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Knitting virtual tribes together: new audiences for cultural objects

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Abstract. A focused re-analysis of knitted items in museum storage suggests a range of new approaches to researching the cultural biographies of objects and writing new chapters for them. The Knitting in Early Modern Europe (KEME) project examined more than 100 knitted caps held in European and North American museums. The project aims to bring a new scientific approach to the under-researched history of knitting as a textile craft and technology and to provide a protocol through which knitted objects which have been silent for too long can tell their stories. New chapters in these knitted objects’ biographies are also being written using innovative research methodologies. Scientific analyses more usually applied to archaeological material (such as scanning electron microscopy) have revealed the sophistication of the raw materials required to make them. Attempts at reconstruction using methodologies drawn from experimental archaeology have provided clear evidence of the complexity of the processes required to turn fleece into aspirational faux fur or mock velvet. A range of audiences was invited to engage with the knitted caps as investigators in a Citizen Science project and as commentators on the evidence via an interactive online database. A tribe has gathered around the material and has an ongoing dialogue with it. Social media have created the opportunity for the knitted caps to continue their lives into the future as dynamic cultural objects as new and different people engage with them reconstruct them and reinterpret them for their own purposes. The KEME project has generated the possibility for mute objects lying in the dark drawers of museum storage to have multiple vibrant new lives among diverse tribes well beyond their geographical and traditional cultural communities. This paper explores how cultural biographies can be set free to change and grow without the need for physical examination or public presentation of the objects.

1. Introduction
Knitting is a widespread popular pastime which has experienced a renaissance in recent years - as serious leisure, as contemporary craft, and as a guerrilla art form among other activities [1]. It has well-known therapeutic effects and provides a strong sense of accomplishment [2]. This increased popularity has generated new interest in its history and a large potential audience for the material culture of knitted objects. Knitters’ motivations include the pleasure of learning about the origins of their craft and the creative inspiration it provides. In addition, there is a demonstrable demand among dress historians and archaeologists, museum staff and wider publics for accurate information about the construction and reconstruction of historic dress, including knitted garments. Museum collections of knitted items are treasure troves of information from which new knowledge about textiles in the past may be generated. This paper explores how archaeological and historical knitted objects’ biographies can be set free to...
change and grow by reaching large and diverse audiences without the need for physical examination or formal public presentation - via an interactive online database.

It has been argued that digital data collection, analysis and presentation in archaeology is a ‘shift to the digital paradigm’ and that in this communications revolution ‘we are all digital archaeologists’ [3, 4]. The study reported here combines textile analysis, dress history, experimental archaeology and the digital collection and presentation of archaeological and historical evidence for the history of knitting. The project explored ways in which a user group can be empowered to become digital archaeologists and suggests how an audience for a virtual collection may be cultivated while data is gathered and then contribute to the design and content of what is made available online.

2. The Evidence – the Problems and the Potential

Definitive evidence for the origin, development and spread of knitting is as yet unclear [5]. It was a key technological innovation of the medieval and early modern eras on which there is little published scientific scholarship. Unusually for a craft activity, European knitting has a short history. It appeared late and moved through Europe at speed compared to other textile crafts (such as weaving, netting and knotting which are millenia older) – a phenomenon almost unnoticed by historians. It appears in geographically diverse places from the 13th to 15th centuries, in some cases associated with ‘magic’ garments said to have been worn by the infant Christ which expanded as he grew [6-8]. One reason why this important development in clothing construction has gone unreported is that knitting is undervalued owing in part to its association with the domestic and the feminine [9].

