*Being Objective: Communities of Practice and the Use of Cultural Artefacts in Digital Learning Environments*

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**Abstract**

*Over the past decade there has been a dramatic increase in the volume of digital content created from museum, library and archive collections but research on how this material is actually used, particularly in digital learning environments, has fallen far behind the rate of supply. Previous research has focused largely on the technical aspects of digitisation and has failed to problematise both the agency of those directly involved in creating and using digitised collections, and the process of end-use. Idiographic research methods have dominated, employing qualitative, top-down forms of analysis that have limited the validity and applicability of findings and betray an ideological belief that artefact use is beneficial without understanding how artefacts are used and why they are used in particular ways. This has led to a gap in our understanding of how digital artefacts are used at a time when universities are under more pressure to offer unique content in digital form, in virtual learning environments (VLEs) and Massive Open Online Courses (MOOCs), and when the cultural sector is under pressure to make digital content available for use and re-use without any clear idea of how this can be done sustainably.*

*In order to address this gap, this thesis examines how communities of practice (CoPs) involved in the supply and use of digital artefacts in the Higher Education sector in the UK interact with content and what factors affect this process. It focuses on a case study involving the digitisation of Shakespeare collections used in postgraduate research, and the testing of use in a range of different learning environments. It uses Grounded Theory to generate typologies of artefact use. Quantitative data (itself unusual for such studies) is used to investigate similarities and differences between groups of practitioners and research students in the way that they engage with artefacts in different contexts.*

*This case study produced a number of significant findings. Firstly, similar patterns of artefact use were found across all users suggesting that there are generic ways in which we all interact with digital artefacts. However, distinct forms of use did emerge which correspond with membership of particular communities of practice. Secondly, members of a CoP appear to share a particular learning style and this seems to be related to the domain of interest around which a CoP forms and how members of the CoP interact with artefacts. Thirdly, the nature of the environment does affect learning style: although differences between artefact use in digital environments tested were slight, the research did demonstrate that hybrid learning environments incorporating physical and digital features would be preferred by most student end-users. Finally, the research indicates that a mixed method mechanism for analysing and measuring use, piloted and tested in the case study, is possible.*

*This research highlights theoretical and practical implications for the way that artefacts are supplied, packaged and used in Higher Education and beyond, and for the way that practitioners and students work together to improve learning from cultural collections.*

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## 1. INTRODUCTION

### 1.1 Identifying the problem

Over the past decade there has been a dramatic increase in the volume of digital content created from museum, library and archive collections but research on how this material is actually used has fallen far behind the rate of supply. With cuts in funding to the museums sector and increased competition in the Higher Education Sector this has created a pressing problem; how can digitisation and digital learning environments meet the needs of users and how can this be sustained? This thesis aims to address this gap in our understanding of artefact use by examining a particular part of this problem – the usage of cultural artefacts[1] in digital learning environments. In doing so, it focuses specifically on the Higher Education and cultural sector in the UK. Using the theoretical framework of communities of practice[2] to ask what influence the identity, knowledge, skills and experience of suppliers and end-users of digital content have on the process of artefact use, and, importantly, a mixed methods approach to data analysis, this thesis asks two fundamental questions:

1. How are cultural artefacts used in digital learning environments?

2. How can the theory of communities of practice help in understanding the people and processes involved in the supply and use of digital artefacts?

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[1] Defined here as an item from a museum, library or archive collection.

[2] Defined by Etienne Wenger as 'groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly' (2013).

Employing Grounded Theory to investigate types of use and patterns among groups of users, and then testing usage behaviour in different environments,[3] the research has provided significant theoretical insights into how artefacts are used and how the learning styles of communities of practice influence interaction with digital artefacts. The employment of a mixed methodology to test the applicability of Wenger's theory of communities of practice and to chart usage patterns demonstrates that it is possible to generate numerical data from artefact use. This has considerable implications for research in an area of study previously dominated by largely qualitative methods of analysis. Using this methodology, the findings reveal that there are generic and specific forms of digital artefact use. The discovery that there are ways of engaging with artefacts shared by everyone is valuable given pressure on the Higher Education and cultural sectors to produce digital resources for a wide audience. The knowledge that specific usage behaviour appears to be related to a shared learning style within particular communities of practice is equally valuable. Tailoring digital artefacts to suit the learning style and usage behaviour of particular groups of users, particularly those who are willing to pay for access to material, offers a way of supporting more general access to digital artefact collections. The research also found that, as well as the social background of the user, the nature of the environment also affects learning style and artefact usage. Findings reveal strengths and weaknesses of both digital and physical environments suggesting that hybrid learning environments would be most effective in accommodating student use of cultural artefacts.

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[3] A method of content analysis that combines an open, qualitative creation of codes from data and the quantitative collation of incidence of those codes, and claims to offer a way of 'arriving at theory suited to its supposed uses' (Glaser and Strauss 1999)

This chapter explores possible reasons for this gap in our understanding of artefact use and outlines why the question is relevant to two of the sectors directly concerned with supplying and using cultural artefacts in digital learning environments: the cultural[4] and Higher Education[5] (HE) sectors. It concludes by summarising the approach chosen to address the research question. The following chapter goes into more detail on the political, economic, technological and strategic context for both sectors and why the research question is so important, before examining what research has previously been undertaken in the area of cultural artefact use, digital learning environments and methodologies used to address the problem of how digital artefacts[6] are supplied and used. Chapter 3 identifies gaps in previous research and rationalises a methodological approach used to address the two central research questions, and describes research activity used to gather and analyse data over two phases. Findings from Phase 1 and Phase 2 are given in Chapters 4 and 5 (respectively) before a reflection (in Chapter 6) on how the research has helped to address the two main questions and the central problem of cultural artefact use in digital learning environments is given in Chapter 6. A summary of main findings, implications for both sectors and directions for future research are then given in a concluding chapter (Chapter 7).

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[4] For the purposes of this thesis, the cultural sector is taken to mean museums, libraries and archives.

[5] Providers of post-secondary or tertiary education, principally universities.

[6] Defined here as a digital representation of an item from a museum, library or archive collection, an 'information package' (DCC 2013) typically comprising multimedia files and associated metadata.

## 1.2 Exploring the problem

As noted above, an exponential growth in the volume of digital content created from cultural collections over the past ten years has not been accompanied by research on usage of content particularly in digital learning environments. For example, the number of images of artefacts available via the Victoria and Albert (V&A) Museum's 'Search the Collections' facility increased by 300% from 86,500 images in 2009 (V&A 2009, 5) to 260,000 in 2011 (V&A 2012, 4). Similarly, in 2012 the British Library claimed to have been digitising its collection at the rate of 8,000 images per day (British Library 2012, 9) building on a 500% increase in the creation of digital images between 2007 and 2009 from 3.1 million (British Library 2007, 26) to 15.1 million images (British Library 2009, 25), compared to the creation of only 43,673 images in 2005-06. On the back of such increases, aggregators such as Culture Grid and Europeana offer access to information on 3 million (Collections Trust 2013) and 30 million (Europeana 2013) cultural artefacts (respectively) indicating that the trend in content creation found in the V&A Museum and The British Library has spread wider across the UK and Europe. More generally, digital content in its broadest sense is predicted to grow over the next 16 years by a factor of 300 to be '40 trillion gigabytes (more than 5,200 gigabytes for every man, woman, and child in 2020)' (Gantz and Reinsel 2012, 1). However, research studies on use[7] of the digital artefact have not kept pace with the rapid increase in content. In particular, questions about the mechanics of interaction with the digital artefact and what effect the identity, interests and skills of those involved in producing and using artefacts has on the experience of end-use,[8] have not been

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[7] For the purposes of this thesis defined as interaction with an artefact at any stage of its creation or development as a means of accomplishing or achieving a goal.

[8] Specifically, the ultimate use of an artefact as a product, i.e. after it has been created and developed.

sufficiently addressed. Furthermore, there is also a lack of published research on the influence of the digital environment on use, specifically how virtual learning environments[9] used across the HE sector, affect artefact use. So why has there been such an increase in the volume of digital artefacts without attempts to understand how they are being used?

### 1.2.1 Hypothetical reasons for lack of research: Technology and funding

Arguably, part of the reason for the imbalance between content creation and research on use might be that digitisation of cultural artefacts has been technologically driven; the tools to create images and metadata[10] and make content available online exist so they have been used. The speed of technological change might also have been responsible for museums 'quixotically chasing the leading edge' (Parry 2010a, 5) in the way that many responded to the opportunities of digital technology. The consequence might have been what Parry termed a tendency to 'fetishise the future' (2010a, 5) by focusing on the 'what' and neglecting the 'how' and the 'why' of digitisation. There are obvious benefits to digitisation of artefacts such as increasing public access to cultural collections and improving record-keeping within institutions and these benefits were perhaps also responsible for many organisations overlooking the precise nature of content use in favour of general analyses of content creation.

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[9] A VLE is defined by Dillenbourg in its most general sense as a 'designed information space' (2002, 3) and by Catherall as 'a Web-based portal to a variety of communication, content publishing, assessment and related tools' (2011, 117).

[10] In the context of this research, metadata is defined as descriptive information about cultural artefacts as well as structural or technical metadata which generally relate to the design and specification of data structures and to information concerning the context in which data was captured, respectively.

The short-term funding available for many digitisation programmes might also have had an influence on the lack of evaluation of the products of digitisation projects (Butterworth, Fields et al.. 2005, 288). Funding for collaborative projects between the cultural sector (which holds collections) and the HE sector (which sometimes makes research use of them), such as JISC's Content Programme 2011-2013 which aimed to stimulate 'creation and delivery'(JISC 2011) of digital resources, has placed little emphasis on what happens to the digital artefact post-delivery. Since 2008, JISC has reduced funding for mass digitisation (ibid.) in favour of projects which generate open educational resources (OERs)[11] and programmes centred on the use and re-use of 'big data'[12]. Although this switch in funding priorities places a stronger emphasis on content use rather than content creation, research interest in 'inter-artefact' use (use of data which links individual artefacts) has predominated over 'intra-artefact' use (use of data solely about an individual artefact). An increased interest in how metadata on cultural collections can be found, for example JISC's Discoverability programme (Marchionni 2013), as well as how metadata can be used, places greater emphasis on machine-readable content to which museums, libraries and archives have been slow to respond (Ridge n.d.). Although the creation of a semantic web focuses largely on the interoperability of data, a greater understanding of how content is actually used is needed so that users are able to find, share and combine data more easily. Arguably, understanding how artefacts are used is instrumental in creating a system that enables machines to 'understand' and respond to complex human requests based on their meaning. This makes decoding the process of using artefacts to make finding, sharing

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[11]   OERs are 'teaching and learning materials that are freely available online for everyone to use' (OER Commons 2013).

[12] In the context of cultural collections, 'big data' is defined by Nick Poole (Collections Trust) as 'large datasets for academic and scientific research' (Poole, 2013).

and combining information on other artefacts more easily a vital part of the cultural sector's contribution to Web 3.0 (British Museum n.d.). Finally, an ongoing and persistent debate about the relative advantages of either physical artefacts or digital artefacts has also played a part in diverting attention from efforts to understand the basic processes behind artefact use regardless of medium.

### 1.2.2 Hypothetical reasons for lack of research: Research methods

A second possible reason for the lack of research on digital artefact use might be methodological challenges in capturing data on usage. The lack of adequate research methods in this area is highlighted, unwittingly, in a recent report published by the University Museums Group (UMG) and University Museums in Scotland (UMIS) advocating greater funding for university collections based on the range of benefits they provide. In it the authors claim,

> Strategic investment in university museums offers significant academic and societal benefits: wider access to university, deeper student learning, stronger community engagement and many opportunities for research impact (UMG and UMIS 2013).

Whilst few would deny that investment in university museums would be expected to bring benefits to academia and beyond, the inability to *prove* the impact of object-centred learning has long been a challenge for university museums. Problems associated with capturing meaningful quantitative data from an individual's interaction with an artefact in digital form has meant that the vast majority of studies (e.g. Chatterjee 2010a) on artefact use are qualitative in nature and focus on physical collections. An underlying reason for an adherence to qualitative methods alone could be museology's place within the humanities where a stress on

individuality (Portin 1981) and the uniqueness of an individual's encounter with an artefact might have restricted the use of quantitative methods of analysis. The result is that the evidence base for how artefacts are used is weakened and the wider applicability of any findings generated is curtailed. But why is it now important to know more about the use of digital artefacts?

## 1.3 Relevance of the research questions

This section examines briefly why the research questions are of relevance to the cultural and HE sectors, and beyond. It looks at changes in how cultural content is valued and controlled, and current issues concerning the context in which digital artefacts are used by the HE sector and the creation of content by the cultural sector. Finally, synergies between the two sectors are examined as pressure builds to collaborate on the creation and use of digital artefacts.

### 1.3.1 Relevance of the research: Value and use

A reduction in funding for digitisation has led many institutions holding collections to question the value of digital artefacts and to tackle issues surrounding the sustainability of resources (discussed in more detail in Chapter 2.2.3). This inevitably leads to an interest in the impact digital content is having on the end-user (e.g. Zorich 2010) and making the 'digital supply chain' (Deutschmann 2009), the set of business functions responsible for the creation and delivery of digital artefacts, more efficient and effective. Lack of demonstrable return on investment for

digitisation (Flow 2010, 15) has also meant that collections institutions are having to make decisions on which content to continue to make accessible and this has also led to an interest in uptake and use. Lack of research on how digital artefacts are used jeopardises future investment for content creation and delivery as priorities have been forced upon the cultural sector. But understanding use might also help inform the process of assessing risks in releasing rights-sensitive material. As Mercer (2000) points out,

> Much has been written on issues pertaining to licensing and archiving of digital information. Until recently, there has not been enough information to evaluate how these digital products, particularly journals, are being used.

Data on use are also needed to enable repositories to make more informed choices about which digital content to procure externally as availability of content rises and budgets are squeezed (Mercer 2000). As pressure builds from end-users and government not only to make content available but usable (see Section 2.2.6) owners of collections have more reason to track usage of assets in order to understand what is done with them and to try to recapture value created 'beyond' the museum's 'institutional walls'(Rumbold 2010, 326). As Rumbold explains, the terms of value creation are changing; the question for museums (and for the cultural sector at large) is no longer about generation of content but about what happens next (2010, 321). Funders such as JISC are placing more emphasis on the value end-users can bring to the production of digital content through 'co-design' (JISC 2013a), and the cultural sector is being encouraged to think of business models based on the end-user,

> A heritage institution looking for a revenue model is best advised to start with its *potential customers*, rather than its collection (DEN Foundation 2010, 85).

Therefore, the question of sustainability for the cultural sector has changed from value *appropriation from* content and end-users, to value *creation with* content and end-users (Mizik 2003).

*1.3.2 Relevance of the research: Control and use*

Greater attention to content use as opposed to content creation has coincided with a general shift in control of the creation of digital artefacts from institutions to individuals. The proliferation of user-generated content online (Grabowicz 2013) created using mobile devices or derivatives of owner-generated images of cultural artefacts has meant that the relationship between cultural institutions and their users has been redefined in terms of how value is created from cultural collections as these have become available and usable online. The owner of an artefact can no longer control fully what is done with its digital representation once online and this has unsettled the power balance between museums and their users (Khan 2002). A shift to cheaper and more diverse forms of digitisation has meant that users have become producers, resulting in the Web 2.0 idea of the 'produser' or one who produces and uses digital content (Bruns 2007). Just as the process of creating digital content from physical artefacts has become more complex so too has the diversity of ways in which content can be used, beyond what was initially intended by museums, libraries and archives. Production of images from the artefact and what is done with them has become decentralised and the digital supply chain has become more multifarious as a result. If museums, libraries and archives are to recapture value from the digital artefact, greater knowledge is needed about how content is used as well as how it is produced. In general, the cultural sector might have been too slow in appreciating the difference between the end-user's experience of the physical and the digital (Teather and Wilhelm 1999) let alone accounting for the diversity found in new forms of production.

Nevertheless, this shift online to a 'user-centered paradigm' (Veldof, Prasse et al.. 1999, 116) has been responsible for a rapid rise in the volume of digital artefacts from non-specialist

sources beyond the control of collections' repositories. This should make understanding forms of usage more vital as cultural gatekeepers are increasingly being expected to become cultural facilitators (McCrary 2011, 365). As Veldof noted on the changing role of librarians, 'Usability is particularly relevant to librarians as their roles change to information specialists and system designers' (1999, 123). In other words, knowing how digital artefacts are used should lead to improvements in how systems work (Duff and Cherry 2000). There is, however, growing evidence among museum, library and archive professionals that this shift in control has created something of an identity crisis among those traditionally involved in regulating the use of physical artefacts (Tousley 2010). This suggests that studying the influence that different practitioner perspectives can make to the way that digital artefacts are produced is timely and, in the context of artefact use in the HE sector, might help prevent what Stiles terms the 'content trap' (Stiles 2004). This describes the delivery of content by practitioner groups (such as librarians) by 'fork-lift' (ibid.), in other words without any understanding of how this will be used or how their packaging of it might influence end-use. A failure to take account of the selective nature of digitisation and the influence of decision makers creating and supplying content, has limited our understanding of how large quantities of digital material are actually being used. Scrutiny of the influence of producers on production and end-users on use is especially important and timely given that increased complexity of the supply chain of digital content described above. So why is it important now to know more about how digital artefacts are used in Higher Education?

### 1.3.3 Relevance of the research: Context and use

Over the past decade, the use of digital learning environments by universities in the UK has

been actively encouraged by government as one way of responding to demands for flexibility

(Irvine 2003) while, arguably, reducing operating costs (Fry 2010).With rapid population growth

in the developing world, 'the demand for post-secondary education is at an all-time high'

(Sedehi and Saccocio 2013). This 'has created sizeable demand for scalable, consistently

produced online courses' (ibid.) delivered via digital learning environments. The recent

development of Massive Open Online Courses (MOOCs) which cater for large numbers of

distance learners through virtual learning environments with often minimal contact with

teaching staff (and, in the case of so-called 'cMOOCs', increased peer-to-peer contact), and the

expansion of mobile learning environments[13] has made the need for understanding how

content is used even more vital as the variety of contexts within which students learn

diversifies further. Moreover, the growth of embedded computing (Fisher, Faraboschi et al..

2005) and Radio Frequency Identification (RFID) technology makes the prospect of an 'internet

of things' (Ashton 2009) - creating intelligent artefacts and artefact-based computer interfaces

– a real possibility which could potentially change digital learning environments still further.

However, the affordances or limitations of the context of artefact usage is a relatively neglected

area of study, despite the growing variety of ways that digital content can be found and

engaged with online (Bautista 2012, 3).

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[13] Mobile learning environments  facilitate learning 'via such wireless devices as mobile phones, personal digital assistants (PDAs), or laptop computers' (O'Malley, Vavoula et al. 2003).

### 1.3.4 Relevance of the research: Content and use

Creating unique content from cultural collections might offer universities a way of making courses stand out as students, many of whom now pay maximum tuition fees, become more selective (Thompson and Bekhradnia n.d., 14). However, just as it is, 'absurd to try and solve the problems of education by giving people access to information as it would be to solve the housing problem by giving people access to bricks' (Laurillard 1996) generating digital images and metadata for research use without paying attention to how this might be used or could be used seems misguided. The adoption of virtual learning environments has stimulated a great deal of debate on the kind of pedagogies required to use them effectively both for distance learning and blended learning.[14] Although within digital learning environments there is an emphasis on problem solving rather than content use *per se*, they are designed to be learner-centred (Siegel and Kirkley 1997) and considering learner use of artefacts within these environments would seem to be an important way of gauging the efficacy of artefact-based content especially as digital learning environments become larger and more open. This openness poses questions about the role of institutional databases and how these relate to course provision and to wider public use. As noted above, funding for the creation and sharing of OERs has increased sharply in the past five years but low levels of uptake, and a lack of evaluation around use, has called into question the value of investing in shared educational resources (Anyangwe 2011). Overall, this lack of knowledge on end-use has created a widening gap between content delivery and awareness of impact on learners.

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[14] Blended learning combines online and face-to-face instruction (Reay 2001, 6).

*1.3.5 Relevance of the research: Collaboration and use*

A restriction in government funding for mass digitisation in the UK over the past five years has been accompanied by greater investment in funding schemes which promote partnerships between content providers (such as the cultural sector) with content users (such as the HE sector). Although economies of scale undoubtedly lie behind such a shift (both in terms of sustainability for the cultural and HE sector, and in the pooling of resources between funding bodies such as the Arts and Humanities Research Council and Arts Council England), the conditions attached to funding awards suggest that releasing content for use and re-use is just as important (discussed in Chapter 2.2.6). At a governmental level, both in London and Brussels, there is also a growing realisation (Etzkowitz and Leydesdorff 2000, 110) that in order to compete globally, innovation requires dynamic partnerships within the 'triple helix' (Etzkowitz 2003) of universities, government and industry (including the cultural sector), although the pay-offs for collaborating to create open content remain unclear (JISC 2013d). Knowledge about how digital artefacts are used in Higher Education would be helpful in persuading organisations that own collections, as well as those that would most benefit from using them, that investment of time and resources would be worthwhile.

## 1.4 Research gaps

Despite a growing number of reasons for a deeper understanding of the use of cultural artefacts in digital learning environments, there remain significant gaps in research activity. There are three principal gaps in published research in this area:

- **Focus**: the relationship between the identity, interests, experience and skills of suppliers and end-users of content and how digital artefacts are created and used has not been researched sufficiently.  The basic processes behind the use of digital artefacts have also not been examined to any appreciable extent. Previous research on the influence of environment has focused on the usability of VLEs rather than the usability of content within them

- **Scope**: previous studies on the digital supply chain have been conducted largely on a particular part of the digital supply chain and by those concerned (for example, in the museums profession). Also, the scope of what is meant by use has tended to refer to usability of a product rather than a broader, more inclusive definition of the term

- **Research methods**: previous studies on artefact use have tended to adopt qualitative, top-down methods of data analysis rather than allow data to suggest new typologies

The research approach adopted in this thesis (outlined in Section 1.5) is designed to address these gaps.

## 1.5 Research approach

> qualities which we attribute to objects ought to be imputed to our ways of experiencing them, and that these in turn are due to the force of intercourse and custom. This discovery marks an emancipation; it purifies and remakes the objects of our direct or primary experience (Dewey 2008, 23).

The 'emancipation' that Dewey is referring to in *Experience and Nature* lies at the heart of the approach adopted in this thesis to address the question of how cultural artefacts are used in digital learning environments. Dewey is pointing to the realisation that interaction with the

artefact or 'object' is as much about the individual and their environment, as the artefact and its environment. This corresponds with two of the gaps identified in previous research on artefact use: the influence of 'intercourse and custom' on the process of use, and the importance of context or environment. Within the context of the research question it is important to consider the people involved in creating, supplying and using digital artefacts and how the 'force of intercourse and custom' (their previous experience) affects how they interact with digital artefacts, as well as the processes associated with producing and using digital artefacts and how this is affected by environment (our 'ways of experiencing' artefacts).

One way of examining the role of 'intercourse and custom' is by using the theoretical framework of 'Communities of Practice'. Etienne Wenger describes a community of practice or CoP as people, 'informally bound together by shared expertise and passion for a joint enterprise' (Wenger and Snyder 2000). Since usage of digital artefacts is usually preceded by decisions made by a cross-disciplinary supply chain of CoPs including, for example, curators, librarians, archivists, academics, and digitisation specialists, Wenger's theories of acculturation and social learning on how practitioners develop knowledge and skills together can be used to analyse the connection between an individual's identity, interests, skills and experience and how they either use digital artefacts or (as suppliers of content) influence end-use. Owing to the lack of progress made on studying artefact use with an idiographic approach (a tendency to specify rather than generalise, seeking to understand the meaning of often subjective phenomena) and qualitative methods of analysis, and in an effort to quantify the influence of 'intercourse and custom' and 'ways of experiencing' artefacts, this thesis adopts an approach which is more nomothetic in character (nomothetic refers to a tendency to generalise rather

than specify, seeking to understand the meaning of often objective phenomena) and employs both qualitative and quantitative methods of analysis in an attempt to be *more* objective in the study of artefact use (see Section 2.3.5.4).

Given the scale and complexity of the problem, coupled with the lack of research activity in this area, it would be impossible and infeasible to research all of it. Therefore, this study looks at a sample digital supply chain between a museum, library and archive, The Shakespeare Birthplace Trust, and a postgraduate teaching and research institution, The Shakespeare Institute (University of Birmingham). However, given the breadth of disciplines involved in the study of Shakespeare,[15] the research findings from this case study should contain practical advice and strategic implications that will be of relevance to other organisations across the cultural and HE sector which have an interest in the use of cultural artefacts in digital learning environments.

## 1.6 Structure of the thesis

In order to address the gaps in our understanding of the use of cultural artefacts in digital learning environments, this thesis roughly follows the same course as the research itself. This began with a closer examination of the research problem and an evaluation of previous attempts to tackle it. This is done in the following chapter (Chapter 2) which contains two reviews: a situation review sets out how the research problem relates to strategic and pragmatic issues for both the cultural and HE sectors, while a literature review examines

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[15] (Burnett et al. 2011, 2) stated that the widescale 'interpretation, appropriation, and translation' of the works and personality of Shakespeare represents a 'multi-faceted, ongoing and accumulating movement'.

previous studies undertaken in and around the research area. Chapter 3 reflects on research gaps before explaining the methodological approach, aims and objectives adopted, as well as the structure and rationale for research activity in both phases. This chapter also explains forms of data collection and analysis used in both phases. The findings from Phase 1 (where the focus is on 'Artefacts and Practitioners') are presented in Chapter 4 which concludes with a discussion of the main findings and the formation of hypotheses relating to the two main research questions tested in Phase 2 (which focuses on 'Artefacts and Environments'). Chapter 5 presents the findings from Phase 2 of the research in relation to hypotheses formed in Phase 1. The findings from both phases are discussed in more depth in Chapter 6 which reflects on the research aims and results, and the implications for the cultural and HE sector in the light of the situation review and gaps in previous research, both described in Chapter 2. Finally, Chapter 7 returns to the main research questions and sets out the main conclusions, implications and possible directions for future research.

## 2. RESEARCH CONTEXT

### 2.1 Introduction

Owing to the lack of research on the topic of digital artefact use, two types of review are included in this chapter. The first is a situation review (Section 2.2) which examines why the question of cultural artefact use in digital learning environments is relevant. In doing so it describes the political, economic, educational, and technological climate of the research questions for two sectors most closely involved in producing and using artefacts in formal digital learning environments: the cultural and HE sector. Next, a literature review (Section 2.3) outlines the most pertinent work around the research area to explain where the main research enquiry sits with regard to previous published work, to expose gaps, and to inform the research methodology. Finally, Section 2.4 attempts to bring together the main points from the situation and literature reviews to reframe the research question in the context of both sectors, and to identify gaps in research.

### 2.2 Situation review

#### 2.2.1 Introduction

Since the question of artefact use in digital learning environments is centred on the cultural and HE sectors, the context in which these two sectors operate is the focus of the situation review. As observed in Chapter 1, a change in the economic climate over the past decade has affected the political and strategic context in which universities and cultural sector organisations in the UK operate. The market for each of these sectors has become more user-driven and both sectors have experienced pressure to utilise digital technologies to respond to demands for

openness, flexibility and sustainability. Greater accountability to the end-user has made the need to understand more about how digital artefacts are used and what affects interaction more vital in delivering relevant and cost-effective services and resources.

### 2.2.2 Higher Education sector

Looking firstly at the Higher Education (HE) sector, restrictions on government spending and disposable incomes during the latest UK recession (which most economic commentators (e.g. Verick and Islam 2010) agree started in December 2007), and changes to the way universities are funded, has raised competition among universities in attracting fee-paying students. Looking specifically at funding in England, the reduction in the recurrent grant budget of the Higher Education Funding Council for England (HEFCE) from £5.9billion in 2008-09 (HEFCE 2008, 1) to £4.9billion in 2012-13 (HEFCE 2013a, 2) represented a 17% decrease in a major source of funding for universities. At the same time, the UK Government's response to the Browne Review (2010) involved a raising of the cap on tuition fees from £3,000 to £9,000 per annum. The response of the majority of English universities (including the University of Birmingham) was to charge the maximum amount allowed under the legislation (Sedghi and Shepherd 2011). This decision to decrease core funding to universities while making them more accountable to fee-paying students in an open market economy (Willetts 2011) was accompanied by calls to improve the quality of provision and widen access to, and increase participation within, Higher Education (HEFCE 2013b). This meant that, to a greater extent, students have become the paymasters of universities and pressure to meet their needs has been felt more acutely across the HE sector (Byre and Howes 2010).

UK universities have been under considerable pressure since the late 1990s to increase access

to higher education for post-16 year olds, highlighted particularly in the Kennedy and Dearing

Reports (Tight 1998). The Fryer Report (1997) introduced the concept of a 'universal learning

culture', and the 1998 green paper *The Learning Age: A Renaissance for a New Britain* set out

the government's determination to ensure Britain's place in the 21st century knowledge-based

economy by encouraging lifelong learning and lifting barriers to learning (DfEE 1998). A

corollary of this drive towards inclusivity in education is that learning is expected to be more

flexible, in order to address the needs of a more diverse student population. As Irvine points

out,

> Higher education today faces rising enrolments and costs, a demographic shift toward
> older students and lifelong learning, and a greater demand for anytime/anywhere
> learning and online services (Irvine 2003, 5).

VLEs and digital content for use within them are regarded as important mechanisms to enable

universities to respond to this demand, something articulated in the European Union's e-

learning strategy, *Virtual campuses for all students* (2002). It recommended that,

> By end 2005 [sic], Member States  [...] should ensure that all universities offer online
> access for students and researchers to maximise the quality and efficiency of learning
> processes and activities (ibid., 13).

The 2009 revision to HEFCE's e-Learning Strategy focuses less on e-learning as a specialist area

instead stressing the broader aim of 'enhancing learning and teaching through the use of

appropriate technology' (2009, 1) suggesting that digital learning environments were regarded

as an established way of widening access to Higher Education, meeting the demand for

flexibility and improving 'quality' and 'efficiency' (HEFCE 2009, 14) especially in the face of

budgetary cuts. This makes the question of how content is being used within VLEs, and how

more diverse user backgrounds affect this process, relevant and timely.

As far back as 2000, a JISC Assist Report suggested that without a Managed Learning Environment (MLE), a university would not be sustainable far into the 21st century (JISC 2000). Today, there are over 157 VLEs in use in Higher Education institutions across the UK (Browne, Hewitt et al.. 2010, 17) corresponding with a general increase in the uptake of distance learning programmes. Although VLEs are also used in blended learning,[16] a recent report by the University of Oxford for JISC (White, Warren et al.. 2010), claimed that over the past decade the provision of online distance learning has 'increased significantly'(ibid., 11) particularly at postgraduate level (ibid., 1).

HEFCE, which commissioned this report indirectly through funding for JISC, is the main government funding body for higher education in England and in a survey conducted in 2010 91% (ibid., 13) of English institutions claimed to use its revised E-Learning Strategy to inform development of technology enhanced learning. This document challenged institutions to employ technologies to enhance learning, teaching and assessment activities. Although deliberately broad in its scope to include other technologies, the report showed that VLEs are still regarded as efficient and effective ways of increasing student access (particularly in the 18-30 age group), lowering administration costs and facilitating the use and re-use of resources (*Ibid*, 6). Added to this, higher education, along with all 'public' services in the UK, also faces calls for greater accountability. Bodies such as the Quality Assurance Agency (QAA) oversee standards and assessments, and VLEs allow for greater tracking and, arguably, accountability.

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[16] Defined by Graham as the 'convergence between face-to-face learning environments and computer-mediated or distributed learning environments' (2005, 1).

For these reasons, VLEs have become conventional tools to enable universities to respond to the demands of users and funders.

However, research suggests that there are fewer issues with the uptake of VLEs and more with their use. In a wide-ranging report on student perspectives (GfK 2011), there is a general perception that VLEs are welcome additions to higher education but that they are underused, provision varies widely across the sector and even within university departments, and that in terms of teaching and learning they tend to replicate 'existing practice' (Bols 2010). In a study undertaken by William Dutton, Pauline Hope Cheong and Namkee Park, 'The Social Shaping of a Virtual Learning Environment' (2004), the authors found that usage of VLEs remains patchy across the HE sector. Limitations on the innovative use of VLEs were attributed to technical restrictions (infrastructure and skills within universities), inflexibility in pedagogy, and what the authors describe as 'risk-adverse academic cultures' (ibid., 78). This reflects the experience of students in a recent survey (GfK 2011) that with the 'penetration' (ibid., 4) of VLEs there is increasing potential for flexibility but levels of satisfaction have decreased (ibid., 5). Therefore, in the HE sector, pressure from government to widen access and increase flexibility, and to make provision more efficient and accountable, has contributed to the utilisation of VLEs. However, what is done with them remains under scrutiny.

HEFCE, the main funding body for the sector, has urged universities to collaborate with content providers, such as the cultural sector, to make delivery of educational resources more efficient (Fry 2010) (a subject taken up in Section 2.2.4). But how is the cultural sector responding to the economic downturn?

### 2.2.3 Cultural sector

In the cultural sector there is a strong perception of a public funding crisis kicking-in after 15 years of major investment in digitisation projects. The outcome of a UK government spending review in June 2013 was a 7% cut in the Department for Culture, Media and Sport (DCMS) resource budget, and a 2% cut in the block grant for Scotland, Wales and Northern Ireland (Steel 2013). It was announced in the Coalition Government's Autumn Statement that £34m of cuts to the DCMS budget would be passed on to Arts Council England (ACE) and national museums (ibid.). The local government budget was cut by 10% and local authority funding for museums fell by 11%, nearly £23m, in 2011/12 (Steel and Atkinson 2013). The Museums, Libraries Archives Council (MLA), which was until March 2012 responsible for 'supporting and developing museums, libraries and archives', had its budget cut by 26% from £62m in 2010/11 to £46m in 2013/14. During a UK Government Comprehensive Spending Review in September 2010 Renaissance funding[17] was also cut by 15% (more than £1.5m) over four years. These funding cuts appear to have been felt at the front line. In a survey of museum practitioners published by the Museums Association (MA) in July 2012, 51% of respondents reported a reduction to their overall budget compared to the year before.[18]

These funding cuts have impacted directly on the creation of digital artefacts from cultural collections. A Europe-wide survey of digitisation by ENUMERATE in July 2012 (Stroeker and Vogels 2012) revealed gaps in digitisation and in thinking about the end-use of content. According to the report, more than three-quarters of cultural institutions surveyed have a

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[17] Renaissance in the Regions is an 'improvement programme for regional museums' administered by ACE (2014).

[18] 31% of those surveyed reported that they had experienced a budget cut in excess of 10% (Evans 2012).

digital collection, or are involved in digitisation, but only 34% have a written digitisation strategy and just 31% have a policy on use of their digital collections (ibid., 4). Beyond web analytics (ibid., 18) few organisations investigate regularly how web based resources are being used. Other key findings from the ENUMERATE report show about 20% of all collections that need to be have been digitised (ibid., 11). Art museums were the 'most digitised' with 42%, but national libraries have only 4% of their collections digitised against a target of 62% (ibid.). Moreover, digitisation was funded from internal budgets in 87% of the institutions surveyed, while public grants or subsidies were mentioned by 40% of them (ibid., 25). The Heritage Lottery Fund (HLF), which funded almost 32,000 projects worth £4.7billion across the UK between 1994 and 2012 (HLF 2013a), many of which have involved digitisation of collections held by museums, libraries and archives, changed the criteria for projects involving digital technologies in December 2012.  The revised HLF policy on digital states that they are able to support cataloguing, digitisation and retro-conversion activities only where they form part of a wider project that will provide additional activities to help more people access and learn from the material. Although 'hard commitment' funding distributed by the Heritage Lottery Fund increased from £680million in 2006-07 to £740million in 2012-13, the London Olympics had a siphoning effect, lowering the number of £50,000 - £5 million grants available for projects such as digitisation by 15% in 2008 alone and, according to some estimates, leading to a direct loss of £161.2 million from the heritage sector to the Olympics (Slavin 2007). In line with these cuts, funding from JISC for mass digitisation fell from £12m in 2004-06 to £3.4m in 2011-13 (JISC 2013b).

The reductions in government spending and a general contraction in budgets experienced by over half the number of museums who took part in the MA survey means that investment in digitisation has been affected by the current economic climate. There has also been pressure on museums to rationalise collections (sponsored through schemes such as the Museum Association's Effective Collections fund (MA 2013)) and negotiate rights (CHIN 2013). Therefore, knowing more about users, *how* they interact with artefacts and what they wish to do with them should inform *what* is collected and *what* is done with it – in both digital and physical form. This knowledge might also help to justify future investment in content creation. Despite the squeeze in core and capital funding, the UK Government seems to recognise the contribution that museums, libraries and archives make to the 'digital sector' which is estimated to be worth nearly £1 in every £10 the UK economy generates every year (DCMS 2009, 13). However, in a report funded by the Collections Trust, *Mapping the use of digital technologies in the heritage sector* (Flow 2010), the failure of many digital projects to provide a demonstrable return on investment was acknowledged. The report admits that, 'the provision of digital content is not necessarily lucrative' and points to the true costs of digitisation (ibid. 15). So how does the Government propose that content is created and made available in a sustainable way?

### 2.2.4 Collaboration between the HE and cultural sectors

With Government policy and funding initiatives advocating economies of scale there is a growing acknowledgement across the HE and cultural sectors that they can respond most effectively to new economic and political pressures through collaboration. A scheme already

used for such cross-sector collaboration is the Knowledge Exchange (KE) programme funded by

the Arts and Humanities Research Council (AHRC). This scheme is designed for,

> Research Organisations already working in strategic partnerships with creative
> businesses and cultural organisations to strengthen and diversify their collaborative
> research activities' (AHRC 2013).

The policy agenda behind funding is a diffusion of knowledge to 'non-academic, public and

private sectors' (ibid.), the backflow to universities being content provision or work with non-

academic audiences for which the cultural sector is ideally placed.


However, the government has also recently restructured regulatory bodies and encouraged

collaboration between funding bodies strongly gesturing that partnerships are required to

make content open and sustainable. In December 2010, the Arts Council England (ACE) agreed

to assume responsibility for museum and library sector development and improvement in

England from the Museums, Libraries and Archives Council (MLA) in a rationalisation measure

introduced by the Coalition Government (ACE 2010). The MLA closed in March 2012 leaving

ACE in charge of the lion's share of their former functions in order 'to create a more coherent

cultural offer that benefits the cultural sector and the audiences it serves' (ibid.). The

Government's twin aim of increasing access and promoting sustainability is also detectable in

cross-body funding initiatives such as the Digital Research and Development Fund for Arts and

Culture (British Council 2011), a partnership between ACE, the AHRC, and the National

Endowment for Science, Technology and the Arts (NESTA), an independent ideas-based charity

and trust (NESTA 2013). The Fund aims to support arts and cultural organisations across

England to work with digital technologies to expand their audience reach and engagement, and

to experiment with new business models (British Council 2011). This fund is rooted in notions of

sustainability, perhaps revealing the future direction of funding for digitally-related projects for the cultural sector.

The tenor of these funding calls, and the movement of funding and authority from the MLA to ACE, an organisation with stronger links to the AHRC (both being government-funded organisations concerned with funding the arts and arts-based research), has implications for strategic alliances between higher education and cultural sector organisations and for the use of something they share an interest in: content. If universities are to increase access while diversifying their offer, then strategic alliances around content and the provision of VLEs would seem to be strongly related. Initiatives which look towards sustaining long term generation, use, and storage of content will increasingly be of interest to cultural sector organisations seeking support from funding bodies such as ACE.

At the same time, there has been a growth in the number of digitisation programmes based on commercial partnerships, primarily among organisations that receive block grant funding from the UK Government. For example, the British Library's partnership with Brightsolid to digitise the British Newspaper Archive and create a subscription-based resource builds on content initially created during a £3million JISC-funded project (British Newspaper Archive 2013). Through commercial collaboration the British Library intends digitising 40 million British newspapers over the course of a decade (ibid.). The British Library's deal with Google to make 250,000 out-of-copyright books available 'to all' (British Library 2011), and the National Archives' intention to digitise three million records from its Crime, Court and Convicts collection in partnership with Brightsolid (National Archives 2011) also demonstrates a shift not only in

how digitisation will be carried out but how it will be made available and how access can be sustained. To a limited extent this has percolated to non-national collections. For example the University of Manchester Library's Digitisation Strategy identifies as a strategic principle,

> To increase capacity, we will seek commercial partners for digitisation projects, and develop and build on existing partnerships with other academic organisations (University of Manchester n.d.).

Though the success of attracting large commercial interest in cultural collections held outside London has still to be proven, it is clear that the government regards collaboration with the business sector as another way of coming to terms with the twin challenges of openness and sustainability.

### 2.2.5 Strategic content creation

The UK Government has also been experimenting with ways of coordinating the creation of usable digital content. Spearheading the Government's attempts to corral content providers, the Strategic Content Alliance (SCA) was established in 2006. The SCA is a partnership initiative funded by the JISC, British Library, BBC, and the Wellcome Trust which seeks to encourage public and not-for-profit organisations to, 'maximise financial and intellectual investment in digital content through a much more systematic approach to pooling and co-ordinating activity' (JISC 2013c). SCA's Content Framework (2006-09) outlines the barriers which, 'inhibit closer co-ordination and investigates potential resolution or mitigating activities' (ibid.).  In a similar initiative, the UK Discovery Programme, also funded through JISC, is a more technically-orientated cross domain project which seeks to create an 'open metadata ecosystem' by encouraging cultural and education sector partners to sign-up to eight principles pledging to,

'enhance the impact of our knowledge resources for the furtherance of scholarship and innovation' (Discovery 2012). Building on the work of the Resource Discovery Taskforce, set-up in 2010, Discovery has attracted some weighty voices, such as the MIMAS Centre (University of Manchester) and the Collections Trust, behind its principles. Despite this, the Discovery message has yet to be reinforced by specific funding and its impact has so far been limited within the cultural and higher education sectors.

### 2.2.6 Open content

In line with reductions in core and capital funding for universities (Section 2.2.2), including a decrease in government grants available for the creation of digital content from cultural collections over the past decade, there has been pressure to make resources available for wider use. Although there have been funding cuts for mass digitisation (Section 2.2.3), projects which generate OERs have gradually been given more funding by JISC as part of their E-Learning Programme (JISC 2013b).[19] Therefore, although VLEs are considered an essential tool to enable the HE sector to cater for a wider student base, the benefits of content creation and use are not intended to remain exclusively within the 'walled garden' (Jones, Pole et al.. 2012, 417) of the institutional VLE. Although VLEs have become more relevant as a way of responding to demands for flexibility and efficiency (White, Warren et al.. 2010), the political and funding agenda has required that digital content needs to be usable by everyone and, although most

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[19] For instance, Phase 1 of this programme (2010-11) targeted £3.1million on the creation of OERs and Phase 2 (2011-12) invested £5million in continuing the creation of OERs and funding studies on their impact on teaching practice (JISC 2013b). Phase 3 (2012-13) aimed to consolidate this work with the co-development of guidance on the creation of OERs, with the Higher Education Academy (HEA) (ibid.).

VLEs are still regarded as 'anti-connectivist' in nature,[20] some are being developed with open access in mind. This has caused some universities to question the role of institutional data repositories (such as museum, library and archive catalogues) and how these relate to the VLE, to MOOCs and to wider forms of provision (Kay 2012).

JISC's support for the creation of OERs reflects growing public expectations – translated in a tranche of government policies and conditions attached to funding - not only for access to data about cultural collections but the ability to use and re-use it. There is now an expectation from funding bodies such as JISC and the HLF that universities and resource providers such as museums, libraries and archives create material which is accessible to, and re-usable by, all.[21] The justification for creating OERs is driven largely by the new realities of the 'digital economy' (Tapscott 1997) which require content and service providers to capitalise on the opportunities offered by digital networking and communications technologies. A history of public investment in digitisation is being used as a lever to encourage what the DCMS regards as more democratic access to content. The UK government is also trying to strike a balance between access and sustainability through the Digital Economy Act (2010) which aims to provide a regulatory basis

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[20] According to Mike Johnston, the VLE is guilty of 'killing connections [with content on the world wide web] for the institution's benefit' (quoted in Cunningham 2009).

[21] The HLF, a major source of project funding for museums, libraries and archive, stipulates that 'digital outputs' from projects funded by its 'Sharing Heritage' grant programme must be 'usable' and 'available', 'free of charge for non-commercial uses', and 'licensed for use by others under the Creative Commons licence 'Attribution Non-commercial' (CC BY-NC)' for five years after project completion (HLF 2013b). Its guidance on digital outputs urged projects to subscribe to the principles of the 'open movement' in terms of creating open file formats and open source software (HLF 2012, 8-9). Although it does not define 'usable' it is clear from the guidance that this implies inter-operability and less restrictive licensing.

for a complex and changing digital society. The Act aims to free up digital access to digital content to generate more value for the end-user, whilst cracking down on illegal downloading of commercial assets to protect business interests. The Blair government (1997-2007) also promoted open data on the back of a social and economic agenda (digital inclusion and increasing digital literacy were part of New Labour's social and economic policy (Selwyn 2008)) as well as using digital technologies to find efficiency savings, although this has been reoriented under the present Coalition government (2010 - ) to focus on provision of superfast broadband rather than other causes of a 'digital divide' (Helsper and Kaczuba 2011).

Museums, libraries and archives in receipt of large government grants have been the first to respond to demands for calls to make data more accessible and usable. In the Netherlands, the decision by the Rijksmuseum to release 40,000 high quality images for public use per annum (from 2013) marked a major shift in thinking about the question of use, albeit among nationally-funded organisations (Siegal 2013). The Rijksmuseum's reasons for releasing high quality images were threefold: firstly, public investment had created the images so this was a way of making them available to taxpayers; secondly, the income generated through image sales was not enough to justify the costs of policing use; and, finally, to try to ensure that any use of the images is of a certain quality (ibid.). Taco Dibbits, the Director of Collections, argued that the issue of public ownership transcends the physical and digital collections at the Rijksmuseum, 'We're a public institution, and so the art and objects we have are, in a way, everyone's property' (ibid.). A number of other publicly funded institutions across Europe are following suit, including the UK's National Gallery and The National Gallery of Denmark (Sanderhoff 2012). The readiness of others museums to contribute data to aggregators such as

Europeana, the use of open standards such the W3C[22] open data standard, RDF ,[23] by

organisations such as the British Museum (British Museum n.d.) which makes re-use of data

easier, and the encouragement of third party use of data via hack days (e.g. CultureHack 2014),

are signs that national and non-national museums are making efforts to make collections data

not only more accessible but more usable in new, previously unimagined ways.

At the same time the technological landscape for VLEs and educational resources is becoming

more open. A patent application registered by Blackboard in 2006 (USPTO 2012) has generated

a great deal of debate in educational circles because it calls into question the degree to which

universities are part of the equation in the provision and use of a VLE. As one of the largest

single suppliers of VLEs in UK Higher Education, Blackboard's patent signals a change to the

centralised model of the VLE hitherto used across the largest universities.  It states that,

> an open platform system is provided such that anyone with access to the Internet can
> create, manage, and offer a course to anyone else with access to the Internet without
> the need for an affiliation with an institution, thus enabling the virtual classroom to
> extend worldwide (ibid.).

This is significant in the present context of the move towards service-oriented approaches in

education, often involving open-source elements, and in changing the relationship between the

university-VLE (provider) and student (user). Proposing to decentralise control of VLEs has

caused a good deal of discussion in terms of the authority of universities and the growing

popularity of the peer-to-peer education movement (Subramanian and Goodman 2004)

embraced, to an extent, in new types of distance learning provision, discussed in Section 2.2.7.

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[22] W3C or the World Wide Web Consortium is 'an international community where Member organizations, a full-time staff, and the public work together to develop Web standards' (W3C 2014).

[23] Resource Description Framework.

### 2.2.7 Massive Open Online Courses (MOOCs)

In response to the demand for more open content and facilitating wider access to Higher Education using digital technologies, the recent growth of Massive Open Online Courses (MOOCs) across the HE sector in the UK and further afield is redefining what is meant by a digital learning environment and reshaping the relationship between course providers, content and users. Although they come in many configurations, MOOCs were originally intended as experiments which combine, 'the connectivity of social networking, the facilitation of an acknowledged expert in a field of study, and a collection of freely accessible online resources' (McAuley, Stewart et al.. 2010, 4). A distinguishing feature of most MOOCs is 'open, networked participation' (Stewart 2013, 229) with more significant peer-to-peer contact than is the case in conventional VLEs. Another characteristic of MOOCs that distinguish them from more traditional forms of online learning is scalability; MOOCs are designed to support 'an indefinite number of participants' (Yuan and Powell 2013, 6).  Regarded widely as taster sessions to encourage participants to enrol in a full-time, fee-paying course, MOOCs have been praised for the degree of access they provide to new audiences for HE and criticised for high attrition rates, by-passing traditional models of student tuition and, more generally, their 'privatisation' (Vernon 2013) of Higher Education. The autonomous nature of most MOOCs and their greater emphasis on heutagogy[24] mirrors the loss of control of content creation in museums, libraries and archives as traditional tutor-student relationships are redefined in favour of peer-to-peer support (Levinson 2013). Stewart argued that MOOCs might have unintended benefits in repositioning traditional roles,

> it is the ways in which MOOCs open up questions of goal, purpose, and teacher/student roles that make their massive scale so powerful (2013, 228).

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[24] Self-determined learning.

Others are less optimistic about the effect of MOOCs in Higher Education. In *Digital Diploma Mills: The Automation of Higher Education* (1998) David Noble points to a convergence in the relationship between the educational, government and technology sectors in the USA embodied in VLEs and, most recently, the MOOC,

> For the universities are not simply undergoing a technological transformation. Beneath that change, and camouflaged by it, lies another: the commercialization of higher education. For here as elsewhere technology is but a vehicle and a disarming disguise (Noble 1998).

According to Noble, the dangers of MOOCs lie in the 'commoditisation' (ibid.) of education via technology – courses run through systems with minimal instruction from experienced academic staff. Noble emphasises the need to know how academic practitioners impact on the learner's experience within the VLE and also to look at the role of content.

Associated with the MOOC movement is a growing acknowledgement of the pedagogical theory of connectivism which emphasises the importance of the connections between specialised nodes or information sources in the process of learning and the value of the 'now' in knowledge creation (Siemens 2005). This emphasis on connectivism is represented in so-called 'cMOOCs' which prioritise connectivism and the learning process more than 'xMOOCs' which adopt a more content-based, behaviourist approach (Yuan and Powell 2013, 7). Regardless of the pedagogical approach, both types of MOOC embody the principle of real time generation of content from numerous sources online, and the repurposing of content created by others. Given the scale of MOOCs, and the diversity of content used within them, this makes addressing the question of how digital content created from cultural artefacts is used more urgent.

### 2.2.8 Technological changes

Recent rapid changes in the technological landscape have made digital content creation and content use easier and more widespread. This has changed user expectations and has impacted on the way that the cultural and HE sectors work. Since the mid 1990s there has been a dramatic increase in the development of Information Computer Technologies (ICT) on a number of different fronts. Among these the most important are considered to be:[25]

- growth and penetration of increasingly powerful, and more affordable, personal computers

- development of user-friendly interfaces

- development of networking hardware and software, including mobile

- development of web technologies often grouped under the umbrella term, Web 2.0

- growth in bandwidth and improving compression technologies

- use of ICT across the public and commercial sectors

- increased digitisation across all media

Since this explosion in the use of ICT, there has been a continued growth in mass usage of digital devices and services with the result that technology is now embedded in the lives of students in the HE sector, and users of museums, libraries and archives. More than eight in ten learners surveyed for the 2008 British Educational Communications and Technology Agency (Becta) report *Survey of FE learners and e-learning* (GfKNOP 2007) had access to a computer in the home, with the majority also having access to broadband. 63% of respondents stated they found it 'essential' to use a computer to study (ibid., 11). Another study, 'Student Expectations Study: Key findings from online research and discussion evenings held in June 2007 for the Joint

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[25] Based on a list compiled by Dunn (2003).

Information Systems Committee' (IpsosMORI 2007), further underlined the confidence and expectations prospective students have of using technology in higher education. Personal ownership of ICT and the growth of platforms where content based on cultural artefacts might be accessed and shared – Flickr, YouTube, Pinterest, blogs, Facebook, Twitter and Instagram – has meant that the means of production (of digital content) is becoming increasingly decentralised . Although many cultural institutions have responded to this by establishing a presence on the same platforms, it is clear that user-generated content and the ability of users of content to also be producers remains 'a challenge for museums' (Ridge 2007). There has also been an increase in the number of universities setting up mobile learning environments in response to a spread in ownership of mobile devices and demands for 'any time, any place learning' (City College Southampton 2005) and a growth in the use of collaborative course authoring software (such as iSpring, and Udutu) which facilitate peer-to-peer and student-to-tutor communication outside the institutional VLE (MindOnSite 2014).

Over the past decade, the generative technologies needed for mass digitisation have also become more sophisticated and user-driven. The growth of 3D scanning in museums and a general trend towards user control post-capture, such as the increased use of RTI (Reflectance Transformation Imaging) scanning allows users to vary light conditions in order to view surface details (Diaz-Guardamino and Wheatley 2014), marks a shift in the possibilities of digitisation and in user demands for more flexible, usable content. The combined use of 3D scanning and 3D printing technologies, which allow the replication of physical artefacts for research or commercial purposes, also emphasises the need to know more about how users interact with artefacts if museums are to make 3D images available while recapturing value from the end-

user. A gradual realisation by museums that websites are not simply a brochure for, or replica of, the physical site is perhaps responsible for technical developments to create what Piacente's (1996) in her tripartite typology of museum websites termed 'true interactives', i.e. that digital artefacts could offer something distinctive. Akin to the move to create a presence on social media platforms and come to terms with user-generated content (UGC), the introduction of self-service digitisation units in libraries and archives (e.g. University of Virginia Library 2014) that allow users to scan paper-based items for their own use before adding this to the institution's digital repository, are attempts to capture value from end-users and simultaneously create and deliver relevant, usable content. Encouraging and enabling digital volunteerism via the editing of database records (such as the recent crowdsourcing initiative at the National Library of Finland which asked volunteers to check transcriptions created using optical character recognition software (frollein2007 n.d.) or the cropping of images (for example the V&A Museum's Beta Crowdsourcing initiative (V&A Museum n.d.)) is another sign that cultural organisations are slowly regarding end-users as co-producers of content. Although issues still exist around what is done with UGC, its status alongside the official institutional record, and rights relating to use, its user-centred nature represents a potential opportunity to find out how users are creating and interacting with digital artefacts.

### 2.2.9 Value and use

So what does this mean for the use of artefacts in VLEs? The institutional ownership of VLEs and the 'walled garden' (Jones, Pole et al.. 2012) approach to education is certainly being challenged in terms of the control of face-to-face teaching and e-learning, so too the exclusivity

of VLEs. Museums, libraries, and archives are under a similar pressure to come to terms with a challenge which is,

> not so much to *remonetise* a product that the Internet has turned into free content as to recapture the cultural *value* that the discourse of new media has ostensibly shifted outside their walls (Rumbold 2010, 320).

Rumbold points out that 'value has always resided not in things, but in the way we talk about them' (2010, 335) a quality which, in the context of Web 2.0, should reassure the cultural and HE sectors whose value might still lie in filtering and 'the way we talk about' things given their closeness to subject and object in a more distributed discussion. Perhaps because of a restriction in funding for digitisation and access initiatives, 'Lean philosophy' (Bhasin and Burcher 2006) which seeks to reduce wastage on any activities which does not bring value to the customer – might also be adding to the change in value systems between museums and their 'consumers'. Rumbold adds that '"Access" has gradually been superseded by a more active language of "participation" and "engagement"' (2010, 321). So, what has changed is the expectation that resources need to be more than accessible in the cultural sector - they need to be usable and sustainable. In the HE sector, arguably, the shift has been more about the value of discourse since the unique value universities are providing – content guidance, teaching, and accreditation – will still be of worth. In an environment where educational resources are more accessible (such as MOOCs), universities as guides through abundance are more important – but they also have a role to play in determining *what* is produced from primary source material. Therefore, both the cultural and HE sectors are repositioning themselves in response to the open movement and changes in how content is created and valued. The walls of the museum and the confines of VLEs are both being challenged as the terms of value creation move beyond access to creativity and use (Rumbold 2010, 313).

### 2.2.10 Identity crisis

The perceived shift in the control of value to users described by Rumbold has been accompanied by something of an identity crisis in the cultural sector. The current economic climate might be in part responsible for uncertainty in the museum, library and archive professions as the number of curatorial staff has decreased (Steel 2013). However, the advent of Web 2.0 and new opportunities for individuals to be producers as well as users of content (O'Reilly 2005) have had an impact on the gatekeeping role of curators, librarians and archivists. Speaking at a curatorial symposium, entitled 'Are Curators Unprofessional?: Group Practices' hosted by the Banff International Curatorial Institute in November 2010, Ann Demeester, Director of de Appel and Head of the de Appel Curatorial Programme in Amsterdam said that a 'major threat' is, 'the cult of the amateur, arising from free, shared, unverified information on the Internet and the blogosphere, wherein anyone can publish opinions' (Tousley 2010). Therefore, UGC is considered by Demeester to be a direct 'threat' to the curatorial profession. At the same event, no consensus was reached on a definition of 'curator' except that it is an 'unstable term' (ibid.).

This questioning of the role of curator is also evident in the UK. For example, in a listserve exchange of the Museum Computer Group in July 2012 on the decrease in numbers of curatorial staff in UK museums, a Museums Access Collections Officer from the West Midlands asked, 'Curators – what are they?' (Ellis 2012) indicating that not only numbers are down but the role might be changing. Added to this, the term 'curate' has been used more generally beyond the museums profession to mean anything from celebrity management of an arts festival (Michaels 2010) to selecting digital material to 'curate your virtual life' (Bea 2012), or

the creation / curation of musical playlists (Robinson 2012). The wider appropriation of the

term and feelings of insecurity within the profession might well be connected. According to

Obadare, new technologies have also changed radically the role of librarians who, 'must ensure

that there is effective and efficient flow of information from the generators to users of

information in the digital environment' (Obadare n.d.). As far back as 2003, one archivist noted

that the 'craze' of digitisation and the 'infusion of technology' unsettled both archivists and

librarians,

> With the expanded use of technology, librarians and archivists were suddenly
> overshadowed by their new cousin - Information Technology [...] Sadly, instead of
> strengthening the identity, the abilities, and the respect of librarians and archivists, IT
> eroded their positions (Salter 2003).

The lack of certainty within the cultural sector could, as Salter suggest, be a consequence of the

fast pace of change in technology and the impact of up-skilling. Digital projects are, by their

nature, inter-disciplinary and the involvement of other professions in the process of digitisation

might have contributed to feelings of insecurity and para-professionalism (ibid.). This

professional self-analysis makes understanding the process of supplying digital artefacts,

understanding the role of practitioners in this, and examining the dynamics between

professions, more important.

### 2.2.11 Situation review: Conclusion

In sum, both user demands and economics have been behind changes in UK Government policy

and this has affected the way that funding is distributed for digitisation and for the use of ICT in

education. As funding for digitisation has contracted in the past five years, funding bodies and

organisations who care for or use research collections are asking themselves how this content

has actually been used and how they can continue to sustain access to it (JISC 2005, 2). In other

words, the policy and funding agenda has shifted from creation to end-use of content.

Conversely, because content is expected to be more available and more usable, value

appropriation, or securing a return on investment, has become more dependent on the end-

user and how they create value. User-generated content, open educational resources and

MOOCs all challenge the way that content has traditionally been delivered by the HE and

cultural sectors, and how they derive value from it. They also raise issues around ownership

and control. Therefore, how digital artefacts are created and how value is created from them

requires a greater understanding of the process of supply and use, and the relationship

between people and processes. The next section reviews extant research in this area.

## 2.3 Literature Review

### *2.3.1   Introduction*

Before surveying published studies relating to the main research area, what lies behind the

presentation of an artefact online? Behind the presentation of an artefact and metadata online

– such as the example given in Figure 1 - lies a supply chain of people and processes which,

determine how an artefact is represented and what information is and is not made available to

the end-user.

**Figure 1. Screenshot of a page from the Shakespeare Birthplace Trust's online database embedded in a course module in Canvas, a VLE by Instructure**

In this example, featuring a Staffordshireware figurine of William Shakespeare, everything from the selection of the artefact from a museum, library or archive collection, to the way that the artefact has been captured digitally (incorporating choices in imagining such as camera angle, lighting, resolution, white balance etc) and information that is captured in cataloguing (date, provenance, description, size, weight, etc), has been decided by individuals involved in a supply chain. Equally, decisions have been made about the nature of the user interface with the artefact, determining the affordances and limitations of the context in which the digital artefact will be used.[26]

To what extent has this transformation of physical objects into digital artefacts been studied and what research has been carried out on the influence of decision makers in the digital supply chain? Also, what research has been conducted on end-use within digital learning

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[26] In the example there are two contexts: the online database in which this item appears and the virtual learning environment – Canvas - in which the catalogue record has been embedded.

environments and how has this been carried out? To answer these questions, the literature

review in this chapter will examine four main areas:

- **Digital supply chain**: the people and processes involved in creating and using digital

  artefacts

- **Basic processes of use**: how artefacts are actually used in the process of interaction

- **Environment**: the effect of context on artefact use

- **Previous research methods**: methodologies that might be used to investigate the

  research questions


## *2.3.2   Digital supply chain*

Three areas related to the supply of digital artefacts are examined in turn: processes, products

and people.


### 2.3.2.1 Digital supply chain: Processes

As pointed out above, the digital supply chain is made up of people and processes that

determine the shape and use potential of a product,[27] the digital artefact. The processes

involved typically in supplying digital artefacts from museum, library and archive collections for

use are analogous broadly to most manufacturing supply chains. Beamon defines a supply chain

as, 'an integrated set of business functions, encompassing all activities from raw material

acquisition to final customer delivery'(1988, 105) . In the case of creating and supplying digital

artefacts, the 'raw material' is the physical artefact (or in the case of born-digital material,

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[27] The use potential of a product is the scope of use, or variety of ways in which an artefact may be used.

which originates in digital form, the artefact in its native state) which must be selected,

digitised, catalogued and made available through a user interface before it is able to be utilised

by an end-user.  Table 1 sets out some of the main activities and agents (those responsible for

directly or indirectly carrying out an activity) involved in a typical journey from the physical

artefact to the creation of a digital catalogue record, and then use in a digital learning

environment.

| No. | Activity | Agent |
|-----|----------|-------|
| a | Selection of artefacts | content provider / digitiser |
| b | Capture | digitiser |
| c | Quality control | digitiser / content provider |
| d | Compression | digitiser |
| e | Create new or open existing file in Digital Asset Management System (DAMS) | content provider / digitiser |
| f | Metadata entry | content provider / digitiser |
| g | Digital rights management | content provider |
| h | Ingest (compressed file and metadata are integrated into the DAMS) | content provider / digitiser |
| i | Content delivery network | content provider |
| j | Digital service provider | content provider |
| k | Selection of digital artefact for use in digital learning environment | academic course tutor |

Table 1. Activities and agents involved in the supply of digital artefacts

Although there are numerous ways in which digitisation and packaging of content can take

place and great variety in who is involved (for instance involving end-users in the selection of

artefacts or even the creation of images and metadata), Table 1 itemises the activities that

constitute the main stages of digitisation and those normally in control of the process of

creating digital artefacts from cultural collections.[28] The basic workflow following selection of

artefacts for digitisation (usually by those who manage collections, the content providers),

begins with capture involving numerous decisions around methods of creating a multimedia

record of the artefact (equipment used, lighting conditions, camera angles, etc) and recording

metadata (technical information associated with the process of capture, as well as details about

the artefact likely to be of interest to end-users). As Eadie points out, the act of conversion

from analogue (the physical artefact) to digital brought about by capture is highly partial,

> A fundamental point to note from any digitisation process is that the binary or digital
> channels are relatively narrow, and only a partial representation of an analogue object can
> ever be rendered in digital form. In other words, the digital object can ever only be a
> version of the real thing. The digitiser therefore has to make informed decisions about what
> level of detail is required in the digital version of an object, for that digital version to serve
> its intended purpose (Eadie 2005).

