based geospatial analysis. Enhances artifact classification, language decoding, and pattern recognition far beyond manual capabilities. Creates interactive virtual heritage experiences for education and cultural preservation.”
“Positive from a ML point of view if carefully used (like any form of statistics). Automation for data completion: less sure”
“*-pour aider dans l'analyse des données -pour la restitution des sites 3D -pour aider la datation…*” (-to assist in data analysis -for 3D site reconstruction -to assist in dating…)
“RAS” (Nothing to report)
“recognition from sufficiently representative dataset (materials or geometric patterns on metal or ceramic objects)”
“Saving time” (twice)
“saving time and processing large batches of data”
“seeing things invisible with nake eye”
“Si il améliore la qualité du travail, comme outil pour les interprétations il faut rester très prudent quant aux erreurs. Positif dans le traitement d'une grosse masse de données.” (Although it improves the quality of work, as a tool for interpretation, one must remain very cautious about errors. Positive in the processing of large amounts of data.)
“Site detection and Remote sensing; Artifact recognition e classification; cultural heritage preservation. Foreseeable future impact: advanced dating techniques to refine dating methods by by analyzing stylistic changes across cultures and time periods; ti refine site mapping and documentation”
“Spare time”
“speed and technic”
“Still need humans to do the thinking and theorising. But AI can do the boring stuff.”
“Text and data mining could help by accessing accurate and high quality references.”
“The ability to consult and search whole digital libraries. Ability to retrieve and process data from many sources with minimal human input. Ability to simplify administrative tasks.”
“The budget question is tricky - how much? Which budget? Also, many of these tools are currently free/covered by university overheads so it's hard to know how expensive they truly are.”
“The current AI impact is modest and I believe we are in the beginning of transformation.”
“the current and future foreseeable impact of AI in the field of archaeology will cast positive on the development of the field.”
“The employment of new methods is always positive”
“The quality of AI- results in archaeology depends on data for training. It is not a question of the method, but on training. This can be difficult sometimes, but realizable. Human-based criticism is subject to the same criticism. Whereas AI-based results can be analyzed and criticized, human-based results sometimes are accepted depending on the authority of the person. In that sense, AI-based results are more transparent, even if there is still a lot of work to be done to open the black box.”
“The use of AI for data management is clearly crucial to get old data back or archive old documents from previous projects.”
“There is a library of unpublished reports rotting away in digital and physical repositories. Ai could aid their use in research.”

“There is high potential for both the generic workflows (administrative tasks, publishing, etc.) and also to the specialised labour-intensive workflows (bulk description, big data analysis, automated information extraction, etc.).”
“There’s obviously a lot of benefits of using AI, but the challenges come from ethics. 1) environmental impact. 2) data ownership. 3) biases in data. But that said, it will absolutely transform heritage for better. It just needs to be fully considered in its use and application.”
“this allows for a much wider consideration of the documentation”
“This can help us if we think logically.”
“this is just the beginning of the wave... (and it's an old man who's telling you this)”
“This would make it possible to automate certain repetitive administrative tasks or those with little scientific content, so that we can concentrate on the real work of research.”
“time saving”
“Utile pour définir des catalogues d'objets ou autres” (Useful for defining catalogues of objects or other things)
“Valuable tool if developed correctly and used appropriately”
“Very positive”
“very useful for data analysis and translation of texts”
“Very useful for trivial and time-consuming tasks and for developing specific tools for new methodological approaches”

The respondents who picked “Negative” answered:
“AI is not a tool that should be used in general and especially not in archaeology. I am strictly against it.”
“AI is unreliable and its results cannot be trusted without human checking, extremely damaging to the environment, and will result in loss of essential skills amongst workers and job losses”
“AI must be stay a tool, no more”
“Archaeology suffers from a general lack of detailed, critical appreciation of the theoretical nature of our basic systematics. Instead, these systematics are mistakenly viewed as methodological problems (i.e. classification, recording, sorting, etc.), requiring a technical solution. This has been the default position since the 1960's, where the solution has been sort through digital techniques, statistical applications, morphometrics. All these approaches have failed to yield any adequate solution to systematics, exactly because it is not actually methodological problems: but theoretical problems. “Archaeological data that is sorted without recourse to a specific archaeological question has typically proved redundant, often in a relatively short period of time. Treating these issues as matters of objectivity (a term wholly misunderstood by archaeologists, compared to how it is more fully appreciated in the natural and materialist sciences, does not help), and universal sorting techniques - separated from specific research questions, will fail. The error rests on the mistaken belief that AI can do some of our work 'better': it will not. It will, however, do our tasks 'differently'. The success of AI will rest of whether that degree of difference represents a legitimate improvement, and whether or not the effort to remodel archaeology in general around that difference is either either socially or philosophically acceptable in the short to medium term. I am certainly not antagonistic to the investigation of the potential of AI in archaeology but I would rather we start from a position where we are honest about its purpose: its fashionable, and projects using it are likely to get funding. It does not, however, have an in-built guarantee of providing anything 'better' that cannot be currently be achieved through passive or analog technologies, and skilled staffing. Archaeology should look to

solve its problems through better staffing and training, and improved retention of that skilled staff, rather than their replacement."
"cela supprime notre travail" (it eliminates our work)
"Currently, we have students (i.e. the future archaeologists) who rely on an AI they don't understand to do the tasks we ask them to think about. I don't think that's great. And, above all, we are aware of how much energy is required to run an AI. It's going to worsen the current climate crisis, it's going to impoverish entire regions of the world, and created even more disparities between those with access and those without access. I have no doubt that once everyone is hooked, prices will be raised and yet again some will benefit and others not, arbitrarily."
"In 20 years, I want to talk to real colleagues, who can defend their results with better arguments than "the AI said so!""
"Generative ai does not do what people claim. It is not ethical to use. It produces a simulacrum of human work with no substance and many errors, technical and ethical."
"i don't see it as a relevant tool (except for grammatical / translation tools) and people who rely on it tend to trust the AI results without questioning them or understanding the process that leads to these results"
"I remain very sceptical about the heuristic and creative aspects of the AI."
"I work mainly with archival materials. Allowing the use of AI in this scope might be safe if and only if it is trained on our own corpus. Otherwise we may risk contaminating our digital data."
"I would qualify AI's impact on archaeology as currently limited: despite being used for decades, its application has largely remained a niche tool within scientific research, without significantly influencing mainstream archaeological practice. However, I remain hopeful that as more researchers contribute to AI applications, this will provide a stronger foundation for increasingly effective and valuable implementations in the field."
"Je souhaite conserver mon emploi et celui de mes collaborateurs" (I wish to retain my job and those of my colleagues.)
"l'archéologie est une science humaine" (archaeology is a human science)
"L'archéologie est une science humaine. HUMAINE." (archaeology is a human science. HUMAN.)
"L'impact c'est que nous allons écrire et réfléchir de moins en moins, car la tentation sera grande de tout faire faire par l'IA avec un glissement dont nous nous rendrons pas compte encore. On finira par rendre l'IA obsolète puisque sans nos créations, elle tournera en rond avec les textes que nous aurons écrit avec son aide et notre recherche finira par s'appauvrir. L'appauvrissement intellectuel est le danger majeur de l'IA générative. On le voit déjà chez les élèves et les étudiants." (The impact is that we will write and think less and less, because the temptation will be great to have AI do everything for us, with a shift that we will not yet realise. We will end up making AI obsolete because without our creations, it will go round in circles with the texts we have written with its help, and our research will eventually become impoverished. Intellectual impoverishment is the major danger of generative AI. We are already seeing this among schoolchildren and students.)
"loss of critical mind, of skills, of ability to adapt, of knowledge... for humans…"
"Mon corps de métier ne se prête pas à l'usage de l'IA (ou si peu)." (My profession does not lend itself to the use of AI (or very little).)
"problème d'interprétation non évolutive contrainte dans un schéma prédéfini" (non-evolving interpretation problem constrained within a predefined scheme)
"Risks of wrong decisions"
"Selon moi, l'IA n'est qu'un moyen de plus pour exploiter l'être humain" (In my opinion, AI is just another way to exploit the human being.)

“This leads to the loss of basic archaeological skills and knowledge. People would rely on a machine that doesn't possess such skills.”
“Using chatGPT to produce our codes, using automated tools for statistic etc and then demanding from our students that they think for themselves and not use AI to do their works is stupid and hypocritical. Add the energetic cost that we cannot afford in a context of global warming, there is no way this is a sustainable way to do science.”

