Upper Palaeolithic female representations: an eye tracking study.

Samuel Jonathan Harvey Hirst

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Abstract

The Venus Figurine tradition of the Upper Palaeolithic has sparked significant academic interest over the last century. Past studies of these sculptures have produced an array of theories relating to their function, ranging from being symbols of fertility and attractiveness, to self-representations and signifiers of identity, as well as evidence of communication networks. Although many differing theories have put forward in the past, much of this work does not consider the morphological differences exhibited by the Venus Figurines. From the existing literature, it is apparent that the inclusiveness of the current method of grouping these sculptures is detrimental to their study. Therefore, the subdivision of this prehistoric art into three distinct categories is proposed. Through the application of eye tracking, a well-established psychological technique, the ways in which each of these categories are subconsciously visually interacted with has been measured. The varying levels of attention that each of the areas within each sculpture gain is indicative of their importance. The findings of this study show that each category of Venus Figurine receives a different viewing pattern, supporting the notion that they should be treated as separate aspects within the tradition of Upper Palaeolithic female representations. This cross-disciplinary approach towards the investigation of this artistic movement has not only encouraged the reclassification of these sculptures into distinct typologies, but also offers insight into the potential ways in which they functioned within Upper Palaeolithic society. Through pairwise comparisons of the effects of each category on the dwell time to the Interest Areas, the relative importance within the sculptures of specific features has been identified. This knowledge both offers support to some existing theories, whilst bringing others into dispute. The success of this joint approach towards the interpretation of archaeological material is indicative of the benefits that can be gained by archaeology through an expansion into the realm of psychology.

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1. Introduction

1.1. What are Upper Palaeolithic female representations

This research will explore the concept of dividing the broad group of Upper Palaeolithic female sculptures, commonly referred to as 'Venus Figurines', into smaller categories based on their stylistic differences. The significance of these differences will be measured through the application of an eye tracking methodology, a common psychological approach towards investigating subconscious visual interactions. Before more is said on this matter, it is first important to explain the nature of the sculptures being investigated.

Throughout the twentieth century, archaeological excavations have uncovered a series of artistic representations, largely sculptures, of women dating to the Upper Palaeolithic. Since the first discovery in 1864, 'Venus Figurines' have been uncovered at archaeological sites at a steady pace. The sculptures from Willendorf and Dolní Věstonice, which were found in 1908 and 1925, are perhaps the most famous of these discoveries, whilst the excavations at Hohle Fels 10 years ago presents a more recent addition to this group (Cook, 2013). Much of the art within this group was created between 30,000 and 15,000 BP, however, the dating of Hohle Fels 'Venus' proved that this artistic tradition extended back to at least 35,000 BP (Conard, 2009). Being no less than 5,000 years older than the other 'Venus Figurines' suggests that the Aurignacian figurine found at Hohle Fels could represent the birth of this artistic tradition; or it could simply be that more of these older figurines exist and are waiting to be discovered.

The substantial period of human history that these works of art occupy is matched by their significant geographical distribution. Whilst Western Europe has produced many of the sculptures, finds at sites such as Mal'ta expose a far wider distribution that extends well into Siberia (Appendix 11). Some scholars have approached the study of these female images through the division of the wider artistic tradition into regional groupings. This allows for the assessment of the figurines' morphological differences as being the result of geographically driven stylistic preference. A strong example of this approach can be seen in the work of Delporte (1995), additionally Mussi has published much work on the site of Balzi Rossi (1991; Mussi, Sinq-Mars & Bolduc, 2000). Furthermore, a focus on a single region alone has been shown to allow for the examination of the

morphological differences presented by these female images over time. When viewing the Moravian figures, a change can be seen between the possession of diverse assemblages of figurines during the Pavlovian period and the individual statues unearthed at later Gravettian sites (Mussi, Roebroeks & Svoboda, 1991; Svoboda, 1995). The limitation of these regional approaches comes from the difficulty in expanding their conclusions to cover the broader pan-European distribution of this art with any degree of certainty.

In addition to the broad range of locations and ages of these artefacts, the media used to create each work of art differs greatly between sculptures. Whilst several statues, notably including the Willendorf figure, were made from limestone, ivory was used to create a figurine from Kostienki 1, two sculptures found at Petřkovice were formed from red haematite pebbles, and baked clay was employed to create the sculpture from Dolní Věstonice (Králík, Novotny & Oliva, 2002). These are just a few examples of the different materials that have been used to create female images during the Upper Palaeolithic to illustrate the diverse nature of this artistic style.

The ‘Venus Figurine’ group varies greatly not only in their distribution, age and media, but also in the stylistic forms that they take. Whilst every member of this group is an artistic representation of the female form, there are numerous ways in which these representations take shape. The majority of this archaeological material are small portable sculptures, however female representations have also been found depicted on large immovable mediums; such as at Venus of Laussel, a limestone bas-relief, and the engravings at La Roche de La Linde (Gaudzinski-Windheuser & Jöris, 2015; McDermott, 1996) (Figure 1). These works are often included amongst the sculptures due to their shared stylistic forms which suggest that they may indicate different approaches towards conveying the same meaning (McDermott, 1996). Beyond the fact that all of the ‘Venuses’ depict women, their stylistic variation becomes great when examining the forms that they take. Many of the figures possess vastly exaggerated sexual features. The large breasts, hips and buttocks of these sculptures stand out when viewing the sculpture, these features are further highlighted by a narrow waist and tapering legs. This exaggeration of the sexual characteristics shaped the early interpretations of the function of these works of art, however, not all of the sculptures possess the curvaceous form described here. Sculptures found at

sites such as Mal'ta, Russia, show thin women with much smaller breasts and hips, whilst many of the sculptures from Gönnersdorf do not have breasts at all. The finds from Gönnersdorf, alongside similar sculptures from sites such as Andernach and Nebra, take a much more abstract approach towards their representation, reducing the female form down to its most basic principles. Many of them depict women's bodies in a rod like fashion, with their subject matter being revealed through their likeness to the parietal engravings also found at Gönnersdorf (Figure 2).