A process of selection to retain images considered most suitable before high resolution images

are compressed for use within a digital assets management system (DAMS) again introduces

more decision-making into the supply chain as choices are made about which images to save,

the degree of compression (ultimately leading to data loss in the compressed file) and which

DAMS product is chosen to store images and metadata, and make them available for end-use.

These technical stages are normally conducted with or wholly by technical specialists. Metadata

entry and management of rights usually falls to content providers (cultural organisations)

before three stages (h-j) of making data available for use online. Finally, for use within a virtual

learning environment, digital artefacts would typically be selected and imported into a VLE or

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[28] Based on the main activities listed in the 'Digital supply chain' Wikipedia article (Wiki 2014).

linked to it by an academic tutor. Behind every step in the process of digitisation are a number

of 'informed decisions' made by the content provider and / or the digitiser. As Eadie notes,

> The notion of 'fit for purpose' is central to all digitisation processes. To make decisions on any technical issue, the digitiser must have a clear understanding of how they expect the digital object to be utilised (ibid.).

But to what extent does the research corpus examine how 'fit for purpose' is arrived at?

Even though much has been published on the development of digitisation activities, the vast

majority of studies have been written from the perspective of content providers or technical

specialists; few studies have looked at the connection between activities and agents. For

example, research on issues surrounding digital preservation (e.g. Gladney et al. 2005; Ross

2007), digital content lifecycles (e.g. McLeod 2006) and metadata standards (e.g. McKenna and

Loof 2009) reflects internal concerns within museums, libraries and archives around

preservation and accessibility rather than studies conducted outside the sector which examine

the impact of the cultural sector itself on the provision of content. Much of this sector-focused

research has examined the challenges of sustaining access to digital collections and future-

proofing content against changes in technology (Karvonen 2010) and is passed on to the

cultural sector via practical guides written by funding bodies (JISC 2008). Indeed, the 'who' of

digitisation in many of these practical guides has most often involved only the decision whether

to digitise in-house, to outsource, or to work with partners (Karvonen 2010, 217) rather than

focus on the partiality of the process itself.

## 2.3.2.2    Digital supply chain: Products

Another corpus of research reflects a well-established interest among humanists (and digital humanists) on the ramifications of digitisation in terms of the relative qualities of the physical artefact and its digital surrogate. Much of the research thinking has focused on the effect of digitisation on notions of value (Gell 1992) and authenticity (Bearman and Trant 1998) and how the physical artefact relates to forms of digital representations. Klaus Müller in his essay, 'Museums and Virtuality' (2010) explores a shift in the role of museums from information interpreters to information providers and asks a fundamental question which many practitioners rushing to digitise might not have stopped to ask, namely, 'do virtual reproductions simply mimic their real counterparts?' (ibid., 296). This question is prompted by Müller's assertion that, 'museums are still struggling to find the connection between the *reality* of an artefact and its *virtual* representation [...] Digitization is more than a reproduction technique' (ibid.). This echoes the seminal work of Walter Benjamin (1936), André Malraux (1951), and others in coming to terms with the differences between the original artefact and its technologically-dependent surrogate. The importance of an artefact's context and what Müller terms its meaning-potential (2010, 300), and how this sits with museums' new role as providers of information rather than interpreters or 'set-dressers', is not fully addressed in this essay but Müller does set out recommendations to exploit the space, time, connectivity, accessibility, depth, and production value advantages of virtual representation over the traditional space of the museum. In doing so, Müller conveys an optimism in what he believes to be the new role of museums using digital technologies to offer versatility and a means of participation. In a similar vein, Frost's work examining virtuality and learning from artefacts stresses that a new 'digital literacy' (2010, 244) should build on the 'strengths and limitations of digital representations so

that they can enhance, not replace, the real world experience of an object' (ibid.), employing

the advantages of digital representations (24/7 access, ability to present contextual info,

interactivity and ability to reach a wider audience) without competing with the qualities of the

real thing and the real visit. Prosser and Eddisford also note the qualitative differences between

the physical and the virtual but in a way which is more technophilic,

> Many museums are failing themselves and their users by creating a digital pastiche of
> the physical museum, rather than seizing the opportunity to extend and enhance the
> museum learning experience offered by effective use of ICT (Prosser and Eddisford
> 2004).

Bandelli (2010) points to the advantages of blurring the real and virtual in the museum, also

helping to depolarise the physical-digital debate. In a similar way, Hawkey points out that

digital technologies can not only support traditional learning tasks but can allow new activities

to take place. Digital technologies allow learning experiences to be tailored to the individual,

> In many ways the opposite of collaboration, digital technologies also facilitate
> personalisation (2004, 3).

In other words, new technologies can provide choice for users. However easy it is to distinguish

between real and virtual visitors, the difference between real and virtual *learners* is much more

difficult to make (ibid., 10). Deciding what is special about the particular nature of learning in

virtual environments is tricky: much of educational theory is brought about from observations

and experiments in the traditional environment of the classroom. However, Hawkey is more

optimistic about the benefits of using digital technologies and artefacts and rises above the

weariness of discussions on value distinctions between physical and digital environments.

## 2.3.2.3    Digital supply chain: People

Whilst there have been numerous studies on the technical aspects of digitisation, what work has been done on the influence of decision-makers in the digital supply chain? Research by Ooghe and Moreels (2009) on the first activity listed in Table 1, the selection of artefacts and its role in digitisation, draw attention to the importance of what has been termed 'supply chain visibility' (Goh, Souza et al. 2009). Ooghe and Moreel's study, funded by the Flemish Government, investigated key points in the digitisation, preservation and digital archiving of (primarily) audiovisual documents. Although their study did not gather new data, their close reading of published standards and advice, and an international survey of current practice, points out the absence of a 'detailed frame of reference' (Ooghe and Moreels 2009) to inform decisions made on what is selected for digital capture. The study points out that,

> current practices are characterised by disparate approaches, different terminologies and a lack of open communication on the selection decisions that are being made. Some might suggest that selection needn't take place at all (ibid.).

The authors recognise that the failure to make decisions on selection apparent makes the process of digitisation seem arbitrary and, therefore, similar to content generated outside 'memory institutions' (ibid.).  This paves the way for a 'bottom-up approach to cultural valuation' (ibid.) as museums, libraries and archives become just one of a myriad of providers of artefact-based content available online. Although Ooghe and Moreels' research moves some way towards uncovering the processes and people behind digitisation, its need to clarify decision-making and standardise approaches leads to fixed categories of criteria which might actually perpetuate rather than end a lack of transparency.  Their research also stops short of examining the criteria behind other aspects of digitisation, both explicit and implicit.

Bas van Heur's paper, 'From analogue to digital and back again: institutional dynamics of heritage innovation' (van Heur 2010), also scrutinises decision-making involved in the creation of what he terms the 'digital imperative' (ibid., 405). Based on observations of a case study involving the development of a cultural heritage management policy for the city of Maastricht in 2002, van Heur deconstructs a decision-making process that might colloquially be termed 'sleepwalking' towards a digital solution. Although not directly related to the production of digital artefacts, his analysis of interactions between practitioners and the course that the project took, draws attention to the influence of different groups of practitioners and a tendency towards technological solutions for cultural problems, in this case the presentation of a cultural biography of Maastricht. The dynamics between individuals with different skills and interests played a pivotal role in shaping the 'logic' and direction of the project,

> diverging forms of expertise between the main actors produced a division between infrastructural logic and content logic from the very beginning that shaped almost all following discussions (ibid., 411).

According to the author, skills gaps between practitioners and different expectations around technology outcomes led to the ''black-boxing' of the digital infrastructure' (ibid., 413) as reasons behind decision-making became obscured during the course of the project. Although the methods used in this study were not especially innovative, the emphasis on 'a less technology-centric and more contextual understanding of digital heritage' (ibid., 405) and its focus on practitioner groups is useful given the multi-disciplinary focus of many projects involving digital technologies and collaborations between the HE and cultural sectors mentioned in the situation review (Section 2.2). The intersection between technological and social determinism also makes this study particularly valuable.

McCrary recognises the socio-political dimensions of digital representation in his paper 'The Political Nature of Digital Cultural Heritage' (2011). In an examination of changes occurring within museums, libraries and archives, McCrary notes that,

> It is now generally accepted that many heritage institutions provide interpretations and representations of the world, rather than the actual objects themselves (359).

The author continually contests the objectivity of the process of digitisation against social, cultural and political power frameworks which seek to commodify the experience of interacting with artefacts. McCrary makes the distinction between representation and experience through digital capture,

> Distinctions can be drawn between using digitization as a technological tool with which to represent the artifact itself or as a mode of interaction to extend the engagement of the viewer's experience of the artefact (sic). (361).

This strategic view of digitisation helps to contextualise decision-making within the digital supply chain and helpfully sets the process of supplying digital artefacts against a grander political narrative.

Bijker's concept of the 'technological frame' (University of Missouri-St Louis n.d.) seeks to explain ecologies of interpretation between practitioner communities where dominant and less dominant 'frames', or ways of interpreting, vie in the application of technology to a particular problem. Bijker regards artefacts as focal points for interaction and 'structural couplers' between communities, a theory which fits well within the field of the 'Social Shaping of Technology' (Williams and Edge 1996) which focuses on the non-linear nature of the development of technology and the effects of different communities who shape, and are shaped by, technologies (Chandler 1996). Ludwick Fleck's 'thought collective' concept,

introduced in 1930, offers a rationale for the dynamics between collaborators in the HE and cultural sectors. Fleck postulated that knowledge and meaning are grounded in communities that reproduce social practice. What he termed 'thought style' or traditions of thinking 'easily overpowers any rationality or logical construction of individual thinking' (quoted in Tuomi 2002 ,111) and dovetails with Bijker's evolutionary theories on dominance and determinism among practitioner groups.

The theory of communities of practice (CoPs), co-developed by the cognitive anthropologist, Etienne Wenger and Jean Lave, following studies of apprenticeship in West Africa in 1991, and subsequently developed by Wenger (with major publications in 1998, 2002, 2009) provides a lens through which to examine the influence of practitioners and end-users' on the process of digitisation and to explain why they might interact with digital artefacts in particular ways. According to Wenger, communities of practice are, 'groups of people who share a concern or passion for something they do and learn how to do it better as they interact regularly' (Wenger 2013). Wenger describes a community of practice along three main dimensions: its members identify with a common *domain* of knowledge and steward that knowledge together, they engage with others within the *community* as they learn together how to solve common problems, and they put that knowledge and learning into *practice*. Wenger states that any individual is normally a member of more than one community of practice; these can range from a knitting club or an academic discipline to what might be considered more traditional professional groups like the subjects of Wenger's original studies: midwives, tailors and quartermasters. Since people's relationship to, and perception of, objects are socially and culturally dependent (Appadurai 1998, 5) the attractiveness of Wenger's theory is that it

proposes one way of bridging the gap between people and processes in the supply and use of digital artefacts. Its focus on tracing the behaviour of individuals to their engagement in a wider social and learning context, and how knowledge they steward as a CoP might influence how they act as a part of the digital supply chain, or as an end-user, offers one way of tackling a complex problem and makes it a potentially valuable conceptual tool. In other words, shared ways of seeing, thinking and acting could explain a great deal about how individuals supply and use artefacts.

Although Wenger's theory has been developed to account for different contexts, for example cultivating CoPs in a corporate environment (2002) and online (2009), and has been referenced across a large research corpus on social learning theory, it has attracted some criticism and has seldom been used in the context of digital cultural heritage. Roberts draws attention to a number of weaknesses and limitations in the concept of communities of practice. Among these is a lack of development in the definition of community, given the different ways that individuals now interact online (Roberts 2006, 632). Developing Wenger's theory to account for new types of relations between practitioners, Brown and Duguid's concept of 'networks of practice' (Brown and Duguid 2001, 205) offers an 'info-centric' alternative to communities of practice and is defined as 'people who work on a similar practice within the same institutional framework' as opposed to CoPs who are 'located in the same space and time' (Lave 1991, 69). While there is a difference between the fixity Brown and Duguid impose on communities of practice and Lave's description of a CoP (which can be distributed in space and time), their loosening of the definition of a CoP to account for electronic networks is an attempt to consider new community contexts. Roberts also challenged the temporal nature of CoPs, some of which

form over a long period of time, while others are fleeting. Roberts drew on Bourdieu's (1990) construct of the *habitus*, the behaviour and beliefs of a particular social groups acquired through experience, to challenge the idea that meaning is formed through the negotiation of members of a CoP (Gherardi, Nicolini et al.. 1998; Mutch 2003) and might rely more on what Roberts termed the 'predisposition' (Roberts 2006, 629) of individuals. Lindkvist (2005) developed a variation of communities of practice which took this into account in the form of 'collectivities of practice' (1189), to refer to temporary groups or project teams concerned with knowledge creation and exchange.

The connection between practice and linguistics has also been identified as an area that requires development. Tusting (2005) contends that a theory of language is needed specifically for communities of practice because Wenger does not go into any depth on the importance of language in the process of meaning making (ibid., 36). Tusting also considered Wenger's theory has too much focus on how CoPs maintain their existence rather than how they change, according to Tusting an essential pre-condition for learning (ibid., 43).  Overall, it is perhaps the versatility of Wenger's theory that has invited most forms of criticism; its ability to be applied in a wide range of scenarios inevitably raises questions on validity especially against the context of rapid changes in technology and in the workplace.

Nevertheless, the theory of communities of practice has been applied widely to a diverse range of fields from social care (Easen, Atkins et al.. 2000) to management (Lesser and Storck 2001) (McDermott 2010) and formal learning (Lipman 1988; Brown and Campione 1990; Scardamalia and Bereiter 1993; Roth 1996; Barab and Duffy 2000; Grossman 2001; O'Keeffe 2009). Steve

Herne's paper, 'Communities of Practice in Art and Design and Museum and Gallery Education' (2006), utilises Wenger's theory in exploring the differences between two CoPs - art and design teachers, and museum and gallery educators – in how they conceive of 'critical and conceptual' studies (ibid., 1). It uses data gathered from interviewing members of each CoP and discourse analysis to explore differing understandings and perceptions of two groups recruited from the HE and cultural sectors. Drawing on the work of Star (1989), Herne identifies several 'boundary issues' between the two CoPs and proposes a number of ways to 'broker' (2006, 26) interaction across boundaries. Herne calls for greater self-awareness of the influence of 'social processes by which their discourse and practice is constructed' (ibid., 27) and the development of trans-institutional CoPs based on 'boundary practices' (ibid.).

David McConnell's (2006) work in investigating the dynamics between users in VLEs also focused on group dynamics but in a digital learning environment. Borrowing from C. Geertz's (1973) use of ethnographic tools and methods to interpret an e-learning groups' social discourse, McConnell tracked, codified and analysed interactions among students within a VLE. Although not solely concerned with content interaction and delivery, McConnell's application of the communities of practice model to e-learning and the VLE is an acknowledgement of the value of examining patterns of user behaviour employing Wenger's theory.

However, the application of CoP theory to specific areas of HE and cultural sector activity, few studies have applied Wenger's theory to the various communities of practice engaged in the digitisation of cultural artefacts or the use of digital artefacts produced.

*2.3.2.4     Digital supply chain: Conclusion*

Summing up, perhaps as a result of pressure to increase the pace of digitisation (Atkinson 2011), much of the research on the digital supply chain is focused on the technical process of digitisation and the value of virtualising collections, rather than on the complexities of the digital supply chain and the process of end-use. Little attention has been paid to investigating social determinism in the supply chain – assessing the influence of decision makers and assessing their impact on end-use of the digital artefact produced - or deconstructing the process of use itself.

## *2.3.3     Basic processes of use*

This section examines to what extent previous research activity has probed how digital artefacts are actually used. It firstly looks at research activity in libraries and archives, predominantly 'service-led' approaches and studies on information retrieval. Research on how artefacts are used in museums is then the focus of review, as well as work done on image usability, the utilisation of web analytics to describe usage behaviour and, finally, on the use of artefacts in digital learning environments.

*2.3.3.1 Basic processes of use: Libraries and service-led approaches*

Generally speaking, research on usage behaviour among library users is far more advanced than that carried out in museums and archives but this has tended to be service-led and lacks conceptualisation and theorisation.  For instance, the JISC-funded User Behaviour

Observational Study conducted by the CIBER team at University College London in 2010 focused on business and economics scholars' use of digital resources (such as e-books) and sought to 'demonstrate the issues that real users (students and researchers) face when navigating the Web and interacting with scholarly resources' (2010, 7). The evidence base for the study was four projects focusing on analysing 'digital usage and information seeking' (ibid.), all part of the 'Virtual Scholar' programme funded by JISC. Log analysis methods[29] were used and two of the projects also employed questionnaires to gather data on usage. The study found that although business and economics scholars shared the same basic behaviour as other virtual users, there were also distinctive patterns of use of resources. For instance, variations in the usage of e-books and e-textbooks, different rates of bouncing, and a marked preference for most current (as opposed to older) material were found between the two disciplines. The study by CIBER is useful in probing the link between usage behaviour and academic discipline through its focus on basic information literacy,[30] but its sole focus on library e-resources limits it scope.

In a similar study, Levine-Clark (2007) tested the use of library electronic resources among different disciplines. Levine-Clark examined 'intra-artefact' patterns of use (for example, dwell times on cover pages of e-publications) and developed a variety of metrics (for example, page views, format), providing more granularity in the description of usage of library materials. The study also compared institutions and subjects, access points or gateways (e.g. Google Scholar), advanced or basic search, type of article viewed, age of article, and so on. Levine-Clark found

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[29] Log analysis is the 'use of data stored in transaction logs of Web search engines, Intranets, and Web sites..[to] [...] provide valuable insight into understanding the information-searching process of online searchers' (Jansen 2006, 407).

[30] Information literacy is 'about the abilities to know when to find, to search for, evaluate and make sense of the content' (JISC 2009).

some subject differences in terms of information-seeking behaviour and frequency of use of e-books among humanities, business, social science and science faculty students. The methodology used by Levine-Clark linked attitudinal data in questionnaires to web log data of the same users to gain a better understanding of users' behaviour. However, this top-down method of describing usage behaviour necessarily restricts the results since subjects' use of electronic resources was tested against categories already developed heuristically by researchers rather than developing these from the evidence.

Tenopir (2003) has provided a useful overview of research in the use of electronic library resources. Her report was an attempt to draw conclusions from over 200 separate studies conducted between 1995 and 2003 which looked at library users' preferences, motivations and behaviour, using a variety of methods. One of the author's main findings recognises a connection between user background and use behaviour with electronic resources,

> Experts in different subject disciplines (work fields) have different usage patterns and preferences for print or electronic. There is no one right solution for services or system design for every subject discipline (ibid., iv).

In a deconstruction of the 'fallacy' (28) that there is a typical user, Tenopir looks at various studies to note factors which affect end-use. Other than discipline, the author states that, 'Differences in motivation or task also cause variations in information seeking and use' (29). In doing so, she cites the work of Nelson (2001), King and Montgomery (2002), and Rudner, Miller-Whitehead, and Gellman (2002) which all found that staff and students engaged in primary research had different usage behaviour to undergraduates and staff not engaged in such research.

A great deal of research on the use of archives (Duff 2002; Anderson 2004; Harris 2005; Sundqvist 2007) and library resources (Siatri 1999; Carr 2006) has taken the form of usability evaluations with a view to improving performance rankings for a particular service in line with such standards (2006) set by bodies as the Public Services Quality Group (PSQG). There have been a limited number of studies which speak about ethnographic methods with service improvements in mind, but most of these (e.g. Nardi and O'Day 1999) stop short of practical application. An exception might be Seadle's (2000) use of cultural anthropological methods to analyse the behaviour of nine 'cultures' or groups of individuals such as engineers and librarians who are involved a project to develop the National Gallery of the Spoken Word (NGSW) set up by the National Science Foundation in the USA in 1998. Perhaps because of the linguistic nature of the collections being built, it is no surprise that Seadle focuses on language use between practitioners as the focus of his research concluding that,

> useful evaluation of digital library services needs to include an understanding of the nuances of the meaning and connotation, implication and limitation, for a wide range of vocabulary across the many micro-cultures involved (ibid., 384).

Although not geared towards artefact use, Seadle's paper is a rare attempt in library studies to use alternative methods to examine tensions between communities of practice manifested in discoursal barriers. This is important because, as pointed out in Chapter 1, the cultural and HE sectors are being encouraged to collaborate in the creation of artefact-based educational resources and communication between different practitioner groups is a crucial aspect of partnership working (Mohr and Spekman 2006, 135).

*2.3.3.2 Basic processes of use: Information retrieval*

In library information science, much research attention has been focused on information retrieval (Tenopir 2009) rather than different ways of using collections. For instance, Armitage et al.'s (1997) study on gauging user needs in accessing moving image material is focused on the categorisation of requests rather than what is actually done once this material has been found.  Equally, the focus of work carried out by Ornager (1997) concerns indexing and information retrieval rather than end-use. Although there is an increasing body of research on user-centred indexing and folksonomy (e.g. Matusiak 2006), the vast majority of studies on user interaction with library collections remain service-driven rather than use-driven *per se*.

One possible reason for the lack of research on the basic processes of artefact use could be that cultural repositories have been customers of database providers rather than innovators (Veldof, Prasse et al.. 1999, 121). Rather than being in the driving seat, museums, libraries and archives are themselves users in the digital supply chain and have limited abilities in changing the way that end-users can find and interact with cultural collections. As Veldof points out,

> Librarians sometimes became like triage nurses, soothing over frayed patron nerves and providing as much help as they possibly could to make online experiences successful. (ibid., 121).

This might have impacted on the type of research which has taken place on use as libraries and end-users are locked in to particular proprietary databases.

*2.3.3.3 Basic processes of use: Museums and the physical*

In museums, most research attention has been paid to the use potential of physical artefacts and to web analytics (as a reflection of use) than to detailed studies of interaction with digital artefacts. Much of the museological literature on artefact use draws uncritical attention to the value of using physical artefacts (Hooper-Greenhill 2007; Chatterjee 2010a) particularly in children's learning (Hein 1998), informal learning scenarios (Falk and Dierking 2000) and in the context of object handling sessions (Chatterjee 2010b). Much of this research is based on an ideological belief that artefact-based learning is unquestionably beneficial (Durbin, Morris et al.. 1990). Simpson and Hammond's research (2012) comparing the use of physical artefacts and digital surrogates at Macquarie University is valuable because it tests the relative impact on didactic learning of the use of physical artefacts and digital surrogates over a period of time. However, no studies have been found which focus on how users *actually* interact with artefacts (physical or digital) rather than what they *could* do or *ought* to do. A failure to problematise artefact use has meant that empirical research which might support assumptions about the use value of museum artefacts in physical and digital form has been lacking. In fact, far more studies exist in material cultures research based on ethnological investigations (e.g. Pearce 1992, 217) into historic use of artefacts and what this tells us about their original use, than present use of the same artefact.

However, there are a few notable advances in probing physical artefact use in a learning context. Duff and Cherry's (2000) investigation of the use of Early Canadiana employed user surveys, an analysis of server logs, and focus group sessions to gauge how end-users were utilising artefacts in different forms (original artefacts, microfiche, and online) in research.

Audio tapes of focus group sessions were transcribed verbatim and analysed qualitatively (presumably using Grounded Theory, a content analysis[31] method which involves the discovery of theory in data (Glaser and Strauss 1999, 1), although this is not made explicit). Transcripts were coded independently for themes by two researchers. A valuable tactic of Duff and Cherry's was post-session questioning about use via a questionnaire which,

> asked people how long they spent using the item today, their reason for using it, how they used it, what features they used, and how satisfied they were with the format of the item they had just used (2000).

Data was then deepened by asking about forms of use in a focus group afterwards. The primary focus of Duff and Cherry's research was a comparison of use between a webpage, paper, and microfiche and they conclude that the connection between the physical artefact and any surrogates needs to be made clear to users to alleviate concerns around value. However, conceptualisation of the data might have revealed elements of artefact use shared by all users across all media, or allowed Duff and Cherry to interpolate behavioural patterns according to the demographic of participants.

Overall, research on artefact use in museums has been ideologically driven and confined, largely, to the use of physical collections in formal and informal learning. Arguably, there are considerable gaps in our understanding of the mechanics of artefact use because of underlying assumptions about the individuality of interaction, particularly when encountered at first hand. This is discussed in more detail in Section 2.3.5.4.

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[31] Defined by Holsti as 'any technique for making inferences by objectively and systematically identifying specified characteristics of messages' (1969).

*2.3.3.4 Basic processes of use: Image usability*

There has been some practice-focused work undertaken outside the cultural and the HE sector

on the usability of images. James Chudley's (2013) practical guide on the creation of usable web

photographs, *Usability of Web Photos*, is based around Aristotle's three types of rhetoric:

ethos, pathos and logos. He explained that,

> For a photo to be effective and usable it must be credible (ethos). It should also elicit a
> desirable emotional response (pathos) and help answer practical questions (logos)
> (ibid.).

Although it neatly side-stepped epistemological issues associated with how advice was arrived

at, Chudley's guide was written precisely because of his frustration about the lack of theory and

practical advice available online.  The field of web usability is also fairly well developed: the

work of Jakob Nielsen (Nielsen and Pernice 2009) and Ben Shneiderman (1987) on web

interfaces is perhaps most cited. Much museological research work in image usability is

devoted to post-capture activities such as search engine optimisation and end-user search

strategies (e.g. Bates 1996; Sacco 2008; Fernandez 2012). Ross and Terras's (2011) research

based on scholar's use of the British Museum's Collections Online portal, based on user survey

data, did include an analysis of user perceptions of the information environment but, again, this

was not conceptualised.

*2.3.3.5 Basic processes of use: Web analytics*

The measurement, collection and analysis of internet statistics have increasingly been used by

museums (and libraries and archives) to evaluate uptake of collections-based data since the

mid-1990s (ClickTale 2010). Although analytics such as page views, click paths, page depths,

bounce rates and so on are generally accepted as useful ways of benchmarking the popularity

of particular resources they provide little in the way of the context of use and information on

exactly how web users are interacting with images and metadata, and can be problematic if

taken at face value (Berthon, Pitt et al.. 1997). The development of social media metrics such as

the content analysis of tweets relating to an exhibition (Villaespesa 2013) does attempt to

provide more qualitative data to support analytics on the use of web resources but this is

ultimately restricted by the degree of contextual data available on social media users.


*2.3.3.6 Basic processes of use: Digital learning environments*

In terms of gauging the experience of users in digital learning environments much of the

literature is dominated by technology acceptance studies (Keller 2009) motivated by a range of

interests not wholly centred on content. This research ranges from educationalists' interest in

the shift from classroom teaching, to new pedagogies used in VLEs (Morón-García 2004) and to

reports seeking to justify return on investment (Urwin 2011) on VLEs or studies concerned with

their uptake and impact (Britain and Liber 1999; Monteith and Smith 2001). Most of the case-

study-based literature on VLEs and pedagogy typically focuses on the extent to which VLEs have

changed pedagogical practice (Newland and Wiles 2004; Jenkins, Browne et al.. 2006) rather

than how pedagogical practice is reforming VLEs, or on the nature of content use. More

research interest has been shown in the use of Second Life and MUVE (Multi User Virtual

Environments) technologies in distance learning (Dickey 2005) than in the specific use of

artefact-based content in VLEs. Skills such as searching and navigation used in online learning

(Kwasnik 1992; Brown 1998) have been the subject of research and these are useful in

investigating patterns of use associated with a new digital literacy. Brumberger's (2011) work on visual literacy and digital nativism represents a constructive addition to a growing research corpus on digital literacies particularly because of its focus on the individual learner and how literacies might influence usage of online material. However, despite longstanding pressure to improve content within digital learning environments (Stiles 2000) there has been a surprising lack of research, particularly relating to digital content created from cultural artefacts.

## 2.3.3.7 Basic processes of use: Conclusion

Therefore, although some progress has been made in building a picture of how users interact with digital resources in the library sector, and connections have been made between types of user group and particular usage habits, there has been an absence of bottom-up, empirical studies that are solely interested in the mechanics of artefact use. Much of the previous research on usage has been service-driven in libraries and archives, and in the HE sector's use of VLEs, whereas research on the use of museum artefacts appears to be dominated by studies that are ideologically-driven and focused on physical artefacts alone. Given the importance of measuring impact in object-based learning (Chatterjee 2010a) and VLEs (Almpanis 2009), and ensuring that the digitisation of artefacts meets user needs, there is a real need for an elemental understanding of how users actually engage with artefacts in physical and digital form.

### 2.3.4 Environment

This section focuses on published research on the effect of environment or context on artefact use. It begins by defining learning environments before moving on to review extant research on artefact use in VLEs, and in museums. It concludes by looking at the theory of environmental affordances and how work done in this area relates, or could relate, to digital artefact use.

### 2.3.4.1 Environment: Defining learning environments

Imperial College London, define a learning environment as, 'The physical or virtual setting in which learning takes place'(2014). More specifically, Hannafin et al. (1999) describe four essential criteria for all learning environments:

1. **Contexts:** authentic or realistic situations to motivate learners e.g. complex, full-scale problems representative of real-world tasks

2. **Resources:** content to help students understand complex problems

3. **Tools:** aids to help learners process information, manipulate data, and discuss data

4. **Scaffolds**: support to bolster student problem-solving as needed (e.g. tutor or student peer support)

For the HE sector, the institutional VLE constitutes the main formal digital learning environment, providing a dedicated space equipped with tools and scaffolds supporting student learning. However, the resources utilised within the VLE might have been imported from elsewhere; in the context of cultural artefacts these might be embedded within the VLE via webpages (such as a museum database record or blogs), multimedia files, or hyperlinks to other kinds of content created and hosted outside the VLE. The provision of cultural artefacts in

online learning environments is widely considered to facilitate situated learning (Brown, Collins et al.. 1996; McLellan 1996) by providing the first of Hannafin et al.'s criteria, a representation of an authentic or real world situation through digital artefacts.

*2.3.4.2 Environment: Learning environments and the use of content*

To what extent has previous research examined the effect of learning environments on the use of content within them? Despite the prevalence of VLE use (mentioned above in Section 2.2) in the HE sector and the widespread provision of cultural artefacts in digital form following a decade or so of digitisation, very little research activity has been devoted to studying the effects of learning environments on the use of digital artefacts. More attention has been paid to the usability of VLEs (Parizotto-Ribeiro and Hammond 2005; Walker and Fraser 2005) and pedagogical evaluation of particular products (Britain and Liber 1999) than to content use. Indeed, Dale and Lane make no mention of the relationship between content and context in their VLE usability study carried out among students at the University of Wolverhampton in 2007. They instead conclude that, 'The extent to which learners engage with VLEs is dependent upon their design and functionality' (Dale and Lane 2007, 102). Since one of the key criticisms about VLEs is that they are simply used as a content repository rather a place where such content is used (Turnock 2008) research on which content is best suited for use in digital learning environments would seem to be long overdue.

*2.3.4.3 Environment: Environmental studies in museums*

In terms of environmental studies in museums, although there was a good deal of research

activity in the 1970s, 1980s and 1990s in examining the influence of the physical environment

of the museum on formal and informal learning (Falk, Martin et al.. 1978; Wolf and Tymitz

1978; Wolf 1980; Peart 1984; Koran 1988; Norman 1988) this, by and large, has not been

developed to take into account the effect of digital environments on how artefacts are used.

Bitgood (2002) somewhat pessimistically sums-up the lack of research on physical factors as

architecture, interpretive design, amenities, and dimensionality (2D and 3D design) on the

museum visitor, 'Environmental design in museums is still in its infancy and suffers from a lack

of competent researchers' (ibid., 17). More accurately, research on the effect of the

environment on artefact use has been limited to studies that use cognitive approaches

(examining the connection between how we think and how we behave) to study meaning

making in physical environments primarily in the context of informal learning (Falk and Dierking

2000, 57). The use of 'baroque and overly complicated' (Gaver 1991, 79) cognitive models to

study the effect of environment has meant that tackling the issue of the use of digital artefacts

in virtual environments has proven to be too problematic and, thus, a neglected area of

investigation. There might also be a failure among museums to appreciate that the online

experience should be more than a replication of a visit to the museum, something that

museums have been accused of in the past (Marty 2004).  In contrast, Ross and Terras claim

that, 'academic users consider the museum website to be a very different information

environment to that of the physical museum' (Ross and Terras 2011) which makes the lack of

investigation into the effect of digital environments on artefact use even more vital. Equally,

research has been slow to acknowledge the increased use of the internet as a learning

environment. As Chadwick and Boverie pointed out,

> There are no empirically based studies on the nature of the Web as an informal
> learning environment and the similarities or differences between the different types of
> visitors (1999)

 In the 15 years since their survey, little has changed.

*2.3.4.4 Environment: Theory of affordances*

The theory of environmental affordances, first developed by the perceptual psychologist J. J.

Gibson (1986) as an alternative to cognitive approaches in studying the effect of environments,

utilised in a museum context by Screven (1974), has been widely used in educational and

technological contexts (for example, Laurillard (2002)). Tan et al. define an 'affordance' as,

> what the environment offers to humans and what it provides or furnishes, which might
> be for good or ill; it emphasizes possible actions that the observer perceives as feasible
> in the environment (2012, 206).

While cognitive approaches focus on perception, action, memory and sensation, the so-called

'ecological' approach to studying the affordances and limitations of the environment prioritises

the link between perception and action, playing down the interference of memory and other

accrued experience on what is enacted. The affordances of an environment, such as the

'climbability' of stairs or the 'pushability' of a door handle (Gaver 1991, 82) exists whether or

not they are perceived but, 'it is because they are inherently about important properties that

they need to be perceived' (ibid., 80). This approach is distinct from the contextual theory of

learning in museums proposed by Falk and Dierking (2000) which takes into account 'the

causality of expectations, experiences, and memories' (Kirchberg and Tröndle 2012, 439) akin

to the cognitive approach. According to Gibson, affordances depolarise the study of

environmental effects since they look both at context and user,

> An affordance cuts across the dichotomy of subjective-objective and helps us to
> understand its inadequacy. It is equally a fact of the environment and a fact of
> behavior. It is both physical and psychical, yet neither. An affordance points both ways,
> to the environment and to the observer. (1986, 129).

This corresponds with constructivist theories on meaning-making in virtual environments

(Osberg 1997) where the meaning of an artefact is dynamically located between the producer

(the artefact's creator or the museum), the user, the artefact and its environment (Rowe 2002,

31).


Various studies involving the usage of VLEs have employed the theory of affordances to identify

features of the technological environment that affect use. Tan et al.'s (2012) part-qualitative,

part-quantitative study of the affordances of a ubiquitous learning environment[32] made

available via personal digital assistants (PDAs) among fifth-grade Natural Sciences students

revealed eight 'actual' and five 'perceived' educational affordances (211). This study, and other

recent research on the affordances of mobile learning environments (Klopfer, K. Squire et al..

2002; Patten 2006; Churchill and Churchill 2008) seek to improve environmental design and

make pedagogies used alongside VLEs more effective (Webb 2005). Clark and Brennan (Clark

and Brennan 1991) identify affordances such as synchronicity, audibility, and co-presence

within VLEs in examining the communication affordances of digital learning environments.

However, despite the potential of the theory of affordances, it has yet to be applied specifically

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[32] A ubiquitous learning environment is 'any setting in which students can become totally immersed in the learning process' (Jones and Jo 2004).

to examine the relationship between digital learning environments and the use of cultural

artefacts within them.

*2.3.4.5 Environment: Conclusion*

Overall, research on digital learning environments has tended to focus more on the usability of

particular VLEs or the pedagogical implications of use rather than the specific effects of context

on content use. Many studies focus either on the learning process or the influence of the tools

and scaffolds within learning environments rather than the association between artefacts and

environments. Of the few environmental studies in museums that have been carried out most

have either focused primarily on complex cognitive approaches to looking at the association

between environments and learning. Museums have generally been slow in acknowledging the

difference between physical and digital environments and the impact this might have on the

use of artefacts. The theory of affordances offers a way of examining the effect of the

behaviour of individuals and the nature of the environment without the complications of

cognitive models, but in the context of the use of artefact-based resources this theoretical

approach has not been adequately applied.

### 2.3.5 Previous research methods

This section reviews research methods and approaches used to address the question of how

individuals use digital artefacts and the extent to which communities of practice influence this.

Given the absence of theory on artefact use, it begins with an analysis of work done on

generating theory from data, before examining two areas closely related to the study of artefact use and communities of practice: learning theory and language as a form of practice. A review of methodological approaches and related qualitative and quantitative methods used in previous studies then follows to look behind patterns in choices made in previous research.

*2.3.5.1 Previous research methods: Bottom-up analysis*

Given the absence of established theories on artefact use it would seem to be more important to scope new theories than utilise a top-down approach to testing existing theories on new data. However, few previous studies (e.g. Ellis 1993) on artefact use employ data analysis techniques which generate theory from data. Julien and Duggan (2000) point out the lack of theoretical foundations of much of the work done on information research concluding, 'it is of great concern that such a small proportion of literature is based on theory' (ibid., 306). In their 'A Longitudinal Analysis of the Information Needs and Uses Literature' which compared published research on use over three periods from 1984-94, Julien and Duggan also conclude that there has been little progress made in using combinations of methods to test the validity of findings, sourcing sound theoretical frameworks for data analysis, and looking outside of Library and Information Sciences for questions and methodologies to examine usage behaviour of readers (ibid., 307). A common theme running across most museological studies of object-based learning is the underlying essentialist belief that artefact use is beneficial. Arguably, this assumption, and the use of top-down analytical approaches suggest an underlying political or ideological agenda and results in relatively uncritical, qualitative commentaries on artefact use.

It prevents the generation of new theories from data which challenge orthodoxies surrounding artefact use and, potentially, are more relevant by virtue of being grounded in data.

However, there are some examples of studies that utilise a bottom-up approach to generate theory from data arising from artefact use. The most notable among these use ethnographic methods and Grounded Theory to base new theories on what is found in the data, rather than testing existing hypotheses with data. Ethnography 'takes the position that the best and most authentic way to understand a different cultural setting is 'to immerse oneself in the data to understand what is going on and be able to write about it' (Kawulich 2005) and ethnographic methods employ qualitative data collection and analysis techniques to provide an in-depth analysis of a particular 'cultural setting'. Khoo, Rozaklis and Hall (2012) provide a comprehensive overview of 81 projects in libraries that have utilised ethnographic methods in the study of libraries and library users. Taking the form of a literature study, the authors categorised methods used (observation, interviews, fieldwork, focus groups, and cultural probes) and found that most libraries were utilising ethnographic methods because they allowed for flexibility and the collection of authentic data (derived from real users). Overall, the authors recognise an upward trend in the use of ethnographic methods in digital environments, for example, Geertz's (1973) interpretation of an e-learning groups' social discourse using ethnographic methods.

Grounded Theory, initially developed by Glaser and Strauss in the mid 1960s, emphasises the constant comparison of indicators, concepts and categories to generate dynamically and verify theory from data (Glaser 1965). It combines an open, qualitative creation of codes from data

and the quantitative collation of incidence of those codes, and claims to offer a way of 'arriving at theory suited to its supposed uses' (Glaser and Strauss 1999). Although criticised mainly for its claim to generate 'theory' inductively (Thomas and James 2006), Grounded Theory has been widely used in sociology and, increasingly, in cultural studies. Ellis's (1993) use of Grounded Theory in a small scale but thorough study of information retrieval behaviour among communities of learners represents an extremely effective and cogent use of Grounded Theory which helps to reduce the research gap on artefact use. In the absence of 'a realistic model of the information environment and information-seeking behavior employed information retrieval research' (ibid., 473) Grounded Theory was used by Ellis in the analysis of data from four studies on information retrieval in libraries carried out at the University of Sheffield. Transcripts created from interviews with different academic groups constituted the dataset which was then analysed and various categories which describe information retrieval behaviour were formed. Although he discovered linguistic differences between groups, Ellis found a high degree of 'internal coherence of the models' which 'reinforced the feeling that the studies have covered the key themes and provided support for confidence in their general validity' (ibid., 483). Moreover, getting real end-users involved in relating their experience of information retrieval represented for him, 'an antidote to perceiving such issues from an orientation very different from that of those studied' (ibid., 484). Ellis rejected heuristic studies in favour of the 'authenticity' (ibid., 478) of data created from real end-users and analysed in a way which is, arguably, closer to intended meaning than looking at data through a preconceived theoretical lens. However, bottom-up studies like this are relatively rare elsewhere in library information science and, more generally, in cultural studies.

*2.3.5.2 Previous research methods: Learning theory*

As noted in Section 2.3.2.3, Wenger's theory of Communities of Practice has been used

extensively in educational, management and social science contexts but rarely in looking at

producers and end-users of digital artefacts. Other studies (e.g. Diaz and Cartnal 1999; Terrell

and Dringus 2000) focus on a key characteristic of communities of practice – the collaborative

learning of members – and patterns in learning styles between students learning on-campus

and at a distance. These studies build primarily on the work of David A. Kolb (1984) whose

theory of experiential learning proposes four different learning styles.[33] Although criticised for

its Cartesian separation of process into stages and its evidence base, it is frequently used in

museological literature to analyse object-centred learning (Black 2005, 133). Alternative

theories such as Riding and Rayner's cognitive styles, which focuses on the 'thinking style' of

the individual rather than the learning process (Riding and Rayner 1998, 50), have received less

attention in studying digital learning environments since Kolb's learning styles focus on the

learning process rather than an individual's hardwiring, the focus of cognitive style theory

(ibid.). Grasha and Reichmann's cognitive approach to learning styles describes six modes which

categorise ways of learning and coping, and has been used to analyse online learning activity

(Diaz and Cartnal 1999) but this is based more on thinking and interaction patterns between

learners in classroom environments than in the context of a museum or, indeed, artefact-based

learning in digital environments (Baykul, Gürsel et al.. 2010). Fleming's Visual, Auditory,

Reading-writing and Kinaesthetic (VARK) Model, based around sensory preferences in learning

is widely used in the context of formal learning but has been used less frequently in informal

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[33] Learning styles are defined by Stewart and Felicetti as, 'educational conditions under which a student is most likely to learn' (1992, 15).

learning environments such as museums, libraries and archives and was singled out by Coffield et al. (2004) in a critique of learning style theories for 'lack of independent research on the model' alluding to the fact that the most salient published work on learning theories is often by the theorists themselves.

Returning to Kolb's theory, he proposes that a 'transformation of experience' (Kolb 1984, 38) occurs as individuals move through the four quadrants of a conceptual learning cycle, between concrete experience and abstract thought on a 'perceptual' axis, and reflection and experimentation on a 'processing' axis. Typically, individuals will have strengths in one particular quadrant and this describes their learning style. The relationship between enculturation and learning style has been probed by, among others, Kolb and Joy (2009). In a two-part study on the connection between cultural background and learning style, the authors found preferences for particular learning styles in some of the seven nations from which 533 participants came. However, research focusing on the relationship between learning styles and communities of practice is under-developed, although some work has been done in the context of healthcare training (e.g. Hart, Daviesa et al.. 2013). Equally, research on the connection between learning styles and artefact usage has not transpired, despite the fact that learning is conceived of as 'a process grounded in experience' (Riding and Rayner 1998, 54) and the experience of utilising artefacts in learning and research is often talked-up in museum literature.

*2.3.5.3 Previous research methods: Linguistic analysis*

According to Wenger, learning is a form of *practice*, one of the three main aspects of a

community of practice (Wenger 2013).  So too is language which reifies shared 'protocols'

(Wenger, White et al.. 2005, 7) developed collectively by members of a community of practice

(Wenger and Lave 2009, 85). Some useful work has been done in examining the conceptual

relationship between linguistic expression and membership of a community of practice (Sarangi

and Leeuwen 2003; Tusting 2005) and presentation styles and CoP membership (Ventola 2002).

Swales's (2003) study of language and CoP membership among campus-based academics found

that the connection is much more likely to be found in texts than in speech, pointing out that

research speech is not taught or vetted. Therefore we should not expect absolutely rigid

patterns. Akin to casual conversation, there is likely to be more consensus in a social setting.

Unlike speech, text is much more regulated,

> it is research writing that is coached, revised, reviewed, copy-edited and generally co-constructed and, finally, it is research and scholarly writing that prevails in research assessment exercises and the like (Swales 2003, 215).

According to Swales, academic texts tend to 'reify our perceptions of disciplinary differences'

(ibid.). Far less work has been done in the cultural sector on the link between language and

membership of CoPs; this limits our appreciation of the extent to which practitioners identify

with particular communities and the influence this might have on their practice.

*2.3.5.4 Previous research methods: Nomothetic and idiographic methodological approaches*

According to the Kantian philosopher, Wilhelm Windelband, there are two basic approaches to knowledge acquisition which describe a different methodological tendency: idiographic and nomothetic (Robinson 2011, 32).

In the context of this research, an idiographic approach focuses on the uniqueness of an individual's encounter with an artefact and would regard usage as an 'uncountable' phenomenon, i.e. subjective (MacMillan 2014a).[34] Perhaps because 'the humanities have less to do with facts as such than with their relationships' (Portin 1981), this might explain why the idiographic approach is more commonly used by humanities disciplines which prioritise the 'distinctive human element and value' (ibid.) in situations and activities with which artefacts are associated. Another implicit reason for a preference for idiographic methods might be the identity crisis spoken about in Section 2.2. In this respect, nomothetic methodologies, which embody a belief in objective (MacMillan 2014b) forms of measurement,[35] might appear to threaten the special nature of the encounter with the artefact (and the presiding role of the curator) and thereby challenge the innate social exclusivity of museums (O'Neill 2002, 24) and the status of gatekeepers. Most often, qualitative methods are used to gather and analyse data on artefact use, since these focus on the contingent and the individual.

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[34] For the purposes of this thesis, 'subjective' is taken to mean 'based on [...] a person's feelings and thoughts that no one else can know directly or completely [...] uncountable' (MacMillan 2014).

[35] For the purposes of this thesis, 'objective' is taken to mean ''based only on facts and not influenced by personal feelings or beliefs [...] countable' (MacMillan 2014).

The nomothetic approach works in the belief that patterns can be found in human behaviour and invokes a positivist epistemology. This objectivist approach is based on an assumption that 'the social world [...] [has] an existence as hard and concrete as the natural world' (Burrell 1985, 4). In other words, scientific techniques might be employed to elucidate patterns of behaviour across the board, even in the arts and humanities. The nomothetic approach tends to employ quantitative methods to collect and analyse data since these focus on phenomena that are 'countable' (i.e. objective) and general patterns.

Although the phenomenon of artefact usage, and methods of analysis used in studying it, will necessarily contain elements which might be described as objective and subjective, most methodologies can be described as favouring one or the other. This attention to the ideology behind methods used is important because it is, arguably, responsible for the lack of research on digital artefact use.[36]

In general, previous research (e.g. Chatterjee 2010a) on the use of physical artefacts has been idiographic in nature while work done on the use of digital artefacts in museums, libraries and archives has fallen between the idiographic and nomothetic approaches (taken up in Section 2.3.5.6). Research on artefact use in museums is dominated by qualitative studies of the use of physical collections, reflecting a strong idiographic tendency. Generally speaking, these to take the form of a-theoretical, small-scale investigations of the teaching use of collections (Romanek

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[36] The term 'ideology' is used in the sense of being 'a body of ideas that reflects the beliefs and interests of a nation, political system, etc and underlies political action' (Collins 2014)

and Lynch 2008) or heuristic case studies[37] based on the (largely intangible) benefits of object-based learning (Sparks 2009; Gould in press). Research techniques typically involve some form of artefact-handling session followed by interviews, focus groups or questionnaires. These studies tend to generate data used by the authors to demonstrate anecdotally the advantages of using research collections in Higher Education curricula. Unsystematic methods of data capture and an absence of theoretical frameworks on artefact use means that pattern analysis among end-users is either not considered, or is not thought verifiable. Although there are some examples of direct observation of artefact use (e.g. Ferreira and Pithan 2005; Marie in press), these have not involved the codification and conceptualisation of empirical data. These methodological approaches undoubtedly reflect either an underlying belief in the unique, individual nature of the encounter with the artefact or a lack of faith in more nomothetic alternatives. The consequence has been that research on the use of artefacts (physical and digital) remains underdeveloped and the use of qualitative methods alone has restricted the applicability of findings to the wider cultural sector.

*2.3.5.5 Previous research methods: Qualitative and quantitative approaches*

In terms of research methods employed to investigate the use of digital artefacts, quantitative methods have been employed by museums, libraries and archives to chart the behaviour of web visitors; qualitative methods have generally been utilised to gain information on the usability of systems rather than content. The cultural sector has tended to utilise log analysis techniques and heuristic forms of evaluation to test the usability of websites, but direct

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[37] Methods that do not require users: inspection-based methods carried out by specialists or museum / education staff.

observation of users and in-depth analysis of the use of content has been limited. Although

some good work has been done on the analysis of quantitative data (e.g. Nicholas et al. 2008),

the lack of information on who users are, their motivations, and what they go on to do with

artefact-related data makes this form of analysis alone severely lacking. As Cunliffe points out,

'the data gathered in a typical web log is relatively poor' (Cunliffe, Kritou et al.. 2010, 209).

Equally, evaluating web resources heuristically (undertaken within museums, libraries and

archives) can introduce 'artificial motivations' (Hardman 1989, 238) into the process since real

end-users are not involved.


As Bailey et al. point out this can lead to false usability problems, something that is confirmed

in an evaluation carried out by the authors where they found that there,

> was relatively little overlap between the usability problems identified by direct
> observation and those identified by heuristic evaluation [...] This emphasises the
> benefits of including real users in the evaluation process (Bailey, Allen et al.. 1992,
> 214).

Perhaps a slowness in recognising the distinct use value[38] of digital collections is responsible for

the lack of development of cultural informatics beyond web logs, but another factor might be

the expense of the direct observation of users (Heinecke 1995). Some studies (e.g. Tröndle M.

and Wintzerith S. 2012) have involved direct observation of real users and these tend to follow

the pattern of VLE testing (e.g. Parizotto-Ribeiro and Hammond 2005; Walker and Fraser 2005)

where the usability of systems is tested by setting participants a task and evaluating ease of

use. These studies tend to utilise qualitative and quantitative methods of evaluation, but data

analysis is systems-oriented and content is, largely, incidental. These tests employ principles of

user interface design developed in the field of Human Computer Interaction (HCI). Indeed, work

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[38] Use value or utility is defined as the 'want-satisfying power of a commodity' (Jain 2007, 57).

done in HCI, particularly in the area of user-centred design (which often employs ethnographic methods to focus on the needs of end-users) and technologies such as eye-tracking, motion sensing, Near Field Communication (NFC) (Blöckner, Danti et al.. 2009) or Radio Frequency Identification (RFID) tagging (Cosley 2009; Haberman 2010), heat maps for tracking touch, and so on, offer a way of developing more precise metrics on use, but this research is in its infancy in terms of application to museum situations, and forms of analysis, remains laborious (Conati and Merten 2007). These technologies might offer a way of bridging the methodological divide; they focus on the individual but produce quantitative data that can be analysed to show patterns of use across a test sample. Online focus groups, which respond to detailed questions about a site or an artefact within it, might also offer a way of combining heuristic and focus group forms of evaluation, and to source data not only on the transmission of information (the focus of systemic usability evaluation) but on the individual experience and meaning-making (Teather and Wilhelm 1999).

### 2.3.5.6  Previous research methods: Conclusion

> When you can measure what you are speaking about, and express it in numbers, you
> know something about it; when you cannot express it in numbers, your knowledge is
> of a meagre and unsatisfactory kind (Thomson 1889, 73).

Although there is obvious value in qualitative methods of research which do not necessarily involve the use of numbers, the existing corpus of research on artefact use, particularly in digital learning environments, does not share William Thomson's faith in figures. In fact, an over-reliance on qualitative methods to study artefact use and a failure to look beyond physical collections has curtailed research on the creation and end-use of digital artefacts. The absence

of studies which generate theory from quantitative data, rather than testing existing theories on data, has also retarded the development of new theoretical frameworks for artefact use in digital learning environments. Equally, the problem of artefact use has rarely been approached from existing theories which examine the influence of producers and end-users of digital artefacts on the digital supply chain, such as Wenger's theory of communities of practice and Kolb's theory of experiential learning. The greater use of idiographic approaches which employ qualitative, heuristic, and top-down methods, or remote studies based on quantitative data, shows a persistent ideological belief in the special nature of the individual's use of artefacts. The consequence has been significant methodological gaps in our understanding of the people and processes involved in artefact use in digital learning environments.

## 2.4 *Situation and literature review: Summary and conclusion*

Given the political, economic, technological and strategic context for the cultural and HE sectors, and previous research on artefact use in digital learning environments, where does the main research question lie?

The main challenge for the cultural sector appears to be how to respond to demands for greater openness in how digital artefacts are produced and what can be done with them in a sustainable way, given severe financial and political pressures. For the HE sector, making educational resources more flexible and more open has also meant that digital learning environments, as well as the content used within them, are a vital part of the strategy to meet user demands. Therefore, focusing attention on the user and how they interact with artefacts is

central to responding to demands for more open and usable digital content, and is something that needs to be examined.

Previous research on artefact use has tended to be conducted only within the cultural sector. Since government funding bodies have stressed the importance of collaboration and interdisciplinary working to meet demands for usable content, research on the use of digital artefacts needs to consider *who* should be involved in scoping and testing the use of cultural artefacts in digital learning environments. The dispersed nature of much of the literature on artefact use is also an indication of the trans-disciplinary scope of the problem. More research is needed which looks at the digital supply chain in its broadest sense.

From a methodological perspective, the literature review has suggested ideological reasons which might be behind the lack of research on artefact use. Therefore, research approaches which challenge the predominance of idiographic methods are needed in this area. Additionally, the use of direct observation and bottom-up forms of analysis would seem to be more important, given the absence of comparable studies and supporting theory on artefact use. Finally, a pragmatic worldview (one which concentrates 'on the primary importance of the question asked rather than the methods' (Creswell and Clark 2011, 41)) is needed which uses a combination of research methods, regardless of the academic context in which they are normally used, in order to deconstruct the processes associated with digital artefact use and look at the influence of individuals and environments on those processes.

From the review of the research context, because the environments used in formal learning and content created for them have become more diverse, more work is required in testing the effects these have on artefact use. Previous research on the influence of environment has focused on the usability of VLEs rather than the usability of content within them. Therefore, it would also seem to be important to maintain a focus on the distinction between the usability of the environment and the usability of the artefact, if progress is to be made in this area. In other words, it is as important to remember what the research question is not about as well as what it is. Gaps in previous research and how these relate to the particular research approach adopted in this thesis are examined in the next chapter.

# 3. RESEARCH DESIGN

## 3.1 Introduction

This chapter begins (Section 3.2) with a reflection on the main points emerging from the situation and literature reviews in Chapter 2, in order to identify failings and gaps that need to be addressed in tackling the main research area. These gaps are then used to form the aims and objectives (Section 3.3) for research activities carried out to answer the main research questions: how artefacts are used in digital learning environments and what influence communities of practice have on this process. The methodological approach is then explained (Section 3.4) in relation to what is missing from previous research and three main theoretical frameworks that will be used to try to fill these research gaps. The structure and rationale is also set out, providing detail on research settings, activities, and methods of data collection and analysis, for both phases of research.

## 3.2 Research gaps

In Chapter 2, previous research on how artefacts are used in digital learning environments, was described and critiqued. From the analysis of the situation and literature, it was clear that a number of significant gaps exist in previous research. Filling these gaps (also outlined in Section 1.8) would help progress research in this area. In particular, as shown in Table 2, three aspects appear to be under-researched.

| Gap | Area |
|---|---|
| Focus | Previous studies have not examined the relationship between the identity, interests, experience and skills of suppliers and end-users of content and how digital artefacts are created and used has not been sufficiently researched. The basic processes behind the use of digital artefacts have also not been examined to any appreciable extent. Previous research on the influence of environment has also tended to focus on the usability of VLEs rather than the usability of content within them. |
| Scope | Previous studies on the digital supply chain have largely been conducted on a particular part of the digital supply chain and by those concerned (for example, in the museums profession). Also, the scope of what is meant by use has tended to refer to usability of a product rather than a broader, more inclusive definition of the term. |
| Research methods | Previous studies on artefact use have tended to adopt an idiographic methodological approach and qualitative, top-down methods of data analysis rather than allow data to suggest new typologies. |

**Table 2. Gaps in previous research on digital artefact use**

There does appear to be some overlap between these gaps. For example, as postulated in Chapters 1 and 2, one of the reasons behind the lack of research in the area of artefact use in digital learning environments has been a failure to problematise the relationship between people involved in the supply of digital artefacts, and the process of end-use. Because of the lack of interest in this relationship, theoretical frameworks which might explore this link have not been used in the context of cultural artefacts and digital learning environments. Equally, a tendency to use only qualitative methods of analysis has, arguably, restricted the scope of enquiry and influenced the focus of enquiry.

### 3.3 Aims and objectives

In order to fill these gaps and address the two main research questions - how are cultural artefacts used in digital learning environments and how can the theory of communities of practice help in understanding the people and processes involved in the supply and use of digital artefacts - four main aims and six objectives were established (Table 3).

| Aims | Objectives |
|---|---|
| To analyse the influence of the identity, interests, experience and perspective of producers and users of content on the way they use digital artefacts | Test the CoP model qualitatively and quantitatively<br><br>Analyse how membership of a CoP might affect usage of artefacts |
| To understand the main factors that affect digital artefact usage | Scope issues associated with the selection, digitisation and packaging of artefacts which might affect end use |
| To identify the mechanics of digital artefact usage | Develop a method of describing and measuring artefact usage |
| To analyse the influence of environment on digital artefact usage | Test artefact use in a range of controlled environments |

**Table 3. Main research aims and objectives**

These aims correspond with the two main themes identified in Chapter 1, namely who is involved in supplying and using digital artefacts (the people), and how usage takes place (the processes), as shown in Table 4. This approach emphasises the importance of the background (the identity, interests, skills and experience) of producers and users, and the influence of environment on the process of artefact use in digital learning environments. Although distinct, the two themes of people and processes are closely related. Looking firstly at the theme of

people, Wenger's conceptual framework of communities of practice was used to assess whether the identity, interests, experience and perspective of those closely involved in supplying and using digital artefacts influences eventual usage of artefacts. To do this, the validity of communities of practice was tested over two phases, firstly with a wide range of communities of practice in the digital supply chain and then with a strand of that chain. Various forms of analysis were employed to test Wenger's model but key to this was codifying and measuring the usage behaviour of communities of practice to look at any patterning and to explore any connections between the attributes of a CoP and the way these groups use artefacts. Therefore, in looking at whether the identity, interests, experience and perspective of producers and users of digital artefacts influences how they use artefacts it was necessary to examine the mechanics of usage and to build a statistical picture of usage among CoPs.

As well as looking at qualitative data suggesting how practitioners might perceive issues surrounding artefact use, quantitative usage data was also used to highlight any behavioural traits among communities of practice. Once a method of describing and quantifying artefact usage was developed in Phase 1, this was then used under more controlled conditions in Phase 2 to isolate the number of communities of practice while varying the nature of the usage environment. Therefore, understanding processes was instrumental to understanding the people behind those processes but gaining an insight into producers and users of digital artefacts also helped explain variations in usage behaviour.

| Themes | Main aims | Main objectives | Research Questions | Phase 1 objectives | Phase 2 objectives |
|---|---|---|---|---|---|
| **People** | To analyse the influence of the identity, interests, experience and perspective of producers and users of content on the way they use digital artefacts | To test the CoP model qualitatively and quantitatively<br><br>To examine how membership of a CoP might affect usage of artefacts | Are individuals in the sample members of a community of practice?<br><br>If individuals are members of a community of practice, how does this affect how they use artefacts? | Recruit individuals from different CoPs normally involved in the production and use of artefacts in VLEs<br><br>Profile individuals in terms of their membership of communities of practice through interviews and workshops<br><br>Explore alternative concepts to explain patterns of behaviour<br><br>Assess usage styles of participants<br><br>Assess learning styles of participants | Recruit individuals from a single CoP and test any variations in behaviour<br><br>Analyse behaviour (usage of artefacts, word use) of each group for characteristics of a CoP<br><br>Assess learning styles of participants |
| | To understand the main factors which affect | To scope issues associated with the selection, digitisation and packaging of artefacts which | What issues are associated with the selection, digitisation | Externalise perspectives and usage behaviour by engaging individuals | Externalise perspectives and usage behaviour by engaging |

| | | | | | |
|---|---|---|---|---|---|
| | artefact usage | might affect end use | and packaging of artefacts which might affect end use? | involved in the *creation* of digital artefacts in *discussions* concerning the research use of physical artefacts and digital surrogates created from them | individuals involved in the *use* of digital artefacts, in *task-based, solo activities* in controlled environments |
| **Processes** | To identify the mechanics of artefact usage | To develop a method of describing and measuring artefact usage | Does the method of describing and measuring artefact usage work? | Analyse behavioural patterns based on verbal, non verbal and written records of *discussions about* artefact use | Analyse behavioural patterns based on verbal, non verbal and written records of *actual* artefact use |
| | To analyse the influence of environment on artefact usage | To test artefact use in a range of controlled environments | What influence does environment have on artefact use? | Scope artefact use in digital and physical format by a range of communities of users and producers | Test artefact use in four different controlled environments by academic users

Compare usage behaviour and learning style in each environment |

**Table 4. Research themes, aims and objectives**

## 3.4 Methodological Approach

### *3.4.1 Methodological Approach: Overview*

As postulated in Chapters 1 and 2, one of the reasons behind the apparent lack of research in the area of artefact use in digital learning environments has been a failure to problematise the relationship between people involved in the supply of digital artefacts, and the process of end-use. Because of the lack of interest in this relationship, theoretical frameworks which might explore this link have not been used in the context of cultural artefacts and digital learning environments.

Another major gap has been methodological: objective, behaviourist methodologies which tend to include quantitative as well as qualitative forms of data collection and analysis have not been used to examine the mechanics of artefact use, or look at patterns of artefact use among different types of user. In line with the neglect of positivist methodologies has been a tendency to use top-down methods of data analysis which test theory on use rather than develop theory from the data. Given the absence of theory on artefact use, this would seem to be a costly oversight.

Therefore, the methodological approach adopted in both phases of the research carried out to address the main research questions seeks to tackle both of these areas: the relationship between communities of practice and artefact use, and methods of deriving meaningful data on interaction with the artefact.

### 3.4.2 Methodological Approach: Communities of Practice and learning

Etienne Wenger's theory of communities of practice was chosen to interpret the behaviour of individuals most closely associated with the supply and use of digital artefacts in HE. Although other theories such as Fleck's thought collectives[39], and communities of interest[40], were considered, crucially, Wenger's theory incorporates the idea of practice, a vital component when analysing artefact supply and use which are both types of reification (turning abstract knowledge into concrete things (Wenger 2009, 57)) . However, other theories such as Brown and Duguid's concept of networks of practice, a looser type of 'info-centric' community of practice whose members need not be co-located (Brown and Duguid 2001) is used to explain variations found on the model proposed by Wenger. Another important aspect of Wenger's theory of communities of practice is the emphasis on social learning. Although Fleck's theory of thought collectives proposes a cogent model of how members of a collective direct the perception or 'thought style' (Sady 2001a) of others, Wenger's theory posits that learning within a CoP is a plural, participatory process brought about by the tension created by four sets of dualities: participation-reification (Wenger 1998, 66), designed-emergent (ibid., 232-33), identification-negotiability (ibid., 188-9) and local-global (ibid., 131-33). Meaning is negotiated by members of a CoP through participation and active practice, leading to reification of that knowledge (participation-reification), and this can be part of a planned (designed) or unplanned (emergent) activity. The identity of a CoP member is negotiated between the individual and the group (identification-negotiability), and knowledge 'local' to a CoP can be shared with those

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[39] A 'thought collective' is defined by Fleck as 'a community of persons mutually exchanging ideas or maintaining intellectual interaction' (Sady 2001).

[40] A 'community of interest' is 'a gathering of people assembled around a topic of common interest' (Henri and Pudelko 2003, 478).

outside the CoP (local-global). In other words members do not just acquire knowledge - through participation they actively learn.

The collaborative nature of learning within a CoP, as opposed to the more rigid, learning-by-transmission model proposed by Fleck, corresponds more closely with Bourdieu's notion of the 'conductorless orchestra' (1990, 53) whereby all members, by virtue of participation in the CoP, learn together and learn through practice. Key to Wenger's theory, is the active participation of members in learning,

> The notion of participation [...] dissolves dichotomies between cerebral and embodied activity, between contemplation and involvement, between abstraction and experience: persons, actions, and the world are implicated in all thought, speech, knowing, and learning (Wenger and Lave 2009, 52).