The respondents who picked “Ambivalent” answered:
“A more universal understanding of the architectures and training procedures for AI must be made aware. Current AI models are typically opaquely trained on an unknown dataset which has ethical problems (intellectual theft) and scientific problems (overfitting on training data, hallucination, unreproductibility). Whilst any deep learning architecture can theoretically model the underlying data generating process, if the archaeologist does not understand that process then they have no understanding at all.”
“Archaeological work relies on constructing theoretically sound models of data generation, AI models are principally aimed at predictive models. As such they have no "world model" and cannot provide an understanding of why the predictions are the way they are. AI models are a black box which sometimes work, this is fine if we are able to discern when they do not work (e.g. classification) but are highly dangerous when we cannot (e.g. pseudoscientic prediction of ethnicity).”
“Again, there are some specific positive uses, e.g. for pattern matching, but mostly I find GenAI is over-hyped” (twice)
“AI can help archaeology but a rational use is required”
“AI can help us in our task, but a direct approach to the data and a human interpretation are necessary to avoid going astray.”
“AI could offer opportunities to improve archaeologists' workflows and data analysis but I think this should be done carefully with systematic human control, or this could lead to poor data generation.”
“AI has uses in processing large and complex data sets. However it needs human oversight to prevent AI determining results and outcomes. The danger of AI is that its results are very beguiling: they look like real outputs rather than created ones.”
“AI in archaeological research assists with answering questions, finding relevant bibliography, and refining text structure and language. However, it also fundamentally reshapes the way research is conducted.”
“AI in archaeology is, so far, * either an old affair * or a fashionable trend, poorly mastered by its proponents. What would be the consequences of AI application to archaeological information and/or reasoning is obviously unsure and ambivalent, since the use of recent IA technologies (LLM) is erratic and at its beginning. Even if the technology is new, it is uncertain that it might bring something new in terms of archaeological reasoning, discourse, and data sharing. (Which remains, even today, one of the main issue in archaeology: not the lack of powerful, costly, and ecologically not sustainable technologies such as IA, but the lack of data sharing and collaborative approaches in our community). I doubt IA technology can do something about that, hence i thing current and foreseeable impact on archaeology are ambivalent.”
“AI is a tool, it can be used in positive and negative ways like everything.”
“AI is such fast moving technology that it can be interesting to automated repetitive and time consuming task but it can also allow easily fraud IMO”
“AI will make it possible to reduce certain language and academic barriers. This will open up incredible possibilities for collaboration and data mining. AI will always be learned through

third-party software or applications, which are black boxes where it is difficult to know what algorithms are being used. Unlike photogrammetry, for example, not everyone can learn the basic principles of AI."
"apparently time saving; new methodology to make progress on old questions; distancing the researcher from the object of study; energy-consumption; the question of environmental ethics arises"
"Artificial Intelligence (AI) is increasingly becoming a transformative force across a variety of disciplines, and archaeology is no exception. The current and foreseeable impact of AI on archaeology can be described as both revolutionary and multifaceted, offering powerful tools that enhance efficiency, precision, and interpretive capacity. However, as we embrace these advancements, it is equally important to remain critically aware of the ethical, cultural, and epistemological implications they carry—ensuring that technological progress does not come at the expense of responsible and inclusive archaeological practice."
"As all research tool, it need good research question and expertise to use them correctly. It could improve our analysis seeing pattern that are not detectable or helping data analysis in general but it need train user that understand the limitation of the tool to not overinterpret or rely to much on it without critics."
"As for archaeometric studies, AI should be sued with caution, by people who understand what they do, otherwise it will be like using a pXRF for ceramic analysis directly with the poor quantification given by the equipment on dirty samples."
"As for the general issue of AI-assisted job, I don't think that augmented productivity is necessary a good thing."
"attention à la création de fausse preuves, prévoir le même genre d'attention avec ces outils que les autres champs scientifiques et sociétaux." (Be careful not to create false evidence; exercise the same caution with these tools as you would in other scientific and societal fields.)
"Cela dépend des champs explorés." (It depends on the fields explored.)
"Come ogni cosa e in ogni campo. È uno strumento. Un aiuto. Deve però esserci una persona competente dietro che valuta, interpreta i risultati o qualsiasi cosa sia." (Like everything else, in every field. It is a tool. An aid. However, there must be a competent person behind it who evaluates and interprets the results or whatever else there may be.)
"Could help with time-consuming tasks"
"Dans mon utilisation, elle n'est pas systématique et demande toujours d'être vérifiée." (In my experience, it is not systematic and always needs to be verified.)
"Depending on the quality of the goals and the accuracy of the questions"
"Depends on the goals."
"Domaines encore méconnus et non maîtrisés pour avoir avis correct" (Areas that are still unknown and not fully understood in order to form a correct opinion)
"Given that field archaeology relies on information gathering primarily through touch and sight (for excavations), basic data acquisition seems to me to be difficult to automate. I do, however, recognize that some computer tools can help with this acquisition."
"good for automation of tasks, dangerous (ie non understood "black boxes") for analytical purposes"
"I am generally not too keen on using AI, however I am not familiar with the possibilities and positive impact it could have on archaeology."
"I am not familiar enough with its current use to say."
"I am scared about how and who is training the algorithms (that have consequences on given results and on a kind of limitation and manipulation of topic to be assessed in research). On the other hand I

think AI tools could significantly help in predicting modelling in Archaeology, data exploration and visualisation"
"I am very interested in AI, but I am yet to find concrete ways of applying it to my own work beyond just simple task automation. I hear a lot of hype about AI, but when it comes to ways to actually use it in archaeology, I struggle to see current applications."
"I believe AI can help us standardize and perform redundant tasks faster. However, I find it dangerous to apply predictive models to past human behavior, or to project hypotheses that are ultimately based only on what is already known and not on what we have yet to know."
"I believe in the critical appreciation of any technology used. I am worried of the increase in digital black-boxing and despite the obvious gains in making sense of large amounts of data or synthesizing information, potentially there may be lots of issues that need attention also."
"I believe that AI is a potent tool and can be seen as both positive and negative. I think it depends a lot on how it is used and by whom. Since archaeology is an activity that is destructive of traces and at the same time 'constructive' of history, I think the greatest attention should be given to how we interpret the outputs provided by AI by being careful about how we have constructed it and influenced it with our ideas."
"I don't know yet."
"I find some uses positive but the negative development is the AI training on pirated material (my research articles were used without my consent), the result ambivalent"
"I have used commercial AIs (e.g., ChatGPT) in a limited capacity to write small bits of code, but I am generally very wary because of their lack of transparency and "hallucinations." I have seen a few examples of the uncritical use of AI, where researchers either depend too much on black box LLMs or apply it to cases where it isn't really necessary (e.g., using AI to help visitors navigate a very small museum). However, I have been very interested in projects that have developed their own LLMs to answer very specific questions. I am inclined to think that control over the training data and the algorithm are necessary for robust use of AI in archaeology."
"I haven't spent enough time yet and therefore don't have enough experience to have a definitive opinion on this subject."
"I still don't have enough experience in using it, to have an opinion."
"I think implementing AI is positive because it can facilitate many processes that can be automatic most of the time. Of course, rigour is needed, and it cannot be implemented directly without testing it.
"I still think that human checking is important to avoid misinterpretation of data."
"I think it depends how it is used. To run pre-assigned protocols etc yes (i.e. a human has designed something, and then the ai runs it for time costs etc). My concern is it taking the human intuition out of archaeology, so I think it would need to be working collaboratively with, rather than simply running, ai. But I am open to the possibility"
"I think that human control remains necessary above all to avoid losing qualitative data"
"I think that AI must use as a tool and not as a solution. I see colleagues that use It in the wrong way"
"I use AI as a basis and then go further by my own and double check the informations the AI gave to me."
"I use artificial intelligence in certain cases"
"I'm sceptic"
"IA se base sur des données établies, l'abstrait et la créativité semble encore limité pour ce qui est de la pensée pure." (AI is based on established data; abstraction and creativity still seem limited when it comes to pure thought.)

