

Introducing VR for use by the Cotswold Archaeology team

Introduction

There is a wide range of factors to consider when you are introducing a new piece of equipment into a team or organisation. Investing in a new technology requires careful consideration of its value and purpose, how it will integrate into the existing organisation and the specifics of how it should be deployed. This essay will the process of introducing Virtual Reality (VR) equipment into Cotswold Archaeology (CA), with the intention of enhancing the outreach activities offered by the company. The will discuss the advantages of investing into this technology, the specific impact it will have on various teams, key considerations for successful integration into the wider organisation and finally the practical considerations of how it will be used in a variety or relevant contexts and scenarios.

Purpose and Approach

Introducing new technologies to outreach is a key way of engaging audiences with archaeology, particularly technologies that “bring the past to life”. One example of this is VR which can help increase the inclusivity of archaeology by allowing those who are not able to travel to archaeological sites to share in the experience of being on site. In a similar vein many of our sites are in a commercial setting where surrounding building work may make visiting the site unsafe or where the client may not feel comfortable with visitors. In these cases VR can bypass these risks and restrictions, improving the accessibility of the discipline. VR also ties in well to Archaeology as a STEM subject and the use of this type of technology in schools to showcase the sector represents a key way of engaging younger audiences in a STEM setting. For these reasons VR equipment represents a significant opportunity for archaeological engagement and would be valuable to include in Cotswold’s outreach collection.

The first step to introducing a new piece of equipment or technology is to consider who will be using it, where they will be using it and what the purpose of its use will be (hwadmin, 2022). In this case VR headsets will be used by the outreach team at a variety of events but most commonly fairs and open days. The underlying purpose of its use will be to provide visitors with an immersive, interactive experience which is not usually possible in settings removed from the archaeology itself.

Why VR?

Before introducing any new equipment into a team it is good to take a moment to evaluate why you want to introduce a piece of equipment. E.g. Is it going to save time for employees? Is it going to reduce the frustration that employees might have using old or difficult to operate equipment? Is it going to improve your outputs or offerings? Once you have considered the advantages it offers, it becomes possible to compare this to the costs involved in procuring the equipment, training people to use it and deploying on an ongoing basis. It is also important to evaluate how the organisation will react to its introduction. People can be reluctant to make changes and while this on its own isn’t a reason not to introduce this equipment, it is worth considering mitigations and their impact (hwadmin, 2022). In the world of archaeological outreach, budgets are often relatively modest so investing in expensive and fast moving

technology like VR represents significant financial risk. As such there need to be sound reasons for this investment and a plan in place to maximise its impact, before the purchase decision is made.

In the case of introducing VR to CA outreach, the key question is how it fits into the company's stated aims and strategy. Having impactful and inclusive outreach is a key element of CA's charitable objectives as well as its sustainability goals (Cotswold Archaeology, 2023), which provides strong justification for investment in this area. VR also fits in well with the current operations of the outreach team. CA's outreach calendar largely consists of events and activities such as school visits, history society talks, fairs and other off site activity. These are also the types of activities most frequently requested by clients when tendering for new projects. As such our operations would benefit significantly from any equipment that would enable us to make our offering more engaging and experiential at these indoor and off-site events. VR would enable us to give visitors curated site experiences, while side-stepping the concerns clients often have regarding physical site visits. This would represent a major improvement over the current situation where these physical visits are often prevented by client concerns or simply because the site is inaccessible or unsafe. It would also allow us to give the public a more holistic view of archaeology, going beyond simply demonstrating finds to allowing visitors to move around a 3D model of the site using VR headsets.

These advantages are particularly pronounced in our work with schools and youth groups. Schools often have limited budgets, which means they cannot afford to do a physical site visits, something that is particularly true for the lower income schools CA often target. VR site experiences remove this barrier and offer a more engaging activity for children than presentations. Archaeologists can forget that site plans and other technical drawings are not easily interpretable for laymen, and this is especially true when working with children, whereas a photo-realistic experience of the site requires less knowledge to understand. In this area a new CA goal is to strengthen archaeology's credentials as a STEM career and emphasize the use of technology and the scientific methods in the discipline. Using cutting edge technology like VR helps contribute to this goal in a way that is more easy to implement and experience than other more commonly used technology such as geomatics or LIDAR.