The idea that 'In contrast with learning as internalization, learning as increasing participation in communities of practice concerns the whole person acting in the world' (ibid., 49) allows for any form of 'embodied activity', such as artefact use or discussions about usage, to be treated as an expression of the learning behaviour of the CoP. Learning through participation also means that other theories of sociocultural learning, such as David A. Kolb's Experiential Learning Theory (1984) and its emphasis on learning styles can be aligned with Wenger's theory of communities of practice.

### 3.4.3 Methodological Approach: Experiential learning and CoPs

David Kolb's Experiential Learning Cycle (1984) is based on experiential learning theories initially developed by Piaget (1936), Dewey (1938), and Lewin (1951), and groundbreaking work

on developmental psychology by the cognitive theorist Leo Vygotsky (1978). Although criticised

for its Cartesian separation of learning into stages and the validity of its evidence base (Smith

2001), it is widely used in museum education to conceptualise object-centred learning (Cook

and Speight 2010, 33) principally because it involves 'a direct encounter with the phenomena

being studied' (Borzak 1981, 9; Brookfield 1983) . Kolb proposes that a 'transformation of

experience' (Kolb 1984, 38) occurs as individuals move through the four quadrants of a learning

cycle, between concrete experience and abstract thought on the perceptual axis, and reflection

and experimentation on the processing axis (depicted in Figure 2). This involves the correlative

processes of apprehension and comprehension, and extension and intension .[41]

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[41] 'Apprehension' is defined as 'the act or power of perceiving' (Merriam-Webster 2013) or in Kolbian terminology, 'concrete experience'. 'Comprehension' is defined as 'the capacity of understanding fully' or in Kolbian terms 'abstract conceptualisation'. 'Extension' is defined by Kolb as a 'transformation of experience' through 'active experimentation'; intension is defined as the use of 'reflective observation' in learning (Baker, Kolb et al.. 2002, 3).
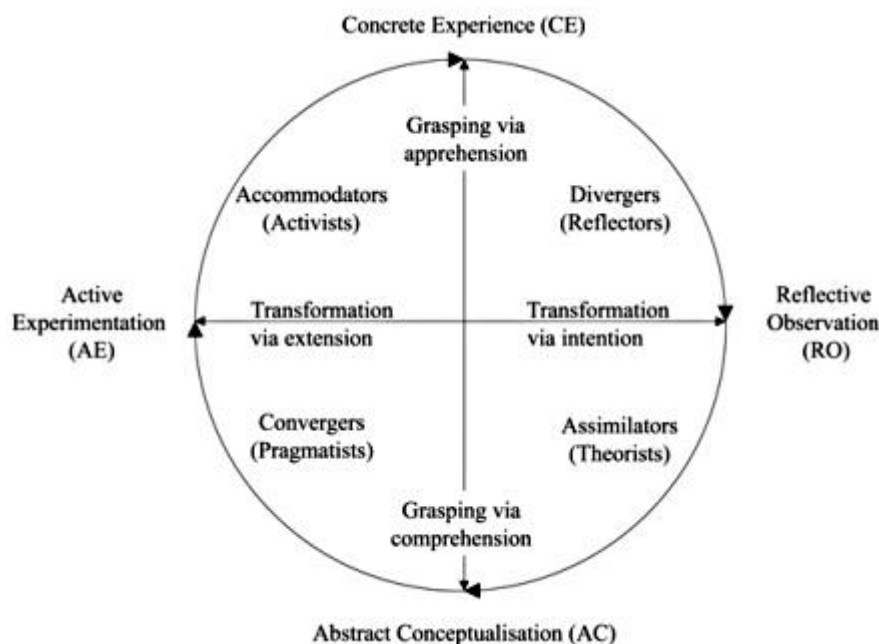
**Figure 2. Kolb's Experiential Learning Cycle (Rodwell 2005, 248)**

Typically, individuals will have strengths in one particular quadrant and this describes their

overall learning style. Although this theory is largely focused on the individual, Kolb (2009) and

others (Witkin 1967; Lessor 1976) have looked at contextual influences on learning style

broadening the scope of experiential learning to communities and to practice. This has

implications for communities of practice because, as Wenger and Lave contest, CoPs have

distributed knowledge bases which depend on members learning together. Research on

'communities of learners' (Wertsch 1998), 'interpretive communities' (Fish 1980),

'technological frames' (Bijker 2009), and 'thought collectives' (Fleck 1935) have all proposed

that individual action is strategic and acknowledge Vygotsky's theory (1978) that meaning-

making is both social and mediated. Taking this further, communities of practice are made up

of individuals with particular learning styles but the community at large might favour a distinct

learning style in building 'stores of knowledge or cultural capital' (Rowe 2002). Kolb calls this

process 'acculturation' (Kolb 1984, 164). The selection and socialisation of knowledge creates a 'homogenous disciplinary culture' (Kolb 1984, 234) which favours a dominant learning style,

> That disciplines incline to different styles of learning is evident from the variations among their primary tasks, technologies, and products, criteria for academic excellence and productivity, teaching methods, research methods, and methods for recording and portraying knowledge (ibid., 163).

In fact, professionalisation and educational specialisation are only two of the 'forces' that shape learning styles according to Kolb (ibid., 97). Another is 'accentuation' (ibid., 164) or the performance of 'primary tasks' which could involve the use of artefacts. Therefore, the way that artefacts are used could both be a way of fathoming an individual's particular learning style and a way of shaping it through contact with others within a CoP.

### 3.4.4 Methodological approach: Experiential learning and learning styles

The practical implication of this connection between ways of using artefacts and ways of learning is that broad patterns in use might be related conceptually to Kolb's Experiential Learning Cycle. Following the employment of Grounded Theory (Section 3.4.5) to generate codes for types of artefact use, these codes might then be aggregated into categories based on any patterns which emerge. This continues the logic of abstraction and comparison on which Grounded Theory is based (Glaser and Strauss 1999, 21). Since artefact use is a form of experiential learning, codes for use must relate to a particular part of Kolb's experiential learning cycle. Therefore, categories formed from codes for use might then be mapped to the four Kolb learning styles based on how well they correspond with the characteristics of each style (Kolb 1984, 65).

However, this mapping exercise has several methodological problems. Firstly, the characteristics of Kolb's learning styles might actually influence the formation of categories and even codes, running against the tenets of Grounded Theory which stipulate that theory must arise from the data and not vice versa (Glaser and Strauss 1999, 12). This makes the order in which codes are created and categories formed crucial; this must be done before mapping and, as far as possible, undertaken independently by more than one analyst. Secondly, the process of mapping is subject to a degree of interpretation in aligning codes with categories, and categories with learning styles. It might be argued that this reduces the validity of the process, especially working from small datasets. The process of abstraction and conceptualisation inevitably removes context as codes are formed and as categories are created and the particular circumstances of use, and the nuances which might be associated with that process by the individual, are lost. The mapping of codes to categories and then to broad learning styles can only accentuate this stripping of context. The use of the constant comparative method (Glaser 1965) to generate codes, and the comparison of the results of independent coding by a number of analysts, might offset some of these issues. Finally, the specificity of artefact use and the generality of questions in most learning style tests is also an issue when comparing the results of each to examine the connection between ways of using artefacts and ways of learning.

Looking at learning style tests, the arbitrary and conceptual nature of the mapping process requires another form of testing for verification. In this case a method of assessment developed from Kolb's learning style inventory (LSI) was used to compare the results of mapping with an independent learning style test. Kolb developed a learning style inventory based on the

quadripartite experiential learning cycle in 1976 and again in 1984. Kolb states that learning

style preference is the product of two pairs of variables, or two separate 'choices' that

individuals make, which Kolb presented as axes (the perceptual and processing axes as shown

in Figure 2), each connecting opposing modes of learning. This explains the format of most

learning style instruments which require a stark choice between two separate answers, or a

ranking exercise whereby participants are asked to prioritise statements about their

preferences in a self-assessment-style learning exercise.

This forced-choice format, and the relatively poor empirical evidence[42] for the LSI  is something

that has attracted a great deal of criticism (Freedman and Stumpf 1978). The LSI scoring system

has also been questioned since it does not reflect degrees of preference, just a first-past-the-

post rating where only the dominant learning style is recognised (Ruble and Stout 1994). The

LSI has also been censured on the grounds of its 'questionable psychometric properties' (Koob

and Funk 2011, 293). The employment of the LSI as a predictive rather than a descriptive tool

has also been criticised (Hunsaker 1980; West 1982) given serious 'conceptual, methodological,

and statistical problems' (Koob and Funk 2011, 303). However, much of this criticism is

unwarranted, given Kolb's insistence that learning is a continuous process which involves

transactions between the person and the environment (Kolb 1984, 35) and, as such, ways of

learning are variable.

The LSI tool has been used extensively in multiple fields from social work to corporate

management to higher education - and there have been numerous variations on Kolb's original

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[42] For example the test-retest scores published by Kolb in 1976 were low (Koob and Funk 2002, 300).

LSI test developed. Most of these are based on four distinct types of learner. Among the most

widely used is Honey and Mumford Learning Style Questionnaire (LSQ), utilised in the fields of

business and management. However, its validity in academia has been called into question (De

Vita 2001). Akin to Kolb's learning styles, the four different learner types described by Honey

and Mumford are: activists, reflectors, theorists, and pragmatics. Also based on four

dimensions (conditions for learning, area of interest, mode of learning, and conditions for

performance) the Canfield Learning Style Inventory has been criticised for its lack of suitability

in academic settings.  Felder and Silverman's Index of Learning Survey (ILS) tool was designed

for academic use, and was first employed in assessing the learning preferences of engineering

students (Felder and Silverman 1988). However, these three alternatives to Kolb's LSI tend to

be lengthy and time-consuming to complete: for example the ILS typically includes 44 questions

with two choices. Because of the largely voluntary nature of participation in Phases 1 and 2, a

shorter questionnaire was needed to achieve a high rate of completion and improve research

feasibility. Therefore, an 18 question variation (Appendix C) of the Honey and Mumford and

Kolbian LSI was used which asked participants to make eighteen choices between two

questions which described their preferences in learning situations.[43] It combines the essence of

the approach initiated by Kolb and later developed by Honey and Mumford but in a more

concise, user-friendly model which can be applied in a range of disciplinary settings. The LSI was

piloted during the MOMD (Modules Outside the Main Discipline) session at the University of

Birmingham described below. Most students found the test easy and quick to complete (taking

on average five minutes).

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[43] This was adapted from a questionnaire written at Carleton University, Ottawa, Canada, by T. Blouin (Clark 2011).

Therefore, Wenger's theory on communities of practice and Kolb's Experiential Learning Theory provide compatible frameworks for considering to what extent artefact use, as a form of reification and practice, reflects the learning preferences of groups of practitioners. However, some theoretical framework was required to analyse forms of practice, both interaction with the artefact (reified in behaviour) and social interaction (reified in language). This was provided by Grounded Theory.

### 3.4.5 Methodological approach: Grounded Theory

Grounded Theory, a systematic form of content analysis which combines inductive and deductive reasoning to generate theory from data, was employed to detect forms of artefact use and to relate this to membership of a CoP. Although it has been argued that Grounded Theory is essentially idiographic in nature (Gay and Weaver 2011), its use in this context to identify and quantify types of artefact use is intended to be nomothetic (see Section 2.3.5.6). Grounded Theory, first developed by Glaser and Strauss in the 1960s, was considered a suitably open approach to content analysis to identify dominant messages (conceptualised as codes and categories) from textual and visual records of interviews, workshops, web fora, and other forms of written work. Since most data would be in text form, this method of analysis fits with the idea of language as practice, a critical, under-researched area of communities of practice theory (Tusting 2005, 36). Again, alternatives to Grounded Theory were considered such as Engaged Theory (Sharp 1985), which proposes four levels of abstraction in the analysis of data, a hierarchy which ranges from ways of doing, acting, relating, and being. However, in comparison

with Grounded Theory, Engaged Theory is highly reflexive and this would have caused problems with the legitimacy, for example, of the collection of data which Engaged Theory regards as a non-neutral act containing theoretical bias from the outset. Grounded Theory on the other hand would regard sampling merely as the beginning of a neutral process which seeks to reduce researcher bias through the constant comparative method (explained in Section 3.5.9).

Other forms of content analysis were weighed-up, such as discourse analysis (a method which analyses communication events) which is primarily focused on verbal communication and meaning. Although much of the data on artefact use in Phase 1 came from discussions about use, Phase 2 involved actual use for which these types of content analysis would have proved limited. That being said, word frequency analysis (another form of content analysis), a basic technique akin to Key Word in Context (KWIC) searching which recognises key words and then quantifies their frequency (Manning and Schütze 1999), was also used. This was to detect whether communities of practice betray a 'shared repertoire' (Wenger 1998, 82) or ways of negotiating meaning in their use of language.

Although Grounded Theory has been criticised on a number of fronts, including its claim to develop inductive knowledge and the improbability of avoiding researcher bias (Thomas and James 2006), given the absence of theories about artefact use, the type of reverse engineering involved in the creation of theory from data, and its versatility as a method to scope and conceptualise types of use was considered advantageous.

### 3.4.6 Methodological approach: Conclusion

As outlined in this chapter, the methodological approach utilises three main theories to analyse artefact use and explore the influence of the identity, knowledge, skills and experience of practitioner groups on that process. Firstly, in the absence of established theory on the mechanics of artefact use, Grounded Theory was chosen in order to analyse patterns in interaction. Glaser and Strauss's theory offered a way of generating new theory from the data up, and to produce quantitative and qualitative results to test the influence of membership of a CoP, and context, on how individuals use cultural artefacts in digital learning environments. Secondly, since the creation and use of digital artefacts in the cultural and HE sector involves groups of individuals from different disciplines, Wenger's communities of practice theory was selected in order to analyse the influence of membership on interaction with the digital artefact. A crucial aspect of Wenger's theory is the notion of knowledge stewardship through collaborative learning and learning-in-practice. This offers a way of understanding the influence of a community of practice on how individuals learn and, crucially, how they act. Conversely, artefact use, as a form of practice, might also reflect how CoPs learn. Thirdly, Kolb's Experiential Learning Theory provides a conceptual bridge between learning and practice. Kolb conceptualises the learning process and proposes that individuals exhibit preferences or styles in how they learn. These preferences are related to an individual's psychological make-up but also to a number of contextual 'forces' that shape learning strategies. Kolb's description of forces such as acculturation relate closely to Wenger's theories on social learning making it possible to look at the connection between ways of using artefacts and ways of learning among communities of practice.

## 3.5 Structure and rationale

### 3.5.1 Phases 1 and 2: Overview

In order to scope and to test hypotheses on people and processes associated with artefact use, research was carried out over two phases. These phases roughly follow two key stages in the use of digital artefacts: artefact production and artefact use. There was therefore a focus on the digital supply chain in Phase 1 (thus the name Artefacts and Practitioners), and a focus on a strand of the digital supply chain (made up of end-users) and the context of usage (thus the name Artefacts and Environments) in Phase 2 (see Figure 3).

Since the aims and objectives of Phase 1 were both ontological (questioning the existence of communities of practice) and phenomenological (probing the effects that these entities might have on the use of artefacts), research design in Phase 1 was broad and exploratory with semi-structured elements intended to externalise usage behaviour and issues surrounding use. Qualitative and quantitative research methods were used to assess whether participants were members of communities of practice, to describe and measure how artefacts were used, and to scope how influential the environment might be. Based on the findings of Phase 1, a number of hypotheses on CoP membership, how CoPs learn, how artefacts are used, and the effect of the environment were formed which were then tested in more controlled conditions in Phase 2. Again, mixed methods of data analysis were used but under more controlled conditions to isolate factors which might explain how digital artefacts are used and what effect communities of practice and environment have on this process.
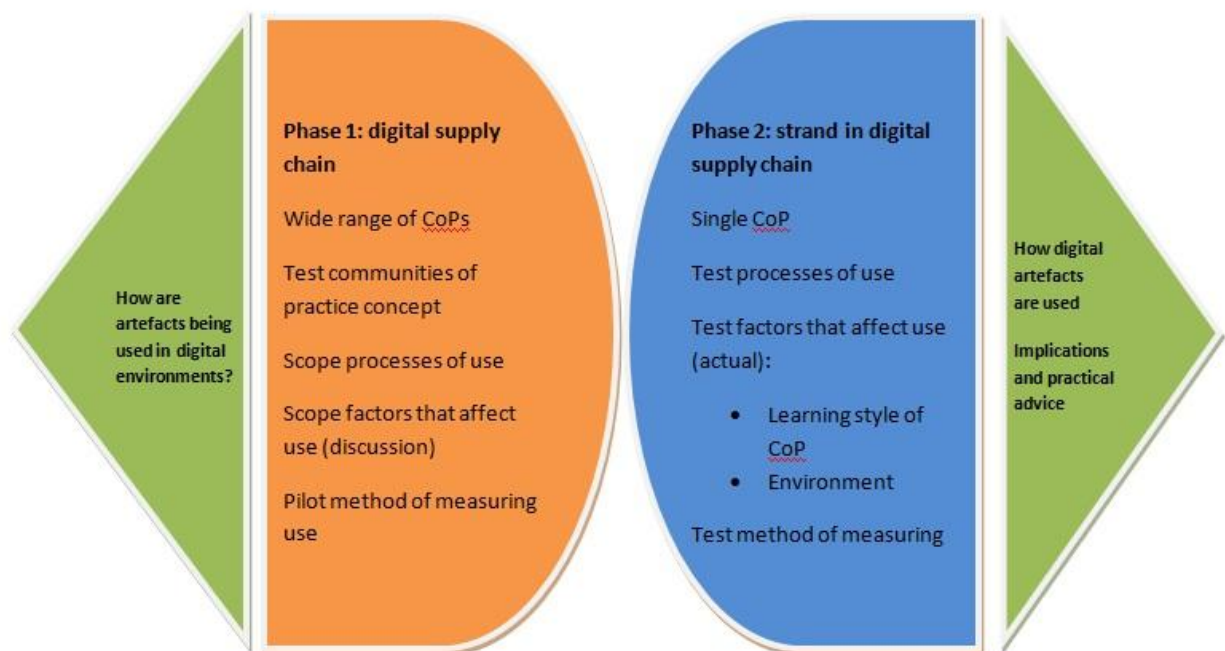
**Figure 3. Outline of research methodology, Phases 1 and 2**

### 3.5.2 An overview of Phase 1: Scoping the digital supply chain

In order to scope issues associated with the selection, digitisation and packaging of artefacts which might affect end-use, a mock supply chain was set up. This required the involvement of practitioners normally involved in the supply of artefacts, end-users, and the digitisation and use of artefacts. Since the case study involved the use of Shakespeare-related artefacts in digital learning environments, individuals normally involved in the selection, care, digitisation, presentation and end-use of artefacts in postgraduate study at the Shakespeare Institute in Stratford-upon-Avon were invited to participate. There were six heritage practitioners, four lecturers, and 14 postgraduate students (three of whom were distance learning students). The heritage practitioners group was made up of a curator (given the code CC), an archivist (AR) and librarian (LT) from the Shakespeare Birthplace Trust, a collections manager (CM) from the same

organisation, a librarian from the Shakespeare Institute (LS), and a rare book librarian (LU) from

the University of Birmingham Library's Special Collections Department. All of these

practitioners were involved to a greater and lesser extent in supplying content for use by

students in the University of Birmingham's VLE. Two lecturers from the Shakespeare Institute

were also recruited. The first lecturer (SS) taught on three different MAs[44] at the Institute and

also coordinates e-learning at the Institute. The other lecturer (AH) was a cultural historian who

taught on various history MAs, including MASSACHRE and an MA in the Cultural Heritage of

Shakespeare's England. The other two lecturers were based on the main campus of the

University of Birmingham and both had a teaching and research interest in heritage and the use

of digital technologies. The first (AT) was a theologian who had worked on various projects

related to electronic editing of ancient textual artefacts and has recently applied some of this

research to Shakespeare-related collections at the Shakespeare Institute. The other lecturer

(AA) taught in Classics, Ancient History and Archaeology with an interest in 3D visualisation of

ancient landscape and heritage practice. This academic chaired the workshops. Of the 14

students, seven were undertaking PhDs and seven were enrolled on MA courses.[45] With the

exception of the distance learning students, all of these participants were known to the author.

The author's role in Phase 1 was participant-observer[46], conducting interviews, carrying out the

administration and planning of workshops, and managing the recording, transcription and

analysis of each session. In order to minimise researcher bias and the Hawthorne Effect (Cook

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[44] MA Shakespeare and Theatre, MA Shakespeare and Education, and MA Shakespeare, Stratford-upon-Avon, and the Cultural History of Renaissance England (MASSACHRE).

[45] Two students were enrolled on the MASSACHRE course and the others were undertaking either the Shakespeare Studies, Shakespeare and Theatre, or Shakespeare and Education MA programmes of study.

[46] With 'moderate participation': maintaining a balance between 'insider' and 'outsider', combining intervention and detachment to attempt research objectivity (DeWalt 1998).

1962), interventions during interviews and workshops were kept to a minimum but were sometimes necessary for example to encourage students to vocalise their thoughts on the use of artefacts and obtain information needed to guide the digitisation of artefacts for subsequent stages of the trial.

Additionally, to give the research wider scope, two other practitioner groups were recruited: 'digital creatives' and performers. Four 'digital creatives', or individuals involved in producing digital content with a creative and cultural element, were enlisted because of their previous participation in digital projects involving cultural collections. Although digital artefacts used by the Shakespeare Institute in its VLE most commonly have either been digitised in-house by the University of Birmingham or in close partnership with the Shakespeare Birthplace Trust, third party sites[47] are often embedded within VLEs. Involving digital creatives was designed to represent the experience of those who create such web resources outside the VLE and also to explore some of the wider issues of interdisciplinary collaboration as a factor influencing the uptake and use of digital artefacts. Since Shakespeare Studies focuses on the interpretation of dramatic work written principally by William Shakespeare, three actors, one of whom had become a theatre educator, and all of whom work, or had previously worked, for the Royal Shakespeare Company, were recruited. Because the artefacts chosen to be the focus of the research project were costumes and props used in theatrical productions of a particular play or historic artefacts thematically related to a play, the input of actors and a theatre educator was intended to add another dimension to the research project - the perspective of practitioners *and* end-users combined. The digital creatives and performers were not known to the author or

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[47] For example, the Year of Shakespeare website, www.yearofshakespeare.com (University of Birmingham 2012).

to any of the other participants. A full list of participants, their roles and a code used in

transcripts to identify them, is given in Appendix A.[48]

Following recruitment, research activity took place over six stages, between February and

August 2012, as shown below in Figure 4.
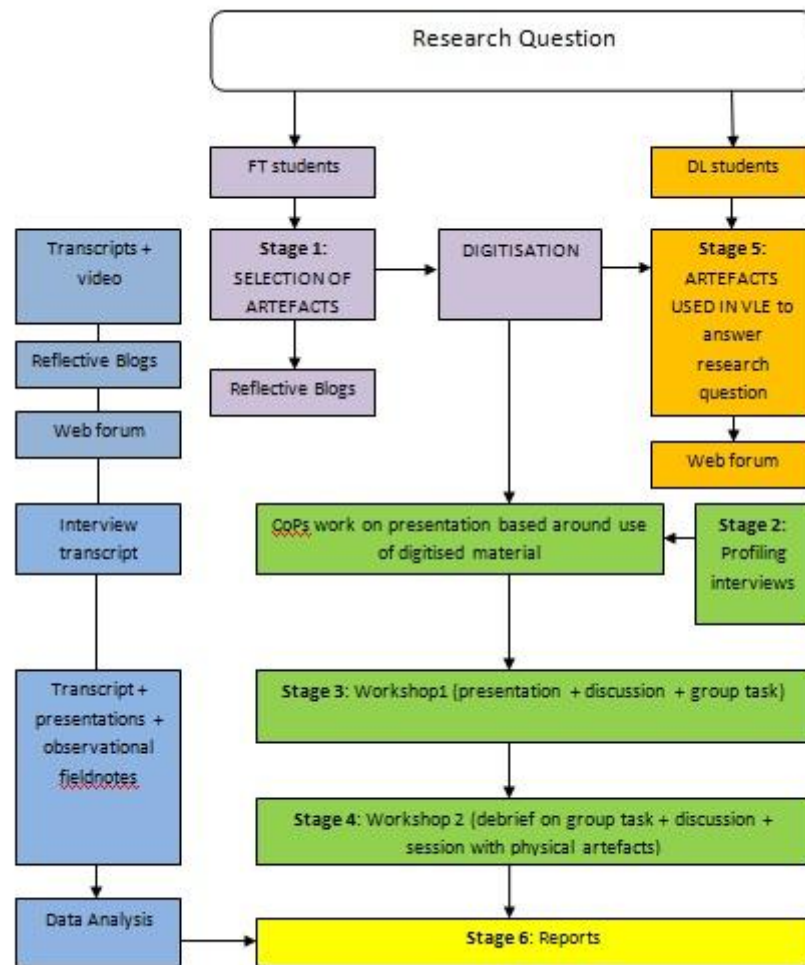


**Figure 4. Phase 1 workflow**

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[48] A missing element in the make-up of the supply chain of practitioners normally involved in the presentation and use of artefacts was e-learning specialists at the University of Birmingham but their involvement over the course of the workshops was infeasible given the time commitment. The Centre for Learning and Academic Development (CLAD) at the University of Birmingham were, however, involved in an advisory role in developing the research design, particularly in Phase 2.

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To subvert the norm, end-users initiated the supply chain by selecting physical artefacts at first hand in the museum store, and stipulated how they should be digitised (Stage 1). This was done in order to examine how the early involvement of end-users might affect supply and eventual use. The resulting images and metadata were then supplied to practitioners who were asked to present ideas over the course of two workshops (Stages 3 and 4) about how they would use artefacts in research, and how they could package the digital artefacts to encourage or facilitate research. Prior to the first workshop, in Stage 2 practitioners were interviewed to profile their membership of one or more community of practice, to obtain information on their role in the supply chain, and previous experience of projects with a digital component. Finally, in order to scope issues associated with the uptake and use of artefacts in digital environments, digital images and metadata were sent to distance learning students with a set of questions (Stage 5). The students who had initially selected physical artefacts were sent digital images and asked to write about the degree of transformation brought about by digitisation. In the same vein, practitioners who had only been exposed to digital artefacts were taken to the museum store to see the physical artefacts at the end of the second workshop. Since one of the objectives of Phase 1 was to scope the influence of the environment on use, comparisons were made between usage of physical artefacts in the museum store and usage of digital artefacts in digital environments.

As explained above (Section 3.4.2), Wenger proposes that learning takes place as a result of the tension between four sets of dualities. These dualities were used to frame loosely the overall research design in Phase 1. Participants were given the opportunity of participating in discussions or activities, such as artefact selection, and were asked to reify knowledge in

presentations. This represented the participation-reification duality. The semi-structured

nature of interviews, workshops and store visits allowed for planned (designed) and unplanned

(emergent) activity, while the use of individual interviews and group activities built on the

duality of identification-negotiability. In this way it was hoped that a temporary community of

practice could be developed during the course of the project which might reveal boundary

issues between CoPs as well as the potential for synergies (working with the local-global

duality). The research design was also intended to facilitate a 'rhythm' (Wenger 1998) between

reflection and practice among participants. This was done by combining opportunities for

interaction through discussion and personal reflection, with practical activities carried out

individually (within one's perceived CoP) and collaboratively. In this way, the trial was focused

on reflective practice within and between different disciplines.

Finally, artefact use is a quiet business; it is difficult to detect and to describe since much of it is

thought to occur on a cognitive level (Rambusch, Susi et al.. 2004). Therefore, one of the key

challenges in research design was creating conditions for individuals to externalise thoughts on

use, as well as interact directly with physical or digital artefacts. This was done through the use

of questions in the profiling interview, and activities set for practitioners and students during

store visits and workshops. Since exposure to artefacts during the course of interviews and

workshops was minimal, discussions about artefact use as well as actual interaction with digital

and physical artefacts constituted the data set which would be used to analyse patterns of use.

Participation, whether spoken or embodied, would be used as a reflection of how artefacts are

used by individuals and would then be related back to their community of practice. To turn a

quote from Shakespeare's *Coriolanus* (Act III, Scene ii) on its head, eloquence is action as much

as 'action is eloquence' (Shakespeare 1991, 851). As Wenger states, 'Words as projections of human meaning are certainly a form of reification'(1998, 62). In his foreword to Wenger and Lave's seminal, *Situated Learning and Legitimate Peripheral Participation* (2009), William Hanks highlights how the authors have acknowledged that,

> a significant body of theory and research has shown that speech is equally a means of acting in the world. The point is germane, since language use entails multiple participatory skills, and is one of the most basic modes of access to interaction in social life (ibid., 22).

The versatility of Grounded Theory allowed both words and actions to be encoded (explained in Section 3.4.5) and for the abstraction of meaning based on a simple question, 'how are individuals using artefacts?'.

### 3.5.3 Phase 1 Stage 1: Selection and digitisation

Six students were recruited from the Shakespeare Institute following an internal email calling for digital interns (Creese 2012a).[49] Given the limited timeframe for the project and the need to make the process seem as close as possible to how artefacts might be used in real research, parameters were set for the process of selection. Students were sent a list of museum, library and archive artefacts relating to Shakespeare's play, *The Tempest*. This play was chosen because students would be reasonably familiar with it through study and because it was then being performed by the RSC in Stratford-upon-Avon, giving the project more topicality and relevance. Students were asked to review the artefact list, consisting only of metadata (no

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[49] Of the six students, one was undertaking a PhD and the others were enrolled on Master's degrees.

images were available), with a view to making a selection once they visited the museum store in order to address a research question: 'how can artefacts reveal performance choices?'

The six students were then filmed over the course of three hours in the Wharf Road museum store, which housed art, props, and costumes owned by the RSC and partly managed by the Shakespeare Birthplace Trust. The visit was video recorded by the author and a colleague; students were asked to articulate any thoughts verbally and asked to record any reflections in a journal, submitted afterwards for analysis. A museum assistant (CS) led the tour, introduced students to the museum database, and responded to student requests to see particular artefacts. Questions were asked by the author, and two lecturers (AA and SS, who also took part in subsequent stages) to clarify the students' criteria for the selection of artefacts, and to ask how they would like artefacts to be digitised. Another separate session took place at the Shakespeare Birthplace Trust's central store on Henley Street, Stratford-upon-Avon, with two students from the MASSACHRE course who were asked to speak about artefacts selected from the museum collection which date from the time of Shakespeare and relate to *The Tempest*. This session, which lasted one hour, was led by a doctoral research student (AP) and video and audio recorded by the author.

In total, ten artefacts were selected and digitised from the Wharf Road store: this included six costumes and four props. Four artefacts were digitised from the Henley Street store (a rapier, medicine chest, leather-covered box, and knife sheath). A digitisation 'wishlist' for each artefact was produced from the transcript of the store visit and passed to digitisation specialists at the University of Birmingham's Vista Centre, which specialised in 2D and 3D visualisation of

artefacts. 25 close-up and full scale photographs were produced of the selected artefacts and three of the four historic artefacts[50] were scanned in three dimensions and made available to participants using Meshlab software.

### 3.5.4 Phase 1 Stage 2: Profiling interviews

With one exception, all 14 practitioners who took part in Workshops 1 and 2 were interviewed in March 2012. Because of professional commitments, one actor (AD) who had previously been interviewed could not attend workshops but was replaced at the last minute by another (AW). The overall aim of the interview was to assess whether individuals were members of particular CoPs, to assess their role in the digital supply chain, to externalise any knowledge, experience or attitudes surrounding artefact use and the use of digital technology, and to make interviewees aware of the structure and purpose of the project. A profiling interview guide based on the three components of a CoP identified by Wenger – domain, community and practice – and referencing previous work done on assessing CoP membership (e.g. Wubbles 2007), was first trialled with a volunteer. Modifications were made to questions mainly to clarify what was being asked and to explain any terminology. Interviews were then conducted either in a neutral location or the interviewee's place of work to try, as far as possible, to put them at ease. The guide was designed to provide enough structure to be able to compare responses across interviews but was employed in such a way that interesting areas of discussion (pertinent to the research questions on communities of practice and artefact usage) were followed-up as far as possible. In other words, interviewees were regarded as informants

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[50] The fourth, a rapier, proved too reflective for 3D scanning.

not respondents (Knight 2002, 51). This semi-structured format suited the scoping nature of Phase 1 and avoided the pitfalls of highly structured frameworks which,

> lock respondents into the researcher's theory of what matters [...] [and] [...] reduce their ability to convey the complexity of their experience, perceptions or feelings (Knight 2002, 52).

Interviews were audio and video recorded, and then transcribed by the interviewer as soon as possible after the event. The transcript was then sent to interviewees for verification of accuracy and any anonymisation to check that this had been carried out appropriately. The interview transcript, plus transcriptions of individual contributions to discussions held later in the trial, was then analysed on a number of different levels (described in Section 3.5.9) to establish whether or not participants were members of a particular community of practice, and how they use artefacts.

### 3.5.5 Phase 1 Stage 3: Workshop 1

All 14 participants were invited to attend a one-day workshop at the IBM Visual and Spatial Technology Centre (VISTA), University of Birmingham. They were joined by four doctoral research students based at the Shakespeare Institute. Prior to this workshop, participants were issued with the images and metadata generated in Stage 1 (made available using Basecamp[51]), and then paired-up (on the basis of the closeness of their areas of practice) and asked to prepare a five minute presentation for Workshop 1 based on how they would encourage and facilitate research on *The Tempest* using this material. After a short introduction by AA, the

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[51] A web-based project management platform that allows large file transfer and communication between participants.

convenor and chair of the workshop, participants introduced themselves and presented their ideas followed by a general discussion. On the basis of this discussion, two groups were then formed to take forward ideas to encourage and facilitate research on the play with a view to creating a blueprint of a product. This format was designed to allow for participation and reification and externalise how each individual uses artefacts or their attitudes about use. Communication between group members after Workshop 1 was encouraged on Basecamp, although this did not happen to a great extent.

### 3.5.6 Phase 1 Stage 4: Workshop 2

Three weeks after Workshop 1, a second workshop was held at the Shakespeare Birthplace Trust's headquarters in Stratford-upon-Avon.[52] There was a high retention rate of participants and all but one of the practitioners from Workshop 1 attended Workshop 2. The reason for the change of venue was to allow participants to gain access to the physical artefacts from which the images and metadata had been taken. Before this took place, each group formed during Workshop 1 presented their blueprint for the encouragement or facilitation of research on *The Tempest* using the digital artefacts created during Workshop 1, followed by a discussion reflecting on some of the main themes emerging from both workshops. Participants then inspected physical artefacts in the museum store and were asked about the differences between the digital artefacts they had been sent and the physical-original.

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[52] This was the closest date to the first workshop which most participants could attend, chosen in order to maintain momentum.

### 3.5.7 Phase 1 Stage 5: Use by distance learning students

Three students (DL1-3), two of whom were enrolled on the MA Shakespeare and Theatre programme and one who was in the final year of their PhD (Shakespeare Studies) were recruited following a general email appeal for volunteers issued to all distance learning students (Creese 2012b). These three students were then supplied the same images and metadata created in Stage 1 which were supplied to practitioners for the workshops. However, these were made available on the University of Birmingham's VLE, WebCT, in order to gauge the affordances or limitations of this environment. Students were asked to review the digital artefacts and then answer three questions:

1. How would you use this material to answer the question, 'how can artefacts reveal performance choices?'

2. What is missing (in terms of tools or other information / resources) which would enhance use of this material?

3. Did you have any problems accessing or using this material?

Responses were sent to the author and any points of interest were then followed-up. Although an attempt was made to encourage all three students to exchange views on a web forum, this did not prove successful because of time differences in home countries.[53] Transcripts of responses were anonymised before analysis. As a way of assessing the efficacy of the digitisation process, three students (B, C and E) involved in Stage 1 were asked to reflect on the differences between the use value (in research) of the physical artefacts they had selected and the digital artefacts that had been produced. These were published as blogs and included within the dataset for analysis.

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[53] One student was in the USA, another was based in Chile, and the third was based in the UK.

### 3.5.8 Phase 1: Data collection

Each activity in Stages 1-4 was video and audio recorded (using a number of separate devices to increase the quality of capture and reduce the risk of data loss) and a series of field notes made based on observations of footage. All audio (approximately 20 hours) was transcribed (172,519 words) by the author and a number of other sources such as participant journals, reflective blogs, and records of conversations held between workshops were gathered and filed, and the identity of all participants anonymised.

### 3.5.9 Phase 1: Data analysis

Different forms of analysis were used to address the main aims of Phase 1, outlined in Table 5.

| Objective | Method of Analysis |
|---|---|
| To test the CoP model qualitatively and quantitatively | Recursive abstraction of interview responses<br><br>Word frequency analysis<br><br>Use of Grounded Theory on all transcripts, reflective journals, blogs, and video footage to generate codes and categories for each individual and for each CoP |
| To assess how membership of a CoP might affect usage of artefacts | Attitudinal analysis of interview and workshop transcripts<br><br>Usage pattern of individual and CoP, assessed using Grounded Theory |
| To scope issues associated with the selection, digitisation and packaging of artefacts which might affect end use | Attitudinal analysis of interview and workshop transcripts |
| Develop a method of describing and measuring artefact usage | Use of Grounded Theory on all transcripts, reflective journals, web fora, blogs, and video footage to produce codes and categories. |
| Test artefact use in a range of controlled environments | Incidence of codes related to whether use is with physical or digital artefacts |

**Table 5. Phase 1 research objectives and methods of analysis**

In order to answer the question of whether individuals were members of one or more communities of practice, three forms of analysis were used. Firstly, responses to interview questions were collated through a process of recursive abstraction. This involved the systematic summarisation of datasets, to form summary sheets and a profiling grid for each practitioner.

Reasons were then noted for the sifting and summarising of data to make any loss of meaning in the decontextualisation of data, transparent and accountable. This allowed a picture of individual responses as well as cross-referencing between practitioner groups and the whole sample to assess the validity of Wenger's theoretical model. The tabulation of data made it possible to assess against Wenger's definition of a community of practice and to detect patterning among individuals. [54] Secondly, examination of the frequency of words used during interviews and workshops was undertaken using N-Vivo 10 software. Reports itemising the top 50 words used by each participant were collated, and then compared across practitioner groups and the whole sample for any patterning. Finally, Grounded Theory was employed to detect types of artefact use from textual and visual records of interviews and workshops. This was done on an individual basis and then compared to other individuals in the sample to detect patterning which might or might not be commensurate with membership of a CoP.

This generated qualitative and quantitative data (see Appendix E) indicating broad patterns in the way that artefacts are used. These were then mapped to Kolb's four learning styles. Qualitative analysis of interview and workshop transcripts was undertaken to discern practitioner perspectives on the use of artefacts and to scope issues associated with the selection, digitisation and packaging of artefacts which might affect end use. Qualitative analysis of the responses from distance learning students, and a comparison of coding patterns (generated using Grounded Theory) across the distance learning sample and the campus-based student, were designed to assess the affordances and limitations of WebCT as a digital learning environment.

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[54] According to Wenger, all communities of practice share three structural elements: a knowledge *domain*, a *community* of people, and a shared *practice* (2002, 29).

In order to recognise and describe forms of artefact usage among communities of practice and in different formats (physical and digital), a broad working definition of use was developed by looking at samples of the trial transcripts and asking the basic question, 'How are participants engaging with artefacts?' Looking through transcripts for descriptors which relate to cognitive and physical engagement with artefacts, 119 different types of use were identified. In total, over 13,661 code references were made from an analysis of the entire transcript, some 2538 references from student-related activities, and 11,123 references from practitioner-related activities. Use of the physical artefact was taken to mean interaction via direct, bodily access to an original artefact or discussion about the same; use of the digital artefact was defined as an engagement with material digitised from an original artefact, or discussion about the same. Context was key when categorising forms of use: video footage was used to discriminate whether artefacts were being used in physical or digital form.

In order to test the robustness of codes and increase validity, transcripts were coded across the whole sample and incidence rates calculated for individuals and communities of practice. Code types were then refined and rationalised into a parent and child code schema (e.g. Figure 10). Negative case analysis was used to revise, broaden and confirm patterns emerging from the data by detecting and analysing deviance. Incidence rates were calculated for individuals and compared to a group mean to ensure patterns of usage were shared across communities of practice. N-Vivo 10 software was used to facilitate the coding of transcripts. This helped with the volume of data and the variety of formats and allowed choices made in the analysis to be auditable.

This example from a discussion of the digitised artefact by a postgraduate student, ST, during

Phase 1, shows how codes were formed from the text:

> Like if you're gonna have an image, it would be [...] if you could somehow link it[55] and have a production photo too[56], because you've got the article of clothing but you're missing the RSC costume so if you could have both linked in together[57] and information like[58], like an art historian (pointing to AH) would have: what's the material[59], what's the medium[60], what's the weight[61], the dimensions[62] these are really really important (ST 2012, 5).

The number of occurrences of these codes was calculated by individual and by CoP and a

percentage formed relative to other forms of use (this helped provide a basis for comparison

between CoPs since the number of practitioners in each varied). This resulted in qualitative and

quantitative data on the incidence of particular codes by each CoP. For example, incidence of

the code, 'assessing materials', across all transcripts can be represented in a chart (Figure 5)

according to percentage use by each CoP.

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[55] Code: links between things.
[56] Code: thinking about other Information.
[57] Code: links between things.
[58] Code: thinking about other Information.
[59] Code: assessing materials.
[60] Code: assessing medium.
[61] Code: assessing weight.
[62] Code: thinking about dimensions.
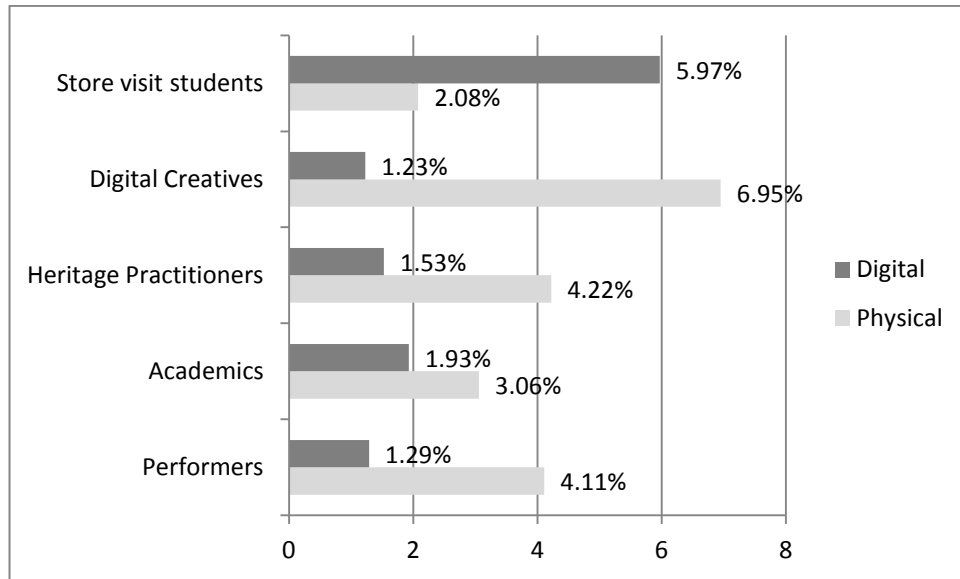
**Figure 5. Incidence of the code Assessing Materials among CoPs, using physical and digital artefacts in Phase 1**

Therefore, abstracting information from transcripts was used to serve three main purposes:

- to detect patterns in practice (manifested in artefact use) across the sample in order to interrogate the community of practice model

- to scope how artefacts are used and how membership of a CoP might affect this

- to scope how the context of use – the usage environment – might affect the quality of interaction

The findings, following these forms of analysis, are given in Chapter 4.

### 3.5.10 An overview of Phase 2: testing a strand of the digital supply chain

Five hypotheses were formed based on findings from Phase 1. These were then tested according to the objectives set out at the beginning of this chapter, as shown in Table 6.

| No. | Hypothesis | Methodological objectives |
| --- | --- | --- |
| 1 | Domain defines the learning style of a CoP | Select three groups representing different disciplines from within the academic CoP<br><br>Analyse behaviour (usage of artefacts, and word use) of each group for characteristics of a CoP<br><br>Assess learning style of each group |
| 2 | The way that artefacts are used is broadly similar but there are differences between CoPs | Analyse behavioural patterns based on verbal, non verbal and written records of *actual* artefact use and compare between different user groups |
| 3 | Usage behaviour and learning styles are linked | Calculate learning style from coding usage behaviour<br><br>Calculate learning style from LSI test<br><br>Compare results |
| 4 | Grounded Theory can be used to describe and measure artefact usage | Analyse behavioural patterns based on verbal, non verbal and written records of *actual* artefact use |
| 5 | Environment affects the usage behaviour and learning style of CoPs | Test artefact use in four different controlled environments by academic users<br><br>Compare usage behaviour and learning style in each environment |

**Table 6. Phase 2 research hypotheses and methodological objectives**

In order to test the five main hypotheses, the scope of Phase 2 narrowed to focus on a strand of the digital supply chain: end-users. Although postgraduate students were selected to represent a single academic CoP, their recruitment from three different disciplines was intended to introduce a variable – domain – to test its influence on usage behaviour and learning style. The other variable in Phase 2 was context: four controlled learning environments, two physical and two digital were selected to test the influence of context on artefact use. Finally, while Phase 1 concerned mainly discussions about use, Phase 2 focused on actual use in order to test hypotheses on categories of use and learning style.

### 3.5.11 Phase 2: Test participants

20 postgraduate students were recruited from three different disciplines at the University of Birmingham to form the sample for Phase 2 testing. There were two main reasons why postgraduate students were selected. Firstly, the research questions concern use and while Phase 1 did scope processes of use the focus was principally on the roles of those involved in the digital supply chain rather than end-users. Phase 2 centred on end-users so the recruitment of those with experience of using digital artefacts in research was essential. Secondly, since context was one of the variables in Phase 2 and digital learning environments are the focus of the main research question, end-users needed to be familiar with virtual learning environments.

To attract student volunteers an advertisement was circulated at the Shakespeare Institute and, separately, in the University of Birmingham's postgraduate newsletter. Ten student

volunteers came forward from the Shakespeare Institute (six PhD and four MA students).

However, only three students came forward from the University and they were from three

different disciplines. These numbers were not sufficient to generate a large enough sample.

Therefore, more proactive recruitment was required. Two disciplines that use physical and

digital artefacts in research were identified: Digital Cultures (a module which is part of the MA

History of Art programme), and Egyptology. Four Digital Cultures students and six Egyptology

students (four PhD and two MA students) were recruited. Of the 20 students, the Shakespeare

Studies and Digital Cultures students were known to the author: the curator of the Eton Myers

Collection[63], also a postgraduate student who took part in testing, was also known to the

author.

### 3.5.12 Phase 2: Test environments

The choice of learning environments was based on the types of context in which all three

disciplines are likely to encounter artefacts in postgraduate research: two types of digital and

two types of physical environments.

In terms of digital learning environments, one formal and one informal environment were

chosen. During 2013, the University of Birmingham was in the process of replacing WebCT as its

virtual learning environment. Therefore the new VLE, Canvas by Instructure was selected as a

learning environment (Environment A). Since outside the VLE most students would be expected

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[63] The Eton-Myers Collection is a collection of Egyptological artefacts owned by Eton College. Part of the collection is on loan to the University of Birmingham.

to use the internet for artefact-based research, different websites (Flickr, a museum database, and a blog) constituted different elements of an online learning environment (Environment B).

Two physical environments were used to continue the line of enquiry started in Phase 1, namely that there seemed to be clear differences in how artefacts are used in digital and physical form. Although the main research question concerns digital learning environments, the inclusion of two physical environments was also intended to act as a control or baseline for the digital environments and to test the recurrence of types of use of physical artefacts found in Phase 1. The postgraduate students in Phase 2 had all used artefacts in a formal museum or gallery context or behind the scenes in a handling session as part of their degree. Therefore, this environment was mocked-up in the test using a handling artefact (Environment C) and a small display case (Environment D). There are undoubtedly other scenarios in which postgraduate students might encounter artefacts, such as hybrid environments where access to the internet and the physical artefact are possible at the same time, and variations within each of the four environments, but these four test environments were considered to be most representative of the experience of postgraduate students, and most feasible given time constraints with each participant.

The tests took place in three locations: the author's office in The Shakespeare Institute, the Eton-Myers Museum on the University of Birmingham's Selly Oak Campus, and a meeting room at Redmarley, the museum collection offices on the University of Birmingham's main campus in Edgbaston. The artificiality of the wider context of each test environment – the setting of the test within an office, a meeting room or a museum - does not correspond with how students

would normally experience Environments A-D and factors such as lighting levels, temperature, time of day, and the physical layout of the test environment varied from test to test. However, attempts were made to reduce these variables as far as possible. Lessons were learned during two pilot studies (see Section 3.4.5) to offset some of the variables which might compromise the test results.

### 3.5.13 Phase 2: Test artefacts

The artefacts used within each environment were selected by the author on the basis that they were related to the discipline of each student group and typologically alike across all three groups. This was done, as far as possible, to allow comparison between each group not on the basis of artefact but environment. By being related to the participant's discipline the artefacts were likely to draw on the knowledge and interests of the test subject. Artefacts that were approximately of the same type (figurines) and size were needed to, as far as possible, eliminate this as a difference between different student groups. A range of figurines (shown in Table 7) familiar to the Shakespeare Studies (coded SS[64]) and Egyptology (EG) students (shown in Table 8) were selected on the basis that they are artefacts which these students would typically have used as part of their research degree. Different figurines were needed in each environment since the tasks involved questions regarding the identification, contextualisation and interpretation of each artefact; if the artefact had been the same in each environment this would have defeated the objective since the test subject would already be familiar with that artefact. The artefacts used in the testing of Digital Cultures (DC) students were the same as

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[64] This includes all students undertaking MA and PhD programmes based at the Shakespeare Institute.

those used in the Shakespeare Institute student test, with the exception of the handling

artefact[65]. This was done because the artefacts were items of decorative art and, as such,

would not have been unfamiliar to DC students, and would provide some basis for comparison

between the two disciplines (SS and DC). The Egyptology artefacts were selected by the author

following a meeting with the Curator of the Eton Myers Collection: the artefacts needed to be

figurines which were accessible and usable during the trial, and for which metadata was

available.

| SS and DC | Environment A – VLE | Environment B - online | Environment C - handling | Environment D - encased |
|---|---|---|---|---|
| Artefact | SBT 1993-31/ 229. A Staffordshire-ware figure of Shakespeare, about 1830 | SBT 1999-2. A bust of William Shakespeare carved from mulberry wood by Henry Cooper, 1769 | SS SBT 2005-34/4A Carlton Ware bust of Shakespeare derived loosely from the Holy Trinity Church monument bust, about 1952-1962. Originally from a Flowers brewery beer hand pump DC BIRRC-H0009a. Carved Figure of William Shakespeare | SI2013a. Bookend bust of William Shakespeare |

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[65] Due to the location of testing DC students a loan agreement would have been required to use SBT 2005-34/4 therefore a replacement was borrowed from the collection of the University of Birmingham.
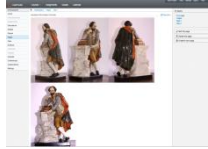
| | | | | |
|---|---|---|---|---|
| Task 1 | Four images within a module in Canvas  | Four images on Flickr (Hopes 2013a)  | SS  DC  | SS and DC  |
| Task 2 | Shakespeare Birthplace Trust catalogue record (SBT 2013a)  Windows on Warwickshire (2006)  | Shakespeare Birthplace Trust catalogue record (SBT 2013c)  Finding Shakespeare blog (Smith 2010)  | SS: Shakespeare Birthplace Trust catalogue sheet DC: University of Birmingham catalogue sheet | Object label |

**Table 7. Phase 2 artefacts, tasks and environments used during testing of Shakespeare Studies (SS) and Digital Cultures (DC) students**
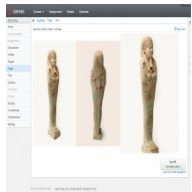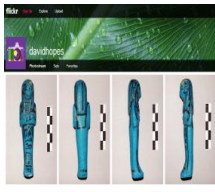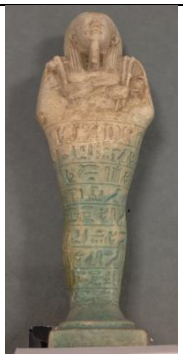
| EG | Environment A – VLE | Environment B - online | Environment C - handling | Environment D - encased |
|---|---|---|---|---|
| Artefact | 3727.B. Shabti of Horudja | E.34a.1887. Ushabti | ECM 360. Shabti of Ptahhotep | ECM 361. Shabti |
| Task 1 | Four images within a module in Canvas  | Four images on Flickr (Hopes 2013b)  |  |  |
| Task 2 | Manchester Museum Flickr page (2013)  Manchester Museum blog (Campbell@Manchester 2012) | Culture Grid catalogue record (Collections Trust 2013)  Fitzwilliam Museum, Cambridge. Catalogue Record (Fitzwilliam Museum 2013)  | Museum catalogue record | Museum catalogue record |

Table 8. Phase 2 artefacts, tasks and environments used during testing of Egyptology (EG) students

### 3.5.14 Phase 2: Test format

The task environment, or the conditions and goals set upon the user, were identical for each test session although there was a degree of flexibility. For example, some questions were not asked if information had already been given in that line, and the order of questions also varied depending on how the participant responded to each task and question. Any points of interest or responses which required clarification were followed-up. There were three tasks set for each environment based on the same artefact, with a number of questions designed to test how each participant used the artefact and how the environment influenced this process. These are given in Appendix D. The task was layered, beginning with the artefact alone, either in image form (digital environments) or in physical form (physical environments), and then involving metadata on the artefact to test forms of use. The tasks and questions were kept relatively simple to make testing of all four environments possible in one session. The order in which these were carried out was varied from session to session again to try to eliminate this as a factor influencing how each environment was experienced.

In Task 1, participants were asked to identify and describe the artefact, thinking about its age, manufacture, and purpose (Questions a-e), and then to comment on what helps or hinders identification of the artefact (Questions f-j). These questions were prescriptive in the sense that they reflect the main categories of use found in Phase 1 – identification, contextualisation, and interpretation – and they attempt to gauge the influence of the environment in which an artefact is used. A structure of this type was considered necessary to turn what had been informal discussions about use in Phase 1 to an artefact-based learning exercise – involving learning goals - in Phase 2. Although use processes themselves are in the spotlight in this test,

some structure was needed to test against to focus principally on the limitations and affordances of the environment, but this was also a way of testing the relevance of use categories since coding was done anew. Task 2 introduced participants to an 'information environment' (Ross and Terras 2011): metadata on the artefact was supplied either via an online database, website or blog (Environments A and B), or a catalogue sheet or object label (Environments C and D). Task 2 questions focused on the difference this metadata makes to identification, contextualisation and interpretation of the artefact, what information is missing, and how the information environment affects artefact use. Finally, Task 3 asked participants to reflect on their experience of each environment and to suggest a utopian alternative. This task was designed to source information on artefact use and environmental affordances outside the parameters of tasks, questions and environments.

In order to assess the participant's learning style, two methods were used: the coding of use types from transcripts and video footage, and subsequent mapping to learning styles, and testing using a Kolbian Learning Style Inventory (LSI). The choice of LSI test is discussed above in relation to Phase 1 and the same reasons applied for selecting this test in Phase 2: brevity and usability for a mixed sample. Participants were asked to complete the LSI test at the end of the session although some, for practical reasons, completed it before.

Tests were conducted one at a time; the author acted as participant-observer (with 'moderate participation' (DeWalt 1998, 24) explaining the purpose of the test and then asking participants to carry out a number of simple tasks followed by a series of questions (explained above). The dis-benefits of influencing the actions of the testers were considered to be outweighed by the

need to provide prompts and to ensure proper recording of the test. Participants were asked to follow a 'think aloud protocol' so that their experience of each environment would be reflected, as far as possible, in the textual record. This was particularly important in the digital environments because of the absence of tracking software either attached in some way to the participant or available on the test computer.

Two pilots of the test were run to assess the validity of tasks and questions, and the usability of data produced. The first pilot was held on 7 March 2013 with eight international undergraduate students from different disciplines, who took part in one of the University of Birmingham's MOMD (Modules Outside the Main Discipline). The pilot took the form of a workshop where an overview of learning environments was given by the author before students were split into small groups (2-3 persons) and given 15 minutes to complete tasks within four different learning environments. Responses were not video recorded but written responses on tasksheets and a general debrief after testing allowed feedback on the setting-up of each environment, the nature of tasks, and the relative advantages and disadvantages of each environment.

The tasks were refined in three different areas. The wording of some questions was altered to make what was being asked clearer, an introduction to each learning environment was factored-in to the beginning of Task 1 in each environment to give participants time to adapt, and some questions were removed to make the tasks quicker to complete.[66] After these modifications were made, a second pilot was held with a librarian volunteer at the Shakespeare

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[66] Feedback from the first pilot indicated that the differences between environments were not clear.

Birthplace Trust on 11 March 2013. This took the form of a one-to-one session and was video and audio recorded. This pilot demonstrated that different equipment was needed to capture data.[67] The manoevreability of cameras was also a problem especially since they needed to be moved between all four environments within the test session. Therefore, webcams were chosen instead for reliability and improved flexibility (the size of webcams make movement between environments and adjustment easier although there are limitations in terms of cable length from a laptop) and discretion (their size makes intrusiveness less of an issue). Finally, a Kolbian learning style test was trialled with MOMD students: feedback indicated that the test was easy to complete and could be quickly analysed.

### 3.5.15 Phase 2: Data collection

In total, 20 sessions were held, ten of which took place with Shakespeare Studies students, six with Egyptology students, and four with Digital Cultures students. Each session took an average of 51 minutes, with roughly 13 minutes spent by most participants within each environment. Each test was carried out at a time to suit students over the course of two months (April – Might 2013). Sessions were video recorded using an iPad and webcam, and audio recorded using an iPhone app[68].  Overall, 17 hours of usable audio were recorded, and this was transcribed by the author with the assistance of Siri voice recognition software to produce

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[67] On trialling the use of flipcams, a short battery life and limited memory meant that data loss was a large risk. One of the flipcams failed to capture five minutes of the trial.

[68] iTalk by Griffin Technology.

transcripts totalling 94,396 words. These transcripts were anonymised and sent back to

participants for verification, before being analysed.

Two problems arose during data collection which impacted on data analysis and findings. Hard

drive failure on 11th April 2013 led to the loss of video data for the test session with student

SS2[69]. This meant that only an audio recording was available. The absence of observational data

affected the calculation of learning style from the incidence of use codes. Also, a temporary loss

of internet connectivity in the Eton Myers Museum Room during the test session with Student

EG1 meant that no data was recorded for this part of the session. Again, this affected the use of

coding information, in calculating learning style and assessing the influence of environment.

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[69] Although regular back-ups were made hard drive failure occurred before this could be done.

### 3.5.16 Phase 2: Data analysis

Table 9 sets out the hypotheses and the methods of analysis used to address these.

| No. | Hypothesis | Method of analysis |
|---|---|---|
| 1 | Domain defines the learning style of a CoP | Word Frequency analysis<br><br>LSI test result analysis<br><br>Grounded Theory: codification of use<br><br>Mapping of use to learning style |
| 2 | The way that artefacts are used is broadly similar but there are differences between CoPs | Grounded Theory: codification of use |
| 3 | Usage behaviour and learning styles are linked | Calculate learning style from coding usage behaviour<br><br>Compare results of LSI test and calculation of learning style from mapping of use to learning style |
| 4 | Grounded Theory can be used to describe and measure artefact usage | Grounded Theory: codification of use |
| 5 | Environment affects the usage behaviour and learning style of CoPs | Comparison of use codes in each environment<br><br>Comparison of learning styles in each environment |

**Table 9. Phase 2 hypotheses and methods of analysis**

The coding of artefact use was a fundamental part of Phase 2 data analysis. It was required to explore the connection between domain and learning style (Hypothesis 1), between usage style and learning style (Hypothesis 3), and to assess the influence of the environment on use

(Hypothesis 5). Coding of Phase 2 data was also required to test whether the ways that

individuals use artefacts are broadly similar but that differences might be found between

particular CoPs (Hypothesis 2). Finally, the process of coding itself was under scrutiny

(Hypothesis 4). Word frequency analysis was identical to that carried out in Phase 1.

The major difference between coding in Phase 1 and Phase 2 was that in the latter, video

footage of test sessions was encoded as well as textual records. This was also done using

Grounded Theory in the same way as coding transcripts: the question 'How are participants

using artefacts?' formed the basis of generating or verifying types of use. All video footage was

coded to increase validity. The constant comparative method was used to refine codes as they

were generated. Incidence rates were then calculated for individuals and compared to a group

mean to ensure patterns of usage were shared across communities of practice. N-Vivo 10

software was used to facilitate the coding of video footage. The order of coding was also

important. In order to focus only on actions, observational analysis was first carried out without

sound. Coding was then rechecked with sound to make sure that the context of use matched

what was supposed.

The mapping of codes for use to learning style was similar to that used during Phase 1 but there

were some revisions made to categorisation of codes. For example, the codes 'describing' and

'comparing ideas' categorised in Phase 1 as examples of interpretation, were reclassified in

Phase 2 as types of contextualisation. The overlap between contextualisation and

interpretation is discussed in Chapter 4 and these codes fall into the grey areas between the

two categories. However, the context of how participants described artefacts and compared

ideas about them in the learning environments in Phase 2 was considered to be closer to placing the artefact within a particular context rather than deriving meaning from them. However, this re-categorisation was exceptional; most codes remained within the same category in both phases. Also, as noted in Chapter 5, a large number of types of use found in Phase 1 were verified in Phase 2. The process of coding expanded and contracted in response to the circumstances in which data was gathered in each phase. In Phase 1, the focus on issues surrounding stewardship of collections was responsible for the code category 'curation'; in Phase 2 the focus on actual use meant that far fewer codes which align with 'curation' were found, and there was a dramatic expansion of the code category emotion-action because of the degree of interaction with artefacts. Finally, so that coding would not be influenced by the LSI test results, the latter were calculated after the usage-learning style mapping exercise was complete.

# 4. RESULTS: PHASE 1 (ARTEFACTS AND PRACTITIONERS)

## 4.1 Introduction

In the previous chapter, a series of aims and objectives were defined for each phase of research in order to address the question of how communities of practice use cultural artefacts in digital learning environments (see Section 3.3). Table 10 shows those aims and objectives and a set of five questions designed to frame findings from Phase 1.

| Main aims | Main objectives | Research questions |
|---|---|---|
| To analyse the influence of the identity, interests, experience and perspective of producers and users of content on the way they use digital artefacts | Test the CoP model qualitatively and quantitatively<br><br>Examine how membership of a CoP might affect usage of artefacts | (4.2) Are individuals in the sample members of a community of practice?<br><br>(4.3) If individuals are members of a community of practice, how does this affect how they use artefacts? |
| To understand the main factors which affect artefact usage | Scope issues associated with the selection, digitisation and packaging of artefacts which might affect end use | (4.4) What issues are associated with the selection, digitisation and packaging of artefacts which might affect end use? |
| To identify the mechanics of artefact usage | Develop a method of describing and measuring artefact usage | (4.5) Does the method of describing and measuring artefact usage work? |
| To analyse the influence of environment on artefact usage | Test artefact use in a range of controlled environments | (4.6) What influence does environment have on artefact use? |

**Table 10. Main research aims, objectives and questions**

This chapter presents findings from Phase 1 in response to each of these questions before summarising the main findings and proposing hypotheses for testing in Phase 2.

**4.2 Are individuals in the sample members of a community of practice?**

*4.2.1 Introduction*

In order to address this question, firstly, evidence of CoP membership among trial participants was sought. Wenger states that members of a CoP share the same three characteristics (Wenger 2002, 29):

- Interest in a *domain* of knowledge which defines a set of issues

- Alignment with a *community* of people who care about this domain

- Signs of a shared *practice* that they are developing to be effective in their domain

Therefore, to qualify as a CoP there must be a focus on a common 'domain of knowledge', relationships between people who steward this, and some practical activity as knowledge is translated into practice. The whole process will involve collaborative learning (Wenger 2013). However, the process of mapping domains of interest, proving whether an individual belongs to a particular community or refines practice as a result of mutual interest in a domain is problematic. An individual might not identify with a particular CoP or might indeed identify with several. Communities might be short or long lived, informal or formal, localised or dispersed. Wenger acknowledges the difficulties of detecting membership by describing a CoP as, 'an intention – however tacit and distributed – to steward a domain of knowledge and to sustain learning about it' (Wenger 2013). Various strategies (outlined in Chapter 3) were adopted to externalise this 'intention' to steward knowledge and 'sustain learning about it' and to reveal attitudes and behaviour which might be 'tacit'. Although all three characteristics of a CoP are closely related, for the sake of analysis, the twin axes of domain-practice, domain-community, and community-practice are examined in turn to look for evidence of the 'intention' to steward

knowledge and learn collaboratively, before looking at how membership of a CoP and ways of learning might influence artefact usage (Section 4.2.2).