“Ideally time saved leads to more time doing further research. In practice, within commercial archaeology, it ends up becoming a cost saving device generating nothing the same level of analysis for less.”
“If data driven it would be helpful as archaeological data is often unwieldy and difficult to interpret”
“If we could train a model to work on our specific tasks, that might be useful. But will we ever spend enough time training an AI tool?”
“Il ne faut pas que l'usage de IA soit un prétexte pour réduire les budget et les effectifs.” (The use of AI should not be a pretext for reducing budgets and staffing levels.)
“Il n'est pas toujours indiqué ce qui est de l'ordre de l'IA, par exemple dans les plateformes de gestion de l'activité archéologique” (It is not always clear what falls within the scope of AI, for example in platforms for managing archaeological activity.)
“I'm afraid that the development of AI in archaeology will reduce our human resources.”
“I'm still uncertain, since AI isn't advanced enough to deliver significant results.”
“I'm wary of expanding the use of AI tools while we have not solved the issue of their environmental impact; I'm also worried about sidelining researchers that do not have the time and resources to invest into the development of AI tools, particularly those in the Global South.”
“impact is just NOT foreseeable”
“In some parts it can be helpful to have AI use in our work, but for a majority part of our work we don't need to have it because even if we can translate or resume an article we have to be confident on the AI, that is not the fact today.”
“It can help archaeological research to go faster or deeper, but I'm afraid that human interpretation and sensibility might disappear, that archaeologists might become simple robots, or might loose their jobs. Humans studying humans seems more accurate.”
“It could make some tasks easier to complete, but not many.”
“It depend of the task, it could be really helpful for increasing the speed of data processing and to avoid repetitive tasks (turning tables for photogrammetry acquisition, etc) but in France 3D modelling is not completely understand by the hierarchy and could lead to dismissal for economic reasons (a computer with automatic tasks in AI is cheaper than an specialist)”
“It depends of the task, the more we will use it the more it will become accurate.”
“It has to be use as a tool and not a magical solution for everything. Simplify data processing but not replacing the thinking process of the archaeologist.”
“It is difficult for me to imagine all the benefits of AI in archaeology. I believe that it would be useful in some segments, for example in archiving and processing data and subsequent searching and extracting the same data. It seems to me that AI will occupy an important place in all sciences in the future, so I think it is important to emphasize that its impact should be well controlled and good parameters should be set that will be useful in research and scientific work.”
“It is not enough, human intelligence remains necessary.”
“It is not sufficient yet”
“It is too early to say. AI is a tool that can be very useful if well used.”
“It is way too early to assess the impact on the sector despite the meaningful potential of Ai employment”
“It need to be better understood by archaeologist before being used widely”
“it remains to be seen if inductive insights can be generated as opposed to deductive responses to questions asked.”
“It requires verification.”
“It will most definitely help but many jobs will suffer from it”

"It would effect the archaeology if it was a wide-spread practice. However it is not. Generally, it is much more difficult with Humanities...."
"It's just tool, not ombilicus of thought. If it's useful, great, if not, put it away. The investment devoted to it is disproportionate to its real contribution."
"je n'ai pas confiance en cette nouveauté" (I do not trust this new thing)
"Je pense que certaines taches de description et de croisement des données pourront être dévolues à l'AI mais qu'un humain sera toujours nécessaire pour la validation et l'analyse qui en découleront." (I believe that certain tasks involving data description and cross-referencing could be assigned to AI, but that humans will always be needed for the subsequent validation and analysis.)
"just need to see what help us or not"
"Lack of help, of models or or set of images (not enough artefact reproductions that are not in open data...)"
*"Le recours à l'AI ne doit pas se faire au détriment de la réflexion archéologique nécessaire et de la critique obligatoire des sources exploitées." (*The use of IA must not be to the detriment of the necessary archaeological reflection and criticism of the sources used.)
"Les outils doivent aider à observer et réfléchir et ne pas remplacer l'observation et la réflexion" (Tools should help us to observe and reflect, not replace observation and reflection.)
"l'IA est un outil potentiellement très riche de promesses. Mais elle ne se substituera pas à la chaîne très complexe des raisonnements archéologique. Exemple concret dans le domaine qui est le mien : identifier la provenance d'un vase à l'échelle de l'empire romain nécessiterait des bases de données que personne n'est actuellement en mesure de mettre en place; sauf coordination internationnale de grande ampleur... le jeu en vaut-il la chandelle ?"(AI is a tool with potentially enormous promise. But it will not replace the highly complex chain of archaeological reasoning. A concrete example from my own field: identifying the provenance of a vase within the Roman Empire would require databases that no one is currently in a position to set up, unless there were large-scale international coordination... Is it worth the effort?)
"L'IA peut être un outil intéressant dans la mesure ou elle reste un outil, pour gagner du temps, automatiser certaines taches mais ne doit pas se substituer et interférer dans les travaux de recherche et de réflexion" (AI can be a useful tool insofar as it remains a tool for saving time and automating certain tasks, but it must not replace or interfere with research and reflection.)
"Like any other science, while there is certainly a fear of misuse (plagiarism, subpar research), I believe strongly that there are many spaces in which AI can be useful, especially in fields a researcher is not specialized in - generating images for ppt presentations for example. AI grammar models are already of great help for everyone who need to prepare a good publication in a language which is not their native, or read a text in a language they are not familiar with"
"Like everything, can be useful or not"
"L'intelligence artificielle doit encore faire ses preuves. Nous n'avons pas assez de recul" (Artificial intelligence still has to prove itself. We don't have enough perspective yet.)
"manque de recul" (lack of perspective)
"Ne pas se fier aux résultats, trouver les preuves" (Do not trust the results, find the evidence)
"Need money and personal to have interesting results"
"Negative impact considering publishing, and in general the research use will definitely cause errors and misunderstandings since many archaeologists with humanities background are not aware of the limitations of e. g. LLMs."
"Neural Networks and data processing is interesting and possibly useful for archaeology, but Generative AI models and their derivatives can be a threat because of multiple factors like illegal

training of models on publicly available data, enormous energy consumption, general reliance on unreliable/biased chatbots and more."
"No idea, all have seen was bad."
"Not enough attention is given how AI can help archaeology."
"Not enough information on the subject to have an opinion"
"not enough perspective yet."
"Nous avons peu de recul sur les différents outils accessibles de l'IA, les domaines d'actions sont très variés" (We have little perspective on the various AI tools available, and the areas of application are very diverse.)
"obligatoire de garder des réserves dans ce genre d'exploitation des données" (mandatory to maintain reserves in this type of data processing)
"On the one hand, AI is already very interesting for archaeology, in particular for finding patterns in shapes recognized by supervised learning, or for recognizing and transcribing texts in excavation archives."
"On the other hand, AI needs to demonstrate its value in responding to scientific problems."
"One again, the main focus has to be the creating of the training set, and thus focus on the documentation of existing data and tools for acquisition."
"pas assez de recul pour répondre" (not enough perspective to answer)
"Pas assez de recul pour répondre à cette question" (Not enough perspective to answer this question)
"Perdita del capitale umano" (Loss of human capital)
"permettre de réaliser un travail répétitif plus rapidement = bien ; remplacer le travail disponible en bureau pour des collègues qui sont trop souvent tout le temps en chantier (préventif) = pas bien. Il faudrait former un maximum de personne : implique un interface user friendly pour les collègues qui ne sont pas à l'aise avec les outils informatiques." (Enabling repetitive tasks to be completed more quickly = good; replacing office work for colleagues who are too often on (preventive) site = not good. As many people as possible should be trained: this requires a user-friendly interface for colleagues who are not comfortable with IT tools.)
"peut aider à être plus rapide sur certaines taches répétitives mais problématique sur l'emploi et la baisse des coûts généralisés" (can help to speed up certain repetitive tasks but is problematic in terms of employment and generalised cost reduction)
"positive for facilitating the work. High energy consumption"
"positive: help in processing large numbers of data e.g. negative: use for students, e.g. in copying texts for examinations without really studying"
"pour l'instant je suis très réservée sur l'IA - generation terminator…" (For now, I am very cautious about AI – Terminator generation…)
"- pros : positive perspective on site detection, data processing - cons : massive energetic consumption, black-box thinking trap (ie possibility of doing things without understanding the how), doubts about true benefice of automatisation (ie automatisation often means more low interest work for humans, like data preparation/pre-processing or fieldwork, and not so much high interest work after treatment, possibility of loss of specialized know-how in particular fields like ceramic studies, for instance if all the graphic works goes to the computer (cf Archaide))"
"Rapidité des traitement à relativiser pour les analyses approfondies" (Speed of processing should be put into perspective for in-depth analyses)
"remplacement des chercheurs par des taches automatisées" (replacement of researchers by automated tasks)
"Requires prior training"

“should be used carefully. I think the impact mostly depends on the care and formation of the users”
“Si l'IA est bien utilisée de façon raisonnée, cela pourrait permettre une optimisation de certaines tâches chronophages.” (If AI is used sensibly, it could help optimise certain time-consuming tasks.)
“Special knowledge like archaeological is not yet there. There are biases and hallucinations since AI cannot find information online”
“The advantages and disadvantages are the same as in other fields. We are well aware of the capabilities, but this should not replace employment, and we are also very aware of the potential for ethical deviations that could arise from AI.”
“The best scenario case would be harnessing AI capabilities to meet academic or companies needs, such as extracting information or detecting patterns from data, ultimately making of AI a supportive tool rather than one overwhelming the human decision-making process.”
“The cost and the storage of data are very unknown to users”
“The current impact is little and, thus, harmless. The foreseeable one can be both positive and negative, depending on how well we control it.”
“the human factor will never could taken in account by the AI because it can't think new possibilities”
“the impact seems unpredictable to me”
“The lack of knowledge lead to use mostly generative language models more than tools to manage data that are too large to be dealt with.”
“The potential is enormous, but also frightening. Archaeology and the way it is practised is undergoing a profound transformation, sometimes to the detriment of the contribution of certain traditional approaches, which are no longer ‘bankable’.”
“The problem is that lacks of data made Ai go wrong..”
“The promise is to make us gain some time to make us work on more relevant and important things. The reality is that we take a lot of time to produce data to train models to allow an IA to make all the fun and interesting part of our jobs…”
“The sources and terminology of archaeology still seem complex for AI. Many useful databases are not open access. The sources it may access are limited.”
“The tools are not sufficiently reliable for now”
“the use of AI presents a potential danger. In the long term, we can expect users to lose their skills.”
“There is a dangerous side to the automatisation of tasks. A lack of data during a survey is by itself a data, so yes it is tedious to make a report with no or small data, but it is necessary for a human and not an ia to produce this work, in order to get the bigger picture of the data.”
“There will be positive outcomes, but the negative ones are usually really damaging (regardless of quantity).”
“To analyze and compare a lot of data”
“too early to predict the impact”
“Too soon to tell!”
“Useful to manage amount of data, useless in pondering results ; does not replace expertise”
“Using Ai can be positive because you save time. However, it can be negative because functions such as memory and fantasy, are "blocked".”
“Very interesting gains in speed of work and types of analysis available (especially with big data). I see 2 main risks: the temptation of "bad use" of AI, without a proper understanding of the interests and limits of this tool (with, for example, systematic automated process of some kinds of data, without reflection about the specificities of the data and toward which archeological questions they could lead). And with the spread of this tool, the gain of time it allow can lead to a systematic decrease of the time allowed for an archeological study/analysis.”

