Neanderthal craft: an assessment of evidence for crafting activities within Neanderthal societies with a focus on clothing

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Abstract

This research investigates the extent to which Neanderthals were carrying out crafting activities and how studying these processes may help us gain a more in-depth understanding of Neanderthal culture. This is examined through a review of the existing literature regarding the crafts of hideworking, clothing production, and personal ornaments. It is found that by investigating the craft processes involved in these activities a deeper understanding of the skills possessed by Neanderthals is gained. In the cases of hideworking and clothing production it is also found that discussing these activities from a craft perspective leads to a better understanding of the objects being produced, which do not otherwise survive in the archaeological record. It is further argued that the use of a craft perspective can assist in narrowing perceived cognitive gaps between Neanderthals and anatomically modern humans through encouraging consideration of Neanderthals as skilled craftspeople.

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Author’s declaration

I declare that this thesis is a presentation of original work and I am the sole author. This work has not previously been presented for an award at this, or any other, University. All sources are acknowledged as References.

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Chapter 1- Introduction

1.1 Crafting and Neanderthals

1.1.1 Introduction

Homo sapiens neanderthalensis (Neanderthals) are an extinct species of hominin which occupied Europe and areas of the Middle East around 400 - 30 Ka BP. Genetic research has also shown evidence for interbreeding between *H. neanderthalensis* and *H. sapiens* (Green et al. 2010). The material culture of Neanderthals has been keenly studied since their definition as a species by King (1864, 81–82), throughout which time they have often been compared to their contemporary anatomically modern human (AMH) counterparts. Some writers argue that the balance of this comparison is often unfairly tipped to considering AMH as a superior species (e.g. Zilhão 2012; Speth 2004; Wolpoff and Caspari 2011; Trinkhaus and Shipman 1992). This bias may have resulted in the general lack of discussion regarding Neanderthal material culture from a crafting perspective, where the actions involved in the production of the artefact are equally as important as any potential meanings or uses of the object itself. This research will therefore begin to examine what evidence there is for Neanderthal crafting activities and how studying these activities in a way that gives the Neanderthal more agency may provide a unique perspective on their lives. Three main crafting activities are considered:

1) Hideworking
2) Clothing Production
3) Personal Ornament Production

The first two represent activities that are complex crafts which have not received much attention within existing literature and about which more can be learned through re-examining the existing evidence. The third, although potentially a less complex craft, has been studied more extensively and is often used as evidence that Neanderthals were capable of symbolic behaviour.

1.1.2 Defining Craft

Exactly what is meant by a “craft” must be defined. The Cambridge dictionary defines a craft as “skill and experience, especially in relation to making objects; a job or activity that needs skill and experience, or something produced using skill and experience” (2021). The key

element of this definition is the idea of producing objects in a way that requires the individual (craftsperson) to have a certain level of skill, likely gained through experience. In the context of craft, Bamforth and Finlay (2008, 2–3) describe skill as being composed of two main aspects: *Connaissance* and *savoir-faire*. *Connaissance* is described as being the cognitive process of making strategic decisions about what action to take next, with *savoir-faire* representing the fine motor skills and physical strength to carry out the action. For the case of this research, crafts will be defined as activities that require a person to be skilled in the selection and modification of raw materials to produce either a finished object, or a component part of an object. Skill may be demonstrated through either the actual production of the object/material or through the careful selection of the raw materials used, or both. At times this research discusses using a "craft perspective"; what is meant by this is viewing an artefact through the lens of its production, rather than its function. This is especially true in the case of hideworking and clothing production as the products of these processes are not preserved in the archaeological record, so they can only be observed through the evidence of their production. This perspective places an emphasis on the active role of the craftsperson in the production process; it is hoped that this will work to encourage a discussion on Neanderthals as craftspeople making experience based decisions which affect the resulting object. The complexity of crafts is also discussed. In this research a craft may be considered complex for a number of reasons. Firstly, if it requires a large number of different actions or processes to be carried out; secondly, if it is a composite technology requiring the bringing together of a number of different materials, especially if those materials themselves are complex to produce; and thirdly, if it requires a degree of skill that requires substantial experience to obtain.

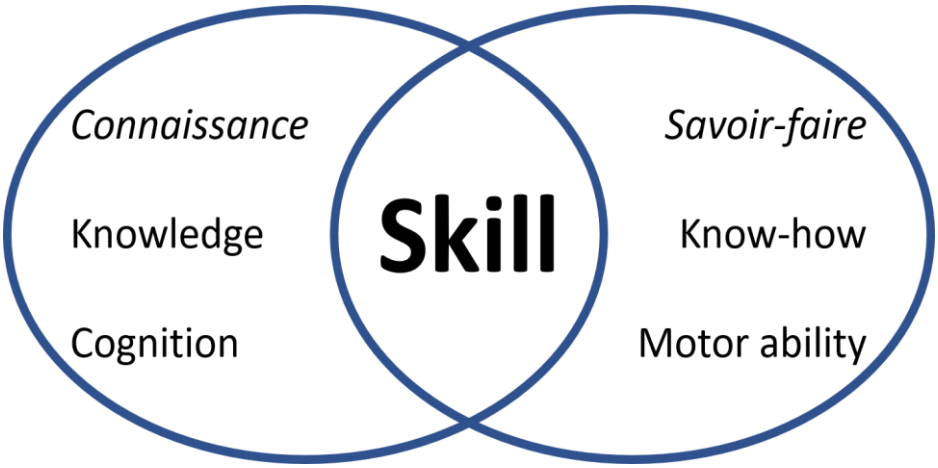

Figure 1.1 *Diagram showing the intersection of knowledge and physical ability. (Redrawn from Bamforth and Finlay 2008, 3)*

1.2 Aim

To investigate direct and indirect evidence for Neanderthal crafting activities and the reasons why craft has not played a part in ongoing debates about Neanderthal social and cognitive complexity. Further investigating whether applying a craft perspective to a Neanderthal context can help craft to further inform these debates.

1.3 Objectives

1. To establish the extent of evidence for Neanderthal crafting activities.

2. To compare the crafting activities carried out by Neanderthals and contemporary AMH

3. To examine why differences in interpretation of comparable crafting activities occur between AMH and Neanderthals

4. To discuss how examining Neanderthal craft can allow for more abstract ideas surrounding material culture to be applied to a Neanderthal context

1.4 Rationale

Although a wide range of activities, which could potentially be considered as crafts, are known from the Neanderthal record, such as the production of stone tools (Bamforth and Finlay 2008), hides/leather (Soressi et al. 2013), clothing (Wales 2012; Gilligan 2007; Collard et al. 2016), personal ornaments (Zilhão et al. 2010; Zilhão 2012; Radovčić et al. 2015; Finlayson et al. 2012), wooden objects (Aranguren et al. 2018; Revedin et al. 2019), shell tools (Douka and Spinapolice 2012; Romagnoli et al. 2017; Villa et al. 2020), birch tar (Kozowyk et al. 2017; Schenck and Groom 2018), pigments (Roebroeks et al. 2012; d'Errico and Garcia-Moreno 2014) and musical instruments (Turk, Turk and Otte 2020), it is rare that they are discussed from a craft perspective. Instead, their cognitive ability to produce and use these objects and materials is more frequently recognised (e.g. Zilhão 2012; Schenck and Groom 2018). This lack of agency given to the craftsperson may have led to infrequent discussion of what the production of these artefacts rather than what the objects themselves can suggest about both the nature of Neanderthals as members of complex societies, and as individuals. It has been decided that this research should focus on clothing production, as this is a significant activity which has often been discussed within the context of Neanderthal

subsistence and competition with AMH. However, the craft processes, tools, and materials involved in the production of clothing have received comparatively little attention, with clothing production yet to be discussed as an example of Neanderthal craftwork. Furthermore, studying the material culture associated with clothing production from a craft perspective may allow for new insights to be gained into the types of clothing being produced by Neanderthals; an area of debate in which there remains a perceived substantial difference between AMH and Neanderthals (Collard et al. 2016; Wales 2012; Gilligan 2007).

Hideworking will also be considered as evidence for Neanderthal craft, as this largely understudied activity is essential in the production of clothing by Neanderthals yet it has not been considered in any detail within the existing debate. The complexity of hideworking is often overlooked within the limited existing literature. For example, studies which focus on clothing production such as Gilligan 2007, Wales 2012, +and Collard et al. 2016 do not discuss hideworking in detail, despite the inference that hide would be the primary material for Middle Palaeolithic clothing production. The existing body of work would therefore benefit from a detailed discussion of the material evidence for hideworking activities within the Neanderthal record and what they can tell us about the types of hide being produced, and therefore the level of complexity of the craft in a Neanderthal context.

Finally, evidence for personal ornamentation will also be considered from a craft perspective, as this topic has gained much attention within the context of assessing whether Neanderthals had the cognitive complexity for symbolism (e.g. Zilhão 2012; Majkić et al. 2017). However, this discussion has rarely extended to the roles of this symbolism within Neanderthal society, such as communicating group identities (e.g. Zilhão 2012; Zilhão et al. 2010; Radovčić et al. 2015; Rodríguez-Hidalgo et al. 2019), using a craft perspective to give more agency to the craftspeople producing these items may allow this to be more easily considered.

I will argue that a discussion of Neanderthal craft is necessary as it contributes to the understanding of an area of Neanderthal's day to day lives that is currently infrequently discussed. Furthermore, the ability of a craft perspective to humanise Neanderthals through viewing them as skilled craftspeople may encourage greater discussion of ideas such as identity and social structures.

1.5 Chapter Overview

In Chapter 2 - Methodology the research methods used and their limitations, as well as potential improvements will be discussed.

In Chapter 3 - Literature Review the existing literature regarding hideworking, clothing production, and personal ornaments will be outlined.

In Chapter 4 - Evidence for Neanderthal hideworking objective 1 will be addressed through examining a variety of tools and materials from the archaeological record that may indicate hideworking behaviour.

In Chapter 5 - Evidence for Neanderthal clothing production objective 1 will be addressed through discussion of existing literature and through the examination of further elements of the archaeological record that may relate to clothing production.

In Chapter 6 - Personal ornamentation as a Neanderthal craft objective 1 will be addressed through examining the production of personal ornaments from a variety of materials, whilst beginning to address objective 2 through comparing this production to that of AMH.

In Chapter 7 - Discussion objectives 2 and 3 will be addressed through analysis of the differences between AMH and Neanderthal craft, whilst also discussing how these differences relate to the differences of interpretation between the two species. Objective 4 is then addressed through examining how the application of a craft perspective may remedy these differences in interpretation.

1.6 Conclusion

Overall, it is clear that there is currently very little discussion surrounding Neanderthal crafting activities and how they may contribute to our understanding of the species. This research will therefore attempt to go begin discussing hideworking, clothing production, and personal ornaments from a craft perspective. It is hoped that by doing so a deeper understanding of Neanderthals as craftspeople may be obtained.

Chapter 2 - Methodology

2.1 Introduction

This chapter will discuss how the study was conducted through the review of existing archaeological literature, with addition of ethnographic resources, in order to build upon the existing data set. Although largely successful due to there being sufficient published work on the topics discussed, this approach was also somewhat limited due to not being able to conduct new analysis of objects where the published data does not include information that would be useful to this research. This could potentially have been mitigated or compensated for by the use of additional methodologies which are also discussed below.

2.2 Research Methods

2.2.1 Introduction

The original focus of the project was to be on using an experimental methodology to discuss the nature and complexity of Neanderthal craft practices. For example, a series of experiments were to be conducted examining the use of lissoirs (discussed in chapter 4) as a hideworking tool, with the aim of establishing at which stage of the process they are most effectively used and how wear caused by their use at these stages compares to that of the archaeological examples. Further experiments considering ideas such as the efficacy of various hide softening agents, and potential Neanderthal needleless sewing technologies were also planned. Unfortunately, the difficult conditions presented by the 2020 COVID-19 pandemic prevented such work from taking place due to travel restrictions preventing the sourcing of the required materials, and restrictions on inter-household interactions would have made conducting experiments requiring multiple participants impossible or impractical, and labour intensive experiments such as hideworking would become too time consuming to be realistic within the available time frame.

Instead, the primary form of research used in this project is a review of pre-existing literature. The majority of this literature was found through use of search tools such as Google Scholar, and through the following of reference chains. The online human relations area files (eHRAF) world cultures database was also used for the sourcing of much of the ethnographic literature, and for general background reading. Literature found through these sources was compiled using a mixture of Google sheets spreadsheets and the paperpile referencing software, with the spreadsheets being used where features of a number of papers needed to be compared.

2.3.2 Google scholar

The majority of literature used was found using Google Scholar, a search engine for academic publications. As with all search engines it was necessary to use a variety of different search terms for the same subject in order to ensure all relevant literature was found. For some subjects, it is better to use the reference chains from existing literature. For example, a google scholar search for ‘Neanderthal Art’ produces very little of the relevant literature, due to it often not having those keywords in the title. Although this methodology of using only published literature is limited in that no new data is being produced, the data used from the existing literature was often applied in a different way to its use in the original publication, or was utilised in combination with another data set to synthesize new outputs. As discussed in the literature review (chapter 3), producing a synthesis of the existing literature in this way still produces a worthwhile output as the majority of that literature has not previously been considered alongside each other. For example, in his publication on Neanderthal symbolism and personal ornamentation, Zilhão (2012) primarily uses a synthesis of existing publications to build a strong argument for the use and production of symbolic objects by Neanderthals.

2.2.3 Online Human Relations Area Files (eHRAF) World Cultures Database

The eHRAF world cultures database is a searchable online resource containing a significant collection of ethnographic resources. This database was used primarily to source ethnographic literature for background reading on hideworking and clothing production. Although some specific sources from the database were used such as Tanner (1944), Speck (1937), and Bernatzik and Ogilvie (1938), the presence of existing syntheses about non-industrialised hideworking and clothing production from Oakes (1988), Wiederhold (2004) and Rots (2009) would make the production of a new synthesis of ethnographic literature within this study inefficient.

The database allows for key subjects and cultures to be searched for (fig 2.1) within all the literature it contains simultaneously, allowing for the relevant studies to be more quickly identified. Further, a search can also be made for any literature containing a certain key term (e.g. “buckskin” in fig 2.2 and 2.3). This makes the eHRAF an invaluable tool for finding ethnographic resources, as the alternative would require the researcher to examine each and every available ethnographic resource individually in order to find out if they contained any relevant information.

Figure 2.1 *Screenshot of eHRAF subject search for tanning hides*

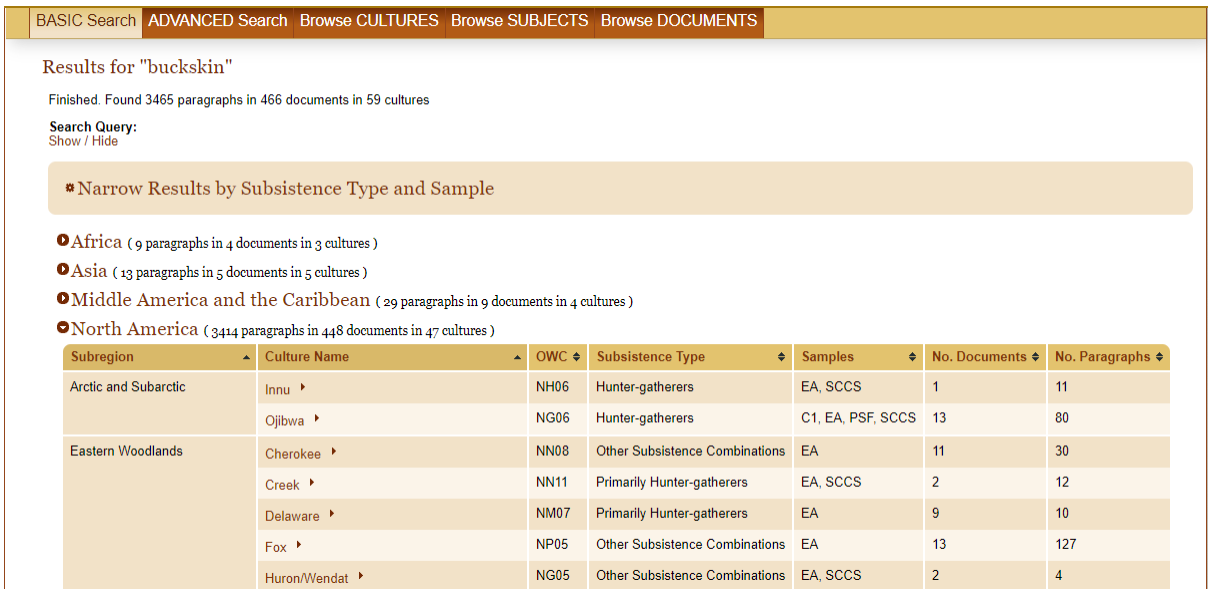

Figure 2.2 *Screenshot of eHRAF keyword search for buckskin, showing the list of available regions and cultures*

Figure 2.3 *Screenshot of eHRAF keyword search after selecting "Cherokee" from the list shown in Fig 2.2. For each resource containing the keyword, a short section of the text either side of the word is displayed, with the option to view the full page or paragraph.*

2.3.4 Google Sheets Spreadsheets

The publications found using the above methods were inputted into spreadsheets made using google sheets (e.g. fig 2.4). This allowed for features of the publications such as their use of ethnography, or whether they discuss a certain topic to be more easily compared, meaning trends in the literature could be identified. This was especially useful in the literature review, where it allowed these trends in the literature to be more easily identified, and also displayed clearly to the reader. The collation of this data using spreadsheets requires the discussion of a particular topic to be marked as either present, or not present for each paper. For example, in the section examining the clothing literature, the use of ethnography by a paper was initially listed as either 'yes' or 'no'. This meant that a paper with a core focus on ethnography, would be given the same value as one that only uses it anecdotally. In order to mitigate this, a 'limited' category was added to better differentiate between papers which used ethnography extensively, and those which used it more briefly. The addition of further categories was considered to allow for an even greater degree of separation; however, this would largely negate the use of the spreadsheet as it would make it far harder to identify trends.

Reference	Primary focus	Discussion of production	Experimental methods	Ethnography	Comparison with AMH	Discussion of hide
Steegmann et al 2002	Thermal Need and Physiology	No	No	Yes	Limited	No
Aiello and Wheeler 2003	Thermal need	No	No	No	No	No
Trinkhaus 2005	Foot morphology	No	No	Yes	Yes	No

Figure 2.4 *Screenshot of google sheets spreadsheet for the literature review of clothing*

2.2.5 Application of *chaîne opératoire*

At a number of points throughout this research a *chaîne opératoire* approach adapted from that of Wragg Sykes (2015) is used to discuss the quantity of decisions and actions involved in the production of an object. Ideally, these would have been directly observed through the use of experimental archaeology. However, as discussed above, the use of experimentation was not possible and therefore it was decided to use a combination of ethnographic and archaeological literature to establish a most likely production sequence for each object. Whilst this approach is not as thorough as observing experimental production, it does still allow for the complexity of the *chaîne opératoire* for different objects to be visualised and compared. It is important to note that this approach is flawed in that it does not account for the complexity of each individual decision or action and values them all equally. For example, in the way this approach is used in this research, a production sequence with 10 steps is viewed as more complex than one with 5, regardless of what those steps actually involve. This is clearly flawed as it results in a simple activity such as the collection of seashells effectively having the same value as a complex one such as flint knapping as they would both be single steps in the sequence. It could be possible to improve this situation by weighting the complexity of each step, such as by giving each step a numerical complexity rating which add up to an overall complexity score for the sequence, thereby allowing the complexity sequences to be compared in a way that accounts for more than just the number of steps involved. Alternatively, complex actions within a sequence such as flint knapping could be broken down further to better represent their complexity.

2.3 Limitations

Although useful, the conclusions drawn from this project are limited primarily by the study's desk based approach, and its reliance on existing data. This dependence on existing literature limits the scope of the project to making a synthesis of these studies and re-interpreting their data. This is somewhat mitigated by the use of ethnographic resources to inform this debate, as although this is not "new" data, they are applied and interpreted in a new context. For example, in chapter 4 ethnographic literature is used to assess the function of lissoirs within hideworking.

A key limitation of the use of a search engine such as Google Scholar is that often not all the relevant literature is easily found, or accessible. This is especially true in the case of ethnographic literature, which often is not accessible online, or is only accessible as a non-searchable scanned book, meaning that relevant literature may not be found, unless the search terms used are present in the title of the publication. Furthermore, many ethnographic resources are studies of all aspects of one particular society, or group of societies, rather than studies of a particular aspect of society, such as clothing use, across the globe. This means that a large quantity of irrelevant information must be sorted through in order to find the studies that contain information relevant to the particular field of interest, such as clothing production. This is often made easier if the text is searchable, allowing for key words relating to the topic to be searched for. This issue was substantially eased by the use of the eHRAF database as this is searchable (discussed above).

A further limitation of the use of ethnography in this research is the issue of applying ethnographic examples gathered from modern *H. sapiens*, to *H. neanderthalensis*, as although the species are similar, and *H. sapiens* represent the closest living analogy, it is not possible to say that all nuances of *H. sapiens* behaviour will apply to *H. neanderthalensis*. This is exacerbated further by the lack of ethnographic literature regarding modern human hunter gatherer groups that live in comparable environments to those of Neanderthals.

It is also notable that a number of the older papers discussing Upper Palaeolithic bone assemblages were published in French. This was primarily an issue with the papers by Leroy-Prost which discussed lissoirs, however, as they were searchable copies, it was possible to identify the sections regarding lissoirs, and translate them using online translation tools.

However, perhaps the most significant hindrance to this particular project was the COVID-19 pandemic necessitating a desk based approach, as discussion of many of the tools and craft processes investigated would benefit greatly from the data that could be gained through use of experimental archaeology. Furthermore, when discussing topics such as the complexity of a craft, the experiential element of experimental archaeology is irreplaceable in gaining an understanding of the reality of how tools and techniques were actually used through human experience.

2.4 Conclusion

Although the limitations of using a desk-based approach limit the scope of what can be achieved by this research, there is still much to be gained through combining the data of existing studies and examining new evidence from ethnographic sources. Further, it is clear that the practical limitations of the research methodology can, on the whole be mitigated, and do not make the outcomes any less valid.

Chapter 3 - Literature review

3.1 Introduction

There is a wealth of literature covering a broad range of topics surrounding the lives of Neanderthals, ranging from biological aspects such as their subsistence and morphology, to more abstract subjects such as their use of art and relationship with death. The following review primarily discusses the literature related to Neanderthal crafting activities - an area of research that has seen notably less attention.

3.2 Cognitive complexity in craft

Although Neanderthal cognition is not a key focus of this research, and is beyond the scope of this project, a brief discussion of the existing debate surrounding cognition and social structures is essential in framing any further discussion of the species. As this debate is very broad in scope, this review will focus primarily on the existing discussions of cognitive complexity in relation to crafting and making activities, including art and personal ornamentation.

Perhaps the best starting point for the discussion of Neanderthal complexity in relation to material culture is Zilhão's discussion of symbolism and personal ornaments (2012). This presents a comprehensive review of the last 150 years of debate surrounding Neanderthal use of symbolism. It is found that there is extensive evidence for Neanderthal symbolism in the form of burials such as those at La Ferrassie (Zilhão 2012, 37–39) and the use of animal teeth and non-food bivalves for pendant production at a wide range of sites over an extended period (Zilhão 2012, 40–43). It is convincingly argued that these examples must demonstrate an extensive use of symbolism by Neanderthals, showing them to be cognitively complex beings capable of independently developing cultures as complex as those of anatomically modern humans (Zilhão 2012, 46).

Since the 2012 publication of this work by Zilhão, a number of additional studies have been published on the subject of Neanderthal personal ornamentation. These largely concern the use of talons and feathers for personal ornamentation (Rodríguez-Hidalgo et al. 2019; Romandini et al. 2014; Radovčić et al. 2020; Callaway 2015; Finlayson et al. 2012; Peresani et al. 2011; Majkić et al. 2017). In all cases it is apparent that the birds were not hunted as a primary food source and would require notable effort to obtain. This therefore suggests that Neanderthals had a significant interest in personal ornamentation, and that it may have

played a role in their social structures. The use of personal ornamentation is particularly relevant to clothing production in that it demonstrates that Neanderthals had an interest in adorning their bodies, suggesting that they may have potentially used clothing for a similar purpose. Interestingly, the idea of clothing as a form of personal ornamentation is not extensively discussed in the existing literature concerning Neanderthal clothing production.

A key study in the discussion of Neanderthal cognition in relation to craft is Wragg-Sykes' examination of the use of birch tar in a *chaîne opératoire* of hafting stone tools (Wragg Sykes 2015, 122–126). Her research outlines four different perceptions of needs and then a following 23 actions required to fulfil that need. This demonstrates an ability to perceive a problem, split it into required 'ingredients', and then carry out a number of complex processes in order to produce those 'ingredients' and assemble them into one object that is required to solve the overarching problem. This study's discussion of the Neanderthal ability to use a complex *chaîne opératoire* strongly suggests that Neanderthals had the cognitive ability to carry out complex crafting activities. This has largely been supported by more recent work surrounding Neanderthal birch tar use and production by Kozowyk *et al* (2017) and Niekus *et al* (2019) (see Schmidt et al (2019) for debate). Whilst this finding alone makes the paper significant, the way it gives the Neanderthal agency in the production of the objects is also vital, as this opens up discussions for considering the creative craft decisions that Neanderthal craftspeople would have made in the production of much of their material culture.