### 4.2.2 Domain and Practice

*4.2.2.1 Domain and Practice: Introduction*

The reification of knowledge, Wenger explains, is a critical aspect of membership of a community of practice. The connection between a domain of interest and how this interest is channelled into some form of activity defines a community of practice and demonstrates how a CoP stewards knowledge. This section looks at two aspects of the link between domain and practice: how participants define their work role, and membership of work-related groups.

*4.2.2.2 Domain and Practice: Defining work roles*

The connections between domain and practice are most easily discerned in the self-definition of work roles. Although trial participants were selected on the basis that they represent the main constituent groups involved in the creation and use of artefacts in a VLE, in order to find out whether participants really identified with particular domains, the profiling interview contained a series of questions about work and work-related groups designed to drill down to their particular 'concern or passion' (Wenger 2013) as well as their formal work role. Therefore, opening with a general question asking the candidate to 'tell me a bit about yourself' (Question 1, Appendix B) and then asking the same question in an extra-curricular scenario (Question 4, Appendix B) was intended to expose any difference between their job title and how they like to

describe what they do in a social setting, to single out possible domains. This produced primary

and secondary descriptors for each participant (excluding students) given in Appendix A. For

example, CC first described her role using its official title, 'Museum Collections Officer' but later

qualified this by saying 'curator'(CC 2012, 1). AT first described what he does as 'teacher' (AT

2012, 1) but then goes on to say 'teacher of the bible' (ibid., 2). Despite variation across the

sample in the way practitioners describe what they do, responses show that trial participants

identify with domain interests broadly commensurate with their perceived community of

practice (heritage practitioners, academics, performers, and digital creatives) and that the

modification between primary and secondary descriptors not only highlights a 'concern or

passion' (Wenger 2013), or in the case of digital creatives a way of referencing what they do to

known professions, but might be suggestive of membership of more than one CoP.

Looking in more detail at how domain fits with practice, heritage practitioners seemed most

confident in identifying their domain and area of practice and demonstrated most consistency

throughout the trial in the desire to be regarded as a distinct community of practice.

Significantly, heritage practitioners make most use of the word 'professional', more than

performers and digital creatives put together. Although the word is used by all participants

from the heritage practitioner CoP there is one outstanding example which is worth looking at

because it places enough stress on the word to go beyond casual use and, importantly, it was

used to make a point to other CoPs in Workshop 1. LU, a Rare Books Librarian, began a

presentation with the following explanation of how heritage professions are involved in the

research process,

> I want to talk briefly as a way of introduction just about the way that *professionals*, collections *professionals*, position themselves in relation to the research process [...] So what we do is [...] as *professionals* is that we look after collections [...] and collections are managed by different types of *professionals*, they're managed by librarians, they're managed by archivists, and they're managed by curators and all of those share the use of conservators so there's four different *professions* that manage different collections [...] used by researchers (LU 2012a, 15).

Such density of use of the words 'profession' and 'professional' reinforces the point that heritage practitioners are clearer about their role or are more dependent on it being regarded as 'professional' to explain what they do. In other words, domain and practice appear to be closely linked for this CoP. However, there was less consensus among heritage practitioners when asked to describe the differences between sub-domains (museums, libraries and archives). All practitioners (with the exception of the collections manager, CM) had recourse to using the types of collections material cared for rather than work practice as the chief way of discriminating between librarians, archivists and curators. This calls into question the shared identity of this practitioner group, even within sub domains, something which is reinforced when looking at levels of participation or activism within the CoP, and ways of learning among this group.

Although digital creatives showed a clear commitment to a domain (described by DW most generally as 'digital' (DW 2012a)) and area of practice, with one exception the digital creatives found themselves hardest to define. When asked to describe what she did, one participant (DP) who co-runs a digital agency said, 'to be honest I always find it quite hard [...] I don't really have a noun as it were' (DP 2012a, 1) suggesting this is a frequently asked question without a single answer. DP went on to say that she was a 'project worker' who does 'internet stuff' (ibid.).

After describing the division of labour which has developed in the digital sector among coders, designers, writers and so on, DP outlined the broad portfolio of work taken on by her agency. They have recently gravitated towards developing digital strategies 'accidentally' (ibid.), although DP later reflected that, 'I see myself as a content strategist at heart' (ibid.). Throughout the course of the profiling interview, DW kept returning to the first question which asked what he did. At one point he light-heartedly added that his young daughter told her friends that her dad, 'tits around on the internet' (DW 2012a, 3). This role flexibility suits the rapid pace of change in digital technology and the agility that is required to win contracts (all digital creatives who took part in the trial were self-employed).[70] DC, the director of a digital SME (which DS works for), found his role much more difficult to pin down talking about his job variously in terms of management, 'digital and design' (DC 2012a, 1) and entrepreneurship though the latter was mentioned reluctantly. Only one participant, DS, defined her role in only one way, as a digital consultant strategist, but this was the exception rather than the rule in this CoP.

The digital creatives' difficulty in classifying what they do has undercurrents of anti-professionalism. One participant, DW, who described himself as a digital writer and producer and 'a sort of digital guy' claimed the medium makes little difference and decried the boxing-in of roles within the digital sector (DW 2012a, 1). DW says that the work that he does directly with audiences places 'professionals under threat' (ibid., 7) by changing the relationship between author and audience. What is proposed is a peer-to-peer rather than professional-to-professional set of relationships in his area of work, and that his area of practice is,

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[70] Whether digital creatives who are not self-employed have fewer issues with self-identification is worthy of further investigation.

becoming industrialised which is a good thing in a way because it allows people to develop a practice and they feel like they've got a job to talk to their mums about but on the other hand I think it sort of limits the potential to some extent because [...] we should still be in quite an experimental stage where we don't know what we're doing with this stuff..(ibid.).

Digital creatives perhaps find it most difficult to identify with a single domain because of the changing nature of their job, and the broad skillset, creativity and flexibility this requires. DC, a company director, points out that 'The whole point of new media is it's new, it's not proven' (DC 2012a, 4) and this requires a degree of dexterity and experimentalism to respond to the particular challenges of a project. AT, a textual editor, in speaking about digital projects, concurs saying that,

there's no reason particularly why how anything was done in the past should apply you know how people relate to each other, how networks are formed, and what the nature of the job [...] it's [...] it is actually changing all the time (AT 2012, 4-5).

This challenges the fixedness of a single domain and the effect this might have on communities and networks which form around a common interest albeit temporarily.

It is more difficult to generalise across the sample of performers who took part in Phase 1 because of the low number of participants and the fact that the actor (AW) who took part in the workshops was not interviewed. However, both full-time performers who took part in Phase 1 described themselves as professional actors and both identified with the actors' union, Equity, as a community of practice of sorts. ED, an arts educator and former actress, still identified with the profession but the interdisciplinary nature of her present role perhaps accounts for the various descriptions given for her job such as 'teacher trainer' (ED 2012a, 1), 'arts educator' (ibid.), and a 'teacher' (ibid., 3).

The academic CoP appears to combine a degree of uniformity in describing their professional

teaching role, with greatest scope in that role suggesting a community of communities of

practice. All but one academic described themselves as a lecturer, but there was considerable

diversity among this CoP in terms of secondary descriptors such as 'project worker' (AT 2012,

4), 'critic' (ibid., 3), 'editor' (ibid., 5), 'teacher' (AS 2012a, 4), and 'researcher' (AH 2012a, 1).

One academic (AH) described herself using five different terms.

The other participant group in the trial was research students recruited from the Shakespeare

Institute. These included campus-based MA and PhD students, and off-site distance-learning

students. Although time constraints and uncertainty of attendance at workshops made profiling

interviews infeasible, these students had elected to study 'Shakespeare' at postgraduate level

which implies an intrinsic interest in the subject and requires externalisation of that interest in

the form of graded work. Analysis of transcripts, reflective journals, blogs, and VLE forum

discussions shows that there is an obvious orientation around the domain of Shakespeare and

Theatre (one of the MA courses offered by the Institute) and the cultural history of

Shakespeare's period and the staging of his plays (another MA offered by the Institute is

'Shakespeare, Stratford-upon-Avon and the Cultural History of Renaissance England', or

MASSACHRE). Tellingly, one distance learning student articulated a sense of kinship around

subject,

> Many people are critical of the likes of us who scrutinise and analyse in fine detail
> everything we see in a performance (DL1 2012, 3).

The scrutinising and analysis of fine detail by this CoP conforms with the notion of 'shared

competencies' (2013) Wenger describes which 'distinguishes members [of a CoP] from other

people' (ibid.) and suggests that within the student group there might be communities

distinguished by the specificities of their subject (e.g. the performance of Renaissance drama) but overlapping in an interest in 'Shakespeare' in the most general sense.

In this respect, Ludwick Fleck's notion of 'thought collectives' (Sady 2001a, 197), although not about practice per se, is useful to conceptualise the connection between CoPs on the basis of domain interests. A thought collective is 'a community of persons mutually exchanging ideas or maintaining intellectual interaction' (ibid.). These communities are both esoteric (a small circle of experts) and exoteric (a larger circle of less expert teachers and students) and the gradual participation of novices is reminiscent of that described in Wenger and Lave's theory of legitimate peripheral participation but is more tightly restricted and one-sided (i.e. transmission of knowledge and skills from master to apprentice rather than a mutual learning experience (Wenger and Lave 2009, 92)). The collective has a dominant 'thought style' (Sady 2001a) which is defined as 'directed perception, with corresponding mental and objective assimilation of what has been so perceived' (ibid.).

In terms of direction, styles of written work, presentation of academic papers, and even modes of performance in the Shakespeare Institute's practical MA Shakespeare and Creativity might all play a part in regulating the link between domain and practice. According to Swales, the relationship between domain and practice is more likely to be expressed linguistically in texts rather than in speech since, 'Academics tend to listen more widely than they read' (2003, 207). Moreover, outlets for written work (such as academic journals) are all peer-reviewed imposing a close control of domain and practice via a community of like-minded scholars. Examining written work produced by both sets of students for Phase 1 does show a common style of

communication among Shakespeare Institute students. Although this is a small sample, all

students who wrote reflective blogs on the difference between costumes and their digital

representation quoted from Shakespeare in some way.[71] This suggests that this form of

interpretive description is part of a 'shared repertoire' (Wenger 1998, 82) developed by this

CoP. Indeed, during a profiling interview, AS, a lecturer of Shakespeare Studies, described her

research and teaching as 'focused more on reading and interpreting ideas' (AS 2012a, 1) and

'mostly what you're doing is looking at the words and what the words are doing intellectually,

artistically' (ibid., 2). This implies that within the domain of Shakespeare Studies, scholarly

expression conforms to a certain type of practice.


In terms of domain of interest, as an academic librarian LS stands at the intersection between

two CoPs linked by domain interest in Shakespeare: heritage practitioners and academics. Her

thoughts (recorded in a reflective journal kept during the trial) on the directorial role of the

librarian are significant,

> How far do people who have no background in the study of Shakespeare, performance and 17th century history [need to] be directed? Quite a lot as they have no lexicon, or background knowledge for interpretation (LS 2012a, 1).

This echoes comments by distance learning student DL1 on how scholars 'like us' are regarded

by others and strongly suggests an insider and outsider perspective relating to domain of

interest. AT, a textual scholar with an interest in Shakespeare, and with whom LS has worked in

the past, is not viewed by LS as an outsider but the digital creatives are all regarded as being

'not in the Shakespeare or academic world' (ibid., 2). The librarian's role in directing perception,

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[71] For example, Student E quotes 67 words by Shakespeare in a 1100 word post, and uses a line from *The Tempest* as the title of the article. Student C quotes 12 words from the play within the article and uses 'I will discase me', a line spoken by Prospero in *The Tempest*, to entitle the post (2012). Each post also uses language which combines description with interpretation. For instance, Student C states that a costume 'shimmers green' (ibid.) while Student E describes another costume as 'reminiscent of bodily decay' (2012a).

according to LS, depends on the degree of autonomy expected of the student. In Workshop 2 LS

explained,

> for postgraduate research you'd want something that is not so directed, you want a
> whole range of material that people can draw on (2012b, 10).

It is clear that the librarian is a director of perception in terms of resources. LU, a university rare

books librarian, reinforces in describing his role,

> students they would come and ask me for advice on what there is on a subject, on a
> topic, on a person or an issue and then you've got a much richer awareness of the kind
> of potential there is within your own locality of finding interesting, relevant material
> (2012b, 6).

However, thought style is most orchestrated by lecturers who are closer to the 'esoteric circle'

postulated by Fleck (Sady 2001a). As lecturers on two MA courses run by the Shakespeare

Institute, AH and AS train students in particular way of thinking. AH reveals to what extent her

role as a director of perception is needed,

> you can't just put stuff up there and hope that people can experience it. You have to
> provide some sort of task to direct that experience: that's our [AH, AS, and AR] role I
> guess [...] my role as curator and academic [...] and it stimulates what you do in the
> classroom (2012b, 24).

AH expresses surprise at the effectiveness of inculcating a certain style of thinking among her

students, admitting that,

> I was very interested to think about how I'd certainly, without realising it, primed my
> students to think in a particular way which has then informed their selection of the
> objects (2012b, 15).

In terms of directing learning, Fleck's concept is in some respects a better fit for a scholarly

community of communities, made up of different practitioners – teachers, students, and

librarians - whose learning is more directed and regulated than one would expect in the type of

situated learning described by Wenger and Lave where both the individual and the CoP learn at the same time (Wenger and Lave 2009, 76).

*4.2.2.3 Domain and Practice: Membership of work-related groups*

In the profiling interview, asking participants whether or not they are members of any work related groups was a way of exploring links between interest in a domain and commitment to that domain. Although this is not a straightforward connection and formalised groups do not necessarily indicate by themselves genuine interest in a domain (for instance data suggests that factors such as career stage influence the decision to participate in a professional association) it at least suggests a degree of commitment to domain beyond casual interest. More direct questions followed, asking about membership of specific professional groups, roles held within the CoP and reason for joining.

Although 87% of practitioners are members of work-related groups, there are clear differences between CoPs on how domain-related knowledge is stewarded. For heritage practitioners, academics, and performers, there are clear expectations of which professional groups should be joined. For heritage practitioners, the Museums Association (MA), Archives and Records Association (ARA), and the Chartered Institute for Library and Information Professionals (CILIPS) are the formal professional groups for curators, archivists and librarians respectively and membership of these groups was confirmed among heritage practitioners participating in the trial. These groups are important in members 'keeping up to date' (LS 2012c, 2) but there is

little in the way of participation.[72] Similarly, academics tend to combine largely passive

membership of remote prestigious groups such as the Institute for Archaeologists, and the

Higher Education Academy, which define and regulate parameters for practice, and special

interest groups such as the British Shakespeare Association where participation is more active.

For performers, membership of professional organisations appears to be restricted to Actors

Equity which acts very much like a union, protecting pay and conditions, rather than a

knowledge stewarding group per se.

For digital creatives, the diversity of domain interests and practice is reflected not only in

membership of work-related groups but in how these groups are formed. All digital creatives in

the trial were responsible for either setting-up or playing a significant role in maintaining

special interest groups related to what they do for a living. The reasons for this degree of

personal initiative relates to personal interest in the stewardship of knowledge with like-

minded individuals (reflecting a domain of interest) as well as cultivating a network to learn

about funding or commercial opportunities in their field as they arise. This financial aspect

distinguishes digital creatives from the other CoPs in the trial. In their profiling interview, both

DC and DS described the value gained from keeping an informal group called the 'Digital Media

Cluster' active in Birmingham. This group was described as a pool of different skillsets –

strategists, coders, developers – who exchange information on opportunities through the

Cluster and, less formally, share knowledge within the Birmingham area. DS said, 'I think that's

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[72] There is much more participation in special interest groups such as the Social History Curators Group, the Group for Literary Archives, and Manuscripts, Theatre Information Group, and the Data Standards Committee of ARA which align more closely with domain and practice on a day-to-day level.

one of the strengths of the city. There is a lot of expertise here and we're all quite keen to share it' (2012a, 4). For DC and DS the Birmingham affinity appeared to be particularly important.

For all digital creatives, the practical value of such groups is significant. DP is a Fellow of the Royal Society of the Arts 'which is pointless - it doesn't really help at all' (2012a, 3), but goes on to talk about two groups she has created, 'Women and Technology' and the 'Makers' Guild' (ibid.).[73] DP derived satisfaction from knowing that the Guild had catalysed working partnerships at every meeting in an 'emerging area' (ibid., 3) of technology founded on 'common interests' and 'shared issues' (ibid., 4). For DW, work on trans-media storytelling necessarily involves keeping in touch with a distributed 'community of people' (DW 2012a, 5) sometimes brought together on individual initiatives such as a geo-location project called 'Golf on the Moon' (ibid., 2). Therefore, for digital creatives there is a marked difference in the pioneering nature of their stake in organising groups around a common domain and the commercial element, as opposed to the combination of larger professional bodies and smaller, less formal special interest groups found among academics and heritage practitioners.

Finally, one area of commonality across the sample was age and activism: the early career academics, most of the younger heritage practitioners, and all of the digital creatives, appear most engaged, one academic (AS) citing active membership of five different associations and groups. Reasons for this were mixed but one academic (AA) claimed that career progression was a compelling reason for associating with a particular CoP (2012, 2).

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[73] The Makers' Guild is concerned with the crossover between craftworking and technology.

*4.2.2.4 Domain and Practice: Conclusion*

Overall, findings from Phase 1 suggest that there is an especially strong link between domain

and practice in academia and the performing arts and that this heavily influences their style of

learning. Although some of the more established professions such as those represented in the

heritage practitioner CoP outwardly identify with professional bodies (compared to a degree of

anti-professionalism and freer associations among digital creatives) this is not reflected by

levels of participation in the life of a CoP. Wenger's CoP model adequately describes most

practitioner group behaviour in terms of interest in a common domain and translation of this

interest into practice, but other conceptual models are helpful in explaining forms of regulation

between domain and practice.

**4.2.3 Domain and Community**

*4.2.3.1 Domain and Community: Introduction*

Wenger defines the communal characteristics of a CoP as a set of relationships that allow

members to 'interact and learn together' (Wenger 2013) on a regular basis around a common

domain. They do this through discussion, sharing information and joint activities (ibid.).

However, the variety of ways communities are formed and maintained can make description

difficult,

> Communities cannot be measured and managed in conventional ways. Traditional
> methods are not likely to appreciate the creativity, sharing, and self-initiative that are
> the core elements of how a community creates value (Wenger 2002, 185).

In order to find out how individuals 'interact and learn together' (Wenger 2013) participants

were asked how they maintain contact with fellow members in work-related groups (Appendix

B, Questions 10 and 11). Further questions on practitioners' immediate work environment were asked to build a picture of working relationships and to examine where domain-related learning is 'situated' (Wenger and Lave 2009).

*4.2.3.2 Domain and Community: Academics*

In academia, domain and community appear to be very closely linked. In its widest sense, academics' domain might be regarded as research and teaching around which a university community has formed with specific modes of practice, importantly the conferment of degrees. In fact, the Latin word *'universitas'* refers in general to 'a number of persons associated into one body, a society, company, community, guild, corporation, etc' (Lewis 1966). Beyond this, the organisation of colleges, departments, schools, and institutes, and the existence of subject-specific communities between universities or with other sectors, plays a large part in defining an academic's membership of particular communities of practice. In describing domain interests, academics in Phase 1 all gravitated towards their subject area in defining who they are and what they do conveying the importance of subject-focused domain and community to their sense of identity. Therefore, the group 'academics' could be described as a community of communities, with common interests, skills and experiences in research and teaching, but specific interests in a particular discipline whose community of practice stretches beyond a particular institution.

Based on findings from Phase 1, academics do appear to share characteristics of both the generic academician and the subject-specific scholar. For instance, the conference functions as

a key event in the life of the university community but takes different forms according to discipline. Teaching and research standards are policed by organisations such as the HEA but there are discrete bodies for regulating practice and influencing community activity within separate disciplines. Accreditation of learning is conferred by universities, teaching and learning tends to take place within particular parts of the campus. Although exchange clearly takes place between departments, domain and community are both situated in the sense that they are physically and metaphysically co-located.

In terms of research, the shaping of academic practice happens both in isolation (through individual research) and during periods of connecting with other academics via community events and network activity. AS describes the academic conference as, 'kind of an impetus to make sure that we catch up in terms of what we're doing' (2012a, 9). For this CoP, the rhythm between individual and group work, reification and participation, is especially important, 'individual research [...] can be very solitary but you've got to keep some kind of connection going with other people in the field, especially people who are very closely allied to your area' (ibid., 11). The conference as a key event in the life of the academic community provides an accepted way to share and shape practice, an outlet and inlet closely linked to the academician's workflow,

> it's a two-way process, you go to tell people what you're doing and I suppose generate interest in it and show the way it might be reshaping some aspect of Shakespeare Studies but you're also taking away as well, hearing what people are working on (ibid.,.10).

The normal route would be to publish research as part of a conference or use the conference as a way of airing research that has or will be peer-reviewed and published in a journal or book. These events – the conference and the vetted act of publishing - are largely driven by the

singularity of the research subject rather than 'working through community problems' (AS

2012a, 6) but, again, this demonstrates an attempt to craft practice using routes that are

socially accepted by that community.

For academics, there is a duality in lecturers' membership of different communities of practice.

On one hand, as teachers they are mostly members of organisations such as the Higher

Education Academy (HEA) which is 'pushing forward in new directions really in teaching' (AH

2012a, 5). According to AH, the HEA is,

> an important kind of gateway to information and also to [...] enthusiasm because
> sometimes you just have to go and..I don't know, [be] woken up and energised by
> different approaches (ibid.).

This professional body is therefore acting as an information resource and provider of

professional development for the teaching profession. It does this by offering training events to

share techniques such as the use of new technologies in the classroom, and by informing

practitioners on other practice-based issues via a web forum. The HEA is therefore using a

particular way of sharing knowledge in focusing on standards and improvements in pedagogy.

Early career academics in particular seemed to have very clear vocational reasons for joining

professional bodies which steward expertise on teaching. However, all lecturers were also

members of subject-specific communities some of which have regulatory bodies. For example,

AA, a senior lecturer in Archaeology is a member of the Institute for Archaeologists (IA). The IA

is as a reference point for technical information on archaeological practice, such as the

'minimum requirements' for 'digging a hole' (AA 2012, 5), and this information is then fed back

into teaching practice. The IA has developed its own way of 'addressing recurring problems'

(Wenger 2013) through the use of statute, adopting a top-down approach to developing

practice among its members. In a similar vein, the IA also acts as a union of sorts, representing

members and advising on wage levels making it 'both carrot and stick' (AA 2012, 4) for

archaeologists. The British Shakespeare Association was described by AS as a mainly 'academic

association' (AS 2012a, 9) which discusses research in the field of Shakespeare Studies.

Although it lacks the regulatory purpose of the IA, the BSA is a membership-based organisation

and is recognised by Shakespeare scholars as a key forum 'to tell people what you've been

working on before it actually comes out in print' (ibid.,10). This layering of membership of

different CoPs was summed-up by AS, 'you know I'm an academic but I'm also specifically in the

humanities disciplines but even more specifically English, Drama History' (ibid.,9-10).

This sense of identity is reinforced by physical distinctions in terms of where teaching and

learning takes place and the subsequent closeness of communities of teachers and learners.

The Department of Classics, Ancient History and Archaeology is housed in a particular part of

the Arts Building on the main campus at the University of Birmingham and within the

Department there are further divisions – physical and intellectual - along the lines of disciplines

such as Archaeology, Egyptology, and so on. Teachers and students of Shakespeare Studies

occupy a small site 25 miles from Birmingham in the town of Stratford-upon-Avon with only

occasional exchanges with the main University. Again there are subject divisions within the

Institute according to subject (there are six different MA programmes) and degree (MA / MPhil

/ PhD) but there is an appreciable amount of overlap between teaching modules and, of course,

a common theme (Shakespeare) galvanised in formal (e.g. weekly seminar) and informal (e.g.

plays staged by staff and students) events within the Shakespeare Institute. This degree of co-

location according to domain undoubtedly builds a sense of community identity which creates

distinctions in the way that subject knowledge is stewarded and learning sustained.

### 4.2.3.3 Domain and Community: Digital creatives

The creative and multi-disciplinary nature of what digital creatives do necessitates membership

of multiple communities of practice and the maintenance of looser 'networks of practice'

(Brown and Duguid 2001) to steward knowledge and sustain learning. When asked whether

working with others is a routine part of what he does, DW said,

> Absolutely necessary unless you're completely brilliant [...] there are some people who
> know how to program, design, write, set-up servers, interact with audiences, design
> the posters, raise the finance, perform, but there aren't that many (DW 2012a, 1-2).

For digital creatives, the formation of communities around domains appears to happen in two

different ways. Groups which meet regularly on a face-to-face basis tend to have a pragmatic

purpose, to share commercial information or to learn a particular skill around a clearly defined

domain of interest. For instance, DC uses Birmingham's Digital Media Cluster to share

information on funding opportunities or 'lessons learnt' (DC 2012a, 4) as a way of honing

practice openly. DP's two self-created groups share experience at meetings and this is normally

task-based or leads to practical partnership projects. DP said that attempts to depart from this

pragmatic focus shared by the Makers' Guild had not been successful.[74] Therefore, local

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[74] For example, speaking about a visit of the Technology Strategy Board, she said that 'a lot of the makers in the group felt that was a little bit too airy fairy' (DP 2012a, 3). That is not to say that members of these groups do not use digital platforms to stay in touch between meetings: of those groups that DP has started up, she uses mainly Twitter as a tool in a 'light touch' (ibid., 2) approach to keeping members in contact with each other.

communities formed around a practical interest tend to be grounded in forms of practice which

achieve particular goals, and which operate on mutually agreed rhythms of activity.

On the other hand, online networks of practice are used by digital creatives to engage long and

short term interests in particular domains according to the demands of mainly project-based

work. These ever-shifting, digital networks allow digital creatives to share technical expertise or

creative practice but do not require the same maintenance or degree of engagement with

other 'members' as CoPs. This allows for flexibility in opting in and out of 'a community or build

a network of people who are like minded' (DW 2012a) according to the needs of a project.

Membership of a part-community[75] and part-network[76] has, according to DW, a sense of shared

endeavour through knowledge exchange and practice,

> we've spent enough time trying to crack these problems together that we sort of know
> each other but we're very distributed, ah, and we don't see each other very often, and
> we tend to keep in touch via Twitter or you know text message or just looking at each
> other's blogs (2012a, 3).

This emphasis on horizontal relationships which criss-cross traditional community of practice

boundaries permits what Wenger describes as 'extreme multi-membership' (2009, 59) as the

individual interacts regularly with a number of different groups, be they CoPs, networks of

practice, or community-network hybrids. A dependence on networks rather than communities

could explain DW's feeling that his perceived community of practice (digital creatives) does not

have a definable identity even though he feels 'very, very at home' in 'digital culture' (2012a,

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[75] According to Wenger, members of a community (of practice) share an identity based on affinity for a domain
(2013).

[76] According to Wenger, members of a network share information but not an identity (2013).

5). This could also be explained by DW's general reluctance to industrialise or professionalise

digital culture even though he feels very comfortable with being associated with it (ibid., 1).


DP and DW, and CM all use Twitter as a key way of building networks and keeping in touch with

like-minded individuals, at least in a work capacity. This way of stewarding knowledge inverts

the traditional focus on domain, so that the person becomes the focus of interest, rather than

the domain *per se*. For DW, Twitter is a 'natural' (ibid., 5) way of sharing interest and refining

practice as well as a medium for his work in trans media. This sharing of practice is based on a

'transactional value' (ibid., 4) which, although less regulated, resembles the peer-review

process for academics, discussed in Section 4.2.2.1.


Drawing on a wide skillset appears to be a vital part of working creatively with new

technologies for this CoP, and this usually means working collaboratively with others. However,

this does not always mean technical staff. DW went on to say,

> what I quite like to do now is that you work with others but the others are the
> audience [...] I step into the ring with my audience and I start something off and then
> they start to take on roles (2012a, 2).

Working directly with audiences is something that digital creatives do as part of their job,

opening up or sharing their 'concern or passion' (Wenger 2013) beyond a community of

practitioners. This can be driven by an experimental or creative urge, or it can be induced by

necessity. The language used by DC and DS during the profiling interviews, joint presentation

and workshop discussions all suggest the competitive, client-facing and user-focused nature of

what they do. DC spoke a number of times of projects his company had 'won' (DC 2012a, 5) and

during the presentation he gave with DS, his colleague opened with an outline of what they do

for clients 'our angle is how we use digital media to help service our clients and their project needs' (DC 2012b, 1). DS explained that this 'service' usually begins with the end-user, 'we come to all kinds of digital projects and propositions starting with [...] content and users' (DS 2012b, 28) and with end-users in mind she repeated the word, 'journey' six times to describe the experience of engaging with digital content from an end-user's perspective.

Therefore, end-users appeared to be an important way of digital creatives defining their domain and in many cases might actually introduce a new dimension to skew membership of a community of practice by widening participation in less formal but nonetheless influential communities or networks of interest. This places digital creatives closer to end-users in the digital supply chain than other CoPs.

*4.2.3.4 Domain and Community: Heritage practitioners*

Among heritage practitioners in the sample there appears to be a mixed picture in terms of domain and community identity. According to CC, a curator, the museums profession seems to have a stronger sense of identity since 'the MA [Museums Association] represents the museums community and sort of brings a cohesiveness to it' and membership is 'indistinguishable from a career in museums' (CC 2012, 5). The MA functions as the sector's professional accreditation scheme and for many years 'dictated' (ibid. p.6) policy and practice via the institutional Accreditation scheme. University librarians do not seem to think that their professional association (CILIPS) has a strong sense of identity although LS feels, 'obliged to become a member of it to be honest' and 'It's a good means of communication with your

profession basically' (LS 2012c, 3). AR feels a part of the Archives and Records Association

(ARA), the professional body for archivists, and this could be because of her active participation

on one of its sub committees (AR 2012, 2). However, she did not feel as if ARA has a strong

sense of identity and this could be related to the size of the organisation and its low profile

compared to such organisations as the MA.  CM, the Collections Manager recognised the value

of groups such as the MA and the Association of Independent Museums (AIM) but perhaps her

role as manager of a collection which is overseen by curators, librarians and archivists had

lessened her sense of affiliation with a single domain. CM said, 'I don't ever perceive myself to

be a member of a club as such' (CM 2012a, 5) and this was reflected in her use of personal

networks, principally via Twitter, to help in her management of the activities of museum, library

and archive collections. This does not seem to disrupt CM's affiliation with the heritage sector

but rather offers alternatives networks and communities of interest which are more self-

selecting based on individuals CM chose to stay connected to.


LS was much more animated on the topic of subject-specific communities and this is the

pattern across all heritage practitioners. Her enthusiasm for finding out about other

Shakespeare-related collections was apparent when discussing the value of membership of the

Association of Performing Arts Collections (APAC) which she claims is,

> very useful with regards to you know what's happening with theatre collections across
> the country which you can always feed back to staff and to students and there's always
> potential with that to develop projects with other people, jump on the funding wagon
> and all that sort of thing (LS 2012c, 4).

Therefore, LS's twin role as an academic librarian and a subject specialist are both served by

APAC membership, but the motivation to become part of this community of practice and the

purposefulness in using information to shape practice suggests a strong interest in the subject as domain. Equally, membership of other collections-focused groups such as the Social History Curators Group (CC 2012, 1) and the Group for Literary Archives and Manuscripts (LU 2012b, 4) appears driven by interest in particular collections and is the basis for a distinctive approach to learning discussed in Section 4.2.5. Therefore among heritage practitioners we see a division between membership of a professional organisation because they feel compelled to be, and voluntary membership of special interest groups. Again, subject area acts as a powerful domain driving personal interest and notions of community identity.

*4.2.3.5 Domain and Community: Performers*

Of all practitioner groups represented in Phase 1, those involved in the performing arts seem least likely to identify with particular communities of practice. Equity, the actors' union, acts as a kind of passport to qualify for auditions and as a union to protect standards of pay and conditions among members, but it is not a knowledge-sharing organisation (AD 2012, 1). Part of the reason that theatre practitioners do not become members of fixed communities is that acting, like project work, involves an intense focus on a piece of work within a temporary community of practitioners for the period of a particular production, unlike the comparative constancy of working in a museum or even in academia. Those in the performing arts also find their particular domain difficult to classify. ED, who works, 'building theatre vocabulary among young people' and running, 'workshops which take theatre practice and apply them to issues to do with classroom teaching or leadership' (ED 2012a, 1) finds her role difficult to pin down because 'it's such a broad area that I work in' (ibid., 2).

Unsurprisingly, working with end-users is a standard part of working practice in the performing arts although, like some heritage practitioners and digital creatives, this is often a fleeting engagement. A recurring concern for ED in both workshops was clarifying who the audience for artefact-based resources would be 'Don't we come back to the issue of audience, each audience will have its own pathway' and 'I'm not clear about the audience you know' (ED 2012b, 11). AW, an actor, considered the audience in discussing the social media platform, Tumblr 'You can even add your comment as an audience member who saw the show?' (AW 2012a, 16) and, in the museum store, reimagining staging ('pros arch') from the way that a costume has been designed (AW 2012b, 6). Worrying about what audiences think of the smell of a costume was also a concern suggesting just how close to end-users AW routinely gets during a performance (ibid., 5-6).

Apart from the sharing of knowledge among actors and production staff during a particular run, all of the performers who took part in Phase 1 claimed that they had developed practice based on the previous experience of other actors and directors. This diachronous and one-sided sharing of knowledge is made possible by viewing archive footage, prompt books, production photographs and theatre reviews to learn about previous interpretations of characters, costume and set designs, stage directions, and so on. This is not always done to copy techniques but to make sure that what they do is different (AW 2012c, 2-3). In this way, the 'solitary' nature of the way that many actors work is offset by connecting with the community's experience and, in turn, leaving a record of what is made of this experience through new performance.

*4.2.3.6 Domain and Community: Conclusion*

Overall, findings from Phase 1 suggest that for all groups, the nature of the domain defines the character of the community. For academics there are distinct, rigid structures for sharing subject-specific research knowledge and more generally for career progression, whereas for digital creatives the nature of their job demands a wide skillset and flexibility in community formation and maintenance, often dependent on social media networks. For heritage practitioners, communities are confined to sub-domains such as museums, libraries and archives, and still further depending on the nature of the collection. For performers, communities are formed around specific projects and knowledge is shared sometimes through past experience. Therefore, the nature of domain-specific knowledge reflects choices in how communities form and knowledge is stewarded.

## *4.2.4 Community and Practice*

*4.2.4.1 Community and Practice: Introduction*

> Members of a community of practice are practitioners. They develop a shared repertoire of resources: experiences, stories, tools, ways of addressing recurring problems—in short a shared practice (Wenger 2013).

Practice is central to Wenger's theory of learning in communities, and learning requires a 'negotiation of meaning' (1998, 52) among members of the CoP. According to Wenger, negotiation of meaning involves the convergence of two interlinked processes: participation and reification. In other words, a consensus on meaning cannot be arrived at without active negotiation (participation) and agreed linguistic structures and ways of using language

(reifications). This dynamic negotiation of meaning within a community results in the creation

of distinctive forms or uses of language use as communities define and refine practice together.

Therefore, since 'Language is one of the principal means by which meaning is reified' (Tusting

2005, 40) it is the main 'tool' in the 'shared repertoire of resources' examined to look for

evidence of a link between community and practice among participants in Phase 1. It is used by

CoPs as both a means of developing practice and a product of practice in itself. It is also

fundamental to collaborative learning because, as Wenger and Lave explain, 'Language is part

of practice, and it is in practice that people learn' (Wenger and Lave 2009, 85).


As well as linguistic analysis (Section 4.2.4.2), types of 'recurring problems' (Wenger 2013) that

might tackled by a CoP in the process of negotiating meaning are also analysed below (Section

4.2.4.3) to look at the connection between community and practice and to suggest factors

which might influence usage of artefacts. These differing perspectives in the digital supply chain

highlight how these communities collectively tackle issues associated with the selection,

digitisation and packaging of artefacts, and working with end-users, but also confirm the ties

between membership of a community and forms of practice.


*4.2.4.2 Community and Practice: CoPs and language*
Although Swales (2003, 207) points out the differences between the spoken and written word

among academic communities and the greater degree of consensus that might be expected

from interdisciplinary *spoken* conversation, responses from semi-structured profiling interviews

with project participants, and content analysis of contributions they made to discussions during

workshops, suggests some linguistic patterning commensurate with membership of a particular community of practice.

Firstly, analysing the frequency of words used during interviews and workshops reveals certain patterns among individuals suggestive of priorities held by particular communities of practice. Although by level of usage very few of these terms reflect what Mätikalo and Säljö term 'categorical knowledge' (2002, 66) i.e. those words whose meaning is shared only by 'insiders', it is significant to find the repetition of verbs such as 'know' and 'look', 'think', and 'see', and 'use', adjectives such as 'professional' and 'interesting', and nouns such as 'collections', 'idea(s)', and 'digital' by certain practitioner groups, as shown in Table 11.

| | Heritage Practitioners | Academics | Digital Creatives | Performers |
|---|---|---|---|---|
| Know | 1.9 | 1.6 | 1.0 | 1.6 |
| Collections | 1.7 | 0.2 | 0.2 | 0.4 |
| Professional | 0.2 | 0.1 | 0.1 | 0.1 |
| Project | 0.8 | 0.2 | 0.4 | 0.4 |
| Look | 1.2 | 0.6 | 0.6 | 0.4 |
| Think | 2.4 | 2.4 | 1.9 | 1.4 |
| See | 1.6 | 1.6 | 1.4 | 1.4 |
| Sort | 1.6 | 2.2 | 0.8 | 0.3 |
| Research | 0.8 | 1.2 | 0.6 | 0.7 |
| Talking | 0.2 | 0.6 | 0.5 | 0.3 |
| Things | 1.2 | 1.5 | 1.5 | 1.0 |
| Idea | 0.1 | 0.5 | 0.5 | 0.4 |
| Objects | 0.7 | 1.4 | 0.6 | 0.6 |
| Digital | 0.8 | 0.9 | 1.0 | 0.7 |
| People | 0.6 | 0.8 | 1.2 | 0.4 |
| Work | 1.6 | 0.9 | 1.9 | 0.2 |
| Use | 1.1 | 1.2 | 0.8 | 1.2 |
| Shakespeare | 0.6 | 0.7 | 0.3 | 0.8 |
| Audience | 0.1 | 0.1 | 0.3 | 0.4 |

Table 11. Frequency of word use compared between the four different communities of practice (figures are weighted percentages)

Table 11 also shows the extent to which CoPs use key words which, generally speaking, fit their area of expertise, or perceptions of their role. For instance the greater use of the words, 'collection' and 'professional' corresponds with heritage practitioners' area of work and the emphasis on professionalism pointed out above in discussing the relationship between domain and practice for this CoP. Equally, the greater relative use of 'research' by academics, 'digital' by digital creatives, and 'audience' by performers reflects what one might expect for communities centred on this type of practice. Significantly, 'people' is a term used to a greater extent by digital creatives reflecting perhaps their user-focused approach to work described in workshops and profiling interviews. The higher use of the word 'look' among heritage practitioners might also confirm Alpers' assertion that 'the museum effect [...] is a way of seeing' (Alpers 1991, 27).

There are some terms that also unite CoPs. The frequency of use of the words 'think' and 'see' are identical for heritage practitioners and academics, and notably higher than for other CoPs, suggesting that these two activities are manifested to a greater extent in their day-to-day practice. The words 'things' and 'idea' are used to the same extent by academics and digital creatives which perhaps reflects the greater exchange of ideas between these two CoPs during workshops discussions. The word, 'use' is spoken by academics and performers to the same extent. Interestingly, some categorical terms such as 'pros arch' (proscenium arch) were introduced by 'insiders' (in this case the actor AW, (2012b, 5)) but then explained and used by academics and heritage practitioners signalling a wider 'speech community' (Barley, Meyer et al.. 1988, 27) which recognises theatre vocabulary.  Over the course of the two workshops there is evidence of mirroring behaviour between different CoPs through word use: the sharing of words such as 'enrichment', 'play' and 'pathway' were all first introduced by digital creatives

in Workshop 1 and subsequently used across all CoPs suggesting a negotiation of meaning during each session much in the way Wenger postulates happens within a CoP.

Taking context into account, the differences between words which are used across the sample also highlights practitioner differences. For example, Figure 6 shows that the word 'curate' and variations such as 'curating', 'curation' and 'curator' were most used by heritage practitioners (0.11%) and digital creatives (0.10%). Looking at the actual context of word use shows that definitions among the former group are based around ideas of management and control of predominantly physical resources whereas for digital creatives what is being 'curated' is metadata and access routes through that data.
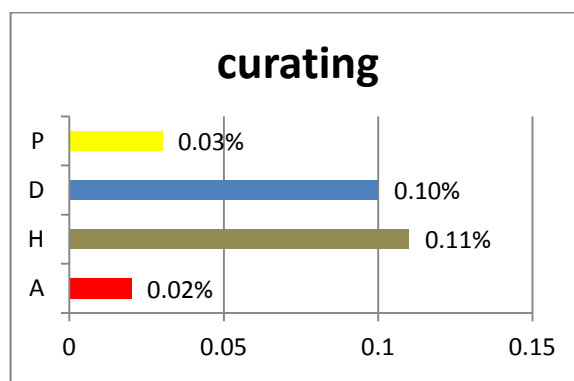


**Figure 6. Frequency of use of the word 'curating' by different CoPs (P: performers, D: digital creatives, H: heritage practitioners, A: academics)**

The pragmatics of the use of the word 'curate' by two different practitioner groups suggests that each associates the same word with a quite different meaning within their own CoP.

We can see from this inter-practitioner exchange (given in Table 12) during an examination of a late 16th Century recipe or receipt chest (SBT 2013b) that the use of language is very different between AH (a cultural and art historian) and DW (a digital writer).

180

| Time | Participant | Transcription |
|---|---|---|
| 15.24 | DW | But why would we say handsomely decorated for [...] . |
| 15.26 | AH | Because it's upper middling again |
| 15.27 | DW | Again, it's the aspiration [...] |
| 15.31 | AH | And obviously it would store very expensive materials (DW: oh right) so it's<br>storing knowledge and materials [...] |
| 15.36 | DW | And it shouts out () [...] it shouts out |
| 15.38 | AH | Exactly which is why it's more consistent with women and a domestic context<br>where it's about display [...] |
| 15.42 | DW | It would be in the front room, right? |

**Table 12. Excerpt from Digital CoPs and Robbers: Stage 4 Workshop 2 PM (AH and DW 2012)**

AH uses precise, categorical terms such as 'upper middling' to refer to class, 'domestic context' to describe use, and hedging terms such as 'more consistent with' to formally identify, contextualise and interpret the artefact. This corresponds with what AP (a PhD student supervised by AH) says about the special skills used in reading or decoding the artefact, 'It's supposed to be read in a certain way so it has this interior logic to it' (AP 2012, 13) and Student C's description of 'close reading' (2012) of an artefact suggesting a learned artefact literacy among the academic CoP, lecturers and students. In contrast, DW is using non-academic language, such as 'it shouts out' referring to the chest's fine workmanship and decoration, and domestic analogies such as, 'It would be in the front room, right?' in discussing the prominence of the item in the home.

Therefore, although professional practice cannot be reduced to language, it is still a fundamental tool involved in learning and socialisation within a community. More extensive research on far larger samples would be needed in order to provide more conclusive data on links between communities of practice and ways in which they communicate, but analysis of

language use in profiling interviews and workshops does suggest areas of differentiation among disciplines worthy of further investigation.

*4.2.4.3 Community and Practice: Practitioner perspectives*

Another way of reifying practice is in expressing common attitudes to 'recurring problems' (Wenger 2013) and fault lines between communities of practice emerged in during Phase 1 in stances taken on the topic of access to, and use of, digital artefacts.  These different perspectives not only provide evidence for the existence of communities of practice but begin to explain why these communities might exhibit different forms of practice around the artefact and influence how end-users interact with the artefact. To scope the opinions and viewpoints of practitioners, interviewees were asked about their use of artefacts in research and about their experience of the digitisation of artefacts. These questions (22 and 23) were intended to build a mental picture of practitioner attitudes to artefact use in physical and digital form. Additionally, during both workshops, activities and discussions were designed to externalise latent perspectives on the supply and use of digital artefacts.

The most important and recurring issue for all CoPs was around physical access to artefacts. According to AH, 'the main problem with humanities research not using objects, is access'(AH 2012c, 20). This point is reiterated in a more oblique way by AP who hoped that the Digital CoPs and Robbers project would reveal 'the extent to which digitisation stops museums from having objects out' (AP 2012, 13) voicing a similar frustration about access. Ownership of artefacts was implied throughout the two workshops in the use of the personal pronoun when referring to

artefacts, 'your objects' (e.g. DW 2012b, 24), by academics, digital creatives and performers,

and even in how practitioners line up during an artefact examination session held at the end of

Workshop 2.[77]

This degree of control was underlined by references to collections access made by a number of

heritage practitioners. CC emphasises 'proper procedures' (CC 2012, 8) in place for gaining

access to artefacts; CC, LU and LS described their gatekeeper role in digitisation in deciding

which objects should be digitised, something which certainly has ramifications for the use of

artefacts. In contrast, digital creatives tend to pick up post digitisation or are concerned with

'connecting datasets' (DC 2012a, 7) or finding innovative ways of using them, but are largely

excluded from the process of selection and capture. This control of physical access to the

collection actually seems to be the last line of defence in capturing value from use. CM

explained that the 'real strength' of the Shakespeare Birthplace Trust is,

> the fact that everybody has to come here to engage with research in Shakespeare's
> biography and being able to make that connection with the town he lived in, see the
> birthplace (CM 2012a, 12).

The stages of access to the artefact within the SBT collection normally involve first hand

inspection due to the basic nature of the online catalogue. This means that quite early on in the

process of research, 'They [the researcher] would have to contact us to look at the book' (CC

2012, 9). Again the personal pronoun is used. The issue of control of physical access is perhaps

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[77] Three artefacts were shown to participants in order to compare the experience of seeing (and using) a digital representation with their impressions of the physical artefacts which had been digitised. This was lead by CC, the curator, assisted by AR (an archivist) with CM (collections manager) and AA (leader of the workshop) on a stage with the artefacts. The digital creatives, performers and academics (with the exception of AA) were all standing below the stage looking up. Although the use of the stage was an attempt to separate the viewing of artefacts from other activities in the room (such as tea drinking), the alignment of heritage practitioners behind the artefact makes an emphatic semiotic statement about ownership and access to collections.

the clearest example of how practitioner perspectives influence the end-use of artefact and reveals boundaries between CoPs involved in the digital supply chain.

Digital creatives were the most outspoken opponents of a fixation with the physical artefact and its intrinsic value preferring to focus on using data associated with collections, and its relationship with end-users, than the collections themselves. Although DW expressed a 'sense of absence' (2012b, 20) that in the first instance, practitioners were not given 3D artefacts to 'manipulate and investigate' (2012c, 14) but digital surrogates, for most of the discussion digital creatives emphasised the use value of metadata around artefacts. DP, DS and DC all referred to artefacts as 'assets' (e.g. DP 2012a, 6) which can be used by institutions 'in times of threat' (ibid.). Artefacts are described as 'connected thing[s]' (DP 2012d, 23) whose value derives from their place in an interconnected network. DP states that 'almost nothing has meaning on its own' (ibid., 24) drawing attention to the social value of artefacts which, unlike the use value ascribed to artefacts by AR and the socially constructed reading of an artefact, comes from connections with other things and even from the artefact itself. DP says that 'an object on its own doesn't start to act in the world until you have an audience I suppose' (DP 2012b, 7) laying importance on the relationship between the artefact and its users. DW goes further, pointing to arts and technology projects which focus on communicating the experience of the artefact itself, so that the object 'nearly has life' (DW 2012b). This almost goes full circle back to the heritage practitioner stance on the intrinsic value of the artefact, but the mediation is more technological rather than hierarchical.

Academics shared this interest in plurality and the human context of the artefact, although their need to access the physical artefact sets them slightly apart from digital creatives. For Humanities scholars, although the artefact itself might be important for the information it contains and its inherent structure and composition (for example the setting-out and printing of Shakespeare's First Folio as well as the textual content), it is the space around the artefact which offers most interest (the interpretation of the First Folio version of Shakespeare's text). For that reason, seeing objects in the round – capturing different perspectives and valuing the use of the artefact rather than the artefact alone – is fundamentally important for the academic CoP. In a similar way, those performers who took part in the trial shared the academics' interest in the person and the artefact. AD uses artefacts and cultural settings to tap into a 'mental state' (AD 2012, 1) but this is more related to building a picture of a period or about watching people's response to art than about the artefact itself.

For academics whose interest is in the cultural history of a particular time, direct access to the material content and context of the artefact is important in 'getting to grips' (AH 2012a, 10) with the experience of the artefact's original owners. AP's physical inspection of artefacts in the collection of the Shakespeare Birthplace Trust is a vital part of generating new knowledge,

> the manipulation, the handling of the object seems to be incredibly important when generating new ideas and new ways of thinking about it (AP 2012, 12).

AP gives the example of a medicine chest that had been,

> fixed into a category partly just through provenance [...] but when you actually start researching it and handling it, it became clear that it had completely different functions really (ibid.).

For AH, the original context of an artefact is equally important and this often requires 'first hand' (AH 2012a, 1) inspection of artefacts and settings. Access to digital versions of objects

supports and informs 'fieldwork and sort of secondary research' (ibid., 5) and the 'interplay' of the two (ibid.), but academics have mixed views on the value of digital representations of artefacts. For AT, a textual scholar, many digital versions of manuscripts allow the user to 'see more than you could if you had the manuscript' (AT 2012, 2) and for AA, an archaeologist, the ability to capture from a dig something which would otherwise degrade and disappear aids analysis (AA 2012, 4). For AH and AP, their interest in the material culture of Early Modern England is facilitated by digital technologies, which can accommodate the sifting of information before a visit, and studying, for example, the iconography of an artefact post-visit, but much of the sensory information needed for their research is not normally supplied as part of digitisation but must be gained at 'first hand' (AH 2012a, 1).

Therefore, based on evidence gained from the profiling interviews and participation in workshops, there are differences between practitioner groups in the way that they value artefacts and use them in their practice. There seems to be some common ground between heritage practitioners and academics in the value they place on the use of physical artefacts, but academics like digital creatives and performers appear to use artefacts as ways of accessing human experience and creating social value, rather than prizing their intrinsic worth and place within an institutional value system.

Another tension, or 'boundary object' (Star 1989) among practitioners that highlighted differences between communities was the status and use of metadata.  Academics, performers, and digital creatives all appeared to value different perspectives on the artefact and saw a place for this alongside the official record. Heritage practitioners appeared less comfortable

with the management of this. In a conversation about creating catalogue content, CM said 'I think my feeling talking about responsibility [for administering the record] is that it does sit with the organisation that manages that object' (CM 2012b, 19). Equally, AR mentions the importance of preservation of content, context and structure within archival records which is endangered by hacking and mashing content which disturbs relationships between records in reusing data. Although DW saw the need for 'a lead enthusiasm' (2012c, 18) in creating metadata, this should be a plural process which could involve a 'hierarchy of curators' (ibid.). AH put this another way when she said that her preference would be, 'moving away from the idea of one authority to multiple authorities' (AH 2012d, 12).

Therefore, around issues concerning access to, and control of artefacts and metadata about them, attitudinal patterns began to emerge between individuals which reveal boundaries between communities of practice. These perspectives on artefact usage signal how each of these CoPs, who all have a stake in the supply and use of digital artefacts, perceive legitimacy and illegitimacy with regard to accessing, controlling, valuing and utilising digital artefacts. Their articulation of particular views (and the way that they actually interact with physical and digital artefacts – described in Section 4.3) make explicit tacit knowledge held by the CoP. This knowledge as Wenger et al. point out is 'social as well as individual' (2002, 10) and is bound up with other aspects of the domain of knowledge which characterises their CoP or CoPs. This undoubtedly influences practice within the digital supply chain or how curators, librarians, archivists, digital creatives or technologists, academics, performers and others interact in the process of creating and using digital artefacts.

*4.2.4.4 Community and Practice: Conclusion*

Linguistic and attitudinal differences between participants in Phase 1 suggest boundaries between CoPs in the way that communities develop practice. However, membership of a community of practice depends not only on interest in a common domain, mutual engagement within a community, and shared practice, but Wenger also identifies another component essential to collective knowledge stewardship: 'collaborative learning' (Wenger 2013) examined in Section 4.2.4.

**4.2.5 Learning**

*4.2.5.1 Learning: Introduction*

Before looking at how communities of practice learn, what is meant by 'learning'? There are a wide range of definitions on what constitutes learning but most acknowledge that some form of transformation occurs in the behaviour of the individual as a result of experience (Thorpe 1963, 55). Kolb's definition of learning as a 'transformation of experience' (Kolb 1984, 38) was considered the most suitable general description of the process of learning since it has been widely used in the context of experiential learning (particularly in museology), is behaviourist in orientation (akin to the research approach described in Chapter 3), and corresponds most closely with Wenger and Lave's theories of social learning in communities of practice which emphasise the simultaneous transformation of the individual and the community through participation in the learning process,

rather than learning by replicating the performances of others or by acquiring knowledge transmitted in instruction, we suggest that learning occurs through centripetal participation in the learning curriculum of the ambient community (Wenger and Lave 2009, 100).

For Wenger and Lave learning involves both internalisation and externalisation since,

'increasing participation in communities of practice concerns the whole person acting in the

world' (ibid., 49).

To examine how CoPs learn in the sample, and how this might relate to artefact use, three

methodological approaches were used:

a. Qualitative analysis of interview and workshop transcripts

b. Learning Style Inventory (LSI) testing of participants

c. Qualitative and quantitative analysis of artefact usage based on interview and workshop

transcripts

Looking for clues to how practitioners learn (a) provides context for the systematic assessment

of learning style using a standard LSI test (b). Mapping patterns in artefact usage to learning

styles (c) is taken up in Section 4.3.3. This combination of methods provides evidence of

distinctive traits in learning behaviour shared by practitioners from similar backgrounds.

### 4.2.5.2 Learning: Heritage practitioners

Heritage practitioners tend to combine an interest in each other's collections with knowledge

exchange which is both practical (for example, the digitisation of manuscripts based on a case

study) and strategic (for instance, information relating to funding cuts or job opportunities in

the sector). A community of practice seems to develop by bringing together the domain of

interest and practice-based issues in individual events or via journals, bulletins, or email lists,

but the emphasis is always on collections,

> you always get a tour around someone else's service, and then everyone tells each
> other what they've been up to, or what problems have been going on with their
> service so at the moment everyone's talking about all the cutbacks and stuff, and then
> there might be training that somebody, so it's all kind of sharing, it tends to be
> knowledge sharing (AR 2012, 18).

Knowledge is then used selectively in the workplace based on its relevance to day to day

practice. For LS, CILIP (the Chartered Institute for Library and Information Professionals) offers

support by raising awareness of issues around projects which impact on her everyday practice

such as Radio Frequency Identification (RFID) tagging of library books. Therefore, for all

heritage practitioners, learning about practice is highly experiential, collections-based and

focused.


Perhaps because of this, the variety of learning styles found among heritage practitioners was

the widest of any of the practitioner groups and there was very little correlation along the lines

of domain (museum, library, archive). As well as six of the participants who took part in Phase 1

interviews and workshops, another five heritage practitioners (Anon 1 – 5) were asked to

complete an LSI test to increase the sample size. The results are shown in Table 13.

| Individual | Role | Learning Style |
|---|---|---|
| Anon 1 | Archivist | accommodator |
| Anon 2 | Archivist | accommodator |
| AR | Archivist | diverger |
| CM | Collections Manager | converger |
| CC | Curator | accommodator |
| Anon 4 | Curator | assimilator |
| Anon 5 | Curator | assimilator |
| CS | Curator | diverger |
| LS | Librarian | accommodator |
| Anon 3 | Librarian | converger |
| LT | Librarian | diverger |

**Table 13. Heritage practitioner roles and Learning Style Indicator test results**

The LSI results show that there is little consistency in learning style among heritage practitioners. This might be because of the collections they manage, lack of a strong community identity (discussed in Section 4.2.2.2), or that these professions attract diverse skillsets.

Although heritage practitioners do operate beyond their comfort zone, responses suggest this is less of a feature of their day to day work. CC responded to the question by giving the example of a 'storage problem' for the collection which makes her feel uncomfortable. Her way of embodying the collection and turning the question around by feeling for the collection rather than feeling out of depth in any way seemed somewhat deflective. CM, a collections manager, was exceptional among the heritage practitioners by saying that she feels outside her comfort zone 'all the time' (CM 2012a, 4) so she seems to share an appetite for working on the edge with digital creatives and academics.

Therefore, the heritage practitioners who participated in Phase 1 all shared an inclination towards experiential, practice-based learning, but this mainly takes place within the workplace

rather than in projects which might be beyond individuals' comfort zones. The range of learning style results suggests that despite an insistence on professionalism and uniformity among practitioners, there is a great deal of diversity within this CoP.

*4.2.5.3 Learning: Performers*

Although the Performance CoP is a very small group and, as such, it is harder to make generalisations, from workshop transcripts it seems that participants seem to share other creative practitioners' difficulty in defining what they do but show a marked inclination to learn by doing. Made up of an arts educator (ED), and a trained actor (AW), both work or have worked with the RSC in Stratford. Their roles are theatre-focused and performance-based. AW found it easiest to define his role introducing himself to the other CoPs at Workshop 1, 'I'm an actor [...] I'm here to give an actor's opinion'(2012e, 4) but later on confides that, 'The difficult thing about acting is that everyone does it in a different way' (AW 2012c). ED found it more difficult to encapsulate her role, explaining 'it's such a broad area that I work in' (2012a, 1). Eventually ED said, 'I guess I'm an arts educator' (ibid.) and a 'teacher trainer' (ibid.) though she was also an academic and an actress. ED's difficulty in summing up what she does might be because of her bridging role between the classroom and the stage but could also be because she is a retired freelancer moving between CoPs on a regular basis.

For both performers, the rehearsal and the classroom are places where ideas are tried out and learning takes place. ED revealed that, 'I'm active and physical by nature and I learn by doing so the theatre is really interesting to me - all the choices it offers' (ibid., 3). Equally, AW's

contributions are frequently accompanied by demonstrations or anecdotes or both showing an inclination towards dynamic learning. During an inspection of a costume in the museum store, he explained what messages he would want to convey once the artefact is digitised,

> I suppose you'd want to communicate [...] I dunno [...] the way it moved I suppose you see how long it is and how it affected his movement it would be huge [...] you'd have to do strong movements (AW 2012d, 4).

AW mentioned 'move' or words related to it five times and his inclination to touch the artefact suggests a strong tendency for kinaesthetic learning. Another actor interviewed in the project, AD, highlighted this learning-by-doing approach commenting that he finds the words of Shakespeare easy to learn because they seem to have a 'muscle memory' (2012, 1) and that there are clues in the play-text about where to breath. This embodied response to learning and practice is confirmed by LSI test results showing both performers are accommodative learners, each by a considerable margin.[78]

Therefore, the performer CoP share some of the reluctance of other creative practitioners to narrow down what they do but their descriptions of how they do this are broadly similar and confirm a dynamic, hands-on approach to learning.

*4.2.5.4 Learning: Digital creatives*

For those involved in the creation of digital resources, learning on the job and learning through experimentalism or 'play' appears to be characteristic.  The project-based nature of the work

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[78] In the LSI test, nine questions test whether or not an individual has a preference for doing or watching; another set of nine questions tests whether individuals have preferences for either thinking or feeling. Both performers were unequivocally doers and feelers, each scoring all doing preferences in the first set of questions, and 7/9 feeling for the second set.

digital creatives normally undertake as well as the variety of skillsets required and the fast pace

of change in digital technologies all seem to be responsible for a great deal of learning focused

on the delivery of resources to clients or the development of art-based projects. For instance,

DP described work on a project for BBC Radio 3 which will typically involved 'a short time for a

deep period of work' (2012a, 8) consisting of 'deep immersion for a week, you know very rapid,

thinking of themes and then coming up with ideas, but more generally I suppose there's an

ongoing relatively lightweight research that happens' (ibid.). This 'immersion' is normally

needed to become familiar with a topic (in this case the work of a particular composer)

whereas the 'lightweight research' (ibid., 5) most often involves consulting a wider network of

peers for technical fixes or building on the work of others. This mimetic aspect is especially

valued in the open source community where sharing and reusing content rather than starting

from scratch is the *modus operandi*. DW explained, 'You're copying and then you're revising

and then slowly it's becoming yours' (2012a, 5). In this way, communities learn from other

communities in a form of mutualism (or commensalism depending on whether the benefits of

adaptation are returned as open resources). Participation in situated learning[79] takes on a new

dimension as distinctions between 'apprentice' and 'old timer' are blurred as different CoPs

tacitly exchange knowledge and experience.

Working at the edge of their 'expertise' (2012a, 5), digital creatives appear to thrive on

stretching themselves in work-based learning which usually entails openness to

experimentation. All digital creatives claimed that they were not only amenable to operating

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[79] 'Situated learning usually involves engaging in tasks which parallel real world applications' (Heeter 2005).

outside their natural 'comfort zone' (Question 17, Appendix B) but this was a vital part of how

they work. DS commented, 'I lap up new experiences and challenges [...] just dive in and go for

it' (2012a, 8). DC confirms that exposure to new areas of practice and to knowledge deficits is

needed for the kind of experimental work he gets involved with, 'I like to push it and get out

the comfort zone so you're kind of forced to catch up essentially' (2012a, 7). The way this is

done requires a degree of adventurousness and trial and error, most frequently described by

digital creatives by the word play (or synonyms thereof). Figure 7 shows the relative use of this

word by all CoPs.
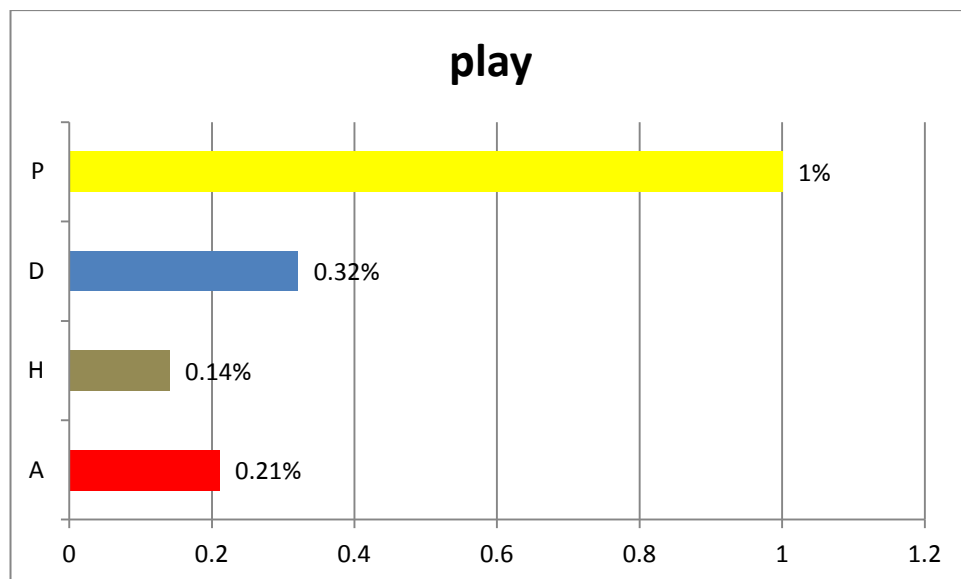


**Figure 7. Frequency of use of the word 'play' by four communities of practice (P = performers; D = digital creatives; H = heritage practitioners; A = academics)**

Although this shows that performers use 'play' most often, examining the context of usage

shows that what is being referred to is a theatrical production, and this explains usage for all

other CoPs except digital creatives. For this CoP, the most common usage of the word 'play' is

in reference to 'investigation' by 'toying' with an idea or a resource. Digital creatives used the

word play to mean 'gaming', 'mucking around' and generally unstructured forms of learning. DC

explains that an area of his business premises is devoted to ideas creation, the focal point of

which is a pool table intended to facilitate ideas exchange between practitioners in a more

relaxing, playful environment. DW frequently uses 'play' in the context of children's ways of

learning as a way of tackling 'recurring problems' (Wenger 2013) or issues encountered during

workshops. In a discussion about a timeline as a digital resource, DW hints at this,

> you always give plastic hammers to the small kids and real ones to the grown-ups but it's quite interesting to do it the other way around (2012d, 8).