Knitting produces fabric similar in appearance to other looping techniques such as netting, nalbinding and sprang. Close and careful study is often needed to determine whether an archaeological find or an historical object is knitted or constructed in another way. This has led to a lack of knitted evidence being securely identified in the archaeological and historical record. It is often incorrectly or minimally catalogued. A second problem is that those knitted items which are accurately identified have not been systematically studied because there are no agreed protocols for scientific interrogation of the physical evidence. This is in contrast to woven textiles for which there are a number of conventional systems for describing their characteristics (for example, the analysis framework developed by Centre International d’Etude des Textiles Anciens) [10]. As a result, much published work on the history of knitting pays little regard to the historical record, with a few notable exceptions [5, 6]. Some excavated items have been reported, although not always with reference to the key characteristics required for a comprehensive overview [11-13]. Knitwork has, somewhat surprisingly, lacked a common language in which to tell its tale. Knitted objects (if they are reported at all) are described in a contradictory collection of craft conventions (which are not agreed across geographical or cultural boundaries) and assumptions about how they were brought into being [14]. What is lacking are straightforward reports of the items which permit interested parties to draw their own conclusions about how they were made.

A recent research project brought a new scientific approach to the under-researched history of knitting as a textile craft and technology. Knitting in Early Modern Europe (KEME) has attempted to tackle these issues by recording a representative body of objects from the late fifteenth to the early seventeenth centuries. It has identified more than 100 knitted caps in museum collections of the kind worn by ordinary people in the early modern era. Despite this abundance of examples and the iconic longevity of the knitted hat, headwear has been of scant interest to scholars, with a few notable exceptions [15, 16]. The 100 caps are recorded as having been shipwrecked, deliberately concealed, preserved in peat bogs or discarded as beyond use. Despite the geographical spread of their discoveries, they present remarkable similarities in their materials and manufacture [17]. The knitted caps have, in most cases, doubtful provenance and little is known about the conditions in which they have been kept. This makes them highly representative of much material held in museums in general and of that which informs the history of knitting in particular. The knitted caps present a range of similar items from
different places discovered at different times and under different conditions and kept in a variety of environments. Very few examples are on public display and those that are have taken on a significance beyond their representativeness. As more examples are made available online, the less influence these individual caps have on the popular perception of the genre [17]. The caps in storage offer an opportunity for extensive comparable data to be extracted and clues about the caps’ construction and new insights into knitting’s history to emerge. KEME aims to overcome the challenges to comparative analysis, the poor standard of reportageto date, and the caps’ relative inaccessibility as physical objects by building a dynamic online digital collection.

3. The Data Collection

This rare evidence for lower-class dress has never before been systematically studied as a collection – partly because of its far-flung locations which range from Copenhagen to Croatia. Each of the identified caps (except three) were examined at the various museums where they are stored. A standard set of measurements, photographs, USB microscope images and (at those places where permission was granted) samples for further analysis were taken. How much of this evidence would prove useful to online visitors to the collection was not clear at this stage of the project.

The samples were taken in order to prepare new chapters in the knitted objects’ biographies using innovative research methodologies. Most have not been studied in any detail although there are exceptions. Only a few early modern knitted caps have been reported in any detail [18-22, 13, 14]. Other work on knitted caps has been cursory or speculative [23-25, 5]. Most of it is descriptive rather than analytical, including a study identifying five distinct categories of caps of which the most common is the flat cap - a term which belies its constructional complexity [19].

Scientific analyses more usually applied to prehistoric and ancient textiles, such as scanning electron microscopy (SEM) have revealed the sophistication of the raw materials required to make them. [26] The fleece for the knitted caps must not only have been suitable for spinning into yarn but also suitable for fulling, napping and shearing into a silky pile after knitting. Results so far have included SEM images of fibres taken from the knitted objects. Further investigations will be undertaken using isotope analysis in the hope of pinpointing the items’ provenance and radioncarbon 14 dating to see how closely the objects match their assumed timeframe for manufacture.

4. The Citizen Science KEME team

A series of research and outreach activities were designed which would assess how online users might interact with the material to provide guidance for the design of the digital interface. The intention was to discover what characteristics of the knitted caps would be of interest to online users. These discussions were also intended to inform the new protocol for reporting knitwork. Input from potential users was key to the identification of appropriate terminology for the continued scientific study of the material. This was motivated by the firm intention that the data be used by people beyond the academic and museum communities. The outreach activities included workshops at conferences and special events on the history of dress in the early modern era targeted at reenactors and other hobbyists interested in reconstructing and wearing historical clothing. A series of seminars were also held at the University of Copenhagen with a core of academic participants and a wider network of knitting and handicraft enthusiasts.