"Wait to see the results…"
"We are not yet really familiar with it"
"While I acknowledge that AI may help in the treatment of massive quantities of data and expediting repetitive tasks, the current state of AI appears to me poorly implemented in terms of ethics, obscure in terms of processing methodology, and all around untrustworthy."
"Who knows... It could go either way ! it all lies in the future."

E. Robotics

E.1. How familiar are you with the use of robotics in archaeology?

Answer	Number of answers	Percentage
Very familiar	6	1.9%
Familiar	32	9.9%
Neutral	66	20.4%
Unfamiliar	124	38.4%
Very unfamiliar	95	29.4%

E.2. Do you use robotic tools in your work?

Answer	Number of answers	Percentage
Yes	36	11.1%
No	287	88.9%

E.3. (Yes) - Which robotic tools do you use in your work? (Select all that apply)

Answer	Number of answers	Percentage
Autonomous vehicles	12	33.3%
Robotic arms and similar devices	12	33.3%
Automated photogrammetry/RTI system	15	41.7%
Other (please specify)	11	30.6%

The respondents who picked "Other" answered:
"Automated injection in GC-MS"
"automatic sample preparation system related to my branch of archaeometry (biomolecular archaeology)"
"Drone" (thrice)
"Roboscan"
"ROV (Remote operated vehicle) for deep sea archaeology"
"Self developed robotic application for automated scanning of 2D and 3D objects (3D in preparation)"
"SIG"
"UAV when used autonomous"
"UAV"

E.4.(Yes) - To which ends do you use them? (Select all that apply)

Answer	Number of answers	Percentage
Assistance in tedious, repetitive or time-consuming tasks	13	36.1%
Data acquisition	31	86.1%
Digitation of artefacts, structures or areas	18	50.0%
Exploration of dangerous or inaccessible areas	13	36.1%
Object manipulation	1	2.8%
Other (please specify)	0	0.0%

E.5.(Yes) - How frequently do you use robotic tools in your work?

Answer	Number of answers	Percentage
Daily	2	5.6%
Weekly	5	13.9%
Monthly	12	33.3%
Rarely	17	47.2%

E.6.(Yes) - Are you allocating or would you allocate part of your budget to acquire robotic systems to facilitate certain activities?

Answer	Number of answers	Percentage
Yes	24	66.7%
No	12	33.3%

E.7.(Yes) - If so, how much does or would this amount represent annually?

Answer	Number of answers	Percentage
€ 0–10K	8	33.3%
€ 10–50K	9	37.5%
Over € 50K	3	12.5%
I do not know / No opinion	4	16.7%

E.8.(No) - What could motivate you to use robotic tools in your work? (Select all that apply)

Answer	Number of answers	Percentage
Ability to delegate tedious, repetitive or time-consuming tasks	149	51.9%
Cost-efficiency	107	37.3%
Increased speed	118	41.1%
Work access or safety in difficult environments	142	49.5%
None	60	20.9%
Other (please specify)	10	3.5%

The respondents who picked “Other” answered:

“Cost of robots.”
“Curiosity”
“i dont know” (twice)
“I work for private companies, they don't do research”
“*je ne sais pas car je n'utilise pas*” (I do not know because I do not use it)
“*Manipulation d'objets ou d'éléments*” (Objects or items handling)
“More information - Being educated in what options are available specific to the field, what they would cost, what companies provide the services, etc.”

"not sure that would be relevant to my work actually…"
"*Per ora non sento l'esigenza*" (I do not feel the need at the moment)

E.9. How would you qualify robotics' current and foreseeable impact on archaeology?

Answer	Number of answers	Percentage
Positive	166	51.4%
Negative	15	4.6%
Ambivalent	142	44.0%

E.10. Please specify here your answer to the previous question:

The respondents who picked "Positive" answered:
"Ability to delegate tedious, repetitive or time-consuming tasks, Cost-efficiency, Increased speed"
"Again, speed, make things cost effective and consistent"
"Again, we are at the doorstep."
"Allow more data acquisition, in less time and easier access"
"Although I am not familiar with robotics, there are many areas for improving archaeological protocols."
"Any measure to make work more effective is welcomed…"
"Anything that can improve safety or prevent physical wear and tear is welcome."
"as field archaeologist involved in cave research, archaeological and anthropological remains are sometimes found in hard to reach places. The use of robotic tools (for mapping sites and remains in them) can greatly increase the speed and precision of data collecting, and also improve safety for people collecting data."
"As I have less information about robotics I can not provide good idea about that, however, I am sure new technologies will shape the world, as well as archaeological research."
"As long as the field of action in which robotics could be used is clearly defined, it seems like it would be a safe option for exploring unsafe locations and features (wells, mineshafts, etc.)."
"As mentioned previously, if robots used to automate documentation, it could be great"
"As with AI. Huge potential, but how do you make it right?"
"Automating tedious and repetitive tasks will mostly help archaeologists to spend their time on more demanding tasks, but some concerns about job market developments might be justified."
"Better security"
"Brak tego typu robotyki w Pl" (Absence of this type of robotics in Pl)
"Can help the human work and makes it less difficult"
"Can see many potential benefits"
"*Certains sites sont inaccessibles pour les humains (grottes profondes, fonds marins). Des robots spécialisés peuvent explorer ces endroits. Exemple : Un robot sous-marin peut examiner une épave sans risquer la vie d'un plongeur. - Des robots peuvent nettoyer, analyser et même reconstruire virtuellement des artefacts endommagés. Exemple : Un bras robotisé peut assembler des morceaux de poterie cassée comme un puzzle.*" (Some sites are inaccessible to humans (deep caves, the seabed).

Specialised robots can explore these places. Example: An underwater robot can examine a shipwreck without risking a diver's life. Robots can clean, analyse and even virtually reconstruct damaged artefacts. Example: A robotic arm can assemble pieces of broken pottery like a jigsaw puzzle.)
“Could increase data collection speed, negate human interference in data collection, ensuring consistency in data”
“Creating better work conditions”
“Currently, I have not encountered robotics in my archaeological research. However, I believe robotics could be highly useful in certain challenging environments, such as underwater.Additionally, they may play a role in automating repetitive measurement tasks, improving precision and efficiency in data collection.”
“development of european datasets with recognition by AI”
“Drones and ROVs allow us to radically change and improve the documentation of sites, both on land and underwater archaeology.”
“Drones are very useful to get a full picture of an archaeological site in its environment. But they are for now the only robots we use.”
“Drones will help survey sites quickly, autonomous robots may assist in excavations, and underwater robots may explore shipwrecks and submerged ruins. They will make data collection faster, safer, and more precise, reaching places that are too dangerous or inaccessible for humans. They will be powerful tools to assist the archaeologist with discovery, documentation, and preservation!”
“Every selected point under question 10 can have positive impact on archaeology”
“Everything is welcomed to improve the archaeological work.”
“Excellent technology”
“facilitating tasks”
“Fast acquisition of data in difficult environment and for repetitive acquisition like laser scanner”
faster and cost-efficiency improvement”
“Field survey using automated systems, possibly with artefact detection. Automated finds processing - not only labeling, but also documentation.”
“For all the answers selected for question 10”
“For boring task or repetitive ones robotics may be a good help”
“For delegate certains task it could be very helpful, i realize often photogrammetry or RTI in caves in southern France and it very difficult to climb or access to points of view, it could be easier with a robotic help”
“Good for repetitive functions”
“good impact”
“Health and safety is an important issue to me in urban sites.”
“Help for safety reason”
“I am aware that it is an advanced technological tool that might help executing many tasks.”
“I believe robotic arms and similar devices can contribute significantly to the digitization of archaeological artefacts. However, while I am very interested in the application of autonomous vehicles (e.g., UAVs) in archaeological research, I doubt they will find widespread use in professional archaeological practice.”
“I believe robotics has a strong potential for saving time in the case of time consuming tasks, such as labwork, but always under human supervision.”
“I believe that in archaeology, robotics is mainly positive because it allows us to explore hard-to-reach or dangerous areas. There are also important applications to delegate tedious, time-consuming or