The inference is that sensory contact with artefacts and less formal forms of instruction are

needed to 'sustain learning' within this CoP. As DW points out, 'Nobody reads a manual'

(2012a, 7).


Learning style test results support the idea that digital creatives learn through play. Although

only two digital creatives undertook the LSI test, both were found to be accommodator

learners. Kolb explains that accommodation is a learning style which combines active

experimentation with concrete experience (Kolb 1984, 78). An accommodator,

> tends to solve problems in an intuitive trial and error manner, relying often on other people's information rather than on own analytic ability (McGill 2013, 3).

In keeping with his thoughts against pigeon-holing what he does, DW initially refused to

undertake the test on the grounds that 'I'm afraid the multiple choice options quite often didn't

reflect how I would want to answer, so it felt like a rather false exercise' (2013). However, the

result does correspond with the unstructured, hands-on ways of learning on the job discovered

in qualitative analysis of transcripts for this CoP.

*4.2.5.5 Learning: Academics*

Although the academics in the sample share an openness to learning outside their domain, results from Phase 1 seem to suggest that domain – or academic discipline - is a powerful determinant of learning style. For academics taking part in Phase 1, embracing new challenges is an essential part of their job and their way of learning. Academics, like digital creatives, appear to thrive working on the edge although register some discomfort in moving into new disciplines. Being stretched is regarded as a good thing by AH, 'I think everything I do is a bit like that because if it was really comfortable I would want to do something else' (2012a, 3). AA, an archaeologist, shares this need for going beyond one's own subject area pointing to the value of interdisciplinary project, 'outside everyone's comfort zone which makes it useful research' (2012, 7). This is also the way that AT, a theologian with scholarly interests in electronic forms of editing text, works on projects with colleagues from other departments and in other institutions, learning with 'overlapping circles of people that I'm in touch with for different things' (2012, 4).

Although it is difficult to typify academics' way of learning, looking at LSI results (see Appendix G) suggests that learning behaviour across the academic spectrum is typified less by role (lecturer, research fellow, postgraduate etc.) and more by discipline. According to the LSI test, all of the Shakespeare Studies and MASSACHRE lecturers who took part in Phase 1 (plus two colleagues also asked to complete the test) are accommodators and the majority of students tested (nine in total) have an accommodative learning style. The remaining students are either assimilative (two) or convergent learners (two). Interestingly, LS, the academic librarian who took part in Phase 1 also shares the same learning style as lecturers and most students of

Shakespeare Studies. If learning style and CoP are closely linked this suggests membership of the academic *and* the heritage practitioner CoP.

This does not mean that all lecturers and students share the same approach to carrying out research. For example, although the MASSACHRE lecturer (AH) and students (eg. AP, and Student B) have the same learning style as more text-focused Shakespeare Studies scholars, they express a stronger preference for direct access to cultural artefacts to further research, 'you need to be able to get to grips with the object and deal with the object at first hand' (2012b, 9). AS, a lecturer who works more with text and performance, content is often more important than medium, 'mostly what you're doing is looking at the words and what the words are doing intellectually, artistically' (2012a, 2). However, despite variations in technique and focus, like performers and digital creatives who completed the LSI test, there appears to be a *dominant* learning style among Shakespeare Institute staff and students which favours kinaesthetic ways of learning. Discerning learning styles from types of artefact use is dealt with in a more systematic way in Section 4.3.3 below.

### 4.2.6 Conclusion: Are individuals in the sample members of a community of practice?

Phase 1 clearly reveals evidence among participants of membership of one or more communities of practice. Although other theoretical frameworks such as Fleck's thought collectives, or Brown and Duguid's networks of practice, are useful in explaining deviations from Wenger's CoP model, all participants in Phase 1 manifested an interest in a common domain of knowledge, alignment with a community of people who care about this domain, and

signs of a shared practice developed to be effective in their domain. Data from Phase 1 also

suggests that members of CoPs share specific ways of addressing 'recurring problems'(Wenger

2013), and have particular ways of learning. This last characteristic is examined in more depth

in the Section 4.3 in order to explain how membership of community of practice might affect

interaction with artefacts.

### 4.3 If individuals are members of a community of practice, how does this affect how they use artefacts?

Findings from Phase 1 suggest two main reasons why membership of a CoP might affect how

individuals engage with artefacts. Firstly, a CoP's learning style appears to affect how members

use artefacts. In this section, usage behaviour is described before a connection between usage

styles and learning styles is proposed. In the process of understanding how artefacts are used,

more evidence is produced for the existence of communities of practice among participants in

Phase 1. Secondly, practitioner perspectives seem to affect how members of a community of

practice perceive the artefact and use it. Like learning style, perspectives are a form of

acculturation within a community that affect how practitioners learn from artefacts and,

subsequently, how end-users are able to interact with collections-based digital material.

Practitioner perspectives are referred to in examining the learning strengths and weaknesses of

CoPs and the dynamics between CoPs responsible for creating and using digital artefacts

(Section 4.3.3).

### 4.3.1 Artefact usage

Data suggests that the basic ways in which all individuals use artefacts are broadly similar but there are also key differences between communities of practice which suggest distinct ways of using and learning from artefacts. Additionally, these ways of interacting with artefacts appear to change depending on the nature of the interaction, i.e. whether an artefact and the environment in which it is used are predominantly physical or digital (discussed in Section 4.4). In order to explore these findings, this section first looks at generic ways of using artefacts shared by all participants in the trial before comparing behaviour between communities of practice within these broad categories of use to expose differences in how CoPs engage with the artefact.

### 4.3.2 Categories of Use

Using the constant comparative method to look for patterning in the 121 codes for use found across the sample, seven broad conceptual categories of use were identified, set out in Table 14 and listed in detail in Appendix E.

| Category of Use | Definition | No. of Child Codes | % physical | % digital |
|---|---|---|---|---|
| **Identification** | Cognitive or sensory interaction with the artefact to establish what it is | 21 | 29 | 16 |
| **Contextualisation** | The placing of an artefact in a physical or informational context to enrich understanding | 29 | 36 | 20 |
| **Interpretation** | A process of comprehension and abstraction of concrete information (supplied by the artefact) in the making of meaning | 30 | 28 | 35 |
| **Location** | The process of discovering an artefact or metadata associated with it | 3 | 0 | 3 |
| **Curation** | The process of controlling use of the artefact | 22 | 5 | 25 |
| **Induction** | The process of looking for coherence between artefacts or metadata associated with them | 8 | 1 | 1 |
| **Affection** | The process of responding to the artefact affectively | 8 | 1 | 0 |

**Table 14. Categories of artefact use in Phase 1**

These categories appear to be non-sequential and connected, and involve different forms of physical and cognitive interaction with the artefact. Although all seven categories were represented across the sample (i.e. all communities of practice use artefacts in this way), based on incidence rates of the child codes which make up each of these categories, the three main types of interaction with the artefact centred around working out what an artefact is

(identification), where it fits in to a wider physical or informational scheme (contextualisation), and what it means (interpretation). Thinking inductively about the artefact (induction), controlling its use (curation), responding to it physically and emotionally (affection), and finding the artefact (location) were proportionately far less common (the incidence of codes relating to curation and location can be explained by the discursive nature of interviews and workshops, discussed below).

Before analysing these findings, why is the grouping of use types into these conceptual categories valid and how it might be useful? One might argue that the degree of abstraction and selection involved in the development of conceptual categories for use - themselves based on the creative codification of text - is arbitrary and lacks validity. Equally, it might be thought that the aggregation of 121 codes into seven categories over-simplifies the complexities of an individual's engagement with an artefact and conceals important nuances. However, the generation of conceptual categories for use is a systematic and logical extension of the process of recursive abstraction and conceptualisation begun in the creation of codes from text and, contests Glaser and Strauss, contains a 'relevance' independent of source (Glaser and Strauss 1999, 30).

Therefore, the aggregation of codes into conceptual categories continues the process of dynamically analysing and comparing data while providing a way of describing the complexity of engagement with the artefact. By its very nature, Grounded Theory requires constant questioning of evidence as theory is developed from data,

> verifying as much as possible with as accurate evidence as possible is requisite while one discovers and generates his theory – but not to the point where verification becomes so paramount as to curb generation' (ibid., 28).

In other words, there is a danger that if a theory is arrived at too early in the process of generation it will be self-verifying and thwart the process of generation. It is important then to point out that in this case conceptualisation of use happened *after* the generation of codes in response to the recognition of, 'underlying uniformities in the original set of categories or their properties' (ibid., 110) but essentially continues the logic of the constant comparative method. This means that rather than papering over differences between how individuals use artefacts, these categories were generated from individual forms of use and would expand, contract and perhaps disappear based on the evidence of other trials involving different communities of practice, different artefacts, and different environments, and different types of use. Therefore, the formation of conceptual categories of use is both methodologically valid and useful provided one remembers that it is constantly open to change. In other words, these categories of use are dynamic representations of use, or 'theory as process' (Glaser and Strauss 1999, 32).

Looking at the seven categories of use, there are notable differences in the use of physical and digital artefacts. Since much of the workshop discussions centred on use of the digital artefact, there is a marked increase in usage under the categories location and curation as communities of practice articulated ways of using digital images and metadata. Finding and controlling use of

digital content created from artefacts dominated many of the discussions, something which did

not happen to any extent when communities of practice encountered physical artefacts in the

museum store. This might be a result of the representation in the trial of communities of

practice who are closely connected to the generation or use of images or metadata created

from physical artefacts, but it might also be a consequence of the particular qualities of digital

representations of the artefact which offer different ways of locating and using material and

challenge traditional forms of ownership.

Looking at the incidence of the three main categories of use – identification, contextualisation,

and interpretation (based on cumulative percentages across all CoPs) - there appears to be a

three-way split between these processes with slightly more identification and contextualisation

taking place with physical material (Figure 8). The higher rates of identification and

contextualisation in the museum store might be because the physicality of artefacts makes the

task of identification more sensorily engaging and encourages more activity seeking to work out

what an artefact is (identification). Equally, the lack of information attached to the artefact in

such an environment could stimulate a need to build context around the artefact

(contextualisation). Students in Phase 1 who spent most time with the physical artefact

remarked on the paucity of information identifying costumes and props, on the physical and

informational gaps between the museum's database and physical items, and on the artificiality

of the museum's typological separation of art, props and costumes which students found

unhelpful when thinking in terms of a particular play, material relating to which was physically

separated. More generally, since the act of collecting and 'museumification' normally involves

storing similar items together and decontextualisation (McLean 1997, 18) the higher rates of

identification and contextualising activity with physical artefacts could be a natural response to

this as opposed to, for example, the presentation of artefact images and metadata on the same

page in an online museum database.[80]

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[80] For instance, one student (E) remarked about a costume in the museum store, 'It would be interesting to see how it looks on stage rather than just hanging here' (2012c, 18-19).
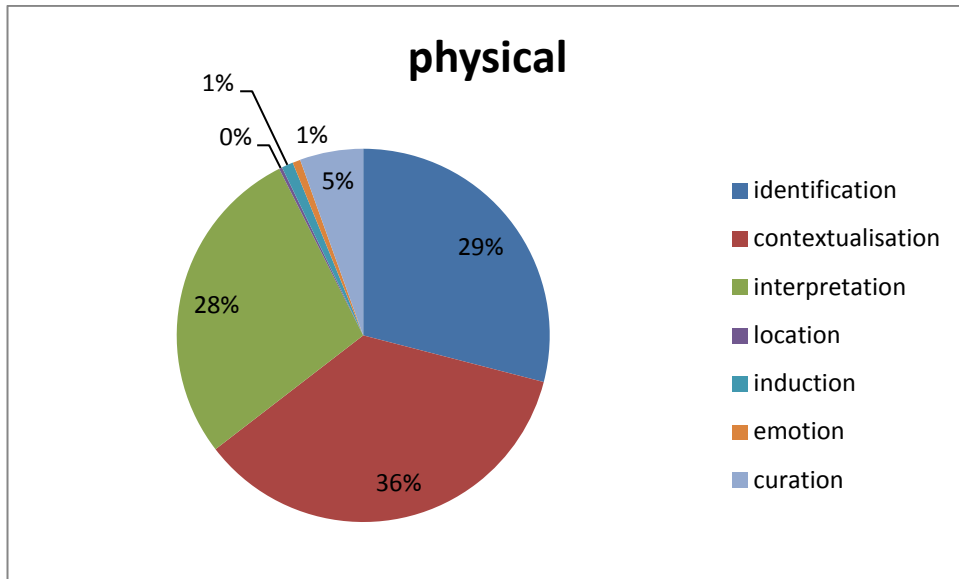
**Figure 8. Incidence of the seven categories of use of physical artefacts in Phase 1 across all CoPs**
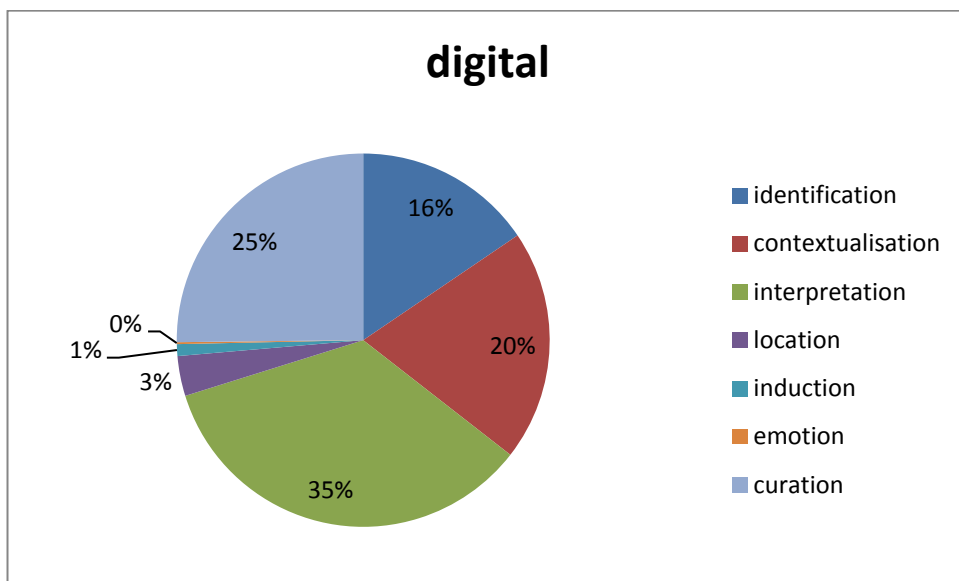


**Figure 9. Incidence of the seven categories of use of digital artefacts in Phase 1 across all CoPs**

Looking at the use of digital artefacts based on cumulative percentages across all CoPs (Figure 9), there is a marked preference for forms of use which attempt to derive meaning from the artefact, falling under the category Interpretation. The higher rate of interpretation using the

digital artefact might be because of the temporal advantages of digital material (having greater time to reflect on images and metadata as opposed to the usual limitations on time allowed with physical artefacts in a museum), the choices made in digitising the material (for example drawing attention to details of an artefact or views from different angles) or recording information about it (for example, opportunities for accessing user-generated content or interpretive blogs accompanying the artefact), or indeed the connectedness of the environment which allows an element of 'flow' (Nakamura and Csikszentmihalyi 2002) from the artefact to other information sources which might extend or deepen the process of meaning making.

Although the seven categories of use are in evidence right across the sample, there is significant variation in incidence rates between communities of practice suggesting a strong connection between membership of a CoP and the way artefacts are used. Each process of use is examined in turn to look at these variations.

### 4.3.2.1 Category of use: Location

Generally speaking, for all users of artefacts, locating material seems to be of more importance in the digital sphere than physically. This interest in searching combines 'finding artefacts', thinking about purposeful routes to encourage use (coded from the transcript as 'access routes'), and the serendipity of discovery (coded as 'discovering artefacts'). Across all practitioner transcripts recording interaction with physical artefacts, none of these codes are in evidence. This might be explained by the relatively short nature of the session and the fact that

material was pre-selected. Students who were required to inspect and select artefacts within a specific timeframe in the store were the only group who were concerned about 'finding' physical artefacts (distance learning students did not mention finding artefacts, again because they were supplied with a limited number of digital images).

However, in terms of finding artefacts online, the data suggests that digital creatives and heritage practitioners are most interested in this, but that digital creatives, performers and academics are far more concerned about creating access routes. This corresponds with the role of heritage practitioners in facilitating searching (i.e. the code 'finding artefacts') but reflects a concern among those not directly associated with artefacts and data about how material is found and used. Although academics were the only group who were interested in the discovery of artefacts (0.11% of use of digital artefacts), there was a wider discussion featuring academics and digital creatives about the pros and cons of finding data. Whilst DP spoke of how restricting access to arts-related data could lead to artefacts being 'un-findable' (2012b, 12), DW explained the benefit of freeing-up data and not overly structuring access to it. The example he gave was the value of how the Google search engine works,

> it's value is in how it doesn't work . That if the thing you put in was the thing that came back as the top line search every time for everybody, Google wouldn't make any money at all because the bare value is in the gap between what you searched for and what you clicked on (2012e, 13).

This 'creativity' (ibid.) is then compared by AH to 'the experience of a library' (2012e, 13) where serendipity plays a role in broadening research horizons. Both DW and AH agree that there are dangers in both the granularity and generality of searching online, but disagree on how to compensate for this: AH suggests that the analogy of the 'nuanced' (ibid., 14) physical search is

required whereas DW places faith in users generating their own 'taxonomy' (2012e, 13). ED

agrees with the points made by DW and mentioned repeatedly the importance of 'pathways'

(2012c, 9) to provide access routes tailored to the individual. Therefore, although heritage

practitioners have a role in the selection and organisation of artefacts and data associated with

them, the other CoPs seem to be calling for more diverse ways of accessing that data. This

appears to separate providers from producers.


*4.3.2.2 Category of use: Identification*

In trying to work out what an artefact is, practitioners and students appear to use sensory and

cerebral interaction with collections material as reflected in a notional taxonomy of codes

related to the identification of physical and digital artefacts (Figure 10).
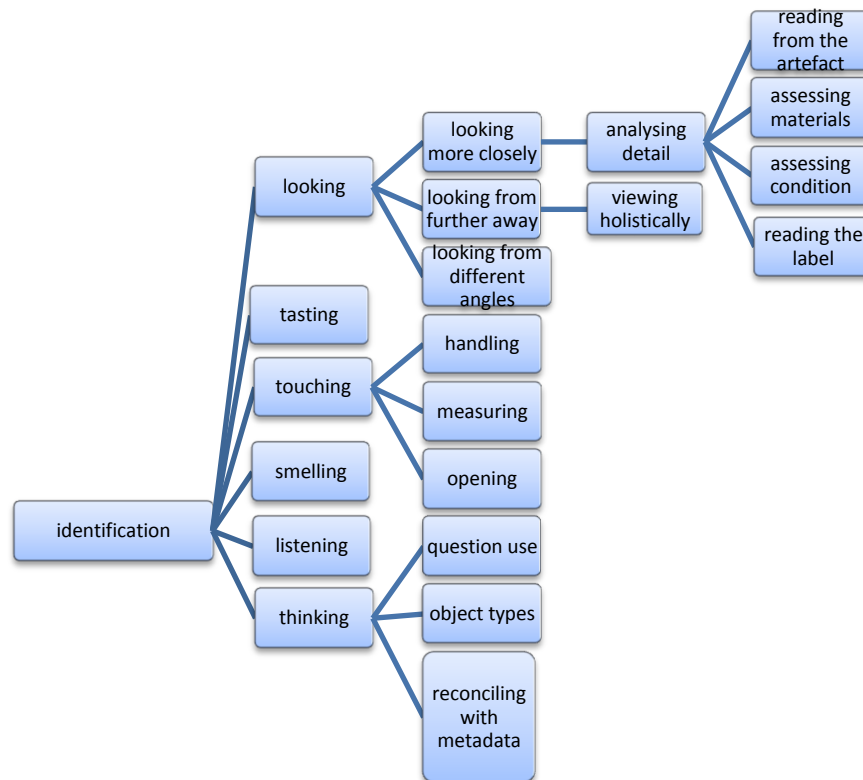
**Figure 10. Taxonomy of Use: Identification**

Identification is principally a sensory process with sight being the main way of working out what an artefact is. The most common ways of looking shared by all CoPs are to 'look more closely' and 'analyse detail' in order principally to 'assess materials' (something which happens 8% more with digital artefacts than physical) and 'assess condition' (something which happens 15% more with physical artefacts than digital). The need to look in more detail occurs at the same rate regardless of medium (physical or digital) but *what* is being looked at certainly does change, with more attention being paid to condition when an artefact is encountered in person, and materials when using a digital surrogate. Distance learning students expressed no interest in the condition of artefacts. This could be because digital images usefully convey close-up

images of artefacts (showing materials) but signs of deterioration are less visible or even

disguised through choices made in digitising the artefact.[81] Another reason might be that an

artefact's materiality is harder to ascertain using digital representations so more attention is

paid to it, something which might be clearer from further qualitative testing.

Touching is the next most used sense for every group except digital creatives, who seem to use

other senses more.[82] Although there was consensus across CoPs in the hegemony of visual

interaction with the artefact (Figure 11), suggesting that the 'ocularcentric' (Dudley 2009, 8)

nature of the museum (Alpers 1991, 27; MacDonald 2002, 118) is perpetuated in the

digitisation process, the extent to which CoPs use sight and the other senses varies widely.
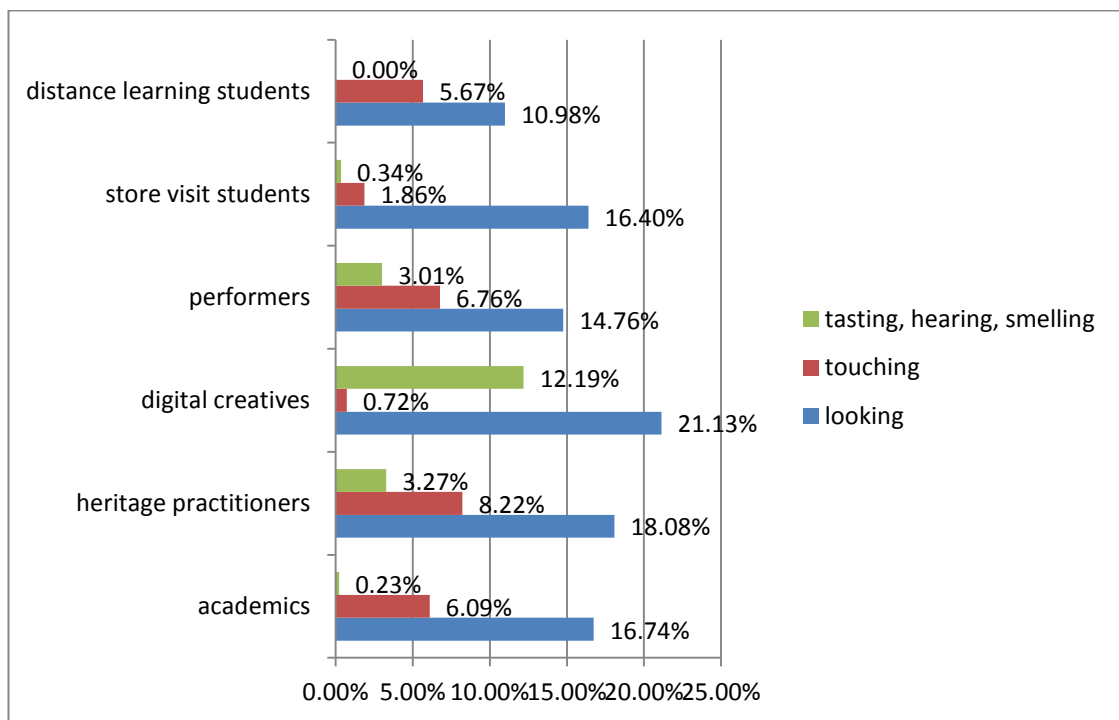


**Figure 11. Sensory identification of artefacts**

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[81] As one student commented in a blog reflecting on the transformation of the physical artefact through digitisation, 'the image privileges detail' (Student E 2012a).

[82] Touching included the manipulation of images.

Figure 12 shows the extent to which each CoP seeks to identify physical and digital artefacts. The overall rates of identification and child codes within this category reveal notable differences between CoPs.
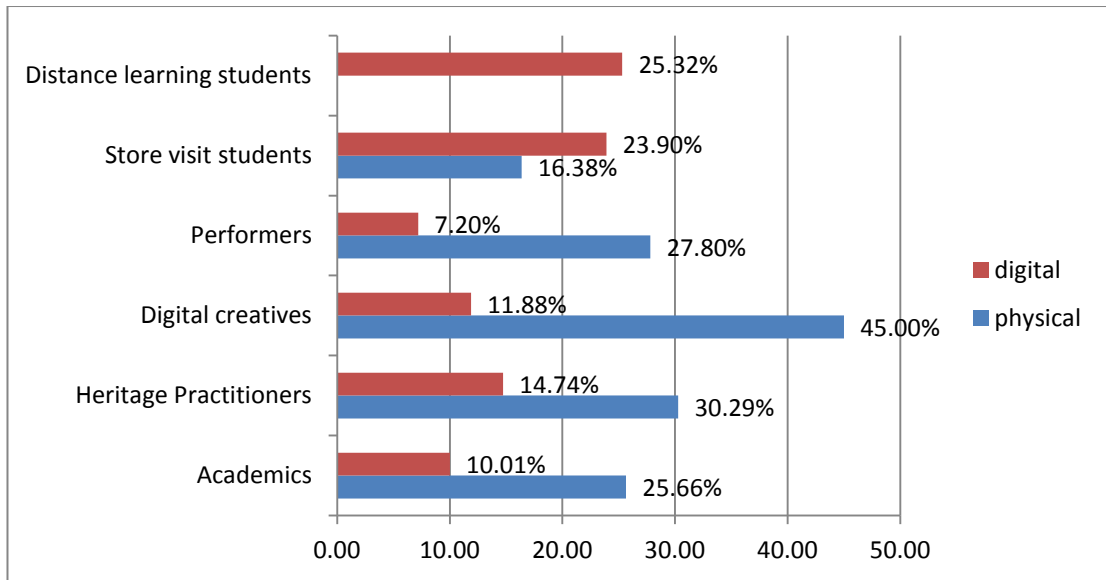


**Figure 12. Incidence rates for identification of digital and physical artefacts by CoPs in Phase 1**

Generally speaking, digital creatives use the widest range of senses in identifying the artefact (for example they are the only CoP to reference taste in the identification of an artefact), particularly with physical material suggesting there might be a connection between creativity and sensory engagement with the artefact. Digital creatives were the only CoP to talk about the use of all five senses when trying to identify the artefact. For example, DW, a digital writer, equated taste with 'truth' (2012d, 7) in talking about a child's natural instinct to place an object in its mouth to identify it. When academics use senses other than sight this is not taken seriously, there was an air of atavism and romance about the idea. For example, the smell of old photographs encountered while conducting research on primary sources (AH 2012e, 12).

Therefore, there seems to be more openness and legitimacy among digital creatives in using senses other than sight to work out what an artefact is which is not shared by other CoPs.

Academics and students spend far less time identifying digital material but demonstrate greatest variety in ways of looking at an artefact, for example, the codes 'looking from further away' (scale); 'viewing holistically' (part and whole), 'looking from different angles' (perspectives), and 'reading from the artefact' (reading written details on the artefact's surface). This visual inquisitiveness marks academics and students out as communities of practice distinct from the others. Within the student body there are different reasons for the need for alternative views of the artefacts: for Shakespeare Studies students a variety of views is important for recapturing an artefact's life on stage, whereas for MASSACHRE students there seemed to be a strong connection between 3D views of the artefact and the realness of the artefact (e.g. Student B 2012b, 19). The MASSACHRE students are also far more interested in the age of an artefact and its provenance whereas for performance students the post-stage life of an artefact is of little consequence in terms of research value.

Behind the different incidence of codes for identification of the physical artefact, rates of 'handling' are markedly higher for heritage practitioners and performers (two CoPs with experience of handling artefacts) than for all other CoPs, particularly digital creatives who did not touch the artefact at all. This also marks a split in the academic CoP between those lecturers who are accustomed to dealing directly with artefacts and those who are not. AH and AP, both historians whose research interests regularly involves direct inspection of physical artefacts, stress the importance of tactility in the investigation of the artefact, 'the need for the

manipulation, the handling of the object seems to be incredibly important when generating

new ideas and new ways of thinking about it' (AP 2012, 12). This implies that handling is

learned behaviour and, more generally, that artefact use is a form of experiential learning.

What about the influence of medium on the identification of the artefact? Overall, across all

CoPs rates of identification are significantly lower for digital material – as pointed out before –

and part of this might be because of the selective and fixed nature of digitisation or the

environment in which artefacts are used.[83]  Incidence of the codes 'assessing materials',

'assessing condition', 'analysing detail' and 'looking more closely' are all significantly higher for

all CoPs when dealing with physical artefacts compared to digital artefacts. For example, the

code 'assessing condition' is much higher (19.56%) with the physical artefact compared to

4.07% with the digital. Malraux refers to the 'specious unity' (1967, 55) of a photograph and

perhaps in the process of digitisation, the heterogeneity of the artefact, its frailties and the

clues to use which might be hinted at when assessing condition, are not fully apparent.

Material culture students certainly appeared to be much more aware of, and interested in, the

condition of the artefact than performance students. This extended to looking for clues of

former use and adaptation and to the affect its provenance might have had on the 'story' of the

artefact and how it might be interpreted today. Therefore, academic discipline and particular

ways of seeing might well be responsible for the varying level of importance of condition

assigned by participants in Phase 1.

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[83] Some distance learning students complained about features of artefacts which were inaccessible, and frustration with software, packaging of images and metadata, and so on.

Data from Phase 1 also suggests that the environment influenced how artefacts were being used. Distance learning students spent proportionately more effort trying to identify artefacts (25.3% compared to 16.38% for students in the museum store). Distance learning students registered difficulties reconciling artefacts with metadata in the VLE given the separation of image files and Word documents containing metadata. There were also technical issues using Meshlab software (needed to view 3D artefacts) within the VLE; heritage practitioners had similar technical problems using Basecamp, a project management platform used by practitioners between workshops. Therefore, the virtual environment presented technical barriers in the identification of content.

*4.3.2.3 Category of use: Contextualisation*

Figure 13 shows a notional taxonomy of child codes relating to the use category of contextualisation.
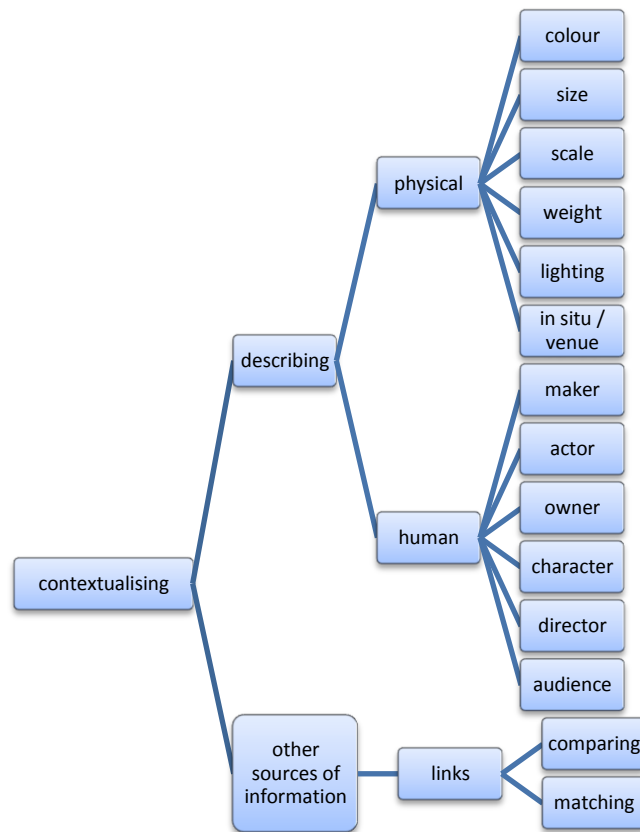
**Figure 13. Taxonomy of Use: Contextualisation**

The process of contextualisation is taken to mean the placing of an artefact in a physical or informational context to enrich understanding. This is closely related both to identification (ascertaining physical attributes to aid contextualisation) and to the interpretation of the artefact, which involves comprehension and an abstraction of concrete information (supplied by the artefact) in the making of meaning.

Generally speaking, contexualisation of artefacts happens to a greater extent with the physical artefact (60% compared to 40% with the digital) and this seems to be prompted by the human associations of a physical artefact. The codes, 'thinking about the actor' or 'thinking about character', and 'imagining the artefact in motion', are noticeably higher across the sample

when using the physical compared to the digital artefact, particularly for performers. This is true too for students who do this a great deal in the museum store (11.86%): distance learners appear to think about any of these aspects of the digital artefact. This ability to relate to the actor who once wore a costume or used a prop corresponds with the code 'imagining trying on', and 'size and scale' expressed across the sample. This preoccupation with the actor was also shared by digital creatives who seemed to appreciate the celebrity associations of particular costumes (several laughter episodes initiated by DW centred around the height of a famous actor who had worn particular costumes in the store). However, academics and both sets of students (particularly distance learners) think about the perspective of the audience more using digital material, suggesting that this way of thinking about artefacts, shared almost exclusively by academics and both sets of students, is facilitated more by the digital.

As well as the preferences of particular communities of practice, the usage environment also seems to be influential in the process of contextualisation. For example, incidence of the code 'thinking about lighting' is higher in the physical environment, perhaps because the effect of lighting in the museum store is more apparent as opposed to merely accepting the lighting conditions used in the digitisation of the artefact. Size and scale were mentioned little by distance learners (1.62%) compared to students using physical artefacts in the museum store (7.46%). Finally, the code 'creating links' is an activity which is largely confined to digital environments while comparing between artefacts is done to a greater extent in the museum store with physical artefacts. By and large, thinking of other sources of information and links to that information is more common with digital material across the sample, and comparing and

matching seems to be much easier with the physical artefact hinting at the importance of environment on the process of contextualisation.

Therefore, ways of contextualising depends on previous experience of the artefacts concerned (so there is variance across CoPs) and medium (with physical artefacts the human associations with an artefact are more apparent; with the digital there is greater focus on abstract associations such as literary or artistic context) as well as environment (which appears to influence both how artefacts are regarded and how to obtain more information to place the artefact in context).

### 4.3.2.4 Category of use: Interpretation

Finally, how did CoPs interpret the artefact? Figure 14 depicts a notional taxonomy of interpretive use of the physical and digital artefact.
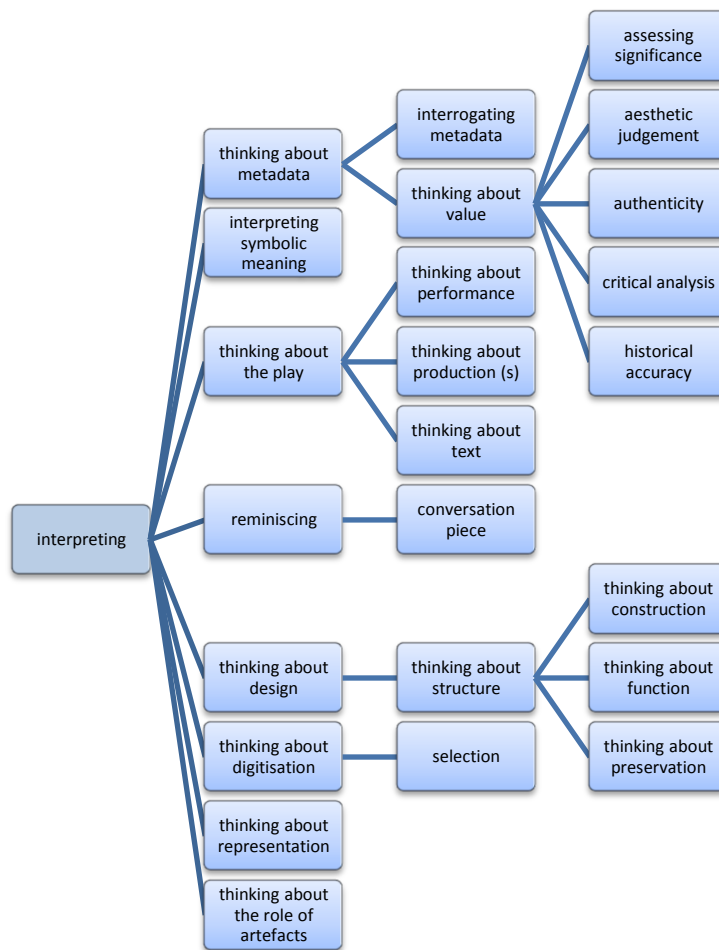
**Figure 14. Taxonomy of use: Interpretation**

As shown in Figure 15, academics and both sets of students (especially distance learners)

interpret more than any other CoP.  Unlike all of the other CoPs, academics and students show

a higher degree of abstract thinking around the digital artefact. Again this could be because of

the temporal advantages of the digital (digital artefacts can be studied for longer[84]), being

accustomed to only using digital material, or a connection between learning and flow within a

digital environment.

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[84] Analysing detail is more evident among store visit students in reflective blogs (5.97%) written afterwards compared to 3.19% use by distance learning students suggesting that the temporal advantages of digital representation are being use in 'close reading' (StudentC 2012) of the artefact, something which AH claims is done after a visit to a heritage site or collection for example to 'engage with the iconography' of a work of art (2012, 1).
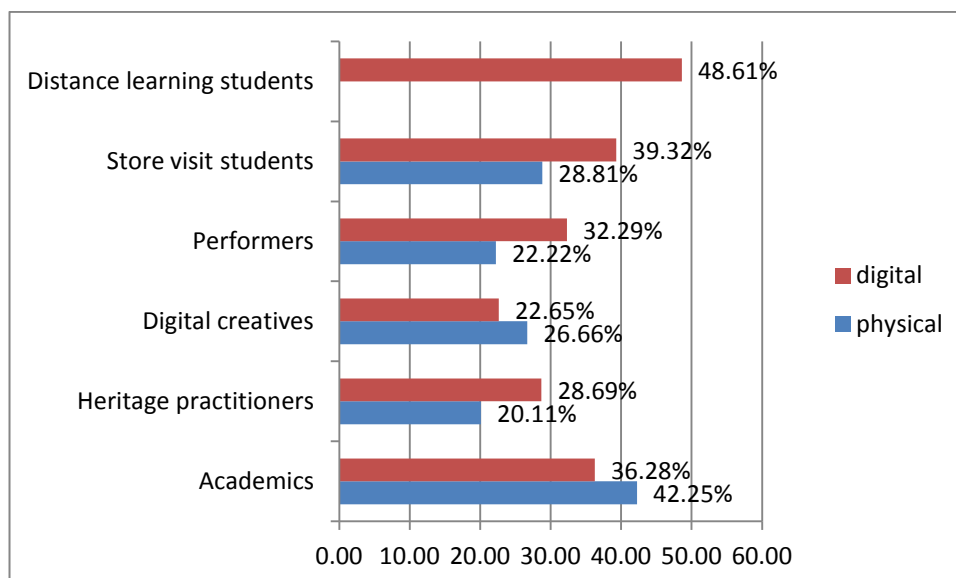
**Figure 15. Incidence of codes relating to the interpretation of artefacts by CoPs in Phase 1**

Moreover, academics and students are the only CoPs to think about the value of an artefact, its design and construction, and symbolic meaning, particularly with the physical. Indeed, these CoPs are unique in their critical analysis of artefacts.[85] Likewise, students were also the only CoP to use the code, 'interrogating metadata' (critiquing the quality of data in museum database). Students recorded in their reflective journals the inadequacy of metadata available on artefacts they were considering for selection with comments such as 'Who are the pictures and paintings by?' and 'Why is it not known to staff'. They were also sceptical of the quality of the metadata. CS admitted that some of the metadata was added by volunteers and would contain the assumptions of the cataloguer, explaining that what is captured is 'how we perceive the object when we're cataloguing it' (2012, 14). This arose because the description of one costume appeared to either be highly subjective or contain some sort of prior knowledge of the production. As such, one student said they would treat the information 'gingerly' (Student E

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[85] For example, in a reflective journal, Student B notes 'Items catalogued according to cataloguer's perception: potential for misunderstanding of concept' (Student B 2012, 3).

2012c, 53) and noted in her journal that she was making 'assumptions forced by the description' (Student E 2012b, 2).

Thinking about the authenticity of an artefact also reveals fault lines between CoPs. Actors use the authenticity of the artefact to tap in to emotions. For example, one actor spoke about visiting a gallery in Rome to prepare for a role. However, it was not the authenticity of the artefacts per se which was useful but their ability to illicit an authentic response from visitors. This then allowed the actor to gauge a 'mental state' associated with a character. For actors who took part in Phase 1, it seems to be the space between artefacts and people which is of interest. In Phase 1, academics seemed to use the authenticity of the artefact in a more factual way, assessing whether something is real or fake and using interaction as a way of assessing an artefact's significance and research value. Although DL students did mention authenticity,[86] there were no discussions about authenticity among students who visited the store, performers or digital creatives. This suggests that for students encountering the physical artefact in the context of a museum store, authenticity of the artefact is assumed. However, as noted above, authenticity of the *interpretation* of the artefact is very much open to questioning as students attempt to assess the value of metadata. Academics and heritage practitioners are the CoPs most interested in the authenticity of artefacts; this is highest among academics who are discussing digital representations of the physical artefact, and among heritage practitioners interacting with physical artefacts who spoke about the originality of artefacts during a handling session at the second workshop.

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[86] For example, DL1 writes that 'In modern performances, producers either try to be entirely authentic in their productions - desiring to reveal an accurate depiction of Shakespearean life, or they try to avoid reality completely' (2012, 1).

Interpreting the artefact, therefore, brings out practitioner perspectives and preferences defined by domain interest, knowledge and experience within each community of practice. Digitisation appears to facilitate abstract thinking around the artefact but also seems to cause end-users to question authenticity and value.

### 4.3.3 Usage styles and learning styles

How each CoP identifies, contextualises and interprets the artefact highlights differences in the way they use artefacts but what else does this tell us? Using the artefact is, like membership of a community of practice, a manifestation of an innate intention to create knowledge and to learn. Since one of the hallmarks of communities of practice is that they learn together, what does shared usage behaviour around the artefact tell us about the way that CoPs learn?

Wenger and Lave propose that collaborative learning within a CoP is about knowledge acquisition gained through practice (2009, 49). Since artefact use is a form of practice and a type of experiential learning, how communities learn ought also to be detectable from how they engage with artefacts. The corollary of this is that membership of a community of practice should be discernible from patterns of artefact usage and learning style preference. In Chapter 3, conceptual connections between learning style and artefact use as a form of practice were proposed. Based on artefact usage data from Phase 1, how can categories of use and learning styles be reconciled?

The three main categories of use identified in Phase 1– identification, contextualisation and interpretation – are concerned with use of the physical and digital artefact in making meaning through concrete experience. This means that it ought to be possible to locate each of the categories of use within the Experiential Learning Cycle proposed by Kolb. Having used recursive abstraction to generate categories of use from use codes, these processes were then mapped to quadrants within Kolb's Experiential Learning Cycle to match use behaviour with learning styles (see Section 3.4.3). Both locating artefacts and responding to them affectively would seem to logically fit in the concrete-experimental quadrant of Kolb's cycle since it is 'action-oriented' and 'encourages independent discovery' (McGill 2013, 3). Contextualisation is a process which involves largely divergent knowledge grasped by apprehension when exposed to concrete experience. For example, 'links between things', 'matching', and 'thinking about other information' all concern drawing on data from a diverse range of sources to place an artefact in context. This corresponds most closely to concrete-reflective learning. Interpretation involves comprehension and a 'mode of adaptation to the world' (Kolb 1984, 29) which is conceptually opposed to concrete experience. Therefore, it corresponds most closely with assimilative learning. Finally, identification of an artefact entails inductive thinking, drawing on comprehension and extension to narrow down the identity of an artefact from an infinity of possibilities. This places identification in the domain of convergent knowledge between abstract conceptualisation and active experimentation. Although other processes (such as curation) are involved which map to quadrants in Kolb's learning style, these are the main areas identified in the study and are largely responsible for suggesting a dominant learning style for each CoP (shown in relation to Kolb's Experiential Learning Cycle in Figure 16).
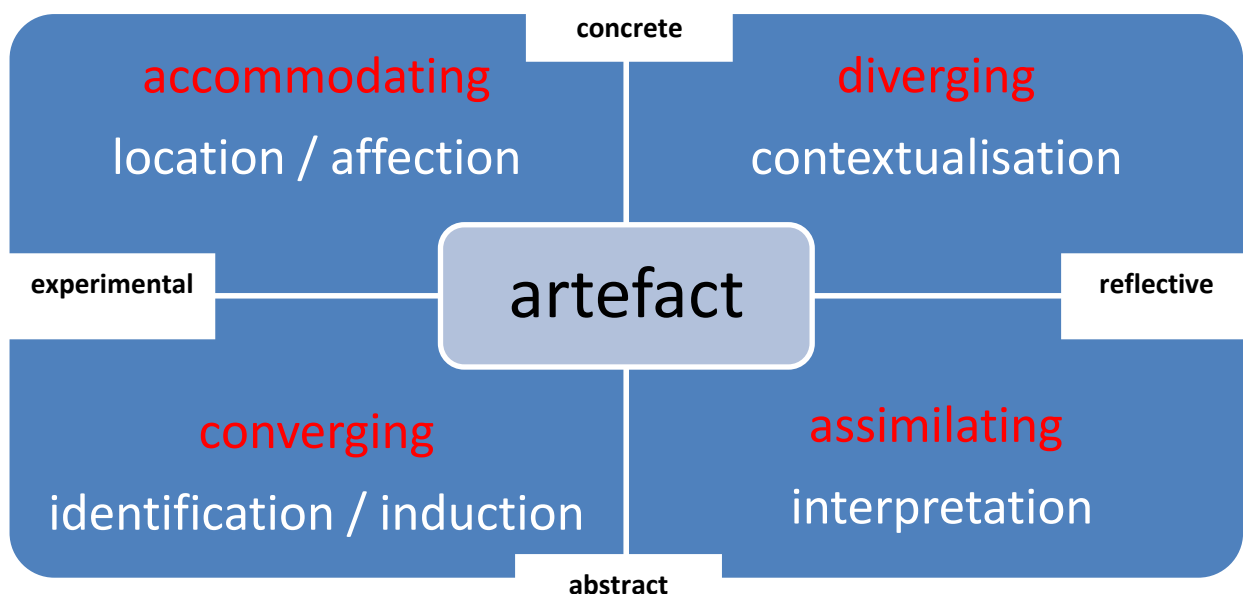
**Figure 16. Kolb Learning Styles and Categories of Use**

Although this was a relatively small sample, data indicates that different CoPs have strengths and weaknesses in the four quadrants of Kolb's Experiential Learning Cycle (ibid., 42) and this depends on whether the engagement with the artefact is physical or digital (Table 15).

| CoP | Learning Style (physical artefacts) | Learning Style (digital artefacts) |
|---|---|---|
| **Academic** | Assimilating (40%) | Assimilating (36%) |
| **Heritage practitioners** | Converging (45%) | Assimilating / Diverging (35%) |
| **Digital creatives** | Diverging (42%) | Converging (49%) |
| **Performers** | Diverging (55%) | Diverging (42%) |
| **Students (store visit)** | Diverging (46%) | Assimilating (53%) |
| **Students (distance)** | N/A | Assimilating (44%) |

**Table 15. Learning styles of communities of practice using physical and digital artefacts in Phase 1**

Looking at the correspondence between CoPs and learning style it is possible to interpret what might be happening during the encounter with the physical artefact and with digital material generated from it. Firstly, no CoPs are classified as accommodators: this is hardly surprising given the brevity of sessions with collections (physical or digital) and the degree of mediation (by gatekeepers) involved in the interaction of CoPs with artefacts in the museum store. All CoPs, except heritage practitioners and academics, assume a divergent learning style in the museum store. In this scenario, curators, librarians, archivists and collections managers were using a convergent learning style which prioritises identification of the artefact as opposed to all other CoPs (except academics) who were contextualising using a divergent learning style. Bearing in mind that heritage practitioners assumed gatekeeping roles during the object-handling events, this stylistic preference certainly makes sense. Given that all other participants were new to the artefacts used in the trial, imaginative responses (characteristic of divergent learners) which seek to make sense of physical stimuli also sounds likely and logical. This learning style pattern was reversed for heritage practitioners (and the performer CoP) when they used digitised material suggesting that with the virtual they engage in more contextualisation than identification activity.  The similarity in learning styles across the scholarly community using digital material is significant (both CoPs become assimilators) although there is a difference in response to physical material. This suggests that the scholarly community contextualises more with the 'real thing' and interprets to a greater extent with the digital.

However, the most notable relationship between CoPs and learning style is that in their 'native' environment, i.e dealing with digital material or physical artefacts, digital creatives and heritage

practitioners exhibit the traits of convergent learners (shown in Figures 17 and 18). This means that these CoPs are most focused on finding solutions to problems as their learning styles combine abstract and active elements. In their 'non-native' environment, each CoP takes on a more divergent learning style, thinking out-of-the-box and generating ideas which split off in a variety of directions. This is significant because it affects the degree of learning and innovation which can occur when these communities come together. It must also affect the packaging and presentation of digital material generated from primary sources and determines the potential use of artefacts in research.
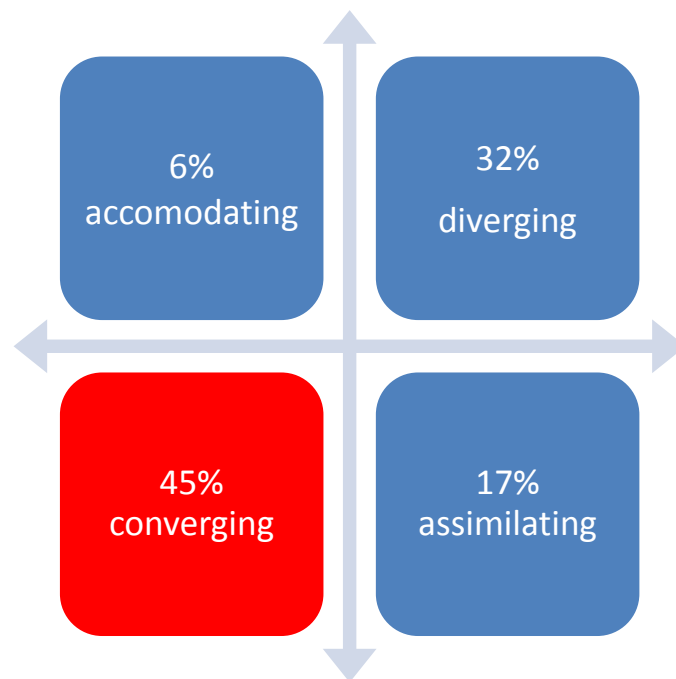


**Figure 17. Learning style of heritage practitioners using physical artefacts**
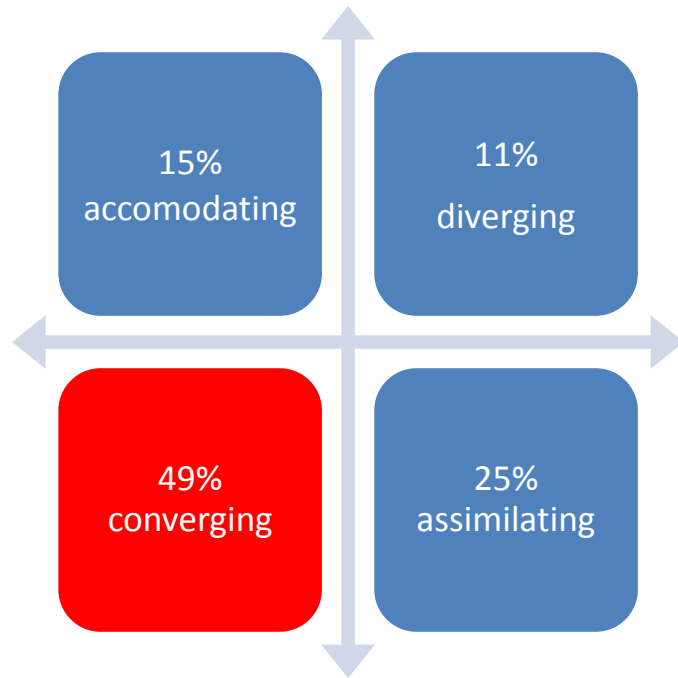
**Figure 18. Learning style of digital creatives using digital artefacts**

These findings have implications for collaborative learning and innovation in the digital supply chain. Kolb points out that specialisation of a learning style within the individual or group involves loss in the polar opposite mode of learning (ibid., 203). To ensure projects bring about creativity and growth, a balance of all four learning styles would, theoretically, be needed. At the earliest stages of a project, divergent learning styles might be most required as ideas are conceived and discussed. Interestingly, the data suggests that this might be done most effectively by exposure of real artefacts to digital creatives and by engaging heritage practitioners (and performers) in the formative stages of a digital project. This fits with the creative ideas recorded in the reflective diary of LS (an academic librarian) whose suggestions (made prior to viewing the actual cloak) on ways of presenting Prospero's cloak digitally included a circle instead of a straight line for a timeline to correspond to 17th Century cosmology and necromancy (2012a, 2). Equally, DC's explanation (given in his profiling

interview) of his company's involvement in a collections-based digital project begins with the 'need to get to grips with [...] content'(2012b, 5) and that 'normally, you get a kind of sniff of an idea and we kind of, and that's when we're brought in to help' (ibid., 6). This indicates that heritage practitioners could be responsible for much of the creative direction taken in the presentation of artefacts online but that digital creatives could benefit from earlier engagement with real artefacts (and expertise in the form of curators or scholars) pre-digitisation. This is discussed further in Chapter 6.

**4.4 What influence does environment have on artefact use?**

The environment appears to affect not only the *types* of use individuals engage in but also the *incidence* of those types of use. Although the majority of codes for use straddle both physical and digital environments, there are some types of use which are only exhibited with physical or digital artefacts. As Appendix F shows, certain forms of finding the artefact, viewing it, interpreting it, curating it, or responding to it affectively are exhibited only with physical or with digital artefacts. For instance, codes for identification such as 'looking from different angles' and 'looking from further away' and interpretive use of artefacts such as 'historical accuracy' are only recorded in digital environments. Equally, codes such as 'reminiscing', 'imagining trying on' and 'completion' are only recorded with physical artefacts. Therefore, either the nature of the artefact itself or the affordances of the environment (or a combination of both factors) seems to be responsible for eliciting different forms of usage behaviour in participants.

As noted in Section 4.3.3, overall incidence rates of usage of digital and physical artefacts are different across the entire sample as well as among different CoPs. As shown in Table 16, there is a marked decrease in rates of identification and contextualisation and a notable increase in forms of interpretation of the artefact when usage passes from a physical to a digital context.

| Use Process | Physical context | Digital context |
|---|---|---|
| Identification | 29% | 16% |
| Contextualisation | 36% | 20% |
| Interpretation | 28% | 35% |

**Table 16. Incidence rates for categories of use with physical and digital artefacts in Phase 1**

This data indicates that the environment either facilitates or obstructs ways of seeing among particular communities of practice, allowing or restricting forms of use which correspond with the interests and learning styles of those communities. In other words, environmental factors influence individuals in terms of their acculturation in the workplace but also by determining what is and is not possible in digital learning environments. Both forms of determinism are tested in Phase 2.

## 4.5 Does the method of describing and measuring artefact usage work?

Generally speaking, the process of describing and measuring artefact usage proved successful in scoping types of use and providing a basis for comparison between individuals and communities of practice. Although a degree of adjustment was needed following a pilot exercise of coding,[87] most codes for use generated from the text proved robust and

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[87] Adjustments were made to the working definition of 'use', and in deciding when the digital and the physical artefact is being invoked in discussions.

representative. This was proven by the survival of such a large number of different codes throughout the exhaustive coding of all text and by the interrogation of each code using the constant comparative method. Although this was principally an issue-based rather than action-based phase of investigation, the conceptualisation of data to form codes and use processes provided a firm basis for testing hypotheses about usage of digital artefacts in Phase 2.

However, attempts to calculate learning styles from usage behaviour did not match all of the results from the LSI test. This was probably because of a combination of test conditions, and methodological difficulties with processing and analysing the data. The mixing of CoPs in Phase 1 might have influenced usage behaviour so that, just as linguistic differences might be less apparent in the informality of such a setting and in mirroring behaviours, artefact-based forms of practice might have been less representative of individuals or communities than if conducted in isolation. The focus on talking about using artefacts rather than actually using them might also have affected results and would explain the relative absence of usage behaviour associated with the accommodative learning style. In processing data, difficulties were experienced in distinguishing between environments (digital and physical) in the coding process for Phase 1 and the exclusion of observational data in the coding process (this was used mainly to clarify the digital / physical distinction in Phase 1). These shortcomings were addressed in Phase 2 by focusing on actual use rather than discussions about use, controlling test environments and artefact-based learning goals, and coding observational as well as textual data.

**4.6    What issues are associated with the selection, digitisation and packaging of artefacts which might affect end use?**

*4.6.1    Other issues affecting end-use: Introduction*

In order to find out what other factors affect end-use of digital artefacts, three approaches were taken. Firstly, in the profiling interview, participants were asked about their involvement in previous digital projects. These questions (18 and 19, Appendix B) were designed to probe which roles different practitioners had adopted in the digital supply chain in the past and what some of the issues were with selection, the process of capture and packaging of artefacts for use. Secondly, campus-based students were asked to stipulate which features of physical artefacts should be captured digitally and then to evaluate the degree of transformation that had occurred in the products of that process. Finally, the use of digital artefacts was compared between campus-based students who had encountered the physical artefacts, and distance learning students who only used the digital material. The first approach was intended to uncover issues involved in supply of digital artefacts from the suppliers' perspectives, and the second and third approach were intended to reveal end-users' perspectives on the efficacy of the digitisation process, even when they are involved.

*4.6.2    Other issues affecting end-use: Supplying content*

Looking firstly at suppliers, the processes of selection and digitisation appear to be intimately linked and remain largely in the control of collections and technical specialists. It was clear that heritage practitioners play a lead role in both controlling access to physical artefacts for

digitisation but a more limited role in directing how this should be done. CC, a museum curator, explained her gatekeeping role in terms of selection and admission to collections,

> I've sat down and talked about what she [a digitisation project officer] can include [...] how she can physically have access to things to photograph them (2012, 5).

CC goes on to point out the passing on of experience to the digitisation specialist through training,

> I've also helped give her a bit of brief training on the proper procedures for getting things in and out of store (ibid.).

Although LS, an academic librarian, has not been closely involved in the process of capture, she has played the role of selector and adviser of what is most significant. LU mentions the act of the librarian to 'acquire material' (2012b, 1) repeatedly as well as 'collecting' (ibid., 3), 'mix and match' (ibid., 2) selection for exhibition, and 'identifying' (ibid., 1) artefacts for digitisation, underlining the role of heritage practitioner as a key selector in the use of artefacts in physical and digital form. Speaking to all heritage practitioners, there seems to be a degree of opacity in terms of the criteria for artefact selection, and then how this translates in terms of the technical approach to digital capture. Ooghe and Moreels (2009) point out that these two processes are frequently confused,

> Regarding selection and digitisation, there is often little distinction between the reasons for digitisation (e.g., increasing access) and the criteria for selection (e.g., prioritising heavily demanded materials) (ibid.).

The outcome is that selection by heritage practitioners tends to drive the process rather than 'the reasons for digitisation', usually justified on the grounds of end-user access. But a further disconnect between roles in the digital supply chain seems to happen between the gatekeeper and the digitiser roles in terms of creative and technical decisions made on photographing or scanning an item and associated metadata capture. The complicity of heritage practitioners in a

process which they ultimately do not fully control is acknowledged by LU, a rare books librarian who explains that, 'there is a real difficulty in arriving at something which is [...] effective for everybody' (2012b, 4) when talking about the technical challenges of digitising manuscripts and annotated books. Therefore, although heritage practitioners play a formative role in deciding what should be digitised and what end users have access to, this degree of determinism does appear to diminish post-selection.

For academics, their involvement in selection and digitisation is variable and generally limited but they have an interest in how this is undertaken. All academics in the sample had experience of working on digital projects and this seemed to vary according to level of technical expertise. For AH and SS, they expressed an interest in the commentary around capture and some of the issues associated with representing material, as well as a shared frustration about actually gaining access to and using digital artefacts related to their subject. AH spoke most about the selection of artefacts that have been digitised for the workshops, going on to discuss the importance of the 'process of selection' (2012b, 33) a number of times in relation to the 'survival' (ibid.) of artefacts and their absorption into collections. The control and the intellectual 'ownership' (AH 2012d, 12) of artefacts is a key issue for AH in her role as an historian. For AA and AT, they had been more closely involved in projects that experimented with digital tools and both of these academics shared an interest in user-driven innovation. For AT he was more interested in creating environments than content, speaking at length about projects to equip biblical scholars with tools to edit ancient manuscripts and he maintained throughout the profiling interview that 'I see myself as the end-user' (2012, 5). Equally, AA, an

archaeologist with a lead role in the 3D visualisation of landscapes and artefacts, stressed that

it was necessary for him to think outside the box when digitising,

> ignore the software, think about what you want to achieve, and then just find a way of
> doing it (2012, 5).

Although academics in the sample are not closely involved in the selection of artefacts for

digitisation, they are interested in the relationship between capture and use, and share a

stronger belief in the potential of the process to be determined by end-use since they

themselves are informed end-users in the digital supply chain.


The performers who took part in Phase 1 either act as mediators in the supply of content to

schools (in the case of the arts educator, ED) or end-users of archive material when researching

previous productions of a play in preparation for a role (AW 2012c, 2). In terms of mediation of

content, what is meant is that archive material which might be of use to school teachers, such

as images of costumes or production photographs, is either created anew from the RSC's

cultural collections or, more commonly, existing content is packaged for school teachers under

the direction of ED. This tailoring of resources for specific audiences is similar to the role played

by heritage practitioners but is very focused on particular end-users rather than collections.

Digital creatives are more likely to become involved in packaging digital artefacts post-capture and this usually revolves around encouraging use of metadata rather than digitisation per se.[88] DC explained his usual involvement in presenting digital material created from cultural artefacts for use,

> how you serve that, how you frame that and how you deliver that to the user in different types of context or in different situations so it's that whole sort of process (2012a, 6).

For digital creatives, the focus is on user selection and creating personalised access 'routes' (e.g. DP 2012a, 5) into data. DC spoke about 'playlists' fourteen times during the two workshops (e.g. 2012b, 27), DS also shows an interest in playlists using the word eight times (e.g. 2012a, 2), while DP speaks about 'favourites' (DP 2012c, 17) and personal 'lists' (e.g. 2012c, 11) of artefacts.

In packaging content for end-use, digital creatives expressed a frustration with the supply of metadata on cultural collections and the difficulties of stimulating uptake and use of resources. DS described the problem of a 'human bottleneck' (2012a, 1) created by relying on 'archivists' to supply collections metadata to keep up with the pace of mass digitisation.[89] However, DP is more realistic in her expectations about user uptake. She spoke about a project which tried to encourage the general public to add a story to an artefact's online catalogue record, admitting that this was over optimistic about the idea that the public would or could respond with what was imagined,

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[88] There was an incidence rate of 2.07% of the code 'Thinking about Digitisation' among digital creatives compared to 6.5% for heritage practitioners and academics, in transcripts of interviews and workshops.

[89] DS went on to explain about a project she was working on to by-pass heritage practitioners in favour of creating digital environments to allow for the crowd-sourcing of information to tackle 'metadata barriers' (2012a, 1).

actually it's your interpretation and your ability to bring context which actually changes the content of the object as it were rather than I think the idea that everyone instantly has a kind of response that they're able to turn into words is actually not really true (2012a, 1).