Whilst covering such a vast span of time, the so-called 'Venus' group can be divided into two chronological periods. Firstly is that of the Middle Upper Palaeolithic, a period in which 'Venuses' in the more traditional sense were created. The creation of these images spans from 35,000 BP with the Hohle Fels figurine into the Gravettian period, the details of this group can be found in Appendix 10 within the Exaggerated and Non-Exaggerated categories. The second period did not occur until the Late Upper Palaeolithic, offering a far more standardised and abstracted collection of imagery, the details of which can be found in Appendix 10 within the Gonnersdorf category.

Figure 1: The Venus of Laussel (left) and the Venus of Willendorf, the wide hips and large breasts exhibited by both of these representations have been used to link them together despite their differences in media. The Venus of Laussel is 46cm in height, significantly taller than the 11cm high Willendorf figurine. Adapted from *Ice Age art: arrival of the modern mind* (p.93; 60), J. Cook, 2013, London: The British Museum Press. Copyright 2013 by Jill Cook.

Figure 2: These sculptures from Mal'ta, Dolní Věstonice, and Nebra, respectively, are indicative of the broad range of forms that are found within the umbrella term of 'Venus Figurines'. At 11cm the figurinefrom Dolní Věstonice stands taller than the others, with the figurine from Mal'ta measuring 8.7cm in height and the figurine from Nebra being just 5.2cm tall. Adapted from *Ice Age art: arrival of the modern mind* (p.88; 64; 76), J. Cook, 2013, London: The British Museum Press. Copyright 2013 by Jill Cook.

The lack of detail, or sometimes complete absence, of certain elements of the body further emphasize the sexual characteristics. A common trait amongst the figurines is a lack of facial features, a characteristic that has inspired multiple theories including explorations into both identity and deification which will be discussed at a later point in this work. Despite the frequency with which faces are not depicted in these sculptures, there are still several sculptures which present these features such as Dolní Věstonice's eyes depicted as two slits, the head from Brassempouy cave and some of the sculptures from Mal'ta (Figure 3). In some instances, the artists engraved the head to show what is either a headdress or hairstyle, this can be found on the sculptures from Willendorf and Brassempouy (Figure 4). Feet are absent in these artefacts, with the legs tapering off into a point, whilst clothing is occasionally shown but mostly in the sculptures from colder climates such as the Siberian figures from Mal'ta. The sculptures are predominantly portrayed as naked, either with or without personal adornments; usually in the form of jewellery such as necklaces and bracelets.

Figure 3: The head of the Dolní Věstonice Venus, the eyes are clearly depicted as slits. This head is approximately 3cm tall Adapted from *Ice Age art: arrival of the modern mind* (p.64), J. Cook, 2013, London: The British Museum Press. Copyright 2013 by Jill Cook.

Figure 4: The Venus of Brassempouy and the head of the Venus of Willendorf, the detail they present is thought to represent either hair or a form of headdress. These heads are similar in size, at 3.5cm in height the Brassempouy head is only 5mm taller than the head of the Willendorf figurine. Adapted from *Ice Age art: arrival of the modern mind* (p.90; 60), J. Cook, 2013, London: The British Museum Press. Copyright 2013 by Jill Cook.

It has been suggested that many of the sculptures present similar deviations from the reality of the human form, as such implying that the artists followed a set guideline for the abstraction of the female form. Leroi-Gourhan described this method of abstraction as a 'lozenge composition', in which the focus is on the torso with the other bodily regions tapering away, a factor that suggests a strong foundation for the grouping of this imagery despite such significant differences (1968). This 'lozenge composition' approach works successfully for some of the sculptures, but is less useful when interpreting others such as those found at Gönnersdorf.

The positioning of several of the sculptures within their sites raises another point of comparison. Figurines such as Dolní Věstonice 1 and Willendorf were discovered next to hearths, while the sculptures at Kostienki and Petřkovice were in pits where they had been deliberately placed (Cook, 2013). The deposition of these items in domestic contexts, such as within dwellings, indicates that they were likely to have been used in similar intra-site areas. If this is the case, these

sculptures were probably used by the whole community rather than select individuals. It also implies that, contrary to the suggestions of some scholars (Collins & Onians, 1978; Guthrie, 2005), their usage was not restricted to one specific gender. If they were only used by one gender, then one would expect the deposition of these figurines to take place in areas which were used solely by that gender.

1.2. The meaning behind the term ‘Venus Figurine’

There has been some debate in recent years as to the appropriateness of the term ‘Venus Figurine’, stemming from an exploration into the origins of this name. Many authors claim that it is a direct link to Venus, the Roman goddess of fertility, sex, love and beauty, this belief is perhaps somewhat responsible for the high volume of investigations that sexualize the nature and function of these sculptures (Guthrie, 2005; Collins & Onians, 1978). However, some authors propose that this label has a more sinister origin, one that also impacted early approaches towards the interpretation of these figures. Rather than referring to the Roman goddess of fertility, this name is suggested to be a means of comparing the sculptures to Saartjie Baartman, the ‘Hottentot Venus’ (Conkey, 1997). A member of the Khoikhoi, a native population of Southwestern Africa, Saartjie Baartman was exhibited in Europe, most notably in Paris, between 1810 and her death in 1815 (Gilman, 1985). She was displayed partially naked in a cage, and portrayed as being barely human and much further down the evolutionary scale than Western Europeans (Gould, 1985). This academic interest extended beyond her death, with the scientific dissection of her body by Georges Cuvier resulting in the publication of a paper outlining the physical characteristics that set her apart from her white counterparts, this largely revolved around her steatopygia (Wallis, 1995). The aftermath of this paper led to a long-lasting scientific interest, the extent of which can be seen in the actions of the Musée de l’Homme. The museum displayed a cast of Saartjie’s body and skeleton until the 1970s, and kept her remains in storage until they were repatriated in 2002 following a seven year dispute over their ownership (Qureshi, 2004).