3.3 Existing Discussions of Neanderthal Hideworking and Clothing production

There are a number of papers which discuss objects and processes that represent the crafting activities of Neanderthals (e.g. Zilhão 2012; Revedin et al. 2019; Romagnoli et al. 2017), the key ones are discussed in further detail within this project. Perhaps the most ubiquitous craft throughout Neanderthal culture, and indeed throughout all hominins, is the production of stone tools; however, there are a number of other crafting activities but these are rarely discussed in the context of "craft".

3.3.1 Hideworking and Skinning

One craft that is infrequently discussed in a Neanderthal context is hideworking. Although it is mentioned in a number of publications (table 3.1), the craft aspect of hideworking forms the core focus of none of them; the focus is instead on the materials being worked by certain tools, broader subsistence behaviours and classifying tool forms.

Reference	Primary focus	Discussion of hide production	Experimental methods	Ethnography	Comparison with AMH	Discussion of clothing
Soressi et al 2013	Lissoirs/Material culture	Limited	Yes	No	Yes	Limited
Gabucio 2014a*	Analysis of Neanderthal activity areas (including skinning) through faunal remains	No	No	Yes	Yes	No
Gabucio 2014b*	Butchery of a wildcat by Neanderthals	No	No	Yes	Yes	No
Romandini et al. 2018*****	The nature of Neanderthal-bear interactions, though faunal remains, including cut marks on bone	No	No	Some	Limited	No
Campana & Crabtree 2019	Evidence of skinning on faunal remains	Limited	Yes	No	No	Limited

Table 3.1 *Table showing the methods and key features of a selection literature in which the primary focus is hideworking or skinning by Neanderthals.*

As can be seen from Table 3.1 there is a limited pool of published studies that directly discuss the subject of hideworking or skinning by Neanderthals. Although this is not surprising given that the organic nature of any direct evidence of this craft is very unlikely to have survived. It is, however, puzzling given the comparatively large number of papers discussing clothing production (table 3.2), as the production of hides is essential for the types of clothing often discussed. Further, it is clear that the few papers which do study Neanderthal hideworking do not then discuss how this activity can contribute to our knowledge of Neanderthal clothing, and shelter production, as well as the other possible uses for processed hides. The paper most focused on Neanderthal hideworking is Soressi *et al*'s study of lissoirs (2013), due to these artefacts being hideworking tools. The paper does

discuss using reproduction tools in an experimental context, however, these experiments are only used to determine that the use-wear on the tools is likely from use on hide (Soressi et al. 2013, 14188). The paper does not attempt to further discuss the details of Neanderthal hideworking and instead focuses on the importance of the tools in demonstrating a similarity between Neanderthal and AMH tool kits (Soressi et al. 2013, 14188). Furthermore, the publication does not use any detailed ethnographic examples to discuss comparative tools in modern hunter gatherer societies, therefore limiting understanding of how these tools were used. Lissoirs are further discussed in a recent paper by Martisius *et al (2020)*, in which ZooMS is used to determine that they are produced from large *bovid* ribs, rather than those of *Cervids* as originally thought. It is argued that a preference for more robust bones was required for the application of pressure that is required in hideworking. However, there is again no discussion of similar tools in ethnography, the specific hideworking processes in which the tool may be used, or the purposes for, and implications of, hideworking by Neanderthals. It is clear that on the subject of lissoirs there is a lack of discussion, or interest, in establishing precisely what these tools were used for within the vast range of tasks encountered during hideworking. This could be best achieved through the comparison of these tools to the ethnographic, and wider archaeological record, to find morphologically similar tools, and tools which could be used in a similar way, as well as investigating which stages of hideworking could best utilise a lissoir. These discussions could then open up avenues for exploration of the kinds of hideworking Neanderthals may have been conducting, and therefore the other materials that *should* be present in the archaeological record to confirm this. Therefore, starting from the subject of lissoirs, there is great scope for expanding discussion regarding hideworking as a Neanderthal craft through discussion of ethnography, experimental archaeology and re-examination of the existing archaeological record for evidence of other materials pertaining to hideworking such as the types of animal skins used, softening/tanning agents, cordage, and other hideworking tools (e.g. stone scrapers).

In terms of the literature relating to skinning activities, a vital precursor to hideworking, Campana and Crabtree (2019) write the one of the few papers which set out to investigate the evidence for Neanderthal's skinning animals and in the process also discusses tendon extraction as possible evidence for clothing manufacture or other crafting activities. Furthermore, experimental methodology is used as a key method, something which is rare in the two main crafts discussed in this project (Table 3.1 and 3.2). The knowledge gained from their experimental work confirms that certain cut patterns on phalanges indicate careful hide removal. This is useful as it could then be applied to datasets which mention skinning anecdotally (along with the wider faunal record) to demonstrate a more widespread

occurrence of this careful hide removal. This paper is limited however, by the small scale nature of its experiments, which only use the legs of white tailed deer, already separated from the main carcass. This means that any possible effects from the movement of the carcass during skinning are not seen, further, factors such as hanging up the carcass during skinning are not investigated. Therefore, there is still plenty of scope for both further experimentation and literature based research in the field of skinning by Neanderthals, as existing data such as the faunal record can be re-examined for evidence of skinning. Further, it is interesting to note the lack of any papers which focus on using experimental archaeology to investigate hideworking, as being a craft, there are human variables in the process which can only be understood through an actualistic study.

3.3.2 Clothing Use and Production

A related and more frequently discussed Neanderthal craft is that of clothing production. With a number of studies discussing the extent to which Neanderthals needed and used clothing, as well as the potential implications it may have on their extinction. (White 2006; Trinkaus 2005; Collard et al. 2016; Steegmann, Cerny and Holliday 2002; Gilligan 2007; Aiello and Wheeler 2003; Sørensen 2009; Churchill 2009; Wales 2012; Toups et al. 2011). A very general trend in the chronology of this literature can be seen, with the earliest papers focusing on the Neanderthal need for clothing through energetics and laying the groundwork for the discussions of the later studies. Many of which use this data in combination with novel approaches to investigate ideas such as the quantity of clothing worn, and the materials used for its construction.

Reference	**Primary focus**	**Discussion of production**	**Experimental methods**	**Ethnography**	**Comparison with AMH**	**Discussion of hide**
Steegmann et al 2002	Thermal Need and Physiology	No	No	Yes	Limited	No
Aiello and Wheeler 2003	Thermal need	No	No	No	No	No
Trinkhaus 2005	Foot morphology	No	No	Yes	Yes	No

White 2006	Thermal need and Material Culture	Limited	No	Limited	No	Yes
Gilligan 2007	Thermal need	Yes	No	Limited	Yes	No
Churchill 2009	Thermal Need	No	No	Yes	Yes	No
Sørensen 2009	Thermal Need	Limited	No	No	No	No
Toups et al 2011	Lice	No	No	No	Yes	No
Wales 2012	Thermal need	No	No	Yes	Yes	No
Collard et al 2016	Faunal remains	No	No	Yes	Yes	Yes

Table 3.2 *Table showing the methods and key features of literature in which the primary focus is clothing use by Neanderthals.*

Table 3.2 makes it clear that the thermal need for clothing is by far the most common focus of the literature regarding clothing production. This approach is well justified by Gilligan (2007) who presents an extensive analysis of advantages of using a thermal approach to establish Neanderthal clothing use. It is suggested that looking at the thermal need for clothing is the most reliable method of estimating clothing use, as it is likely the motivating factor in its development (Gilligan 2007, 501). The paper makes good use of climatic data and estimates of Neanderthal thermal efficiency to establish that Neanderthals likely did not require 'complex' forms of clothing for the majority of their occupation of Europe, leading to a lack of clothing development. The paper's focus then shifts entirely to a comparison with AMH, arguing that their lack of cold adaptation created a motivation to innovate and produce clothing technologies, before the cold spikes of MIS3, effectively allowing them to outcompete Neanderthals in Europe. As with the papers discussed above, little consideration is given to the discussion of the physical processes and materials used in the production of simple or complex clothing. Further, despite emphasising the complexity of tailored clothing production, the potential complexity of the accompanying hideworking is ignored entirely. However, some consideration is given to how the Chatelperronian may represent a late cultural adaptation by Neanderthals in order to allow for more complex clothing production in response to changing climate and/or competition with AMH (Gilligan 2007, 507–508). Overall, Gilligan's work offers a good justification for the use of a thermal model for estimating clothing use, both in this study, and in those preceding and following it.

However, there is a lack of consideration given to aspects such as material culture and hideworking, as well the emphasis on making comparisons to contemporary AMH. Furthermore, table 3.2 also demonstrates that the emphasis on making a comparison with AMH is a consistent feature across the majority of the studies discussing Neanderthal clothing. This often results in a discussion of how and why AMH clothing was more advanced than that of Neanderthals, and how this may have led to them gaining an advantage in Europe. Although important to consider, this focus on a comparison with AMH has led to a lack of discussion regarding clothing as an aspect of Neanderthal material culture, rather than as a subsistence material.

The lack of discussion of Neanderthal clothing as an item of material culture is exemplified by the general lack of studies examining the production of Neanderthal clothing, with none of the core literature making this its primary focus (table 3.2). Further, in the studies where production of clothing is discussed (White 2006; Gilligan 2007; Sørensen 2009), it is usually anecdotal, or limited to raw material and tool availability, rather than the creative craft process of designing and producing clothing. As an extension of this, there is also little thought given to how the production and wearing of different types of clothing may be indicators of societal structures, such as specialisation of labour, or cognitive traits such as group and personal identity. Further, this discussion of the material culture and materials surrounding clothing production is, again, often framed as a comparison to AMH. For example, the detailed discussion of materials used specialised cold weather clothing production conducted by Collard *et al* in 2016, is framed entirely as a comparison between AMH and Neanderthal clothing production. This leads to a satisfactory conclusion being reached in suggesting that the faunal record shows Neanderthals were using the resources required to produce specialised cold weather clothing less often than AMH. This is a clear example of the emphasis on making a comparison to AMH being detrimental to the understanding that is gained regarding Neanderthal culture, as the discussion shifts to explaining why those differences exist. This therefore creates a focus on what materials are absent/underrepresented from the Neanderthal record, rather than what can be learned from those which are present. Collard *et al*'s (2016) paper is an excellent example; they identify 9 mammal families which are indicators of cold weather clothing production, and find a significant difference in the frequency of their use between AMH and Neanderthals in 3 of the families (Collard et al. 2016, 238). These three families then become the focus of the paper, with the other 6, which were shown to have no significant difference in their frequency between AMH and Neanderthal sites, being largely ignored.

Similarly, Wales' 2012 discussion of Neanderthal clothing use is also focused on a comparison between AMH and Neanderthals. It does however, succeed in using a novel modelling method to provide an estimate of the clothing coverage likely required by Neanderthals living at sites from across a broad geographic, and temporal range. The nature of this clothing use is also discussed to a small degree, with suggestions made that it was likely in the form of wrapped hides rather than tailored or sewn garments. The evidence for the production methods of these hides or garments is again not discussed in any detail. This paper does however, make the significant step of comparing Neanderthals to a large ethnographic data set, and also emphasises that Neanderthals occupying different areas likely used different forms of clothing to one another. This paper also acts fairly well as a synthesis of much of the work that has been done previously, with its conclusions presenting a generally accepted view that some Neanderthals wore clothes, whilst others may not have, with those that wore clothing, using it to varying degrees.

As well as discussing what is present in the literature, it is important to consider what is currently absent. One methodology that is noticeably missing from the existing literature is the use of experimental archaeology (table 3.2). This is unfortunate as many of the conclusions reached by studies such as those by Collard *et al* (2016) and Wales (2012), regarding the types of clothing used by Neanderthals, and the suggestions made by Gilligan that they lacked the technology to produce tailored clothing, could be built upon through archaeological experimentation. As discussed by Outram, a primary use of experimental archaeology is to test the findings of lab based experiments, or in the case of Collard *et al*'s and Wales' studies, data analysis, under real world conditions (2008, 2). This therefore makes the application of experimental archaeology to Neanderthal clothing use and production a logical progression. Further, the human insight that can be gained from experimental archaeology would greatly benefit the understanding of the creative decision making that is involved in craft processes such as clothing production. This would therefore offer a valuable insight into the cognitive processes that would be required for Neanderthals to produce clothing.

Another interesting omission from the current literature is a synthesis in which a wide variety of the existing studies concerning Neanderthal clothing use are brought together. Although this is achieved to some extent through the various publications referencing each other, a study combining all of the current literature would provide a much clearer picture of Neanderthal clothing use. Similarly, it is rare for the evidence for Neanderthal hide working to be discussed in the context of clothing and vice versa (tables 3.1 and 3.2). Combined with a synthesis of the existing clothing literature this would likely lay the foundation for more in-

depth discussions of previously uninvestigated aspects of clothing production, such as its frequency, and the roles it may have played in society.

3.3.4 Summary of Clothing and Hideworking literature

Overall, it is clear that there is a relative wealth of literature concerning the use of clothing by Neanderthals, but very little which actually examines how this clothing was produced, and the materials used. This existing literature primarily focuses on whether Neanderthals needed clothing to survive, with the general consensus being that in some areas Neanderthals may have needed to wear clothing. However, the exact type of clothing or the methods used to produce it are left open to debate. Generally, the literature refers to clothing made using animal hides. However, the assumption that Neanderthals made hides suitable for clothing production is not necessarily supported by the existing literature discussing Neanderthal hideworking, as this literature is sparse and primarily focused on discussing the use of tools. Therefore, any study looking to contribute further to the discussion regarding Neanderthal clothing could do so by addressing this gap in knowledge regarding the production of clothing. In order to do so, it would also be necessary to examine in more detail the ways in which Neanderthals were processing hides, as currently this essential raw material is oversimplified, or overlooked by the current body of work. It is also clear that the study of hideworking would benefit from the use of experimental archaeology, a greater degree of ethnographic research, and examination of the wider archaeological record in order to establish how the known hideworking tools may have been used. A greater understanding of this would help better understand the types and quality of hides available for clothing production. Which in turn may allow for a greater understanding of the types of clothing that Neanderthals were producing.

3.4 Existing Literature Concerning Personal Ornament Production

One Neanderthal craft that has received a lot of attention is the use of personal ornamentation. However, as discussed below the study of these ornaments has focused largely on using them as evidence for symbolism with comparatively little emphasis on how they were made, or what symbolic roles they played in Neanderthal society.

Reference	Material	Capable of symbolism	Role of Symbolism	Discussion of *Chaîne opératoire*
Zilhão *et al* 2010	Shell	Yes	No	Limited
Peresani et al 2011	Feathers	Yes	No	No
Finlayson et al 2012	Feathers	Yes	Limited	No
Morin and Laroulandie 2012	Talons	Yes	No	Limited
Zilhão 2012	Multiple	Yes	No	No
Peresani *et al* 2013	Shell	Yes	No	No
Romandini et al. 2014	Talons	Yes	No	Yes
Radovčić et al 2015	Talons	Yes	No	Limited
Majkić *et al* 2017	Bird bone	Yes	Limited	Limited
Rodríguez-Hidalgo et al. 2019	Talons	Yes	Yes	Limited
Finlayson *et al* 2019	Talons and feathers	Yes	Limited	Limited
Radovčić et al 2020	Talons	Yes	No	No

Table 3.3 *Table showing a selection of the literature concerning Neanderthal personal ornaments.*

Table 3.3 clearly illustrates that in the majority of cases Neanderthal personal ornaments are discussed as evidence that Neanderthals were capable of symbolic behaviour, and that in very few of those publications are the roles that symbolism plays in society considered. Further, it is shown that a detailed discussion of the *chaîne opératoire* is rare, with those studies that do discuss the details of the production of the ornament focusing on proving that it was intentionally produced by Neanderthals, rather than on the potential meaning behind things such as the choice of material, or the skill level of the craftsperson. For example, Romandini *et al* (2014) conduct a detailed analysis of the cut marks and on a set of eagle

talons, including the use of experimental archaeology. However, this analysis is only used to evidence that the talons were intentionally removed from the carcass for use as personal ornaments, with little discussion of why they were processed in that way. Further, the potential symbolic significance of the material, or the symbolic function of the artefact is not considered. This is true for the vast majority of the available literature regarding Neanderthal ornament production. One significant exception to this rule is Rodríguez-Hidalgo et al. (2019), where a discussion of the potential significance of using bird materials is discussed using ethnographic examples. For example, it is suggested that the talon jewellery may have played a role in nonverbal communication of identity between individuals or groups. It is worth noting that in contrast this sort of interpretation is common in the sphere of AMH personal ornaments (e.g. Vanhaeren and d'Errico 2006; Lbova 2020). This therefore shows that it is possible to discuss these concepts in a Neanderthal context, and that more recent literature is moving in that direction. This is further supported by Finlayson *et al* 2019, which uses ethnography to discuss the idea that eagles are considered to be symbolic by many cultures around the world. They apply this as evidence that the eagle remains in Neanderthal contexts are symbolic; however they do not go so far as to discuss the sorts of symbolic roles these artefacts may have played, such as communication of identity, or social status. The table also shows that the most dominant material found in the record is bird remains, and that the majority of publications concerning them date to after Zilhão's 2012 publication on Neanderthal symbolism which is the main synthesis of the personal ornaments known before 2012. This therefore means that this publication is now somewhat outdated due to the substantial body of work pertaining to the use of bird remains in ornament production being absent.

Overall, there is a general consensus that Neanderthals were producing personal ornaments and using them in a symbolic manner. However, discussion of the role symbolic artefacts played in Neanderthal society is often lacking. Similarly, although a number of publications consider the production of the ornaments, they do so to prove that the modifications to the materials were intentional, rather than to observe the craft aspects of the process.

3.5 Summary and Conclusions

Overall, it is clear that within the existing literature there is ample evidence to suggest that Neanderthals were cognitively complex enough to carry out advanced crafting activities. Within the limited literature concerning hideworking there is a lack of discussion regarding the methods that may have been used to produce hides, with much of the emphasis being placed on defining the tools used, and their comparison with those of AMH. The theme of

comparing Neanderthals to AMH is also persistent in the literature discussing clothing where much of the emphasis is placed on determining whether or not they were using clothing, with little time given to discussions of the types of clothing worn, or how they were produced. Throughout the discussions of both hideworking and clothing, it is rare to see the processes involved being discussed as a crafting activity. It is evident that what is largely missing from the literature is a study examining the hideworking methods that may have been used by Neanderthals, and an in-depth analysis of the material culture pertaining to clothing production. Such a study would also allow for more discussion of hideworking and clothing production as a craft, and therefore allow for consideration of Neanderthals as craftspeople, giving them some agency in the production of these materials, as has been demonstrated by Wragg-Sykes (2015) discussion of hafting. This lack of consideration for the actions of the craftsperson in the production of Neanderthal material culture is also seen in the case of personal ornamentation, where the *chaîne opératoire* is rarely discussed in a way that considers the skill of the maker. Therefore, it is possible to argue that the current understanding of Neanderthal material culture would benefit from more frequent discussions of *chaîne opératoire* in relation to the skill of Neanderthal craftspeople.

Chapter 4 - Evidence for Neanderthal Hideworking

4.1. Introduction

One of the lesser studied areas of Neanderthal crafting activities is that of hideworking, which is likely due to the poor preservation of organic remains, and therefore, the end product of hideworking activities. This therefore leads to the relative paucity of evidence relating to this activity, in comparison to other tasks such as stone tool production. This has meant that there is little work currently published directly relating to the nature of Neanderthal hideworking. This section therefore aims to present all available in-direct evidence for hideworking by Neanderthals in order to assess the most likely extent to which it was occurring. As there is no surviving direct evidence for hideworking from Neanderthal contexts, this chapter focuses on the three main in-direct forms of preserved material evidence: lissoirs, stone scrapers, and the faunal record.

4.1.1. An Overview of Non-Industrialised Hideworking Methods

In order to discuss hideworking in a Palaeolithic context, it is important to understand a general outline of the processes involved in the production of hide products. Firstly, for the purpose of this study, hideworking is defined as: the activities and processes involved in the transformation of a raw animal skin into a finished product, such as leather, buckskin, or rawhide. A generalized model for the production of these materials is suggested by Schultz (1992), and further developed by Wiederhold (2004) although this model does not cover all possible variations in hideworking activities, it does allow for the consistent aspects of the craft to be summarised. The flow of the processes is illustrated in Fig. 4.1, with the tools used described in table 4.1 and the details of each stage and product are described below. All details are summarized from Wiederhold (2004, 12–36) and Schultz (1992, 334), unless otherwise stated.

Rawhide

Rawhide is the most basic form of processed hide. It is produced through the drying of a scraped hide and has a stiff cardboard like consistency. As it is not tanned or smoked, if exposed to water, rawhide will become soft and effectively return to being a wet skin.

Buckskin

Buckskin is produced through the 'brain tanning' method of hideworking, where fats, such as brain, are worked into the hide. This results in a soft, pliable product that can be used in applications such as clothing production. If smoked buckskin will be resistant to water and maintain its pliability after being wetted and dried.

Vegetable-tanned hide

This best represents modern leather and is produced through the use of tannic acid to chemically alter the skin. This is usually done through soaking the scrapped and slipped skin in a solution made using tannin rich plants such as oak bark. Once processed in this way, a skin will be permanently altered and will not return to its unprocessed state.

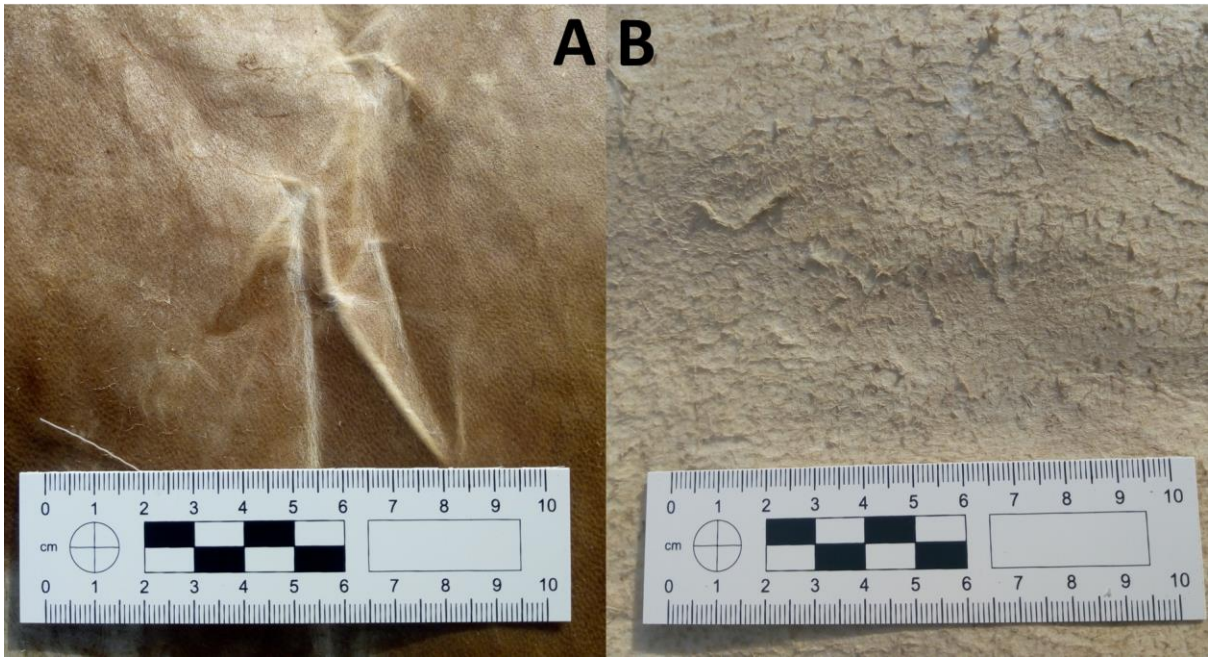

Figure 4.1 *Image showing hair-on rawhide (A) and hair-on buckskin (B) (Author's Image)*

Fleshing

This is the one universal stage of hideworking, and sometimes also referred to as scraping. In this stage, the membranes and fatty deposits on the flesh side of the skin are removed, often through the use of stone scrapers or bone 'fleshing tools'.

Dehairing

After fleshing, some skins will then have the hair removed. The hair can be removed by a number of means, including shaving it with a sharp blade, scraping it from the hide with stone tools, or by **slipping**. Slipping occurs when the hair is removed from a skin by chemical means, such as soaking in lye, causing the hair to fall out of the hide. Slipping

generally leaves the outer layer of skin - the **grain** - intact making it more difficult for the fats used in ‘brain tanning’ to penetrate the skin. Therefore, slipping is more commonly associated with ‘vegetable tanning’ methods.