DP organised hacking workshops that aim to stimulate 'co-creation' (ibid., 5) of content based on principles such as 'openness, collaborative working, the idea that technology's a good thing' (ibid., 3). In playing a key role at the user end of the digital supply chain, digital creatives on the one hand face problems with the supply of usable content and on the other with the challenge of how to package that content so that users will want to engage with it and add to it. This, DP supposes, requires a balancing act between 'freedom and structure' in order to provide 'stimulus in at an appropriate level' (ibid., 3). Therefore, in a way the role of heritage practitioners in managing selection which, 'prevents us from ending up with a cumbersome mass of data that is practically and financially impossible to maintain or access' (Ooghe and Moreels 2009) is repeated in the work of digital creatives who find that although supply of material is important, actual use is more likely if the focus of their activity is narrowed.

### 4.6.3   Other issues affecting end-use: Using content

The engagement of students as directors of the supply chain in Phase 1 was intended to test whether giving end-users a degree of control in digitisation would lead to more usable digital artefacts. Having selected fourteen artefacts based on various productions of Shakespeare's play *The Tempest* (thus assuming the traditional role of heritage practitioners), students were asked what information was important to capture in the process of digitisation. A list of artefacts and priorities for digitisation was drawn up with students and this was passed to

digitisation staff at the University of Birmingham's VISTA[90] Centre to capture artefacts on the list. Metadata on each of the artefacts was prepared by a doctoral research student in accordance with the priorities given by the students. The resulting image files and metadata were then passed to those students who had originally selected artefacts and instructed digitisation for a before-and-after-style evaluation, given by three research students in reflective blogs. The digital material was also given to distance learning students to compare their responses with those of students in the museum store. The main features specified by students in the digitisation of artefacts are listed in Table 17.

| Specification | Artefacts |
|---|---|
| High resolution images of detailed and holistic shots of the artefact | All artefacts |
| Links with other related artefacts | All artefacts |
| Ability to compare with other artefacts | All artefacts |
| Measurements and weight | All artefacts |
| Modelling of costumes or demonstration of use of artefacts (convey texture, moving parts, noise etc) | All artefacts |
| Maker / designer and production / actor details related to costumes | All artefacts |
| Materials | All artefacts |
| 3D image (historic artefacts only) | Historic artefacts only |
| Date | Historic artefacts only |
| Construction | Historic artefacts only |
| Provenance | Historic artefacts only |
| Separation of basic and interpretive descriptions | Historic artefacts only |

**Table 17. Specifications made by students for the digitisation of artefacts in Phase 1, Stage 1**

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[90] Visual and Spatial Technology Centre

Although most students wanted digitisation to deliver the same things, there is a degree of differentiation among them which depends on the type of object and the discipline of the students. Material culturists were more interested in 3D representations of historic artefacts and this might be associated with their interest in construction and changes to the artefact since it was made. Whereas for students of performance the post-stage life of the artefact is of less interest, what is of most concern is recapturing the moment an artefact is used on stage. For these students, detailed and holistic imaging of the artefact, and under different lighting conditions, would be most useful. Therefore, a strong connection between the domain of interest of students and what they expect from the digitisation of material and how they would wish to use this material is apparent.

So how far did digitisation deliver what students wanted? Despite students' role in directing the process of digitisation, we can see gaps in delivery which results in different levels of satisfaction with the product. These gaps seem to depend on exposure to the physical artefact and the process of cataloguing it. Distance learning students distinguished between different types of image according to how they could be used and for whom, suggesting that decisions made during the process of capture have altered an artefact's use potential. Commenting on a close-up photograph of the blade of a sword (Image 2674), DL3 pointed out that the image was 'Good for museum archival photo but not much use from a performance perspective' (2012, 1). Looking at another photograph of the tip of the sword (Image 2704), DL3 added that the image has, 'No performance value but a fine example of markings and material for museum archives' (ibid., 2). Another image (Image 019_1) was a 'great photo for inventory or rental purposes' (ibid.). This signals a dissatisfaction with digitisation given the particular purpose this student

had in mind for the artefact (to answer a research question about performance) and a change

in value according to how an artefact had been represented. Repeated distinctions are made

between the adequacy of a photograph for internal purposes (i.e. identification in a collection)

and its use beyond the repository. Therefore, students appear to regard some images as a

museum record, while others are more usable by providing information more geared towards

their research interest. In other words, they detect a degree of intentionality behind the taking

of these photographs.


The students' criteria for selection of artefacts suggests the importance to them of original

(stage) context and the use potential of images and metadata might be related to how far these

facilitate a reimagining of an artefact's original context of use. DL2 stresses that 'Images need a

context' (2012a, 2) while DL3 states that a particular photograph is 'unintelligible [...] when

standing alone' (2012, 2). Student C makes it clear that, for her, digitisation is a process of

decontextualisation. In speaking about an image of a robe worn by Derek Jacobi in 1982 as

Prospero (SBT 2012) she points out that, 'Digitised, divorced from its context, the costume

insists upon its singularity' (2012, 1).


Although the parameters of selection were narrowed by the play and the research question,

the artefacts they chose collectively showed that the completion of a particular outfit,

'collating' (AS 2012b, 31) Prospero's cloak, staff and book from a particular production, was as

important to them as an artefact's association with iconic or 'seminal productions' (Student D

2012, 20) or 'selecting costumes that are emblematic of a performance' (Student B 2012a, 44).

One student claimed that bringing together the whole outfit worn by a character is more likely

to achieve, 'full usefulness in interpreting performance choices' (DL3 2012, 2) just as digitising

those costumes worn by key characters (10 of the 14 artefacts selected relate to Prospero, one

of the protagonists in *The Tempest*) and from well known productions of the play are more

likely to excite interest as well as 'reveal performance choices' owing to their prominence.

Student E speaks about the 'double vision' (Student E 2012a) which digitisation necessitates in

the astute researcher,

> at times it is hard to know whether the connotations that arise [from 'reading' the digital artefact] are a function of the costume or of its digitisation: the image privileges detail, and thus, a kind of double vision is needed to negotiate the boundary between what can be perceived by an audience because of its design; a spectator in an exhibition space because of its proximity; or by an online-viewer because of its digitisation (ibid.).

Student E makes the point that digitisation is affecting how students 'see' the artefact and that

this probably affects how they should second-guess how an audience once 'saw' the artefact,

given the degrees of separation between the staged-artefact, the displayed /stored-artefact

and the digitised-artefact. Digitisation is, therefore, responsible for a form of dramatic irony,

allowing the user of a digitised costume a view of the artefact which was not possible for the

audience and, as such, should be treated judiciously.

Information about the context of capture appears also to be very important to student end-

users. For DL2, an explanation of why images were taken and what they were intended for is

vital,

> I missed a kind of background or contextual information regarding the images. Something like: "These images were taken for such and such purpose…They can be used for such and such…", etc (2012a, 1).

Student A also makes a point about distinguishing between images according to the context of capture,

> it depends on what kind of image because if it's a production image then you get to see it in a completely different context and perhaps something which can give you further insight into that performance cos here it's, it's things are like stored but in a theatrical space is totally different (Student A 2012, 20-21).

Therefore, vital contextual information of relevance to researchers of performance history (e.g. how a costume looked on stage, how it moved, how it affected the actor's movement, as well as what has been done during digitisation) might be left out in focusing digitisation on particular aspects of an individual artefact.

The efficacy of digitisation can also be gauged from what students did not say as well as what they did. Codes for use concerning the weight, texture and condition of the artefact were entirely absent from the distance learning student transcripts. This means that distance learning students did not express an interest in these features of the artefact compared to students who had encountered the physical artefacts at first hand suggesting that digitisation appears to be removing data of value to research students, despite the involvement of their peers in specifying how these artefacts should be represented. In comparing an artefact with its digital representation, Student E admits that 'much is lost in the digital image's composition' (2012a) and the 'eloquence' of the physical artefact is 'frustrated' and 'muted by its digitisation' (ibid.). The loss of 'tactile associations'; and the pliability of the costume, experienced in the museum store, are 'harder to extrapolate from the virtual images' (ibid.). However, only students who encountered the artefact in digital form drew attention to its authenticity, historical accuracy, aesthetics and value.

Therefore, apart from difficulties in representing aspects of the artefact's physicality, the process of digitisation also seems to be causing a qualitatively different response, leading students to question the authenticity of an artefact (is it real or is it fake?) and its research value, as opposed to assumptions of authenticity and value in the museum store.  This difference between those students who dealt only with the digital and those who worked with both the physical and the digital artefacts is made clear in their opinion on the partiality (Student E 2012a) of images and metadata, or the degree of trust they place in the relationship between the physical artefact and its digital representation. For students who interacted with physical artefacts in the museum store and specified how they should be digitised, they regarded the images produced favourably but called into question the quality of the metadata that accompanied both the physical and the digital artefacts. For these students the images 'partially tempered' (ibid.) the subjective nature of the metadata and allow for different forms of interpretive response. Whilst the metadata 'does little justice' (ibid.) to the physicality of artefact and relates 'too confident a narrative' (ibid.) which can mislead the researcher, the images are 'presented impartially' (ibid.) and provide a 'record' (Student C 2012) of the artefact which 'gives a lie to the catalogue description' (ibid.) and offers 'a space for speculation' (ibid.) through 'the opportunity to study the costume by a process akin to close-reading' (ibid.) in different light conditions. This might be because the process of reconciling metadata from the museum database with physical artefacts was difficult and revealed degrees of interpretation on the part of 'volunteer' (Student E 2012c, 53) cataloguers. For example, a costume (STRPG:C:TEMP.026) was described in the museum catalogue as, 'Wine coloured body suit covered with stiffened strips of material giving it a rotting flesh appearance' (SBT 2012) whereas students soon realised that this was the interpretation of a volunteer rather than a

formal description or even a reference to part of the playtext or character. This is represented

by the incidence of the code, 'reconciling with metadata', which was 4.98% among students

who visited the store and zero among distance learning students. In contrast, for students who

were only exposed to digitised material (images and metadata), the imaging of the artefact was

considered 'partial' and the veracity of the metadata was generally 'good' (DL2 2012a, 1), and

unquestioned. DL2 commented on the degree of editing that has happened before students

engage with the digital artefact,

> Even the 3D images are not a copy of the real object or costume. The image captures a perspective of it. We do not see how objects move or are used. The fact that some images have been selected means that someone else has chosen what to see (DL2 2012b, 1).

Therefore, for students who had access only to the digital artefact the image itself is crucial; for

those who had already experienced the physical artefact at first hand they regard detailed

digital images as helpful but were far more critical of their first access point to artefacts –

descriptions given in the museum catalogue. In other words, for both sets of students the

relationship between physical and digital is not explained. Since the digital artefact is for many

end-users the 'primary access-point to collections, regardless of the institutional setting within

which their analogue counterparts are housed' (Ooghe and Moreels 2009), there is perhaps

greater need for making decisions clear and standardising approaches. This underlines the

point on the importance to end-users of the context of capture, made above.

### 4.6.4 Other issues affecting end-use: Conclusion

Although all CoPs represented in Phase 1 have an important role to play in directing the selection, digitisation, and packaging of artefacts, influencing what is represented digitally and to whom, decisions made about how digitisation is carried out has an inordinate effect on the use potential of digital artefacts. Choices made at the point of capture on which aspects of an artefact will be represented, both in terms of imagining and cataloguing, and how this information will be accessed by end-users, play a large role in determining the use potential of the digital artefact. The lack of satisfaction among students in the products of digitisation even when end-users are placed in the driving seat demonstrates that digitisation is an interpretive act which is based on the selective nature of technology and the selective interests of providers of content. Although students in this case and heritage practitioners more generally, are responsible for selecting artefacts for digitisation, defining the relationship between the physical artefact and its digital representation falls to digitisation specialists and to cataloguers. The decisions made by technical staff are therefore firmly embedded in the digital artefact made available for end use. This echoes what Wenger and Lave said about the 'cultural transparency of technology' (Wenger and Lave 2009, 30) in that the products of the digital supply chain evidence the varying degrees of influence of decision makers at different points in the chain. Since defining the digital artefact 'depends on what aspect of it will turn out to be important' (Lanier 2011, 134), if the interests and learning styles of end-users are not considered by digitisers and cataloguers, and of the influence of their own learning styles and perspectives is not appreciated, then there is the real possibility of a disconnect between the use potential of the physical artefact and the use potential of the digital artefact.

**4.7 Phase 1: Summary, conclusions and hypotheses**

Returning to the central question concerning how digital artefacts are used and what factors influence use, the testing of the concept of communities of practice and the derivation of quantitative data from interviews and workshops has revealed important patterns in the way that artefacts are used as well as suggesting factors which might influence use. These findings can be expressed as a number of hypotheses that need testing.

As a way of understanding the dynamics of the digital supply chain and the perspectives of suppliers and users of digital artefacts, Wenger's theory of communities of practice is a useful conceptual tool illuminating patterns of behaviour that might otherwise go unrecognised. Although other concepts help explain alternative ways of stewarding knowledge, the CoP model provides a way of comparing the way how practitioners identify with a particular domain, form communities and refine practice with like-minded others. It provides a framework for rationalising the way that practitioners who took part in Phase 1 identify with a domain of interest, steward knowledge about that domain, and learn collaboratively. Moreover, it seems to suggest how practitioners are likely to learn since each CoP appears to have a dominant learning style. Although Phase 1 showed that most practitioners are members of more than one CoP, of the three components of a community of practice – domain, community and practice - domain appears to be the most influential in determining which learning style is most dominant. Although in many respects members of the academic CoP exhibit the characteristics of a single community, there are signs that domain is influential in determining a CoP's learning style. Therefore, findings from Phase 1 suggest a hypothesis on the connection between domain and learning style.

**Hypothesis 1: Domain defines the learning style of a CoP**

Phase 1 identified two main factors which appear to explain how membership of a CoP might affect usage of artefacts: the roles and perspectives of practitioners involved in the supply and use of artefacts, and the influence of collective learning styles. The perspectives of practitioners on issues associated with the selection, digitisation and packaging of artefacts, suggests that these play a large part in guiding their use of artefacts, influencing the dynamics of interdisciplinary projects, and, through the crystallisation of decisions made by practitioners in creating digital artefacts, directing the scope of end-use. Data derived from discussions of artefact use indicates that the way all participants use artefacts is broadly similar (conceptualised in three major use processes: identification, contextualisation and interpretation) but there are particular patterns of use shared by members of each CoP. Since artefact use is a form of experiential learning, it has been proposed that patterns of artefact use and learning styles are connected. The corollary of this is that the learning style of a CoP might be influencing how artefacts are used. However, since data was based largely on discussions of use there remains a need to test actual usage in controlled conditions. Moreover, disparities between calculations of learning style from coding of usage and LSI testing make the findings inconclusive. Therefore, this suggests two hypotheses on artefact usage and learning style.

**Hypothesis 2: The way that artefacts are used is broadly similar but there are differences between CoPs**

**Hypothesis 3: Usage behaviour and learning styles are linked**

With some exceptions, the use of Grounded Theory to describe forms of artefact use and harvest quantitative data from usage behaviour, proved successful. However, modifications are needed in data processing (incorporating observational data into the analysis) and the

management of test conditions to assess whether the data can more closely reflect actual

usage behaviour. A measure of this will be how closely usage behaviour and calculation of

learning styles based on usage behaviour, matches the results of an independent learning style

test. Based on evidence from Phase 1 a hypothesis on methodology is proposed.

**Hypothesis 4: Grounded Theory can be used to describe and measure artefact usage**

Data from Phase 1 also indicates that the types and incidences of artefact use vary according to

the context of usage. This might be because of features of the environment and / or the format

of a digital artefact. Therefore, it is possible to form a hypothesis on the influence of

environment for testing.

**Hypothesis 5: Environment affects the usage behaviour and learning style of CoPs**

As Table 18 shows, these five hypotheses relate closely to the main research objectives listed in

Section 3.3.

| Hypothesis | Main research objective |
|---|---|
| Hypothesis 1: Domain defines the learning style of a CoP<br><br>Hypothesis 2: The way that artefacts are used is broadly similar but there are differences between CoPs<br><br>Hypothesis 3: Usage behaviour and learning styles are linked | To test the CoP model qualitatively and quantitatively<br><br>To examine how membership of a CoP might affect usage of artefacts |
| Hypothesis 4: Grounded Theory can be used to describe and measure artefact usage | To develop a method of describing and measuring artefact usage |
| Hypothesis 5: Environment affects the usage behaviour and learning style of CoPs | To test artefact use in a range of controlled environments |

**Table 18. Hypotheses based on data from Phase 1 and the main research objectives**

These hypotheses were tested in Phase 2; the results are given in Chapter 5.

# 5. RESULTS: PHASE 2 (ARTEFACTS AND ENVIRONMENTS)

## 5.1 Introduction

In Phase 1, individuals from different communities of practice associated with the supply and end-use of digital artefacts were involved in a scoping exercise designed to find out whether they were members of a community of practice and, if so, how that might affect their use of artefacts. Based on data from Phase 1, five hypotheses (listed in Table 19) were defined for testing in Phase 2. Findings from Phase 1 suggested that, although the CoP model has limitations, it helpfully illuminates how an individual's membership of a CoP might affect the way they use artefacts and the way they learn from them. A key determinant in directing both processes seemed to be the domain of interest shared by members of a CoP so the first hypothesis to be tested in Phase 2 was the extent to which domain defines the learning style of a CoP. Broad patterns were found in the way that all individuals interacted with artefacts in Phase 1 but there did appear to be differences in usage commensurate with membership of a particular CoP. The second hypothesis tested in Phase 2 is whether this pattern in generic and particular forms of artefact use is found again. Content analysis of interaction with artefacts in Phase 1 and subsequent mapping of usage typologies to Kolb's Experiential Learning Cycle and the four learning styles associated with it suggested a connection. The link between usage and learning styles was tested in the third hypothesis. Analysis of artefact use employing Grounded Theory as used in Phase 1 was tested further in Phase 2, except behavioural patterns were based on verbal, non verbal and written records of *actual* artefact use rather than transcripts of discussions about use (which was principally the case in Phase 1). Phase 1 also sought to gauge the influence of the environment on the use of artefacts and there did appear to be differences in usage behaviour and learning styles among the CoPs who took part. To this end, artefact use

by a single CoP (but representing three different disciplines) was tested in four different

controlled environments in Phase 2 (to address Hypothesis 5).

Table 19 sets out the five main hypotheses and the methodological objectives set out in

Chapter 3.

| No. | Hypothesis | Methodological objectives |
|-----|-----------|---------------------------|
| 1 | Domain defines the learning style of a CoP | Select three groups representing different disciplines from within the academic CoP<br><br>Analyse behaviour (usage of artefacts, and word use) of each group for characteristics of a CoP<br><br>Assess learning style of each group |
| 2 | The way that artefacts are used is broadly similar but there are differences between CoPs | Analyse behavioural patterns based on verbal, non verbal and written records of *actual* artefact use and compare between different user groups |
| 3 | Usage behaviour and learning styles are linked | Calculate learning style from coding usage behaviour<br><br>Calculate learning style from LSI test<br><br>Compare results |
| 4 | Grounded Theory can be used to describe and measure artefact usage | Analyse behavioural patterns based on verbal, non verbal and written records of *actual* artefact use |
| 5 | Environment affects the usage behaviour and learning style of CoPs | Test artefact use in four different controlled environments by academic users<br><br>Compare usage behaviour and learning style in each environment |

**Table 19. Hypotheses and methodological objectives for Phase 2**

In order to test these hypotheses on use, a strand of the digital supply chain was singled out involving a specific set of end-users: postgraduate students. Whilst research design in Phase 1 was scoping in nature, involving multiple communities of practice in discussions about the supply and use of physical and digital artefacts, Phase 2 involved using a single CoP (an academic community of practice made up of three student groups of end-users)[91] and testing actual use of artefacts in a series of controlled learning environments, two physical and two digital.

## 5.2 Findings

Findings from Phase 2 are presented in response to each of the five hypotheses based on findings from Phase 1.

### 5.2.1 Hypothesis 1: Domain defines the learning style of a CoP

*5.2.1.1 Hypothesis 1: Introduction*

In order to test the hypothesis that the domain of a community of practice defines its learning style, firstly the question of whether individuals are members of a CoP is addressed followed by analysis of the connection between domain and learning style based on the coding of artefact use and LSI test results.

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[91] Shakespeare Studies (SS), Digital Cultures (DC), and Egyptology (EG) students.

By virtue of enrolment on a particular course, postgraduate students express an interest in a common domain of knowledge. The stewarding of knowledge about this domain or discipline is evidenced by postgraduate students in the writing of an assessed piece of original research. Other forms of practice are regulated by course tutors via lectures and tutorials and in the marking of coursework, and to an extent, through interaction with student peers in physical and virtual environments (for example, online discussion groups). The formation of a community of learners is driven largely by the composition of a class but the different rhythms of participation and reification, group and individual work would normally be defined both by the course tutor and student peers, and by the requirements of a particular course.

Artefacts in Phase 2 were selected deliberately to draw-out domain-specific knowledge and provide qualitative evidence of membership of a community of practice; patterns of use certainly revealed knowledge differences between groups. The use of the same artefacts by both Shakespeare Studies and Digital Cultures students clearly revealed differences in *a posteriori* knowledge utilised in the identification, contextualisation, interpretation and affective use of each artefact. For example, none of the Digital Cultures students were aware of connections between the figurines used in testing and the original artworks on which they were based. In contrast, 70% of Shakespeare Studies students referenced these artworks in Environments C and D (respectively, the Holy Trinity Church bust and the so-called Chandos portrait of Shakespeare) and 40% knew that the porcelain figurine in Environment A was based on the Westminster Abbey statue of Shakespeare by Peter Schumaker. One student even admitted that this was not obvious and 'I brought Westminster Abbey to it via prior knowledge'

(SS10 2013, 2). All Shakespeare Studies students knew of the date and historical context of the Shakespeare Jubilee in Stratford-upon-Avon (1769) and used this to contextualise and interpret the mulberry bust of Shakespeare used in Environment B (e.g. SS1 2013, 7), in contrast to Digital Cultures students who first became aware of the event in reading about it in the catalogue description for the artefact. Equally, Shakespeare Studies students were able to use domain-specific knowledge to interrogate the depiction of period costume in Environment A. One student commented that the figurine's clothing, 'doesn't quite look right for Elizabethan it's more like it 17th or 18th century trying to look Elizabethan' (SS4 2013, 1), while another decided that a 'ruff' is sufficient evidence of 'a Renaissance look' (SS6 2013, 1). One student twice mentioned the peculiarity of a spelling of Shakespeare's name with reference to an inscription on a mulberry bust in Environment B. He noted, 'the Johnsonian spelling of Shakespeare without the first 'e'. Shakspeare' (SS5 2013, 4), which might help date the artefact since, 'it might be someone misspelling it in the 18th century and not following Dr Johnson' (ibid., 5).

Digital Cultures students did not evidence such categorical knowledge but they did reveal domain-specific knowledge related to the topic of their research degree. For example, Digital Cultures students were unique in using art historical knowledge to identify and interpret figurines of Shakespeare as well as drawing on knowledge of the digital humanities. For example, DC1 described the posture of Shakespeare in terms of classic Greek conventions ('contraposto' (2013, 1) and DC2 stressed his 'art history background' which made him wish to know the 'function' of an artefact (DC2 2013, 3). DC4 agreed that the interests of 'an art historical person' in an artefact will be different from 'someone who's just wandering in to the

museum and looking at something first hand' (DC4 2013, 2). Knowledge from their current

course on Digital Cultures was also based more around techniques for finding out more

information on each artefact online: DC2 would use a 'reverse image search' (2013, 4) to trace

metadata on the porcelain figure in Environment A or some other 'digital tool' (ibid., 5). DC4

spoke about a 'digital sphere' (2013, 11) for tactile interaction with an artefact, while DC1

criticises the unfulfilling use of digital technology in capturing the artefact in Environment A

(2013, 4). All Digital Cultures students repeatedly mentioned the possibilities of 3D technology

in representing artefacts. Therefore, these students evidenced stewardship of knowledge

relating to at least two different domains as they used art historical knowledge to describe and

interpret the artefact, and knowledge of digital technologies to critique each environment and

to find out more about the artefact.


Egyptology students shared the Digital Cultures students' affinity with a domain and a far

greater use of domain-specific knowledge than any other group. All Egyptology students made

some reference to belonging to a scholarly community of Egyptologists. For instance, one

student spoke about how faïence, the material from which most of the shabtis used in Phase 2

were made, is more recognisable and meaningful to Egyptologists,

> Faïence certainly means a lot to me as an Egyptologist but I think other people would
> probably be confused as to what faïence is as a material (EG4 2013, 3).

Another student went further, claiming that her technique of trying to date an archaeological

find before thinking about where it was found is 'just an Egyptology thing' (EG5 2013, 1) making

a definite connection between identification with a domain and stewardship of domain-specific

knowledge. Although all Egyptology students knew that the artefacts chosen are shabtis and

were able to explain what purpose shabtis served in Ancient Egypt, there was an acknowledgement of sub domains of knowledge within Egyptology. For example, one student referred to 'the funerary sphere of Egyptology' (EG1 2013, 6) and others were more reticent about translating hieroglyphic text given their degree of expertise in this area. Nevertheless, all students were able to utilise prior knowledge in identifying, contextualising and interpreting the shabtis used in testing and were able to express this categorical knowledge using categorical terms.

Table 20 shows the categorical or 'insider' terms used by each student group. In the case of Egyptology students, many of the terms were period-related (e.g. 'Third Intermediate Period') or associated with specific features of the shabti (e.g. 'dorsal pillar'). Shakespeare Studies students also used particular terms to refer to historical periods (e.g. 'Elizabethan' or 'Jacobean') or to the study of Shakespeare (e.g. 'bardolatry') or artefacts associated with him (e.g. 'Shakespeareana'). As mentioned above, Digital Cultures students' stewardship of knowledge of two domains was reflected in the use of categorical terms such as 'contraposto' (DC1 2013, 1), 'decoding' (DC3 2013, 6), and 'megapixel' (DC4 2013, 1).

| Group | Categorical Terms |
|---|---|
| Shakespeare Studies | Back-story; Jacobean; trinket; bardolatry; bardolatrist; doublet; nick-nacks; Shakespeareana; metadata; Elizabethan; memorialistic; memorialisation; Tudor; bog standard |
| Digital Cultures | Contraposto; metadata; S-curve; gilded; TinEye; terracotta; decoding; megapixel |
| Egyptologists | Hieroglyphic; hieroglyphic bands; hieroglyphic text; dorsal pillar; back pillar; back pedestal; mummiform; shabti(s); faïence; spell; Third Intermediate Period: New Kingdom; transliteration; afterlife; afterworld; pigment; dynasty; tomb goods; ushabti; glaze; Osiris; hieratic; RTI; false beard; shabti box; headband; find spot; Early Ptolemy; deceased |

**Table 20. Student groups and categorical terms in Phase 2**

These terms are, therefore, signifiers not only for what is intended (the age of the artefact or its physical description) but, it is proposed, for membership of a particular community of practice and a particular way of learning from the artefact.

*5.2.1.3 Hypothesis 1: Domain and learning style*

But how are these forms of practice, which evidence interest in a domain, reflected in the learning style of each CoP? The learning style of each participant was assessed in two ways: by using Grounded Theory to encode examples of artefact use of transcripts and video footage of each test session and, independently, using an LSI test. The results of each form of assessment are given in Table 21.

|  | Coding | LSI |
|---|---|---|
| SS1 | Divergent | Assimilative |
| SS2 | Assimilative | Accommodative |
| SS3 | Accommodative | Accommodative |
| SS4 | Accommodative | Accommodative |
| SS5 | Accommodative | Accommodative |
| SS6 | Assimilative | Convergent |
| SS7 | Convergent | Convergent |
| SS8 | Assimilative | Accommodative |
| SS9 | Accommodative | Accommodative |
| SS10 | Accommodative | Accommodative |
| DC1 | Convergent | Convergent |
| DC2 | Convergent | Convergent |
| DC3 | Convergent | Convergent |
| DC4 | Convergent | Assimilative |
| EG1 | Convergent | Convergent |
| EG2 | Accommodative | Convergent |
| EG3 | Assimilative | Assimilative |
| EG4 | Accommodative | Accommodative |
| EG5 | Assimilative | Divergent |
| EG6 | Assimilative | Assimilative |

**Table 21. Student learning styles based on coding and LSI testing in Phase 2**

What this shows is that for Shakespeare Studies students there appears to be a preference for the accommodative learning style. This is more pronounced in the LSI results where 70% of students seemed to share this way of learning.[92] Looking at Digital Cultures students, 75% of those who took part in testing were convergent learners according to the LSI method of testing, and 100% of students shared this learning style as calculated from coding of artefact use. For Egyptology students, the results were more mixed: according to the LSI test 33% of students

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[92] Extending the LSI test to lecturers at the Shakespeare Institute demonstrated that of the six members of staff who regularly teach these students, five were also accommodators.

are assimilative and another 33% are convergent learners. The remainder were either divergent

or accommodative learners.[93]

Why might there be variations in some of the sample? A simple answer might be multi-

membership of several communities of practice or the existence of sub domains.  Looking at

the Egyptology sample where there was greatest variation, EG1 and EG4 had recently become

museum curators so this could exert an influence on their learning behaviour, something each

remarked upon during the test session (e.g. EG1 2013, 3). Equally, the sub domains within

Egyptology referred to by student EG5 might help explain the variety of learning styles found

(2013, 1). Indeed, this concurs with a study of learning styles conducted by Kolb among

different practitioners in 1976 which found some variation within professions that are more

specialised, such as in the field of medicine.

But why might domain define learning style? The connection between domain and practice is

key in answering this question. Wenger states that,

> The domain inspires members to contribute and participate, guides their learning, and
> gives meaning to their actions (Wenger 2002, 28).

The domain directs the attention of members. It enables members to recognise that a piece of

information or a particular problem is valuable to the community at large, and demonstrates an

understanding of a community's domain and 'a commitment to a shared learning agenda'

(Wenger 2002, 29), motivates members to participate in problem-solving with other members.

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[93] Unfortunately it was not possible to obtain LSI scores for lecturers in Digital Cultures and Egyptology but this would have been a logical extension of the investigation to probe the link between domain and learning style.

This sense of communal, trained observation also fits with how Fleck describes thought collectives' way of seeing,

> It is not possible to see anything definite simply by looking. We need specific mental readiness to notice new objects or processes, to separate them from attendant phenomena, to describe them, and to turn them into subjects of collective investigations (Sady 2001b, 199).

If domain is clearly defined and practice regulated tightly within a community then one would expect learning - which is a form of improvised practice (Wenger and Lave 2009, 93) - to follow a particular pattern and for artefact-based learning to follow suit. Kolb tells us that,

> When there is a mismatch between the field's learning norms and the individual's learning style, people will either change or leave the field (1984, 88).

In this way, the domain will direct what is important in terms of knowledge stewardship and in learning, and the dominance of a learning style within a particular 'field' will influence the personal preference of individuals within the CoP. Wenger explains that what, 'guides the actual learning of the community is an insider's view of the domain' (Wenger 2002, 31) and this will be expressed in forms of 'learning-in-practice' (Wenger and Lave 2009, 56), such as artefact use. However, since the student groups who took part in Phase 2 work in close physical proximity and interact on a frequent basis, there is undoubtedly also a strong community dimension to their CoP. Observational learning theory highlights the way that community can exert an influence on learning preferences,

> individual behaviors can spread across a culture through a process called *diffusion chain.* This basically occurs when an individual first learns a behavior by observing another individual and that individual serves as a model through whom other individuals learn the behavior, and so on (Schacter and Wegner 2011, 295).

Further research which examines disparate communities within the same discipline might help determine the relative influence of domain and community in affecting the learning style of a CoP.

*5.2.1.4 Hypothesis 1: Conclusion*

In testing whether domain defines the learning style of a CoP, data suggests that the three student groups who took part in Phase 2 are members of a different community of practice centred on a particular domain or discipline. Moreover, evidence from the coding of artefact use (discussed in Sections 5.2.2 and 5.2.3) and LSI testing shows that two of the three student groups have a distinctive and dominant learning style. Although further testing would be required on a larger sample, results do indicate a connection between interest in a common domain and preference for a particular learning style.

**5.2.2 Hypothesis 2: The way that artefacts are used is broadly similar but there are differences between CoPs**

*5.2.2.1 Hypothesis 2: Introduction*

Data from Phase 2 shows that although differences exist in the way that student groups interact with artefacts in different environments, they share many of the same basic traits. This is evident in the types of use coded across all groups. Similarities in digital artefact use are examined before differences between student groups in how they interact with artefacts are highlighted and appraised.

*5.2.2.2 Hypothesis 2: Similarity in patterns of use*

Broad similarities in how all three student groups interact with artefacts were evident from coding types and incidence rates. For instance, in terms of identifying an artefact, all groups were interested in its materiality and its classification. Code incidence of 'material' and 'type' was consistent across all groups suggesting that an artefact's material composition (whether it is made of marble or plastic or bronze) and being able to identify an artefact according to standard typologies (such as 'sculpture', 'bust', or 'shabti') are fundamental aspects of the process of determining what an artefact is. This curiosity about materiality is consistent with incidence of the code 'assessing materials' in Phase 1 (Appendix E), although the need to classify an artefact according to 'type' only became apparent when recording actual use of artefacts in Phase 2.

In terms of the contextualisation of the artefact, again there were broad patterns of use shared by all of those who participated in Phase 2. The original location in which the artefact was used and when it was originally made and used appeared to be important to all groups in placing the artefact in a spatial and temporal context. This was apparent from incidence of the codes 'contextualising original location' and 'date' across all groups in Phase 2. Equally, the importance of 'detail', especially facial features in the case of the figurative artefacts selected for test sessions, and 'different views' (expressing an interest in different opinions and perspectives) in the contextualisation of the artefact, was demonstrated by all users in Phase 2.

Coding also suggested a degree of consistency across all groups in terms of how they interpreted artefacts. The importance of metadata in the interpretation of the artefact (code:

'interpreting metadata'), and interests in the authenticity (code: 'authenticity'), provenance (code: 'provenance'), condition (code: 'condition') and manufacture (code: 'manufacture') of an artefact were demonstrated by all users regardless of their CoP. There was also a degree of consensus among all groups on reading information on the artefact itself (code: 'reading the artefact') and passing comment on the aesthetics of an artefact (code: 'aesthetic judgement'). With the exception of 'provenance', these types of use were all evidenced in Phase 1, suggesting that these are fundamental aspects of how all individuals interpret the artefact.

There also appeared to be a degree of commonality in users' affective response to artefacts. Just as all users showed an interest in the materiality of the artefact, all student groups paid attention to the size (code: 'size'), weight (code: 'weigh'), colour (code: 'colour'), structure (code: 'structure') and surface (code: 'surface') of the artefact, albeit in varying degrees. All users expressed a wish to view the artefact (code: 'view artefact') in different ways and to be able to rotate it in physical and digital form. Incidence of the code 'touch' is remarkably similar across all CoPs with the exception of use within Environment B. Again, all of these codes except 'rotate' and 'surface' were evident in Phase 1.

Therefore, although further testing is needed to provide a larger statistical basis for usage behaviour, there appear to be firm patterns of use shared by all users, regardless of their community of practice.

*5.2.2.3 Hypothesis 2: Differences in patterns of use*

Despite evidence of a set of core codes for use shared by all individuals, Table 22 shows the

relative incidence of those codes grouped by category of use across all environments. With the

exception of the category of interpretation, Table 22 shows that there are notable differences

between CoPs in the rates of identification, contextualisation and affective use of the artefact.

| Use category | SS | DC | EG |
|---|---|---|---|
| Identification | 71.2 | 132.3 | 73.9 |
| Contextualisation | 100.4 | 64.8 | 80.8 |
| Interpretation | 113.9 | 121.0 | 124.5 |
| Location | 0.1 | 0.3 | 0.0 |
| Induction | 0.2 | 1.0 | 0.6 |
| Affection | 113.8 | 79.8 | 120.2 |
| Curation | 0.4 | 0.8 | 0.0 |

**Table 22. Incidence of use categories among student groups in Phase 2[94]**

Digital Cultures students appeared to invest more effort on the identification of the artefact

and far less on contextualisation, and affective use of the artefact, than any of the other

groups. Examining the incidence of codes for use within the process of Identification, Digital

Cultures students associate an artefact with a particular person (code: 'associate with particular

person'), consider posture (code: 'posture') and shape (code: 'shape') in the identification of an

artefact, and are more interested in classifying an artefact by type (code: 'type') than all of the

other groups. This perhaps reflected this group's art history training and interest in using form

(explaining an interest in, for example, 'posture') and recognised typologies to establish what

an artefact was. Conversely, these students appear less interested in the contextualisation of

an artefact with low incidence of codes such as 'historic context', 'place made', and 'part of set'

compared to other groups. Equally, Digital Cultures students' affective response to artefacts

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[94] Figures are cumulative percentages across all four test learning environments

was far less pronounced with lower incidence of such codes as 'expression' and 'weigh', although a higher incidence of codes associated with looking at different parts of an artefact were recorded for DC students. This could suggest a lack of interest in, or experience of, forms of sensory access to artefacts beyond the visual. Finally, although Digital Cultures students appear to interpret artefacts to the same extent as other CoPs, they have a greater interest in metadata associated with an artefact compared to Shakespeare Studies and Egyptology students.

Shakespeare Studies students contextualise to a greater extent than any of the other groups. Table 23 contains incidence rates for use codes which relate to the process of contextualisation and manifest the greatest differences between CoPs.

| Use Code | SS | DC | EG |
|---|---|---|---|
| date | 22.2 | 14.9 | 21.3 |
| historic context | 6.4 | 0.7 | 0 |
| place made | 8 | 2.2 | 1.3 |
| unique | 3.1 | 0.6 | 1.0 |
| contextualising current location | 6.2 | 1.2 | 0.0 |

**Table 23. Incidence of a selection of codes for contextualisation of the artefact by student groups in Phase 2[95]**

This shows that the historical context of an artefact, its age (codes: 'date', and 'anachronism'), and where it was originally manufactured (code: 'place made') are more important to Shakespeare Studies students than the other CoPs. This corresponds with ways that this CoP interpreted artefacts, for example their interest in period costume (codes: 'interpreting clothing' and 'interpreting style') as represented in the figurines of Shakespeare was not found in any other group. Shakespeare Studies students are also unique in looking for evidence of

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[95] Figures are cumulative percentages across all four test learning environments.

manufacture in identifying an artefact: they are the only CoP who looked specifically for a maker's mark (code: 'maker's mark'). These students also showed a greater interest in the rarity (code: 'unique') of an artefact, its current location (code: 'current location'), and its historic significance (code: 'historic significance'). This indicated not only an interest in artefacts related to the legacy of Shakespeare but a trained competence in assessing and using them in research.

Although Egyptology students demonstrated a similar division of attention paid to the identification, interpretation and affective use of the artefact as Shakespeare Studies students, looking at incidence levels of particular codes revealed niche interests and skills in how Egyptology students interact with artefacts. Looking at three codes which relate to the category of affective use (Table 24), Egyptology students appeared to be far more interested in the colour and lighting (code: 'lighting') of the artefact, and in its structure than the other CoPs. One student explained that the style of an artefact, often evident from the colouring and form of the shabti, is a route towards dating taken by many Egyptologists (EG5 2013, 1).

| Use Code | SS | DC | EG |
|----------|-----|------|------|
| colour | 5.9 | 4 | 14.3 |
| lighting | 0.9 | 0.8 | 1.9 |
| structure | 20.7 | 11.5 | 32.4 |

**Table 24. Incidence of three codes for use by students in Phase 2: colour, lighting and structure[96]**

As shown in Table 25, Egyptology students paid more attention to the original location (where a shabti was found) and facial features of the shabti in describing and contextualising an artefact. This is undoubtedly because shabtis can represent the deceased in some way (Mark 2012) so

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[96] Figures are cumulative percentages across all four test learning environments.

the face might provide clues to their gender and social status (Török 2008, 279), and the burial

location provides clues to both the date and cultural context of the artefact.

| Use Code | SS | DC | EG |
|---|---|---|---|
| contextualise original location | 11.2 | 11.3 | 16.4 |
| facial features | 3.8 | 5 | 9.6 |

**Table 25. Incidence of two codes for use by students in Phase 2: contextualise original location, and facial features[97]**

For Egyptology students, the interpretation of the artefact involved more reading (code: 'reading the artefact') and thinking about the original user of the artefact than all of the other CoPs.[98] The much higher incidence of reading behaviour among Egyptology students might be largely attributable to the nature of the shabti which would normally have hieroglyphs on the surface (codes: 'hieroglyphic text' and 'hieroglyphic bands') of the artefact but these features require knowledge and skills in recognising and decoding hieroglyphic signs, evident in the incidence of the codes 'transcribe' (3.2%), 'transliterate' (0.5%), and 'translate' (9.2%).

This activity is connected with 'thinking about the user' most probably because shabtis were made or sourced for a particular person and stayed with them in the tomb (James 2005, 122). Moreover, the hieroglyphic text usually contained information about the deceased (Teeter 1998) so, 'reading' the artefact or finding a translation is a vital part of interpreting their particular meaning. Since the text usually appears on the surface of the shabti, it is important to see the artefact in the round and this is no doubt responsible for the slightly higher incidence of the code 'rotate' (3.5% compared to 3.2% for SS, and 2% for DC students) and the desire by all

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[97] Figures are cumulative percentages across all four test learning environments.

[98] In the case of a shabti, the 'original user' is the deceased buried with it or rather them since shabtis are almost always found in groups.

Egyptology students to be able to see the artefact in 3D when asked about the representation

of the artefact in an optimal learning environment (Question 3a, Appendix D).  The reliance on

surface detail in interpreting the artefact makes condition an important factor for this group as

evidenced in the far higher incidence of the code, 'interpreting condition' as shown in Table 26.

| Use Code | SS | DC | EG |
|---|---|---|---|
| reading the artefact | 7.3 | 8.6 | 31.2 |
| interpreting condition | 3.4 | 4.8 | 13.1 |
| thinking about user | 9.2 | 7.9 | 16.7 |

**Table 26. Incidence of three codes for use by students in Phase 2: reading the artefact, interpreting condition, and thinking about user[99]**

Therefore, the distinctive nature of the shabti seems to require specialised ways of learning

from the artefact. However, the dual nature of the shabti (part-figurative, part-textual) and

specialisms within the field of Egyptology means that there are preferences within this CoP in

how artefacts are analysed,

> There's a split in the object really and one set of scholars might go for the text the
> other scholars might go for the rest of the shabti [...] I'd probably put it 80 or 90%
> looking for a chronology first but mightbe there's a few others that would do
> something different (EG1 2013, 1).

Indeed, these sub-domain interests might even explain the variety of learning styles among

Egyptology students. Regardless of these differing priorities in this group compared to the other

CoPs, the use of the structure of the shabti and categorical terms (mentioned in section 5.2.3)

by Egyptology students to arrive at a date made responses to Question 1a (Appendix D) on

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[99] Figures are cumulative percentages across all four test learning environments.

describing the artefact seem much more standardised and trained compared to the other CoPs.[100]

*5.2.2.4 Hypothesis 2: Conclusion*

Therefore, in testing whether the way that artefacts are used is broadly similar but there are differences between CoPs, test data shows that, although all three CoPs demonstrate generic ways of using artefacts, the use of particular knowledge and ways of responding to artefacts is distinctive to each CoP. All users were interested in the materiality and condition of the artefact, aspects of its provenance (codes: 'location', 'date', 'manufacture'), type and a diversity of perspectives on the artefact. Since all three CoPs are from the Humanities, these common interests manifested in similar ways of using the artefact might well be expressions of 'the particular configuration of situations and activities and the distinctive human element and value in those situations and activities' (Portin 1981, 18). However, data from Phase 2 also indicated that there are preferences and peculiarities in the way that students from different disciplines interact with artefacts. Digital Cultures students utilised art historical knowledge and information literacy skills in trying to identify and interpret artefacts and focused less on its contextualisation, perhaps because of a lack of knowledge or fewer competencies in placing the test artefact in a particular context. Shakespeare Studies students focused more on the historical context of an artefact and utilised prior knowledge of its connection with a particular artwork and identifying marks on the artefact to describe and interpret Shakespeare-related artefacts. Although further testing with a larger sample and different disciplines would

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[100] For example, all Egyptology students mentioned type, structure and condition in describing the artefact in each learning environment whereas this varied across the other student groups.

undoubtedly reveal other patterns in terms of generic and specialised types of use, data

suggests that the main use processes discovered in Phase 1 are also relevant in Phase 2 and

these indicate that some ways of using the artefact are, to a degree, common and predictable.

Other aspects of the usage of digital artefacts are more specific and harder to predict and this

seems to vary according to the skills, interests and experience of communities of practice, and

of individuals, and the nature of the artefact itself.

### 5.2.3 Hypothesis 3: Usage behaviour and learning styles are linked

*5.2.3.1 Hypothesis 3: Introduction*

Although evidence was cited in Section 5.2.1 suggesting that each student group was a

community of practice and that there appeared to be a dominant learning style in two of the

three CoPs, to what extent is artefact use connected with learning styles? As pointed out

above, learning styles were calculated in two separate ways to begin to answer this question. In

order to calculate learning style based on the way that participants used artefacts, codes were

generated from transcripts and observational analysis of test sessions, and then grouped in use

categories in a similar way to Phase 1. The incidence of each code was also recorded and this

was used to indicate the preferences of each individual for different types of artefact use.

These use categories were then aligned with a particular learning style according to the

mapping exercise carried out in Phase 1 (see Section 4.3.3).

*5.2.3.2 Hypothesis 3: Learning style results*

The results indicated a connection between individuals' learning styles and membership of a CoP, and that environment seemed to influence ways of learning. An average was calculated across all environments to arrive at a single, 'dominant' learning style. Separately, individuals undertook a learning style inventory test but the results from this test (given in Appendix C) were not computed until after the coding and mapping exercise was complete so as not to prejudice the outcome.

Although based on a small sample, the results indicate that there is a link between artefact usage behaviour and learning style. Table 27 shows that of the ten Shakespeare Studies students, six results matched. The loss of video data for the test session with Student SS2 might be responsible for the difference in outcome between the learning style derived from the coding and mapping exercise and the LSI test in the case of this individual.[101]

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[101] This is because most coding from observational analysis was associated with the identification and affection categories of artefacts which tended to suggest participants were more accommodative or convergent learners. This might be expected to skew the results of SS2 towards either the accommodative or convergent learning styles.

|        | **Coding**    | **LSI**       |
|--------|---------------|---------------|
| SS1    | Divergent     | Assimilative  |
| SS2    | Assimilative  | Accommodative |
| SS3    | Accommodative | Accommodative |
| SS4    | Accommodative | Accommodative |
| SS5    | Accommodative | Accommodative |
| SS6    | Assimilative  | Convergent    |
| SS7    | Convergent    | Convergent    |
| SS8    | Assimilative  | Accommodative |
| SS9    | Accommodative | Accommodative |
| SS10   | Accommodative | Accommodative |
| DC1    | Convergent    | Convergent    |
| DC2    | Convergent    | Convergent    |
| DC3    | Convergent    | Convergent    |
| DC4    | Convergent    | Assimilative  |
| EG1    | Convergent    | Convergent    |
| EG2    | Accommodative | Convergent    |
| EG3    | Assimilative  | Assimilative  |
| EG4    | Accommodative | Accommodative |
| EG5    | Assimilative  | Divergent     |
| EG6    | Assimilative  | Assimilative  |

**Table 27. Learning styles of all students who participated in Phase 2, based on coding of artefact use and LSI testing**

Table 27 also shows that the coding and LSI test results of three out of four Digital Cultures students match, which is the highest of any of the CoPs. Four out of six of the results calculated from the two tests also match for Egyptology students. Although not all results tally, and the process itself requires an averaging across different learning environments, based on this data there does appear to be a connection between usage behaviour and learning style.

*5.2.3.3 Hypothesis 3: Usage behaviour and learning styles*

So what might be behind this link? The conceptual link between use types and use categories, and between use processes and Kolbian learning styles was made in Chapter 3 (Section 3.4.3). In short, the mapping of use types to learning styles is based on the premise that artefact use is

a form of experiential learning and there are patterns between use codes which make up use categories, and parallels between these use categories and Kolb's four learning styles. The link is also based on the forces of acculturation and accentuation which Kolb claims shape, and are shaped by, learning style preferences. Given this line of logic, the incidence rates for particular types of use reflect the strength of user preferences in interacting with artefacts and it is this weight of numbers and the dominance of particular use types which determines the calculation of learning styles of individuals and CoPs. Kolb stated that, although the process of learning depends on a combination of all four learning styles, individuals have a preference for either accommodative, assimilative, convergent or divergent forms of learning. Based on both ways of assessing learning style, the majority of Shakespeare Studies students are accommodative learners and the majority of Digital Cultures students are convergent learners.

Looking at the most common types of use associated with the category of affection (aligned with accommodation) and identification (aligned with convergence) is it possible to rationalise this connection between ways of using artefacts and ways of learning? According to Kolb, 'accommodators' use concrete experience and active experimentation to learn (1984, 23-24). These learners tend to rely on 'judgements based on feelings' and 'are not primarily interested in theory; instead they like to treat each case as unique and learn best from specific examples' (McGill 2013, 2). Moreover, an accommodator's approach to learning 'relies heavily on experimentation' (ibid., 2). In other words, accommodators are active, hands-on learners who prefer a learning situation, 'that encourages independent discovery' (ibid., 3).  But how far is this reflected in the type of codes for use, and their incidence rates, aligned with this learning style? Table 28 shows the top ten codes (based on incidence rates) for Shakespeare Studies

students and Digital Cultures students in the affection category of use. What is immediately obvious are the higher values associated with Shakespeare Studies student artefact use: 81.1% compared to 55.5%.

For eight out of ten of the types of use listed in Table 28, Shakespeare Studies students are more active. Comparing these results with all use types related to the category 'affection' shows that not only are incidence rates far lower among Digital Cultures students (79.8% compared to 113.8% among Shakespeare Studies students), but the range of different codes is far narrower (36 codes by Digital Cultures students compared to 50 codes used by Shakespeare Studies students). This suggests that Shakespeare Studies students show a distinct preference for interacting with the physical attributes of the artefact (its size, shape, surface, and weight) and are more actively engaged in finding a variety of ways of doing this. In other words, they are more interested in investigating the physicality of the artefact and more inclined towards 'independent discovery' (McGill 2013, 3) in doing so. For example, based on these figures Shakespeare Studies students are more likely to wish to weigh an artefact or touch it than Digital Cultures students.

| Code | DC | SS |
|------|------|------|
| size | 12.7 | 18.7 |
| structure | 11.5 | 20.7 |
| posture | 5.5 | 3.6 |
| zoom | 4.3 | 3.2 |
| touch | 4.2 | 7.6 |
| colour | 4.0 | 5.9 |
| view artefact | 3.6 | 6.2 |
| surface | 3.6 | 6.7 |
| shape | 3.2 | 3.6 |
| weigh | 2.9 | 4.9 |

**Table 28. Incidence of ten codes for affective use of the artefact by Digital Cultures and Shakespeare Studies students, Phase 2 (figures are cumulative percentages across all four test learning environments )**

A number of factors might explain the greater propensity of Shakespeare Studies students to engage in hands-on, active learning. Compared to Digital Cultures students, the greater use of artefacts in research by Shakespeare Institute students[102] might account for their greater interest in the physicality of the artefact. Training in artefact use and relative ease of access to online and physical collections in Stratford-upon-Avon might also help explain the greater diversity of types of 'hands-on' investigation. All students at the Shakespeare Institute engage in at least some form of performance history, and exposure to dramatic performance is a key part of the curriculum. This involves 'learning by doing' (Healey and Jenkins 2000, 186). The creation of an MA in Shakespeare and Creativity in 2013 and, beyond the curriculum, the existence of two groups of players made up largely of students who regularly enact plays by Shakespeare or other Renaissance writers, might also either help explain a preference for hands-on, active learning with artefacts or, indeed, might be responsible for encouraging this way of learning.

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[102] Reflected in the Research Skills module which all students enrolled on MA Shakespeare and Theatre and MA Shakespeare and Education undertake.

Turning to Digital Cultures students, both tests indicated that the majority of students are convergent learners. Those with a convergent learning style share the accommodator's preference for active experimentation but are more inclined towards abstract conceptualisation than concrete learning (Kolb 1984, 77). This means that they are active learners only insofar as they might, in the case of an object-based learning situation, return to an artefact to solve a problem or test an idea. Convergent learners are strong problem solvers and they have a preference for active forms of engagement combined with narrowing down options through experimentation to arrive at a solution (ibid.). This is why incidence of codes for use associated with these types of activity grouped within the categories of 'identification' and 'induction' are higher for these learners. But why should Digital Cultures students show a stronger preference for identification and induction than Shakespeare Studies students? Looking at the overall rates of both use categories (identification and induction) shows a clear difference between the two CoPs: 133.3% for Digital Cultures students compared to 71.2% for Shakespeare Studies students. Table 29 sets out incidence rates for the top 16 codes for use for Digital Cultures students, compared to rates for Shakespeare Studies students.

| Use Code | DC | SS |
|---|---|---|
| type | 35.4 | 17 |
| associate with particular person | 30.3 | 14.9 |
| material | 28.5 | 21.2 |
| display case | 5.2 | 1.6 |
| stamp | 4.6 | 0.9 |
| look at middle | 4.2 | 0.0 |
| books | 3.8 | 0.7 |
| scroll | 3.7 | 0.4 |
| look at top | 3.0 | 0.0 |
| look at back | 2.8 | 1.4 |
| look at right side | 2.8 | 1.8 |
| look at left side | 0.8 | 1.3 |
| look at front | 2.2 | 3.6 |
| look at head | 1.8 | 0.1 |
| look from above | 1.5 | 0.4 |
| look at base | 1.2 | 0.4 |

**Table 29. Incidence of sixteen codes for identification of the artefact by Digital Cultures and Shakespeare Studies students, Phase 2 (figures are cumulative percentages across all four test learning environments )**

Since the Digital Cultures module is part of an MA programme in History of Art, this might be responsible for students' greater interest in an artefact's type (classifying an artefact by terms such as 'statuette', 'bust' etc), its material composition, and the display context (code: 'display case'), all of which are related to the study of Art History or, 'the fabrication of elaborate typological orders of 'specimens' of artistic activity linked by multiple chains of causality and influence over time' (Preziosi 2009, 10). This might also account for an interest in an artefact's details reflected in the variety of codes for looking at parts of an artefact, including specific details such as a 'book' and 'scroll' held by the Shakespeare figurine in Environment A. Conversely, lack of knowledge about Shakespeare iconography might be the reason why Digital Cultures students feel the need to reference William Shakespeare (code: 'associate with a particular person') more to narrow down and identify the artefact. These trained ways of

seeing (Alpers 1991) found in the Digital Cultures students sample might explain the dominance

of usage behaviour associated with identification and with the convergent learning style.

*5.2.3.4 Hypothesis 3: Conclusion*

Results from LSI testing and from coding transcripts and video footage indicate that not only do

student groups share a dominant learning style (behaviourally related to their area of study),

but that preferences in ways of learning can be explained by preferences in ways of using

artefacts. This link has implications for the use of digital artefacts and digital environments in

learning, discussed in Chapter 6.

**5.2.4 Hypothesis 4: Grounded Theory can be used to describe and measure artefact usage**

*5.2.4.1 Hypothesis 4: Introduction*

In order to assess the efficacy of a method of describing and measuring artefact usage based on

Grounded Theory, the types and incidence of codes from both research phases are analysed to

gauge how the method adapted to changes in test settings.

*5.2.4.2 Hypothesis 4: Use categories and use codes in Phase 1 and 2*

A fundamental characteristic of Grounded Theory is that it involves 'the discovery of theory

from data' rather than the 'verification of theory' using data (Glaser and Strauss 1999, 1). Glaser

and Strauss stated that the generation of theory and its verification should go hand in hand. In

the process of testing hypotheses in Phase 2, there was a danger that verification would dominate the process and generation of new insights would be stifled by attempts to confirm codes and use processes from Phase 1. However, data from Phase 2 suggests that generation and verification were occurring at the same time because new codes were created, while others (produced in Phase 1) were found to be relevant again and were reused. This suggests that the method proved versatile enough to adapt to new circumstances, while corroborating the validity of generic forms of use discovered in Phase 1.

But how far did Grounded Theory allow for the description of use in Phase 2? Table 30 shows the expansion and contraction of the number of codes in each use category from Phase 1 to Phase 2. Overall, the number of codes expanded in the three main use categories discovered in Phase 1: identification, contextualisation and interpretation. The number of new codes needed to describe types of use was most marked in identification and interpretation.  In terms of identification, the ability to look in different ways at the artefact (as noted in Section 5.2.3 in discussions about convergent learners), the specific interests of particular CoPs, or the nature of the artefact itself (as seen, for example, in the codes 'transcribe' and 'transcription' by Egyptology students) might be responsible for the increase in the variety of codes. Looking at interpretation, again the change in coding can be explained by the particular interests of different CoPs (for example, the use of the codes 'interpreting costume' or 'literary significance' by Shakespeare Studies students). There was also a significant increase in the number of codes for use in the affection category and a reduction in codes relating to curation.

| Use Process | No. of codes Phase 1 | No. of codes Phase 2 | No. of new codes generated in Phase 2 |
|---|---|---|---|
| Identification | 10 | 32 | 29 |
| Contextualisation | 29 | 36 | 19 |
| Interpretation | 31 | 38 | 24 |
| Location | 3 | 1 | 0 |
| Induction | 8 | 2 | 1 |
| Affection | 18 | 64 | 42 |
| Curation | 21 | 3 | 3 |
| **Total** | **120** | **176** | **106** |

**Table 30. Use categories and number of child codes, Phases 1 and 2**

The most likely reason for this was the change in emphasis from discussions about use among those associated with supply of digital artefacts in Phase 1, to controlled testing of individual end-users actually interacting with artefacts in Phase 2. This meant that issues around 'curation' of collections did not feature in Phase 2, while the affordances of the environment required 106 new codes for use. Data collection also became more precise as individuals could be asked to clarify any comments made – meaning that codes could describe behaviour more accurately - whereas the group nature of workshops in Phase 1 made this difficult. Consequently, codes categorised as 'location' and 'induction' in Phase 1, became better qualified and more specialised in Phase 2 and some were re-categorised as a result.[103] Therefore, changes to the collection of data, the affordances of the environment, differences in the knowledge, skills and interests of different CoPs, and the nature of particular artefacts, could all be responsible for the generation of new codes to describe new forms of use. Despite these changes, 70 codes were re-used from Phase 1 and overall incidence rates for use

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[103] For example, 'finding artefacts' in Phase 1 became 'Internet search', 'library search' and 'reverse image search' in Phase 2 and, because of the context in which they were used, were mapped to the category of contextualisation instead of location. Equally, the code 'photograph' which appeared in the category of curation in Phase 1 was reallocated to the category of 'affection' in Phase 2 due to a change in the context of use from discussions about digitisation and control (Phase 1) to capture for research use in test environments (Phase 2).

calculated across all CoPs and environments in each Phase are reasonably consistent with the

exception of the category of affection (Table 31).

| Use category | Phase 1 | Phase 2 |
|---|---|---|
| Identification | 22.5 | 23 |
| Contextualisation | 28.0 | 21 |
| Interpretation | 31.0 | 30 |
| Location | 1.5 | 0 |
| Induction | 1.0 | 0 |
| Affection | 1.0 | 26 |
| Curation | 15.0 | 0 |

**Table 31. Incidence of use categories across all CoPs in Phases 1 and 2 (figures are cumulative percentages across all four test learning environments )**

The durability of use codes and use categories between Phases 1 and 2 helps to verify the

hypothesis that all users wish to identify, contextualise and interpret artefacts. The

enlargement of the category of affection and the contraction of the other use categories, shows

that using Grounded Theory to describe and measure artefact use remains sensitive to context.

Therefore the technique appears to be capable of both the generation and verification of

theories surrounding artefact use and would be transferrable to other test settings.

*5.2.4.3 Hypothesis 4: Methodological problems*

However, certain features of the technique remained problematic. Despite adjustments made

between Phase 1 and Phase 2 to control test environments and to take into account

observational data, this method of describing and measuring artefact use remains largely a

language-based technique that depends on the expression of tacit knowledge, skills and

interests through verbal expression. Separating action from intention continued to be difficult

even in controlled environments. For example, the code, 'flicking between images' is an action but the intention could be a number of things. Equally deciding on use categories depends on context and requires the judgement of the encoder to create and refine codes. Data capture could be improved by using more sophisticated ways of tracking digital use such as eye tracking, motion sensing equipment, or more sophisticated forms of tracking within the VLE. Finally, a major factor affecting the feasibility of the technique was data processing and analysis time; the need to work from a transcription or video footage makes data processing and analysis is labour-intensive.

*5.2.4.4 Hypothesis 4: Conclusion*

Despite these drawbacks, the utilisation of Grounded Theory in Phases 1 and 2 to generate meaningful quantitative data, does indicate that an objective method of analysing artefact use is possible. Further testing of the method is needed before refinements can be made.

**5.2.5 Hypothesis 5: Environment affects the usage behaviour and learning style of CoPs**

*5.2.5.1 Hypothesis 5: Introduction*

In order to test the effect of context on use, four environments (A – D) were set up as outlined in Table 32 (described in more detail in Section 3.4.3).

| Environment | Features |
|---|---|
| A | Digital artefacts in a Virtual Learning Environment (Canvas) |
| B | Digital artefacts found online (social media sites and museum database) |
| C | Physical artefact available for handling |
| D | Physical artefact in display case |

**Table 32. Test environments in Phase 2**

The extent to which these environments accommodate or challenge individuals' learning style is examined before differences in categories of use in each of the test environments are considered. Finally, differences between the two digital environments are scrutinised and, based on data from participants, an optimal learning environment is described.

*5.2.5.2 Hypothesis 5: Use categories and environment*

Table 33 shows the distribution of usage activity by use category and by environment. This shows several significant patterns:

- Identification of the artefact generally occurs more in physical environments (Environments C and D) and the online environment (Environment B)

- Contextualisation of the artefact occurs more in the VLE (Environment A)

- Interpretation of the artefact occurs most in the online learning environment (Environment B)

- Affective use of the artefact occurs most in the VLE (Environment A) and the handling environment (Environment C)

| Use category | A | B | C | D |
|---|---|---|---|---|
| Identification | 57 | 71.1 | 69.5 | 79.8 |
| Contextualisation | 69.8 | 55.8 | 61.6 | 58.8 |
| Interpretation | 86.8 | 98.4 | 83.9 | 90.3 |
| Location | 0.1 | 0.3 | 0 | 0 |
| Induction | 0.1 | 0.7 | 0.8 | 0.2 |
| Affection | 85.8 | 72.9 | 84.2 | 70.9 |
| Curation | 0.4 | 0.8 | 0 | 0 |

**Table 33. Incidence of use categories in Environments A – D (figures are cumulative percentages across all four test learning environments )**

The environment does appear to be affording or limiting particular ways of learning but, there is not a straight split between usage behaviour in digital and physical environments and this is in keeping with the type of environment that most students said would be optimal.  However, the evidence also points to the influence of content (the nature of the artefact and the way it is presented or represented) on how artefacts are used and learning takes place.

Looking at all learning environments employed in testing, the way that artefacts are used within them suggests that all four environments appear to facilitate all four learning styles but particularly accommodative and assimilative ways of learning. Table 34 shows the total incidence rates for all CoPs within each environment, mapped to learning styles.

| Environment A | | | |
|---|---|---|---|
| Accomm | Conv | Div | Assim |
| 30 | 18 | 25 | 27 |
| Environment B | | | |
| Accomm | Conv | Div | Assim |
| 24 | 24 | 20 | 32 |
| Environment C | | | |
| Accomm | Conv | Div | Assim |
| 30 | 20 | 22 | 28 |
| Environment D | | | |
| Accomm | Conv | Div | Assim |
| 25 | 25 | 20 | 30 |

**Table 34. Learning styles calculated from codes for use in Environments A - D**

This demonstrates that the way that individuals use artefacts in Environment A and C indicates more accommodative learning activity there than any other learning style, while the way that individuals use artefacts in Environment B and D indicates more assimilative learning activity. Therefore, these environments appear to be affording particular learning styles, even for those CoPs for whom accommodation and assimilation are not dominant learning styles (such as, Digital Cultures students). The possible reasons for this will be discussed below but, it is important to point out that, although some environments appear to be favouring one way of learning, each environment is also affording all four learning styles.

