ChronoTable: Interacting with the Rhythms of Research

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Abstract
This paper presents our investigation into the rhythm of research activity during an archaeological excavation, through observation, interviews with archeologists and use of the ChronoTable, a tool for capturing and representing rhythms in research. The ChronoTable attempts to engage archaeologists with the temporality of their own research practice, encouraging the reflection and annotation of paper timeline scrolls displaying the rhythmic patterns of the day's research.

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Human-Computer Interaction; Time; Rhythm; Research; Archaeology; Reflection.

ACM Classification Keywords
H.5.2. User Interfaces.

Introduction
Archaeological practice is deeply entwined with the contemplation of time. However, while archeological excavation involves the recording of temporal data with regard to the materials excavated, temporal data relating to the process of excavation is often overlooked. Our particular interest is in how research time is represented, absorbed and compressed in archaeology, and whether technologies can positively or negatively adapt or support these processes. This intervention constitutes part of a

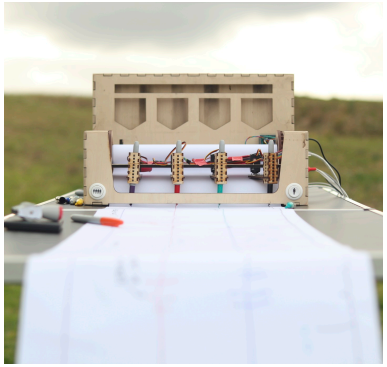

Figure 1. The ChronoTable in the field.

larger research project exploring how effects of technologies on research rhythms may drive contemporary issues around research such as specialism, hierarchy and politics. Critical to this attempt was the pace, rhythm and representation of time suggested by our technologies. One key question, therefore, is whether it is possible and indeed desirable to design a technology (and associated media) that can suggest, or adapt to, a particular interactional rhythm and whether and how these technologies influence the working rhythm of the archaeological excavation.

The Rhythms of an Archaeological Dig

Archeological excavation is characterized by distinctive rhythms, which lend it a particular pace as a research practice. Both environmental and human factors contribute to these rhythms. On the particular excavation on which we employed the ChronoTable, for example, the excavation was timetabled annually to take place at the beginning of September, taking into account both the end of the nesting period of the birds for which the site provided a protected nesting ground and the start of the academic year. The fact that the majority of the excavators were students or volunteers also impacted on the rhythm of the excavation, as the students rotated between different tasks to gain experience, and the volunteers were only available sporadically. The need to satisfy these requirements conflicted somewhat with the ideal rhythm for the excavators, which, according to the site director, would be achieved by keeping the same excavators on the same trench throughout the excavation. This would allow them to gain situated knowledge and develop interpretations through a sustained material engagement with the trench over time.

The daily routine of the dig followed a 9am to 5pm structure including a midmorning and midafternoon tea break. As the excavation progressed, complications and ambiguities developed, which required interpretation and decisions about how work should best proceed. These pressures often resulted in the latter tea break being missed in favour of continuing work uninterrupted on the trench, until enough progress had been made to resolve important questions before the end of the day. This uninterrupted rhythm of work was made possible by the fact that, as the excavators moved down the layers of the trenches, they were more often working with trowels. This latter activity was sustainable for long periods of time in a way that the heavy labour of mattocking, which had dominated the excavation of the initial layers, was not. A further temporal factor, which affected the rhythms of the excavation, was the fact that this was the final year of excavation planned for the site by the current research team. This lent increased intensity to the final weeks of the excavation.

Given the importance of temporal rhythms to archeological excavation, an importance both testified to by archeologists and apparent in our observation of the excavation, our question was whether the recording of such rhythms might be a useful addition to the documentation of the excavation. Archeological excavation is extensively documented, but the data recorded is largely spatial (trench measurements and coordinates; cataloguing and description of layers; graphs, photographs and diagrams). The temporal data that is recorded relates to the materials excavated (chronological order of layers, dating of finds), but not to the process of excavation. We wanted to investigate the impact of representing to archeologists the particular temporal

Figure 2 A 'Finds Tray' is used to store new items; each tray is connected to the ChronoTable. The activity level in each tray is measured with the piezoelectric sensor that detects vibrations in and around the tray.

rhythm of the excavation, as it was constructed through their own rhythmic processes.

The ChronoTable

Our resulting design is the *ChronoTable*, a 'research activity seismograph' that traces temporal data streams onto a roll of paper (fig.1). The starting point for designing the ChronoTable was our previous project, the ChronoTape [1], an interface that augments paper timelines with digital genealogy data. In this work we have extended the ChronoTape design to allow for the recording of digital data onto the paper, and increased the dimensions to encourage multi-user interaction.