Scraping

This can be viewed as an extension of fleshing. In many cases, this process aims to further remove material from the flesh side of the hide in order to thin it to the desired thickness, this is therefore very dependent on the species of the skin. In the case of skins being processed hair off, the grain is also removed from the outer side of the skin. This allows for the fatty substances used in ‘brain tanning’ to better penetrate the skin. Scraping may occur whilst the hide is still fresh, but it is also common for hides to be dried prior to scraping. This is generally the final stage of processing in the production of rawhide.

Drying

Drying occurs for a number of reasons, including preserving a skin that has been fleshed for later processing. It is also often used prior to scraping the hide, to allow for an easier thinning of the skin.

Softening

Sometimes also referred to as ‘**brain-tanning**’ softening generally involves either soaking a scraped and dried hide in a brain/fat and water emulsion, or rubbing the fat directly into the hide. This process works to coat the collagen fibres in the skin with the fats, preventing them from sticking together, and giving a degree of water repellency, resulting in a soft and pliable hide. It is worth noting that although brain is a common source of softening fats in Wiederhold’s North American context, a variety of other substances may also be used, as illustrated by Badenhorst’s 2009 study of hide processing in Southern Africa, which mentions over 15 different materials used to soften hides.

Vegetable tanning

This is an alternative process to softening which chemically alters the hide. This works by tannin molecules from plants such as oak, chemically binding to the collagen fibres in the hide, and making them more durable, and stable. Although this is also possible through the use of brain, which can break down into an aldehyde, it is rare. Tanning does not necessarily soften a hide, so fats may also be used in a similar way to brain tanning.

Physical Manipulation

This can be the final process in hideworking, and encaptures a wide range of activities. However, these all centre around stretching and manipulating the hide in order to separate the collagen fibres from one another. Without this process, a brain or vegetable tanned hide would remain stiff, as the fibres in the hide would still be bundled together. This stage often occurs whilst the hide is drying after having been soaked in a softening or tanning agent. It can take many forms, including stretching the hide using hands and feet, using a tool to apply pressure to the hide whilst strung on a frame, or through pulling the hide over a stake or through a wire hoop. Further, in some cases softened hide is achieved through the use of physical manipulation and scraping alone, as is the case with some Inuit groups (Oakes 1988, 166–173).

Smoking

This is a somewhat optional stage of hideworking, as it is not required to produce a functional product. However, it holds a great benefit to ‘brain-tanned’ hides, as the smoking of the hide helps to prevent the water-soluble fats from being washed out of the hide with repeated wettings over time. The smoking of hide is usually carried out by sewing the hide into a bag, so that it captures smoke from a fire often fed with rotted wood to increase the quantity of smoke produced.

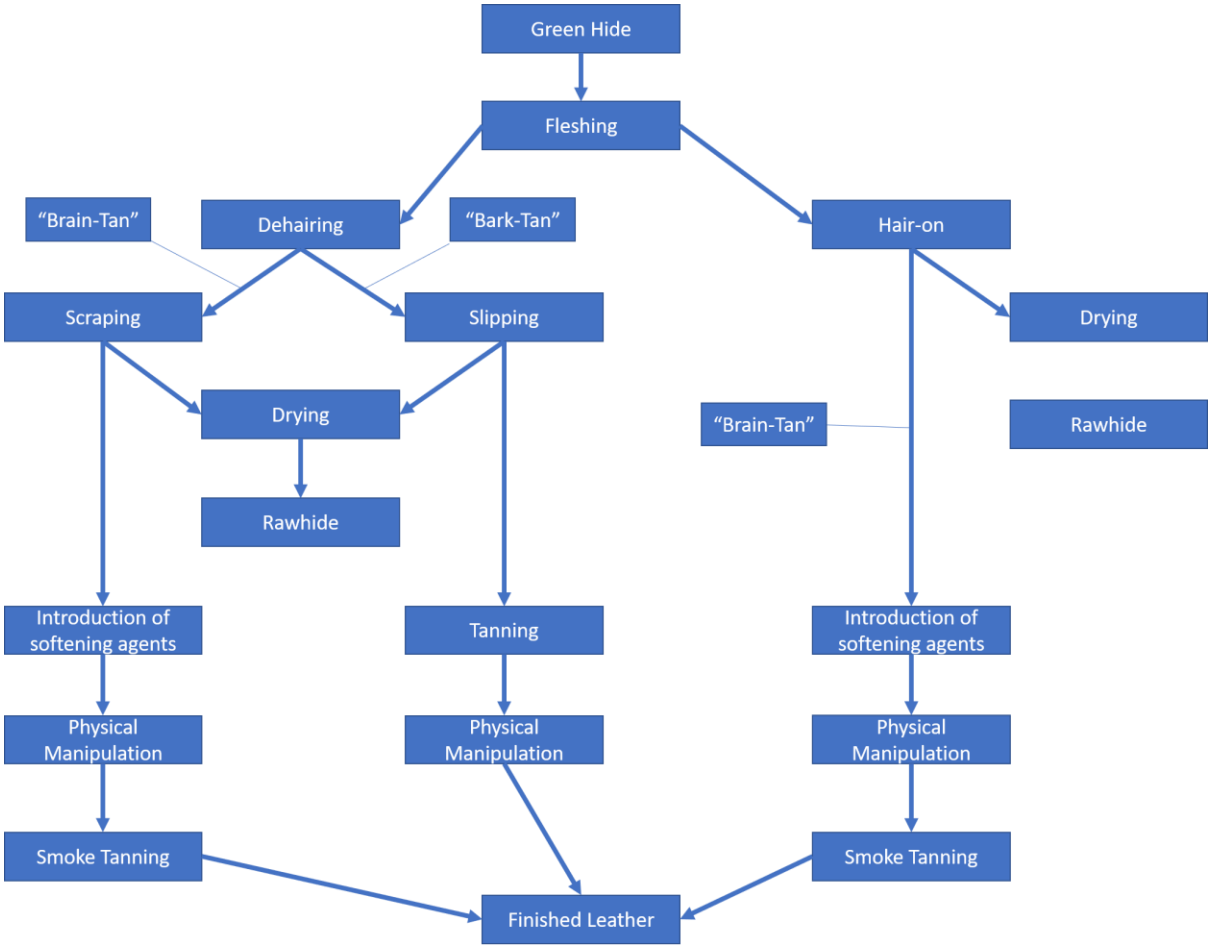

Figure 4.2 *Diagram showing generalised hideworking by indigenous people, across time, space, and species. Redrawn from Wiederhold, 2004, 143*

4.2. Lissoirs as Evidence for Hideworking

Of the types of preserved in-direct evidence, lissoirs are the most definitive, but also the least frequent, with few examples known, the best discussed are four tools tools reported in a 2013 study by Soressi *et al.* However, a recent publication by Baumann et al. (2020) outlines three further examples from a cave site in the Altai region of Russia (dated to between 47,000 and 59,000 ka BP), which although somewhat different from the French examples, are argued by the authors to represent comparable tools to those published by Soressi *et al* (2013) (Baumann *et al, 2,16)*.

The four confirmed tools were found in three separate deposits, at two sites 35km apart in southwestern France, with one tool (G8-1417) being found in layer 4 of Pech de l'Adze I, and the remaining three coming from levels 3A and 3B at Abri Peyrony (Fig. 4.3.). Cut bone fragments from levels 3A and 3B have been dated using 14C accelerator mass spectrometry to 47,710–41,130 Cal B.P. Further, the tool from Pech de l'Adze, is found at the base of an undisturbed sequence (layer 4), with layer 4 itself (OSL dated to 51.4 ± 2.0 ka) lying below

3m of undisturbed Middle Palaeolithic deposits. This therefore places all four tools securely within a Neanderthal context, with surrounding artefacts indicating the sites belong to the Mousterian of Acheulean Tradition (Soressi et al. 2013, 14186–14187). The tools can be easily defined as lissoirs, as they fit well within the descriptions given for the much more extensive sample of lissoirs found in Upper Palaeolithic contexts (Leroy-Prost 1979, 1975) the similarity between the tools is visible in figures 4.3. and 4.4. Leroy-Prost describes a variety of lissoirs, however, the consistent factors in the descriptions are a rib with a rounded end and convex section, with some worn spongey bone (1979, 237, 266, 275, 313). The use of the tools in hideworking is supported by Soressi *et al* (2013) through analysis of use wear patterns, and comparison with experimentally produced and used tools. Soressi *et al* suggest that the tools were used for smoothing dry hide, which although an ambiguous term, is supported both by the similar use wear on experimental tools used to smooth dry hide, and with the fact that the wear shown is consistent with use on a soft material, such as dry hide (2013, 14188).

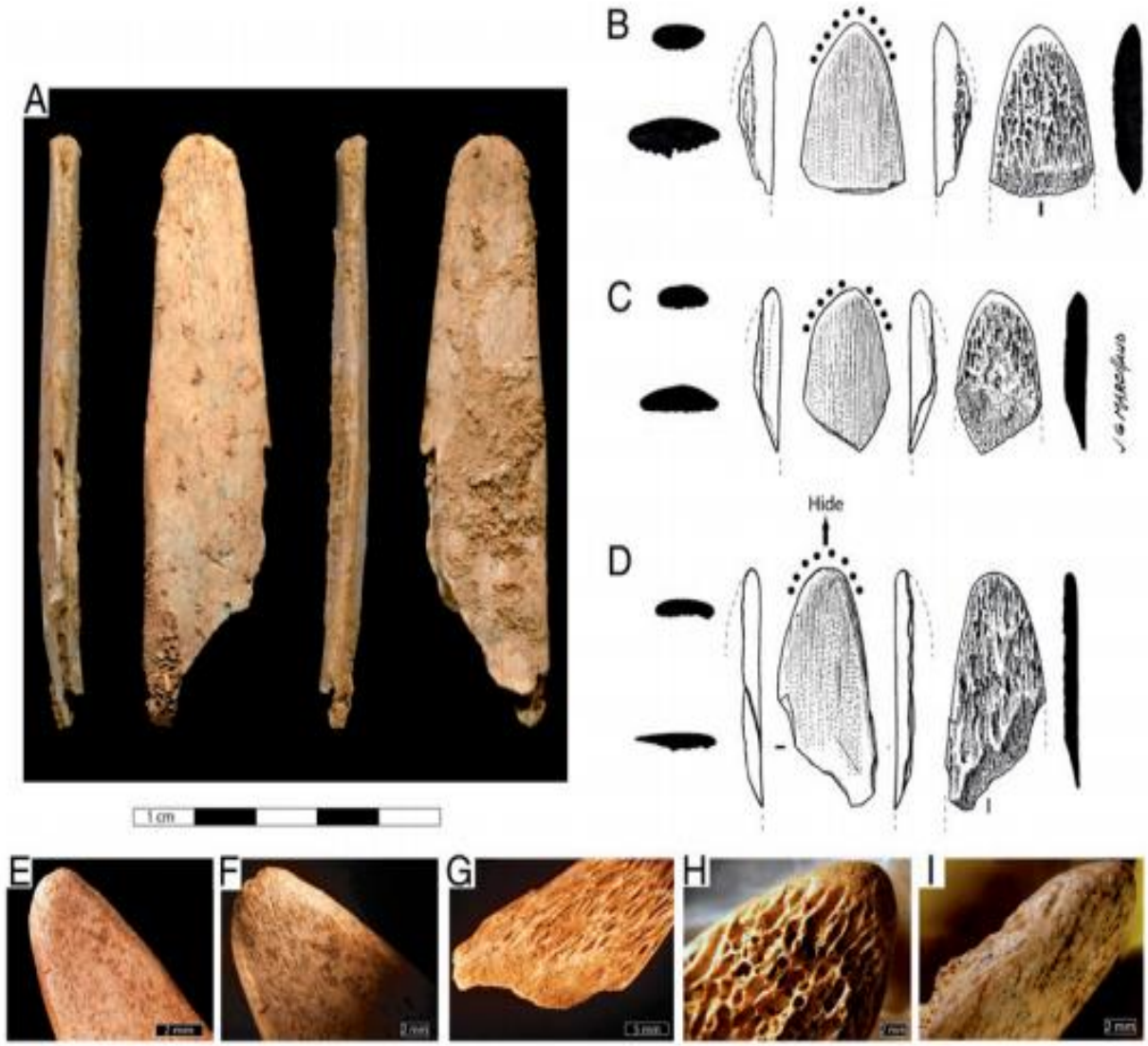

Figure 4.3 *Lissoirs from Soressi et al 2013 (14188). (A) AP-7839. (B) AP-4209. (C) AP-4493. (D) PA I G8-1417. (E, F,and G) G8-1417. (H and I) AP-4209*

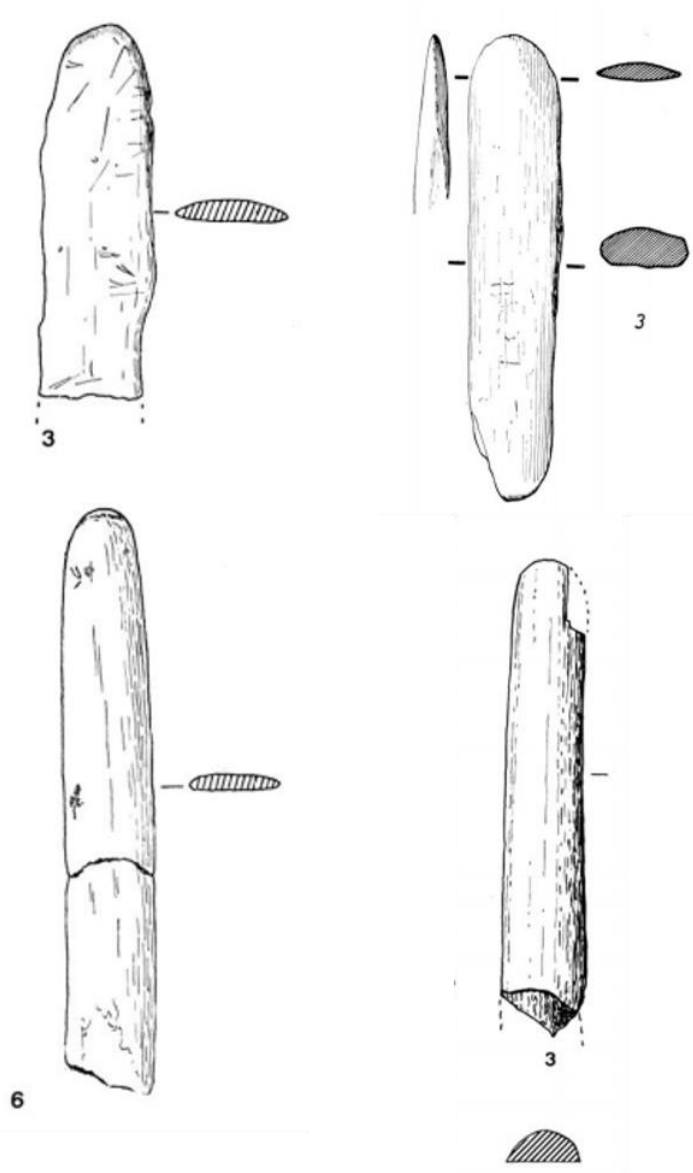

Figure 4.4 *Selection of Aurignacian lissoirs from Leroy-Prost (1979, 1975).*

It is difficult however, to understand exactly what use ‘smoothing a dry hide’ is, as this does not fall under any of the hideworking activities summarized above. With the only dry activities being the scraping of a hide, for which the blunt ends of the lissoir would not be functional, or the physical manipulation of rawhide. Therefore, if taking Soressi *et al*’s interpretation as wrote, lissoirs must have been used for the manipulation of rawhide, as no other action in hideworking fulfils the definition of ‘smoothing dry hide’. It is also troublesome that dry hide is described as a ‘soft material’ as it is the hardest material present within the hideworking process. This means it is worth considering alternative areas of hideworking where a lissoir may be applied, as is discussed below. Despite this, it is clear that the lissoirs were used for working hide in some form and therefore firmly establish a likelihood of hideworking crafts by Neanderthals, as they show the development of a specialised tool for the purpose of working

hides, something that would not occur without a demand for hideworking. However, it should be noted that lissoirs are far more common in Upper Palaeolithic contexts, with numerous examples from the Aurignacian, recorded in just Leroy-Prost's study of bone industries (1979, 1975). Meanwhile, there are only a maximum of seven examples known from the entire Neanderthal occupation of Europe, which suggests that the occurrences of hideworking activities by Neanderthals, may have been less frequent than in an Upper Palaeolithic context. It is worth considering however, the archaeological context of the Neanderthal lissoirs, and how this potentially indicates a more widespread usage than is shown by sample size alone. As mentioned above, the four French tools are found in three separate deposits, and across two different sites 35km apart; meaning that the tools can be viewed as both geographically, and temporally isolated. Whilst the addition of the Russian examples greatly increases the geographical range, the sample size remains small and distributed across only 3 sites, two of which are very close together. However, this distribution shows that although the sample size is minimal, these tools were being produced and used, by Neanderthals, over an extended period of time, and at more than one location, demonstrating that they were not a 'one-off' invention. Further, the standardised form of the tools suggests that they are not three separate instances of reinvention, but an example of a continuing technology, thereby suggesting that the small sample size is likely more an indication of preservation bias, than an indication of a lack of hideworking by Neanderthals. Overall, the current work on the Neanderthal lissoirs provides good reason to suggest that these tools were used for hideworking, over an extended period of time. What is left unclear, is exactly what element of hideworking the tools were likely used for, beyond smoothing dry hide.

When considered with reference to ethnographic literature regarding hideworking, the meaning of the term 'smoothing dry hide', becomes confused, as there are numerous points in hideworking when a hide is dry, and a variety of actions that may be considered smoothing. For example, within the hideworking method developed by Wiederhold (2004) from a number of modern hunter gatherers in North America describes at least six stages of processing a hide, these are outlined in figure 4.2. Within these stages none are typically referred to as smoothing, however, a number may take place whilst the hide is dry, although these largely use sharp tools. Instead of seeking examples of hideworking processes that may be described as smoothing dry hide, it may be better to look for analogous tools within the ethnographic record and assessing whether how they are used could create the use-wear seen on lissoirs. The tools discussed by Wiederhold are displayed in table 4.1 below.

Tool	Description	Use	Reference (Wiederhold 2004)
Beamers	Analogous to a draw knife, although variations on endscrapers, and some bone tools are used	Removing flesh and fatty deposits from the hide.	pp.13-16
Flesher type 1	Chisel-tipped long bones with deep notches	Removing flesh and fatty deposits from the hide. Thinning the hide Sometimes used for removing brain tanning solution	pp.14
Endscrapers	Endscrapers hafted on an L-shaped haft	Removing flesh and fatty deposits from the hide. Removing hair and epidermis from a dry hide Thinning the hide Sometimes used for removing brain tanning solution	pp.14-15
Flesher type 2	Unhafted ‘modified edge tools’	Removing flesh and fatty deposits from the hide.	pp.15
Dull beamers, or dehairing tools	A beamer sufficiently dull as to not cut the hide. Unmodified rib bones have been used.	Used for removing hair from a wet hide	pp.22
Slickstones	Smooth stones	Rubbing brain into larger hides	pp.27

Wooden paddle	A flattened wood implement, it's noted that any tool could be used, as long as it allows application of force	Stretching hide on a frame	pp.31
Abrading tools	Rough, porous stones, or cancellous bone	Breaking up hard 'crusts' that form whilst the hide dries, ensuring a soft finish.	pp.32

Table 4.1 *Table describing form and function of tools used in hideworking*

This table clearly shows there are a variety of tool types which may be involved in hideworking, with many of those having a number of sub-types. However, all tools within one category have the essential characteristics required to complete their task. For example, fleshers are required to be a sharp tool capable of applying force and pulling tissues from the hide. Therefore, it is possible to examine the form of a lissoir and use-wear of the lissoirs, to determine what the essential characteristics of the tool are. Firstly, it is clear from images of the tools, that they are not sharp, or intended to be sharp. Secondly, the consistent nature of the breaks in the tools suggest that they are broken through being used to apply force (Soressi et al. 2013, 14187). Finally, although it is stated that tool AP-4209 has polished spongy bone at the tip (Soressi et al. 2013, 14187), this is not the case for the other tools, with AP-7839 having minimal spongy bone exposed. However, they do display signs of wear, showing that they are not unused or unfinished examples. Therefore, it is clear that the exposed spongy bone is not essential in the use of the tools. These characteristics mean that use as beamers, fleshers, endscrapers, and abrading tools can be ruled out. This leaves the most analogous tools as the 'wooden paddle', slickstones, and dehairing tools. Interestingly, in a 2011 study of Pavlovian hide processing, Zelinkova identifies beveled tools made of longitudinally split horse rib (fig 4.5), as a possible abrading tool (Zelinková 2011, 193). The efficacy of this tool as an abrader, and as a 'slickstone' is confirmed by Zelinkova through experimental work (2011, 190 and 193).

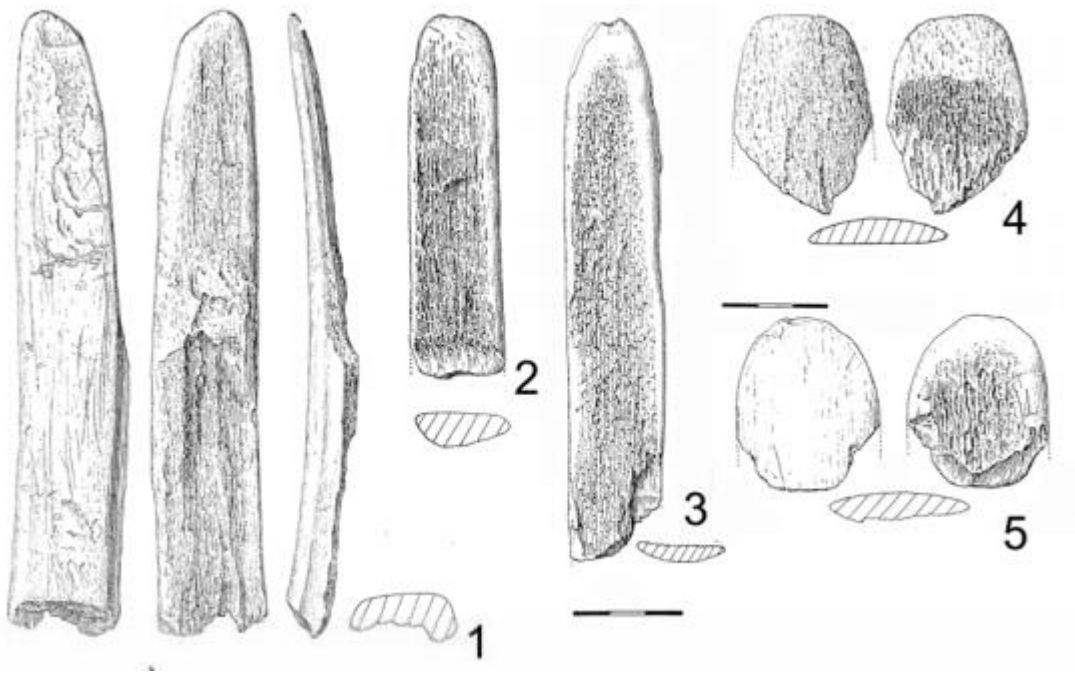

Figure 4.5 *Drawing of bevelled tools from longitudinally split ribs. 2-5 clearly demonstrate the exposed cancellous (spongy) bone, suggested to be intentionally exposed for use as an abrasive (Zelinková 2011, 19).*

It is clear that these tools are exceedingly similar in form to the lissoirs from Abri Peyrony and Pech de L'aze, with the most noticeable difference being the quantity of exposed cancellous bone. This is problematic, as for Zelinkova, the exposed cancellous bone is key to the function of the tool as an abrader. However, it is worth noting that three out of the four Neanderthal lissoirs do show significant amounts of exposed cancellous bone, with only one example, AP-7839, having no cancellous bone exposed (fig 4.2). Therefore, it is worth reconsidering whether the exposure of cancellous bone on the Neanderthal examples may have been key to their function. One suggestion would be that the difference in material has forced a slight difference in manufacturing of the tools. Horse ribs are notably more robust than those used at Abri Peyrony and Pech de L'aze, this could mean that exposing cancellous bone through splitting the rib, would not be possible when using these smaller ribs. Therefore, it is possible that the lissoirs made of smaller ribs worked through gradually exposing fresh cancellous bone throughout the life of the tool, as the cortical bone is worn away. If we view the Pavlovian tools as an evolution of the Neanderthal lissoirs, with the material and method changing to expose the cancellous bone more efficiently, we can discuss them as the same tool. In light of this, the use of Neanderthal lissoirs as abrading tools is possible and is further supported by the polished cancellous bone seen on AP-4209 (Soressi et al. 2013, 14187). These suggestions could be further investigated in future through experimental work to examine the efficacy of splitting smaller ribs, and whether

using replicas of the Neanderthal lissoirs in a way that focuses on the cancellous bone, will create similar wear patterns to those seen on archaeological examples.