Key to the project was the recruitment of a representative audience for the digital collection before its content and design were finalised. The online knitting community is active and diverse [1]. Ravelry, the premier online hub for knitting, has more than 212,000 Facebook followers and more than four million members registered on its website. At least 25 of the subgroups within Ravelry pursue an active interest in historical knitting, including the study of sheep and yarn and how to knit reconstructions of historical objects. These groups are indicative of the online community of knitters at
large for whom access to original archaeological and historical knitted objects is desirable. It was prudent to consider whether their requirements were in line with the plans for data collection and, if not, whether the digital evidence gathered could be interrogated to plug any gaps.

Recruiting a pilot audience followed the principles of Citizen Science, which began with the pioneering use of idle computers for identifying Mersenne prime numbers in 1996. It recruited 1.25 million participants (www.mersenne.org) to generate what has more recently been dubbed crowdsourced knowledge [27]. Facebook groups devoted to the discussion of sixteenth century clothing and its reconstruction were alerted to the need for volunteers and mailing lists of people who had expressed interest in this area of activity were contacted with an invitation to spread the word about participation in KEME. Many of the people who belong to these groups have an active interest in making historic garments and it seemed that their participation would be better secured by giving them a practical task relevant to the archaeological material.

An experimental archaeology project was already planned to explore a key variable in the construction of the knitted caps. This was developed into a participatory activity for which people could volunteer in order to stimulate interaction with the digital collection. This focused on the raw materials and processes required to manufacture and finish the caps. Unlike most modern knitted wool, which is fluffy and hairy, the knitted caps of the early modern era originally had a silky surface with smooth vertical fibres akin to velvet. The knitted wool fabric was fulled, napped and shorn to create this raised surface, which obscures the knitted loops with what looks and feels like velvet pile. It is likely that in the sixteenth century this nap was intended to mimic silk velvet or real animal fur – both luxury textiles usually reserved for the elite [28].

The choice of fleece from which the yarn is spun and knitted affects the quality of the nap produced. Modern European fleeces differ from those available in the sixteenth century and today vary across the world [29]. Sheep breeds have moved a long way from their early modern ancestors and it is difficult to know the precise differences in the yarns produced now compared to those of the past [30]. Volunteers were invited to participate by testing fleeces they could obtain locally in the hope of capturing a wide variety to compare and contrast. A small experimental flat circle of knitted fabric was designed (12.5 cm in diameter) based on the circular linings found in some of the original caps. These circular swatches – or ‘swircles’ – became the evidence the experimental archaeologists produced by knitting, fulling and napping a variety of yarns. Details of the swircles were to be reported via an online questionnaire and then sent for physical evaluation according to the characteristics of the nap.

Workshops were also held at Jamestown, Virginia and Chicago, Illinois in the United States and in Copenhagen in Denmark. At these workshops, participants carried out fulling and napping experiments on swircles knitted from five different fleeces provided for the purpose and on examples they brought with them. Invitations were issued for the attendees to join the online KEME team with the opportunity to view and provide comment on the proposed digital collection of knitted caps. A series of eNewletters was circulated to the participants explaining how the project was progressing, promoting the workshops in Copenhagen, and encouraging people to visit and interact with the planned online material. These were not as regular or frequent as originally intended but, on average, one per month was sent out during the first eight months of the project.

A total of 164 people volunteered to participate online in the KEME fleece experiment which was well in excess of the 100 target for recruitment. Of these 164 volunteers 48% (78 people) were from the United States with 27% (45 people) from the United Kingdom. The remaining 25% were very diverse but when numbers were divided into language regions, English-speaking countries accounted for 85% (139 people) with the Nordic countries providing the bulk of the remaining volunteers at 8% (13 people). English was the only language used to promote the project, which explains the lack of
diversity, although the representation of Nordic countries can be explained by the KEME project’s base at the University of Copenhagen, Denmark which has close connections to its neighbours.

