

Digital Interaction in the exhibition 'Whitehorse Hill: A Prehistoric Dartmoor Discovery' - how Prehistory met the Gamers and Scanners

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Introduction – Background to the Exhibition

Whitehorse Hill: A Prehistoric Dartmoor Discovery was a temporary exhibition at Plymouth City Museum & Art Gallery, open from 13 September 2014 to 13 December 2014. The exhibition displayed finds of national and international importance, which were excavated from an early Bronze Age burial cist, constructed c. 1730-1600 BC., [radiocarbon dated to around 1900-1700 BC](#) .

The burial cist was, and following reconstruction is, located at Whitehorse Hill in an extremely remote part of Dartmoor. The decision to excavate was taken under the auspices of the Dartmoor National Park Authority and English Heritage. The reason for excavation was that efforts to reinforce the cist with a protective wall had failed. This was due to the extreme weather conditions which prevail at this exposed location. In 2011, the cist was excavated by Dr Andy Jones of the Cornwall Archaeological Unit.

While it was hoped that the excavation might provide some interesting environmental evidence, there was certainly no expectation of any significant finds. However, when a shale bead fell out from the cist, it was immediately obvious that the contents were potentially of significance. At this point, the decision was taken to lift the contents as a block on the base stone of the cist and transport it to the Wiltshire Conservation Laboratories. Once there, painstaking micro-excavation and conservation of the finds took place under the supervision of Helen Williams. In February 2014, the finds were transferred to Plymouth City Museum & Art Gallery.

Much of the importance of the finds is due to the fact that many are made of organic materials; several of them are completely unique. One such find is a wrist or arm band, braided from 'cow' hair (perhaps from a species of auroch) and studded with tin rivets (Figure 1). Thirty-two rivets survive: [it is thought that](#) originally there were thirty-five. These tin rivets, along with a tin bead, are the earliest tin artefacts ever found on Dartmoor.

Four wooden studs, interpreted as two pairs, were also recovered. While there are no signs of actual wear, it is thought that such studs could have been used as body ornaments, possibly in pierced and stretched earlobes or lips. ~~It is thought that the larger pair was most likely used as ear decorations in pierced and stretched earlobes and that the smaller pair could possibly have been used as adornments in pierced lips.~~ The studs predate any other known examples of turned wood, ~~certainly from Britain and Ireland possibly from Northern Europe,~~ by around 500 years.

Other significant organic items include the fur from what was ultimately identified as the pelt of a European brown bear, and an unidentified object ~~interpreted as a~~

'garment or girdle' made from woven nettle fibre and fringed with precisely cut triangles of calf skin.



Figure 1: Detail of braided wrist or arm band showing tin rivets: AR.2011.908.1.5.
Image by Dom Moore. © Plymouth City Council (Arts & Heritage).

A further incredible artefact is a lidded basket. It is a coil-made basket which, apart from the cattle hair decorative detail around the rim, is entirely made from lime bast - lime bast being the processed inner bark from lime trees. Once at the museum the basket was examined by a panel of basketry experts convened by Sherry Doyal, who together created a report outlining what would be required to make a replica. The panel (Maggie Cooper, Sherry Doyal, Dinah Eastop, Linda Lemieux and Ruth Stungo) all agreed that whoever made the basket was an extremely skilled craftsman. 'Bundle' coiling with fine fibres is incredibly labour intensive and today the technique is not commercially viable. The replica took 130 hours to produce.

The development of the 'Whitehorse Hill' computer game

Discussions on mounting an exhibition of the finds at Plymouth City Museum & Art Gallery were started with the Dartmoor National Park Authority (DNPA) at the end of 2011. A formal partnership was formed. Key to this partnership were Jane Marchand, Senior Archaeologist (DNPA), and Mike Nendick, Communications Officer (DNPA). However, while some limited funding was available from both partners, fuller funding, which would help ensure that the exhibition did justice to the finds, was more elusive. While the Heritage Lottery Fund (HLF) was the obvious funding body to approach, the Whitehorse Hill exhibition was one of many competing projects both within the museum and the wider Arts & Heritage Service in Plymouth

City Council (the local authority to which Plymouth City Museum & Art Gallery belongs). By May 2013, with the exhibition opening set for September 2014, the timescale to secure further funding, which would enable the exhibition to include elements with long lead-ins, was beginning to encroach.