With this in mind, it is worth considering that the tools abrading tools are often used at the same time as stretching tools such as the ‘wooden paddle’, the use of which immediately follows the use of ‘slickstones’. Therefore, lissoirs may represent a multi-function r tool that is used for the majority of the later stages of hideworking. However, without further work such as experimenting with the use of the tools, and further use-wear analysis focusing on how these uses wear the cancellous bone, it is not possible to legitimately narrow down the use of these tools any further. However, this does not make these tools any less meaningful in establishing the extent of Neanderthal hideworking, as they are still shown to clearly illustrate extensive hideworking activity.

4.2. Stone Tools as Evidence for Hideworking

The area in which Neanderthal hideworking is most commonly discussed is that of scraper function analysis. Both residue analysis and micro-wear analysis have been used to suggest that Neanderthal scrapers were used in the preparation of hide, alongside other tasks (Anderson-Gerfaud 1990, 405; Hardy and Moncel 2011, 5; Hardy 2004, 559; Rots 2009, 42, 48; Beyries 1988, 214–219; Solodenko et al. 2015, 9, 13). Hardy and Moncel (2011) examine a sample of 182 minimally handled flints from the Middle Palaeolithic site at Payre in South-Western France, using micro-wear and residue analysis to establish tool function (Hardy and Moncel 2011, 1–2). Although focusing on subsistence activities - primarily exploitation of small mammal, fish, plant, and avian resources - the study does also find evidence for possible hideworking activities. However, these are not differentiated from use-wear and residue relating to other animal processing tasks such as butchery (Hardy and Moncel 2011, 5). Rots (2009, 58-59) carries out functional analysis on tools from the G-complex at Sesselfelsgrotte, in Bavaria. This study similarly places little emphasis on hideworking activities, instead focusing on hafting. However, Rots does suggest that the low frequency represented in the sample shows that Neanderthal hunting activities were aimed at food procurement, rather than for obtaining skins. In contrast, Anderson-Gerfaud (1990, 405) discusses the presence of both pushing, and pulling use-motions on scrapers, suggesting they indicate use on wet, and dry hides, respectively. It is further suggested that Middle Palaeolithic stone tools were only used for the early stages of hideworking, whilst those of the Upper Palaeolithic are used at all stages. Exactly how this conclusion is reached is not clear.

Overall, the analysis of hideworking in this existing body of evidence is largely limited to ascribing a function to a tool, with few studies discussing the use of the tool in hideworking, or how prolific hideworking is within the assemblage. However, doing so is clearly challenging when in many cases hideworking use-wear, is not, or can not be separated from that of processing other animal products.

One potential way to use the existing data to further examine hideworking is to discuss what proportion of stone tools in these studies are associated with hideworking, thereby allowing an approximation of how frequent hideworking activities were in Neanderthal society. Table 4.2 below shows the percentage of scrapers in each study found to have evidence of hideworking. Although relatively low in terms of the overall percentage, when the number of tools with no evidence of use is accounted for, hideworking activities represent a relatively high proportion of the activity. Therefore, hideworking can be viewed as a relatively frequent activity within Neanderthal society, suggesting that it was part of daily life, rather than an occasional occurrence. However, it is challenging to use this existing data to draw any further conclusions regarding the craft processes involved in Neanderthal hideworking, as the current studies do not compare the use-wear observed, to experimental tools used for a variety of different hideworking methods. Furthermore, any conclusions drawn from this existing data set are limited in value, due to the small sample size available. Additionally, as discussed by Gallagher's study of hideworking in Ethiopia, scrapers are retouched frequently when used in hideworking, potentially leading to many tools not displaying signs of use-wear (1977, 413–414).

Paper	**Percentage of scrapers associated with hideworking**	**Percentage of scrapers with unknown, or no evidence of use**
Anderson-Gerfaud (1990)	10.00	No Data
Rots (2009)	8.51	46.80
Beyries (1988)	5.94	26.73
Hardy and Moncel (2011)	17.60	31.30

Table 4.2 *Table displaying percentage of scraper assemblages that display traces of hideworking.*

This suggests that in order to gain greater insight into Neanderthal hideworking through stone tools further use-wear analysis is required. For example, a macro scale study examining existing collections for evidence of hideworking would allow for a much clearer idea of the scale of Neanderthal hideworking, and potentially demonstrate regional or temporal differences in levels of production.

Overall, the lithic record does offer a substantial indication of hideworking activities by Neanderthals, as this is shown by the not infrequent occurrence of hideworking use-wear on Middle Palaeolithic scraping tools. However, without further work to compare this wear to experimental tools used for a variety of defined hideworking tasks, it is impossible to draw any more substantial conclusions, such as the hideworking methods being used.

4.3. Faunal Evidence of Neanderthal Hideworking

Having established the tools with which Neanderthals were working hides, further insight into these processes can be gained through examining the raw materials used in hide production. As with the finished hides, the unprocessed skins are also absent from the record due to their low likelihood of preservation. Similarly, many of the materials used to process the hides, such as softening agents, are organic and also do not preserve. However, it is possible to view these materials through proxies from the faunal record, such as evidence of skinning, the extraction of animal based softening agents, the seasonality of animal exploitation, and the exploitation of ‘fur bearing’ species.

4.3.1 Skinning

Although mentioned in a number of studies, evidence for, and the significance of, Neanderthal skinning activities is rarely discussed or studied in detail (Campana and Crabtree 2019; Gabucio et al. 2014a, 314–316; Romandini et al. 2018; Gabucio et al. 2014b, 41–43). The only published study dedicated to Neanderthal skinning processes is the recent publication by Campana and Crabtree (2019), in which faunal remains from Shanidar cave are examined for evidence of skinning and tendon removal, and compared to bones from deer that have been experimentally processed. They find that the cut marks on the Shanidar assemblage are indicative of fine butchery, and suggest that the motivation of the cuts was not meat procurement, but obtaining the largest possible pelt, and removal of tendons (Campana and Crabtree 2019, 12). This study confirms that Neanderthals were paying close attention to the removal of pelts. It is worth noting however, that in the experiment the pelts were removed from the deer legs after the legs had already been removed from the deer (Campana and Crabtree 2019, 9). Although unlikely, it is possible that this removal of the

legs from the whole carcass could change the way in which the cut marks from skinning are presented. Further, it may also be worthwhile to experimentally examine the cut marks that are caused by skinning the entire animal, such as those on the crania, mandible, and the distal metaphysis of metapodials, suggested by (Gabucio et al. 2014b, 41). However, the focus on phalanges is useful as this helps confirm the association made between cut marks on phalanges and skinning, made elsewhere (Campana and Crabtree 2019, 10–12; Gabucio et al. 2014b, 41, 2014a, 313–314; Romandini et al. 2018, 78, 80, 87–88). Overall, this study represents a rare use of experimental archaeology in the investigation of Neanderthal crafting activities, and an even rarer insight into Neanderthal hideworking. It does however, leave an open door towards further experimental investigation of Neanderthal hideworking technologies, by having established that the cut marks suggested as evidence of skinning by other studies are representative of those made during fur removal.

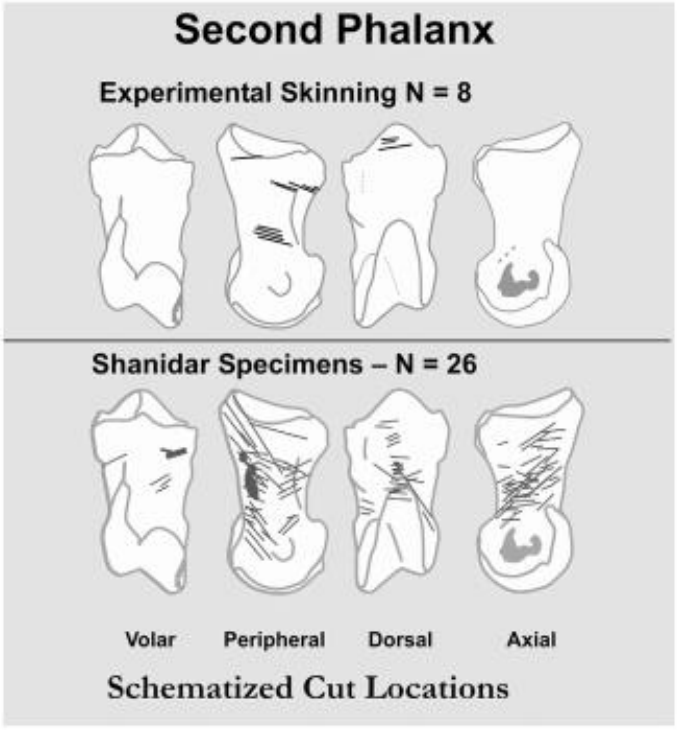

Figure 4.6 *Illustration comparing cut marks from experimental skinning to those found on bones in the Shanidar assemblage (Campana and Crabtree 2019, 12)*

Skinning practices are also considered by Romandini *et al (2018)*, who examine Neanderthal exploitation of bears at Rio Secco Cave and Fumane Cave in northeast Italy. The discussion regarding skinning is largely based on cut marks. With evidence for skinning being found on the ribs, the anterior and posterior limbs, phalanges, sesamoids, and a metatarsal (Romandini et al. 2018, 78–80). The MNI of bears across the two sites is 39, however, it is not made clear what proportion of these individuals exhibit evidence of skinning, or the

extent of that evidence. The paper does suggest that the removal of fur from the animals was carried out as a priority as the removal of fur was only possible when the animal was fresh (Romandini et al. 2018, 88). This is significant, as it suggests that Neanderthals wanted the skin removed from the animal in a way that would allow for the skin to be used for hide production. Although this does not place fur exploitation as the sole purpose of hunting these animals, as there is also substantial evidence for their use as a food source (Romandini et al. 2018, 78–80), it does, show that it was of some importance. Further, Collard *et al*'s study of Neanderthal clothing, shows *ursids* as an indicator species of cold weather clothing production (2016, 239). This combined with the suggestion that the site of Rio Secco represents a targeted, rather than opportunistic, exploitation of bears (Romandini et al. 2018, 89), adds weight to the idea that the evidence presented here could represent an example of targeted fur exploitation by Neanderthals.

More anecdotal discussion of skinning based on faunal remains is made by Gabucio *et al* in two 2014 studies examining faunal remains from Level O at Abric Romani, a rock shelter site in Spain. The level dates to around 55ka BP, and contains a total of 9,299 coordinated faunal remains, and 19,652 uncoordinated faunal remains (Gabucio et al. 2014b, 37–39). Cut marks were identified on 456 of the remains of which 21 remains have cut marks associated with skinning, consisting of, crania, mandibles, distal metaphysis of metapodials, and phalanges. These remains are associated with red deer (*C. elaphus*), aurochs (*B. primigenius*), horses (*E. ferus*), and wildcats (*F. silvestris*) (Gabucio et al. 2014b, 40–41). It is suggested that activities such as skinning and evisceration likely occurred at the kill site, to prepare the animal for transport (Gabucio et al. 2014b, 42). This may go some way to explaining the low frequency of cut marks related to skinning, as bones such as the phalanges may have often been left at the kill site, rather than transported back. This is supported by the fact that of the 4,793 anatomically identified remains, only 31 are phalanges, 22 of which belong to a single *F. silvestris* (Gabucio et al. 2014b, 40, 2014a, 313), which may have been processed on site due to its small size. Further, only 24 metapodials are identified, this demonstrates that the low frequency of skinning related cut marks is likely due to these small non-meat bearing bones, often not being transported to the site. Unfortunately, the paper does not state the volume of skinning related cut marks for each species, or each bone type. This makes it difficult to discern whether the data represents the skinning of four individuals, or as many as thirteen. However, *C. elaphus, B. primigenius,* and *E. ferus*, do represent the three most populous species at the site each with an MNI of four (Gabucio et al. 2014b, 40), this suggests that the presence of skinning evidence for these species may be at least partly due to their frequency at the site, rather than any specific association of these species with hideworking. This is further supported by

these three species being large ungulates that were likely hunted for food, meaning that their hunting by Neanderthals can not be considered substantial evidence of hideworking. In contrast however, the wildcat (F. silvestris) which is subject to its own publication (Gabucio et al. 2014a), does represent a possible example of an animal being hunted primarily for its hide. This is due to *felids*, and especially wildcats, not providing a particularly convenient food source when compared to ungulates, with it suggested that they are exploited opportunistically (Gabucio et al. 2014a, 308). Further, in an investigation of Neanderthal clothing use though the proxy of faunal remains Collard et al (2016, 239) suggest that *felids* are a key indicator of animal exploitation for hide as they are commonly used for the production of cold weather clothing by modern hunter gatherers. This combined with their recurrence at Abric Romani throughout time (fig 4.5) helps to suggest that the presence of these remains at the site may represent targeted exploitation of an animal for its hide. However, it is worth noting that the remains do also demonstrate clear evidence of the European wildcat, *F. silvestris,* having been eaten, and possibly roasted (Gabucio et al. 2014a, 314–315). Although this does not mean the cat was hunted purely for food, it does demonstrate that it was not hunted only for its hide either.

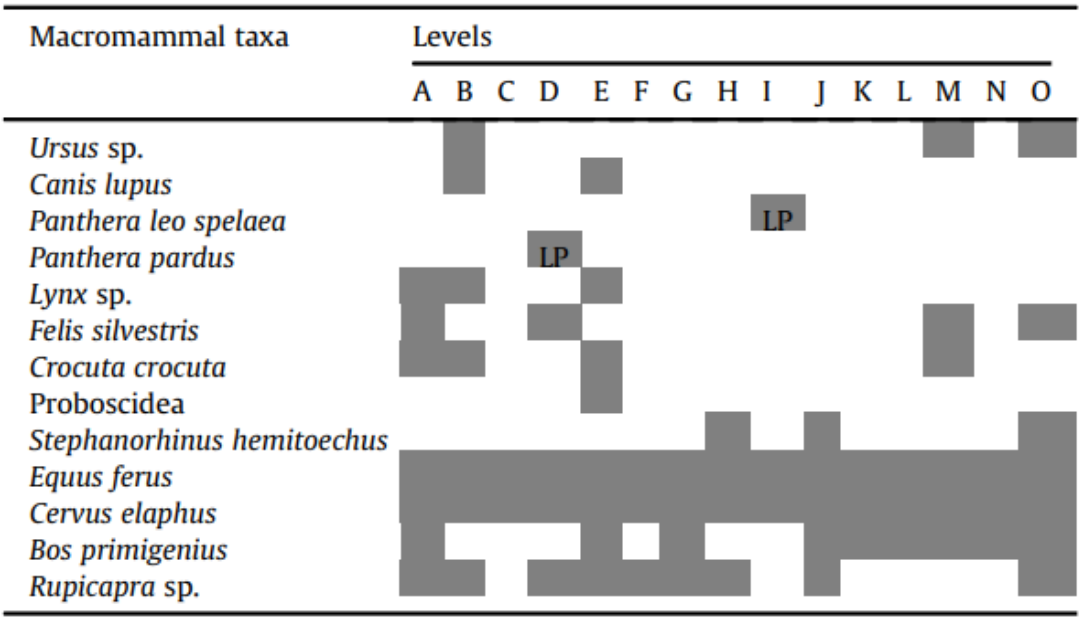

Figure 4.7 *Diagram illustrating presence of species at Abric Romani through time (Gabucio et al. 2014a, 308)*

To summarise, there is a relatively good body of evidence suggesting that in many cases Neanderthals were carrying out precise skinning activities (Campana and Crabtree 2019), and that a broad range of species, including 'fur bearing' species were exploited (Gabucio et al. 2014b; Romandini et al. 2018; Collard et al. 2016, 239). However, in all cases it is difficult

to establish whether these animals were hunted primarily for hide, as cut marks relating to skinning are accompanied by those caused by butchery. Further, in most cases, any animal that is hunted for nutritional value will have to first be skinned, in order to allow for butchery to take place. Therefore, the current analysis of skinning related cut marks in the faunal record does not allow for skinning required for butchery to be discerned from that taking place for hide procurement.

4.3.2. Use of Animal Based Softening Agents

A further way in which the faunal record can demonstrate Neanderthal hideworking is through evidence of extraction of materials that are often used within the hideworking process. These materials primarily relate to the 'softening' stage of the process, where fatty substances are added to hide through soaking in them or them being rubbed into the hide. Two common sources of these fats are brain, liver, and bone marrow (Zelinková 2011, 190; Schultz 1992, 334–335; Wiederhold 2004, 24–27; Mandelbaum 1940, 194; Badenhorst 2009, 37, 39–42; Beyries, Vasil'ev and David 2001, 12–17), however, a wide range of other materials may be either added to, or used instead of brain and marrow. For example, Badenhorst's 2009 study of hide processing in Southern Africa mentions over 15 different materials used to soften hides. Both brain and bone marrow extraction are visible within the archaeological record for a wide range of Neanderthal sites. For example, systematic bone marrow extraction is visible at Salzgitter Lebenstedt in Northern Germany (Gaudzinski and Roebroeks 2000), Pech de l'Aze IV in South-Western France (Niven 2013), Abri Du Maras in South-Eastern France (Daujeard et al. 2019), and Amud Cave in the Levant (Rabinovich and Hovers 2004, 295). The extraction of brain by Neanderthals is less frequently mentioned, however a good example is a mammoth skull from layer 3 at La Cotte de St Brelade, where a rib has been driven through the skull to access the brain (Smith 2015, 190). Although the presence of such systematic bone marrow exploitation in the record does not necessarily indicate that marrow was used for hideworking, it validates discussion of hideworking methods that use bone marrow, as Neanderthals clearly had access to this material. However, it is worth noting that the presence of a softening agent in the record does not always indicate its use in the hideworking practices of a specific culture. For example, the Copper and Caribou innuit soften reindeer hides without use of a softening agent, despite having access to brain, and bone marrow. Instead using repeated wettings, scrapings, and physical manipulation to soften the hide (Oakes 1988, 171). Further, the use of bone marrow and brain as a food source can not be overlooked, as it is likely that at least some of the use seen is for nutrition. Although this can be somewhat questioned in light of White *et al*'s conclusions in their study of Neanderthal hunting strategies, which suggests that

Neanderthals often had access to a food surplus (2016, 18). This makes it less likely that they would make the effort to extract bone marrow, unless it provided some unique properties, either nutritionally, or in crafting activities. Overall, it is clear that a number of sites demonstrate that Neanderthals had ample access to the fatty materials required to soften a hide, however, this alone is not enough to suggest that Neanderthals were using fat based hideworking methods.

4.3.3. Seasonality of Kills

A further possible indication of hideworking within the faunal record may be drawn from any patterns in the seasonality of Neanderthal hunting activities. It is suggested in the ethnographic record, that animals hunted for cold weather clothing, should be killed in the Autumn (EWS), or winter (CS), as this is when their coat is thickest (Speck 1937, 61; Tanner 1944, 105; Bernatzik and Ogilvie 1938, 69). Therefore, the available faunal record will be examined for evidence relating to the seasonality of Neanderthal hunting. It must be noted however, that a wide variety of factors may affect the seasonality of Neanderthal hunting at a particular site, including climate, seasonal migrations of both animals and Neanderthals, and the nature of the occupation of the site. Therefore, examples should ideally be from a non-migratory species, at a site that displays evidence for year-round occupation.

Site/Context	**Species**	**Season**	**Reference**
Pech de L'aze I - Layer 4	Red Deer	Year round	(Rendu 2010)
	Bison	EWS	
Pech de L'aze I - Layer 6	Red Deer	EWS	
	Bison	BWS-MWS	
Pech de L'aze I - Layer 7	Bison	EWS	
Les Pradelles	Reindeer	EWS	(Rendu et al. 2012)
Mauran	Bison	EWS	
Abri du Maras	Reindeer	EWS	(Daujeard et al. 2019)
Salzgitter Lebenstedt	Reindeer	EWS	(Gaudzinski and Roebroeks 2000)

Pech de L'aze IV - Layer 4A	Reindeer	BWS	(Niven 2013)
Pech de L'aze IV - Layer 4B	Reindeer	BWS	
Pech de L'aze IV - Layer 4C	Reindeer	BWS	
Pech de L'aze IV - Layer 6A	Red Deer	BWS and CS	
	Wild Boar	BWS	
Pech de L'aze IV - Layer 6B	Red Deer	BWS and CS	
	Wild Boar	BWS	
Pech de L'aze IV - Layer 8	Red Deer	EWS and CS	
	Wild Boar	BWS and CS	

Table 4.3 *Table showing species and seasonality data across site from published literature. BWS: Beginning of the Warm Season; MWS: Middle of the Warm Season; EWS: End of the warm season; CS: Cold Season*

Although seasonality of death data is available from a number of sites and contexts, due to the inconsistency in reporting for numbers of individuals and other occupation data for the sites, it is difficult to establish which seasonal trends indicate seasonal occupation, and which indicate seasonal exploitation of a species. Further, it is clear from table 4.3 that there is little consistency between the seasonality of hunting and species, suggesting that the primary motive for these seasonal exploitations is not hide procurement and is instead a more local factor, such as the time of year a migratory species is moving through the area. In the cases where a site or context does display seasonality ideal for hide procurement, such as, Pech de L'aze I, Les Pradelles, Mauran, Abri du Maras, Salzgitter Lebenstedt, and Pech de L'aze IV - Layer 8, there is little to suggest that the seasonality of hunting reflects anything more than the seasonality of site occupation. Overall, it is clear that currently available data on seasonality of faunal remains does not allow conclusions to be drawn as to whether Neanderthals were hunting animals with the quality/thickness of fur being a primary concern

4.4. Summary

The evidence presented here shows that Neanderthals were engaging in hideworking activities to some extent. The presence of lissoirs is the strongest evidence of hideworking

available, as they represent a specialised tool produced to carry out some form of hide processing task. However, without further investigation of the tools, it is not possible to use them to establish any more detail regarding which hideworking activities Neanderthals were participating in. Similarly, the stone tool evidence goes as far as to confirm that hides were being scraped in the Middle Palaeolithic, but does not allow for any more detail to be established. Additionally, it is clear that although the faunal record holds great potential for the examination of aspects such as the frequency of hideworking, the currently available data prevents any conclusions from being drawn. This is further complicated by the multiple uses of animals by Neanderthals, as unlike tools such as lissoirs, which can only indicate hideworking, the presence of butchered and skinned faunal remains indicates nutritional consumption as much as it indicated hideworking; however it is likely that this simply represents total exploitation of animal resources. Overall , it is clear that there is a good body of evidence indicating that Neanderthals were carrying out hideworking activities, however, it is fragmented across a variety of publications, and is not centred around better understanding Neanderthal hideworking. In this sense, what the current record is lacking is both a synthesis of all these fragmented points of evidence, and clear case studies focusing on identifying hideworking at one particular site. This sort of future work would allow for aspects of hideworking such as spatial analysis, and social structures to be investigated. An example of this from an Upper Palaeolithic context is available in Beyries *et al*'s (2001) study of UI1, a site in Siberia. In this study, lithics, faunal remains, and structural data from the site are brought together with ethnography to discuss the likely hideworking processes being carried out at the site. Application of a similar methodology to a site such as Pech de L'aze I, where specialised hideworking tools, lithics, and faunal remains are available, could potentially allow for more substantial conclusions regarding Neanderthal hideworking to be drawn.

Chapter 5- Evidence for Neanderthal Clothing Production

5.1. Introduction

The use and production of clothing by Neanderthals remains a debated topic within Middle Palaeolithic archaeology, with much of the uncertainty fuelled by the lack of direct evidence due to preservation bias. This means that research attempting to establish the nature of Neanderthal clothing use is often focused on factors such as environment and physiology. This naturally leads to much of the discussion focusing on clothing as an aspect of subsistence, and a factor in understanding Neanderthal competition with anatomically modern humans (AMH). Establishing whether Neanderthals were producing clothing also offers a valuable insight into their crafting activities, as the production of clothing is a craft which remains relevant to nearly all modern-day populations. Therefore, the existing discussions of Neanderthal clothing will be summarised here to establish the types of clothing likely to be used by Neanderthals. This will then be discussed alongside other archaeological evidence in order to establish whether the production of these forms of clothing would be possible with the technology available.

5.2 Existing Discussions of Neanderthal Clothing

A key paper in understanding Neanderthal clothing use is that of Aiello and Wheeler (2003) who discuss the relationship between Neanderthal thermal regulation and the climate at the time of their occupation of Europe. When discussing Neanderthal thermal regulation, a number of potential figures for a minimum survivable temperature are suggested. These range from 8 degrees to -23.9 degrees with raised BMR and one clo of insulation considered (Aiello and Wheeler 2003, 150–151). It is noted however, that the 1 clo of insulation required for this lower figure is unlikely to be provided by subcutaneous fat, and would likely require some form of clothing to achieve (Aiello and Wheeler 2003, 151). The study then goes on to compare these figures with wind chill adjusted temperature estimates for a number of Palaeolithic sites across Europe. In doing so, they suggest that it is likely that Neanderthals would have needed some form of cultural adaptation to the climate in order to survive in the glacial climate for as long as they did. (Aiello and Wheeler 2003, 151–155). However, it is suggested that behavioural mechanisms such as huddling could have also fulfilled this role (Aiello and Wheeler 2003, 155). Overall, Aiello and Wheeler's study strongly suggests that Neanderthals would have required some form of cultural, or behavioural adaptations to survive in glacial Europe. The exact nature of these adaptations is, however, left open to

interpretation, with obvious caution being applied to ideas surrounding Neanderthal clothing use. Regardless, the suggested behavioural mechanisms for surviving in cold conditions do not seem to be a realistic approach towards Neanderthal adaptation to the environment. A reliance upon 'huddling' for survival would be an incredibly limiting factor in the species' ability to carry out day to day tasks in the winter months. Considering what is known about the Neanderthal ability to problem solve (Wragg Sykes 2015), it also seems unlikely that Neanderthals would not use the tools and resources available to them to produce some form of insulation. Importantly, for the discussion of Neanderthal clothing use, this study establishes an understanding the climatic conditions of Europe, at the time of Neanderthal occupation, would require cultural adaptations in order to survive. However, it is not possible to suggest from this data alone, whether Neanderthals were using clothing, let alone the complexity of the craft involved in its production.