repetitive tasks; even in these cases, I think the contribution is mainly positive, although I don't believe that having them available, I would always use them in these cases."
"I can see it use in fx use-wear studies, in experimental archaeology, and in specific workflow components of pollen analysis etc. - but I don't know enough about it."
"I cannot"
"I consider the impact of robotics on archaeology to be highly valuable, particularly in reducing the time required for classification processes. However, despite these advancements, I believe that robotic systems still require human oversight. Even if automation significantly improves efficiency, a final human revision remains essential to ensure accuracy and contextual understanding. I am not certain that, at least in the near future, we will reach a point where we can fully rely on a machine-driven process, no matter how well-designed it is. Moreover, while robotics can eliminate much of the repetitive and mechanical work, I believe it should not be extensively used in student training. Hands-on experience in recognizing, classifying, and analyzing ceramics is crucial for developing expertise in archaeological material culture. That said, robotics can be particularly useful when dealing with large datasets, especially when working with numerous variants of the same ceramic type under tight time constraints. In such cases, robotic assistance can significantly enhance efficiency without compromising the integrity of archaeological research."
"I could see it having a use in certain fields."
"I do not have a specific opinion on this topic, aside of what I have already marked in question 10 above."
"I don't think it makes sense to try to stop trends which will shape the nearer future in every case anyway"
"I guess it must be helpful ?"
"I have no idea, as I'm not familiar with the possibilities offered by robotics."
"I mentioned that AI brings promising advancements to archaeology through data analysis and reconstruction. Similarly, robotics offers positive contributions by supporting precise, non-invasive excavations and improving field efficiency."
"I mostly do SIA and geometric morphometrics. At the moment, I cannot envision the applications to my field, but that might be due to ignorance rather than reality. I imagine it'd be very helpful in experimental archaeology, but that's not my field"
"I think it is very promising"
"I think it may have a good impact in precision work and also in dealing with places inaccessible to humans."
"I think positive but I have no idea"
"I think that all the novelties can have a positive impact on archaeology if used well (RTI for example)"
"I think there are many repetitive tasks, and even tasks which harm people because of their repetitive level, and it would be better that a robot do it. It could also be made more reliable."
"I think there will be a range of potential benefits, but it will require a large reduction in costs and either greater technical accessibility or upskilling of archaeologists to use this tech."
"I'd prefer to project myself into a world where robotics would help us go beyond our current limits
"Idem than precedent section"
"If I have access to such equipment I would apply it, both for archaeological fieldwork and lab work (cleaning, pre-processing, classification)"
"If possible to design useful robots… welcome!"

“If well-trained, robotics would make it possible to facilitate field work and especially the handling of artifacts, whether from the point of view of cleaning, preservation and diagnostics.”
“I'm most familiar with applications of robotics such as robotic total stations, drones programmed to gather imagery according to some pre-programmed plan, underwater ROV's and such. My current work doesn't really involve use-cases for any of these, so I haven't paid attention to developments in this field.”
“I'm much less familiar with what robotics could do for me.”
“I'm sure that the contributions could be positive, I just have no knowledge of how it's being used in this space. It would sure make things easier if a robot dug test pits. It could routinely analyse the soils, take samples, provide 3D scans continuously, remove human error, reduce stress on backs and knees, etc. It could even work in the dark to take samples for luminescence samples easier than a human.”
“in order to speed up and automate the work”
“In some specific fields, they have significant uses, but I think those fields are limited.”
“In the previous question, I stated that artificial intelligence has a positive impact on archaeology by facilitating 3D modeling, analysis, and preservation of archaeological remains. Similarly, robotics can also have a positive influence by assisting in delicate excavation processes, accessing hard-to-reach areas, and minimizing human-induced damage. However, its full integration into archaeology may depend on technological accessibility and ethical considerations, which makes its impact somewhat ambivalent at this stage.”
“Increased speed, delegation of time-consuming repetitive tasks etc”
“It can analyze lots of data access to areas that physical can not otherwise.”
“it can be really helpful to develop some precision tasks that are difficult to implement nowadays.”
“It can help people do something harder to do with the age or the environmental security/access, and can help people do tasks to increase the study of some artifacts.”
“It can help process of studying remains and explore difficult places easier”
“It might be useful to sample in remote area. However is Robotic necessary for archeology ? Other sectors might need it more. Robotic is not yet as widespread as to use it in a cultural sector without much money to finance it.”
“It will be beneficial if many tasks are delegated and followed up.”
“It would help a lot to access remote places such as thick forest or jungle”
“Je n'ai pas d'avis sur la question. Dans mon champ d'investigation, le recours à la robotique ne peut être à mon avis qu'exceptionnelle et liée à des environnements spécifiques.” (I have no opinion on the matter. In my field of research, the use of robotics can only be exceptional and linked to specific environments, in my opinion.)
“Just the above-mentioned possibilities are enough to get excited about.”
“la rédaction d'un rapport demande beaucoup de tâches répétitives. Les spécialistes pourraient être grandement aidés par la robotique” (Writing a report involves a lot of repetitive tasks. Specialists could benefit greatly from robotics.)
“Let us to do work faster”
“l'exploration de milieux difficiles ou agressifs (zones marines profondes, cavités naturelles ou artificielles, rivières et lacs aux eaux turbides, milieux pollués...) ne peut qu'être facilitée par ces technologies voire remplacer l'intervention directe.” (Exploration of difficult or hostile environments (deep sea areas, natural or artificial cavities, rivers and lakes with murky waters, polluted environments, etc.) can only be facilitated by these technologies, which may even replace direct intervention.)
“like with AI anything that facilitates robust data acquisition would be a good thing.”

"L'utilisation des UAV apporte une autre vision, une autre perception des paysages et des sites archéologiques. Les UAV permettent également de produire rapidement des données précises grâce à la photogrammétrie et les LIDAR" (The use of UAVs provides a different perspective and perception of landscapes and archaeological sites. UAVs also enable accurate data to be produced quickly using photogrammetry and LIDAR.)
"Meilleur documentation et meilleure lecture des artefacts" (Better documentation and better reading of artefacts)
"My research goals do not require the use of robotics but I had very good feedbacks from my colleagues involved in experimental archaeology"
"My understanding of the role of robotics in archaeology is pretty limited to examples where robots have been used to access dangerous or hard-to-reach spaces, which I think is a great development."
"New possibilities…"
"No idea really. I just like robots."
"None" (twice)
"Not really applicable in my field, but useful for subaquatic archaeology."
"Of use for other parts of the discipline but not my own practice"
"Olumlu" (Positive)
"Once accessible and familiar to people, robotics would be incorporated in archaeology customarily because of the easiness of application"
"Perfect to test and produce baseline hypotheses."
"permettre de développer de nouvelles approches techniques impossible à mettre en place avec des agents (zones dangereuses, vols de drone, etc.)" (enable the development of new technical approaches that would be impossible to implement with agents (dangerous areas, drone flights, etc.))
"Positif pour le travail en zone difficile d'accès, trop dangereuse, mais je n'en ai jamais vu ni entendu parler : trop cher? pas déployé partout?" (Good for working in areas that are difficult to access or too dangerous, but I've never seen or heard of it: too expensive? Not deployed everywhere?)
"Positive"
"Positive — Robotics is already proving valuable in archaeology, and its future impact looks very promising. Precision excavation and handling of fragile artifacts without human error or physical strain. Exploration of inaccessible or hazardous sites — like submerged ruins, deep caves, or unstable ancient structures. Use of robotic drones and rovers for aerial mapping, photogrammetry, and LIDAR scanning of vast or remote areas. Integration with AI for automated artifact detection, classification, and analysis in the field. Robots can support non-invasive documentation and 3D reconstruction of sites for research and digital preservation"
"positive impact of the AI in archaeology"
"Principally, the ability to delegate tedious, repetitive or time-consuming tasks."
"Remplacement et compléments aux travaux pénibles" (Replacement and additions to arduous work)
"repetitive operations need a lot of time. in unaccessible places, robotic can be very helpful."
"robotic can ease and help our work, but it need to be done for the user (removing tedious and repetitive task, easing difficult work...) not to replace them or degrade their working condition (as we can see in industry)"
"Robotic GPR systems make better data. Rapid and accurate data collection."
"Robotic is a great way to improve our work in some areas, in my situation, we are just lacking Time to use it but we are into it !"
"Robotics and AI will revolutionize archaeological work and access to objects."
"Robotics can help in automating tasks not performed by humans."