Looking at the learning style of each individual and comparing this with usage activity in each of the test environments does, however, show that the physical environments are the most versatile in terms of facilitating most individuals' natural learning style. In the case of Environment C, 13 users expressed their true learning style in this environment as reflected by affection-related usage behaviour and 12 users in Environment D (Appendix G). This compares

with nine users in Environment B and eight users in Environment A, the least compliant environment in terms of accommodating an individual's natural learning style. These findings have pedagogical implications since both digital and physical learning environments are supporting a range of learning styles, something discussed in Chapter 6.

Environments A and C are the environments in which most accommodative learning appears to take place but they also score highly on encouraging artefact use related to assimilative learning. In terms of use categories, this means that the VLE and the handling environment seem to facilitate affective use of artefacts more than the other learning environments, but incidence of the interpretation of artefacts is also high. But why might this be the case?

Looking at the incidence of codes for use within the categories of affection, identification, contextualisation and interpretation across all CoPs provides some clues as to why the environment is influencing usage behaviour and, in turn, learning style. In terms of Environment C, incidence of forms of use associated with sensory interaction with the artefact are all higher. For example, incidence of the codes 'pick-up' (4.8%), 'touch' (10.8%), 'turn upside down' (2.4%), 'weigh' (5.2%), 'colour' (8.1%) are all higher in the handling environment. The range of codes for use relating to affection is far wider in Environment C compared to other environments: 42 codes compared to 36 in Environment A, 33 in Environment D, and 31 in Environment B. This includes some types of use found only in the handling environment. For example, the ability to knock (code: 'knock'), shake (code: 'shake'), count (code: 'hieroglyphic bands'), mimic the pose of a shabti (code: 'mimic pose', and 'mimic crook and flail'), and take the temperature (code: 'temperature') of an artefact were only evident in this environment.

Therefore, the physical freedom found in direct interaction with the artefact in Environment C

seems to encourage these forms of independent discovery and allows participation in active

learning, two of the key characteristics of the accommodative learning style.

The display case itself (code: 'display case', 7.9%) and its physical influence on viewing to

identify artefacts (represented by various codes which reflect looking at different parts of the

artefact) are also responsible for the higher degree of identification activity with the encased

artefact.  One student noted the display case's effect on the isolation of the artefact and

emphasised its distorting effect on viewing the artefact,

> It would be nice to take it out of its case it doesn't have to be touched but the actual
> box itself is a big distraction because of the lighting you can see it reflecting other
> objects in the room and then the corner of the case itself getting a bit of the way (DC4
> 2013, 9).

Proximity to the artefact aids identification, but the glass acts as a barrier which facilitates and

frustrates sensory access. As Dudley points out, the 'dominant visual paradigm' favoured by

museums and apparent here in a mock display environment 'brings about increased distance

and reduced intimacy'(2009, 9). This form of visual access to the artefact leads undoubtedly to

the encoding of forms of use such as 'looks at base' which are either not possible with digital

images or were not detected using this data collection technique. Just as the 'boxing' of

information available online within the VLE is found to reduce distractions and aid

interpretation, the display case appears to be intervening in the user's gaze and making the

identification of the artefact a more involved process in terms of active experimentation. Since

active experimentation is one of the two components of convergent learning, this might explain

why the encased environment favours identification and the convergent learning style.

All students appeared to contextualise the artefact within the VLE to a greater extent than in any other learning environment. For instance, the incidence rates for comparing artefacts (code: 'compare', 2.1%), speaking about artefacts in three dimensions (code: '3D', 2.1%), examining details of the artefact (code: 'detail', 7.9%), and consulting other perspectives (code: 'different views', 7.8%) are all higher in the VLE. Again, this is more likely to be because of the nature of the resources embedded within the VLE than the VLE itself. The artefact chosen for Environment A was the most intricate in terms of detail and most students seemed frustrated by the fact that more detail (such as the wording on books and a scroll on a figurine of Shakespeare in Environment A) could not be seen clearly. This prompted calls for 3D images and more information from different sources to enable the user to gain more contextual information on the artefact.

The range of codes for use relating to the category of affection (Table 35) also explains partly why Environment A appears to facilitate the accommodative learning style. But, why should the VLE be any different from the online environment in this respect? Although the overall difference in affective use of artefacts in Environment A and B is reasonably small (85.8% in A compared to 72.9% in B) Table 35 sets out the incidence of codes which might provide a clue to any differences in the affordances of each environment.

| Use code | Environment A | Environment B |
|---|---|---|
| manipulate | 1.7 | 1.2 |
| rotate | 2.5 | 1.9 |
| save | 1 | 0.5 |
| select | 0.8 | 0.2 |
| touch | 1.7 | 0.3 |
| view artefact | 5.4 | 3.5 |
| weigh | 1.3 | 0.9 |
| zoom | 5.8 | 4.9 |

**Table 35. Incidence of eight codes for affective use of the artefact by all students in Environments A and B (figures are cumulative percentages across all four test learning environments )**

Users were more inclined to manipulate the artefact in the VLE by selecting the image, saving it, zooming-in, or trying to rotate the artefact than online. They were also more likely to want to touch or view the artefact in the VLE than online. However, these affordances are more likely to be attributable to the affordances of the webpage which is embedded in the VLE, rather than the VLE since these forms of use relate to options associated with the webpage. Therefore, it is likely that the degree to which Environments A and B facilitate artefact usage related to the accommodative learning style depends on tools and features found in webpages rather than affordances associated with the structure of the VLE. This was corroborated by a number of students from each group who either expressed the opinion that the two environments were very similar when asked (for example, 'to my untutored eye, [Environments A and B] were essentially the same and I wasn't conscious of much difference' (SS4 2013, 13-14)) or who confused the two digital environments when questioned about their relative advantages and disadvantages (e.g. SS3 2013, 3).

Perceptual differences between the online environment and the VLE might account for the different ways in which artefacts are interpreted within the VLE and online.  Although the

incidence rate of codes for interpretive use of artefacts are generally higher in Environment B

than in Environment A (98.4% compared to 86%), these differences indicate that information

within the online environment is being treated with more caution than in the VLE. For example,

the higher incidence of codes such as 'provenance' (13.7% in Environment B, 4.2% in

Environment A), 'aesthetic judgement' (2.8% in Environment B, 2.2% in Environment A),

'authenticity' (1.7% in Environment B, 1.0% in Environment A), 'quality' (1.2% in Environment B,

1.1% in Environment A) and 'value' (3.0% in Environment B, 2.7% in Environment A) in

Environment B reflects a scepticism about the value of images and metadata relating to an

artefact found online compared to those within the VLE. Looking at the context of these codes

shows that students generally questioned the reliability of websites and were more likely to

trust those sites embedded within a VLE simply because they had been put there by a course

tutor (e.g. SS1 2013, 8). Moreover, the ability to contact the tutor via the VLE appears to make a

difference to the use value of artefacts placed there (SS2 2013, 11). This quality was not

confined to the VLE. One student, SS10, noted that a museum blog which was embedded in

Environment A also made the reader feel as if they could trust information contained in an

article and contact the author, unlike in a museum or in an online catalogue,

> you could ask that question and start a conversation which is always useful when
> you're researching to find somebody else that's working in a similar area (SS10 2013,
> 6).

This compares to the seemingly 'rootless' (SS4 2013, 13) nature of artefact images placed in an

online environment such as Flickr; the 'anonymous' (SS1 2013, 8) nature of their creators made

students much less trusting in using them. The importance of the validation of information by

an expert or a respected institution was also found in a study by Tenopir conducted on the

trustworthiness of library information:

Respondents report a difference in how they trust information that comes from the library versus that from the Internet [...] when information comes from the library almost all (98.2%) believe it is from a credible source. Less than half (45.9 %) reported using information from the Internet without verifying it' (Tenopir 2009, 13).

Therefore, the use of artefacts within the VLE appears to be affected by *who* placed them there as well as *what* they are and what the environment affords in terms of tools or barriers. This is what Heft (2003) refers to as the 'multidimensionality of affordances' (154) - the fact that there are 'values' at work beyond the physicality or 'digitality' (Parry 2010b, 293) of the environment.

*5.2.5.3 Hypothesis 5: Digital learning environments*

Another difference between the VLE and the online environment which affects artefact use is the framing of the on-screen work area. Although it is possible to make the tool bar disappear in Canvas so that only learning content is visible, no students selected this option. Students noted that the framing of webpages by Canvas restricted the window in which artefacts could be viewed and that removing additional scrollbars would make it 'nicer for comprehension' (DC2 2013, 8). The reduction in screen size when using Canvas does appear to impact on the use of artefacts displayed there for some students (e.g. SS9 2013, 7). However, most students were either not aware of the impingement of Canvas on what they were viewing or welcomed the ability of the VLE to reduce online 'distractions' by providing 'a space dedicated to study' (DC2 2013, 8). Indeed, this property of the VLE, and the ability for tutors to direct students to particular resources within it, are underlined in a Canvas tutorial based on 'how to post a link to the outside world, somewhere on the internet',

these sites can already be pre-selected [by the tutor], deemed as relevant, deemed as safe, and they can really help guide and focus you for instruction and really can avoid

the pitfalls of having your students search and search and search on the internet and waste a lot of time and be off-task for a while so these links can be very very informative and intentional and very deliberate for your teaching practices (Kisow 2013).

The inference made in the tutorial is that the internet is dangerous or not 'safe' and can waste time through lack of focus and distractions leading students 'off-task'. The VLE on the other hand is safe, intentional, informative, and deliberate.

This focus on resources through trusted direction and the lack of distraction from other resources might well explain the differences in the degree of interpretation found between Environments A and B but what about the higher degree of artefact usage related to convergent learning found in Environments B and D, the online and encased environments? Rates of activities related to the identification of artefacts are highest in the encased environment (79.8%) but also score highly in the online environment (71.1%) and in the handling environment (69.5%). Three codes for use stand out as users attempted to identify artefacts in the online environment: 'association with a particular person' (17.7%), 'type' (23.1%), and 'material' (22.3%). Looking at the context of these forms of use, the need to narrow down a figurative artefact's identity based on who it is based on, its classification according to type, and its material composition might be higher because the environment is less trusted than the VLE or less obvious than the physical environments. The bust of Shakespeare made of mulberry wood and used in Environment B caused most students difficulty in identifying what it was. Referring to the images alone, most students pointed out the artefact's association with Shakespeare or attempted to pin down what it was made of (e.g. 'bronze' (DC3 2013, 3), or 'wood' (SS10 2013)) or what class of artefact it belonged to (e.g.

'chess piece' (SS6 2013, 6), or 'bust' (DC2 2013, 5)) to try to answer Questions 1a and 1b. This is especially true of Digital Cultures students who, as noted above, have least *a posteriori* knowledge of these artefacts. Another reason for the higher degree of identification in Environment B could be the option to seek other information online to aid identification. One participant said that they were, 'more likely to 'travel outward' online than in VLE' (SS9 2013, 7). Therefore, although the physical affordances of Environment B were similar to Environment A, the fact that it is accessed online might be influencing the degree of caution shown by students in identifying the artefact.

### 5.2.5.4 Hypothesis 5: Optimal learning environments

Although there were some differences between physical and digital environments, the incidence rates for Environments A – D, and student responses to Question 3a (Appendix D), suggest that properties from all test environments would be needed in creating an optimal learning environment for all learning styles. Metadata appears to be much more important in digital environments than in physical environments; incidence rates for the code 'thinking about metadata' are twice as high in Environments A and B than in Environments C and D. Just like Phase 1, students were far more likely to notice the condition of a physical artefact (7.9% in Environment C and 7.5% in Environment D) than a digital artefact (3.7% in Environment A and 2.2% in Environment B) and to contextualise an artefact by considering its 'original location' (16.6% in Environment C and 8.6% in Environment D, compared to 8.3% in Environment A and 5.4% in Environment B). Equally, as noted above, users are more likely to express their individual learning style in physical environments than in digital environments and this could be

because of the absence of certain value-based distractions associated with digital artefact use; for example, questioning the authenticity of the artefact or information associated with it, in comparison to digital environments. This was summed-up by one student talking about the advantages of physical access to the artefact, 'Just the knowledge of what you're looking at is there and is real, I guess' (EG3 2013, 7). Another student also made a connection between direct, physical access and confidence about authenticity, crucial when conducting artefact-based research,

> I think even from an authenticating perspective you're able to know that this is the object you're able to handle it you can feel the connection to it (EG4 2013, 12).

This also corresponds with the findings from Phase 1 which describe the far higher incidence of the code 'authenticity' by distance learning students who had not been given direct access to physical artefacts. However, the incidence of codes in all four environments (given in Appendix F) suggests that there are elements within the physical and the digital environments that are desirable to users, and that blended learning or hybrid environments are more attractive for a range of learners rather than a straight choice between physical or digital environments. Table 36 sets out a summary of the affordances of each environment considered desirable by students based on a qualitative analysis of the types of use code in each environment (Appendix F). Both physical environments allow some forms of tactile and visual access to the artefact and choice in how this is used. As one student said,

> I think I'd like to have access to the physical objects [...] and the ability to do with it what I want to it in terms of identification just because what I want to do with it would not be what anybody else would (SS2 2013, 14).

The majority of students mentioned the importance of being in control of artefact use. This was especially the case in the physical environments but, the enclosure of the artefact in

Environment D had an effect. Both environments allowed the user to appreciate instantly the size and scale of the artefact but the glass barrier also created problems viewing the artefact and gauging its material composition through weight and temperature (SS2 2013, 11) and connoted higher status and value of the artefact (SS5 2013, 11). On the other hand, the uncased artefact removes these barriers to access, 'Object handling is 100% uninterrupted unmediated access to the object' (2013, 9).

| Physical | Digital |
|---|---|
| Manipulability<br>Tactility<br>Proximity<br>Visibility<br>Scalability<br>Weigh-ability | Share-ability<br>Contact-ability<br>Magnification<br>Citability<br>Search-ability<br>Accessibility (24 hour access)<br>Link-ability<br>Tag-ability<br>Save-ability |

**Table 36. Affordances of physical and digital environments based on the types of code for use in test environments**

The internet was considered by the majority of students as a better environment for 'deeper levels' (SS2 2013, 14) of contextual information (via links and tags), accessible anytime, more easily shared (SS8 2013, 14), and more easily referenced than an artefact displayed in a museum (SS6 2013, 11). Although limited in the test, the ability to zoom to high resolution and to search quickly and extensively was considered by students to be another advantage of artefacts presented in the VLE and online. Finally, the digital environment was also considered to be better than the physical in terms of starting 'conversations' (SS10 2013, 6) with others about an artefact and providing direct access not to the physical item but to expertise about it.

All students wished for some sort of hybrid environment which offered a way of 'Bridging the two' (EG4 2013, 12) worlds of the physical and the virtual. This would involve the type of 'unmediated' sensory access at the control of the user associated with Environment C combined with the ability to access different levels of metadata directly from the artefact. The emphasis was on user control, instant access, and flow between the physical and virtual. Not only would this provide what most students consider an ideal learning environment but it would seem to fit with the results of learning style testing. This shows that each environment supports a range of styles because features of both physical and digital environments suit all four Kolbian learning styles.

*5.2.5.5 Hypothesis 5: Conclusion*

In summary, the usage environment does seem to affect the usage behaviour and learning style of CoPs but distinctions between environments are not as clear-cut as one might expect. Only perceptual differences seem to affect how users identify, contextualise, interpret and make affective use of artefacts in a VLE compared to an online environment, although more extensive testing, probing other tools available within the VLE, and more sophisticated methods of data collection, would be needed to prove this conclusively. The physical environments provide a useful basis for comparison, highlighting the strengths and weaknesses of handling and display environments and the relative advantages and disadvantages of digital learning environments for the use of artefacts. This study also reiterates the importance of the way that an artefact is digitised and packaged since the nature of content as well as the affordances of the

environment seem to exert a strong influence on usage behaviour and ways of learning from

the artefact.

## 6. DISCUSSION

### 6.1 Introduction: The problem and the approach

Over the past decade, there has been a strong drive to create digital content from cultural collections and to use digital learning environments to cater for distance and blended learning. However, there has been little research on how the people and processes associated with the digital supply chain affect content creation, and on how digital learning environments affect end-use. In practice, this relates to three principal gaps in previous research categorised in Section 1.4 as research focus, scope and methods.

Within the context of these gaps, the research presented in this thesis focused on two main research questions:

a. How are cultural artefacts used in digital learning environments?

b. How can the theory of communities of practice help in understanding the people and processes involved in the supply and use of digital artefacts?

As outlined in Chapter 3, in order to address these questions, four main aims were identified:

- To analyse the influence of the identity, interests, experience and perspective of producers and users of content on the way they use digital artefacts

- To understand the main factors which affect digital artefact usage

- To identify the mechanics of digital artefact usage

- To analyse the influence of environment on digital artefact usage

These aims were addressed through two phases of study. In Phase 1, individuals from communities of practice (CoPs) closely involved with the supply and use of digital artefacts in Higher Education, comprising academics, digital creative professionals, curators, archivists,

librarians, theatre professionals, and students, participated in a mock digital supply chain.

Transcripts from interviews and workshops with participants were analysed using Grounded

Theory to look for patterns in how individuals use digital artefacts and what effect membership

of a CoP, and context of use, have on this process. Based on this analysis, five hypotheses were

produced. The testing of these hypotheses formed the basis for Phase 2 of the study which

focused on end-users, a single strand of the digital supply chain (involving postgraduate

students from three different academic disciplines) and four different learning environments.

Transcripts and video footage were analysed using Grounded Theory to test each of the five

hypotheses. Although conducted on a small sample, the main findings reveal significant

patterns in how all individuals interact with digital artefacts and demonstrate the influence of

the special nature of communities of practice on this process.

This chapter reflects on the main findings from both phases and on the process of carrying out

the research. Section 6.2 discusses the results of this research in relation to the four main aims.

This is followed in Section 6.3 by a reflection on the methodologies used to carry out this

research. Section 6.4 explores the relevance of these results to the broader issues outlined in

the situation and literature reviews in Chapter 2. Finally, Section 6.5 provides a summary and

conclusion on the main points from the discussion of findings, methods and implications.

**6.2 Discussion: Main aims and findings**

Results of the research are discussed below in relation to the four main aims, rephrased here as questions.

***6.2.1 What influence does the identity, interests, experience and perspective of producers and users of content have on the way they use digital artefacts?***

Evidence from both research phases suggests that membership of a community of practice appears to help define the identity, interests, experience and perspective of producers and users of content, directing their attention to particular ways of interacting with the digital artefact. As noted in Section 6.2.3, general patterns were detected in the way that all individuals who took part in both research phases interact with artefacts, described in seven categories of use.[104] However, variations in usage were also found in the dataset which seem to relate to the identity, interests, experience and perspective of communities of practice that produce and use content. One possible reason for variations between the way that different CoPs use artefacts is that the domain of knowledge around which the community is formed might be directing the perception of members to particular features of the artefact. Another related reason could be the manifestation of a particular learning style through artefact use. Most individuals who took part in the research appeared to share a preference for 'educational conditions' (Stewart and Felicetti 1992, 15) under which they are most likely to learn with members of the same CoP. In other words, ways of using artefacts might mirror ways of learning within a CoP. These forms of use might also be affected by distinctive ways of tackling recurring problems among practitioner groups such as the selection, digitisation and packaging

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[104] The seven categories of use are identification, contextualisation, interpretation, location, curation, induction and affection.

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of artefacts and views on accessing, controlling, valuing and utilising digital (and physical) artefacts by practitioners. These perspectives on the value and use of digital artefacts might affect interdisciplinary working in the digital supply chain as well as end-use.

### 6.2.2    What are the main factors affecting digital artefact usage?

Data from both research phases indicate that there are three main factors affecting how digital artefacts are used:

a.  How digital artefacts are created

b.  The context in which digital artefacts are used

c.  The learning style and perspective of the end-user

The effect of the environment on digital artefact use (b) is considered in Section 6.2.4, and the influence of the learning style and perspective of producers and users of content on digital artefact use is discussed in Section 6.2.1 above.

But what about (a), how digital artefacts are created? Research findings from Phase 1 reveal serious shortcomings in the process of digitisation and cataloguing which affect the end-use of digital artefacts. Even when end-users specified what was wanted this was not delivered, both in terms of capture (visual and other sensory information) and metadata. The requirements of end-users were translated by digitisation specialists into digital artefacts that did not meet expectations. This suggests that those who direct or carry out digitisation play a fundamental role in determining the use potential of digital artefacts. To counteract the seemingly innate partiality of digitisation and cataloguing, plurality, transparency and diversity would seem to be

important in making the creation of digital artefacts more relevant and the products more usable. As the digital supply chain becomes more complex with more user-generated content available online, knowing the fundamentals of artefact use (explained in Section 6.2.3) and being aware of the partiality of production could provide museums, libraries and archives with the upper hand in the battle for sustainability. This is discussed at more length in Section 6.4.3.

### 6.2.3 What are the mechanics of digital artefact usage?

Findings from Phase 1 and 2 expose the mechanics of digital artefact use for the first time and they highlight that more research is needed in this area. Employing a predominantly quantitative methodology to describe and measure usage of digital artefacts suggests that this activity is, to a degree, generic and predictable; users will want to identify, contextualise, interpret and make affective use of digital artefacts in the same way as they do physical artefacts. However, digitisation (and usage in digital environments) tends to make identification more difficult and certain aspects of contextualisation and interpretation easier. Other types of artefact usage are more specific and harder to predict and this seems to vary according to the skills, interests and experience of communities of practice, the aptitudes and interests of individuals, and the affordances of the environment in which interaction takes place. Although this was a small scale study, the data suggests that, while the use of artefacts in digital learning environments is not wholly objective and predictable, it is not hopelessly subjective and unpredictable.

### 6.2.4 What influence does the environment have on digital artefact usage?

The findings from both phases of research suggest the importance of environment in influencing usage behaviour. Data indicates that object-based learning is facilitated by all physical and digital environments tested in Phase 2, drawing attention to the strengths and weaknesses of each environment for users with different learning styles. Interestingly, this is not split along the lines of physical versus digital - all users tended to prefer specific aspects of both physical and digital environments, something that is supported by quantitative and qualitative data.

This research also suggests that content is key in encouraging particular types of artefact use. Within each digital learning environment tested in Phase 2, local affordances associated with, for example, artefacts found on a website or a catalogue page embedded within a VLE, seem to be as important as the tools and layout of the virtual environment. In fact, the main differences found between artefact use in the VLE and in the other online environments tested were attributable to content (either the nature of the artefact or the way it has been packaged in digital form) or the selection of that content for use. This perceptual difference between proprietary learning environments and online environments reaffirms the importance of universities' role as guides through abundance and underlines the importance of digital literacy and visual literacy, the 'reading' of images (Avgerinou and Ericson 1997), in assisting students in the use value of digital artefacts found inside and outside the institutional VLE.

### 6.2.5 Summary discussion: Aims and results

This research suggests that there are three main factors which affect the use of digital artefacts: the identity, interests, skills and experience of those involved in the digital supply chain, the processes involved in producing digital artefacts, and the environments in which they are used. The way that individuals interact with artefacts appears to be directed by domains of interest and learning styles within a CoP. These usage styles and learning styles are either afforded or limited by the context of use. The findings show that digital and physical environments have strengths and weaknesses in terms of their ability to support different usage and learning styles, and that the differences in artefact use in two types of digital learning environment were largely perceptual. The discovery of factors influencing artefact use was made possible by content analysis of research data based on Grounded Theory. This form of analysis also found generic and specific patterns of digital artefact use which suggest that artefact usage is neither wholly subjective nor wholly objective. This means that it is possible to quantify and compare how individuals interact with artefacts and to demonstrate that certain aspects of interaction are predictable. This enables research on artefact use to go further than idiographic analyses (described in Section 2.3.5.4) have previously allowed.

## 6.3   Discussion: Methodological approach used

Research in this thesis draws on three main theories: Wenger's theory of communities of practice, Glaser and Strauss's Grounded Theory, and Kolb's Experiential Learning Theory. The following sections (6.3.1 – 6.3.3) look at how successful the use of these theories has been before providing recommendations for future work (Section 6.3.4). Finally, the overall research approach adopted is discussed in Section 6.3.5.

### 6.3.1 The application of Wenger's CoP model

Based on its application in this thesis, Wenger's theory of communities of practice illuminates helpfully patterns of behaviour which might otherwise go unobserved. It provides a theoretical lens through which to examine the complexity of the digital supply chain and the nature of an individual's interaction with a digital artefact. It allows the effect of social learning within special interest groups to be assessed compared to the actions of the individual operating outside these groups. Its emphasis on shared practice also permits patterns in the usage of artefacts to be explained and, conversely, for behaviour with artefacts to be interpreted as forms of learning cultivated with the CoP.

However, there were several issues with Wenger's theory which proved problematic when applied to the question of digital artefact use. In recruiting individuals for each phase, assumptions were made about CoP membership which overlooked the fact that individuals might not subscribe to a particular community or, even if they do, that this has an appreciable effect on their attitudes and behaviour. Although the profiling interviews conducted in Phase 1 attempted to verify membership of a CoP, this proved difficult, especially given the possibility of multi-membership of different CoPs. Although Wenger attempted to develop CoP theory to account for a 'digital age' (Parry 2010c), his description of communities of practice does not account for all manifestations of practitioner behaviour in Phases 1 and 2 and other theories such as 'networks of practice' (Brown and Duguid 2001, 205) and 'thought collectives' (Sady 2001a) better explain participant attitudes and behaviour. Indeed, Wenger's theory might even be considered a distraction to studying the issue of patterning in artefact usage, placing too much emphasis on formal structures and the effect they might have. Additionally, the absence

of theory around CoPs and language as a shared 'protocol' (Wenger, White et al.. 2005, 7) makes linguistic analysis to prove CoP membership problematic.

Despite these ontological and phenomenological issues, CoPs provide a cogent, well developed theoretical perspective with which to tackle a complex problem. The application of Wenger's theory to a wide range of practitioner settings demonstrates its versatility but might also explain why it does not account for every manifestation of behaviour. As such, it ought to be regarded as one of a number of ways of exposing linkages between who is using artefacts and how this is done. However, its use in this thesis highlights patterns in behaviour which might otherwise go unnoticed and, as such, shows that other forms of investigation into artefact use are possible.

### 6.3.2 The application of Grounded Theory

As discussed in Section 5.2.4, the use of Grounded Theory in the analysis of data from both research phases produced meaningful results which suggest that, although improvements could be made to the technique of coding forms of use, the method is sensitive to context, flexible and transferrable to other usage scenarios. Reasons were given in Section 3.2.5 for the choice of Grounded Theory which included its versatility (being able to conceptualise both linguistic and visual data) and the degree of openness or neutrality which suited both the scoping nature of Phase 1 and the testing of hypotheses in Phase 2. The application of Grounded Theory in both research phases proved its worth in generating and verifying theory easily and effectively, and to enable comparison of data from two separate datasets.

However, there remains significant blind spots in employing Grounded Theory to describe and measure digital artefact use. Although observational data was coded in Phase 2, the technique still relies on verbal expression as a signifier for knowledge, perspectives and learning preferences. Although language was conceptually linked to Wenger's CoP theory through reification and practice (see Section 3.5.2), it is debatable whether words always reflect preconceived thought. Among other voices in the field of hermeneutics, Georg Christoph Lichtenberg observed that, 'one draws from the well of language many a thought one does not have' (as quoted in Bennett 1997, 539). In other words, what was said by participants during both phases of research might not actually be as strategic and deliberate as one might think. Language and intention are not always the same. The ambiguity of language is therefore an issue when coding artefact use from textual records or interpreting it from video footage.[105] So too the extent to which the tacit knowledge of practitioners is being fully externalised in test environments, and the ability to collect usable data (such as information derived from eye tracking) other than language. Another issue with Grounded Theory is the legitimacy of the coding process (discussed in Section 3.5.9) and the time-consuming nature of data analysis associated with this technique.

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[105] Equally, the conceptual framing and analysis of data using linguistic labels may be misleading. For instance, terms used to investigate artefact use such as 'digital supply chain', 'digital artefact', and 'market', although defined earlier in the thesis may, in attempting to simplify the question, bias the methodology and the conclusions drawn. For example, the words 'market' and 'chain' to describe the context and mechanisms in which 'digital artefacts' are 'produced' assumes a coherent, integrated view of how digital content is created which is not only loaded with formalist economic theory but may actually bear little resemblance to how digital artefacts are actually created.

However, despite these issues, Grounded Theory proved that for the first time it is possible to

extract quantitative data from artefact use. This helps to shed light on the influence of social

context, environment, and the inner workings of artefact use itself. In the absence of theories

on artefact use, content analysis utilising Grounded Theory proved an important mechanism for

generating new insights into how individuals interact with artefacts. It has demonstrated that,

although refinements are needed, a Grounded Theory-based method is transferrable to other

scenarios, whether looking at artefact use (physical and digital) or, more generally, the use of

any other type of learning content.


### 6.3.3 The application of Kolb's Experiential Learning Theory

Although Kolb's theory on learning from direct experience complements Wenger's theories on

how communities of practice steward knowledge, and helps to explain broad patterns in how

members of a CoP engage with digital artefacts, a few precautionary points are needed on

learning styles and their relationship with artefact use.


The theory of learning styles has been widely criticised for lacking validity (Riding and Rayner

1998, 78) and for the multiplicity of definitions used (Gardner 1996, 585). This variety in the

interpretation of the 'construct' (Koob and Funk 2011, 304) has led to multifarious use of

learning styles which in turn has resulted in allegations that the theory is 'fuzzy' (Verheij,

Stoutjesdijk et al.. 1996) by meaning different things to different scholars. Moreover, proper

detection of learning styles via direct observation has also been dismissed by some scholars

who claim that the construct deals with hidden processes that occur inside the brain meaning

learning styles can only be inferred not proved (Browne 1986). Abstracting meaning from how individuals use artefacts and then linking this with another form of abstraction leads to circularity in the relationship between artefact use processes and learning styles and does raise questions on validity. If artefact use reflects learning style, and learning style influences artefact use, both might be accused of propping the other up in an attempt to understand patterns in experiential learning. In this sense, the discovery of a possible link between learning and use styles raises more questions than answers. For instance, are producers of digital content more likely to create digital artefacts that suit their usage and learning styles? Also, are learning styles conceptually capable of explaining the variation in use styles across different environments? Therefore, the possible connection between learning styles, communities of practice, and the way artefacts are used, although promising, should be treated with caution especially given the exploratory nature and scale of this research.

Nevertheless, Kolb's Experiential Learning Theory provides a way of conceptualising and categorising the great variety of types of artefact use and explaining differences between individuals based on learning preferences. It provides a well-defined structure against which to map codes for use generated using Grounded Theory. Its ability to accommodate and explain both the social learning theory of Wenger (learning through participation and practice) and the phenomenon of artefact-based learning (usage both as a form of reification and as a transformation of experience) makes Kolb's theory a vital theoretical tool in understanding the two main research questions on cultural artefact use and the influence of communities of practice.

### 6.3.4 Recommendations for future studies

This research has added significantly to our understanding of the use of digital artefacts and has highlighted a variety of directions for further study. Bearing in mind the points made above about the use of three theoretical frameworks, and the experience of carrying out the research, several recommendations might be made about conducting future studies based around the gaps identified in previous research: focus, scope and methods.

In terms of focus and scope, research designed to include a larger sample and *in vivo* testing (following a live project) might help offset the choices made in setting up a mock digital supply chain in Phase 1. Focusing less on establishing membership of a CoP and more on how decisions made by individuals are invested in artefacts and environments would also be aided by this form of testing. Narrowing the research focus to look at the precise nature of identification, contextualisation, and interpretation of the digital artefact would also help to provide more depth on types of artefact engagement, as well as broadening testing to include different types of digital environment and different types of end-user to scope any other patterns in artefact use, or nuances thereof, which might have been missing from the research carried out.

In terms of methods, trialling other types of data collection and making adjustments to data analysis would be advisable. Methods of data collection used in Phases 1 and 2 were focused mainly on audio and video recordings; improvements could certainly be made to the dataset by using more sophisticated equipment to capture other aspects of user behaviour (such as eye movement and motion sensing which would provide additional datasets) and to externalise user preferences. In terms of the analysis of data, this proved laborious and time-consuming

and subject to researcher bias as codes were generated from data and categories formed. The act of code creation is interpretive and, although the constant comparative method is designed to reduce the degree of partiality, coding large datasets can lead to lock-in as the same codes are recycled to describe behaviours in different contexts. Sampling transcript text before coding and extending the practice of independent coding would make the process more manageable and more rigorous.

### 6.3.5 Being objective?

This thesis adopted a positivist, behaviourist methodological approach and pragmatic worldview in order to address fundamental gaps in our understanding of how we engage with cultural artefacts in digital form. In doing so it attempted to analyse the phenomenon of artefact use in a more objective way than had been the case in the majority of previous studies. It was argued in Section 2.3.5.4 that a principle reason for the lack of research on artefact use is because of the domination of idiographic methodological approaches in the Humanities and their use in cultural contexts might reflect the social exclusivity of museums, libraries and archives and insecurities among those who work in them.

The theoretical frameworks chosen to align with this methodological approach were all essentially nomothetic in character. Wenger's theory of communities of practice attempts to explain individual behaviour within the context of practitioner groups. Glaser and Strauss's Grounded Theory involves the abstraction of meaning to find patterns within a dataset. Kolb's Experiential Learning Theory describes learning in terms of fixed modalities and categorises

learners according to the relative strength of learning preferences. All of these theories attempt

to find order in disorder, and help to analyse a complex problem previously tackled using a

largely idiographic, subjective approach and qualitative methods.

But exactly how objective was this approach? It could be argued that Wenger's CoP theory pays

as much attention to subjectivity than it does to objectivity in terms of practice-based learning,

since it focuses both on social interaction (objective participation) and individual action

(subjective reification[106]). Grounded Theory requires subjectivity in the generation of new

codes from data as analysts creatively interpret the words or actions of others. Continuing this

emphasis on the subjective, Experiential Learning Theory is based on the learning preferences

of the individual rather than the group. Equally, moving between these three theories in the

analysis of data has required a degree of interpretation, for instance in the mapping of

categories of use to Kolb's learning styles or the equating of code incidences to communities of

practice.

However, although each of these three theories involves a degree of subjectivity in how they

are applied, the emphasis overall is on rationalising phenomena and making it more objectively

understood.  The theories chosen share a tendency towards grouping: studying the effects of

collectivity through membership of a community of practice, the formation of categories from

codes using Grounded Theory, and the classification of only four types of learner by Kolb.

Although Grounded Theory allowed for the generation of codes, this did not remain a

subjective process; use of the constant comparative method and, crucially, the collation of

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[106] According to Lave, learning 'is neither wholly subjective nor fully encompassed in social interaction' (1991, 64).

incidence rates provided units of measurement for both the process of artefact use and factors

which affect it. Above all, it is the formation of numerical data from words and actions that

facilitates the nomothetic study of artefact use and overcomes barriers to researching a

phenomenon previously considered wholly subjective in the sense that it is entirely partial and

unknowable (see Section 2.3.5.4). In this respect, this research, whilst not wholly objective in its

application is nomothetic in its approach. Ratner (2002) makes the point that objectivity and

subjectivity can be complementary,

> Objectivism integrates subjectivity and objectivity because it argues that objective
> knowledge requires active, sophisticated subjective processes—such as perception,
> analytical reasoning, synthetic reasoning, logical deduction, and the distinction of
> essences from appearances. Conversely, subjective processes can enhance objective
> comprehension of the world.

Therefore, the approach taken and methods used in this research fit within the scope of

objectivism in that they incline more towards the 'knowability' of artefact use (using objective

processes) than the 'unknowability' of artefact use (using subjective processes).

## 6.4 Discussion: Wider implications

### 6.4.1 Wider implications: Introduction

In Chapter 2, the relevance of the main research questions to the cultural and HE sectors was

explored in a situation review, and published research on digital artefact use and the influence

of communities of practice was surveyed and critiqued. Sections 6.4.2 – 6.4.4 revisit the

situation and literature reviews and look at the implications of the main research findings for

the cultural and HE sectors. These sections situate the findings in the research corpus in

relation to three of the four areas examined in the literature review: the digital supply chain,

basic processes of use, and the environment. The fourth area of the literature review, which focused on research methods, is addressed in Section 6.3.

### 6.4.2 Wider implications: Digital supply chain

The research findings have implications for the products, processes and people involved in the digital supply chain, discussed here in turn.

### 6.4.2.1 Digital supply chain: Products

This research has underlined the importance of the use value of digital artefacts to the end-user. Although more digital content was welcomed by those who took part in Phase 1, in particular by academic users, end-users were generally dissatisfied with the products of digitisation and cataloguing produced in Phase 1. Jones et al. (1999) suggest that multiple voices and different user interfaces in the museum, library, or archive record are a way of making digital seem more 'authentic' (ibid.). They observed that, 'the more information the system provides about an item, the more they will trust it' (ibid.) and this is supported by qualitative data in Phase 1. However, data suggests that the supply of usable 'products' could be improved by diversifying forms of capture, and by embedding technical metadata which contextualises capture to allow the use value of artefacts to be evaluated by end-users.[107] An acknowledgement of the degree of interpretation involved in digitisation and the need for transparency connects with the work of Tenopir (2009) on decision-making in the digital supply chain and chimes with what has been proposed by JISC in their eContent strategy (2011) which

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[107] Technical metadata related to capture might include details of who digitised or catalogued an artefact, when this was done, when it was done, which equipment was used, and so on.

calls for clear parameters and standards in the creation of digital content from cultural

collections. The underlying principle is that mechanisms for assessing the value of information

should rest with the researcher not the institution.

This research also indicated the importance of content creation and curation outside the

cultural sector. The ubiquitous nature of user-generated content and its use by students means

that, as digital learning environments become larger and more open (for instance with the

growth in popularity of the use of MOOCs), the role of course tutors as directors to suitable

content, and the cultural sector as content facilitators, becomes more important.  The

importance of quality in content also represents an opportunity for the cultural and HE sectors

to collaborate on content creation and curation. Examples of universities and cultural

institutions teaming up to tailor unique content for end-users are becoming more common, for

example the Shakespeare Birthplace Trust and the University of Warwick's recent partnership

to create a MOOC, 'Shakespeare and his World' (University of Warwick 2013), and the

collaboration between the Shakespeare Institute and the Cadbury Research Library (both part

of the University of Birmingham) to create the MOOC, 'Shakespeare's Hamlet: Text,

Performance and Culture' (University of Birmingham 2014). Since the research findings endorse

the importance of creation and curation of content to end-users, this type of initiative would

seem to be more likely to deliver products which end-users trust.

However, these findings also endorse moves to integrate VLEs with institutional repositories,

mentioned in Chapter 2. Although in Phase 1 there were clear differences between

practitioners in the use value and control of digital artefacts, and all academic and student

users welcomed a greater variety of user-generated content, the value of content selection and

curation by universities to end-users was evident in Phase 2. The perceptual differences in the

use value of content between the VLE and the wider internet (Environments A and B) suggests

that greater integration of institutional repositories with VLEs and MOOCs would strengthen

the position of universities and give end-users what they want. These findings support the

direction already adopted by some academic libraries (Kay 2012).[108]


## 6.4.2.2 Digital supply chain: Processes

Research findings suggest that adjustments to the way that digital artefacts are made would

benefit end-users. Given the research findings relating to artefact use and learning styles, the

process of capturing information (images and metadata) from the artefact needs to take

account of the widest range of learning styles possible. This could either be done by getting

end-users involved in the co-creation of content as a 'produser' (Bruns 2007, 2), either through

consultation in the selection and digitisation of content, by encouraging the production of user-

generated images or metadata, or by building end-user control into the products of digitisation

(such as through 3D imaging or RTI scanning which allow a degree of choice in viewing

artefacts). By making digitisation more user-driven, creating and sustaining digital artefacts

should become more efficient and sustainable because it should then respond 'to actual rather

than theoretical demand'(JISC 2005). Diversifying forms of capture to cater for the widest range

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[108] Chumbe et al. (2007) note that, 'Various studies have reported that achieving effective use of increasingly heterogeneous scholarly objects within institutional learning and teaching frameworks is becoming critical to the performance of educational institutions. The integration of digital information environments, such as a University library, within a virtual learning environment (VLE) encapsulates this challenge'.

of interests and learning styles among end-users, and to counter-act the tendency of digitisation to prioritise visual information (Dudley 2009, 8) would also help make content accessible and usable for those with sensory impairments. The use categories discovered in Phases 1 and 2 could help frame such diversity by guiding capture with a view to likely future use.

*6.4.2.3 Digital supply chain: People*

The research findings indicate that, if communities of practice have strengths and weaknesses in how they learn, knowledge of this could help improve interdisciplinary working between different practitioner groups involved in the supply of digital artefacts. Kolb states that a balance of all four learning styles is needed in order to provide optimal conditions for creativity and learning (Kolb 1984, 203). Therefore, a mix of skills and learning styles would be most desirable in the creation of digital artefacts. This could involve end-users as well as different CoPs, such as those involved in Phase 1, and accords with much of the literature on user-centric or participatory design (e.g. Kodama 1995) and moves by funding bodies such as JISC to involve end-users in co-design (JISC 2013a). Rather than dissolving disparities between CoPs, acknowledging that interdisciplinary boundaries necessarily involve differences and dependences (Carlile 2002) is more likely to produce better resources (AHRC and CBR 2011). Acknowledging differentiation in the skills, backgrounds and attitudes between sectors and building on dependences (such as physical access, metadata creation and knowledge of end-users) is more likely to achieve innovation on joint projects.

From profiling interviews it was apparent that learning about the use of digital technologies in the cultural sector happens on the job. Therefore, treating collaboration as a learning event and working at boundaries (which is where innovation is most likely to take place (Tuomi 2002, 4)) is most likely to provide a mix of learning styles and opportunities for CoPs to stretch themselves and even adjust their habitual learning style as they become acculturated within temporary CoPs which might form around projects. If artefacts are regarded as 'boundary objects' (Star 1989), articles that help mediate differences between CoPs, then they could catalyse and accelerate this process of adjustment through learning,

> Learning transforms our identities: it transforms our ability to participate in the world by changing all at once who we are, our practices, and our communities (Wenger 1998, 226).

Encouraging CoPs to be self-aware about how they learn could be a useful part of the learning process. Speaking about cognitive styles, Riding and Rayner stress the value of awareness of differences in 'styles' in their general sense,

> The significance of an awareness of style is its potential for enhancing and improving human performance in a variety of contexts (1998, 5).

The idea that practitioners might be more confident and adept in an area which suits their learning style is an attractive one but an awareness of stylistic weaknesses might also help to counteract some of the entrenched practitioner perspectives evidenced in Phase 1 (see Section 4.6). Equally, acknowledging that one's learning style might be embedded in a product such as a digital artefact and might consequently restrict end-use might also be a useful outcome of conducting further research into the connection between CoPs and learning styles.

Much has been written on the advantages and disadvantages of applying learning style theory to teaching (e.g. Dunn, Griggs et al.. 2000) and specifically in digital learning environments (e.g. Kanninen 2009). In the same way that raising awareness of one's preferences in learning could be beneficial for practitioner groups, the LSI test is widely believed to be an aid to meta-learning, i.e. learning-to-learn. In other words, learning styles should be regarded as a descriptive rather than a predictive tool to reflect on one's preferences rather than suggesting how learning should take place. Knowing that CoPs have distinct learning styles should not automatically mean that resources are tailored to focus on one dominant learning style, the so-called 'meshing hypothesis' (Pashler, McDaniel et al.. 2008). Research has shown that stereotyping learners in this way might be counter-productive and tending towards multi-modality, by catering for different learning styles through a range of learning opportunities, might be more productive (Massa and Mighter 2006-334). For example, digitising an artefact in a variety of different ways and making this available in different formats and different environments is not only likely to appeal to a wider audience (a key aim of OERs), but is considered a more efficacious way of encouraging learners to become more versatile in adopting learning strategies outside their comfort zone (Pask 1998, 96).

Finally, although not conclusive, the learning style of a CoP does seem to be determined to a large extent by the domain of interest around which the community is formed. Differences in how artefacts are used and patterns in LSI test results both indicate that a student's discipline plays an influential role in directing knowledge stewardship and learning style. The dominance of domain has implications for the HE sector. As the number of core subjects which the government recommends is reduced (Garner 2014), if domain does determine learning style

then this could mean that the breadth of learning styles is correspondingly narrowed. The

implications for non academic fields are less clear. Although in Phase 1 heritage practitioners

appeared to be the most sure of their 'professionalism' and sense of identity in interviews and

workshops, the learning style test results show that this is not reflected in a dominant learning

style even among sub domains (museum, libraries, and archives). Indeed, this variation could

be behind the sense of professional unease among curators and librarians described in Chapter

2. Perhaps an acknowledgement of the diversity among members of these professions should

instead be regarded as a strength in appealing to a wide range of end-users. However,

discovering that performers in Phase 1 shared the same learning style (accommodation) as the

majority of Shakespeare Studies lecturers and students, demonstrates a strong link between

domain and 'learning by doing' (Healey and Jenkins 2000, 186) and might be useful in

developing pedagogies for distance learning and face-to-face teaching within Shakespeare

Studies and beyond.

### 6.4.3 Wider implications: Basic processes of use

There are certain themes or principles which emerge from the usage data that are potentially

helpful when creating artefacts or packaging them for use. The discovery that some ways of

using artefacts are shared by all users is good news for the creation of content suited to a

general audience. For example, universities have been encouraged to create more Open

Educational Resources (OERs) to widen access to Higher Education and the fact that all users

seem to engage with material in the same basic ways is helpful when creating content and

evaluating uptake and use in the knowledge that it will be of use beyond the university campus.

To the same extent, museums, libraries and archives that create collections content for access and use online might also benefit from knowledge of a basic taxonomy of use to cater for a mix of academic end-users. The main use categories identified in this research could act as a framework for the preparation of content. For example, those responsible for the delivery of digital artefacts could ask themselves how end-users might identify, contextualise, interpret and make affective use of content which might influence choices made in the production and presentation of resources. In the cultural sector, categories of use could be used as a checklist for improving the efficacy of content. For instance, the identification of material could be promoted through tagging or more diverse and sensorily-engaging forms of digital capture. The contextualisation of artefacts could be facilitated through the provision of online tools to compare artefacts, to create links, and encourage 'flow' (Nakamura and Csikszentmihalyi 2002) between VLEs and other online learning environments, while the interpretation of artefacts could be aided by providing space within the record for meaning-making and sharing.

Equally, knowing that some types of artefact use are specific to particular user groups is also helpful. For example, knowing that those with an interest in theatre studies are more likely to be accommodative learners, resources could be tailored either to cater for their learning strengths or to stretch users with different opportunities to engage with artefacts depending on the pedagogical imperative (see Section 6.4 for a discussion on learning styles). If actors have a kinaesthetic learning style then providing opportunities for hands-on access to theatre archives, for example, might be more effective than simply online forms of access and use. Knowing that Egyptologists have niche interests in the artefact – for example, they appear to be more interested in the colour, lighting and structure of artefacts than the other two student

samples – could inform the digitisation of the artefact by emphasising these qualities during capture or providing forms of capture which allow end-users to vary colour, lighting, and manipulate the artefact in three dimensions.

Although much more research and development is needed, having an elemental understanding of how users interact with the digital artefact should also help with the development of ways of evaluating artefact-based learning. On the back of this research, metrics could be developed not only to assist in the creation of digital content, but to build lessons and to measure the impact of object-centred learning, the 'Holy Grail' of museum education (Rice and Yenawine 2002, 289). For example, types and rates of interaction with particular aspects of an artefact could be assessed before and after other forms of teaching to assess whether or not exposure to artefacts (in digital or physical form) has improved understanding of a topic. The corollary of this is also possible; ways of reading artefacts could also be used as a way of gauging the efficacy of lectures and tutorials by highlighting the impact of these sessions on interest in the artefact. In the cultural sector, using metrics to quantify the value of engagement with digital artefacts, long considered marketing lost-leaders (Kelly 2013, 5) within the sector, could justify investment in the improvement of online collections access. Incorporating better tracking systems (developed from categories of use) in websites and VLEs and conducting direct observation trials of content could help in quantifying the value of digital artefact use. Knowing how artefacts are used could also help the cultural sector co-create value with end-users and provide tangible ways of returning investment by facilitating forms of use grounded in experience. Generating quantitative data on end-use should also help both sectors provide the sort of statistical evidence of use required by funding bodies such as JISC to prove that projects

respond to 'actual rather than theoretical demand' (JISC 2005). In other words, identifying categories of use should give the cultural and HE sector more confidence in working with a wider range of end-users.

This research contributes to a small body of work which has looked at how artefacts are used. As mentioned in Chapter 2, Seadle's (2000) use of cultural anthropological methods to analyse the behaviour of engineers and librarians involved a project to develop the National Gallery of the Spoken Word (NGSW), and Duff and Cherry's investigation of the use of Early Canadiana (2000), also attempted to look for patterns in use but they stopped short of an elemental analysis of artefact use. The granular research of Levine-Clark (2007) on the use of library resources, combining attitudinal data in questionnaires with web log data, comes closest to the approach used in this research, but their formation of categories was heuristic and highly reductive. Although this research helps in terms of reach and detail, more work is needed to probe the applicability and utility of use categories, not least because of the effort required to collect and analyse data, the degree of validity in this process, and the experimental nature of this research. However, the potential for the HE and cultural sector to digitise more smartly, and to deliver more relevant and usable resources for different end-users in sustainable ways, and to evaluate end-use, is considerable.

### 6.4.4 Wider implications: Environment

Despite the fact that of the four test learning environments the virtual learning environment was the least versatile in allowing users to express their natural learning style, the ability of

VLEs to still support a broad range of learning styles when artefact-generated content is used is an encouraging finding for the HE sector. Data from Phase 2 indicates that although virtual learning environments impose some limitations on the end-user (such as restricting working space, issues with software compatibility, and so on) and are dependent on the quality of content, they do not seem to discriminate against particular learning styles. This research suggests that the strength of VLEs lies in the curation of quality content and on its reliability. In a comparable way to the effect of the display case in Environment D (which represented authority, selectivity, and value for participants) by virtue of content supply by an expert (the course tutor or librarian) the VLE is regarded as more dependable and focused. Therefore, investing in the supply and vetting of content would seem to be more important than ever.

Investment in staff training and utilisation of the major categories of use identified in Phases 1 and 2 – identification, contextualisation, interpretation, and the affective use of artefacts – could also aid the process of selecting suitable artefact-based digital content. For example, asking how digital content might allow students to identify an artefact (for example selecting rotatable artefacts) and contextualise them (exploiting hyperlinks or providing different perspectives on the same artefact) and utilising the VLEs communication tools to promote dialogue about the interpretation of an artefact could substantially improve use. Looking to those aspects of the handling environment (Environment C) which make it the most stylistically versatile would be another way of benchmarking the use potential of content within the VLE.

That being said, technical improvements could also be made to facilitate more diverse forms of artefact use within the VLE. Incorporating user-extensible features so that students can add

their own content and share this with others could allow VLEs to embrace student activity outside the VLE while maintaining something of its perceived integrity. Through peer-to-peer discussion of the use value of content harvested by students from beyond the VLE this could enrich content, while developing skills in digital literacy, building on the connectivist properties of VLEs and the constructivist credentials of artefact-based learning (Hein 1998, 155). Some learning software, such as Curatr (2013), already does this using gamification to encourage users to select relevant content although the pedagogical value of a scoring system which rewards the finding of content rather than its use is questionable.  Improving tracking systems within VLEs to include measurement of how digital artefacts are used would allow course tutors to evaluate the efficacy of content and comply with calls for greater accountability across the HE sector. This is especially important given the investment in MOOCs without any real indicators, beyond uptake and completion rates, of how content based on artefacts might be being used. This research could provide some direction to the technical development of tracking systems: for example, detecting how an end-user seeks to identify, contextualise, and interpret an artefact could involve eye tracking technology as well as more overt methods to externalise types of use such as written or verbal description.

Artefact usage data suggests that different disciplines have distinct learning styles and some environments are more suitable than others to support their particular learning style. For example, Shakespeare Studies students (accommodators) would benefit most from hands-on access to artefacts and using digital artefacts in the VLE, while Digital Cultures students (convergers) would benefit most from access to artefacts in a display environment or online.

Although a nomothetic approach was deliberately chosen to take an objective look at the processes involved in using artefacts to avoid assumptions made in previous studies about the beneficial aspects of object-based learning, studying the effect of four different environments appears to show that, despite these variations, in every case all four Kolbian learning styles are catered for by artefact-based learning. This endorses the view that using artefacts in physical and digital contexts stimulates a broad range of learning styles, while highlighting the strengths and weaknesses of particular learner groups and learning environments.

The results from Phase 2 also suggest that there are continua within physical and the digital environments - elements of each that are desirable to users – and that blended learning or hybrid environments are more attractive for a range of learners rather than a straight choice between physical or digital environments. This should help to depolarise the debate on whether the physicality or the 'digitality' (Parry 2010b, 293) of environments is most suitable for research use of artefacts. Analysis of the affordances of physical and digital environments and learning styles of users suggests that each learning style seems to prefer a combination of features found in physical and digital learning environments. Therefore, understanding the latent affordances and limitations of different usage environments should allow tutors and e-learning specialists to tailor content more effectively. Realising the advantages of blended learning environments is not new (e.g. MacDonald 2008), but knowing that hybrid environments might be the most stylistically versatile when engaged in artefact-based learning, is encouraging, especially given the growth in interest in mobile learning environments (Masie, Baker et al.. 2012).

Learning about the strengths and weaknesses of different environments should also inform

how artefacts are presented in physical spaces, for particular users. In general, while digital

environments privilege detail and contextual information, physical environments privilege scale

and functionality (though this was not always true in the encased environment, Environment

D). Designing hybrid learning environments which allow end-users to move effortlessly

between the physical and virtual environment (for example, by embedding computation in

physical artefacts) would, in the opinion of all twenty students who participated in Phase 2,

combine the best of both worlds.


## 6.5 Discussion: Conclusions

In taking a more objective approach to the analysis of artefact interaction, this study has

proven that other research methodologies are capable of deconstructing the process of digital

artefact use, generating meaningful qualitative and quantitative data from an area largely

untouched by previous research. Looking at the phenomenon of artefact use through the prism

of Wenger's theory of communities of practice, and conceptualising artefact use as part of the

Experiential Learning Cycle conceived by Kolb, sheds new light on an old problem: just how

subjective is the encounter with the artefact? This research shows that two types of context

influence artefact use: the knowledge, experience and learning preferences gained through

membership of a CoP appears to affect an individual's behaviour, and the usage environment

affords or limits certain types of interaction with the artefact. This research demonstrates that,

although there are broad similarities in how we all engage with digital artefacts, our 'ways of

experiencing' (Dewey 1938, 23) them are also determined, as Dewey observed, by 'the force of

intercourse and custom' (ibid.). These findings have significant implications for the way that

digital artefacts are created and how they are used within digital learning environments. Most

importantly, the research findings draw attention to the influence of ways of learning on ways

of using artefacts and, in turn, provide guidance on how digital artefacts can enhance object-

based learning.

# 7. CONCLUSIONS

## 7.1 Being objective

The research presented in this thesis sought to address significant gaps in our understanding of digital artefact use and to find out to what extent two contexts affect this process: the social learning of communities of practice involved in creating or using digital artefacts, and digital learning environments. In doing so, it adopted a nomothetic approach to data analysis and tested a more objective method of obtaining qualitative and quantitative data on artefact use than had previously been used in researching this area of enquiry.

Chapter 6 outlined how the research addressed the four main *aims* identified in Chapter 3. This chapter highlights the main findings and theoretical and practical implications arising from them in relation to the two overarching *research questions* presented at the start of the thesis:

1. How are cultural artefacts used in digital learning environments?

2. How can the theory of communities of practice help in understanding the people and processes involved in the supply and use of digital artefacts?

These questions are significant because of the growing importance of digital content and services for both the cultural and HE sector as users demand more open, usable digital material. However, despite more than a decade of major digitisation and the widespread adoption of virtual learning environments, there is no clear way of measuring usage of artefacts in digital environments, or gauging return on investment for the creation, presentation and use of cultural artefacts in digital form.  Despite the prevalence of this problem and the expected expansion of digital content available online, little research has been carried out which focuses

on how digital artefacts are actually used and to what extent those interacting with artefacts, and the environment itself, affect this process. Later parts of the chapter address other broad considerations stemming from the research findings and how this might affect the work of the Higher Education and cultural sectors.

## 7.2 Returning to the research questions

This section examines how the research carried out addresses the two main questions.

### 7.2.1   How are cultural artefacts used in digital learning environments?

All users appear to interact with digital artefacts in seven main ways. These categories of use are listed and defined in Table 37.

| Category of Use | Definition |
|---|---|
| Identification | Cognitive or sensory interaction with the artefact to establish what it is |
| Contextualisation | The placing of an artefact in a physical or informational context to enrich understanding |
| Interpretation | A process of comprehension and abstraction of concrete information (supplied by the artefact) in the making of meaning |
| Location | The process of discovering an artefact or metadata associated with it |
| Curation | The process of controlling use of the artefact |
| Induction | The process of looking for coherence between artefacts or metadata associated with them |
| Affection | The process of responding to the artefact affectively |

**Table 37. Categories of use and their definitions**

Of the seven categories of use, four are most common in terms of levels of usage: identification, contextualisation, interpretation, and affection. In other words, users want to

identify an artefact (work out what it is), contextualise it (place it in relation to a physical or informational context), interpret it (work out what it means), and respond affectively to it. Although there was some variation between research phases, these categories of use represent 170 different types of use (e.g. trying to establish an artefact's date and where it was made are types of use code within the category of contextualisation).

The usage environment does seem to affect how individuals interact with digital artefacts. Although there were only minor differences in artefact usage between the digital learning environments tested, the findings underline the importance of how digital artefacts are created and curated. VLEs and online environments were found to accommodate a broad range of ways of using artefacts and learning styles, but there were perceptual differences in the use value of content and test participants preferred features of both digital and physical learning environments in affording different types of artefact use.

### 7.2.2 How can the theory of communities of practice help in understanding the people and processes involved in the supply and use of digital artefacts?

Wenger's theory of communities of practice provides a way of understanding the influence of practitioner groups involved in the creation and use of digital artefacts, compared to how individuals interact with cultural artefacts. As noted above, general patterns were detected in the way that all individuals who took part in the study interact with artefacts, described in the seven categories of use listed in Table 37 (in Section 7.2.1). However, using CoP theory, variations in usage were also found in the dataset which seem to relate to the identity,

interests, experience and perspective of communities of practice who produce and use content. One possible reason for variations between the way that different CoPs use artefacts is that the domain of knowledge around which the community is formed might be directing the perception of members to particular features of the artefact. Another related reason could be the manifestation of a particular learning style through artefact use; most individuals who took part in the research appeared to share a preference with members of the same CoP for 'educational conditions' (Stewart and Felicetti 1992, 15) under which they are most likely to learn. In other words, ways of using artefacts might mirror ways of learning within a CoP. These forms of use might also be affected by distinctive ways of tackling recurring problems among practitioner groups as evidenced in particular perspectives on the value and use of digital artefacts which emerged during research. Whatever the reason, Wenger's theory of communities of practice exposes linkages between who is using artefacts and how this is done which might otherwise go unnoticed.

Using Wenger's theory, the use of cultural artefacts in digital learning environments appears to be both a subjective and objective phenomenon. Although there are generic ways in which all individuals appear to interact with digital artefacts, common traits shared by communities of practice appear to strategically direct the attention of individuals to particular aspects of the artefact. For example, all users appear to try to identify an artefact by examining its material composition and general typology, contextualise it physically and chronologically, interpret the artefact by thinking about authenticity, provenance, and value, and engage with it on an affective level by assessing its size, weight and colour. However, particular communities of

practice placed different emphases on each of these forms of use and exhibit usage behaviour peculiar to their CoP.[109]

## 7.3 Theoretical implications

This study makes three contributions to theory on communities of practice and the use of digital artefacts. Firstly, developing a method of extracting meaningful qualitative and quantitative data from a field in which only qualitative forms of analysis have predominated, is innovative.[110] The method used in this study derives qualitative and quantitative data to assess priorities among users in aspects of artefact usage that are important to them. The same broad categories of use found in both phases of research would be expected were the method to be used elsewhere, although one would also predict specific use types to arise in the same way that occurred in Phase 2. Although further development and testing is needed, the method is, therefore, transferrable and capable of reuse in different scenarios, digital and physical. The implications of this are far reaching. Not only might it be possible to develop metrics for evaluating the efficacy of artefact-based content (both formatively in its creation and summatively in its use) in digital environments but, more widely, it ought to be possible to measure the impact of any type of digital content, especially given the expected expansion of

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[109] For example only Shakespeare Studies students who took part in Phase 2 of the research identify an artefact using a maker's mark, while only Digital Cultures students, who also took part in Phase 2, would contextualise an artefact using a reverse search engine.

[110] Although some valuable work on the use of Grounded Theory has been done by, among others, Ellis in his study on information retrieval at the University of Sheffield (1993), this did not pursue a numerical end-point and was confined to broad patterns of information-seeking behaviour among academic researchers rather than usage of artefacts per se.

content over the next two decades (Gantz and Reinsel 2012, 1). Being able to generate data on use should allow more usable content to be created and for smarter systems of evaluating usage. This would help justify investment made in content creation and to guide future investments as usage patterns change. More generally, this methodology breaks the impasse created by using only qualitative methods of analysis in this area.

Secondly, making an association between types of artefact use and learning styles is also new. Although Kolb describes the 'force' of acculturation or the performance of 'primary tasks' and its influence on shaping learning style among members of a discipline (Kolb 1984, 97), this has yet to be applied to the phenomenon of artefact use. Conversely, the influence of learning styles on how members of a CoP interact with artefacts has also not received due research attention. This opens up the possibility of studying the psychometric properties of cultural artefacts, and investigating new pedagogies around artefact use in digital environments.

Finally, although work has been done on the connection between cultural background or educational discipline, and learning style, proposing a link between a community of practice and a dominant learning style is novel. Wenger (Wenger and Lave 2009) and Kolb (1984, 163) have both developed theories of social learning among practitioner groups, but the two theories have so far remained unbridged. The development of a quantitative method of analysing artefact use has facilitated the creation of linkages between membership of a CoP and learning style but other manifestations of learning style could be also be investigated including language use.

**7.4 Practical implications**

The findings from this research also have considerable practical implications for both the cultural and HE sectors. Three real problems shared by the cultural and HE sectors and raised in Chapter 2, are addressed in turn to show how findings could be used to tackle pressing issues for both sectors.

*7.4.1 How can we create more usable digital content?*

This research has exposed the role of people and the types of processes involved in the supply and use of digital artefacts. In so doing, it points to problems in the supply and use of artefact-based content and ways of improving usability. Firstly, knowing about the mechanics of artefact use provides valuable criteria for the creation and usability of content. Utilising the seven categories of use (itemised in Section 7.2.1) to evaluate how forms of capture and presentation facilitate the identification, contextualisation, interpretation, location, curation, and promote inductive and affective use of the artefact would allow collections' institutions to create smarter and more usable digital content. Moreover, these categories also provide a more precise framework for evaluating forms of use post-capture; for example, evaluating risk to rights holders and collections institutions for rights-sensitive material by looking at potential forms of use, and, conversely, for assessing which material should be collected and sustained by museums, libraries and archives in the long term based on likely use. Knowing that artefact-based content is likely to appeal to general audiences as well as particular groups is good news for the creation of artefact-based open educational resources (OERs). Equally, knowing that

CoPs' interests in particular aspects of the artefact varies provides direction for tailored forms of digitisation for different audiences.

Secondly, data from Phase 1 has highlighted weaknesses in the digital supply chain which have the potential to reduce the usability of content. It has shown that even when end-users stipulate how cultural artefacts should be digitised, decisions made during capture significantly affect the use value of digital artefacts. Diversifying methods of capturing content and making decisions taken during digitisation more transparent could help ameliorate the dissatisfaction users expressed in the digital artefacts. Also, involving end-users in every aspect of the co-design of digital artefacts might also reduce levels of dissatisfaction with the usability of material. More radically, recruiting the artefact to generate and transmit its own data by embedding sensors or processors to generate information on temperature, colour, pressure, humidity and so on, could help tackle weaknesses in the supply of metadata. In this way, inherent information which was not obvious following the digitisation of artefacts in Phase 1 could be conveyed, by-passing decisions made by practitioners.