Academia's views on race were heavily dominated by Saartjie Baartman during the 19th century, thus, when Palaeolithic female figurines were first discovered, links were drawn between the two areas of research. This connection was driven largely by the perceived similarities between Saartjie Baartman's steatopygia and the exaggerated sexual characteristics exhibited on some of the sculptures.

The term 'Hottentot Venus' was a deliberate link to classical goddess, however, this was not implying her great beauty as some might think, but instead highlighting the perception that, in the eyes of white European men, she exhibited a complete lack of beauty (Lindfors, 1996). Thus the term 'Hottentot Venus' was an act of promoting the superiority of white Europeans through the suggestion of differing notions of attractiveness between the races. Some academics take the view that, as the term 'Venus Figurine' relates back to this anthropological study, continuing to use this name justifies the actions of these 19th century researchers; as such they chose to refrain from using the label 'Venus Figurine' (J. Cook, personal communication, September 12, 2016).

The varied uses of the term 'Venus' within academic literature furthers discontent with the appropriateness of the label. A brief exploration of the literature will reveal the many uses of 'Venus' and how these uses differ between authors. These variations will be briefly summarized but have been explored further by Lander (2005). 'Venus' is firstly used in identifying specific sculptures, such as 'the Venus of Willendorf' or the 'Dolní Věstonice Venus'. This immediately ties the sculptures together through the shared element in their names, however, 'Venus' is also used to indicate a certain type of figure, with the implication that all sculptures that fall under the designation of 'Venus' are stylistically similar. This contrasts the first use of the term 'Venus'. If the label asserts an adherence to a strict style, why are the 'Brassempouy Venus' and 'Venus of Willendorf' grouped together despite having incomparable designs? The term 'Venus Figurine' has also been used generically to reference the entire collection of Upper Palaeolithic female representations (Lander, 2005). Whilst this is more inclusive of the range of forms present amongst female imagery, it removes the importance of the variations possessed by each sculpture.

These variations in the application of the term 'Venus' seem to simplify the identification of this art. The continued use of the label has turned these sculptures into a recognisable brand, one where people can form a picture of

what a specific sculpture may look like based solely on the possession of the name ‘Venus’. The major drawback to this is that it relies on stereotyping the figurines, eliminating characteristics that do not fit into the pre-existing notion of what a ‘Venus’ should be. This, along with the ambiguity over what is actually meant by the use of ‘Venus’, acts more to confuse and mislead the reader than it does to simplify and inform.

Due to the uncertainty created in the literature over what is actually meant by using the term ‘Venus’, as well as the sordid origins of the name causing some people to find the phrase ‘Venus Figurine’ offensive (J. Cook, personal communication, September 12, 2016), the author will refrain from using this term within this work.

2. Past investigations into the functions of Upper Palaeolithic female imagery

The significance academic interest produced by these figurines during the last century has led to the creation of an array of theories seeking to explain why Upper Palaeolithic communities created these works of art. As is the case with a lot of scientific research that has been conducted in the past, investigations into the function of these sculptures have been heavily influenced by the socio-political environments of their time. This chapter will give a broad overview of the leading theories that have been applied to Palaeolithic female sculptures, highlighting how academic approaches have advanced over the last century.

2.1. The androcentric approach

Unsurprisingly, early interpretations of these sculptures suffered from an androcentric view on the past. This stemmed not only from a male dominance over the study of archaeology, but also from the strict sense of Victorian ideals that dictated life in the late 19th century. In these early years of the discovery of what we now know to be an extensive collection of female representations, archaeologists were confronted with the archetypal ‘Venus’; taking the form of overweight or pregnant women possessing wide hips and pendulous breasts. The distinctiveness of these exaggerated sexual features alongside the lack of

clothing depicted steered archaeologists to the conclusion that the function of these figurines must have been sexual.

The investigation into the attractiveness of these sculptures created a long lasting interest within the archaeological community and is still popular today as evidenced by the work of Dixson and Dixson (2011) and Guthrie (2005). In the eyes of Karel Absolon (1949), it was the artists' lack of interest in clothing that led to the nakedness of the sculptures. This lack of interest, combined with the exaggeration of the breasts was seen as evidence of the artist's sexual libido (Absolon, 1949). Whilst the belief that these sculptures were symbols of attractiveness was born from the Victorian's distaste in what they saw as overtly sexual forms, it was also due, in part, to views on race at the time. As discussed previously, the term 'Venus Figurine' links the sculptures to the 'Hottentot Venus' and by implication also the indigenous peoples of Africa. This link was used as a way of promoting the sense of white supremacy through the suggestion that African populations were no different from the Palaeolithic hunter-gatherers who sculpted these figurines and therefore are inferior to the more developed western societies. It is important to remember that this viewpoint was due to the nature of society at the time, and despite this nature, theories based around the attractiveness of this art cannot be discounted as a possibility.

Developing from this view on the attractiveness of these sculptures, they gained the label of being Palaeolithic pornography depicting what was seen as the ideal female form. This theory suggests not just the purpose of these figurines, but also who sculpted and used them, implying that their existence can be attributed solely to men. To Collins and Onians (1978), these women were carved for the pleasure and education of the males within Upper Palaeolithic society. To them, the three dimensional nature of these works of art acts to allow their fondling in male hands (Collins & Onians, 1978). This belief was furthered by Guthrie, who thought that the waist-to-hip ratio of each figurine would reveal their attractiveness (2005). From the measurement of these ratios, Guthrie came to the conclusion that the figures were Palaeolithic erotica and that their prehistoric users were attracted to curvaceous women (2005).