“Robotics could indeed benefit research in supporting difficult tasks or accessing out of reach/inaccessible sites”
“Robotics greatest value lies in accessing, documenting, and preserving sites and artifacts, especially in situations that are difficult, dangerous, or too delicate for humans to handle directly.”
“Robotics has the potential to free up archaeologists time for more productive work, increase accessibility and improve reliability of fieldwork.”
“Robotics is having an increasingly positive impact on archaeology, both now and in the foreseeable future. They contribute to more precise and less invasive excavation techniques, high-resolution 3D documentation, and automated sampling or analysis. In the near future, advancements in robotics are likely to further enhance field efficiency, support conservation efforts, and expand the scope of archaeological exploration into previously inaccessible areas.”
“Robotics, if you include drones, for example, are tools that have already proved their worth in many aspects of archaeology and archaeometry. After that, for example, to robotise laboratory tasks related to archaeometry, the problem is the cost of developing solutions. Our field of activity is not a "market" for which companies are going to develop products.”
“Robotics, including drones and ground robots, are increasingly used for non-invasive surveying, mapping, and excavation. These robots can access hard-to-reach or dangerous sites, such as caves, underwater ruins, or fragile structures, allowing archaeologists to collect data without risking human safety or damaging the site.”
“Robotik teknolojiler, kazılarda hassasiyetin artırılması, otomatik ölçümleme ve müdahalesiz belgelenme gibi alanlarda arkeolojik uygulamaların ayrılmaz bir parçası haline geliyor. Yakın gelecekte, yer altı keşifleri ve kırılgan alanların korunması gibi konularda daha da önemli roller üstlenmeleri beklenmektedir.” (Robotic technologies are becoming an integral part of archaeological applications in areas such as increasing precision in excavations, automated measurement and non-intrusive documentation. In the near future, they are expected to play even more important roles in areas such as underground exploration and the protection of fragile sites.)
“Robots are cool”
“Robots are the future of 3D acquisitions where time consuming and human errors are the main actual problems”
“Robots can perform difficult tasks in places inaccessible to archaeologists during exploration, preventing the destruction of the environmental context”
“Robots or cobots can facilitate greatly digitisation process, especially in 3D scanning and RTI. They are consistent, accurate and quick.”
“Robotics could help in repetitive tasks.”
“Scan and examine cave for example”
“Si elle permet de gagner du temps et d'offrir des résultats, c'est positif.” (If it saves time and delivers results, it is a positive thing.)
“SO far, we have been using drones and different underwater equipment that could only be made better in the future. I can also imagine robotized vehicles with cameras and/or other tools to explore places that ar otherwise dangerous or impossible to examine (e.g. caves).”
“surveying & mapping (drones, ground robots), monitoring & preservation, experimental archaeology technical help”
“The cost I imagine for this kind of machines would not allow for a generalised use of them, therefore limiting them to specific uses when truly needed.”
“The current development of deep-sea archaeology, and the significant scientific contribution of the new found wrecks, proves the value of using these ROVs.”

"The dangerous and repetitive tasks can be given to robots but humans needed for real practice of archaeology"
"The same thoughts developed in the previous section apply here as well."
"The work process could be optimized for better efficiency."
"They can save time and improve accuracy."
"this allows for a much efficiency"
"This use could allow difficult or dangerous tasks to be carried out and thus limit risks for teams."
"time reduction and increase of quality"
"time saving and more reliable acquisition than using other methods"
"to automate acquisition and avoid repetitive tasks"
"To mapping areas; scan sites to detect underground features before excavations; digital reconstruction"
"Underwater and non-underwater robotics will be part of our future work."
"Une aide à la pénibilité du travail, accélérer la 'acquisition des données et cela sert à ma recherche : travaux sur des traces d'outils, sur les marques visibles en surface des objets" (Help with the arduous nature of the work, speeding up data acquisition, which is useful for my research: work on tool marks, on marks visible on the surface of objects.)
"Use of USV makes sense in underwater archaeology" (twice)
"We can delegate to robots repetitive and unsafe tasks"
"we lack staff so they can help gain time, be more efficient"
"What would an archaeologist do without a UAV nowadays? Nothing…"
"Whatever impact robotization has on archaeology, it can only be positive. Even on a small scale."
"With no experience w robotics, I still think there is a positive connection between it and archaeo-logical problems and positive outcomes will depend on how robots are programmed - based on questions being asked."
"Would enable less personnel required for smaller museums/sites so that already small budgets can go further."

The respondents who picked "Negative" answered:
"Again, robots were supposed to help us have more time for ourselves, it's now just replacing people, and the gain of time isn't great. We have automated injections on one of our GC-MS and you have to re-do the work often because the injection went wrong and the automatic process was unable to see that there is a problem with the data."
"Can't understand how robotics would be able to make judgement calls in the field. Changes in strat are often very hard to discern."
"don't need this technology in Archaeology"
"I am not certain if robots could assist mechanical tasks with sufficient amount of caution and precision as required when handling with archaeological objects, but I am not an expert so I may be wrong"
"I cannot see how this could be useful."
"I can't see any concrete applications in my research at the moment."
"Je passe des moments agréables et enrichissants avec mes collègues. Je ne veux pas qu'ils soient remplacer pas un robot." (I enjoy spending time with my colleagues and find it enriching. I don't want them to be replaced by a robot.)
"No robot can be more precise than a real person. No programming can change that."
"Non ne sono al corrente" (I am unfamiliar with it.)

“We need trained archaeologists and curious, inventive researchers, not robots obeying codes written by non-archaeologists and ignoramuses.”

The respondents who picked “Ambivalent” answered:

“à voir” (we’ll see)
“absolutely no idea on this field”
“Again, depends on use. My concern would be prohibitive costs and further widening the divide between large well funded labs, and smaller labs which also do significant research but cannot afford this technology.”
“all depends "What are we looking for”
“All these things are interesting for researchers but I don't see needs by private companies”
“à mieux connaître pour émettre un avis” (need to know more in order to give an opinion)
“At the moment I don't understand what impact robotics could have in archaeology, apart from on sites where there are dangers such as war-torn countries.”
“automatisation par soucis de rentabilité sans regard critique du chercheur” (automation for the sake of profitability without critical input from researchers)
“can be useful but i don't really have an opinion on this”
“cela va supprimer notre travail” (this will eliminate our work)
“Ces outils ne doivent pas remplacer l'observation” (These tools should not replace observation.)
“Cost savings should led to more work but inevitably will just led to tighter deadlines of the same work”
“Don't have the tools the use robots”
“È uno strumento. Va saputa usare e non sostituisce l'uomo” (It is a tool. You need to know how to use it, and it does not replace humans)
“Exploration of dangerous or inaccessible areas”
“Here I think there is a lot to think about the socio-technical disruptions that may result from the uncritical adoption of a technology that is still under development.”
“Honestly I have not enough knowledge about it”
“I am not sure about the correct use of robotics in archaeology except for inspection tasks (i.e. underground survey, etc.)”
“I am familiar only with the use of ROW in underwater investigations. I think they are useful in those environments, but I don't know other uses for it”
“I am not aware of this subject.”
“I am not familiar enough with its use to say.”
“I am not familiar with the argument so i do not have a solid opinion about the topic”
“I am not familiar with this field”
“I can't see robotics being relevant to my area of work”
“I do not have any experience.”
“I don’t know how robotic tools could help us about archaeologic tasks.”
“I don't have a specific opinion, I know too little on the subject “
“I don't know anything about this last topic”
“i don't know because i've never seen robots work in archaeology”
“I don't know it at all”
“I don't know much about this subject”
“I don't really have any idea on this topic”
“I don't really see the point.”