It is also worth considering the wider context our outreach is operating in. If we want to put archaeology on a bigger stage and compete with other STEM carriers such as engineering or bio-medical sciences we will be competing for attention with major companies from these spaces. At larger career or STEM fairs, CA's stand will often be placed near major STEM employers such as EDF or AstraZeneca and the very high level of investment by these companies in comparison to the heritage sector could be stark. To ensure our stand receives its fair share of attention and archaeology comes across as a credible pathway into the sciences it is important that our offering is innovative and showcases the latest developments in the industry. The heritage sector is increasingly capitalising on 3D modelling and the use of GIS to communicate and explain to the wide public, so not reflecting this in our outreach work would be doing the sector a disservice.

Finally VR provides a point of differentiation that CA can use to improve its competitiveness in the outreach space. Outreach tenders tend to be less well funded than commercial work and there is a significant number of small, very lean archaeology outfits that can bid for work at

lower prices than CA. This leaves CA with the option of either running these activities at a loss in furtherance of its charitable objectives (Cotswold Archaeology, 2023) or to try and offer a wider and more appealing outreach package at a higher price. VR is something that could help provide this differentiation and fit well into a larger holistic outreach package. This means that when deciding whether to invest into this technology CA should not only consider the improvement in outputs, but also the potential financial return of integrating it into its outreach offering.

How to Integrate Into wider Company?

Once the decision to purchase the equipment has been made, the question becomes how to effectively integrate the equipment into the company. To do this one has to consider what teams will be affected by the equipment and new ways of working. In this case integrating VR will primarily affect the work of the outreach team who will be deploying the equipment, the geomatics team, who will be providing the models and the field team who will help in the selection of sites and provide the underlying data.

How these teams work together to produce VR outputs and activities needs to be governed by one unified guidance document. This document needs to provide:

1. An overarching statement of each departments role within the process
2. Key contacts in each team, with a statement on what areas each contact is responsible for.
3. Examples of types of VR models that can be created (artefacts/sites/landscapes)
4. Checklist of requirements for effective use of VR (e.g. Wi-Fi, space requirements etc.)
5. The fieldwork team's responsibility to identify suitable sites for 3D modelling
6. Do's and Don'ts for the field team in producing the photographs
7. Health and safety policy and considerations.
8. References to other related documents (e.g. operations guide, risk assessment, ect.)

The field team will be integral in providing the underlying photos and data to build the 3D models used in any VR activity. At this point in time they already produce photogrammetry data for specific features. As such providing photogrammetry for VR will represent an extension of work they are used to doing and they will be able to build on skills they already possess (Havard, 2021). This means that no formal or external training will be required to implement the technology in this team. As their work will provide the foundation for all VR models it will be important to gain their buy-in by clearly communicating the advantages of VR for CA, to contextualise and justify the additional work that will be required. The outreach team would also have to closely coordinate with the field team to decide what sites would be appropriate for VR models and to ensure that any additional costs and time are factored into the planning.

The geomatics team would be responsible for taking the images from the field team and producing the 3D models required by the outreach team. Similarly to the field team they will already have some familiarity with this type of process, using Agisoft Metashape to produce 3D models published on the CA website (Havard, 2021). The software CA currently uses to host these models (Sketchfab) already offers VR options, which means the team are already familiar with the software that would be required to make the jump into VR (Lumion, 2021). The best

way to implement VR in this team would be to designate one subject matter expert who would receive basic external training on key considerations around VR models and who would then be given five person days to familiarise themselves with the process and experiment with techniques. Once this designated expert has reached a sufficient level of expertise they would then run sessions with the rest of the team to train them to the required standard. The buy-in of this team would also be key, though as this technology is very directly relevant to their work and should be aligned with their professional interests, it is unlikely there would be significant issues with motivation (Pantelidis, 2009).

The outreach team will be the primary operators of the VR equipment. Unlike the other teams, there will be limited existing experience to build on, however most commercially available VR equipment is aimed at non-specialist consumers and is therefore relatively intuitive (Brewster & Gies, 2023). This means that unlike the geomatics team, there should be no formal training required for the outreach team. However as the operators they will have to spend significant time familiarising themselves with the interfaces and experience of using the equipment, so that they are able to facilitate a good experience for visitors. They will also need to be able to set up in a variety of environments. The next section outlines key considerations on the practical use and setup of the VR equipment.