There are several limitations to this notion of Palaeo-erotica, foremost is the reliance on the principle that they were used exclusively by men. Not only is this concept subjective, but the arguments against it are far stronger than those for it.

Collins and Onians believed in this male dominated usage because, to them, there was no conceivable way in which women would have any interest in depictions of the female form (1978). Contrasting theories, such as McCoid and McDermott (1996), have found evidence of the opposite, that women could have been the creators and users of these sculptures with men having little to do with them at all. Whilst the concept of views on attractiveness in the Palaeolithic is a near-impossible topic to answer, there is plenty of evidence to refute Guthrie's suggestion of Palaeo-erotica. Guthrie's (2005) test on waist-to-hip ratios, which formed the foundation of his theory, was retested in 2013 by Tripp and Schmidt. However, this later study found the opposite results to Guthrie, challenging the idea of Paleo-erotica (Tripp & Schmidt, 2013). This idea is further challenged by the work of Rice (1981), who found the sculptures to depict a broad range of ages. Alongside the varied ages represented, slimmer sculptures such as the ones found at Mal'ta question Guthrie's view on the role of waist-to-hip ratios in the function of the sculptures. On top of this, the depositional locations of the figurines in shared domestic contexts suggest that they are likely to have been used by both sexes.

Whilst it is not possible to understand what the standards of attraction were in Upper Palaeolithic Europe, it is clear from the broad range of body morphologies and ages depicted that these sculptures do not represent one pan-European shared view on attraction. Despite this, due to the nature of our limited understanding of this period in prehistory, it is impossible to fully discount attraction as having played some role in the creation of these works of art. Thus, the theory of Palaeo-erotica remains a valid argument, although it is a very weak one.

2.2. Towards a feminist archaeology

During the late 20th century, scholars began to move away from the androcentric views on the past that had dominated earlier research conducted. This change in perspective can be attributed to the spread of the feminist movement into academia. Prehistoric studies were heavily influenced by this development in research, especially investigations into the function of Upper Palaeolithic female representations (Conkey & Gero, 1997; Voss, 2000).

These investigations sought to undo the monopoly that men had over prehistory by attributing elements of the archaeological record to women. The main theory relating to Upper Palaeolithic female sculptures was that of the ‘mother goddess’. Here it was suggested that these figurines were evidence of a monotheistic religion that extended across much of Europe, one centred on a female deity (Baring & Cashford, 1991; Carmody, 1981; Gimbutas, 1974; Gimbutas, 1989; Markale, 1999). This theory saw the abundance of this female imagery as evidence for women holding a higher social standing than men during the Palaeolithic. The belief that Palaeolithic women were not just equal to men, but instead at the centre of a society that revolved around them (Conkey, 2003), complemented the social movement aimed at gaining equality between the sexes that began in the late 1900s.

A key limitation to the mother goddess theory is the notion of the same religion being practised across such a large expanse of geography. Palaeolithic societies were unevenly distributed throughout the continent, with each group inhabiting a vast landscape despite having what is thought to be a small population density. Whilst there is evidence of long-distance movement and interaction during the Upper Palaeolithic, the discovery of coastal shells at inland sites has been seen as evidence of this (White, 1982), for the ‘mother goddess’ theory to be true, communication between tribes would have to be very high. The long-distance interactions indicated within the Upper Palaeolithic material culture are not as vast as may be required for a Pan-European ‘religion’. The scale of both the distance and the degree of interaction implied within the ‘mother goddess’ theory renders it improbable. This theory is brought further into question by the personification of the deity. In modern hunter-gatherer societies, the reliance and interaction with nature exhibited by a non-agricultural world view leads to religions focussed on spirits and forces (Ehrenberg, 1989).

An additional drawback to the idea of a monotheistic religion is the presence of male sculptures at sites such as Brno and Dolní Věstonice. In regards to Neolithic sculptures, Ehrenberg believed that irrespective of the quantity of male sculptures, the idea of a cult to a mother goddess was not possible unless a male god is also considered (1989). This same point may be applicable to the Upper Palaeolithic. Despite the short comings of this theory, which can be seen as an over interpretation of the restricted evidence present (Russell, 1998), it

successfully moved research away from androcentric views and towards less restricted theories not held back by restricted opinions on gender.

Further studies have also attributed the creation of these figurines to women. McCoid and McDermott reacted to the trend in thinking that these sculptures must have been made by men, stating that “this view assumes women were passive spectators of the creative mental life of prehistory” (1996, p.319). McDermott suggested that rather than men creating these as observations of women, they were instead made by women who modelled the sculptures on their own bodies (1996). Within this theory, McDermott believes that no matter how these figurines were seen in Palaeolithic society, they are evidence of women developing a desire to control their reproductive systems (1996). The idea that these figures are self-representations takes into account the ‘lozenge composition’ that they possess, explaining it as a by-product of perspective; with bodily elements that are closer to the head seeming larger (McDermott, 1996). On top of this, the self-representation theory justifies the realism of individual features when viewed in isolation (McDermott, 1996). This theory possesses one distinct advantage that is not often found in Palaeolithic studies, it is testable. Simply taking photos of both the sculptures and women’s bodies from their own perspective reveals a similar form of abstraction, suggesting that self-representation could account for the abstracted bodily proportions present in the sculptures (McDermott, 1996).

However, this theory does have its limitations. First is the assumption that artists required a live model to work from. Upper Palaeolithic sculptures of animals and stone tools show that objects could be created whilst working from remembered information (Bisson, 1996). Further to this point, there is no explanation as to why women did not use other women’s bodies to overcome their limited views of certain areas of the body; additionally, this theory does not fit to all of the sculptures as well as it does to the examples given by McDermott (Bahn, 1996; Cook, 1996). Bahn also takes the view that by removing men from having any involvement with the sculptures, this theory is just as sexist as the androcentric theories it aimed to rectify (Bahn, 1996).