Volunteers were asked their primary reason for being interested in contributing to the project. There was a wide overlap in motivation with many volunteers expressing an interest in both knitting and archaeology. Interestingly, 25% (41 people) were primarily motivated for professional or tertiary education reasons, often citing qualifications in the field. A further 22% (36 people) were reenactors with a third of these specifically belonging to the Society for Creative Anachronism. Volunteers were also asked to rate their craft skill level. A large proportion (41%; 67 people) said they were expert knitters. Only two were non-knitters, both of whom stated that their interest lay in analysing and measuring the extant caps rather than providing swircles. The KEME volunteers had a wide range of professional and amateur knowledge relating specifically to experimental archaeology, which was something that had not been anticipated.

5. The KEME Database
A pilot database was developed using the data and images from 31 knitted cap linings, which provide a useful subset of the knitted caps. The pilot version of the database lacked a home page but provided attractive and easily navigable access to the archaeological objects with detailed information about them. The requirement to produce a nap on their knitted swircles encouraged many of the volunteers to register for the pilot KEME database, which was launched in May 2017. This provided photographs with overviews and measurements of the 31 knitted linings plus descriptions and dimensions.

The database was built using Filemaker by Jodie Cox, an illustrator and relational database specialist. The design drew on experiences with a previous visual database which provided online images of sixteenth century effigies in churches in England and Wales (www.tudoreffigies.co.uk). This database stimulated a great deal of feedback from local historians whose churches were featured, costume designers researching period clothing, and reenactors reconstructing historic garments [31] It was originally launched in 2007 and still generates considerable traffic. The current platform has been running since 2015: there were 34,307 page visits in that year followed by 21,410 in 2016 and 14,307 in 2017. The falling numbers probably reflect the lack of new material in the database.

It was crucial that the online collection be attractively presented with an intuitive interface to accommodate the anticipated international audience. An essential measurement to understand knitted fabric is the gauge – the ratio of knitted loops in the horizontal and vertical directions. These are conventionally recorded per inch or per 10 cm. Although it is relatively easy to convert from one to the other, British and North American knitters can visualise the former and mainland Europeans the latter very easily and find it tiresome to make the calculation. The database was designed with the option for each user to designate their preferred units.

Feedback on the data to be presented in the KEME database was also gathered in workshops held throughout the project. Participants had opinions of the usefulness of specific measurements – for example, the gauge of the knitting and the diameter of the yarn are essential for reconstructions. These discussions led to specific features being included in the database such as a ‘knit this cap’ icon, which displayed the gauge and yarn diameter when activated. A refined and expanded version of the database was launched in August 2017 with information on 37 split-brimmed flat caps in addition to the 31 linings. This provided opportunities to generate graphs of the data and to view a digital 3D reconstruction of a knitted cap. A series of curated collections was also offered on the home page to provide instant insights into the collection.

Each object’s detailed record offers an invitation to comment via a detailed questionnaire asking the viewer to check the observations recorded in the database. Key questions about how the
knitted caps may have been knitted were included – for example, knitters who wish to reconstruct the caps want to know whether they were knitted from the centre of the crown outwards or from the brim inwards. It is rare that any evidence is cited for one method or the other. One aim of the database interaction was to stimulate debate about how this method of working might be deduced with confidence. Visitors to the database were invited to give detailed responses to the objects including close inspection and measurements based on the photographs by answering ten questions. A few objects inspired respondents to provide very detailed observations, including tracings, which were uploaded to the questionnaire as jpgs. It was noteworthy that of the seven object-specific responses, four were from the same person.

People still continue to join the project. There are currently 179 people signed up for the experimental archaeology, which will officially end in August 2018. A total of 91 people continue to make regular visits to the database (not including the three people in the project development team). This represents more than half of the people who signed up for the project.

6. Discussion
The KEME project’s aims were to provide a protocol through which knitted objects, which have been silent for too long, can tell their stories in a scientific and scholarly way, while providing access to the physical evidence for the history of knitting to a wide audience. The development of the online database employed Citizen Science to recruit a constituency of first adopters, whose engagement with it and feedback on it were crucial to its current format and content. As a result, a tribe has gathered around the material and has an ongoing dialogue with it. However, opportunities to respond to the material are currently too demanding and a lighter touch is required for users to feel they can interact easily and quickly.

