Scenario: enabling collaborative interpretation

This scenario outlines a concept for a technology developed through PATINA that primarily focuses on supporting the interactions that occur between individuals and artefacts in a research environment. As stated in the original proposal, PATINA aims to "develop future research spaces that will enrich the experiences of individual researchers and create new opportunities for sharing research and building communities". This document describes a scenario which permits a greater level of collaboration in a research environment whilst simultaneously allowing a researcher to focus on the primary research material without distraction.

Example research environment – archaeological excavation

As with work in many field environments, as research is conducted at an archaeological excavation a large variety of data is continuously collected and documented. This data is recorded to a variety of media, both digital and analogue. As an example, the archaeological record frequently consists of both digital data such as survey data, digital photographs, databases and paper based media such as context record sheets and hand-drawn plans and section drawings.

The ability to experience and comment on the collection of data as it occurs would be particularly helpful to archaeologists working in the field. Among other benefits, this would raise archaeologists' awareness of the activities occurring throughout the site under excavation, permit them to make comparisons between different trenches and to provide the own interpretations of others finds and bring a greater level of satisfaction to the job by further engaging archaeologists with the archaeology.

With such a large flow of information being experienced, this system would have to be designed to avoid distracting the user from the primacy of the research material. This could be achieved by having the majority of this data visualised in the peripheral vision of the user, moving into focus only when required (signified by the user or through task awareness). Similarly auditory and haptic cues could stimulate peripheral engagement. Information relevant to the task at hand, or of an urgent nature, might attract the attention of the user in a subtle manner.

In addition to allowing a researcher to experience the data, this system would also allow a variety of contextual information to be conveyed to a researcher in the field, based upon the task that they were currently performing. Therefore, an archaeologist sorting and cataloguing finds would be able to access records of similar finds from previous excavations, and an archaeologist conducting a landscape survey would be able to access historical records and maps for the surrounding area. Variables such as the density of objects, points of commonality between different indicated datasets and intensity of study expressed as time spent working in a given area could all be made available in subtle, multimodal and user-definable ways. Therefore the system supports the flexibility required by most researchers including archaeologists, whose roles as part of an excavation team are likely to be fluid throughout an excavation.

The system would also integrate multimodal forms of real-time communication with other researchers working either in the same location or outside of it. So for example, traditional forms of interaction through technology, such as audio and audio/visual, could be utilised in conjunction with

more novel forms of communication, such as the use of haptic feedback to guide a researcher around a research environment based on cues provided by a remote colleague. On an archaeological site this level of communication would transform the research space, with one major benefit being the increased integration of specialists into the excavation process. Often these specialists are unavailable (as they are working off site) or have limited time available to visit the site, so being able to communicate and interact with these specialists in real time would improve the process of excavation and interpretation on site.

Tenets of PATINA

How the system fits the requirements of the PATINA project:

- **Provenance:** Records interactions between researchers. Could also record the various interactions between researchers and data.
- **No Infrastructure:** System could be built largely on existing technologies that require no infrastructure.
- **Elegance/subtlety:** Interactions are subtle to avoid distraction.
- **Lightweight:** technologies could be lightweight both digitally and physically.
- **Flow:** system designed to maintain flow and not to distract a researcher from their primary material.
- **"Space-thickening"/Atmosphere:** creates an atmosphere where social connections and collaboration is amplified.
- **Collaborative:** the system focuses on collaboration.
- **Wearable:** based on portable technologies, the majority of which already exist.
- **Performance:** The system incorporates multimodal communication (including gestural input and feedback) and a performative interface.

Example Scenario

An archaeologist arrives on site at an excavation and as is allocated a trench to work in. As he starts to approaches the trench, he feels a communication attempting to contact him. He is happy to be interrupted at this moment is time, and with a nod of his head several images come in to view depicting several stages throughout the previous day's work in the trench he is now standing in front of. At the same time he hears several short audio recordings of the archaeologist who was here last, talking about their interpretations of the archaeological evidence. His hand vibrates repeatedly, and he realises that this archaeologist must have been digging quickly, unsurprising given the weather at the moment.

As he kneels down to begin excavating, he again feels that a visual is attempting to come into focus. He nods his head, and a digital plan of the trench appears in front of him. He points at the trench, and the plan disappears from his field of vision, appearing a second later projected over the trench. Section plans are projected up the trench walls, and the finds from the material visible in the trench, recorded via survey equipment and then removed for the finds specialist, are visualised in front of him. From this perspective he can see that all of the features visible in the soil have already been accurately recorded, and with a swipe of his hand they disappear from view and he begins to excavate.