The theory of self-representation was developed further through the suggestion that the figurines functioned as obstetrical aids, and that their proportions were used to help women judge their progression through the stages of pregnancy (McCoid & McDermott, 1996). This function suggests that having control over

reproduction was significantly important to people in the Palaeolithic. Whilst maternal and infant mortality would likely have been desirable to control, it is unlikely that tribes would have wanted to increase their population density. Hunter-gatherer subsistence strategies are more likely to create a desire for limiting population size, not increasing it; a statement that is supported by ethnographic evidence (Nesbitt, 2001).

2.3. Removing gender from the equation

Leading on from these theories that regard women as the artists and users of this set of female imagery, scholars began to re-evaluate them out of such gendered contexts. Seeing that fertility theories were born largely from the analysis of only a small sample of the sculptures, Rice conducted a study into the reproductive status of a broader range of the sculptures (1981). She believed that although many of the figurines within the subset commonly used in the creation of fertility theories appear pregnant, this is not representative of the collection of female representations as a whole (Rice, 1981). Using an attribute rating system, the sculptures were divided between four categories based on their perceived age and reproductive status: pre-reproductive, reproductive and pregnant, reproductive and non-pregnant, and post-reproductive (Rice, 1981). This subcategorization of the figurines found that the majority of the sculptures depict women who are of reproductive ages but are not pregnant, whilst the smallest category comprised of women who were deemed to be pregnant (Rice, 1981). This, combined with the presence of women who would not be able to conceive, led to the conclusion that fertility did not have such a strong influence over the creation of these sculpture as had been suggested previously (Rice, 1981). This is a thought that is supported further by the lack of women either with children or in the process of childbirth. Instead, Rice believed that the sculptures were a representation of womanhood as a whole (Rice, 1981).

Developing this idea of a focus on womanhood, Rice suggested two potential reasons for the creation of these images. The first is that they were made to honour women and their contributions towards society (Rice, 1981). This creates an image of a society that worshipped women for the roles they played in Palaeolithic daily life. Although ethnographic evidence would suggest that men

played the most active role in hunting, childcare and gathering practises would probably have been performed by women (Rice, 1981). These societal roles were likely to have been equally, if not more, important than the roles of men; with the gathered food forming the core pillar of diet during the Upper Palaeolithic (Rice, 1981). Elman Service explains the importance of gathering by how most hunter-gatherer societies cannot survive without these resources but can live without the food provided through hunting for long periods of time (as cited in Rice, 1981). It is clear from Rice's findings, alongside ethnographic data, that women's importance within Palaeolithic society extended well past their role as mothers, but the idea of these sculptures acting as reminders of their contributions to society is still questionable. Firstly, it does not explain the shared style of abstraction that many of the figurines share, and, much like the mother goddess theory, implies a shared culture of woman worship that extended across Europe. Furthermore, if women played such a significant role in society as is suggested by the archaeological record, would people need constant reminding of this contribution through the use of art?

The other theory put forward by Rice allocates a more ritualistic purpose to the art. One where women were believed to have magical abilities and that these sculptures were needed in order to control these powers (Rice, 1981). As women would have no desire to restrict their own powers, this theory suggests that their creation and usage were exclusively the result of men (Rice, 1981). The main limitation of this theory comes from the range of styles, ages, and pregnant status, as well as, in Rice's opinion, the use of realism over idealism presented by the sculptures (Rice, 1981), factors which are not indicative of uniform ritualistic function. While there is no evidence to support the view of male artists creating these sculptures, this does offer an explanation for the lack of Palaeolithic male sculptures; as men would not have wanted to restrict their own magical abilities (Rice, 1981). Further explanation for the relative scarcity of male imagery sees the celebration of their achievements take other forms, such as cave art (Rice, 1981). Due to the many variances exhibited by the sculptures, Rice concludes that whilst both theories are possible, they are more likely to hold the less ritualistic function despite the contradictions raised by ethnographic evidence (Rice, 1981).

A major limitation to this work as a whole is the subjective nature of rating art, especially that which belongs to prehistoric cultures. To minimise the impact of this limitation on the study, five individuals separately rated the sculptures and the results were then compared. Although this may remove some of the personal influences, it does not cancel them out completely. Despite this, it still seems undeniable that these sculptures represent a range of different ages. These compositional differences could be accidental and the result of nothing more than a variance in artistic skill, but the high degree of skill needed to work the raw materials into such detailed pieces removes the validity from this viewpoint. Conversely, if we believe that the differences are solely down to a lack of artistic abilities, then the fertility theory is still unlikely as the pregnant women are more likely to be mistakes as they form the smallest of the sub-groups.

Another alternative to the fertility theories is that these sculptures were used by Palaeolithic populations to protect their homes. This is to say that the sculptures were thought to possess magical abilities that could be used for protection (Koenigswald, 1972). Koenigswald observed that throughout history, the possession of supernatural abilities, whether they belong to a deity or not, is commonly represented by an abstraction from reality in their physical features (1972). Egyptian mythology provides a good example of this, where gods such as Horus and Anubis have human bodies but the heads of animals. Following this trend, the sculpture's lack of facial features is thought to imply their magical properties (Koenigswald, 1972). Despite applying a supernatural function to thee sculptures, Koenigswald does not believe that the exaggerated sexual characteristics are in any way ritually significant, instead they act simply to make the figurines more visible from a distance (1972). As the sculptures have been found deposited in domestic contexts, it is believed that they were designed to protect these households from intruders whilst the occupiers were absent for short periods of time (Koenigswald, 1972). Although ethnographic evidence of the Ifugao tribe from the Philippines, who guard their houses with a particular type of branch when away, is provided in support of this argument; the agricultural substance and advanced technology of this tribe makes them a poorly suited comparison to Palaeolithic life (Koenigswald, 1972).