However, a fortuitous meeting with Karin Jordan, a Programme Leader who also works on 'live external projects' at Plymouth College of Art (PCA), led to a new working relationship. Karin already had a great interest in archaeology and had visited the *Ice Age Art* exhibition at the British Museum. While she said that the costs involved and the technology required to create a 'smart phone app' (such as was available for visitors to *Ice Age Art*) were prohibitive, it was clear there could be other ways for the college students to help. Group discussions with students followed and during the next few months suggested outcomes evolved and consolidated. Final contributions to the exhibition included: ~~and it was agreed that they would make the following contributions to the exhibition:~~

- photographs used within the exhibition;
- a leaflet featuring local Bronze Age sites which could be visited as well as finds on display at the museum;
- a two minute exhibition 'trailer', which was projected onto the exterior of the museum on the evening of the exhibition opening, and played in the museum foyer for the duration of the exhibition and is also available on YouTube;
- an interactive computer game inspired by the finds from Whitehorse Hill.

Of these, the most challenging was the interactive computer game.

To start the project, the students visited the museum and were taken around the existing archaeology gallery and shown local Bronze Age artefacts. They were also taken to the gallery where the Whitehorse Hill exhibition would be installed. Museum staff talked to the students about how Whitehorse Hill fitted into the local Bronze Age and provided images and references for Bronze Age life as well as copies of the draft archaeological reports on Whitehorse Hill.

After a few weeks the museum team went to see a presentation by the games students on their work so far. The students had been very ambitious in their aims and wanted to make a game based around a Dartmoor Bronze Age village and the activities taking place there, particularly those which would have contributed to the production of some of the artefacts found in the Whitehorse Hill cist. This objective was largely influenced by a half hour BBC documentary about the site, *Mystery of the Moor*, which had featured the making of several replica artefacts.

It was a very promising start. However, there was a great deal of work to do in terms of the detail: how a Bronze Age village might look, as well as the appearance of the Dartmoor landscape, never mind the intricacies of craft activities. The students were keen to understand the details of technologies which might have been taking place in a Dartmoor Bronze Age village. The usual couching of any archaeological fact with a host of 'might haves' and 'maybes' was not what they required. There was a worry that in pursuing a very detailed reconstruction of the Bronze Age village, the interactive gaming element might risk getting lost. As such, further discussions centred on getting the basic details to an acceptable level of archaeological correctness in the timescale available. It was agreed that the way forward was to place greater importance on the computer game as a 'response' to the finds from

Whitehorse Hill, rather than as a literal representation of the prehistoric landscape and probable human activities that took place there.

Aside from ongoing discussions with museum and DNPA staff, the real change in progressing the game came after the students visited the site at Whitehorse Hill (Figure 2). Karin, was determined to get the students out of their comfort zone; ~~this seemed to be~~ characterised as mainly working in dark rooms and ~~inhabiting a~~ creating worlds of fantasy and imagination rather than exercising in the great outdoors.



Figure 2. Plymouth College of Art students at Whitehorse Hill. The cist is visible in the side of the peat mound.

© Tatsu Ishikawa (Plymouth College of Art).

As previously stated, Whitehorse Hill is remote, even by Dartmoor standards. It is a good two and a half hours walk from the nearest parking for a reasonably fit person. The weather on the day of the fieldtrip was very hot and the students were loaded up with equipment for all weathers. By the end of the day they were all utterly exhausted. However, going to the site had a real impact on them. It made them really appreciate the quality of the landscape and the local Bronze Age heritage for which Dartmoor is famous. In short, it really inspired them.

The Council for British Archaeology's 'Festival of Archaeology' took place in July shortly after their fieldtrip. By this time the students had made a completely new version of the game. As one of the museum's Festival activities, the students tested it out ~~their game~~ on the visiting public. ~~They had made a completely new version.~~

They continued to work extremely hard on refining the game throughout the summer. This continued right up until a week before the exhibition opening in September.

What does the game do?

The aim of the game is to look around the village and walk up to a burial cist. On the way the player can collect up to 14 beads and studs, and one bracelet. As the player moves around the village they can go into most of the huts and have a look inside. There is evidence of animal husbandry and other activities around the village. The only human present is a young woman (Figure 3). Her character was inspired by the human remains within the cist burial. Examination of these remains suggest ~~that she was~~ a small, slight person, around 15 to 25 years old ~~when she they~~ died. It was not possible to determine the gender. However, on the basis of the artefacts recovered, specialists suggested that a female was more likely.



Figure 3. A young woman sits and sews. From the 'Whitehorse Hill computer game'. Image courtesy of Plymouth College of Art.

The game is excellent in that it provides a real sense of Dartmoor and the distant past. As well as creating a powerful evocation of atmosphere and place, it encourages the player to explore the village and stone rows, along which they can progress to the cist. As artefacts are collected, snippets of information about them pop up on screen.