One study that further utilises environmental data is Wales' (2012) study of Neanderthal clothing use. This study combines climatic data from OIS-5 to the Holocene, a study of the clothing and climate of 245 hunter-gatherer groups, and the locations of 179 sites from the Mousterian and 330 Aurignacian and Gravettian sites, in order to establish the percentage of the body that Neanderthals would have to cover at different regional locations and times during their occupation of Europe. For each hunter-gatherer group, an estimate of the percentage of body covered by clothing was made using the following percentage for each area of the body that was clothed: hands, 1%; lower arms, 8.5%; upper arms, 8.5%; torso, 36%; genitals, 1%; upper legs, 17.5%; lower legs, 17.5%; feet, 1%; and head, 9%. Alongside this data, the climatic conditions the groups lived in were recorded. This allowed for an estimate to be made for how much clothing is used by humans living in certain climatic conditions. The locations and time of occupation for the Mousterian, Aurignacian, and Gravettian sites was then combined with the estimated climatic conditions for the period. This allowed for these archaeological sites to be given an estimated clothing requirement, based on the percentage of clothing used by hunter-gatherers in similar conditions. It is found that although some Neanderthal populations would need to cover up to 80% of their body (Wales 2012, 789), the majority would only need to cover 50% or less (Fig.5.1). Further, as figure 5.1 shows, there is a clear shift to warmer areas as temperatures decline towards OIS-3, this may suggest that Neanderthals were moving away from colder climates due to a lack of suitable clothing. However, it is not possible to say this with any certainty, as a change in climatic conditions may motivate migrations for a number of other reasons, such as the availability of food. What is firmly established by this study however, is that Neanderthals were, at times, covering up to 80% of their bodies with clothing. Wales argues that this could be achieved through use of non-tailored clothing, using the example of

Australian groups who achieve up to 80% coverage with non-tailored clothing, such as draped furs and cloaks, despite also discussing two groups that do use tailored clothing, such as hide leggings, moccasins, and shirts, and live in a more comparable environment (Wales 2012, 790). This highlights a key issue with many studies regarding Neanderthal clothing use: the motivations for clothing use other than of insulation are rarely discussed. In this case, Wales appears to be assuming that the Australian groups in question are covering up to 80% of their body in order to retain heat, without consideration of other cultural, or environmental factors that may influence the wearing of clothing. Further, the assumption is made that all clothes that cover a certain percentage of the body are as effective as one another; this discounts the importance of the materials and methods of production used, as well as the possible layering of garments. Overall, Wales' study adds further weight to the idea that Neanderthals were utilising clothing and begins to develop understanding of what form this clothing would likely have taken. Further work to examine the clothing of non-industrialised people living in similar conditions to Neanderthals would allow for a greater understanding of the types of clothing that may have been used by Neanderthals. This in turn, would allow for a discussion of the craft processes involved in producing this clothing.

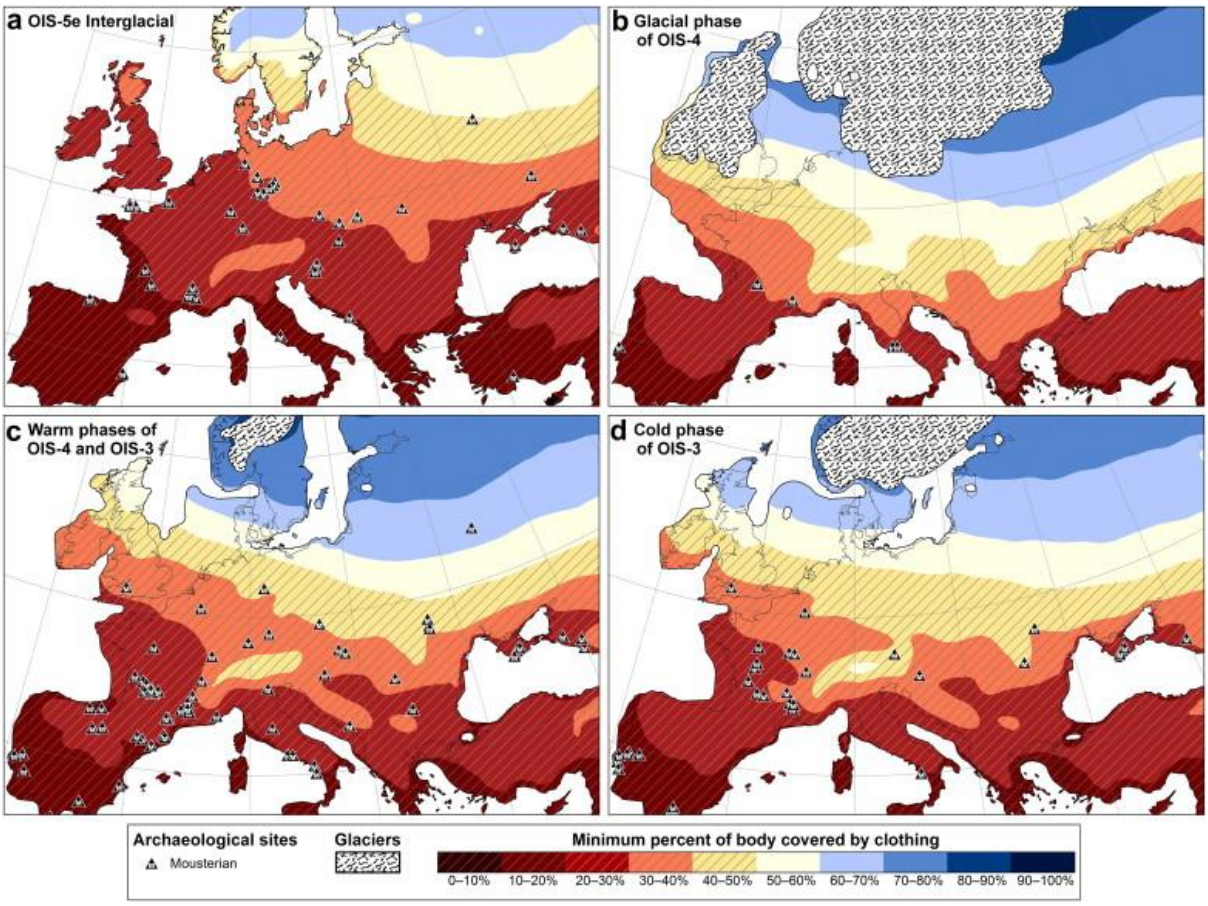

Figure 5.1 *Map showing Mousterian sites of occupation, and the estimated clothing coverage required from OIS 5 to OIS 3 (Wales 2012)*

A study which does focus on the types of clothing produced by Neanderthals is Collard *et al*'s 2016 study of clothing difference between Neanderthals and AMH, through the use of differences in faunal remains between Aurignacian/Gravettian and Mousterian strata recorded in the 'Stage 3 Faunal Database'. They also study the eHRAF world cultures database and identify all animal families associated with the production of 'specialised cold weather clothing'. They find that the most commonly utilised species in the eHRAF database are: *Cervidae* (32%), *Bovidae* (16%), *Mustelidae* (14%), *Leporidae* (10%), *Canidae* (10%), *Ursidae* (6%), *Sciuridae* (4%), *Castoridae* (4%), and *Felidae* (2%) (Collard et al. 2016, 238). This is then compared to the faunal record of the Stage 3 database, to establish the frequency with which each family occurred in Mousterian strata compared with Aurignacian/Gravettian strata, this data is shown in table 5.1.

Family	**%Moust**	**%Au/Gr**	**p-value**
Bovidae	91	84	0.096
Canidae	51	78	0.000*
Castoridae	7	9	0.559
Cervidae	92	95	0.188
Felidae	44	40	0.492
Leporidae	23	55	0.000*
Mustelidae	20	42	0.000*
Sciuridae	18	18	0.998
Ursidae	54	45	0.136

Table 5.1 *Frequency of cold-weather clothing families in Mousterian and Aurignacian/Gravettian strata. P-values based on chi-squared test; P-value significant at 0.001. Redrawn from (Collard et al. 2016, 239).*

A Chi-squared test was then used to establish which families display a significant difference in frequency between the strata. This means that from this point forward all families other than *Canidae, Leporidae and Mustelidae*, are excluded from the discussion as these three are shown to have a significant difference between Mousterian, and Aurignacian strata

(Collard et al. 2016, 238). In this discussion it is concluded that the significant difference seen in these families indicates that Neanderthals were not producing specialised cold weather clothing, or fur trims (Collard et al. 2016, 240–241). Although it is important to discuss this statistically significant difference, it does instantly disregard the potential importance of the other families, which are observed earlier in the paper as being significant in the production of cold weather clothing, and which appear in up to 92% of all Mousterian strata examined (table 5.1). The data therefore shows that of the 9 families considered, there is only a significant difference in frequency displayed by three of them, this significant difference could be driven by a variety of factors other than cold-weather clothing production. For example, the use of family, rather than species allows for the inclusion of domesticated dogs under the umbrella of Canidae, making it possible that the significant difference in this family is due to AMH's association with dogs. Further factors such as the possibility of differential hunting strategies between AMH and Neanderthals also bring the significant difference of the remaining two species into question. This method can also be criticised more generally, as the presence of a fur bearing species at a site can not be said to be a certain indication of clothing production, unless tools at the site are found to have use-wear correlating to hideworking activities.

In most cases then, the study shows Mousterian strata are shown as displaying just as much potential for the production of specialised winter clothing as those of the Aurignacian. When considered with the conclusions of Wales, discussed above, and the evidence of skinning and hide working discussed in chapter 4, it becomes possible to suggest that Neanderthals were producing tailored clothing, and in some cases, fur trims. The discussion of fur trims is made more interesting with the inclusion of *felids* in 44% of the Neanderthal faunal record; as discussed in chapter 4, small *felids* such as *F. silvestris* were being skinned by Neanderthals. It is unlikely that the skins of these animals would be effective materials for clothing production on their own, owing to their small size, as the construction of a cloak, for example, would require an impractically high number of skins to be stitched together. Although this has been observed for the construction of garments from possum skins in some areas of Australia (Gilligan 2008, 487). It is possible then, that the use of *felids*, is for the addition of fur trims to clothing, either for thermal efficiency or for aesthetic purposes. The use of fur trims for their aesthetic value is made plausible by the extensive evidence of Neanderthals valuing aesthetics, such as the use of personal ornamentation, and production of art (Hoffmann et al. 2018b; Radovčić et al. 2015; Rodríguez-Vidal et al. 2014; Jaubert et al. 2016). It is especially possible to draw parallels between the aesthetic use of fur trims and the proposed use of Corvid and Eagle talons, and feathers in Neanderthal personal ornamentation (Romandini et al. 2014; Rodríguez-Hidalgo et al. 2019; Callaway 2015;

Radovčić et al. 2020; Finlayson et al. 2012). In the case of using talons and feathers Neanderthals are seen either hunting a species which would likely be both hard to catch, and yield little nutritional value, or scavenging these species and extracting elements which hold an aesthetic value. In both cases, the primary motivation appears to be the use of the aesthetic elements of the animal, rather than its nutritional value. Applying this logic to the exploitation of *felids*, which are also not a typical 'prey species', would suggest that their occurrence in the Neanderthal faunal record may be motivated by their use in personal ornamentation through clothing.

***Figure 5.2** Australian Possum skin cloak, representative of 'simple' clothing. Produced by Lee Darroch for the Australian Institute of Aboriginal and Torres Strait Islander Studies. (Australian Institute of Aboriginal and Torres Strait Islander Studies 2017).*

A further method used to discuss the use of clothing by Neanderthals is energy use, one study which examines energy use by Neanderthals is that of Sørensen (2009). Sørensen uses a multi-layer heat loss calculation to establish the minimum amount of insulation that would be required for a Neanderthal to survive. It is concluded that Neanderthals would have needed at least a set of mostly airtight garments, and footwear to survive average winter temperatures (Sørensen 2009, 2202–2203). The data used to draw these conclusions is displayed in table 5.2. From this data it is clear to see that by Sørensen's estimates clothing use by Neanderthals is inevitable. This study ties in well with Wales' findings, discussed

above, as both studies reach similar conclusions, that Neanderthal's would have needed a reasonably significant amount of clothing to survive, through two different forms of evidence.

Deg. C if no other unit mentioned	**Male**	**Female**
Body mass (kg)	80	75
Body height (m)	1.65	1.55
Body surface area (m2)	1.87	1.74
Metabolic rate of energy conversion at sleep (W)	92	77
Naked on dry ground (at wind speed *v* = 1.5 m/s)	31.8	32.3
On dry ground with one layer of clothes (*v* = 1.5 m/s)	17.8	19.6
On dry ground with mammoth skin cover (*v* = 1.5 m/s)	−10.3	−5.7
On dry ground with mammoth skin cover (*v* = 5 m/s)	−8.6	−4.1
Temperature rise from dying wood fire (*v* = 0)	1–2° for a few h	
Naked in cave or small hut	26.9	27.8
In cave or small hut with one layer of clothes	12.9	15.2
In cave or small hut with mammoth skin cover	−15.3	−10.1
In cave or small hut with mammoth skin cover and one layer of clothes	−29.3	−22.7

Temperature rise from body heat and embers from dying wood fire in small hut	1–3° for some 4 h
Temperature rise from body heat and embers from dying wood fires (5) in cave	up to 10° for 4 h
Eem (Bispingen, 125 ky BP) July temperatures	17.4 (0, 8, 27, 36)
Eem (Bispingen, 125 ky BP) January temperatures	1.0 (−30, −9, 7, 12)

Table 5.2 *Table showing estimates of ambient minimum endurable temperatures for Eem Neanderthals during sleep, and actual temperatures. Redrawn from Sørensen 2009, 2202.*

A further source of evidence used to estimate whether Neanderthals were utilising clothing is the divergence of the two ecological types of human body louse (*Pediculus humanus*), head, and clothing lice (Toups et al. 2011; Kittler,Kayser and Stoneking 2003). Both studies that utilise this source of evidence examine mtDNA to establish how long ago the two types diververged. Both find this to be around 100 ka (Kittler,Kayser and Stoneking 2003, 1414–1415; Toups et al. 2011, 30), however, they disagree on what this means for the development of Neanderthal clothing. Kittler *et al* suggest that as this post-dates the divergence of *H. sapiens* and *H. neanderthalensis,* and roughly coincides with the *sapien* expansion out of Africa, that it indicates that Neanderthals did not utilise clothing, as otherwise the origin of body lice would be far older (2003, 1415). This is brought into question by Toups *et al*, who conclude that clothing use by 'archaic humans' can not be assessed through this method, as had they developed clothing, they would have also developed their own species of clothing lice, which will have likely become extinct with their host species and would have little to no chance of preservation (Toups et al. 2011, 30–31). This therefore makes it difficult to apply this data to Neanderthals in a useful way, as it can only really be used to conclude that AMH developed clothing as part of their cultural adaptation to the climatic conditions in Europe.

When taken as a set, the current discussions of Neanderthal clothing strongly suggest that Neanderthals were utilising some form of clothing. However, only Collard et al's study offers a discussion of the use of this clothing from material evidence that can be tied, more or less, directly to clothing production. Whilst the other studies focusing on the need for clothing, as

opposed to whether it was being produced, are less directly relevant to craft; establishing this need is essential to allow for further discussion of clothing production. As discussed by Gilligan (2010, 17), these thermal motives are most likely for the initial development of clothing, and therefore must be established. However, Gilligan does also discuss how clothing development may be tracked alongside the use of personal adornment and art, using this as a possible indication of a lack of clothing use by Neanderthals (2010, 63–65). At the time of publication, there was very little evidence of Neanderthal art, personal adornment, and symbolic manipulation of landscapes, however, since 2010, there have been a number of new publications showing extensive evidence of these behaviours (Rodríguez-Hidalgo et al. 2019; Romandini et al. 2014; Bar-Yosef Mayer et al. 2020; Rodríguez-Vidal et al. 2014; Hoffmann et al. 2018b; Zilhão 2012; Jaubert et al. 2016). This adds further weight to the idea that clothing use may have been a well-ingrained aspect of Neanderthal culture. Overall, the current discussions regarding Neanderthal clothing indicate that, in all likelihood, Neanderthals were making extensive use of some form of clothing, however, whether that clothing is complex sewn garments, or simple draped clothing, has not yet been established.

One of the most prolific authors on the subject of Neanderthal clothing is Gilligan, who writes two papers discussing primarily the thermal motivations for clothing use, but also mentioning the significance of other factors (2010, 2007). The 2007 publication advocates for the idea that Neanderthal cold adaptations played an important role in delaying their development of clothing, as it meant they had little need to develop fitted clothing. It is further suggested that this meant that when harsh conditions of late OIS 3 occurred, Neanderthals were not able to develop the clothing required to survive due to a previous lack of exposure to this selection pressure, and therefore went extinct (Gilligan 2007, 506–507). The question of why Neanderthals didn't adapt to these conditions is resolved through discussion of the Chatelperronian, suggesting that it represents the technological evolution required to cope with these new adverse conditions, but that it was "too little, too late" (Gilligan 2007, 507–508). The 2010 publication builds on these ideas, discussing the thermal motivation for clothing production in greater detail, whilst further building the case for sewn clothing in AMH. This is done through use of a variety of material evidence such as Upper Palaeolithic 'venus' figurines which depict clothing (Gilligan 2010, 56–59), and the presence of tools such as bone needles and blades, which are argued to be essential in the production of sewn clothing (Gilligan 2010, 45–53). Further, the presence of rondelles in the Magdalenian, suggested to be buttons, as well as pendants and other ornaments are also suggested as evidence that AMH were producing sewn or fitted clothing (Gilligan 2010, 53–56). The clear inference from this use of material evidence is that the absence of these objects from the

Middle Palaeolithic record suggests that Neanderthals were likely not producing sewn clothing, and certainly were not producing clothing to the same degree of complexity as AMH. Interestingly, throughout these publications, Gilligan does not suggest that the primary reason for the lack of complex clothing in Neanderthals is inferior cognition, instead arguing that it primarily lies in a lack of need to produce such garments. However, it is suggested that the more advanced tool technologies of AMH allowed for the production of sewn clothing, and therefore still firmly linking clothing development and AMH's cognitive capacity. One helpful concept established by Gilligan is differentiating between simple, and complex clothing, an idea which is further utilised, and built upon by both Collard *et al* (2016) and Wales (2012). For Gilligan the differences between simple and complex clothing are determined by factors relating to the structure of the clothing, its thermal efficiency, and the technology required to produce it (table 5.3). Whilst making this distinction Gilligan also states expected societal repercussions of the use of simple vs complex clothing (table 5.3).

	Simple Clothes	**Complex Clothes**
Structure		
Number of layers	1	>1
Fitted (or 'tailored')	No	Yes
Thermal Physiology		
Level of protection	1-2 clo	2-5 clo
Technology (Palaeolithic)		
Scraping implements	Yes	Yes
Piercing implements	No (generally)	Yes
Cutting implements	No	Yes
Technological mode	3	4
Repercussions		
Impairs cold tolerance	No	Yes
Acquires decorative role	No	Yes

Acquires social role	No	Yes
Promotes modesty/shame	No	Yes
Becomes habitual	No	Yes

Table 5.3 *Features distinguishing simple and complex clothing (Redrawn from Gilligan 2007, 502).*

Although an essential starting point for discussing Neanderthal clothing use beyond a simplistic clothing, or no clothing argument, Gilligan's method of defining simple vs complex clothing, and their assumed societal repercussions is too simplistic. Further, Gilligan places great emphasis on the need for cutting tools in tailored clothing production and suggests that Neanderthals did not possess the tools required (table 5.3). This is confusing, as general consensus suggests that Neanderthals were more than capable of producing flint blades (Hayden 1993, 117–118).

Overall, Gilligan's discussions of Neanderthal clothing use are primarily limited to his advocation of using a thermal model in the 2007 publication, in which it is concluded that Neanderthals did not use complex clothing, due to the cold not being a significant selection pressure for much of their occupation of Europe, rendering its development unnecessary. Although the arguments made are logical, the uncertainty regarding the extent of Neanderthal cold adaptation (e.g. Rae *et al* 2011), combined with later work such as Wales' 2012 study, do draw into question whether Neanderthals could have survived with only simple, draped clothing.

5.3 Other Archaeological Evidence

One key aspect of Neanderthal clothing which has gone largely unexamined is whether the Middle Palaeolithic record holds evidence of the materials and technologies which are required for its production. The most fundamental of which is a material from which to make the garments, with the absence of any substantial evidence of Neanderthals weaving fabrics, animal hides are the most logical source of this material. The evidence presented in chapter 4, would suggest that Neanderthals were capable of producing hides that have been processed in such a way that they are relatively flexible, and will not rot. This is significant as it suggests that Neanderthals would have been able to produce the wrapped, tied, or cape-like clothing.

Production of more complex forms of clothing would require Neanderthals to have access to awls/needles, and a form of thread or string. There are currently no examples of needles from a Neanderthal context. However, a recent publication of the Neanderthal bone industry at Chagyrskaya cave in Southern Russia, details four ‘micro borers’ (fig 5.3) which are suggested to be related to leather working, and are found in conjunction with lissoirs (Baumann et al. 2020, 16). This represents an example of a Neanderthal tool that is used for the piercing of holes through processed hide, therefore allowing for sewing to take place. However, these are only four examples of such a tool, all from a single site, making it impossible to say whether borers such as these were a widespread technology in the Middle Palaeolithic, and therefore it is difficult to use them to infer widespread use of sewn clothing. Further work to determine the efficacy of these tools through experimentation would also allow for a more certain labelling of these artefacts as a leatherworking tool. However, at the very least, these tools offer more substantial evidence of hide piercing tools than the Chatelperronian examples discussed by Villa and d’Errico (2001, 72). This evidence of specialised tools for the piercing of hide supports the idea that Neanderthals may have been sewing clothing, however, they do not suggest it with total certainty as hides may have simply been pieced for tying to the body in the form of a cloak. However, taken alongside the findings of Wales (2012) discussed above suggesting that Neanderthals needed up to 80% body coverage, it would be logical for this sort of tied clothing to develop into sewn, or tailored garments.