Thirdly, research data has also shown potential boundary issues between communities of practice which might affect the usability of digital artefacts produced collaboratively. This is important because pressure from funding bodies to collaborate on the creation of digital content from research collections has made interdisciplinary working more crucial. The discovery that CoPs have distinctive ways of using artefacts, particular perspectives on how they should be used, possibly different ways of learning collaboratively, and different shared protocols for stewarding knowledge, raises the potential for friction and dissonance. However,

data has also hinted that greater awareness of the strengths and weaknesses of CoPs could also make for the creation of more usable digital artefacts.  Since Kolb suggests that a combination of different learning styles is required to promote creativity and learning, achieving a balance of learning styles among practitioner groups involved in cross-disciplinary digital projects is not only more likely to deliver more interesting content but also content that appeals to those with different learning styles. This endorses the importance of user-generated content since it will necessarily reflect the different learning styles of a multitude of content creators. Also, being aware of potential discoursal barriers between CoPs working in collaboration (as evidenced in the word use analysis undertaken in both phases of research) would also help improve the delivery of content. Confronting boundary issues around ownership, control, and value between suppliers and users of content might also be a way of improving interdisciplinary working and encouraging professional self-awareness especially in the case of professions who feel threatened by the opening up of content and use.

### 7.4.2 How can we create value from digital artefacts?

The creation of content without any clear understanding of how it might be used has inevitably led to a situation where it is likely that content providers will not be able to understand how effective that content is for different end-users and how they can share value with those users. Data from this research helps tackle this problem in two main ways: knowledge about generic types of use, and knowledge about specific types of use. Being aware of how all users are likely to interact with digital artefacts should give museums, libraries and archives a huge advantage in stimulating demand by adjusting how they prepare content. As noted above, drawing on

categories of use as a yardstick for the generation of content is more likely to appeal to potential users. In so doing, the cultural sector would adopt a demand-led rather than supply-driven approach to digitisation but, importantly, be driving demand through knowledge of artefact use rather than simply responding to demands for more content without any clear understanding of how it will be used.  As noted in Chapter 1, value for the user has moved from access to participation; being aware of ways that users interact with digital artefacts should allow museums and universities to create opportunities to enable end-users not just to access content but to participate in its use. By identifying key ways of measuring usage of digital artefacts, the cultural and HE sectors should also be able to prove demand by generating statistical data required by funding bodies.

Equally, knowing that CoPs engage with digital artefacts differently should allow the cultural sector to tailor creation to potential use and thereby create value with those users in mind. For example, Brightsolid's partnership with the British Library to create content for family history researchers could be strengthened by regarding end market users as a distinct community of practice with common motivations and needs (Brightsolid 2013). Data and services could be packaged and delivered in ways which complement end-users' usage and learning styles. On a wider scale, knowing how artefacts are used could also help return value to the museum, library or archive by informing the development of semantic searching. Basing algorithms which find digital artefacts on actual patterns of use could allow end-users to locate content more easily and give museums, libraries and archives direction in where value lies for the end-user, bringing the processes of finding and using artefacts closer together, and promoting the discoverability agenda of funders such as JISC (Marchionni 2013). In this way, two business

models emerge from the findings which complement each: the generation of generic digital resources which appeal to a mass market but provide no monetary return per se, and the creation of tailored digital resources which users are willing to pay for and, in turn, support the wider remit of the HE and cultural sectors.

However, realising that artefacts are engaged with in the same basic ways by all users, and that greater variety of content is widely welcomed, might not make comfortable reading for members of the museum, library and archive profession concerned about controlling the value of digital artefacts and, by consequence, the traditional role of curator, librarian or archivist as gatekeeper. Data from Phase 1 revealed a defensiveness among heritage practitioners on their role as managers of digital artefacts and an uneasiness about the value of user-generated content (UGC). Realising what users want and increasing self-awareness among heritage practitioners about issues which might be curtailing these forms of use, might help curators, librarians and archivists come to terms with a perceived loss of control of the supply and use of digital artefacts. Although categories of use might help as a way of improving the quality and usability of digital artefacts, learning from the way that UGC is created and used is more likely to lead to the co-creation of use value in the digital artefact for the cultural sector.[111]

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[111] In other words, appreciating that UGC and producer-generated content is subject to the same types of use should allow museums, libraries and archives to focus on ways of creating content more effectively with others. In the same way that museums, libraries and archives are responding to calls for the use of 'big data', acknowledging the value of all artefact-based content by embracing UGC could allow museums, libraries and archives to maintain their position as subject and object specialists or providers of 'deep data' by leading on the creation of more usable content with end-users.

### 7.4.3 How can digital learning environments be used more effectively?

This research endorses the potential of both artefact-based learning and digital learning environments. Data suggests that formal and informal digital learning environments support a broad range of learning styles when artefact-based content is used. This is important given the difficulties associated with proving the value of object-centred learning and the uncertainty surrounding the efficacy of new learning environments such as mobile learning environments (MLEs) and MOOCs. The discovery of categories of digital artefact use should lead to improvements in tracking systems within proprietary digital learning environments to allow course tutors to evaluate the efficacy of content and comply with calls for greater accountability across the HE sector.

However, data also shows that the differences between using digital artefacts on the world wide web and within institutional VLEs are slight and relate largely to the selection of suitable content by course tutors as opposed to unprovenanced material found online. Incorporating user-extensible features so that students can add their own content and share this with others would allow VLEs to embrace student activity outside the VLE, while maintaining something of its perceived integrity. Equally, greater integration of institutional data repositories with VLEs and MOOCs would strengthen the value of digital learning environments for end-users. Pedagogies that encourage digital and visual literacies would allow the diversity of content found on the internet to be used more effectively within the VLE or MOOC rather than seeking to deny its value by perpetuating a 'walled garden' (Cunningham 2009) approach to online learning.

Data also suggests that blended learning or hybrid environments are more attractive for a range of learners rather than a straight choice between physical or digital environments. This is an encouraging finding for the development of mobile learning environments and, more generally, for any-time-any-place learning which is increasingly in demand (Irvine 2003, 5). A preference for hybridity of physical and digital environments is also a positive finding for promoting the use of digital and physical artefacts in museums, libraries and archives and should help depolarise the persistent debate surrounding physicality and virtuality. More generally, the overwhelming preference of test participants for elements of both physical and digital environments is an affirmation of the learning potential of an 'internet of things', blurring the boundary between the physical and the virtual, and for the intelligent use of digital technologies in the museum, library and archive environment.

## 7.5 Directions for future research

This is the first study to examine the influence of membership of a community of practice on the ways that cultural artefacts are produced and used. It is also the first to use a mixed methods approach to describe and measure artefact use. The extraction of numerical data from an area of study where qualitative methods have dominated must be considered an achievement. However, this was done using small sample sizes and particular forms of data capture and analysis. Larger sample sizes and other types of data capture such as eye tracking or motion sensing would provide additional datasets for analysis. Although this study represents an important step forward in indicating how digital artefacts are used and what influences this process, the connection between artefact use and learning style, the role of

language in communities of practice, and the affordances of a wider variety of digital learning environments (including MOOCs) all require further research.

This study observed pressure points in the digital supply chain but a closer examination of digitisation is needed to assess the impact of the people and processes involved. This could perhaps be done *in vitro* by studying a real digitisation project from beginning to end. Subjecting digitisation to new theoretical perspectives such as Actors Networks (Law and Hassard 1999; Whittle and Spicer 2008) which attempts to account for non-human activity, has the potential to analyse the material and semiotic role of the artefact in use as well as the role of technical equipment in determining usage of digital artefacts. Since content and context were found to influence artefact use in Phase 2, further research on the role of features of the artefact in usage would seem to be warranted.

## 7.6 Impact of work

In February 2012, the AHRC awarded the University of Birmingham £20,679 for a project entitled, *Digital CoPs and Robbers: Communities of Practice and the Transformation of Research* as part of the AHRC's Digital Transformations scheme. Although the primary focus of this project was on the question of how artefact-based research is transformed by digital technologies rather than the social context of the transformation process, *Digital CoPs and Robbers* generated data for Phase 1. Findings from the Digital Transformations project were contained in a report to the AHRC submitted in October 2012 (Hopes and Chapman 2012).

To enable the dissemination of findings from Phase 1 to the HE and cultural sectors, three papers were written for publication during the period of research. A findings paper entitled, 'What's the Use? Learning from Digital Artefacts, Learning about Users'(Hopes 2013c) was published in *Rosetta* in Autumn 2013. A methods paper, 'Being Objective: A Nomothetic Methodological Approach to Describe Usage of Physical and Digital Artefacts among Communities of Practice' was submitted to the professional journal *Museum Management and Curatorship* in December 2013 and is expected to be published in 2014. This paper explains the methodological approach adopted to describe and measure artefact use, and examines the connection between usage and learning styles. Finally, a positioning paper intended to pass on some of the main findings from Phases 1 and 2 will be published online by the University of Birmingham's Digital Humanities Hub (formerly Do.Collaboration) in 2014. The paper, 'Around the Digital Artefact: Improving the use of Cultural Collections in Higher Education', seeks to make the findings from both phases of research meaningful and useful for the HE and cultural sectors (Hopes 2012).

The research contained within this thesis has been presented at a variety of conferences and events. A paper was delivered by the author in April 2013 to the Institute of Archaeology and Antiquity Colloquium at the University of Birmingham Colloquium outlining methods and findings from Phase 1 of the research. Another paper was given by the author at the Ashmolean Museum, Oxford, in November 2012 relating some of the main findings of Phase 1 to the main themes of the AHRC-funded 'Ways of Seeing the English Domestic Interior, 1500-1700: the case

of decorative textiles' research network.[112] Building on findings from the 'Digital CoPs and Robbers' project, a large grant application was made to the AHRC by the University of Birmingham in January 2013. Although unsuccessful, the bid, entitled, 'All The World's A Digital Stage', received the support of a number of departments across the University and from external partners including the RSC, the Shakespeare Birthplace Trust (SBT), and the Chicago Shakespeare Theater. Finally, a pilot project run by the University of Birmingham and the SBT to create a prototype to gauge visitor responses to the use of digital representations of artefacts in historic properties managed by the Shakespeare Birthplace Trust draws on the findings from Phases 1 and 2 of this research with a view to submitting a fuller application to the Digital Research and Development Fund,[113] and to the AHRC's Digital Transformations Amplification Fund. These projects were developed from the findings of this research and respond directly to the circumstances which brought the research about: a shifting of the research and funding agenda to understand more about the user and use.

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[112] This project involved past and present reception of textiles in historic domestic interiors and shared a focus on communities of practice and ways of experiencing artefacts, principally through sight. There has also been cross-pollination between this research project and a number of other initiatives involving digital technologies and artefact-based research.

[113] Operated by NESTA, the Arts Council for England, and the AHRC. Mentioned in Chapter 2.

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# 9. APPENDICES

## Appendix A: Participants in Phase 1

| CoP | Individual | Primary Descriptor[114] | Secondary Descriptor[115] |
|---|---|---|---|
| Heritage Practitioners | AR | Archivist | - |
| | CC | Museum Collections Officer | Curator |
| | LS | Manager | Librarian |
| | LU | Rare Books Librarian | - |
| | CM | Collections Manager | Head of Collections and Interpretation |
| | CS | Assistant Museum Collections Officer | - |
| | LT | Collections Librarian | - |
| Academics | AT | Teacher | Teacher of the Bible, editor, project worker, textual critic |
| | AA | Senior Lecturer | Archaeologist |
| | AH | Historian | Art Historian, researcher |
| | AS | Lecturer | Teacher |
| | SO | Research Student | - |
| | ST | Research Student | - |
| | SP | Research Student | - |
| | AP | Research Student | - |
| | A | Research Student | - |
| | B | Research Student | - |
| | C | Research Student | - |
| | D | Research Student | - |
| | E | Research Student | - |
| | F | Research Student | - |
| | G | Research Student | - |
| | DL1 | Research Student | - |
| | DL2 | Research Student | - |
| | DL3 | Research Student | - |
| Digital Creatives | DC | Manager | Company Director |
| | DS | Digital Consultant Strategist | - |
| | DW | Digital Writer | Producer |
| | DP | Co-runner of an agency | Content strategist |
| Performers | ED | Teacher Trainer | Arts Educator |
| | AW | Actor | - |
| | AD | Actor | - |
| Total | 32 | | |

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[114] If interviewed, taken from first descriptor in response to Question 1 (Appendix1) or generic descriptors assigned if not interviewed
[115] If interviewed, taken from subsequent descriptor used by interviewee

**Appendix B: CoP Interview Guide**

Phase 1
<u>Pre interview</u>

Before the interview you might like to think about:

- What you do and who you work with on a regular basis
- Any groups you're a member of related to your work
- How what you do involves research
- How what you do involves digital technologies

Participant information and consent form also issued in advance of the interview.

<u>Interview: Introduction</u>

a. Thanks for taking part
b. Introduce self
c. Introduce AHRC project and PhD project
d. Purpose of the study: to find out how communities of practice and digital affect the research process
e. How the data will be used

<u>Interview: Main questions</u>

1. Can you tell me a bit about yourself?
2. What does your main job involve?
3. Who does this involve?
4. If you were 'down the pub' and asked you what you do, what would you say?
5. Who would you turn to if you had a professional issue you needed help with?
6. Are you a member of any groups?
7. What's the purpose of the group?
8. What were your reasons for joining?
9. Can you describe the group (longevity, size, formality, status, date set-up)?
10. How does the group communicate?
11. How often does the group meet?
12. What is your role within the group?
13. What are some of the hot topics discussed by the group?
14. Can you give an example of something discussed by the group that you've put into practice?
15. Does the group have a distinct identity?
16. Do you share that identity?

17. Can you give an example of a situation where you've recently been outside your comfort zone at work?
18. Can you give me an example of a project you've been involved in which has used digital technologies?
19. What was your role?
20. Does your job involve research of any kind?
21. Can you tell me about this (your role, subject matter, tools used, outputs)?
22. Does this involve artefacts?
23. Have you been involved in the digitisation of artefacts?
24. If so, who was this for and how did you go about it (and where did the content eventually end up)?

**Appendix C: LSI test**

Choice 1
○ I often produce off-the-cuff ideas that at first might seem silly or half-baked
⊙ I am thorough and methodical

Choice 2
○ I am normally the one who initiates conversations
⊙ I enjoy watching people

Choice 3
⊙ I am flexible and open minded
○ I am careful and cautious

Choice 4
○ I like to try new and different things without too much preparation
⊙ I investigate a new topic or process in depth before trying it

Choice 5
⊙ I am happy to have a go at new things
○ I draw up lists of possible courses of action before starting a new project

Choice 6
⊙ I like to get involved and participate
○ I like to read and observe

Choice 7
⊙ I am loud and outgoing
○ I am quiet and somewhat shy

Choice 8
⊙ I make quick and bold decisions
○ I make cautious and logical decisions

Choice 9
⊙ I speak fast, while thinking
○ I speak slowly, after thinking

## Choice 10

○ I ask probing questions when learning a new subject

○ I am good at picking up hints and techniques from other people

## Choice 11

○ I am rational and logical

○ I am practical and down to earth

## Choice 12

○ I plan events down to the last detail

○ I like realistic, but flexible plans

## Choice 13

○ I like to know the right answers before trying something new

○ I try things out by practising to see if they work

## Choice 14

○ I analyse reports to find the basic assumptions and inconsistencies

○ I rely upon others to give me the basic gist of reports

## Choice 15

○ I prefer working alone

○ I enjoy working with others

## Choice 16

○ Others would describe me as serious, reserved and formal

○ Others, would describe me as verbal, expressive, and informal

## Choice 17

○ I use facts to make decisions

○ I use feelings to make decisions

## Choice 18

○ I am difficult to get to know

○ I am easy to get to know

**Appendix D: Environment Test Task Questions**


Task 1: images or artefact alone (no metadata)

a.  Can I ask you to describe the artefact
b.  What do you think it is?
c.  Who might have used it?
d.  When might it have been made?
e.  Why might it have been made?
f.  What other information or tools would help in identifying the artefact?
g.  How do these images help or hinder your identification of the artefact?
h.  What would you like to do with these images which is possible within the VLE?
i.  What would you like to do with these images which isn't possible within the VLE?
j.  How does the VLE help or hinder your identification of the artefact?


Task 2: images or artefact and metadata

a.  What information does the record give you which wasn't obvious from looking at the images alone?
b.  What information is missing?
c.  Describe the pros and cons of the way that the information is presented
d.  What does this resource allow you to do that the images in Task 1 didn't?
e.  How does viewing this resource within WebCT affect how you use it?


Task 3: reflection

a.  If you were to take the best elements of all four learning environment to create a 'fantasy' learning environment, what would it look like?

## Appendix E: Phase 1 Use Codes and Use Processes

SFT = Students Full Time; SDL = Distance Learning students; P/D = reflective blogs written about both digital and physical artefacts

| Physical (P) or Digital (D) | | P | P | P | P | P | P/D | D | D | D | D | D | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Use Process** | **Use Code** | **A** | **HP** | **DC** | **P** | **SFT** | **SFT** | **A** | **HP** | **DC** | **P** | **SFT** | **SDL** |
| identification | identification | 2.39 | 3.75 | 3.33 | 9.28 | 7.56 | 1.63 | 0.96 | 5.52 | 4.44 | 1.20 | 2.49 | 8.77 |
| | analysing detail | 3.74 | 2.41 | | | | | 1.81 | 0.43 | | | 5.97 | 3.19 |
| | assessing condition | 2.41 | 7.77 | 5.00 | 3.70 | 0.68 | 1.01 | 0.68 | 1.28 | 0.62 | | 1.49 | |
| | assessing materials | 2.14 | 5.90 | 13.33 | 5.56 | 3.05 | 3.03 | 1.36 | 0.94 | 0.41 | 0.60 | 5.97 | 3.19 |
| | question use | 0.53 | | | | | | 0.23 | | | | | |
| | reconciling with the metadata | 0.27 | | | | 1.02 | 6.31 | | | | | 4.98 | |
| | reading the label | | | | | | 0.25 | | | | | | |
| | reading from the artefact | 4.55 | 1.34 | 1.67 | | 0.34 | | 2.15 | 0.85 | 0.10 | | 0.50 | 0.35 |
| | thinking about use in teaching | | | | | | | 0.79 | | | | | |
| | adding content | | | | | | | | | 3.52 | 1.80 | | |
| **Use Process** | **Use Code** | **A** | **HP** | **DC** | **P** | **SFT** | **SFT** | **A** | **HP** | **DC** | **P** | **SFT** | **SDL** |
| contextualisation | contextualising | 5.61 | 6.17 | | 1.85 | 6.44 | 0.85 | 3.49 | 4.61 | 2.28 | 1.80 | 5.72 | 7.25 |
| | comparing | 0.80 | | | 1.85 | 3.49 | | | 1.45 | 0.31 | | | |
| | thinking about object types | | | | | | | 0.11 | | | | | |
| | links between things | | 0.27 | | | 0.68 | | 4.07 | 4.01 | 4.55 | | | 0.35 |
| | thinking about context | 0.80 | | | | | | | | | | | |
| | gathering evidence | | | | | | | 0.56 | 0.51 | | | | |
| | getting into mindset of maker | | | | | | | 0.11 | | | | | |
| | imagining the former owner and use | 7.22 | 1.88 | 5.00 | 9.26 | 1.02 | | 1.36 | 0.68 | | | | 1.06 |
| | thinking about other sources of information | | 3.75 | | | 5.42 | 4.29 | 0.45 | 3.33 | 0.21 | 1.20 | | 6.03 |
| | study artefacts in situ | | | | | | | 0.23 | | | | | |
| | thinking about weight | 1.07 | 1.34 | | | 1.48 | 1.77 | 1.13 | 0.34 | | 0.60 | 0.50 | |
| | thinking about the actor | 1.07 | 5.63 | 8.33 | 14.81 | 11.86 | 7.58 | 0.90 | 3.41 | 1.45 | 8.98 | 3.68 | |

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| | Physical (P) or Digital (D) | P | P | P | P | P | P/D | D | D | D | D | D | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Use Process** | **Use Code** | **A** | **HP** | **DC** | **P** | **SFT** | **SFT** | **A** | **HP** | **DC** | **P** | **SFT** | **SDL** |
| contextualisation (contd) | thinking about the character | 2.41 | 3.49 | | 11.11 | 5.08 | 13.38 | 4.29 | 3.75 | 1.14 | 2.40 | 9.95 | 2.48 |
| | thinking about the maker | | 0.80 | | 1.85 | | | 0.11 | 0.26 | 0.31 | | | 1.06 |
| | thinking about the designer | | | | | | 0.51 | | | | | | |
| | thinking about the artist | | | | | | 0.51 | | | | | | |
| | thinking about director | | | | | | 0.51 | | | | | | |
| | thinking from the perspective of the audience | 0.27 | 0.80 | 1.67 | 1.85 | 1.02 | 0.51 | 1.36 | 0.68 | 0.10 | 0.60 | 1.99 | 3.55 |
| | thinking about size and scale | 1.34 | 5.36 | 10.00 | 3.70 | 7.46 | 2.02 | 0.79 | 1.45 | 0.52 | | | 1.62 |
| | thinking about noise | | | | | 0.34 | 0.71 | | 0.17 | | | | |
| | Imagining artefact in motion | | 1.61 | | 1.85 | 0.68 | 1.01 | | 0.26 | 0.10 | | | 0.45 |
| | imagine on stage | | | | | | 0.51 | | | | | | |
| | matching | 0.27 | | | | | 0.25 | | | | | | |
| | measure | | | | | | | 0.11 | | | | | |
| | thinking about sound | | | | | | | | 0.09 | | | | |
| | thinking about colour | | 1.07 | | | 0.34 | | | | | | | 1.16 |
| | deduction | | | | | 0.68 | | | | | | | |
| | historical context | | | | | | 3.28 | | | | | 1.00 | 0.35 |
| | thinking about lighting | | 1.61 | 1.67 | 1.85 | 0.34 | | 0.90 | 0.34 | 0.10 | | | |
| **Use Process** | **Use Code** | **A** | **HP** | **DC** | **P** | **SFT** | **SFT** | **A** | **HP** | **DC** | **P** | **SFT** | **SDL** |
| interpretation | interpreting | 3.21 | 1.61 | | | 2.03 | 7.12 | 4.37 | 2.82 | 2.38 | 5.99 | 6.47 | 3.55 |
| | Interpret symbolic meaning | 3.48 | 3.75 | | | 0.34 | 1.77 | 0.90 | 1.02 | 0.31 | | 5.97 | 3.19 |
| | links between ideas | | | | | | | | | | 2.99 | | |
| | comparing ideas | | | 3.33 | | | 1.77 | 1.81 | | | 0.60 | 1.00 | |
| | describing | 2.14 | 4.02 | 13.33 | 5.56 | 5.76 | 2.77 | 1.56 | 1.54 | 0.10 | | | 3.55 |
| | researching | | | | | | | 0.56 | | | | | |
| | thinking about value | 4.55 | | | | 2.37 | | 2.03 | 0.43 | 0.31 | | | 1.42 |
| | retrospective observation | | | | | | | | | | | | |

| Use Process | Physical (P) or Digital (D) | P | P | P | P | P | P/D | D | D | D | D | D | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Use Process** | **Use Code** | **A** | **HP** | **DC** | **P** | **SFT** | **SFT** | **A** | **HP** | **DC** | **P** | **SFT** | **SDL** |
| interpretation (contd) | thinking about authenticity | 1.34 | 0.54 | | | | | 0.90 | 0.09 | 0.10 | | | 0.35 |
| | thinking about design | 4.01 | 0.27 | 5.00 | | 0.34 | | 2.03 | | 0.10 | 1.20 | | 1.77 |
| | bringing back to life | | | | | | | 0.56 | | | | | |
| | life of the object | 0.27 | | | | | | | | | | | |
| | thinking about metadata | 7.75 | | | | 0.68 | | 6.89 | 9.22 | 11.38 | 0.55 | | 8.19 |
| | conversation piece | | | | | | | 0.11 | | | | | |
| | reminiscing | | | 1.67 | | | | | | | | | |
| | thinking about the play | 0.80 | 2.14 | | 9.26 | 2.37 | 5.05 | 2.82 | 3.07 | 2.07 | 7.78 | 2.99 | 3.55 |
| | thinking about the text | | | | | 0.34 | 0.76 | 1.69 | 1.54 | 1.45 | 2.40 | 5.97 | |
| | thinking about the venue | 0.27 | | | | | 0.76 | | | | | | |
| | thinking about structure | 4.01 | 3.22 | 3.33 | 3.70 | 1.02 | 0.25 | 0.56 | 0.43 | | | 1.99 | 2.48 |
| | thinking about the performance | 2.94 | | | | 4.07 | 2.78 | 2.03 | 1.96 | 0.52 | 3.59 | 0.50 | 7.45 |
| | thinking about production | 1.60 | 4.29 | | 3.70 | 6.44 | 8.84 | 1.13 | 2.99 | 0.83 | 6.59 | 8.96 | 5.67 |
| | thinking about other productions | | | | | | 0.76 | | | | | | |
| | thinking about construction | 5.88 | 0.27 | | | 0.34 | | 3.05 | | | | | 2.13 |
| | aesthetic judgement | | | | | 0.34 | | | | | | | 1.06 |
| | critical analysis | | | | | | 0.25 | | | | | | |
| | thinking about representation | | | | | | 1.26 | | | | | | |
| | historical accuracy | | | | | | | | | | | | 2.48 |
| | interrogating metadata | | | | | | 2.27 | | | | | | |
| | thinking about function | | | | | | 3.54 | | | | | 5.47 | 1.06 |
| | thinking about selection | | | | | 2.37 | 2.78 | 3.28 | 3.58 | 3.10 | 0.60 | | 0.71 |
| **Use Process** | **Use Code** | **A** | **HP** | **DC** | **P** | **SFT** | **SFT** | **A** | **HP** | **DC** | **P** | **SFT** | **SDL** |
| location | discovering artefacts | | | | | | | 0.11 | | | | | |
| | access routes | | | | | | | 3.16 | 1.62 | 4.45 | 3.59 | | |
| | finding artefacts | | | | | 1.36 | | 1.13 | 2.72 | 3.31 | | | 0.71 |

| Use Process | Use Code | P | P | P | P | P | P/D | D | D | D | D | D | D |
| | | A | HP | DC | P | SFT | SFT | A | HP | DC | P | SFT | SDL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| induction | induction | 1.60 | | | | | | | 0.26 | | | 0.50 | |
| | thinking about themes | | | | | 0.34 | | 0.90 | 0.51 | 1.45 | | | |
| | thinking of a solution | | | | | | | 0.11 | | | | | |
| | mapping artefacts | | | | | | | | | 2.07 | | | |
| | grouping artefacts | | | | | | | 0.34 | | | | | |
| | completion | | | | | 3.05 | | | | | | | |
| | looking for order | | | | | | 0.51 | | | | | | |
| | reassembling | | | | | | 0.51 | | | | | | |
| **Use Process** | **Use Code** | **A** | **HP** | **DC** | **P** | **SFT** | **SFT** | **A** | **HP** | **DC** | **P** | **SFT** | **SDL** |
| affection | experience of contact | | | | | | 0.25 | | | | | | |
| | getting excited | | | | | | 0.25 | | | | | | |
| | presence of artefact | | | | | | | | | | | 0.50 | |
| | confused | | | | | | | | | | | 0.50 | |
| | inspired by design | | | | | | 0.51 | | | | | | |
| | conversing with artefact | | | | | | 0.51 | | | | | | |
| | Imagining trying on | | | | | 3.39 | | | | | | | |
| | handling artefacts | 5.08 | 6.17 | | 5.56 | 1.36 | | 0.90 | 2.05 | 0.72 | 1.20 | | |
| | sensing artefacts | | 2.41 | 11.67 | | | | 0.23 | 0.60 | 0.52 | 1.20 | | |
| | looking more closely | 4.28 | 0.54 | 1.67 | 3.70 | 2.37 | 0.51 | 0.90 | 3.07 | 1.24 | 1.20 | 1.00 | 1.06 |
| | looking from a distance | 0.27 | | 8.33 | | | | | | 0.31 | | | |
| | touching | | | | | | 0.76 | | | | | | |
| | thinking about touching | | | | | | | | | | | 0.50 | |
| | opening images | | | | | | | | | | | | 1.32 |
| | turn it over | | | | | | 0.25 | | | | | | |
| | viewing object from different angles | | | | | | | | | | | | 5.67 |
| | looking from further away | | | | | | | | | | | 1.00 | 1.77 |

| | Physical (P) or Digital (D) | P | P | P | P | P | P/D | D | D | D | D | D | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Use Process** | **Use Code** | **A** | **HP** | **DC** | **P** | **SFT** | **SFT** | **A** | **HP** | **DC** | **P** | **SFT** | **SDL** |
| affection (contd) | viewing holistically | | | | | | 0.76 | | | | | | |
| **Use Process** | **Use Code** | **A** | **HP** | **DC** | **P** | **SFT** | **SFT** | **A** | **HP** | **DC** | **P** | **SFT** | **SDL** |
| curation | thinking about curation | | | | | | | 0.45 | 0.09 | | | | |
| | thinking about users | | | 1.67 | | | | 5.86 | 8.87 | 21.92 | 26.95 | | |
| | thinking about digitisation | 7.22 | 0.54 | | | 0.34 | 2.53 | 6.55 | 6.48 | 2.07 | 2.40 | 12.44 | |
| | looking after artefacts | | 8.04 | | | | | 0.11 | 2.90 | 0.10 | | | |
| | playing | | | | | | | 1.47 | 0.17 | 3.41 | 2.40 | | |
| | preservation | 2.41 | | | | | | 1.02 | | | | | |
| | virtual hang | | | | | | | 0.68 | | | | | |
| | collecting artefacts | | | | | | | 0.34 | | | | | |
| | owning artefacts | | | | | | | 0.34 | | | | | |
| | packaging content | | | | | | | 0.68 | 0.43 | 0.21 | 1.20 | | |
| | personalise content | | | | | | | 4.05 | 0.43 | 3.31 | 1.80 | | |
| | thinking about role of artefacts | | | | | | | 0.11 | | | | | |
| | create resource | | | | | | | 5.65 | 1.02 | 4.96 | 5.39 | | |
| | creating metadata | | | | | | | | 1.54 | | | | |
| | sharing metadata | | | | | | | | 0.68 | 3.21 | | | |
| | publishing content | | | | | | | | 0.26 | | | | |
| | reusing metadata | | | | | | | | | 2.69 | | | |
| | attaching metadata | | | | | | | | | 0.41 | 0.60 | | |
| | retrospective observation | | | | | | | | | | | | |
| | photograph | | | | | | | 0.23 | 0.60 | | 0.60 | | |
| | controlling use | | 7.24 | | | | | 0.45 | 2.65 | 0.83 | | | |

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# Appendix F: Phase 2 Use Codes and Use Categories

| Use Process | Use Code | SS = Shakespeare Studies students, DC = Digital Cultures students, EG = Egyptology students | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Physical (P) or Digital (D) | A | A | A | B | B | B | C | C | C | D | D | D | |
| | | SS | DC | EG | SS | DC | EG | SS | DC | EG | SS | DC | EG | Rubric |
| identification | alt text | 0.1 | | | | | | | | | | | | Identification using alternative  text |
| | associate with particular person | 3.3 | 6.0 | | 5.9 | 11.8 | | 2.5 | 7.0 | | 3.2 | 5.5 | | Identification of artefact by association with a particular person |
| | authority of metadata | | | | 1.3 | | | | | | 0.3 | | | Trustworthiness of metadata to enable identification |
| | books | 0.7 | 1.8 | | | | | | 2.0 | | | | | Identification of detail: books |
| | carvings | | 0.2 | | | | | | | | | | | Identification of detail: carvings |
| | hieroglyphic bands | | | | | | | | | 0.7 | | | 0.8 | Identification of a shabti by counting the number of hieroglypic bands |
| | display case | 0.1 | | | | | | 0.3 | | | 1.2 | 5.2 | 1.5 | Identification of the artefact by considering its display context |
| | scroll | 0.4 | 3.2 | | | 0.5 | | | | | | | | Identification of detail: scroll |
| | full figure | 0.1 | | | | | | | | | | | | Identification by referring to the entire artefact |
| | gender | 0.1 | | 0.3 | | | | 0.3 | | 2.3 | 0.1 | | 0.2 | Identification of the gender or sex of a figurative artefact |
| | image size | 0.1 | | | | | | | | | | | | Identification taking size of image into account |
| | imagining operation | | | | | | | 0.6 | | | | | | Identification of an artefact by considering how it works mechanically |
| | maker's mark | 0.8 | | | 0.4 | | | 0.6 | | | | | | Identification of an artefact by looking at imprint of maker's |

| Use Process | Use Code | SS | DC | EG | SS | DC | EG | SS | DC | EG | SS | DC | EG | Rubric |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | details |
| identification (contd) | material | 3.5 | 6.0 | 4.2 | 11.1 | 7.0 | 4.2 | 2.4 | 7.5 | 6.5 | 4.2 | 8.0 | 3.2 | Identification of an artefact through its material composition |
| | stamp | 0.2 | | | 0.5 | 1.5 | | 0.2 | 1.3 | | | 1.8 | | Identification of an artefact by looking at imprint of manufacturer's details |
| | transcribe | | | 1.0 | | | 0.4 | | | 0.9 | | | 0.9 | Identification of an artefact by transcribing surface details |
| | translate | | | 2.6 | | | 1.4 | | | 2.0 | | | 3.2 | Identification of an artefact by translating surface details |
| | transliterate | | | 0.3 | | | 0.2 | | | | | | | Identification of an artefact through transliteration of surface details |
| | type | 4.0 | 8.6 | 6.6 | 5.5 | 13.2 | 4.4 | 2.5 | 5.8 | 5.7 | 5.0 | 7.8 | 7.0 | Identification according to artefact type eg. sculpture |
| | hieroglyphic text | | | 2.5 | | | 1.8 | | | 1.1 | | | 2.7 | Identification through features of hieroglyphic text appearing on surface |
| | look at back | | | | | | | 0.1 | 0.3 | | 1.3 | 2.5 | | Identification through visual inspection of the back of the artefact |
| | look at base | | | | | | | 0.4 | 1.2 | 0.6 | | | 0.3 | Identification through visual inspection of the base of the artefact |
| | look at face | | | | | | | | 2.3 | | | | 0.2 | Identification through visual inspection of the face on figurative artefacts |
| | look at front | | | | | | | 0.8 | | | 2.8 | 2.2 | | Identification through visual inspection of the front of the artefact |
| | look at head | | | | | | | 0.1 | 1.8 | 0.7 | | | | Identification through visual inspection of the head of a figurative artefact |
| | look at left side | | | | | | | 0.2 | 0.8 | | 1.1 | | | Identification through visual inspection of the left hand side of the artefact |
| | look at middle | | | | | | | | 4.2 | | | | | Identification through visual inspection of the middle of the artefact |
| | look at right side | | | | | | | | | | 1.8 | 2.8 | | Identification through visual inspection of the right hand side |

| Use Process | Use Code | SS | DC | EG | SS | DC | EG | SS | DC | EG | SS | DC | EG | Rubric |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | of the artefact |
| | look at top | | | | | | | | 3.0 | | | | 0.7 | Identification through visual inspection of the top of the artefact |
| | look from above | 0.1 | | | | | | | | | 0.3 | 1.5 | | Identification through visual inspection by looking from above the artefact |
| | look inside | | | | | | | 0.5 | | | | | | Identification through visual inspection of the inside of the artefact |
| | look underneath | 0.2 | | | | | | 0.3 | | | | | 0.5 | Identification through visual inspection of the underside of the artefact |
| | TOTAL | 13.7 | 25.8 | 17.5 | 24.7 | 34.0 | 12.4 | 11.5 | 35.2 | 22.8 | 21.3 | 37.3 | 21.2 | |
| **Use Process** | **Use Code** | **SS** | **DC** | **EG** | **SS** | **DC** | **EG** | **SS** | **DC** | **EG** | **SS** | **DC** | **EG** | **Rubric** |
| contextualisation | 2D | 0.2 | | | 0.1 | | | 0.1 | | | | | | Considering the two dimensional context of an artefact |
| | 3D | 0.7 | 0.8 | 1.2 | 0.3 | 0.4 | 0.6 | 0.8 | 0.2 | 0.3 | 0.3 | | 0.3 | Considering the three dimensional context of an artefact |
| | anachronism | 0.1 | | | | | | 0.1 | | | | | | Attributing an artefact or a detail of it to a different period |
| | archaeological context | | | | 0.1 | | | | | | | | 0.3 | Considering the physical location of an artefract's discovery |
| | associated artefacts | | | | 0.2 | | | | | | | | | Contextualisation by considering relationships with other artefacts |
| | compare | 0.6 | | 1.5 | 0.1 | | 0.2 | 0.5 | | 0.2 | 0.7 | | 0.3 | Contextualisation by comparing artefacts with other artefacts |
| | connection with artwork | 2.4 | | | 0.2 | | | 2.3 | | | 1.9 | | | Contextualisation by considering associations with specific work of art |
| | contextualise | 0.7 | | | 1.2 | | 0.2 | 0.3 | | 0.2 | 0.7 | 0.2 | | Placing an artefact in a particular physical, informational or other context |
| | contextualise original location | 1.7 | 1.3 | 5.3 | 1.3 | 0.5 | 3.6 | 6.4 | 6.5 | 3.7 | 1.8 | 3.0 | 3.8 | Placing an artefact in the context of a physical location where it was first used |
| | contextualising current location | 2.5 | 0.7 | | 1.2 | 0.5 | | 2.0 | | | 0.5 | | | Placing an artefact in the context of its current location |

| Use Process | Use Code | SS | DC | EG | SS | DC | EG | SS | DC | EG | SS | DC | EG | Rubric |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| contextualisation (contd) | contextualising posture | | 0.5 | | | | | | 0.2 | | | | | Contextualisation of an artefact on the basis of the posture represented |
| | date | 6.7 | 4.2 | 6.2 | 3.4 | 4.5 | 5.7 | 6.7 | 2.2 | 4.1 | 5.4 | 4.0 | 5.3 | Attributing artefact to a particular time period |
| | deduction | | | 0.2 | | | | | | | | | | Using contextual information about an artefact in the process of deduction |
| | describing | | | 0.2 | | | 0.2 | | | | | | | Using contextual information to describe an artefact |
| | detail | 2.0 | 3.2 | 2.7 | 1.5 | 2.0 | 2.2 | 0.7 | 0.5 | 0.8 | 1.1 | 0.8 | 1.7 | Contextualisation of an artefact by taking into account specific details |
| | different views | 2.7 | 3.6 | 1.5 | 3.2 | 1.5 | 1.8 | 0.6 | 1.6 | 1.8 | 0.8 | 0.8 | 2.3 | Contextualisation of an artefact by considering different perspectives or viewpoints |
| | display context | | | | | | | | | | 0.9 | 0.8 | | Contextualisation of an artefact on the basis of where and how it is displayed |
| | facial feature | 0.4 | 1.0 | 1.8 | 1.0 | 1.5 | 1.7 | 0.6 | 0.6 | 3.6 | 1.8 | 1.9 | 2.5 | Contextualisation of an artefact by taking into account facial features |
| | historic context | 1.2 | | 0.5 | 2.7 | | | 1.4 | | 0.2 | 1.1 | | | Placing an artefact in a particular historical period |
| | image quality | 0.3 | | | 0.2 | | | | | | | | | Contextualisation by ranking the quality of an artefact image |
| | Internet search | 0.9 | 0.6 | 1.2 | 1.2 | 1.7 | | 0.6 | 0.3 | 0.3 | 0.7 | 1.0 | | Contextualisation by searching in libraries for more information about an artefact |
| | library search | | | | | | | | | | | 0.2 | | Contextualisation by searching on the internet for more information about an artefact |
| | likeness | 0.1 | | | 0.1 | | | 0.1 | | | 0.4 | | | Contextualisation by comparing a figurative artefact with whom it portrays |
| | link | 0.4 | 0.3 | 1.2 | 0.6 | 2.0 | 0.8 | 0.3 | 0.3 | | 0.1 | 0.2 | | Contextualisation of an artefact by linking to other information |
| | literary context | | | | | | | | | | 1.6 | | | Considering the literary context of an artefact |
| | parallels | | | | | | | | | | 0.1 | | | Contextualisation of an artefact by looking for other similar examples |

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| Use Process | Use Code | SS | DC | EG | SS | DC | EG | SS | DC | EG | SS | DC | EG | Rubric |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| contextualisation (contd) | part of set | 0.1 | | 1.2 | 0.7 | | 1.0 | 0.3 | 0.4 | 0.9 | 0.2 | | 0.7 | Placing an artefact in a wider context if part of set of artefacts |
| | place made | 2.5 | | 0.3 | 0.8 | | | 2.6 | | 0.3 | 2.1 | 2.2 | 0.7 | Contextualisation of an artefact by considering its place of manufacture |
| | pushes imagination | | | | | | | 0.1 | | | 0.1 | | | Contextualisation of an artefact by imagining the circumstances of original use |
| | reverse engine search | | 1.0 | | | 0.3 | | | | | | | | Contextualisation of an artefact by finding other information through the use of a reverse engine search |
| | search catalogue | 0.1 | | | | 0.8 | | | 0.9 | | | | | Contextualisation of an artefact by searching a museum, library or archive catalogue for more information |
| | share | | | 0.3 | 0.8 | | | 0.1 | | 0.3 | 0.1 | | 0.3 | Contextualisation of an artefact by using information about it shared by other users, or sharing information oneself |
| | social history | | | | | | | | | | | 0.3 | | Placing an artefact in a particular social and historical context |
| | thinking about other information | | | | | | | 0.6 | | | | | | Contextualisation of artefact taking into account information that is missing |
| | unique | 0.4 | | | 0.8 | | | 0.9 | | 0.6 | 1.0 | | 1.0 | Contextualisation of an artefact by evaluating its uniqueness or rarity among others |
| | what's missing | 0.4 | | 0.2 | 0.1 | 0.3 | | 0.1 | 2.4 | | 0.5 | 0.3 | | Contextualisation of artefact taking into account features which might be missing |
| | **TOTAL** | **27.1** | **17.2** | **25.5** | **21.8** | **15.2** | **18.8** | **27.6** | **16.7** | **17.3** | **23.9** | **15.7** | **19.2** | |
| **Use Process** | **Use Code** | **SS** | **DC** | **EG** | **SS** | **DC** | **EG** | **SS** | **DC** | **EG** | **SS** | **DC** | **EG** | **Rubric** |
| interpretation | acquisition | | | | | | | | 0.2 | | | | | Considering the acquisition of the artefact in its interpretation |
| | aesthetic judgement | 1.0 | 1.0 | 0.2 | 0.4 | 0.8 | 1.6 | 2.0 | 1.2 | 1.0 | 0.4 | 2.0 | 0.5 | Making an aesthetic judgement in the interpretation of the artefact |
| | authenticity | 0.3 | 0.5 | 0.2 | 0.3 | 1.0 | 0.4 | 0.1 | | 0.7 | | 1.8 | 0.3 | Considering the authenticity of the artefact in its interpretation |
| | commemoration | 0.6 | 0.2 | | 0.4 | 0.5 | | 0.1 | 0.5 | | 0.5 | 1.2 | | Considering the commemorative function of the artefact in its |

| Use Process | Use Code | SS | DC | EG | SS | DC | EG | SS | DC | EG | SS | DC | EG | Rubric |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | interpretation |
| interpretation (contd) | funerary significance | | | 0.7 | | | 1.7 | | | 1.3 | | | 1.7 | Considering the funerary significance of an artefact in its interpretation |
| | historic signficance | | | | 1.9 | | | 0.1 | | | | | | Considering the historic significance of an artefact in its interpretation |
| | interpeting manufacture | 1.7 | 2.0 | 1.3 | 1.4 | 3.0 | 2.8 | 2.6 | 2.2 | 0.5 | 1.5 | 1.5 | 0.7 | Interpreting the artefact through the way it has been made |
| | interpreting | 0.5 | 0.2 | 0.2 | 0.8 | 0.3 | | | | | 0.2 | | 0.5 | Creating meaning from the artefact |
| | interpreting art history | | 0.2 | | | | | | | | | 0.8 | | Interpreting the art history of an artefact |
| | interpreting books | | 0.5 | | | | | | | | | | | Interpreting the meaning of books which appear in a figurine |
| | interpreting clothing | 2.3 | | | 0.7 | | | 0.8 | | | 0.6 | | | Interpreting the meaning of clothes which appear in a figurine |
| | interpreting colour | | | | | | | 0.3 | | | | | | Interpreting an artefact through its colouration |
| | interpreting condition | 0.9 | 1.5 | 1.3 | 0.2 | 0.2 | 1.8 | 1.6 | 2.0 | 4.3 | 0.7 | 1.1 | 5.7 | Interpreting an artefact through its material condition |
| | interpreting costume | 0.1 | 1.6 | | | 0.3 | 0.4 | | 0.8 | | | | | Interpreting the meaning of historical costumes which appear in a figurine |
| | interpreting design | 0.4 | | | 0.2 | | 0.2 | 0.6 | | | 0.1 | | | Considering the design of the artefact in its interpretation |
| | interpreting features | 0.8 | | | | | | 0.1 | | | 0.1 | | | Considering features of the artefact in its interpretation |
| | interpreting function | 1.6 | 1.1 | | 2.7 | 1.2 | | 4.2 | 2.0 | | 2.9 | 2.5 | | Considering the function of the artefact in its interpretation |
| | interpreting location | | | | | | 1.5 | | | | | | | Interpreting an artefact by considering its past, present or future physical location |
| | interpreting podium | | 0.5 | | | | | | | | | | | Interpreting the meaning of a podium which appears in a figurine |
| | interpreting posture | 0.1 | | | | | | 0.2 | | | | | | Interpreting the meaning of posture in a figurine |
| | interpreting style | 0.6 | 0.6 | 0.2 | 0.4 | | | 0.7 | | 0.5 | 0.9 | | | Interpreting the stylistic meaning of an artefact |

| Use Process | Use Code | SS | DC | EG | SS | DC | EG | SS | DC | EG | SS | DC | EG | Rubric |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| interpretation (contd) | interpreting text | | | | | | | 0.4 | | | | | | Interpreting the textual content of an artefact |
| | literary significance | | | | 0.1 | | | | | | 0.2 | | | Considering the literary significance of an artefact in its interpretation |
| | protection | | | | | | | | | | | 0.5 | | Considering the physical protection of an artefact in its interpretation eg. display case |
| | provenance | 1.6 | 1.3 | 1.3 | 2.2 | 1.5 | 10.0 | 3.2 | 2.8 | 1.0 | 5.7 | 4.2 | 2.0 | Considering an artefact's previous and present ownership in its interpretation |
| | purpose | 0.1 | | | 0.5 | | | 0.9 | | | 0.8 | | | Considering the material quality of the artefact in its interpretation |
| | quality | 0.1 | 0.3 | 0.7 | 0.8 | | 0.4 | 0.2 | 0.2 | 0.4 | 0.1 | | 0.3 | Considering the purpose of the artefact in its interpretation |
| | reading the artefact | 1.7 | 1.7 | 6.8 | 2.8 | 2.8 | 7.0 | 2.0 | 2.5 | 7.0 | 0.8 | 1.6 | 10.4 | Interpreting the textual content of an artefact by reading from it |
| | relatability | | | | | | | 0.2 | | | | | | Considering the meaning of an artefact in relation to the life experience of the end-user |
| | ritual significance | | | 0.8 | 0.1 | | | 0.2 | | 0.2 | | 0.3 | 0.3 | Considering the ritual significance of an artefact in its interpretation |
| | symbolism | 0.4 | 0.3 | 0.2 | | | | 3.2 | 0.5 | | 0.5 | | 0.2 | Interpreting the symbolic meaning of the artefact |
| | thinking about artist | 0.7 | 2.7 | | 0.4 | 0.7 | | | 0.8 | | 0.2 | 0.8 | | Considering the artist / creator in the interpretation of the artefact |
| | thinking about designer | 0.3 | | | | | | | | | | | | Considering the maker of an artefact in its interpretation |
| | thinking about maker | 0.9 | 1.1 | | 1.4 | 2.4 | 0.6 | 0.8 | 0.8 | | 0.7 | 0.5 | | Considering the designer in the interpretation of the artefact |
| | thinking about metadata | 7.5 | 11.6 | 8.8 | 8.8 | 10.0 | 9.2 | 5.9 | 6.5 | 2.7 | 5.2 | 6.8 | 4.2 | Considering information about the artefact in its interpretation |
| | thinking about source of digital | | | | | 0.8 | | | | | | | | Considering the process of digitisation and its relationship to the artefact in its interpretation |

| Use Process | Use Code | SS | DC | EG | SS | DC | EG | SS | DC | EG | SS | DC | EG | Rubric |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| interpretation (contd) | thinking about user | 2.2 | 0.9 | 5.2 | 1.7 | 1.0 | 3.1 | 1.4 | 2.0 | 4.9 | 3.9 | 4.0 | 3.5 | Considering the past or present user of an artefact |
| | value | 0.7 | 1.4 | 0.6 | 0.7 | 1.5 | 0.8 | 1.3 | 0.8 | 0.5 | 2.5 | 1.7 | 0.2 | Considering aspects of the value of an artefact in its interpretation |
| | **TOTAL** | **27.1** | **31.2** | **28.5** | **28.9** | **29.5** | **40.0** | **29.9** | **28.5** | **25.5** | **28.0** | **31.8** | **30.5** | |
| location | search for artefact | 0.1 | | | | 0.3 | | | | | | | | Locating the artefact |
| | **TOTAL** | **0.1** | **0.0** | **0.0** | **0.0** | **0.3** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | |
| induction | accuracy | 0.1 | | | 0.1 | | 0.6 | | | | | | | Evaluating the accuracy of an artefact through a process of induction |
| | detective work | | | | | | | | 0.8 | | | 0.2 | | Using induction to solve a problem in the identification of the artefact |
| | **TOTAL** | **0.1** | **0.0** | **0.0** | **0.1** | **0.0** | **0.6** | **0.0** | **0.8** | **0.0** | **0.0** | **0.2** | **0.0** | |
| affection | adjust viewing position | | | | | | | | 0.4 | | | 0.2 | | Adjust viewing position to see an artefact |
| | blow | | | | | | | 0.1 | | | | | | Blow the surface of an artefact |
| | click | 1.1 | 0.8 | 0.7 | 0.9 | 1.0 | 1.5 | 0.2 | 0.2 | | 0.1 | | | Click a mouse to afford action |
| | comment | | | 0.3 | 0.4 | | | | | | | | | Make a comment on a blog or use information from other comments |
| | communicate with author | | | | 0.1 | | | | | | | | | Contact the author of a web resource eg. blog |
| | contact museum | 0.8 | | | 1.9 | 0.2 | | 0.3 | | | 0.5 | | | Contact a museum curator with responsibility for an artefact |
| | copy | 0.1 | | | | | | | | | | | | Make an electronic copy of a resource |
| | delete | 0.1 | | | | | | | | | | | | Erase an electronic resource |
| | dismantle | | | 0.2 | | | | | | | | | | Deconstruct an artefact |
| | download | | 0.6 | | 0.1 | 0.3 | | | | | | | | Download an electronic copy of a resource |

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| Use Process | Use Code | SS | DC | EG | SS | DC | EG | SS | DC | EG | SS | DC | EG | Rubric |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| affection (contd) | draw | | | | | | | | | 0.3 | | | | Sketch an artefact |
| | enlarge image | 0.4 | 0.8 | 0.5 | 0.7 | | 0.8 | 0.3 | | | 0.2 | | 0.3 | Magnify an image |
| | expression | 0.4 | 0.7 | | 0.3 | | | 0.1 | | | 1.2 | 0.2 | | Consider the facial expression of a figurine |
| | feel static | | 0.3 | | | | | | | | | | | Sense the static electricity on the surface of an artefact |
| | flick between images | | | 0.2 | 0.1 | | | | | | | | | Move between images of an artefact |
| | handle | | | 0.2 | | | | | 0.5 | 0.2 | 0.2 | | | Touch an artefact |
| | hear | | | | | | | | | | 0.1 | | | Listen to an artefact or information about it |
| | hieroglyphic bands | | | | | | | | | 0.7 | | | | Count hieroglyphic bands on a shabti |
| | humour | | | | | | | 0.3 | | | | | | Use humour while using artefact |
| | knock | | | | | | | | 0.5 | | | | | Tap physical artefact |
| | looking closer | | 0.8 | | | | | | 0.3 | | 0.2 | | | Visually examine the artefact more closely |
| | manipulate | 0.1 | 0.3 | 1.3 | | 0.3 | 0.9 | 0.3 | 0.8 | 0.2 | | | | Manipulate electronic images of an artefact |
| | mimics crook flail | | | | | | | | | | | | 0.3 | Mimics the pose of a shabti, particularly the crook and flail |
| | mimics pose | | | | | | | 0.3 | | | 0.2 | | 0.2 | Mimics the pose of a shabti |
| | move around artefact | | | | | | 0.6 | | 0.3 | 0.9 | | 0.5 | 0.8 | Reposition oneself around the artefact |
| | move artefact | | | | 0.1 | | | 0.6 | | | 0.4 | | | Move the artefact or information about it |
| | move cursor | 0.1 | 0.2 | | | | | | | | | | | Move the cursor on a computer screen while using the digital artefact |
| | open | | | | 0.1 | 1.0 | | | | | | | | Open an artefact image file |
| | paste | 0.1 | | | | | | | | | | | | Paste an electronic image into another context |
| | photograph | | | | | | | | | | 0.2 | 0.1 | | Image capture for research use |
| | pick up | 0.2 | | | 0.6 | | | 2.6 | 1.0 | 1.2 | 0.4 | 1.0 | 0.2 | Lift an artefact |

| Use Process | Use Code | SS | DC | EG | SS | DC | EG | SS | DC | EG | SS | DC | EG | Rubric |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| affection (contd) | point at | | | | | | | 0.6 | 1.1 | 1.8 | 0.3 | 1.2 | 1.0 | Gesture towards an artefact |
| | point at case | | | | | | | | | | 0.4 | | | Gesture towards an artefact's display case |
| | reference | 0.8 | | | 0.3 | | | 0.1 | | | 0.2 | | | Cite an artefact or metadata about it in an academic text |
| | rotate | 0.5 | 1.2 | 0.8 | 0.6 | 0.5 | 0.8 | 1.6 | | 1.7 | 0.5 | 0.3 | 0.2 | Spin an artefact |
| | save | 0.7 | | 0.3 | 0.2 | 0.3 | | | | | | | | Save an artefact image or metadata |
| | see all round | 0.1 | | | | | | | | | | | | Examine the artefact in 360 degrees |
| | select image | 0.1 | 0.5 | 0.2 | | 0.2 | | 0.1 | | | | | | Choose an image of an artefact |
| | separate | | | | 0.9 | | | 2.6 | | | | | | Separate different parts of an artefact |
| | shake | | | | | | | 0.1 | | | | | | Move the artefact quickly from side to side |
| | smell | | | | | | | | | | 0.1 | | | Smell the artefact |
| | tag | | | 0.4 | 0.3 | | | | | | 0.1 | | | Classify the artefact using an electronic tag |
| | taste | | | | | | | | | | 0.1 | | | Tasting the artefact |
| | temperature | | | | | | | | 0.5 | | | | | Taking the temperature of an artefact |
| | tilt | 0.2 | | | | | | 0.1 | 1.6 | 0.5 | | | | Inclining the artefact |
| | touch | 0.7 | 0.5 | 0.5 | 0.3 | | | 4.5 | 2.2 | 4.1 | 2.1 | 1.5 | 0.3 | Handling the artefact |
| | trace hieroglyphic text | | | | | | | | | | | | 0.7 | Replicate hieroglyphic text by tracing its outline |
| | trace pose | | | | | | | | 0.3 | | | | | Trace the posture of a figurine |
| | turn over | | | | | | | 0.1 | | | | | | Turn the artefact over |
| | turn upside down | 0.4 | | 0.2 | | | | 1.3 | 0.8 | 0.3 | | | 0.2 | Invert the artefact |
| | twist | | | | | | | 0.5 | | | | | | Twist the artefact |
| | view artefact | 1.3 | 0.5 | 3.6 | 1.1 | 1.0 | 1.4 | 1.5 | 0.5 | 3.0 | 2.3 | 1.6 | 2.7 | Visually examine the artefact |

| Use Process | Use Code | SS | DC | EG | SS | DC | EG | SS | DC | EG | SS | DC | EG | Rubric |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| affection (contd) | weigh | 0.8 | 0.3 | 0.2 | 0.6 | 0.3 | | 1.2 | 2.0 | 2.0 | 2.3 | 0.3 | | Judge the weight of an artefact |
| | zoom | 1.3 | 1.9 | 2.6 | 1.8 | 2.4 | 0.7 | 0.1 | | | | | | Zoom-in to an electronic image of an artefact |
| | colour | 2.2 | 2.0 | 2.5 | 0.7 | 1.0 | 3.4 | 1.7 | 0.2 | 6.2 | 1.3 | 0.8 | 2.2 | Note the colour of an artefact |
| | scale | | 0.3 | | | | | | | | | | | Note the scale of an artefact |
| | shape | 0.3 | | 0.2 | 0.2 | 1.7 | 0.8 | 0.7 | 0.5 | | 2.4 | 1.0 | 0.2 | Note the shape of an artefact |
| | size | 7.8 | 6.6 | 1.9 | 5.1 | 4.1 | 7.2 | 1.9 | 1.2 | 1.0 | 3.9 | 0.8 | 0.8 | Note the size of an artefact |
| | structure | 5.9 | 1.9 | 8.2 | 5.9 | 4.4 | 4.6 | 3.7 | 2.2 | 5.3 | 5.2 | 3.0 | 14.3 | Visually examine the physical structure of an artefact |
| | surface | 1.5 | 0.5 | 1.0 | 0.5 | 1.2 | 4.0 | 2.5 | 0.2 | 2.3 | 2.2 | 1.7 | 1.5 | Visually examine or touch the surface of an artefact |
| | photographic background | 0.3 | | 0.2 | 0.1 | | | | | | | | | Visually examine the photographic background of an artefact |
| | posture | 2.6 | 4.3 | 1.3 | | | 0.6 | 0.8 | 1.2 | 2.0 | 0.2 | | 2.7 | Visually examine the posture of an artefact |
| | lighting | 0.3 | | 0.5 | 0.5 | 0.3 | 0.7 | 0.1 | | 0.5 | | 0.5 | 0.2 | Discuss lighting of the artefact |
| | plinth | 0.3 | 0.8 | 0.5 | 0.1 | | 0.2 | 0.1 | 0.3 | | | | 0.3 | Visually examine the plinth supporting a figurine |
| | **TOTAL** | **31.5** | **25.8** | **28.5** | **24.5** | **20.2** | **28.2** | **31.0** | **18.8** | **34.4** | **26.8** | **15.0** | **29.1** | |
| curation | curating | 0.3 | | | | | | | | | | | | Considering how the artefact should be managed, accessed and used |
| | permission | 0.1 | | | | | | | | | | | | Considering access to the artefact and any permissions required |
| | cite | | | | | 0.8 | | | | | | | | Considering how the artefact should be referenced in scholarly work |
| | **TOTAL** | **0.4** | **0.0** | **0.0** | **0.0** | **0.8** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | |

**Appendix G: Phase 2 CoPs and Learning Style**

| | A | | | | B | | | | C | | | | D | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Accomm | Conv | Div | Assim | Accomm | Conv | Div | Assim | Accomm | Conv | Div | Assim | Accomm | Conv | Div | Assim | Usage | LSI |
| SS1 | 20 | 9 | 43 | 28 | 15 | 25 | 26 | 34 | 23 | 13 | 32 | 32 | 27 | 10 | 30 | 33 | Div | Assim |
| SS2 | 28 | 17 | 19 | 36 | 22 | 28 | 15 | 35 | 28 | 8 | 28 | 36 | 33 | 9 | 19 | 39 | Assim | Accom |
| SS3 | 43 | 11 | 29 | 17 | 39 | 24 | 19 | 18 | 30 | 11 | 28 | 31 | 10 | 32 | 29 | 29 | Accom | Accom |
| SS4 | 47 | 5 | 24 | 24 | 35 | 18 | 20 | 27 | 23 | 10 | 29 | 38 | 25 | 22 | 26 | 27 | Accom | Accom |
| SS5 | 29 | 13 | 31 | 27 | 17 | 30 | 28 | 25 | 36 | 10 | 27 | 27 | 34 | 21 | 21 | 24 | Accom | Accom |
| SS6 | 34 | 21 | 23 | 22 | 19 | 28 | 21 | 32 | 28 | 13 | 31 | 28 | 28 | 23 | 15 | 34 | Assim | Conv |
| SS7 | 27 | 16 | 27 | 30 | 25 | 29 | 18 | 28 | 29 | 30 | 23 | 18 | 16 | 31 | 30 | 23 | Conv | Conv |
| SS8 | 28 | 22 | 23 | 27 | 20 | 26 | 22 | 32 | 24 | 9 | 26 | 41 | 27 | 34 | 22 | 17 | Assim | Accom |
| SS9 | 28 | 15 | 20 | 37 | 17 | 18 | 37 | 28 | 44 | 7 | 18 | 31 | 34 | 15 | 24 | 27 | Accom | Accom |
| SS10 | 32 | 13 | 32 | 23 | 36 | 22 | 12 | 30 | 45 | 4 | 34 | 17 | 34 | 16 | 23 | 27 | Accom | Accom |
| | 31.6 | 14.2 | 27.1 | 27.1 | 24.5 | 24.8 | 21.8 | 28.9 | 31 | 11.5 | 27.6 | 29.9 | 26.8 | 21.3 | 23.9 | 28 | | |
| DC1 | 32 | 20 | 15 | 33 | 15 | 37 | 14 | 34 | 25 | 36 | 11 | 28 | 15 | 44 | 11 | 30 | Conv | Conv |
| DC2 | 16 | 27 | 12 | 45 | 20 | 30 | 11 | 39 | 7 | 59 | 9 | 25 | 9 | 43 | 12 | 36 | Conv | Conv |
| DC3 | 22 | 30 | 20 | 28 | 21 | 43 | 18 | 18 | 15 | 22 | 25 | 38 | 16 | 31 | 28 | 25 | Conv | Conv |
| DC4 | 33 | 26 | 22 | 19 | 26 | 29 | 18 | 27 | 28 | 27 | 22 | 23 | 20 | 32 | 12 | 36 | Conv | Assim |
| | 25.8 | 25.8 | 17.2 | 31.2 | 20.5 | 34.8 | 15.2 | 29.5 | 18.8 | 36 | 16.7 | 28.5 | 15 | 37.5 | 15.7 | 31.8 | | |
| EG1 | 20 | 19 | 28 | 33 | 0 | 0 | 0 | 0 | 31 | 38 | 10 | 21 | 17 | 35 | 19 | 29 | Conv | Conv |
| EG2 | 29 | 22 | 20 | 29 | 43 | 19 | 14 | 24 | 32 | 38 | 13 | 17 | 30 | 33 | 15 | 22 | Accom | Conv |
| EG3 | 36 | 27 | 21 | 16 | 22 | 18 | 17 | 43 | 22 | 16 | 24 | 38 | 27 | 14 | 26 | 33 | Assim | Assim |
| EG4 | 26 | 16 | 25 | 33 | 37 | 12 | 17 | 34 | 39 | 18 | 17 | 26 | 41 | 16 | 15 | 28 | Accom | Accom |
| EG5 | 28 | 13 | 25 | 34 | 24 | 10 | 26 | 40 | 50 | 16 | 16 | 18 | 22 | 17 | 23 | 38 | Assim | Div |
| EG6 | 32 | 8 | 34 | 26 | 15 | 6 | 20 | 59 | 32 | 11 | 24 | 33 | 38 | 12 | 17 | 33 | Assim | Assim |
| | 28.5 | 17.5 | 25.5 | 28.5 | 28.2 | 13 | 18.8 | 40 | 34.4 | 22.8 | 17.3 | 25.5 | 29.1 | 21.2 | 19.2 | 30.5 | | |
| Totals | 590 | 350 | 493 | 567 | 468 | 452 | 373 | 607 | 591 | 396 | 447 | 566 | 503 | 490 | 417 | 590 | | |
| As % | 30 | 18 | 25 | 27 | 24 | 24 | 20 | 32 | 30 | 20 | 22 | 28 | 25 | 25 | 20 | 30 | | |