The statistics around creating the game

The final game represents an immense amount of work (Figure 4). It has been estimated that the project took the eight game students 1,500 hours of work. The students were supported by lecturer, Stas Krackiewics, and then by part-time lecturer, Colin Head. The project was managed by MA student, Viki Johnson. Each of the eight students played an essential role in creating the game: a concept artist to build the landscape; a 3D modeller to build the people and animals; a sound designer; an animator; a texturing artist to work on the detail of the objects; level designers to ensure that the different stages of the game were consistent and flowed easily; a character designer and a producer (Figure 5).

The museum was successful in its application to the HLF with permission to spend from the end of April 2014. Consequently, £2,500 was put towards employing an external professional programmer to increase the game's 'finish' on the game. This is a sixth of what the College estimate it would cost to produce such a game commercially at around £15,000.



Figure 4. 'The creation of this plaited bracelet was a long, arduous, and frustrating one, in which I spent many hours perfecting the weave between Illustrator and Photoshop. I think it is a truly beautiful piece, which I am immensely proud of'. Viki Johnson, MA Student, Plymouth College of Art. Image courtesy of Plymouth College of Art.

Outcomes of the Game

There were many mutual benefits for both the Art College and the museum. Feedback from Karin is that the students, many of whom are from the local Plymouth area, now take great pride in the museum. There are far more visits by students than

was previously the case and a much greater appreciation of what the museum can offer.

The final question is did the game work? On a practical level, the game was operated using an X-box, where only 3 controls were necessary. It was quite easy for the uninitiated to use with support from a simple graphic panel placed next to the game. The game was positioned within a defined interactive area in the gallery. This gave visitors an opportunity to engage with the exhibition in a way that was different but complementary to the rest of the displays. It also provided subtle ambient sound for the exhibition as a whole, which helped to create a reflective atmosphere.



Figure 5. Plymouth College of Art 'Whitehorse Hill Game Team' at the exhibition opening. Image by Adam Milford. © Plymouth City Council (Arts & Heritage).

Visitor responses to the game were overwhelmingly positive, as they were for the rest of the exhibition. 133 feedback forms were filled in. Of these 66% rated it as excellent, 31% very good, 2.25% good, 0.75% not very good and 0% poor. In addition to the formal exhibition feedback forms, feedback was also collected through visitor comments cards. Children's comments referred to the game as 'amazing', 'epic', 'awesome', 'cool' and 'enormous' and often proudly stated how many artefacts a child had collected. Adult comments centred on children's enjoyment of the game and how engaging it was for them. However, Front of House staff noted that adults were also playing with the game and that they had received positive feedback from a wide-ranging audience (Figure 6).

A final outcome is that the museum is working with Plymouth College of Art to convert the game so that it can be hosted as part of the exhibition archive on the museum's web pages.

Touching the Past

From 2009 till present, one author (Linda Hurcombe) has led the interdisciplinary *Touching the Past* project at Exeter University, exploring ways of introducing multi-sensory experiences into museums with a focus on touch experiences (for discussions of materiality, sensory perception and touch in heritage contexts see Brewster 2005; Chatterjee 2008; Hurcombe 2007; Pye 2008; for more information on



Figure 6. Grown-ups working the Xbox for the Whitehorse Hill Computer game. Image by Adam Milford. © Plymouth City Council (Arts & Heritage).

the results of the project see Dima, Hurcombe & Wright 2014; and Hurcombe et al in preparation). A mixture of traditional crafted replicas and modern technologies have been exploited through trial installations in a variety of different museums (see acknowledgements). The installations range from the traditional crafted replica to computer-mediated experiences. One particular technology, 3D print replicas, has proved very successful and formed the basis of the installation developed for the Whitehorse Hill exhibition. Before addressing this specific installation, a short overview of the *Touching the Past* results sets the scene. Two conceptual issues are crucial: synaesthesia, a concept in psychology, and, borrowed authenticity, defined by the *Touching the Past* project.