The basis for this attempt to disprove fertility interpretations comes from a belief that Palaeolithic populations could not possibly know about the biological

processes involved in reproduction (Koenigswald, 1972). This thought was increased by the belief system of Australian tribes in which women became pregnant by touching stones that housed spirits, as well as stories of the wind being able to impregnate women that can be found in Greek mythology (Koenigswald, 1972). Although it is impossible to know the extent of Palaeolithic knowledge on this topic, Koenigswald holds the existence of such views in classical Greece as an indication that Palaeolithic mothers must have known less (1972). It appears highly probably that Palaeolithic populations had at least a basic grasp of how women become pregnant, just not why it works.

Perhaps the most immediate comment that comes to mind when reading this paper is that, if ethnographic examples show a belief that touching stones can cause pregnancy, why could Palaeolithic people not believe that touching a sculpture would create the same result? Whilst this is probably not the case, especially in relation to the sculptures Rice found to represent women of non-reproductive ages (1981), it cannot be fully discounted. This seems to be a rather simple link between Koenigswald's ethnography and the sculptures that has been missed, one that is emphasised by Koenigswald writing his paper almost a decade before Rice revealed that not all of the sculptures are pregnant.

Another limitation to his work is the comparison to classical mythology. Although highlighting humanity's tendency to give mystical beings non-human attributes as a signifier of their powers is an interesting direction with which to approach the sculptures, too much of Koenigsewald's argument rests on the certainty of the Greeks having a far greater biological knowledge than Palaeolithic populations (1972).

2.4. Implications towards social conditions

Clive Gamble attempted to give these sculptures a more functional use, explaining that they were made in reaction to changes in the social conditions of Palaeolithic society (1982). This takes a different approach from previous studies, focussing not on the individual importance of the figurines, but on their role between societies on a regional scale (Gamble, 1982). Social evolution led to the formation of alliance networks between tribes, the maintenance of which required the exchange of visual information as the only viable form of communication over

such vast distances (Gamble, 1982). These alliances would have provided groups with greater access to resources which could have aided them in overcoming unforeseen hardships caused by the Palaeolithic environment (Gamble, 1982). The sculptures acted as a shared tradition between these groups which may have been cemented through inter-marriage ties, creating a significant network of interaction across Europe (Gamble, 1982). The Wonkonguru, an Australian tribe, provide ethnographic support for this theory, as in adverse times they were allowed to encroach into their neighbours' territories (Gamble, 1982). The use of art as a form of Palaeolithic information exchange has been explored further, finding that the low population density allowed for social networks to be created as well as for information to be moved across the continent (Barton, Clark & Cohen, 1994).

The main limitation to Gamble's theory is that it requires a vast scale of interaction between tribes in much the same way as is required by the 'mother goddess' theory. Despite this, alliances between groups would likely entail a lesser degree of social interaction than a shared monotheistic 'religion', as such the movement of people and ideas suggested by Gamble is more in line with the evidence provided within the archaeological record. However, the low volume of sculptures that have been discovered, relative to the geographical spread that they exhibit, does not support this idea fully. This suggestion was also created on the premise that the sculptures would have been kept on constant display for all to see (Gamble, 1982). Whilst there is evidence for the display of these sculptures, such as the Hohle Fels figurine's suspension loop, the exact nature of this display remains unknown.

Throughout history, images have been use to express information in similar ways to those proposed of the Palaeolithic sculptures. Visual representations were used in the first half of the 19th century as a means of distancing Europeans from Africans, Lindfors describes the effectiveness of this medium in its ability to convey information to both literate and illiterate audiences (1996). This links in with Gamble's theory that the sculptures created the ability for differing groups, with potentially differing languages, to communicate. Additionally, Lindfors suggests that the accuracy of the image did not have to be great to express its information (1996), mirroring Gamble's view on the unimportance of the stylistic differences between sculptures not having any impact on their function (1982).

The idea of the visual exchanging of information can be linked to other theories such as their use as obstetrical aids, though this would require a more individual use rather than being openly displayed for all as Gamble suggests (1982).

2.5. Thoughts on a functionless existence

Most of the theories discussed thus far have tried to unlock the function of these sculptures without factoring in their stylistic differences. In relation to Chalcolithic statues from Bulgaria, it has been suggested that these sculptures represent individuals and their personal identities (Bailey, 1994). This can also be applied to the Palaeolithic figurines, although it does not account for the similarities between some sculptures and vast differences amongst others. These differences are perhaps better explained through the sculptures having shared meanings, but appearing different due to the artists working from different models (J. Cook, personal communication, September 12, 2016). This opinion can be supported through the comparison with historical art, for example there are an abundance of sculptures and paintings that depict the Roman goddess Venus, however they all show different women (J. Cook, personal communication, September 12, 2016). This viewpoint suggests that the details of the sculptures were unimportant, what mattered instead was what they represented.

Running alongside all of these theories is the belief that these sculptures do not have such special functions, and exist solely as an output for creative energies. Aptly named ‘Art for Art’s Sake’, this theory suggests that there is no meaning behind the sculptures. This is to say that were made simply for the sake of making them. Whilst many other major theories have witnessed rises to prominence and subsequent falls from grace; ‘Art for Art’s Sake’ has had little acceptance within academic research (Halverson, 1987). Perhaps the reason for this lack of success stems from the lack of impact this theory has on our view of the past. Despite this, Halverson states that every other theory regarding Palaeolithic art is significantly flawed in one way or another, these limitations are seen to be the result of archaeologists focusing on the wrong aspects of the art thus creating a failed understanding of the archaeological record (1987). This belief proposes that limitations, such as the inference of a single gender use of the figurines as suggested by Collins and Onians (1978) or the notion of their bodily proportions

indicating that they were self-representations despite the broad range of stylistic forms that have been discovered (McCoid & McDermott, 1996), can be overcome by the assumption that there was no purpose behind Palaeolithic art (Halverson, 1987). Halverson does however hint at the possibility of female representations being an exception to his functionless explanation of early art forms.