The volunteers who signed up to the KEME team reported that they were more interested in analysing the online materials (41%) or the practical craft elements of spinning and knitting (51%). However, this distribution was not reflected in the contributions received from them. Despite 41% of volunteers expressing an interest in working with the database and a total of 339 visits to it being recorded, only eight observations of objects featured there were received from three people over the initial six months of the project. This was particularly disappointing as the database received traffic well in excess of the capacity for which it had been designed. This lack of direct engagement with the material was also reflected in the practical experimental archaeology. More than 200 people are now subscribers to the KEME eNewsletters and approximately 50% open them each time they are sent. Nevertheless, only 29 people reported their swircles data in the online questionnaire and just 15 actually sent processed swircles. Some of the participants sent more than one set of swircles bringing the total number received to 20. There may have been far more people who knitted and napped swircles but were not sufficiently inspired to report them or send them. Many people may have been satisfied with access to the database and to knit their own swircles without feeling the need to report their participation. This form of indirect engagement with an online community has been termed lurking and in some contexts it is criticised as parasitical behaviour [32, 33]. However, research into how people decide whether to reveal themselves online suggests that ‘lurking is not free-riding but a form of participation that is both acceptable and beneficial to most online groups … all members of a group are part of a large social milieu, and value derived from belonging to a group may have far-reaching consequences’ [34]. Guidance for encouraging more active online participation may be found in specialist research projects which have demonstrated how the fear of interacting online in inappropriate ways influences how active and visible a person will be [32].

The project has demonstrated that social media created the opportunity for the knitted caps to continue their lives into the future as dynamic cultural objects as new and different people engage with
them, reconstruct them, and reinterpret them for their own purposes. But for this to be sustained, there
must be regular social media activity to inspire and drive people to actively register their responses.
Devising a reward for participation may help to build the active audience. Alternatively, tracking the
number of people who log in and use the database provides a clear indication of its use, even if their
relationship to the material is limited to lurking.

7. Conclusion
The knitted caps in the KEME project were for the most part a forgotten collection of objects which
have lain in relative obscurity until the recent past. Very few have been on display and those that are
have contextual information which merely hints at their complexity. A focused re-analysis of knitted
items in museum storage suggests a range of new approaches to researching the cultural biographies of
objects and writing new chapters for them. It is hoped that hobbyists can draw creative inspiration from
online access to the archaeological material and specialists may use the evidence to build new
knowledge.

The KEME project has produced a rich database of accessible evidence using an innovative
blend of disciplines (archaeology, textile analysis, craft expertise, and dress history). An audience of
early adopters was invited to engage with the knitted caps as investigators in a Citizen Science project
and as commentators on the evidence via an interactive online database. The results suggested that
imaginative effort is required to generate a tribe which wishes to engage in the material with the
provision of simple pathways for interaction. There was evidence, however, that some individuals
became very deeply engaged with the objects and were willing to put considerable time and thought into
their interpretation of them.

This virtual collection, which is available online to both hobbyists and specialists, can now be
viewed as a ‘family’ of objects despite the physical distance between them. As a result, their individual
characteristics are available for scrutiny in new and different ways by a wide constituency of users. This
paves the way for novel and exciting interpretations. It has been suggested that ‘traditional expertise is
seen as obsolete in the era of crowdsourced knowledge’ and that it remains to be seen how ‘digital
community archaeology co-production public engagement and participatory technologies will affect the
future of professional practise’. Further study of the KEME database and its tribe may prove instructive
in this context. Nevertheless, at this stage, it may be confidently asserted that the KEME online
interactive database has freed the cultural biographies of early modern knitted caps to change and grow
without the need for physical examination or public presentation. The KEME project has generated the
possibility for mute objects lying in the dark drawers of museum storage to have multiple vibrant new
lives among diverse tribes well beyond their geographical and traditional cultural communities.

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