“I don't see in which aspects the use of robotics could differ from the use of technical tools”
“I don't think I've ever needed it, but that may be due to a lack of training and information.”
“I have no clear opinion about this.”
“i have no experience in this”
“I have no experience in this field, I do not think I can give a satisfactory answer”
“I have no experience of using robotics in archaeology”
“I have no experience to answer this question.”
“I have no opinion.” (twice)
“I have no opinion as my work is in the lab.”
“I have no specific idea”
“I have too little practice”
“I honestly do not know enough to provide and answer.”
“I never asked myself such a question.”
“I personally don't have any particular thoughts on robotics in archaeology. I'm sure there are some tasks which could be outsourced to them, I just can't think of any that are realistic.”
“I see few possibilities for applying robotics to the field archaeology that I practice (I prefer to have well-sharpened tools that are well-adapted to a task)”
“I think that human control remains necessary above all to avoid losing qualitative data”
“I think that robotics might be as helpful in archaeology as in other disciplines as well - but as I am not very familiar with the use of robotics in archaeology I might be wrong”
“I will try to see robotic in charge of digging!”
“Idem, son usage peut être intéressant mais il doit être raisonné, utilisé de manière éthique et ne pas avoir vocation à remplacer l'humain.” (Similarly, its use can be beneficial, but it must be considered, used ethically, and not intended to replace humans.)
“Il faudrait une grande maitrise de la robotique. Il ne faut pas remplacer l'humain par le robot, qui n'a aucune capacité d'expertise, d'évaluation et d'appréhension de telle ou telle situation.” (We would need a high level of expertise in robotics. We must not replace humans with robots, which have no capacity for expertise, assessment or understanding of specific situations.)
“It can be positive because you save time, but it can also be negative because functions such as memory and fantasy are "blocked"”
“It can help us to be faster, but is it the point of science ? Can't it be another reason to remove time for archaeologists who are always missing time, especially in some public organisations where we are asked to go faster and faster. Science looses Do robots makes us robots ?”
“It depends of the context, not all archaeological survey is an opportunity for robotic tool and it's still very expensive for what it can really do in the archaeological field.”
“It depends on continuing developments and budget. Many technical parameters like calibration are determiner to a considerable extent.”
“It depends what robotics is used for. Some uses will be inappropriate, others quite proper.”
“It is only useful for transportable and non-fragile items.”
“It is still not cost effective”
“It might be useful but the possibilities are still unclear to me.”
“Je crains que cela réduise le nombre de contrat en archéologie à l'avenir et donc la formation de la nouvelle génération qui s'éloignera de ce domaine de recherches pour des raisons financières. Cela est à l'heure actuelle déjà compliqué d'avoir une place.” (I fear that this will reduce the number of contracts in archaeology in the future and therefore the training of the new generation, who will move

away from this field of research for financial reasons. It is already difficult to find a place at the moment.)
"je n'ai pas confiance en la robotique" (I do not trust robotics)
"Je n'ai pas d'avis par manque de connaissance de ce sujet" (I have no opinion due to a lack of knowledge on this subject.)
"Je n'ai pas d'avis, car je n'ai pas expérimenté l'usage de la robotique dans mon travail." (I have no opinion, as I have not experienced the use of robotics in my work.)
"je n'ai pas l'usage de la robotique dans mon domaine d'expertise." (I do not use robotics in my field of expertise.)
"je ne comprend pas" (I do not understand)
"Je ne connais pas suffisamment" (I don't know enough about it)
"Je ne maitrise pas du tout la question." (I have absolutely no expertise in this area.)
"je ne sais pas car je n'utilise pas" (I do not know because I do not use it)
"je ne sais pas encore quelle type de machine pourrait être proposé par les industriels pour nous aider dans notre métier" (I do not yet know what type of machine manufacturers could offer to assist us in our work.)
"La destruction de certains emplois" (The destruction of certain jobs)
"Là encore beaucoup d'effets sur peu d'échantillon et pas assez de recul" (Once again, many effects on few samples and not enough hindsight.)
"la robotique doit être utilisée avec parcimonie en milieu difficile uniquement" (Robotics should be used sparingly and only in difficult environments.)
"Les robots pourraient réaliser les tâches peu importantes, répétitives et fastidieuses, mais cela pourrait aussi générer des pertes d'emploi" (Robots could perform unimportant, repetitive and tedious tasks, but this could also lead to job losses.)
"None"
"Not clear yet "
"not enough articles or demonstration of efficient in archaeology"
"Not enough information on the subject to have an opinion"
"Not enough knowledge on the question to make an informed answer."
"Not enough research conducted"
"Not sure"
"Not sure. Haven't thought about it too much."
"obviously useful for certain hard tasks, but questionable in terms of increased dependence on tools with high energy cost of fabrication, maintenance, alimentation, in a moment where the environmental factor should be taken in account (batteries, etc.). Questions about potential loss of contact with fieldwork and the sensitive dimension of it, in a all-remote-perspective"
"pas assez de connaissance pour répondre à la question" (Not enough knowledge to answer the question)
"Pas assez de recul pour répondre à la question" (Not enough perspective to answer the question)
"pas assez de robotique pour juger" (not enough robotics to make a judgement)
"pas d'opinion" (no opinion)
"Perdita della capacità di elaborazione" (Loss of processing capacity)
"Robotic assistance is a positive point, but it may not be relevant for all types of work…"
"Robotics can make certain tasks less arduous or perform new tasks that were previously impossible. But the use of robotics must give meaning to the research activities that use them, which cannot, as a matter of principle, always be repetitive tasks, except in rare cases."

“Robotics seem to play a growing role in archaeological practice, introducing new possibilities while also prompting important questions. Such technologies hold the potential to improve access to difficult or hazardous excavation sites, assist in delicate tasks, and enhance data collection with remarkable precision. However, their integration to archaeological practice raises uncertainties around cost, accessibility, and the potential displacement of traditional methods and human expertise.”
“Since I do not foresee any application that is both cost effective and useful, I can't predict the future impact of robotics.”
“stay care with that”
“The same than before”
“There is not a need for this in what I do”
“There is potential for robotic in archaeology, but for now, the cost is too high in everyday use.”
“There still work to be done to implement some difficult tasks that require automatic arms and manipulation. Image-related activities are relatively easy to implement, but haptics is still not well developed.”
“They could help. Keen to know how. I would not let a robot do what I like to do the most.”
“To find superficial linear structures”
“Toujours vérifier le travail fait pour détecter des erreurs” (Always check the work done to detect errors.)
“Value has yet to be demonstrated with examples “
“Way too early to asses its impact”
“We'll need to see where it's applicable, definitely not everywhere. Since it's all about research, giving any part of the process to robots means distancing it from the researcher. So, the research may not benefit from efficiency and speed.”
“what does it really do for human and other living species well-being?”
“Work in tight space? Unknown application. Computer vision to assist fieldwork”
“Your questions on this issue are too general to necessitate an informed or critical response.”

F. The AUTOMATA project

F.1. Would using an AI-augmented robotic system to digitise ceramic and lithic remains and perform archaeometric analyses on them improve your work process?

Answer	Number of answers	Percentage
Very likely	79	24.5%
Likely	105	32.5%
Neutral	82	25.4%
Unlikely	28	8.7%
Very unlikely	29	9.0%

F.2. Which potential benefits do you see in using such a system? (Select all that apply)

Answer	Number of answers	Percentage
Ability to delegate tedious, repetitive or time-consuming tasks	196	60.7%
Cost reduction in the long term	138	42.7%
Massive data processing	225	69.7%
Speed efficiency	196	60.7%
None	36	11.1%
Other (please specify)	17	5.3%

The respondents who picked "Other" answered:

"A greater degree of accuracy by eliminating human error. Depending on how portable this technology is, it could also really augment results in the field and help to make informed decisions about how scientifically valuable a site is based on tool analysis. Large databases could be formed to compare sites as well. Really the possibilities are endless."

"Acquire new types of data"

"better pattern matching due to camera versus human eye capabilities. This will and does override, or create new, categories of 'thought' used in analysis."

"can work at night or on weekends"

"Consistency"

"controlled environment (digitization may be easily reproduced in the very same way again and again)"

"Have more time to interpret, to read references, then to go deeper in our knowledge."

"Higher productivity of permanent staff. Total costs will not go down."

"If proven geometrically correct, the main benefit I see would be an increase in precision."

"Interpretation of technical processes"

"no idea at present, basically it depends from the research questions"

"*Penso ad un database a portata di tutti e dove confrontare i risultati*" (I am thinking of a database that is accessible to everyone and where results can be compared.)

"*Si cela permettrait d'effectuer des analyses archéométriques sur des objets sans les casser / dégrader, c'est effectivement un avantage*" (If this would enable archaeometric analyses to be carried out on objects without breaking or damaging them, it would indeed be an advantage.)

"The depressing intention by employers and project directors, professors, etc., with little insight or experience in dealing with direct material skills - such as processing and researching ceramics - to reduce field and research costs by not having to employ skilled, well-educated and trained ceramicists, under the mistaken belief that a dynamic technological solution will attain the same results quicker and cheaper. They are much mistaken, however, in the latter view."

"*traitement massif des données : la machine ne peut pas tout faire, il faut un contrôle humain pour repérer les variations non statistiques. L'archéologie est une science humaine !*" (Massive data processing: machines cannot do everything; human oversight is required to identify non-statistical variations. Archaeology is a human science!)

"Well paid from the companies"

F.3. Which potential concerns do you have about using such a system? (Select all that apply)

Answer	Number of answers	Percentage
Difficulty to integrate the system into current work practices	129	39.9%
Lack of training or expertise to use the system	187	57.9%
Lack of transparency in the tools' decision making process	179	55.4%
Loss of human expertise	205	63.5%
Risk of inaccuracy	174	53.9%
None	16	5.0%
Other (please specify)	25	7.7%

The respondents who picked "Other" answered:

"At a community level this is not going to be something to direct limited funds towards."
"*Brak informacji. Wysoki koszt*." (Lack of information. High cost.)
"Cost" (5 times)
"Costs and support."
"Data management and storage. Integration with legacy IT systems might also be an obstacle in the short term."
"energetic cost of a full digital work process (production, processing and storage of enormous amounts of data : who wants a data-center in his backyard ?) , high level of dependency on quite opaque tools"
"Environmental impact"
"Ethical concerns."
"extractivist, energy consumption; diverting attention"
"Inability to perform qualitative analysis."
"Interest"
"*licenciement, hausse du chômage, perte de sens du métier*" (Layoffs, rise of unemployment, loss of meaning in the job)
"Loose of job for specialist"
"lost of work for human"
"no idea at present, basically it depends from the research questions and possible answers"
"Perpetuating biases / bad assumptions in the training data (e.g. what is a 'culture'?)"