Specific deployment e.g. health and safety

As with the introduction of any new equipment or methodology health and safety considerations are very important and risk assessments and supporting policy needs to be updated to incorporate any new risks and process is associated with the introduction of the equipment. For VR these risks vary from common but low severity risks like losing the sense of your real world surroundings and colliding with real work objects (He et al., 2018), to uncommon but high severity risks like seizures (Class VR, 2023). Mitigations need to be developed to reduce the likelihood and/or severity of these risks. To take example of losing awareness of your surroundings operators need to set up a “safe space” in which the activity can be safely carried out, demarking the limits of this both in the VR headset itself and the physical space it is being carried out in. VR headsets can be set up to have virtual walls which will appear when the user is getting too close and warn them if they are leaving the designated area. These would need to be calibrated and programmed every time the activity is set up, as each space the outreach team operates in will be different. Secondly before going to the event and planning the activity that will be done, we will need to consider how much movement might be required so that adequate space is given to carry out this activity. There will need to be communication between the outreach and geomatics teams to ensure that the models are appropriately built for the space in which they will be used. It may make sense to adjust the model between events to maximise its impact. To give the example of fairs where your individual stall space might be limited, one needs to consider whether you need to upgrade the size of the stall to accommodate the activity. Upon arriving for setup one also needs to consider how traffic will flow around the activity and if there is a need to divert traffic to prevent it flowing through the activity area. Depending on the context this may be as simple as marking the floor with tape as to where that activity zone is or it could require additional barriers set up just outside of this area to stop people walking through. In addition there should be signage before the activity to let passers-by know that there is someone using VR headset in the vicinity.

Something else to be aware of when planning and setting up any VR activity is the issue of motion sickness amongst many VR users (Whelan, 2021). The disconnect between how the users avatar is moving through the virtual world and the bodies experience in the physical world can create uncomfortable sensations that detract from the experience. One way of reducing the incidence of this is to invest in higher quality equipment, as a higher refresh rate makes this issue less common. This does of course have the downside that this equipment will be more expensive than less powerful alternatives. It is also key here to work closely with the geomatics team as models can be designed around how users interact with the space to again reduce the incidence of motion sickness in users (Kourtesis et al., 2019).

How to use it

Finally we have to consider how the VR equipment would fit into the work and strategy of the outreach team. The key here is that VR should be an integrated aspect of the outreach offering, enhancing the experience as a whole, rather than being a disparate addition. The best way to achieve this is by ensuring there are common elements and themes that tie the outreach offering together. One potential example of this would be to have artefacts found at the site physically available to handle on the stand and then allow people to experience where they were found using the VR interface. Similarly the VR models could bring to life the site plan and images by converting features like post holes into VR reconstructions showing how the original inhabitants might have experienced this space. In this way VR could create a practical foundation for wider theoretical learning in archaeology (Pantelidis, 2009).

In evaluating the best practices and scientific literature around the use of VR for outreach and learning one has to bear in mind that it is a very fast moving technology so paper that is only five years old might well be significantly out of date. A good example of this is the many references to the very high cost of VR headsets and the associated equipment which some have used to argue it is not suitable for the limited budgets of the education sector. While cost is clearly still an important consideration the market has developed significantly since then with newer entry level devices being offered for much lower prices (The Economist, 2020). Similarly there are a lot of statements around the idea that the software involved is not user friendly or targeted at the average person, but with the increase in consumer sales and interest this is again an area there has been significant developments with many headsets being designed to pick up and play (Musdiaq Bidar & Dan Patterson, 2022). What this means is that there is a limited set of best practice which is still relevant to draw from and the outreach team will need to develop their own practices and rely more heavily on hobbyist/consumer focused advice available on the internet (Kavanagh et al., 2017).

So far the essay has primarily discussed the use of VR in fairs where visitors will vary in age and have relatively limited time to engage with the outreach offering. Much of what has been said still holds for schools but due to the greater time available and stronger educational focus there are some additional considerations. Most importantly it should be noted that simply using virtual reality is not enough to make a meaningful experience in an educational context. As with any other learning method students taking away deep learning from using VR is highly dependent on the teacher actively engaging with the virtual reality and using it creatively as a method to aid learning as opposed to simply using virtual reality as the activity in of itself. This means that the outreach team needs to carefully consider how they will be using VR to engage

with students and how it relates to the wider learning objectives, using a bespoke set of models and tools to teach in schools rather than re-use general models or download pre-made activities from existing learning providers (Alizadeh, 2019).

When working with schools it is also important to consider the difference in flexibility and space that they offer when compared to fairs. A fair provider will usually be able to tailor their space and equipment to the requirements of your stand (e.g. by providing additional plug sockets), but a school may be much more limited in the changes it can make. If you are running an activity in a classroom the space may be limited due to the presence of tables and chairs which need to quickly be reset once you have left. In response you may choose to run the activity in the sports hall, but here the availability of Wi-Fi or plug sockets might be limited. As a result it is important to always communicate with the school being clear about the requirements so that it is possible to identify whether VR makes sense for each event early in the process. To ensure this is done consistently and efficiently the outreach team should create a checklist of requirements and potential mitigations to make a decision on this on the planning stage of the activity.