It is highly unlikely that these sculptures had no purpose. The stylistic similarities that are found between certain figurines regardless of their geographical location and age, alongside the high level of artistic skill required to work the raw materials they are created from all suggests that Palaeolithic populations must have had a reason for making them. Experimental archaeology has been applied to recreating the Upper Palaeolithic sculpture known as the 'Lion Man', this study found that over 360 working hours were required to carve it (Museum Ulm, n.d.). Even though the 'Lion Man' is significantly larger than the female figurines, measuring 30cm high, this experimental work provides a strong indication of the length of time required in the creation of Upper Palaeolithic female sculptures. Considering the expenditure of time and energy required to make these figurines, the idea that they were created simply as a way of passing the time is highly questionable.

2.6. In the style of Gönnersdorf

Throughout the above review of the various interpretations that these sculptures have been given, the range of stylistic forms that these sculptures take has repeatedly provided a drawback to their analysis. Whilst in most cases these theories are limited by the presence of slimmer statues that do not possess the exaggerated sexual features exhibited by figurines such as the one found at Willendorf, what has not been mentioned are the further abstracted images such as those found at Gönnersdorf. Whilst the stereotypical 'Venuses' are identifiable by their large breasts, wide hips and distinct lack of facial features, Gönnersdorf images take the opposite approach to the abstraction of the female form. Rather than emphasizing sexual characteristics, they reduce the female body down into a highly minimalistic form. In these examples, the human body is depicted by a rod like shape with a protrusion for the buttocks and sometimes an additional protrusion to indicate the breasts.

The absence of these sculptures in the review of previous works mirrors their absence within the investigations themselves. When these theories are looked at with the Gönnersdorf style images in mind, many of them do not hold up. Theories on fertility which derive from the presence, in some cases, of over-developed sexual features are not so easily placed on to these abstract forms as they lack the very feature which gives meaning to this function. The same can be said for the idea of these sculptures representing Palaeolithic pornography. The belief that the large size of the sexual features acted to aid in their visibility for protection purposes is also undone by the slight nature of this non-representational art. Clive Gamble's view on a cross-continental exchange network does however account for variations in style, although these sculptures may be too far removed from the others to convey the same information (1982). Additionally, whilst Rice's work takes an active look at the differences between the figurines, it would be difficult to 'attribute rate' those of a Gönnersdorf style into her pre-described categories (1981).

The study of the Gönnersdorf style images usually focuses on both their age and uniform style. This leads to beliefs that they acted as symbols that communicated information between societies (Mithen, 2003). The work of Gaudzinski-Windheuser and Jöris provides a good indication of the approach that academics take towards the investigation of Gönnersdorf style images (2015). Here, the Upper Palaeolithic figurines are divided into two groups, Willendorf style and Gönnersdorf style, allowing for their differences to be assessed during the process of uncovering their function. This led to the conclusion that the Gönnersdorf style acted as a form of anonymous information exchange whereas the Willendorf style had a greater focus upon the individuality of the subject (Gaudzinski-Windheuser & Jöris, 2015). The major limitation within this work is found within the formation of the Willendorf category. Whilst the unique and uniform style of the Gönnersdorf imagery provides strong justification for their separation within this artistic tradition, the Willendorf style includes a great range of variation. This form of categorization simply groups all sculptures that do not subscribe to the style of abstraction exhibited by the Gönnersdorf category together. In essence this creates a Gönnersdorf style and an 'anything-else' style. Gaudzinski-Windheuser and Jöris have formed a strong argument for the interpretation of the Gönnersdorf imagery based upon their stylistic separation

from the wider artistic group, however they have not accounted for the differences within their 'Willendorf style' (2015). In order for these works of art to be fully understood, this so-called 'Willendorf style' must be further divided.

This chapter has illustrated that the current approaches towards the interpretation of these figurines are in need of restructuring. As the archaeological record is restricted in terms of the information it reveals regarding the nature of Palaeolithic interaction with these artefacts, this work proposes that a greater understanding of their function can be gained from following new routes of investigation and interpretation. To overcome the informational limitations of the archaeological record in relation to the ways in which individuals interacted with these sculptures, it is suggested that the inclusion of psychological methods and theories could provide a greater insight into this Palaeolithic artistic tradition. The upcoming chapters within this work will illustrate the academic precedent for this style of cross-disciplinary investigation as well as introduce the nature of eye tracking, the psychological approach adopted in this research.

3. Cognitive archaeology

The scope of this research project falls within the realm of cognitive archaeology, a sub discipline that became popular in the 1980s (Flannery & Marcus, 1998). As the name suggests, this approach to understanding the past is focused on attempting to gain an insight into the thought processes of archaeological individuals. Rather than exploring cognition in terms of testing the mechanisms within the brain as the psychological definition would imply, cognitive archaeology is focused on an inclusion of what and how people may have thought in the past. This sub-discipline draws it conclusions on ancient cognition largely from inferences inspired by findings within the archaeological record.