He turns his attention to a dark pit feature that stands out in the trench. As he begins to move his trowel back and forward over this feature, he feels numerous vibrations, and realises that a number of finds have already been removed from this area of the trench in the previous material. One location, towards the centre of the feature, has a particularly strong sensation associated with it. He points to this location in space with his trowel and nods, and immediately he is presented with the visual depiction of a heavily corroded metal object. At the same time, the voice of the finds specialist enters his head, describing the object as a Roman brooch, most likely dating from the 1st century AD. He moves his trowel round this area, and several more finds appear, this time several carbonised fragments of human bone. Another audio clip begins to play, this time a conversation between the archaeologist who was excavating here yesterday and the environmental specialist, who is discussing the bone fragments. The environmental specialist states that several cremation burials have been found in this area historically, and that she wouldn't be surprised if more turn up.

Noting that he better take care whilst excavating this feature, he returns to work, dismissing the visuals with a flick of his trowel. He removes about an inch of material from the feature before uncovering what appear to be several sherds of a Roman amphora. He points his trowel at one of the sherds and nods; as he does so numerous examples of similar fragments of amphorae are projected around the object. Observing numerous similarities he verbally states he believes that the fragments are those of an amphora, removes them from the ground and places them into a finds bag. He then turns to his portable device and prints out a digital tag, containing all the necessary contextual data.

These sherds are collected by the finds specialist, who scans the tag back at the site hut. As she does so she hears the archaeologist's audio stating that he believes the sherds to be those of an amphora. On close inspection she agrees, and updates the site database with this interpretation. A few minutes later, the archaeologist back at the trench decides to check the site feed, which documents the latest entries into the site database. He notices his find and interpretation is one among many of

a Roman date discovered by the other archaeologists, and is pleased to find out that it appears they are working on a site with a large amount of Roman activity.

Following further excavation, it becomes apparent that an almost complete amphora is surviving in the ground. The archaeologist decides to communicate with the osteoarchaeologist back at the unit, in order to ascertain how she would like the object removed from the ground. She is working in the laboratory when she notices that a visual communication is trying to get her attention. She nods and it comes into focus, establishing an audio and video connection with the archaeologist. The archaeologist explains his concerns, and from the camera he is wearing, she can see exactly what he is referring to. As the object looks delicate, she decides to assist with the excavation of the object by providing haptic feedback to the archaeologist as he excavates. Once she is satisfied that the object has been safely removed, she returns her attention back to her original research, secure in the knowledge that the cremation will be on its way to her in good condition.

Having removed the cremation burial from the pit and passed it on to the finds specialist, complete with digital tag, the archaeologist cleans and defines the cut of the pit and stops work. Aware that a large amount of time that has now passed since the archaeologist began to excavate, and that the archaeologist has temporarily ceased digging, a visual communication has become increasingly visible. The archaeologist agrees to see it, and the Harris Matrix diagram is visualised before him. Several markers are also projected onto the ground in front of him, highlighting new contexts in the Harris Matrix which have been added based on the archaeologists recent excavation. He gestures at the new contexts that have been added to the diagram, and accesses a more detailed record for each. His device has attempted to fill in some of the basic data automatically, but he chooses to override this by describing the contexts verbally. As he does so the contexts are updated, and the Harris Matrix diagram changes to reflect this. He consults the site feed once more, and notices that one of the archaeologists has recently been attributed with recording a large collection of Roman coins. He decides to go observe the work occurring in this archaeologist's trench and talk to him about this find.

Figure 1: An example of how context sheets could be placed peripherally to avoid distraction

An alternative perspective – nursing staff

Nursing staff are expected to have an awareness of their co-workers' actions throughout their shift. Despite this, communication frequently does not occur as often as it should, especially when there are shortages of staff. Awareness of important issues is usually communicated through a brief team meeting at the start of a shift.

The scenario described here could equally be utilised by nursing staff, raising their awareness of their colleagues' actions without distracting them from their primary task of caring for patients. The contextual information provided by the system would also help diagnose and assist with patient care. Nursing staff also rely heavily on the support of medical specialists, and being able to communicate with these staff remotely in real time would be beneficial, as would a system which could bring a specialist on site up to speed with a patients background without the assistance of a nurse.

Finally, the system would play an important and much needed role in helping train junior members of staff. These junior nurses will shadow an experienced member of staff until they are able to work independently. Once they have reached this point they will work alone but remain the experienced nurse's responsibility, who is held accountable should any mistakes be made. The system would therefore allow the progress of an inexperienced member of staff to be monitored as they performed their duties, permitting any intervention required when necessary.