As with any activity involving children care needs to be taken in planning the safeguarding requirements, particularly as it is likely a member of the outreach team will need to act as a “spotter” for whoever is using the headset at any given time. Based on the academic literature children are especially prone to the issue of forgetting their physical surroundings (Southgate et al., 2019) so the spotter may need to step in to stop them from leaving the safe area and potentially injuring themselves. As this may involve physically stopping a child from leaving the safe zone additional safeguarding training should be provided to the relevant staff. There are also implications on the staffing of each event as it is likely there will need to be at least two members of the outreach team present, one focusing on spotting and the other on delivering the activity and learning (Southgate et al., 2019).

Conclusion

The above essay has laid out an overview of how VR could be integrated into the CA organisation. The technology would offer significant advantages to justify the financial investment. The teams that would be affected already possess much of the relevant skills and should be able to smoothly integrate the technology into their existing processes. The outreach team as the primary deployers would likely have to make the greatest changes, carefully following the procedures and considerations described above, but the overall impact on their work has the potential to be transformative.

Word Count 3511

Bibliography

- Alizadeh, M. (2019). Virtual Reality in the Language Classroom: Theory and Practice. *CALL-EJ*, 20(3), 21–30. <https://www.researchgate.net/publication/335969992>
- Brewster, S., & Gies, A. (2023, February 23). The Best VR Headset. *New York Times*. <https://www.nytimes.com/wirecutter/reviews/best-standalone-vr-headset/>

- Class VR. (2023). *Virtual Reality Health & Safety Usage Guide*. Class VR. <https://www.classvr.com/policies/health-and-safety/>
- Cotswold Archaeology. (2023). *Cotswold Archaeology Mission and Values*. <https://cotswoldarchaeology.co.uk/how-we-work/about-us/our-culture/>
- Havard, R. (2021, June 16). *Structure-from-Motion: Photogrammetry at CA*. <https://cotswoldarchaeology.co.uk/photogrammetry-at-cotswold-archaeology/>
- He, Z., Zhu, F., Perlin, K., & Ma, X. (2018). *Manifest the Invisible: Design for Situational Awareness of Physical Environments in Virtual Reality*. <http://arxiv.org/abs/1809.05837>
- hwadmin. (2022, July 2). *How to Introduce Employees to New Equipment*. DeLong's. <https://delongs.com/how-to-introduce-employees-to-new-equipment/>
- Kavanagh, S., Luxton-Reilly, A., Wuensche, B., & Plimmer, B. (2017). A systematic review of Virtual Reality in education. In *Themes in Science & Technology Education* (Vol. 10, Issue 2).
- Kourtesis, P., Collina, S., Doulas, L. A. A., & MacPherson, S. E. (2019). Technological Competence Is a Pre-condition for Effective Implementation of Virtual Reality Head Mounted Displays in Human Neuroscience: A Technological Review and Meta-Analysis. In *Frontiers in Human Neuroscience* (Vol. 13). Frontiers Media S.A. <https://doi.org/10.3389/fnhum.2019.00342>
- Lumion. (2021). *How to create architectural VR walkthroughs with online tools, Pt. 1: Sketchfab*. YouTube. <https://www.youtube.com/watch?v=OkB-mtkVrHg>
- Musdiaq Bidar, & Dan Patterson. (2022). Why 2022 is the year virtual and augmented reality will come to life. *CBS News*.
- Pantelidis, V. S. (2009). Reasons to Use Virtual Reality in Education and Training Courses and a Model to Determine When to Use Virtual Reality. *Themes in Science and Technology Education*, 59–70.
- Southgate, E., Smith, S. P., Cividino, C., Saxby, S., Kilham, J., Eather, G., Scevak, J., Summerville, D., Buchanan, R., & Bergin, C. (2019). Embedding immersive virtual reality in classrooms: Ethical, organisational and educational lessons in bridging research and practice. *International Journal of Child-Computer Interaction*, 19, 19–29. <https://doi.org/10.1016/j.ijcci.2018.10.002>
- The Economist. (2020, October 1). Headset technology is cheaper and better than ever. *The Economist*.
- Whelan, C. (2021, June 1). What Causes Virtual Reality (VR) Motion Sickness? *Healthline*. <https://www.healthline.com/health/vr-motion-sickness>