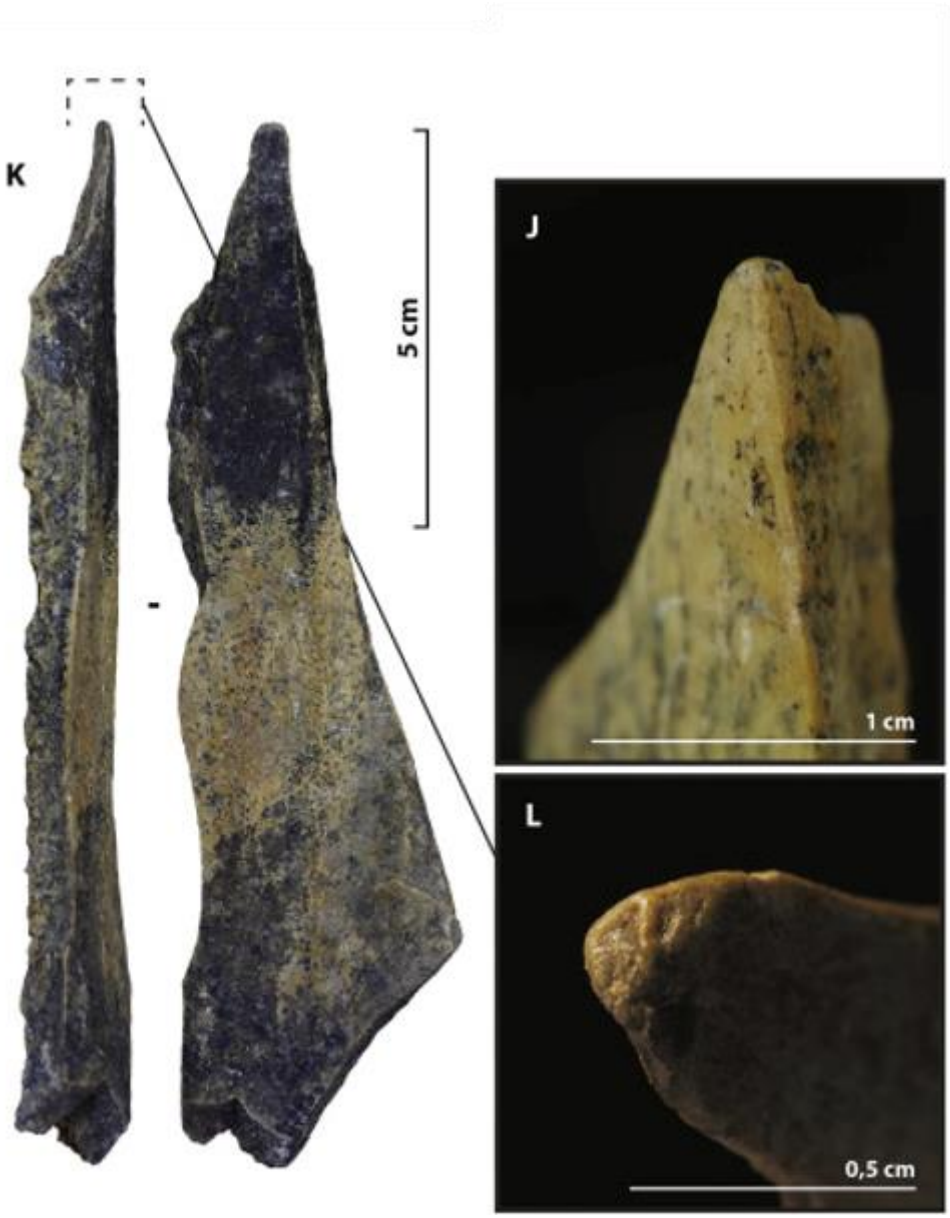

Figure 5.3 *Bone 'Borer' from Chagyrskaya cave. Adapted from (Baumann et al. 2020, 16), 17.*

The production of cordage by Neanderthals is also noted by a number of studies (Hardy et al. 2013, 2020; Radovčić et al. 2020). Radovčić *et al*'s study examines a fibre found attached to an eagle talon, likely used as personal ornamentation. Results of analysis by infrared synchrotron beam found the fibre to be protein based, and most likely collagen. Therefore, it is likely that this fibre represents evidence of Neanderthal production of sinew, or tendon based cordage. Faunal remains at sites such as Abri Du Maras, and Shanidar display evidence for the removal of tendons (Daujeard et al. 2019, 998; Campana and Crabtree 2019, 12) with Campana and Crabtree's experimental work, and examination of cut marks on faunal remains showing that attention was paid to ensure extraction of large tendons

during butchery. Tendons are a common material for the manufacture of cordage and are capable of providing a finer cord than plant based fibres, for this reason, sinew cord is often used in the manufacture of clothing. A 2011 study of Eastern Siberian clothing production suggests that groups value sinew cord over other fibres believing it to be stronger and more waterproof. It is also mentioned that reindeer sinew is considered to be the best for thin and strong threads (Brandisauskas 2011, 109–110). This presence of sinew based cordage in the Neanderthal record further suggests that Neanderthals had the technologies and materials to produce clothing. It is of course difficult to say with any certainty that these sinew cords were used for manufacturing sewn clothing, however, in combination with awls they do make it possible.

5.6 Summary and Conclusions

The evidence discussed in this chapter allows for a greater overall understanding of Neanderthal clothing production. The discussions of energetics, climate, and clothing used by hunter-gatherers from, Aiello & Wheeler, Wales, and Sørensen, establish that Neanderthals needed to produce and use clothing in some form, whether simple, or complex. The idea of defining the clothing of a species as either simple or complex, is itself limiting for a number of reasons, such as the possibility of a group mixing both complex and simple clothes. Collard *et al*'s examination of the faunal record, and its comparison with both ethnography, and the Upper Palaeolithic record, suggest that Neanderthals may have been specifically hunting fur-bearing species for clothing production, though not to the same extent as AMH. Further, the evidence of sinew based cordage production from Campana & Crabtree, Radovčić *et al,* and Daujeard et al, along with the 'borers' discussed by Baumann et al, demonstrates that Neanderthals had the tools and materials required to sew hides, to produce sewn clothing. Combined with the knowledge that Neanderthals were processing hides to an extent that they had developed specialised tools for the purpose (chapter 4), it is clear that Neanderthals had both the need to produce clothing, and all of the tools, materials, and technology to do it. In conclusion, the evidence for the production of clothing by Neanderthals is largely circumstantial, with no single piece of evidence alone suggesting the production of clothing. However, when all the factors above are taken into account there is a clear case to be made that Neanderthals were utilising at least simple forms of clothing, as they had both a need, and the means to fulfil it. However, whether more complex sewn clothing was being produced, or less complex alternatives remains unclear. To establish the use of sewing with any certainty, a greater number of examples of sewing technology, such as needles or awls, and a more clear need for sewn clothing, are needed.

Chapter 6 - Neanderthal personal Ornaments as Evidence of Craft

6.1 Introduction

The production of personal ornaments by Neanderthals is an activity that is particularly relevant to clothing production, as to some degree they merge into one another, with some clothing acting as ornamentation, and some ornaments forming parts of clothing. The personal ornaments of the Middle Palaeolithic can be split into three main material categories: animal teeth, shells, and bird remains. All three of these materials are worked in different ways, requiring varying degrees of effort to obtain from the environment. This chapter will aim to present and discuss the available evidence for the crafting of each material and assess to what degree Neanderthal personal ornament production can be considered a crafting activity.

6.2 Tooth Ornaments

Some of the best known, but also most controversial personal ornaments that have been attributed to Neanderthals are the Châtelperronian (CP) tooth, bone, and ivory artefacts from Grotte Du Renne in North Central France (Zilhão 2012). Much debate has surrounded the attribution of these artefacts to Neanderthals (Higham et al. 2010; Mellars 2010; Caron et al. 2011; Hublin et al. 2012; Zilhão 2012; Welker et al. 2016). However, as noted by Caron *et al* (2011, 7), the discovery of a number of artefacts at other sites indicating symbolic behaviour by Neanderthals since 2011 has made the Grotte du Renne objects less controversial. This is further demonstrated by the lack of publications concerning the dating of Grotte du Renne after 2012. With Welker *et al*'s 2016 paper being the most recent effort to associate Neanderthals with the CP at Grotte du Renne. This is achieved by identifying 28 bone fragments within the CP layers as being Neanderthal remains through use of ZooMS, amino acid analysis, and ancient mtDNA analysis.

Although the attribution of the personal ornaments from Grotte du Renne to Neanderthals is debated, in the case that they are indeed made by Neanderthals, they represent an extensive and complex example of Neanderthal craft. Figure 6.1 shows a selection of the personal ornaments as well as a number of awls and pigment sources also associated with the CP at Grotte du Renne. Interestingly, much of the analysis of these objects is framed as discussion of Neanderthal symbolism (e.g. Zilhão 2012). However, why these objects were

symbolic, or indeed the significance of the complexity of their production, is not fully discussed, with the majority of focus instead on whether or not the CP is a Neanderthal or AMH industry. This has meant that the significance of ornaments in terms of what they represent as a Neanderthal crafting activity has been left largely undiscussed. The production of these objects is most thoroughly elaborated on by d'Errico *et al (1998)*, however, this research is mostly concerned with determining the nature of the relationship between the CP and Aurignacian. White (2002) also discusses the production of some of the CP ornaments, however this is done only where the author suspects the artefacts are intrusive from the overlying Aurignacian contexts. Because of this gap, these objects have been selected as a case study for exploring Neanderthal craft. Although in depth analysis such as use-wear can not be conducted by the author, more macro scale discussions such as the *chaîne opératoire* can still be had.

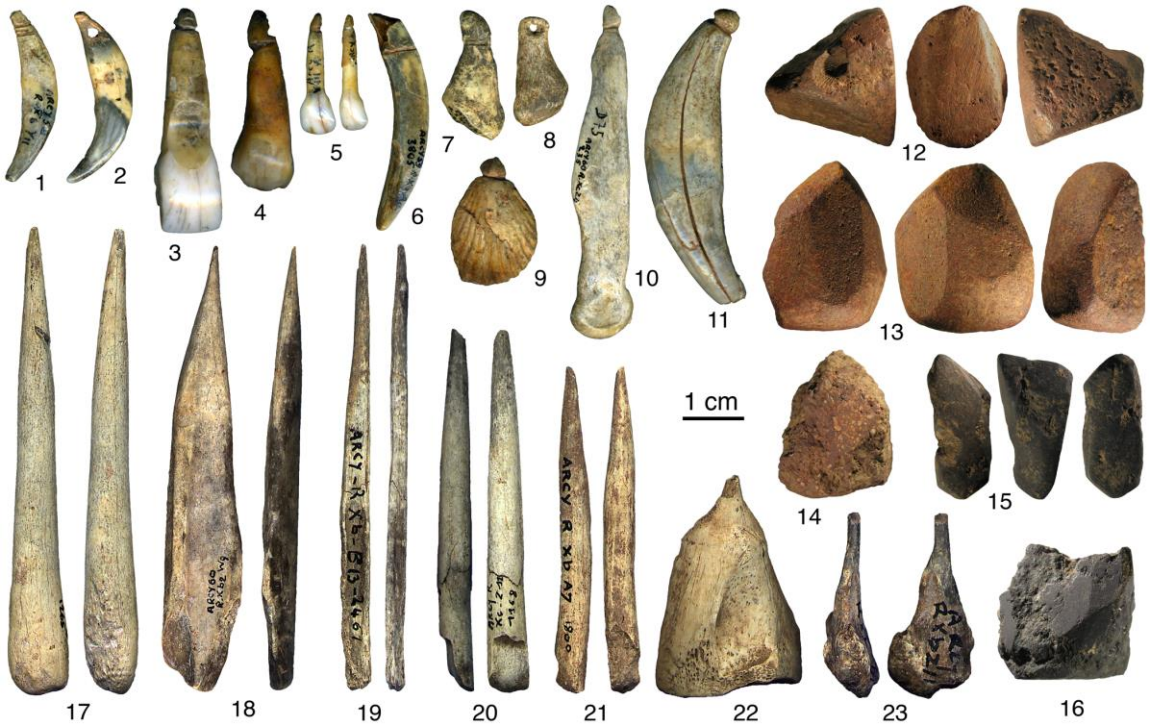

Figure 6.1 *Châtelperronian artefacts from Grotte du Renne. Personal ornaments made of perforated and grooved teeth (1–6, 11), bones (7–8, 10) and a fossil (9); red (12–14) and black (15–16) colorants bearing facets produced by grinding; bone awls (17–23) (Caron et al. 2011, 2).*

It is clear that the personal ornaments represent relatively sophisticated objects with a complex *chaîne opératoire*. For example, in the case of object 2 (a perforated tooth), a decision has been made to select and remove the tooth from a carcass. A process which in of itself shows a degree of creative thinking, with the craftsperson observing the existing form of the material, and how it will contribute to the form of the end product. A further decision has then been made to perforate the tooth, rather than cut a notch, as is the case

with object 1, a very similar tooth. This again shows that a decision has been made based upon a future idea of the end product being produced. This creative aspect of Neanderthal craft is demonstrated by this assemblage on the whole, as it shows a variety of different teeth, bones, and a fossil being used. Lack of consistency suggests that each object is being thought about individually, rather than being produced in a standardised manner, indicative of craft as the craftsperson is working with the materials in a reactive way rather than simply using them as a source of raw material to convert into a new object. However, it is important to consider the extent of the modification that is required to produce these objects, as this assists in establishing the complexity of the craft. The artefacts are still largely in their natural state, with cuts or perforations added to allow them to be worn. In this sense the production of these ornaments is not a craft which involves transforming one object into another that is completely different, as is the case with some Upper Palaeolithic personal ornaments such as beads. However, it is not possible to suggest that Neanderthals were cognitively incapable of such transformative crafts, as they are known in the form of birch tar production (Grünberg 2002; Wragg Sykes 2015; Kozowyk et al. 2017; Niekus et al. 2019), and most commonly in stone tool production, where the resulting tool is an entirely separate object from its source material. Therefore, the limited modification to produce these artefacts is not likely due to a cognitive limitation, and may instead be due to a variety of reasons from aesthetic preference, to the availability of time for non-subsistence activities. The most important caveat in discussing the Grotte du Renne ornaments is that they are not generally representative of the rest of the Neanderthal record, with the few comparable artefacts coming from CP contexts (Zilhão 2012, 41–42). This makes it problematic to suggest that all Neanderthals were producing personal ornamentation in this way as there is limited evidence for it outside of CP contexts. This is further complicated by the debate surrounding the attribution of the CP to Neanderthals in the broader record. For example, Gravina *et al*. (2018) carry out extensive taphonomic analysis of the CP contexts at La Roche-à-Pierrot, finding that their association with Neanderthal remains is unreliable. Whilst this does not absolutely rule out a Neanderthal authorship of the CP at Grotte Du Renne, it does significantly undermine the certainty with which it can be stated.

However, if Neanderthal authorship can be attributed to the Grotte de Renne assemblage it demonstrates that Neanderthals were producing personal ornaments from animal teeth. However, the production methods of simply cutting grooves are not hugely complex, and the scale of production remains relatively small. It is clear that these artefacts alone do not suggest that Neanderthals were extensively involved in crafting personal ornaments, however, they do show that they were capable of doing so.

6.3 Shell Ornaments

Personal ornaments produced from shells are also present to some extent within the Neanderthal record. The most substantial evidence for the use of shells for personal ornamentation by Neanderthals comes from the sites of Cueva de los Aviones (Cartagena, Spain) and Cueva Anton (Mula, Spain) (Zilhão et al. 2010; Hoffmann et al. 2018a). This initial date has since been pushed back significantly by Uranium series dating of a flowstone cap at the site, which gives dates of 117 ± 3 Ka and 115 ± 1 Ka BP (Hoffmann et al. 2018a, 3).

The finds from Aviones are more plentiful than those from Anton, with shells from *Acanthocardia tuberculata, Glycymeris insubrica, and Spondylus gaederopus*, showing evidence for use in the production of personal ornaments including perforations and pigments. These shells are all from non-food taxa and were found to have been collected dead from the beach rather than collected alive. This is evidenced by the abraded and bioeroded surfaces (Zilhão et al. 2010, 10). Although these three taxa are all present in at least two different strata, only those from level II possess perforations (Zilhão et al. 2010, page 1024 and table 6.1). It is also worth noting that of the 24 shells of these species present at the site, 3 are perforated and 2 had pigment traces, with only the larger *Glycymeris insubrica* shell being both perforated and displaying pigment traces (Zilhão et al. 2010, 1024). The pigment traces on the shells are shown to not be of the same composition as the blocks of pigment found independently at the site (Zilhão et al. 2010, 1027), showing that the presence of pigment on the shells is not due to post-depositional contamination. The date for the site was originally obtained through radiocarbon dating of shells and placed the

deposits between 45-50Ka cal BP (Zilhão et al. 2010, 1023).

Figure 6.2 *Perforated Glycymeris insubrica from Cueva de los Aviones (Zilhão et al. 2010, 1025)*

	I	II	III	IV	V	Total
Acanthocardia tuberculata	—	1	1	1	—	3
Glycymeris insubrica	10	6	2	—	—	18
Spondylus gaederopus	1	1	—	1	—	3
Total	11	8	3	2	0	24

Table 6.1 *Table showing the number of shells of each taxa present at each strata of Cueva de los Aviones (adapted from Zilhão et al 2010, 1024).*

Cueva Anton produced only a single shell that has been associated with possible personal adornment: a single half of the flat valve of a *Pecten maximus* (fig. 6.3). Radiocarbon dating of level I-k, which yielded the shell, suggests an age greater than 37.4Ka BP (Zilhão et al. 2010, 1024). However, it is worth considering that the radiocarbon dating for Aviones from the same study, was shown to possibly be up to 70Ka too late. The shell displayed significant evidence of bioerosion, suggesting it was collected dead from the beach (Zilhão et al. 2010, 1024). The external surface of the shell is painted with a yellow goethite and red

hematite pigment, with no artificial colour being present on the internal concave surface of the shell (Zilhão et al. 2010, 1025). There is also a perforation present in the shell, however, it has not been determined whether this is anthropogenic, or the result of bioerosion before collection as post-depositional processes have excessively worn the diagnostic edges of the hole. However, post-depositional causes for the perforation are ruled out by Zilhão *et al*, as there is pigment present on the exposed internal structural hollows of the shell, suggesting that that the pigment was applied with the perforation already in place (Zilhão et al. 2010, 1024 – 1025). This discussion of the nature of the perforation in the Cueva Anton shell raises questions as to why the origins of perforations in the Aviones shells are not addressed in the same way, with no indication given by Zilhão *et al* (2010) as to whether this was investigated at all.

Figure 6.3 *Perforated and pigmented Pecten maximus shell from Cueva Anton (Zilhão et al. 2010, 1025)*

These artefacts from Cueva de los Aviones and Cueva Antón present some of the more conclusive evidence of Neanderthals manufacturing personal ornaments; they are directly comparable to similar personal ornaments from AMH sites such as Qafzeh Cave (Bar-Yosef Mayer, Vandermeersch and Bar-Yosef 2009; Zilhão et al. 2010, 1026), where there are near identical perforated *Glycymeris insubrica* to those found at Aviones. Further, Zilhão (2012,

44) displays a *Pecten jacobaeus* shell from a Gravettian context at Finca Dona Martina that is perforated and painted in a near identical manner to the *Pecten maximus* shell from Anton. Perhaps the most important factor in showing these artefacts to be personal ornaments is the recent use-wear analysis and experimental work conducted by Bar-Yosef Mayer *et al* (2020), which finds that the perforations in *Glycymeris* shells at Qafzeh Cave were used to suspend them on strings (Bar-Yosef Mayer et al. 2020, 9). However, it is worth noting that without conducting use-wear analysis, it can not be certain that perforations on *Glycymeris* shells indicated stringing, as the notches previously thought to be indicative of string abrasion (Bar-Yosef Mayer, Vandermeersch and Bar-Yosef 2009, 308; Zilhão et al. 2010, 1026), have also been shown to occur naturally (Cabral and Martins 2016, 481). This therefore means that without use-wear analysis it is not possible to conclusively say that the Aviones shells were threaded on string for use as personal ornaments.

Phase		Description
0	Perception of need	A desire for personal ornamentation
0a	Perception of sub-problem	Strung, painted, and perforated shell is required
0b	Perception of partial problem 1	Perforated shell needed
0c	Perception of partial problem 2	String needed
0d	Perception of partial problem 3	Pigment needed
I	Produce Perforated Shell	
	Action 1	Source Raw material: locate shell source, or search among collected shells
	Action 2	Prepare Raw material: If shell is not naturally perforated, perforate shell
II	Source String	

	Action 3	Source raw materials: Search existing collection for string, or Gather plant fibres, or remove tendons from animal carcass
	Action 4	Prepare raw materials: Such as pounding tendons and plant fibres
	Action 5	Twist or plat fibres to produce thread
III	Produce Pigment	
	Action 6	Source raw material: retrieve previously collected pigment mineral, or find new/visit known mineral source
	Action 7	Collect minerals suitable for pigment production
	Action 8	Transport mineral to location for pigment production
	Action 9	If using liquid pigment/paint, grind pigment mineral
	Action 10	Source a container
	Action 11	Mix ground mineral with water, or other solvent
IV	Assemble ornament	
	Action 12	Apply Pigment to shell
	Action 13	Thread pigmented shell onto string
V	Satisfaction of need	Personal ornament has been created

Table 6.2 *Table showing chaîne opératoire for the production of shell personal ornaments*

In terms of viewing these shell artefacts as evidence for Neanderthal craft, whilst they demonstrate that Neanderthals were modifying shells for ornamental use through threading them on string, or through the application of pigment, they do not offer a great deal of evidence for the craft being complex. As although these objects may demonstrate a significant Neanderthal ability for symbolism and appreciation for aesthetics, their actual production is quite basic when compared to other activities such as hideworking, or birch tar production, which have a far greater number of stages in their manufacture and can be

considered transformative technologies. Further, the only conclusive evidence of modification to the shells is the addition of pigments, as the perforations may be naturally occurring, which further reduces the complexity of producing these ornaments. However, it is worth considering that short of turning them into beads, the painting and threading of perforated shells probably represents the highest level of complexity that is possible with the material. Furthermore, the production of these ornaments itself requires two other crafts: the production of pigments, and string making. When the three are considered together, the variety of skills and quantity of processes required to produce a finished ornament from the raw materials is substantial (table 6.2). This shows that although the production of shell ornaments may appear to be a simple making activity, where naturally perforated shells are threaded on string, when the production of the other materials involved is considered it becomes a more complex craft, creating a composite object.

6.4 Feather and Bird Bone Ornaments

Perhaps the most recent development in the discussion of Neanderthal personal ornaments is the potential use of a variety of materials obtained from birds. Anthropogenically modified bird remains likely represent the most widespread evidence for Neanderthal personal ornament production, with evidence for their use present at 18 different Neanderthal sites (Majkić et al. 2017, 4–5). It would therefore be impractical to discuss every individual artefact here, so a number of case studies broadly representative of the wider trend will be used to assess the use of this material from a craft perspective. The bird materials used fall into three categories, the use of feathers, the use of talons/claws, and the modified bones, examples of which are present across Western Europe, and from the 190-30Ka cal BP date range (Majkić et al. 2017, 4–5).

The most recently discussed and one of the most thoroughly examined examples is a set of eight white-tailed eagle (*Haliaëtus albicilla)* talons (fig 6.4) from the sandstone rockshelter at Krapina, Croatia, dated to 130,000ka BP (Radovčić et al. 2015, 2020). Extensive microscope analysis of surface features on the talons was carried out in 2015, finding that the cut marks observed on the talons were anthropogenic, and likely resulted from the separation of the talon from the foot (Radovčić et al. 2015, 7,11). Areas of polish were noted with these regions said to represent areas of the talons which rubbed whilst strung together as part of an assemblage (Radovčić et al. 2015, 10–11). A more in-depth surface analysis was then conducted on one of the talons in 2020, including the use of infrared synchrotron spectrometry to examine suspected fibres and spots of pigment originally identified using a light microscope (Radovčić et al. 2020). The fibre was found to be of animal origin, and the

pigments made up of two different types of ochre, not naturally present at the site, and potentially a third charcoal pigment; however, this can not be proven to be intentional due to the presence of charcoal at the site (Radovčić et al. 2020). This more detailed analysis makes it hard to debate the use of talons as jewellery, or ornaments at Krapina as they are shown to be intentionally and carefully removed from the carcass, coloured with pigments, and strung together with animal fibres to create an assemblage. The significance of this is further amplified by the dating of the site to 130,000ka BP, placing this behaviour firmly before the arrival of AMH in Europe; indicating that it is an independently developed Neanderthal behaviour. Analysis of talons at other sites across Europe also draw similar conclusions (Morin and Laroulandie 2012; Romandini et al. 2014; Finlayson et al. 2019; Rodríguez-Hidalgo et al. 2019), showing that the production of these ornaments should not be considered as an isolated occurrence.