Synaesthesia

In research on sensory perception it is accepted that, contrary to the popular five senses model, all the senses are related to one another and act as sensory cues to

each other (Botvinick and Cohen 1998, Clark 1998, Varela 1992). Synaesthesia is a key aspect of how the installations works. A variety of sensory cues can provide a rewarding experience even if the sensory information is not a precise match. In the museum trials with 3D printed replicas, several factors were observed to enhance the ease with which different experiences were stitched together: first, locating the original object (or a photo at least) together with the proxy experience and, second, orientating them so that there is a very direct visual relationship. Despite varying the material itself used for the 3D printed replica (for example replicating a textile in hard plastic media) and not adding a colour match, the public trials showed that visitors of all ages would willingly engage with these kinds of objects. The colour match can be added via the print process or as a layer of paint. However, during trials it was noticed that where there was an obvious mismatch of colour there was immediate 'honesty' about the proxy experience and the surface textures and morphology were isolated in ways that focused visitor attention on this one aspect. This was not detrimental because different information was conveyed.

'Borrowed authenticity' or 'authenticity transfer'

The second key concept relates to authenticity because nobody goes to a museum to see a fake. Therefore the proxy experience has to be accepted, that is it has to be perceived as authentic in at least some respects. The agenda for providing any proxy touch experience has to be based on the authenticity of that experience. The public trials of the *Touching the Past* project showed a concept we define as 'authenticity transfer' or 'borrowed authenticity'. This focus on the relationship of the proxy touch experience to the original object also met the key concern of all museums curators, namely, that the technology should not overwhelm the object in the case. Curators were particularly concerned that the focus should be kept on the original artefact. This undoubtedly helped build authenticity. The direct colocation of the replica objects with the ancient object or with a photograph of that object made this link obvious and strengthened the way the replica object borrowed authenticity from the original.

The project's public trials tested many different kinds of installations but all dealt with visitor perceptions. Thus the methodology relied on a social science style collection of data via triangulation of the following data sets: the collected views of the public (surveys, questionnaires, comments, interviews), the views of the researchers working with the project (direct observations of visitor reactions and overhearing spoken comments), and the views of different kinds of museum professionals from curators, education officers, exhibition specialists, and gallery staff. The intersection between these triangulated data sets showed the installations provided some strong positive experiences for visitors to the museums.

The materiality of the original object was sometimes directly copied but where scans had led to 3D prints, the materiality of the 3D prints also became an element of choice in designing the installation. Some print materials are translucent and others are transparent. The trials showed that the use of light could highlight surface details and if the 3D print was thin enough the translucency showed textural details very well. Where the 3D prints were moveable and placed near a light source visitors could discover the details of the object's surface as the 3D print was moved by them to catch the light.

Using a mosaic of touch experiences enabled the project to observe that the visitors got different information from crafted replicas versus 3D print replicas. The crafted replicas reflect in-life qualities. These are especially valuable where the material is unfamiliar and where the original artefact has lost its colour, textural detail and softness or hardness. In contrast, the 3D print replicas emphasise the object as it is today, which may be in a fragmentary state, in a fragile condition, distorted in shape, and discoloured. Yet these very factors of change are also those which immediately identify the object as 'ancient'. Thus, the crafted replicas and 3D prints provide different information. The 3D print can be explored and visitors were observed checking details by referring to the original object. In this way, the provision of crafted replicas and 3D prints alongside the original are complementary; both kinds of replica can augment the understanding and appreciation of the original artefact. It was these research conclusions which informed the idea and realisation of the touchable element within the Whitehorse Hill exhibition.

The touchable installation

The material from Whitehorse Hill includes several unique objects whose rarity, fineness and exceptional material qualities made them the ideal basis for a collaborative project to develop an installation suitable for a three month exhibition. The first discussions centred on the choice of objects and it was agreed that the basket had sufficient detail, unique qualities, and recognisable features to make it the key object in the installation. The textile from Whitehorse Hill was also scanned as were several other Bronze Age objects from the museum's collections with the idea of using these as handling objects and educational aids. The armband was assessed but proved too challenging to process.

To obtain 3D prints, four processes are necessary (for more information on the scanning to print process see Cooper et al 2006; La Pensée et al 2012; Wachowiak and Karas 2009). The first is the scan itself (there are many different devices ranging from laser scanning to structured light scanners and photogrammetry). The data is collected into a computer file. Depending upon the complexity, a great deal of time might be spent in the second phase of post-processing where the scanned data is turned into a visualised object, viewable on the computer. This version of the object then needs to be further manipulated using appropriate software in the third phase of processing to become a printable file. For the fourth phase, the print process itself, there are choices in the selection of the print method and materials. The size and colour, and the final finishing techniques can also be varied (for example, adding colour, or 'frosting' the surface or mechanically finishing any sharp or rough edges if the object is to be handled). The realisation of the four stages of the process rests on an understanding of the objectives to be achieved and an appreciation of the original archaeological objects.