The ChronoTable was deployed on the dig site to record and represent the research activity of the archaeologists. The initial intention was to use the ChronoTable to capture a wide range of on-site research activity ranging from digital interactions (tweets, emails, database entries) through to physical interactions (conversations, gestures, movement). After an initial exploration into integrating these diverse sources of research activity it was decided to concentrate on one simple measure; firstly so the rhythmic patterns would come to the fore; secondly so that the perceived functionality of the device (as a potential means for checking tweets, remembering conversations) did not get in the way of engaging with the rhythms of research; and thirdly so that the device was conceptually simpler and hence easier to understand and use.

After initial observations were made of archaeologists at work, a potential solution was found as a base unit of archaeological research activity, namely activity around each of the 'finds trays'. Throughout the archaeologists diverse range of tasks and activities there was one constant factor in the form of the plastic 'finds-tray', used as the first place to collect interesting material found in each of the trenches (fig.2). The finds-trays acted not as only a place to temporarily store items until further classification but also as a hub for which to gather and discuss the general activity in the trench.

The activity around each tray is measured with a piezoelectric sensor that picks up vibrations in and around each tray. The activity level from each tray is stored and the total activity over every 5 minutes is summed. The stream of activity can be printed out on the ChronoTable by the archaeologists who could gather around the ChronoTable during spare time such as lunch and tea breaks. The timeline prints out in 5-minute sections, with the amplitude of the wave being proportional to the amount of activity in the 5-minute section. This printed timeline helps uncover the rhythms of the dig by showing periods of activity and inactivity around each trench unfolding over the day. Annotation of the printouts by the archaeologists allows the interpretation of activity over the day (fig.3).

Evaluation

The ChronoTable was deployed at two archaeological excavations for a total of nine days in the field. Due to bad weather, the first dig was only suitable as a test run as it wasn't possible to evaluate the ChronoTable in use. The second dig, spanning four days, proved to be more successful, primarily due to the sunny weather. During the second dig a number of videos were taken of the ChronoTable in use, and along with a number of interviews they form the basis of the following brief evaluation. One outcome was the raising of awareness between trenches, and potentially increasing the activity levels in a trench that has been considered as inactive. When questioned

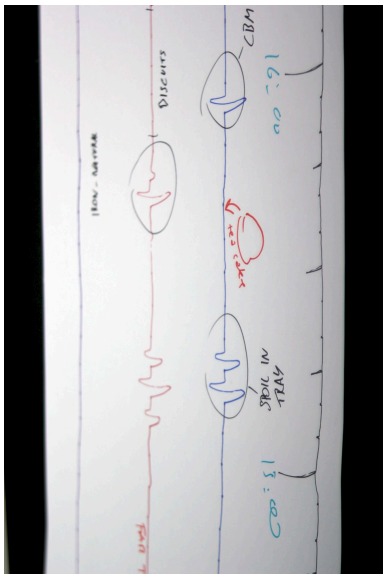

Figure 3 ChronoTable timeline after annotation. This shows notes made both around times of activity and also in lengths of inactivity (such as a tea break). Timeline ticks are printed on the line on the right.

about whether it was 'interesting seeing what happened in the other trench?' one response was: *"I think it is. It's always a bit of, a bit of a competition between us. Our trench is better than yours, and they've found the ancient stuff now. [Laughter] And you keep looking harder."*

There was general feedback from the archaeologists that the activity around the tray did not sufficiently capture the full spectrum of activity around a trench*: "Mm, you know, what's there in your feature is, is what you find. So you could dig a feature with nothing in it but still whack out a massive amount of earth, whereas someone could, you know, dig a tiny feature and get mountains of, of pot out of it, so the stuff that you put in your finds tray isn't necessarily representative."*

The use of the ChronoTable for alerting another archaeologist from a distance was highlighted *"I think if you we ever have, we were working further away and it couldn't be seen and you have someone actually monitoring it, it could be quite useful to know if something's just gone in a tray."* The benefit of annotating blank space in the timeline was raised: *"Yes, and when people have been doing photos, cleaning, I suppose all that could be put on because … nothing is going to be going in the trays."*

Further Work

The ChronoTable has been designed as a 'slow technology' [2], with the intended use of the paper tape being the long-term reflection and display of research activity. This long-term use may be achieved if the scrolls are displayed on the wall of the archaeologist's office/lab/department after the dig. In addition to the ChronoTable's development as a slow technology, further developments would allow a more flexible, modifiable and personal method for tracing and reflection upon research activity. The integration of multiple forms of digital data, including social media, videos, audio and photographs, would be key to allowing researchers greater choice over their representations of research activity.

Conclusion

The ChronoTable elicited useful understanding as to what archeologists felt was relevant or otherwise about temporal data relating to the process of excavation. Its focus on the recording of temporal data as an ongoing aid to reflection and interpretation met with some resistance from archeologists accustomed to entirely different recording conventions. It also revealed the difficulty of capturing the variety and complexity of archeological activity in an integrated representation. However the ChronoTable also suggested some ways in which providing instant feedback on the rhythms of research might potentially be useful to researchers. It raises questions in relation to the existing recording conventions of archeology, which merit further investigation.

Acknowledgements

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