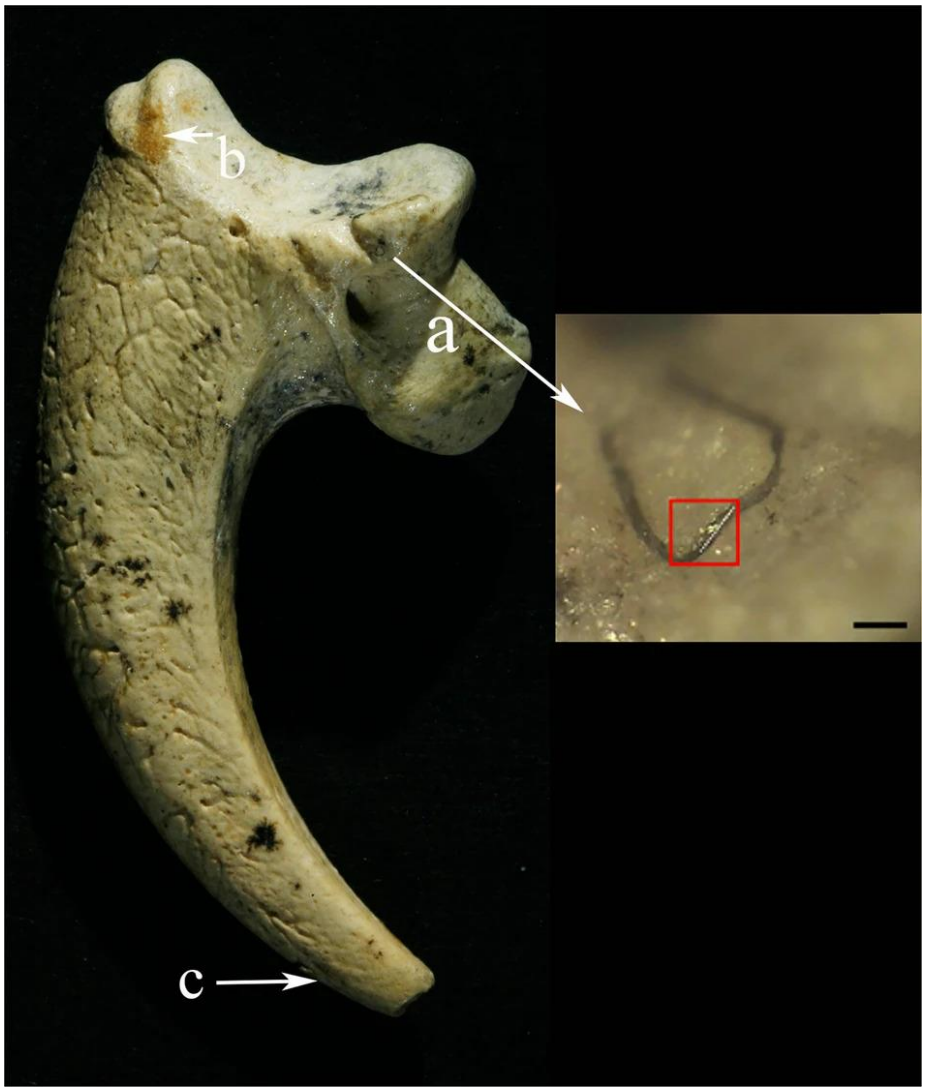

Figure 6.4 . *Eagle talon from Krapina (a) Shows the location of the protein fibre. (b) Indicates the area with pigmentation. (c) Shows the approximate area of black staining. (Radovčić et al. 2020)*

Feathers have also been shown to have an association with Neanderthal personal ornamentation (Peresani et al. 2011; Finlayson et al. 2012, 2019). A detailed analysis of the evidence for feather exploitation at Fumane cave in Italy, is made by Peresani *et al* (2011), and is representative of the findings at other sites discussed in the broader studies by Finlayson *et al* (2012 and 2019). It is found that there is a high proportion of anthropogenic cut marks on wing bones and other areas where there is very little meat, and often on species that are not considered edible (Peresani et al. 2011, 3892). Finlayson *et al* (2012) expand on these initial findings in their discussion of similar cut marks on bird remains from Gorham's, Vanguard and Ibex Caves in Gibraltar alongside the use of a database of bird remains at 1699 Palearctic Pleistocene sites (Finlayson et al. 2012, 2). It is found that there is a preference for bird species with darker plumage, such as raptors and corvids, as these species are more likely overrepresented at the Middle Palaeolithic sites in the database, than birds with lighter plumage (Finlayson et al. 2012, 3). The analysis of the Gibraltar remains finds that there is an over-abundance of wing bones, with them making up 55.7% of the assemblage (Finlayson et al. 2012, 4). Further, it was found that there was no differential post-depositional destruction based on bone density, meaning that the over-abundance of wing bones is not due to preservation bias (Finlayson et al. 2012, 4). It is again noted that the highest concentrations of anthropogenic marks are on wing bones, rather than meat bearing areas of the birds (Finlayson et al. 2012, 6). Combined with the over-abundance of wing bones, and the overrepresentation of corvids and raptors in the wider Middle Palaeolithic record an argument can be made that Neanderthals across Europe were targeting these species for the exploitation of their flight feathers which were likely then used as personal ornamentation.

The final category of bird material used by Neanderthals is bone. This is less widespread than the use of the other two materials, being primarily represented by a notched raven bone at the site of Zaskalnaya VI in Crimea. The object (Fig. 6.5) was found in a layer dating between 33666 and 46566 cal BP and was associated with other fragmented bird remains (Majkić et al. 2017, 8–11). The object was found to have 7 notches, numbered 1-7, with numbers 2 and 6 being added last to fill in gaps between other notches (Majkić et al. 2017, 25). It is argued that the addition of these two extra notches would do little to enhance any possible use for the tool, so most likely represent an aesthetic choice to make the notches appear regular in spacing (Majkić et al. 2017, 25–26). The exact use of the object is unknown, and likely difficult to ascribe due to its fragmented nature, however, Majkić et al suggest that the non-utilitarian nature of the notches suggests it was a symbolic object (2017, 26).

Figure 6.5 *Notched (labelled 1-7) raven bone from Zaskalnaya VI. (Adapted from Majkić et al. 2017, 9).*

Overall, it is clear that there is strong evidence to suggest that Neanderthals were producing personal ornaments from bird products, with the strongest evidence pertaining to feathers and talons. It is also clear that there is a preference for corvids and raptors in both materials, across a wide geographical, and temporal range (190-30Ka cal BP). This makes talon and feather based personal ornaments particularly important as they represent a consistent crafting tradition over a considerable period of time. Their significance as a craft is somewhat amplified if the acquisition of the materials is taken into account. As discussed by Radovčić et al (2015, 221-222) and Finlayson et al (2019) the hunting of raptors and corvids would be a difficult and time consuming process. The preference for these relatively rare birds demonstrating that Neanderthals were willing to dedicate significant effort to obtaining a certain material. Meanwhile, Finlayson et al's 2019 discussion of the Neanderthal preference for eagles emphasises the significance of the symbolic or ritual role that these materials likely played in Neanderthal cultures. However, this does not address their significance of their production as a craft activity. The crafting of talon jewellery is demonstrated to be relatively complex in much the same way as the shell jewellery from section 6.3, with the raw material being specifically selected for its aesthetic value then modified so that it may be

strung as an ornament. In some cases, also painted. The use of feathers however, is somewhat harder to discuss as they themselves do not survive, only the evidence of their removal from the carcass. Examples of their use from ethnography can be quite complex, including the production of headdresses and cloaks (Peresani et al. 2011, 3892; Finlayson et al. 2012, 7). It is, however, equally possible that they were used in a far less complex manner, simply by being tied to clothing or worn in a similar way to the talons. Therefore, it is difficult to establish the exact degree of complexity of craft that is being practiced using this material.

6.5 Conclusions

When assessed individually, the categories of personal ornaments discussed above all have aspects that cast doubt over the idea that personal ornament production was a significant craft within Neanderthal society. For example, the tooth and bone ornaments from Grotte du Renne are relatively isolated examples and their association with Neanderthals is uncertain, whilst the shell ornaments come primarily from just two sites so can not be argued to represent a widespread trend. However, when all three of the materials discussed are taken into account, they present a more certain picture. For example, even the earliest dates for the Grotte du Renne assemblage place it in close temporal proximity to the AMH occupation of Europe: potentially suggesting that it was a craft adopted from AMH culture, or one that only developed just before Neanderthal extinction. However, when combined with the much earlier dates from the Krapina talons, which present a very similar kind of ornament, and the Cueva de los Aviones shells, it becomes clear that Neanderthals were producing ornaments for an extended period of time. Similarly, if only the shell ornaments were discussed, Neanderthal ornament production would appear very geographically limited, as nearly all examples come from just two sites in Spain. However, when viewed alongside the locations in which there is evidence of bird exploitation for personal ornament production, the geographical area over which ornament production was occurring is greatly expanded. Furthermore, this ability to demonstrate the production of personal ornaments across both a large area and over a long period of time confirms these artefacts belong to Neanderthals. Therefore, it is clear that personal ornament production represents a craft that can be seen across a number of different Neanderthal societies, using different materials.

The importance of personal ornament production in demonstrating complex symbolism in Neanderthals is well acknowledged: authors such as Zilhão *et al* (2012) and Finlayson *et al* (2019) have argued this convincingly, with the latter suggesting that Eagles may even have played an important ritual role in Neanderthal society. However, the complexity of the

craftwork to produce many of the ornaments discussed in this chapter is not similarly complex, as no one artefact represents a particularly long *chaîne opératoire*. Further, in most cases these ornaments are found in quite low numbers, suggesting that their production was not necessarily all that frequent. However, the capability for more complex crafts is shown elsewhere in the record, such as birch tar production, meaning this relative lack of complexity in ornament production could be simply due to an aesthetic, or symbolic, preference for mostly unmodified natural materials. Therefore, the main contribution that personal ornament production can make to our understanding of Neanderthal craft is through demonstrating a crafting tradition that is both geographically and temporarily widespread through Neanderthal cultures.

Chapter 7 - Discussion

7.1 Introduction

Throughout this research it is clear that there is a great deal of evidence that Neanderthals were engaging in a number of craft activities, with varying degrees of complexity. Although hideworking, clothing production, and personal ornamentation form the core of this study, it should be mentioned that a number of other crafts are present in the record but are beyond the scope of this research. These include, but are not limited to the production of: stone tools, wooden objects (Aranguren et al. 2018; Revedin et al. 2019), shell tools (Douka and Spinapolice 2012; Romagnoli et al. 2017; Villa et al. 2020), birch tar (Kozowyk et al. 2017; Schenck and Groom 2018), pigments (Roebroeks et al. 2012; Dayet, d'Errico and Garcia-Moreno 2014) and musical instruments (Turk, Turk and Otte 2020). In this chapter the extent of Neanderthal craft will be discussed, along with the implications of these craft activities on our knowledge of Neanderthal societies, as well as how the interpretation of the crafts discussed differs from that of AMH.

7.2 The Extent and Implications of Neanderthal Craft

7.2.1 The Extent of Neanderthal Crafts

As discussed above, only three out of a number of activities that may be considered crafts have been discussed in this research. This section will set out to answer two main questions: whether the activities discussed can be considered craft and why defining them as such is significant. It is clear in the discussion of hideworking, clothing production, and personal ornaments (chapters 4, 5 and 6) that there is evidence for each of these activities taking place. However, in all the cases the evidence is somewhat limited, as although it clearly displays these activities taking place it does not always give a clear picture of how widespread or frequent they may have been. For example, in chapter 4 lissoirs are found to be the most direct evidence of hideworking, as they have no known purpose other than the processing of hides. Most information regarding lissoirs in a Neanderthal context comes from four tools from Abri Peyrony and Pech de l'Adze I (Soressi et al. 2013). Based on this evidence alone it is difficult to say with any certainty that hideworking was a widespread Neanderthal practice.

Similar issues also arise with evidence for clothing production, such as the limited quantity of awls known from the record, and for personal ornaments with the relatively small number of artefacts such as shell beads and bone pendants. This makes it clear that when considered

in isolation, it is difficult to suggest that these activities show extensive evidence of frequent crafting activities within Neanderthal culture. However, if taken as a set they exemplify a wide range of craft skills. Furthermore, if the other activities mentioned above are also considered to be crafts, then this range of skills is diversified even more. This makes it difficult to suggest that Neanderthals were not sophisticated craftspeople, who possessed a diverse range of skills far beyond just the production of stone tools. These activities can be considered crafts as all of them require the application of learned skills in the sourcing of a specific material, and the working of that material in a reactive way, to produce an object that is substantially different from the starting material. For example, in the case of hideworking the raw material is an animal skin, which must be scraped and dried before it can be used. The extent of this scraping varies from skin to skin, with each one needing to be treated differently (Wiederhold 2004). It must then be decided whether the hide requires any further processing such as softening or tanning for its intended use. This is also a good example of why crafting activities are significant, as they demonstrate the Neanderthal as being a craftsperson who is using previously gained knowledge to make informed decisions about how to best apply their fine motor skills. Viewing Neanderthals in this way works to close the perceived gap between them and AMH, as it helps us to see them as intelligent individuals making experienced based decisions in a very human way.

7.2.2 The Relationship Between Hideworking and Clothing Production

As addressed in chapter 3, the current literature concerning both clothing production and hideworking does not often crossover. This is unfortunate as the two crafts are inextricably linked, and both areas of research have substantial bodies of evidence which can increase understanding of the other. The evidence presented for hideworking in chapter 4 demonstrates that Neanderthals were making specialist tools for hideworking (lissoirs) and exploited the resources necessary to process hides beyond the stage of simple scraping and drying. This makes it possible to suggest that they may have been producing hides that would resemble “buckskin”. When considered alone this finding is useful, as it is a clear example of Neanderthals engaging in a transformative craft, with the raw animal skin being converted into a long lasting material from which objects may be produced. Furthermore, the complexity of this process should not be underestimated, as shown by Wiederhold’s (2004) summary of pre-industrial hideworking processes. This demonstrates that Neanderthals were committing extended periods of time, over the course of a number of days, to the production of a material. It is also important to consider the conclusions made about hideworking (chapter 4) in the context of clothing production. The production of buckskin would suggest that Neanderthals were producing sewn clothing, or other sewn objects, as this is primarily the use of buckskin within ethnographic examples. Similarly, the evidence

discussed in chapter 5 suggests that Neanderthals at times would have needed to cover up to 80% of their bodies with clothing, and also possessed the tools and materials (e.g. awls/borers and cordage) to produce sewn clothing. This indicates that Neanderthals may have been producing tailored garments. However, the degree of this tailoring remains impossible to discern from the archaeological record. Regardless, the sewing of garments at any level would represent a Neanderthal craft requiring a substantial amount of effort to learn and would potentially require a specialisation of labour.

7.2.2. Implications of Clothing Use on Neanderthal Extinction

One of the most commonly discussed implications of clothing use by Neanderthals is its potential role in their extinction. Gilligan (2007), Wales (2012), Collard et al (2016), Snodgrass and Leonard (2009), and Churchill (2009), all suggest that a lack of clothing use by Neanderthals may have led to their extinction; either through exposure to cold, or due to superior clothing of AMH allowing them to outcompete Neanderthals. However, as discussed above, when considered as a set, the evidence for both hideworking, and clothing production suggest that Neanderthals had the materials and technology to produce sewn clothing. Admittedly, it is unclear whether they were producing specialised cold weather clothing of the type discussed by Collard et al (2016), however even basic sewn clothing facilitates the use of layering to produce an efficient, and mobile barrier to heat loss. This combined with the effect of the assumed cold adaptation of Neanderthals seriously undermines the idea that a lack of clothing production played a major role in their extinction.

7.2.3 Implications of Hideworking and Clothing Production on Neanderthal Complexity

The cognitive complexity of Neanderthals is commonly discussed (e.g. Langley, Clarkson and Ulm 2008; Pearce, Stringer and Dunbar 2013; Langley, Benítez-Burraco and Kempe 2020). However, the consideration of crafting activities (rather than their products) in these discussions is rare outside of the realm of stone tools. One example of where a craft has been used to discuss Neanderthal complexity is the production of birch tar and its use in hafting tools. In 2015 Wragg-Sykes suggests that the production and use of birch tar by Neanderthals is representative of their complexity. This was however, disputed by Schmidt *et al* (2019) who argue that the production of birch tar alone can not suggest cognitive complexity as it can be produced through simpler means than those suggested by some authors (e.g. Schenck and Groom 2018). This makes the need for further discussion of Neanderthal craft and how it can represent complexity clear. At the core of Wragg-Sykes argument is the use of a *chaîne opératoire* (table 7.1) to display the extent of the actions and

decisions that need to be made for the production of a hafted tool using birch tar (Wragg Sykes 2015, 122–125). If such a *chaîne opératoire* is also produced for clothing production (table 7.1) it is possible to see that it represents a similar degree of complexity in terms of the number of experienced based actions that are required. This demonstrates therefore, that through examining the production of a wider variety of Neanderthal craft objects, we can build an ever stronger case for the complexity of Neanderthals. We can see that the uses of these complex *chaîne opératoires* are not isolated elements in Neanderthal culture but are instead the norm, much as they are in AMH culture.

Hafted Tool Production (Wragg-Sykes 2015, 124-125)				**Clothing Production**		
Phase		Description		Phase		Description
0	Perception of basic need	Carcass requiring intensive processing		**0**	Perception of basic need	It is cold
0a	Perception of sub-problem	Hafted tool for protection of hand/control over angle of tool use		**0a**	Perception of sub-problem 1	Clothing is required
0b	Perception of partial problem 1	Stone tool needed		**0b**	Perception of partial problem 1	Processed hide needed
0c	Perception of partial problem 2	Wooden handle needed		**0c**	Perception of partial problem 2	Stone tools needed
0d	Perception of partial problem 3	Adhesive needed		**0d**	Perception of partial problem 3	Bone tools needed?
0e	Perception of partial problem 4	Fire needed		**0e**	Perception of partial problem 4	Thread needed?
I	Produce stone tool			**I**	Produce processed hide	

	Action 1	Source stone: locate stone source/identify best stone source already known/search among collected stone			Action 1	Source skin: locate source of skin e.g. hunt animal or search among already collected skins
	Action 2	Source hammerstone: find alluvial deposits/collect hammerstone already possessed			Action 2	Source stone tools: Search among existing collections, or produce new tools - phase II
	Action 3	Source soft hammer: find bone or antler in landscape/find bone or antler from existing material/collect soft hammer already possessed			Action 3	Source bone tools (if required): Search among existing collections, or produce new tools - phase III
	Action 4	Knap flake to be hafted, possibly including backing retouch or thinning for better adhesion Transport flake to location for hafting			Action 4	Source hide working materials: Find/search existing collections for softening agents

II	Produce Wooden handle				Action 5	Process the hide: flesh, soften and stretch the hide. Possibly smoke the hide
	Action 5	Source wood: find tree suitable for handle/find fallen branch/search already collected wood		**II**	Produce stone tools	
	Action 6	Process wood to required form for haft (may involve lesser or greater adjustments e.g. bark removal through to carving, and possibly extended drying phase if fresh wood)			Action 6	Search existing collections for suitable tools, if none, actions 6-9
	Action 7	Transport handle to location for hafting			Action 7	Source stone: locate a stone source/search among existing collections
III	Collect birch bark				Action 8	Source hammerstone:
	Action 8	Source bark: retrieve previously collected bark/find birch trees			Action 9	Source soft hammer:

	Action 9	Collect fallen bark of suitable quality/remove bark with tool			Action 10	Knap stones to desired form, and transport to location for clothing production/hide processing
	Action 10	Transport bark to location for pitch processing		**III**	Produce bone tools	
IV	Collect fire kit				Action 11	Source bone: remove from previously acquired bone, or hunt for new bone
	Action 11	Source tinder, fuel			Action 12	Source stone tools to work bone: Search existing collections if not, produce stone tools (see phase II)
	Action 12	Source fire-starting tool: striking kit either already available or search for pyrite and flint/collect embers from another fire			Action 13	Work bone to desired form e.g. lissoir/awl
	Produce birch pitch				Action 14	Transport bone tool to location for hide processing/clothing production

	Action 13	Build fire/Dig pit (requiring stone or other heavy-duty tool) and build fire		**IV**	Produce thread	
	Action 14	Source tool for placing bark in fire (sticks)/container or flat surface to collect pitch in pit			Action 15	Source raw materials: Gather plant fibres, or remove tendons from animal carcass
	Action 15	Place bark in fire/pit			Action 16	Prepare raw materials: Such as pounding tendons and plant fibres
	Action 16	Feed fire until correct heat is reached for bark transformation into pitch			Action 17	Twist or plat fibres to produce thread
	Action 17	Monitor fire/pitch if visible for length of time required to produce pitch		**V**	Begin production of garment	
	Action 18	Retrieve pitch from fire to cool			Action 18	Bring together processed hide, thread, and required tools
V	Haft tool				Action 19	Identify garment to be produced
	Action 19	Bring together wooden handle, stone flake and pitch			Action 20	Select correct size and type of hide

	Action 20	Align the stone flake with the wooden handle for correct angle for intended functional application			Action 21	Measure and cut hide to required shapes
	Action 21	Manipulate pitch into correct form, e.g., rolling in the hand			Action 22	Puncture holes using stone or bone tools
	Action 22	Apply pitch around the stone flake and handle or between them			Action 23	Stitch through holes using thread
	Action 23	Place hafted tool in safe area for pitch to dry and harden		**VI**	Satisfaction of need	Garment has been created
VI	Satisfaction of need	Hafted tool has been created		**VII**	Possible perception of sub-problem 2	More clothing is required
					Action 24	Repeat from phase 0b

Table 7.1 *Table comparing the chaîne opératoires of hafted tool and clothing production (adapted from Wragg-Sykes 2015, 124-125).*

7.3 Difference of Interpretation of Crafts Between AMH and Neanderthals

7.3.1 Comparing the Differences in Craft Activities Between AMH and Neanderthals

One further way of discussing the complexity of Neanderthal craft is through examining how the crafting activities of the two species differ. In the context of this research, it would be logical to examine the differences between Neanderthal and AMH hideworking, or clothing production. However, hideworking and clothing production are rarely discussed in an AMH context, this is potentially due to the lack of controversy surrounding the use of clothing by AMH. Fortunately, the discussion of personal ornamentation is common within the literature

pertaining to both species, though often with very different interpretations, as discussed below (Section 7.3.2). As discussed in chapter 6, the production of personal ornaments can be seen as a widespread, and recurring feature in Neanderthal culture, with a variety of materials being used. Despite this however, there are some key differences between the production of personal ornaments in a Neanderthal and AMH context.

The first is the scale of production. The most directly comparable example of this is the production of shell beads, as there are very similar artefacts being made at similar times by both AMH and Neanderthals. For example, the shell beads found in an AMH Middle Palaeolithic context at Misliya Cave and Qafzeh Cave in the Levant are near identical to those found at the Middle Palaeolithic contexts of Cueva de los Aviones in Spain (fig 7.1). However, the shells from the Neanderthal sites total to just three examples that are perforated and could therefore be used as beads (Zilhão et al. 2010, 1024). Meanwhile, from the AMH contexts at Qafzeh cave there are over double this number (Bar-Yosef Mayer, Vandermeersch and Bar-Yosef 2009, 331). Further to this, similar shell beads have been found at even greater numbers at the Middle Stone Age (MSA) contexts of Blombos Cave in South Africa (fig 7.1), with 31 beads being found dispersed into groups of 5-12 beads (d'Errico et al. 2005, 4).

It is clear from this comparison that based on the current evidence of Neanderthal shell ornament production, Neanderthals were producing fewer of these personal ornaments than AMH. However, the complexity of the production of the artefacts is much the same with both consisting of generally naturally perforated shells that have been threaded onto string. Therefore, one of the primary differences in ornament production between the species is the numbers in which these objects are produced. This is a trend that is shown at its extremes when comparing the later CP personal ornaments from Grotte du Renne to those of the Gravettian graves at Sunghir; graves I and II at Sunghir contain the remains of four different individuals, who are buried with more than 10,000 mammoth ivory beads, representing over 10,000 hours of work (Dobrovolskaya, Richards and Trinkaus 2012, 97). This scale of ornament production is clearly beyond the scale of anything currently known from the Middle Palaeolithic record.

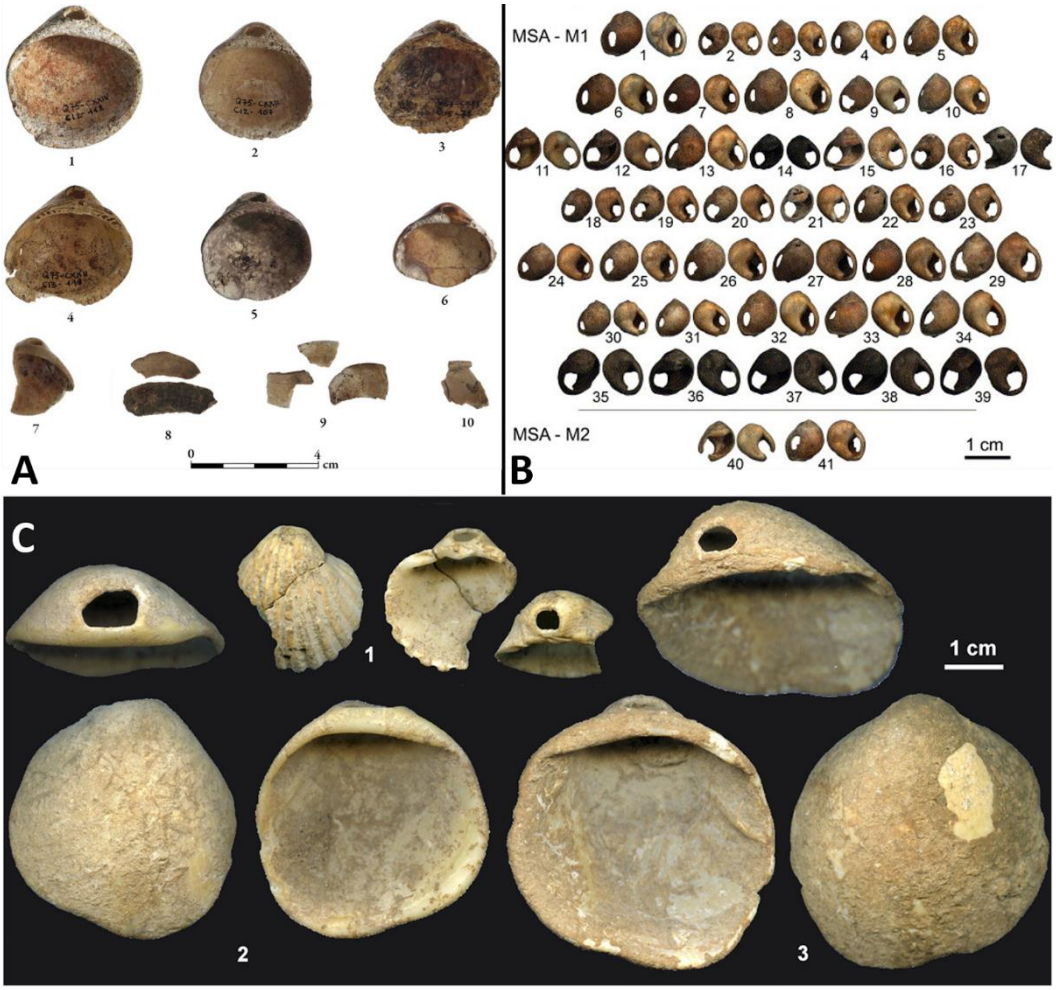

Figure 7.1 *A comparison of shell ornaments from AMH and Neanderthal contexts. A) AMH* Glycymeris insubrica *shells from Qafzeh Cave, B) AMH Perforated* Nassarius kraussianus *from Blombos Cave, C) Neanderthal perforated* Acanthocardia tuberculata *and* Glycymeris insubrica *shells from Cueva de los Aviones (Bar-Yosef Mayer, Vandermeersch and Bar-Yosef 2009; d'Errico et al. 2005; Zilhão et al. 2010).*

The Upper Palaeolithic record also displays a significant difference in the variety of personal ornaments that are produced and their complexity. For example, Vanhaeren and d'Errico (2006) consider a wide range of Aurignacian ornaments (Fig 7.2) which include perforated bone and stone beads, as well as zoomorphic and anthropomorphic pendants. It is clear that a number of these ornaments are more complex to produce than the majority of ornaments known from the Neanderthal record. However, as the Neanderthal ability to produce complex objects can be seen elsewhere (e.g. birch tar hafting (Wragg Sykes 2015) and clothing production (this research), it is possible that these differences in the objects do not stem from a difference in cognitive complexity, but rather represent a difference in aesthetic preference. Further, examples from modern European life clearly exemplify that the complexity of an object or its production does not necessarily correlate with its symbolic role in society, or the meaning it holds for an individual. For example, a simple wooden crucifix

may be made through the joining of two pieces of timber, for many groups in society this is a significant symbolic artefact, representing a complex set of ritual beliefs and social structures. This object is clearly less complex in both form and production than any number of other objects in modern society, the vast majority of which hold little symbolic value for most people. This shows that it is vital to consider Neanderthal crafts in their own right, and move away from the idea that just because AMH were producing more complex objects, that it is not worth considering the significance that the simpler objects made by Neanderthals may have had within their society.