Practical and economic constraints are important. The object needs to be in an area with free space around for the scan process to work. On a practical note, it is best to select a range of objects to scan in one session so that this part of the process can be achieved in an intense burst of activity. The selected team may have to travel to the scanner so grouping objects makes the process more cost-effective. The scans for Whitehorse Hill were made in collaboration with Andy Holland of Bradford Visualisation, led by Dr Andy Wilson of the University of Bradford. The scanning took two days (not including travel). By contrast, the post-processing activities took up

weeks of skilled computer manipulation time. The end product, the printable file and the visualised file, should not need to be reworked in the foreseeable future. The printable file can be given to web-based companies who specialise in the print process. These companies may have limits on the size of finished object that can be produced through particular print processes.

For the Whitehorse Hill basket, previous research and pragmatic constraints suggested two sets of printing would work best. A one-to-one replica was made from a print process that could create an object of this size and resulted in a 3D print made of a translucent cream coloured material with a slightly rough texture. This was



Figure 7. The touchable installation immediately beside the case showing the original basket and crafted replica. The light box illuminates the translucent 3D print of the complete basket. The transparent moveable tiles are also on the light table. The thread attaching one of the tiles to the plinth is just visible on the right.

supplemented by two small tile-like slabs showing details of the oval lid and part of the side respectively. These were printed using a more expensive process which gave better surface texture details. The tiles were provided for the exhibition without further treatment. (The first set of detail tiles had been 'frosted' post-printing in order to remove the remnants of the print process, but this had also caused some of the artefact surface detail to be lost).

The one-to-one complete 3D print had an obvious and direct overall copy-relationship to the original basket whereas the two tiles provided finer textural details and a smoother surface quality on moveable elements. Both were placed next to the ancient artefact and close to the crafted replica. A small plinth with a light box inserted provided a light source and resting place for the 3D prints. Figures 7 and 8 show the juxtaposition and arrangement with the one-to-one replica fixed but touchable and the moveable elements can be directly picked up. The museum found the fixings relatively straightforward although the swivel clips for the movable pieces occasionally had to be replaced. After three months, the fixed 3D print was a little grubby. Fortunately, the 3D prints were washable.



Figure 8. The touchable installation in use with the translucent whole basket 3D print fixed on the left and the two transparent tile-like moveable 3D prints on the right, where the fine thread can just be seen.

Comments and Reactions

One question on the visitors' feedback form related directly to the touchable element: 'Did you look at the 3D *Touching the Past* laser scans of the basket? If so, what did

you think of them?'. The comments were mostly positive, with 68 positive and enthusiastic responses, 4 a little more mixed, 44 more neutral, and 7 negative. Some of the negative comments or mixed responses referred to a lack of understanding or a desire to have a craft material replica to touch instead. The strongest negative comment was: 'Waste of money, the real thing is not plastic'. Enthusiastic comments included: 'This is a really impressive innovation that allowed a closer encounter with the past'; 'to be able to touch the basket certainly appealed to my awareness of the object'; 'Loved looking and touching at the same time'; 'Loved this section of the exhibit'; and 'I felt very connected to the artefact'. A strong theme was that this kind of exhibit was more appealing for children. For example visitors replied: 'I didn't, but our grandchildren did and thought it was great'; and 'No, but I didn't come with my kids, they would have enjoyed it'. Some older visitors were happy to engage with the 3D prints, writing that it was: 'A new experience for a senior unused to 3D-IT!'

A few visitors also commented on the 3D prints and touchable element under Question 3: 'Was there anything in the exhibition that you particularly liked?'. Considering the range of possible answers, the fact that nine people chose to emphasise the touchable element is significant. The professional comments from Fiona Pitt (curator), the conservator, education officer and exhibitions manager all supported the benefit of including the installation as an addition to the overall provision and to a variety of casual visitors, gallery tours and educational visits.

The collaboration between the University of Exeter and Plymouth City Museum & Art Gallery allowed the *Touching the Past* project to take a research idea and place it in a public arena. Much of this was achieved in conjunction with Bradford University within a short timescale and limited budget. The collaboration resulted in a first – an original object was augmented by a touchable 3D print installation for three months without facilitators in the gallery.

Conclusion

Working with both Plymouth College of Art and Exeter University brought very significant benefits in enhancing the range of methods through which visitors could engage with the exhibition. Certainly, the exhibition would have been poorer without them. It is hoped that the relationships built through this project will be maintained and further outcomes will emerge.

Fiona Pitt is Senior Curator and Curator of Archaeology at Plymouth City Museum & Art Gallery. Dr Linda Hurcombe is Professor at Exeter University.

Acknowledgements – Touching the Past

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