"Reluctance within the field/humanity to change. Overcoming fears associated with AI and robotics. Also, challenges getting traditional owners to trust the technology, and in turn their artefacts with the technology."
"Storage of data, the cost"
"This is not an area of research I am interested in. I imagine however that if I did specialise in ceramic or lithic remains this could be beneficial."
"What do we do with 3D models of objects ? A typical dig is millions of pottery parts, what's the point of digitizing them ? If it's for museum grade objects, then the number of potential users is very low. Where do we have the space for TBs of data ? Why maintain servers with digital copies of shreds when we can access them directly ? What's the point of having the 3D model of a random shred ?"

F.4. Would you be interested in any of the following support or training resources from AUTOMATA? (Select all that apply)

Answer	Number of answers	Percentage
Workshops on good work practices	185	57.3%
Technical training sessions on using the system	202	62.5%
Detailed documentation	171	52.9%
None	74	22.9%
Other (please specify)	6	1.9%

The respondents who picked "Other" answered:
"explanation of input/output process, and costs/benefits, quantity of time necessary for implementation and getting results"
"Have more information about the AUTOMATA project and the possibility to participate."
"I'm most interested in ideas and examples of potential use-cases. Networking opportunities might also be interesting."
"*Musi być w języku panego panstwa*" (It must be in your country's language.)
"Training schools"
"While I think this is very interesting, I myself mostly use the data that would come out of this kind of documentation, so I'm not currently involved in initial object excavation documentation"

The respondents had the possibility to leave their email address in order to be notified by the AUTOMATA project in case of the organisation of a training event. Out of 323 submissions, 177 chose to do so (representing 54.8% of the total).

G. Final thoughts

G.1. Is there anything else you would like to share about your experience with 3D modelling, non-destructive archaeometry, AI or robotics?

The respondents who answered wrote:

"3D modelling could help us in having permanent access to artefacts in museum/collections not always accessible (for example : artefacts in countries at war like Syria or Iraq). If, in the future, it is possible to have systems that are easy to use in field archaeology or in museums/collections, we could have quality documentation that could be used later, regardless of local conditions (war, etc.). This will also require major data storage infrastructures. These data could also be shared easily with local researchers (remote access). Staff and money will be needed."

"AI and robotics are really useful tools. But it will never replace the action of regarding carefully a lithic or a ceramic. What we can detect as specialist cannot be replace bu engines I think."

"As indicated I have no experience of using them. I am wary of AI as a tool because its outputs seem convincing: it is not always obvious they are the product of a machine which has limitations and biases in its programming. The latter are of course opaque to users so impossible to adjust for."

"At my level I'm not involve in all this processes, but with an interest in valorization of my archaeological research I'm please and proud to present work done in 3D modelling for common people and specialists."

"*Besoin de formation et de temps*" (Need for training and time)

"*C'est un outil formidable mais encore jeune et des progrès restent à faire. Les IA génératives (GPT notamment) veulent toujours faire plaisir à l'usager ce qui les incite à donner des réponses inexactes ou inventées.*" (It is a wonderful tool, but still new, and there is room for improvement. Generative AIs (GPT in particular) always want to please the user, which encourages them to give inaccurate or fabricated answers.)

"*Il est difficile de sortir d'un cycle d'erreur sur ces mêmes outils.*" (It is difficult to break out of a cycle of errors on these same tools.)

"Depending on the type of data we work on, AI and robotics may greatly help and save time. for other types of data, archeological remains are too variable and sometimes badly preserved to hope for an automation…"

"Having used TLS for decades, photogrammetry for over 10 years, and 3D scanners for several years, I have a strong background in 3D acquisition and workflows. I look forward to seeing what the Automata project brings to the table."

"I am interested in those issues because I am working trying to develop new methods in archaeology"

"I am not competent or experienced enough to objectively evaluate these new applications and resources for the future in archaeology and beyond. This is precisely why institutions should organise large-scale training in 3D modelling, non-destructive archaeometry, AI and robotics, but in particular AI that could include 3D modelling, non-destructive archaeometry and the use of robotics."

"I currently have limited experience with 3D modeling, non-destructive archaeometry, AI or robotics, but I am very interested in learning more about these innovative technologies. I am particularly interested in how they can be used in archeological research, especially in documenting artifacts, improving spatial analysis, and preserving cultural sites. These tools have the potential to transform the way we study, interpret, and preserve archeological material and I look forward to exploring their possibilities in the future."

"I have no doubt that this is the future. One of the main obstacles seems to me to be the lack of standardisation in current archaeological studies."

"I have no experience in this field"

“I will learn this in the time I will luckily employed by someone that is interested in use all these and want to invest on a person and on his/her training”
“I’eager to have some news from here”
“I’m deeply intrigued by this project and would like to weave it into my hesitant, stuttering explorations — guided by torrents of uncertainty — into the realm of computer vision for ceramic decorations.”
“I’m glad someone is asking these questions and gathering this data. I am one of many people who are very strongly against ai. When you consider your responses, please do not dismiss us as sticks in the mud, old fashion, just resistant to change etc. there are many real big practical and ethics concerns that people who are into this stuff seem to ignore. My gut reaction to this stuff is negative but I try to be thoughtful and open… but there are so many concerns that are ignored by people whose gut reaction is positive and thing the rest of us are just old fashioned. Please take seriously the idea that many people to not want ai or ai generated material as part of archaeology for real reasons”
“I’m open to learn more about how I can integrate digital technology to heritage conservation”
“Important to train the workforce and adapt the workflows as well as increase understanding on the potential of AI for multifaceted Field work , documentation and digitisation of both tangible and intangible aspects of archaeology work and material heritage”
“In Italy there are courses on 3D modeling (I did three course in GIS, laserscanning, photogrammetry), but they are always very theoretical, they fill you with a lotta information without letting you actually practice”
“It may be handled from a spatial-environmental data analysis and geostatistics perspective for assessing the measurements.”
“It's the future, so I'm happy that your project has been funded.”
“Just to mention - one of the potential benefits mentioned throughout this survey was about the ability to delegate repetitive or time-consuming tasks. I think we need to not lose sight of the fact that these repetitive tasks are often how we develop expertise; one will have a much better understanding of the ceramic chronology of a site if they have handled and described thousands of ceramic sherds from that site. While I do think there is some value in saving time and delegating tasks, we need to be careful about implying that such experience has no value, and be critical about where we are and aren't delegating work to machines.”
“*Le temps fait mûrir la réflexion.*” (Time makes reflection grow.)
“Lot of potential, but the problem in our organisation is the lack of resources, both money and staff.”
“*Restons humains. Notre intelligence nous appartient. La réflexion humaine est l'essence même de la science. Il est inutile de vouloir remplacer l'homme par la machine, pour des raisons de rentabilité. La rentabilité pure est nocive au développement du bien être humain.*” (Let us remain human. Our intelligence belongs to us. Human thought is the very essence of science. It is pointless to try to replace humans with machines for reasons of profitability. Pure profitability is detrimental to the development of human well-being.)
“Such a study will be useful in transferring accurate information to future generations.”
“the use of 3d modelling really helped rescue archaeology to draw and survey structure with the help drone images to have them as a background to draw faster and to scale archaeological remains”
“We need a better understanding of what AI technologies can be appropriate for certain work practices and what archaeological data is suitable for such technologies.”
“Would also like better quantification of the environmental impact of genAI data processing (e.g. cooling of data farms).”

“We need more fund in order to be more efficient. More money for more result. Going for AI or robot to save money is not an option. IA or Robot wont be able to do the work of a fieldwork archaeologist. At least, not in the next decades.”
“While I am not opposed to the use of these techniques, my main concern is that their use should always be meaningful and that they should always be considered as a means of addressing a scientific problem and not as something that is imposed, without any reflective distance or problematization.”
“Wonderful initiative!”
“Yes, I have a growing interest in applying 3D modeling and AI technologies to the study of animal remains within archaeological contexts. These tools help document and analyze specimens non-destructively, enabling more detailed interpretations of past environments and human-animal relationships.”
“Yes, I would like to add that I have a particular interest in the application of these technologies—especially 3D modeling and AI—in the analysis of animal remains. These tools provide valuable support in identifying species, reconstructing skeletal structures, and understanding past human-animal interactions without causing damage to the samples. I believe such interdisciplinary approaches can significantly enhance archaeological research.”

AUTOMATA

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