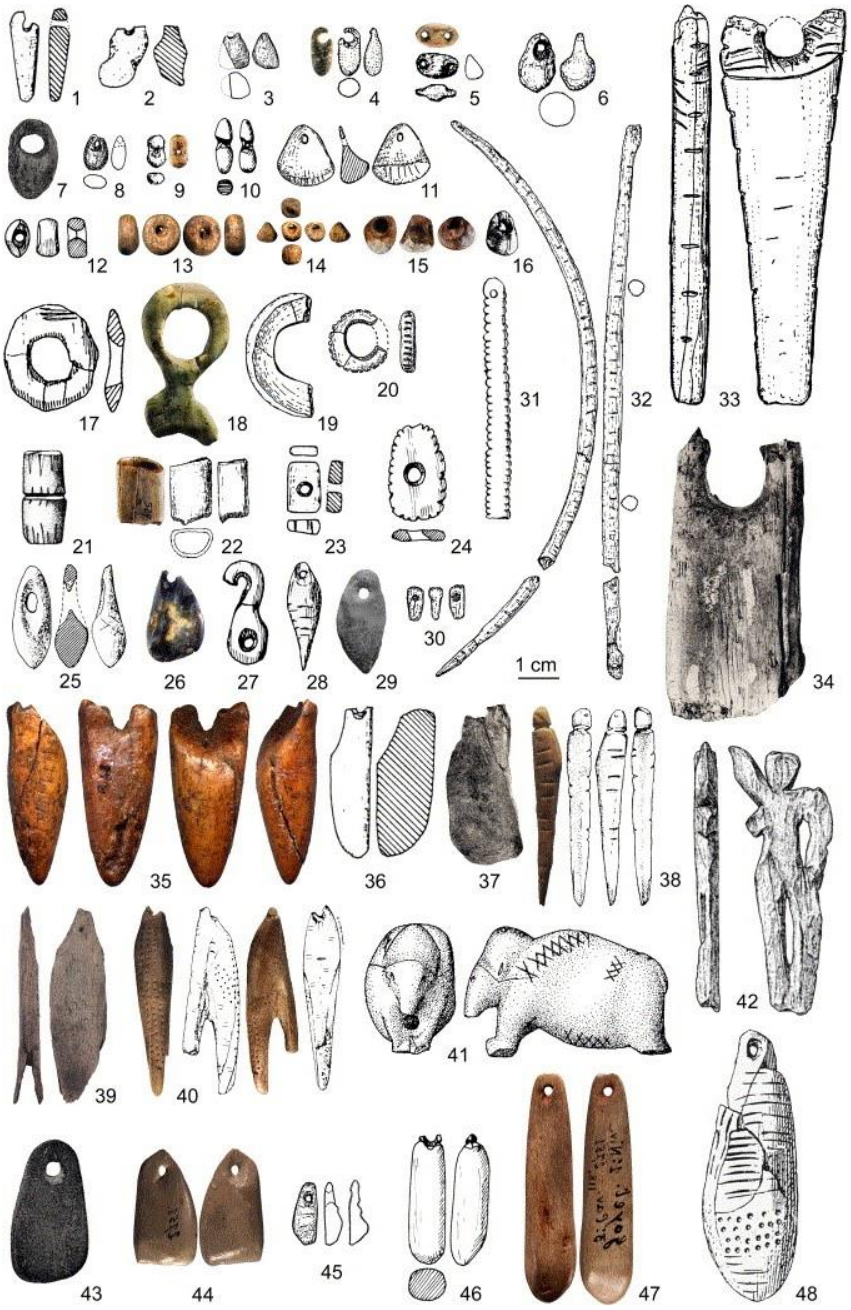

Figure 7.2 *A selection of Aurignacian personal ornaments showing a diverse range of forms and materials (Vanhaeren and d'Errico 2006)*

7.3.2 Difference in Interpretation Between Neanderthal and AMH Craft Objects

As discussed above, there are a number of differences between the crafting activities of AMH and Neanderthals; despite this there are a number of directly comparable examples of craft objects, such as shell beads. It is interesting that potentially the greatest difference between these objects is how they have been interpreted by archaeologists. When personal ornaments are discussed in a Neanderthal context it is common for them to be discussed as evidence for symbolism (e.g. Zilhão 2012). However, the focus is on whether or not the artefacts are evidence of symbolism, with the role of this symbolism rarely being discussed. For example, the shell ornaments from Cueva de los Aviones and Cueva Anton are suggested to be evidence that Neanderthals had the same symbolic capacities as AMH, with emphasis placed on how this validates Neanderthal authorship for other symbolic objects in Europe (Zilhão et al. 2010, 1027). But with this said, there is then no discussion of the symbolic role these objects may have played in Neanderthal society. Meanwhile, discussion of the similar shell beads from the AMH record often goes much further, using these objects to discuss concepts such as group and individual identity (Bar-Yosef Mayer, Vandermeersch and Bar-Yosef 2009, 313; Bar-Yosef Mayer et al. 2020, 9); the use of syntactical language (d'Errico et al. 2005, 19–20); and shifts in cultural norms and rule making (Vanhaeren et al. 2013, 515). For example, Vanhaeren *et al* 2013 use a combination of archaeological use-wear analysis and experimental reproductions to identify a number of different stringing styles for the beads (Vanhaeren et al. 2013, 515). This change between the two styles is suggested to represent a possible shift in cultural norms, either within one community, or through the replacement of one community with another. Further, it is suggested that the consistency of the perforations of the shells represent a craft that is being governed by strict norms concerning the style of bead production (Vanhaeren et al. 2013, 515). Similar themes are also seen in studies discussing personal ornaments from the Upper Palaeolithic, which although not quite so directly comparable in their production still demonstrate the differences between how AMH and Neanderthal craft objects are discussed (e.g. Vanhaeren and d'Errico 2006; White 2007; Kuhn and Stiner 2007).

These kinds of analysis are largely absent from discussions of Neanderthal material culture; there are a number of possible explanations for this. Firstly, overall, there are fewer known artefacts of this type present in the record, making comparative studies such as those by Vanhaeren and d'Errico (2006) between objects and sites challenging. Secondly, the artefacts that are known, are not as complex as those produced by AMH. Thirdly, it may be a result of the ever present view that Neanderthals were inferior, leading those authors

discussing Neanderthal material culture to focus on having to justify attributing Neanderthals' authorship of symbolic objects, leaving little space for the discussion of the meaning of that symbolism. Addressing these explanations in order: whilst the first statement is correct, the small sample size does not prevent in depth study of the artefacts that are present. In fact, such studies do take place, for example the analysis of the Krapina talons shows that they were strung together as an assemblage (Radovčić et al. 2015, 2020). However, the authors do not then discuss the wearing of these artefacts in terms of concepts such as identity or group culture. The second statement is also problematic, as although a number of Upper Palaeolithic artefacts are more complex to produce than those of Neanderthals, it is not only these artefacts that are discussed in terms of their societal role. As shown above, the comparable artefacts such as shell beads from Blombos cave have also been used to investigate the societal role played by ornaments. This therefore leaves the third statement as a likely reason for the lack of interpretation of Neanderthal symbolism, which is likely caused by the viewing of Neanderthals as a completely separate species, making it harder for us to empathize with them and see our own behaviours reflected in their material culture.

7.3.3 Applying a Craft Perspective to Neanderthal Material Culture

This situation could potentially be improved through beginning to discuss Neanderthal material culture from a craft perspective, which focuses on the production and use of the artefact, rather than the artefact itself. Placing emphasis on the production process of an object encourages a greater degree of thought regarding aspects such as the choice of material and the decisions that must be made by the craftsperson throughout the process. This sort of discussion regarding the relationship between the craftsperson and the objects they produce is common within the study of craft practices in the field of anthropology (Portisch 2010; Glăveanu 2010; Patchett 2016). Although studies of this kind rely upon directly observing the craftsperson, something which is impossible in a Neanderthal context, with the use of a *chaîne opératoire*, it is possible to understand the decisions being made by the craftsperson, albeit in a detached way. Furthermore, the addition of experimental archaeology would allow the archaeologist to experience firsthand the mental and physical processes associated with the production of the artefact thereby gaining a valuable insight into experiences of the Neanderthal craftspeople producing the original artefacts. To a degree this echoes Outram's (2008, 3–4) discussion of how experimental archaeology can provide the real world variables not available in a lab, except applied to the cognitive processes of craft, rather than just the physical. This is in effect, a form of participant observation which is used to great effect by anthropologists and ethnographers in understanding how modern craftspeople select and interact with their materials, and the processes of transferring knowledge between individuals (e.g. Portisch 2010; Patchett

2016). For example, in the case of the clothing production which is the focus of this research, the production of a *chaîne opératoire* (table 7.1) clearly demonstrates how a number of decisions must be made based upon the availability of materials, and the desired product, as well as possible interactions with other individuals to obtain tools or materials. This shows therefore how examining craft processes can begin informing further discussion regarding the social processes involved in Neanderthal society, including ideals such as cultural transmission. Overall, the study of Neanderthal material culture from a craft perspective has great potential both from gaining knowledge of how artefacts were produced, and from obtaining a better understanding of Neanderthals as active participants in the production of objects. This shift in viewpoint may also help researchers to relate to Neanderthals in a similar way to how they relate to AMH, making the presence of things such as symbolism require less justification, allowing for more emphasis on the role it plays within society. Furthermore, studying craft in this way allows for a broader range of Neanderthal activities which can be used to inform debate on concepts such as social structures, cognition, and cultural transmission.

7.4 Summary

It is clear that there is substantial evidence that Neanderthal activities discussed in this research may be considered to be crafts as they represent production processes that require the individual to utilise a substantial amount of skill in the selection of materials, the decisions made in the production process, and in the physical actions involved. Whilst it is obvious that in the case study of personal ornamentation that AMH produce a wider variety, and sometimes more complex objects than Neanderthals, there are also a number of directly comparable artefacts. Further, the discussion of the *chaîne opératoire* for clothing production also demonstrates that Neanderthals were capable of extended and complex production sequences.

It is found however that artefacts are often interpreted differently in a Neanderthal and AMH context, with the AMH examples being used to discuss the roles of symbolism in society to a much greater extent than the Neanderthal examples. This is found to be unjustified as a number of the artefacts discussed in this way in an AMH context are directly comparable to artefacts known in the Neanderthal record. It is also clear that the discussion of Neanderthal activities from a craft perspective may open up further discussion regarding the structures of their societies, and lead to a greater general understanding of their day to day lives.

Chapter 8 - Conclusions and Future Work

8.1 Conclusions

This chapter will discuss the extent to which the aim and objectives of this research have met by briefly summarising the evidence that has been presented.

8.1.1 Establishing the Extent of Evidence for Neanderthal Crafting Activities

Within this research it was attempted to establish the extent of three main crafts: hideworking, clothing production, and personal ornamentation. Chapter 4 discussed the existing evidence for hideworking through the examination of lissoirs, stone tools and the faunal record. It was argued that lissoirs represent the best empirical evidence of hideworking as they are a specialised tool with no other purpose currently known. Furthermore, through comparing them with tools from elsewhere in the archaeological and ethnographic records and examining their form, it has been suggested that these tools were likely used either for the application of softening agents such as brain or bone marrow to the hide or as an abrading tool to help produce a softer surface on the hide. The discussion of the faunal record further supports this view that Neanderthals were carrying out hideworking, through modifying faunal remains in such a way as to access materials such as bone marrow and brain, although it is also possible this may be for nutritional consumption alone. Examples of faunal remains demonstrate that Neanderthals were skinning animals with the intention of maximising the amount of hide obtained. With all this evidence combined it becomes clear that Neanderthals were engaging in hideworking and that this more likely than not involved the softening of hides to produce buckskin. The degree to which this craft was taking place at regional and temporal scales is less certain and would require new material evidence to be assessed further.

Chapter 5 examined the evidence for clothing production by Neanderthals; it is found that many of the existing discussions regarding clothing production focus on using the physiological need for clothing by Neanderthals to determine whether or not they were using clothing. When combined these studies present a confusing picture of Neanderthal clothing use with very little in the way of a general consensus. However, it appears that Neanderthals may have needed clothes on up to 80% of their bodies in certain areas at certain times. This therefore suggests they were making some form of clothing. The archaeological record shows that the tools and materials to produce clothing are present: awls/borers, thread, and fur-bearing faunal remains were all available for use in Neanderthal clothing production.

Chapter 7 explored the relationship between hideworking and clothing production and suggested that the evidence we see for hideworking is effectively also evidence for clothing production. It is, however, difficult to suggest with any certainty the types of clothing being produced, with the two main types identified as sewn/tailored and draped/tied. The key distinction being the use of sewing. The best way to evidence this is through the presence of needles/awls/borers in the archaeological record. Although they are present, they can not be considered at all common. Therefore, we can consider there to be a good body of evidence that Neanderthals had the available materials to make clothing and that they were likely doing so as there are few other reasons to practice extensive hideworking. It is, however, not possible to determine the types of clothing being produced using only the existing record. It must also be noted that processed hide can also be used to produce objects containers or as bedding; so hideworking can not be linked solely to clothing production.

Chapter 6 investigated the extent to which Neanderthals were producing personal ornamentation. The production of personal ornaments from bone/tooth, shell and bird remains was examined, with the production of bone and shell ornaments currently shown to be infrequent and geographically isolated. Meanwhile, the use of bird remains in personal ornamentation is demonstrated to be a relatively widespread trend found at a number of sites across Europe. I have argued that the production of these ornaments was generally not as complex as hideworking or clothing production, as it does not involve the same level of skill from the craftsperson, or as many stages of production. However, in their use as a composite ornament, such as being painted and strung together they represent a more complex crafting process than when viewed in isolation.

When these three crafts are considered together, they present a strong case for the presence of crafting activities within Neanderthal societies; however due to the often limited sample size of the evidence the frequency of these activities is difficult to establish. A greater understanding of clothing production may be gained through examining hideworking in more detail, particularly the use of lissoirs which represent the best available evidence for complex hideworking by Neanderthals, and therefore are key to understanding the materials that they had available for clothing production.

8.1.2 Comparing the Crafting Activities Carried Out by AMH and Neanderthals

In chapter 7 personal ornaments were used as a case study to compare the crafting activities of AMH and Neanderthals. It was found that in the case of personal ornaments, AMH carry out the same crafting activity as Neanderthals, but with a different degree of

complexity, by making ornaments that require a greater number of steps to produce, and in a larger number. From this it is suggested that, in the case of personal ornaments, AMH are participating in craft activities in a different way to Neanderthals. However, it is also noted that in a number of cases, such as shell ornaments, the objects being produced by both species are very similar. Hideworking and clothing production were compared to a much lesser extent between the two species as there is also little discussion about these crafts in an AMH context, so it is difficult to make a fair comparison without first conducting a detailed analysis of these crafts in an AMH context. Therefore, the extent to which this objective was fulfilled was limited largely to the comparison of personal ornamentation; this facilitated effective discussion of objective 3.

8.1.3 Examining Why Differences in Interpretation of Comparable Crafting Activities Occur Between AMH and Neanderthals

The differences and similarities in personal ornament production between AMH and Neanderthals from chapter 7 facilitated an analysis of how this craft is interpreted differently in the two contexts. It was found that similar artefacts were discussed differently depending on whether they were produced by AMH or Neanderthals. AMH artefacts were more commonly used to discuss ideas such as the roles of symbolism in society and personal/group identities. An analysis was conducted as to whether these differences in interpretation can be justified by differences in the production or form of the individual artefacts. It was found that although there are differences in the production of some personal ornaments between the two species there are also a number of examples of directly comparable artefacts. In the case of these objects there is still a substantial difference in interpretation between the two species. Neanderthal examples are more commonly used as evidence for the cognitive complexity required for symbolic behaviour. Meanwhile, in an AMH context the capability for symbolism is rarely debated, with discussion focused on the role of symbolism in society and concepts such as personal identity. As these objects are comparable in terms of material, manufacture, and end form, it is argued that this difference in interpretation stems from the perceived cognitive and technological gap between AMH and Neanderthals, which becomes difficult to justify when both species can be observed producing identical objects. This raises questions as to whether the bias caused by this perceived gap between the species flows into discussion of the other Neanderthal crafts such as clothing production, where there is a hesitancy by some authors to consider that Neanderthals may have been producing sewn or tailored clothing. The extent to which this objective has been fulfilled is limited by the emphasis on personal ornamentation, as it can not be certain that the trends here hold true in the case of other crafts. However the results

from this case study may also be applied in other areas - as demonstrated by the example of clothing production.

8.1.4 Discussing How Examining Neanderthal Craft Can Allow for More Abstract Ideas Surrounding Material Culture to be Applied to a Neanderthal Context

It became evident during the investigation of objective 3 that the perceived gap in cognitive complexity between AMH and Neanderthals may be encouraged by a lack of consideration of Neanderthals as individuals within the crafting process. However, it was found that viewing the production of Neanderthal objects through a *chaîne opératoire* encourages a consideration of the skill used, and decisions made by individual craftspeople when making these objects. Being something that we all do in our day to day lives, makes Neanderthals much more relatable and easier to accept their ability to make and use symbolic objects; this therefore stimulates discussion of the roles these symbolic objects may have played in Neanderthal society and personal identity. Further, the presence of crafting activity within Neanderthal society can be seen as evidence for social structures such as the transfer of skills and knowledge between individuals as well as the possibility of specialisation of labour. The latter can be argued to stem from the knowledge and time commitment required to carry out crafts like hideworking. Therefore, objective 4 is met by the research presented here in that I have established that viewing Neanderthal material culture from a craft perspective allows for a deeper understanding of their lives as individuals, enabling a discussion of ideas such as the transfer of skills between individuals and the role artefacts may have played in the construction of personal and group identities.

8.1.5 Summary of Conclusions

This research has shown that there is a relatively good body of empirical archaeological evidence for the presence of crafting activities within the Neanderthal record. Perhaps the most significant finding is the importance of lissoirs in understanding both hideworking, and clothing production. This suggests that future work, as discussed below, should be carried out to better understand the function of these tools so that they may be better used as proxy or indirect evidence for clothing production. It is further found that crafts and the use of a craft perspective in a Neanderthal context has much to contribute towards gaining a greater understanding of social identity and society more broadly.

8.2 Recommendations for Future Research

Although this research has been largely successful there are a number of ways in which the findings presented here may be built upon in future research. These can be broken down into two main areas: the use of experimental archaeology and the application of a craft perspective to a wider variety of Neanderthal activities.

8.2.1 Experimental Archaeology

In chapter 2, it was stated that the original focus of this research was to employ experimental archaeology to better understand Neanderthal crafts. The application of experimental archaeology to Neanderthal crafts might enable new insights into variation in tool use, including craft-related tasks, on a broad variety of materials used by Neanderthals. Perhaps the most important among these is the experimental assessment of lissoirs. Although Soressi *et al* (2013) conduct some experimental work to determine that lissoirs are used on hide they do not examine different types of hideworking such as brain tanning, or compare stages, such a stretching vs smoothing; making it hard to use this data to discuss hideworking as a craft beyond saying that it happened and used lissoirs. Therefore, through experimentally producing lissoirs and using them in a variety of hideworking activities and comparing the resulting traces with archaeological specimens it may be possible to establish different hideworking practices (e.g. the difference between working soft/fresh and dry hide). As a result, it could be possible to establish the types of hides that Neanderthals were producing, gaining a better understanding of both hideworking and clothing production. This understanding of clothing could then be expanded upon through using experimental archaeology to investigate the efficacy of other Neanderthal tool forms, for example, “borers”, as discussed in chapter 5, and whether they would facilitate the production of sewn clothing.

Further experimental work could be used to examine the production processes of the crafts mentioned more anecdotally in this research, such as shell and wooden tools. Examining the production and use of these tools through experimentation would allow for a much greater understanding of the experienced based decisions taken in the production process and selection of materials. Further, in the case of shell tools, for example, their efficiency in working a variety of different materials could be compared to that of stone tools to better understand whether Neanderthals may have chosen to use certain tools to work different materials.

One possible experimental programme would the construction of a reference collection of hideworking tools, consisting of replicas of both archaeological and ethnographic tools. These tools could then be used in a variety of hideworking activities such as scraping or softening hide, and the use-wear compared to archaeological examples. During this entire process researchers should actively reflect on the process of learning/teaching a craft such as tool production or hideworking, and how learned experience affects the decisions they make. This could be further supplemented by interviews and/or participant observation with modern craftspeople. Such a project could inform on Neanderthal craft in a number of ways: firstly, during the production of the tools researchers could explore the experience of both teaching and learning a craft, as well as gaining an understanding of motives behind material selection such as shell vs stone scrapers or ribs vs long bones for lissoirs. Secondly, the experience of using these tools in different stages of hideworking could inform on their intended function, along with providing a varied selection of use-wear to which archaeological artefacts may be compared. Thirdly, through working hide with these tools researchers could reflect upon the thoughts and decisions that they are making throughout the process and how those change as they become more experienced in the craft. A programme such as this would clearly require a substantial time and resource commitment but may yield a far greater understanding of both Neanderthal hideworking technology, as well as the human experiences involved in learning and carrying out craft activities.

8.2.2 Wider Application of a Craft Perspective

Chapter 7 argued that viewing Neanderthals from a craft perspective allows us to better understand them at an individual level: facilitating further discussion of key concepts such as personal identity. Therefore, further work to recognise Neanderthals as craftspeople will allow for the craft perspective used throughout this research to a wider range of Neanderthal activities (e.g. woodworking, pigment production, and musical instruments); this would enable a fuller picture of the variation in craft skills practised by Neanderthals. Furthermore, it would be beneficial to our understanding of Neanderthal hideworking and clothing production to better investigate these crafts in an AMH contexts. This would allow for a true comparison for the material evidence for clothing use between the two species to be established: contributing to the ongoing discourse regarding the extinction of Neanderthals, in which the ability to use clothing is currently seen as a significant technological difference that may have led to the AMH ability to outcompete Neanderthals in Europe.

Overall, the most significant future application of this research may be in demonstrating the role a craft perspective can play in making Neanderthals more relatable to us as modern humans, by allowing us to understand that they made similar creative experience based

decisions to those we make in our own lives and crafts. Therefore, facilitating consideration of concepts such as how material culture plays a role in the construction and reflection of personal identity.

8.3 Concluding Remarks

This research has found that there is currently a lack of discussion regarding craft activities in a Neanderthal context. Through the examples of hideworking, clothing production, and personal ornamentation the benefits of discussing crafts have been demonstrated. I have argued that through examining craft we can gain a deeper understanding of both the technologies and materials used by Neanderthals, and their lives as skilled craftspeople. Viewing Neanderthals as craftspeople may allow for future research to more easily consider them as skilled participants in the production of artefacts and therefore better understand their relationship with the objects they produced. This more humanising view of Neanderthals may help close the perceived cognitive gap between them and AMH allowing us to better consider them as the skilled craftspeople that they were.

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