Archaeology as a whole is heavily rooted in cognition, as ancient materials only become of interest if they have been, either directly or indirectly, impacted upon by deliberate human behaviour (Segal, 1994). As such, it makes sense for there to have been a desire to unlock the inner workings of these prehistoric minds. By studying the remains and material culture of the past, a degree of knowledge relating to these cognitive processes can be gained. Whilst this approach does

not offer a complete view of how and what people thought in the past, it does provide some information which can be combined with other archaeological theories to create a fuller understanding of our archaeological origins. The fact that it is not possible to know about past cognition with absolute certainty should not be dwelt upon, after all, no archaeological theory can ever claim to be correct with 100% accuracy. In this sense, cognitive archaeology is no different from any other form of archaeology. Huffman believes that cognitive studies are no less valid than studies in other areas such as economy and technology (1986). Stating that the reason archaeological investigations into these industries have had greater success in stems from limited potential explanations and that more academic thought has been offered to them (Huffman, 1986).

Cognitive studies have been performed on a broad range of archaeological topics, both in terms of the time periods studied and the elements of these time periods that are investigated. A large portion of this cognitive research has been directed at the Lower Palaeolithic in an attempt to determine whether individuals possessed certain cognitive abilities. Perhaps the most popular cognitive ability to research, as shown by the relative volumes of cognitive studies, is communication (Belfer-Cohen & Goren-Inbar, 1994). Several studies have shown, with varying success, that flint knapping and language are intrinsically linked. It has been suggested that the similarity between the cognitive abilities required by the processes of tool construction and language means that it is likely that both developed during the same evolutionary stage of the brain (Kitahara-Frisch, 1980; Steele, Quinlan & Wenban-Smith, 1995). There is some debate over whether this similarity in cognitive ability is enough to provide a link between the two; Isaac (1976) argues that lithic technology can provide answers into the origins of language, however, Wynn states that this connection alone cannot shed light on the origins of grammar (1991). As the development in cognition indicated by stone tools is directly linked to the cognitive abilities required for the development of language, inferences regarding the possession of both of these skills appear justified.

Perhaps this interest in the cognitive abilities of individuals in the Lower Palaeolithic is a result of the use of archaeology within evolutionary psychology, a topic which will be discussed in the next chapter of this work. It is logical for archaeologists to use the same topic of human evolution as an effective way of

bringing psychological approaches and understandings into the sphere of archaeological interpretation. From this starting point, cognitive archaeology has branched out to investigate a great range of time periods. Not only has the cognition of later hunter gatherers in the Upper Palaeolithic been explored (Mithen, 1994), but this subdiscipline has also investigated much more recent civilisations such as Ancient Greece and Mesopotamia (Postgate, 1994; Schnapp, 1994). As well as expanding into other time periods, cognitive studies have grown to cover more diverse aspects of these cultures. Rather than focusing on the possession of certain cognitive abilities, these examinations into the lives of humans and our predecessors look into the development of culture, whether that be material or intangible. For example, cognitive archaeologists have investigated technology in attempts to understand how individuals created such items. In the process, they develop an insight into why tools were made in certain ways and can still infer the cognitive abilities employed (Karlin & Julien, 1994; Pond, 2014). Studies into the cognition behind technology can be very fruitful, especially due to the significant attention that has been paid to this topic during other forms of archaeological investigation. The results of these cognitive studies can be used to reinforce pre-existing theories surrounding technological industries. Further studies have extended the trend of investigating Lower Palaeolithic verbal communication into the study of symbols and writing systems (Bradley, 1994; Postgate, 1994). Some researchers have also had success in tackling the ever-elusive understanding of ‘religion’, a theme within prehistoric studies which provides great difficulty in interpreting (Scarre, 1994).

Overall, the validity of cognitive archaeology as an area of study is clear. Not only is it able to inform about a range of time periods but can also be applied to a variety of aspects within each culture. It has already been stated that cognitive archaeology found its feet in the 1980s, from here it continued to develop, reaching its height in the 1990s; despite being a promising route for archaeological investigation, the popularity of this method did decline. However, in recent years there has been a revival in interest of cognitive archaeology. This ‘neo-cognitive’ archaeology is evidenced by the presence of a whole session on the approach at 2017’s TAG conference in Cardiff titled “A look forward at the study of the mind in the past” (TAG, 2017). From simply looking at the papers presented during this session, the ethos of this latest approach to cognitive

archaeology can be seen. This ‘neo-cognitive’ method follows the old cognitive methods whilst also branching out into the exploration of how individuals interacted with objects and their environments on a more personal and spiritual level. From this, it would seem that the cognitive archaeology revival stands to offer a significant means of archaeological interpretation which will impact upon the discipline for years to come.

4. Psychology and archaeology: a cross-disciplinary approach

It has already been stated in the justification of cognitive archaeology that the study of archaeology is deeply rooted in an interest in human cognition. As such, the practise of archaeology is intrinsically linked with the discipline of psychology, as psychology seeks to understand the functions of the human mind with an emphasis on the cognitive processes that govern our behaviour. If archaeology is an investigation into past human behaviour, then it goes hand in hand with this exploration into the causes behind specific human behaviours. Steven Mithen (1996, p.10) believes that archaeologists can contribute greatly to psychology’s understanding of the mind, stating that “…we can only understand the present by knowing the past”. This is true; it is also true that we can only understand the past by knowing the present. Thus, in order to gain the fullest understanding possible, these disciplines must work together.

3.1. Archaeology within psychology

The field of psychology has found uses for archaeological knowledge, perhaps the greatest identifier of this combined approach to research can be found in the subject of evolutionary psychology. Although at first it may seem that archaeology may not have too much to offer towards the psychological understanding of modern day individuals, this sub-discipline has found a use for the Lower Palaeolithic osteological remains found through archaeological excavation. Evolutionary psychology views the mental and physiological features that we possess such as language and memory as the result of adaptations gained by our ancestor species in order to survive in past environments. This theoretical approach touches on a range of different scientific disciplines, including biology and behavioural ecology to support the argument of how evolution forced such

changes in cognitive abilities. Arguably the most important of the disciplines employed during this search for understanding is in fact archaeology. It is through analysing the variations in morphology witnessed as we climbed the evolutionary ladder that the evidence for evolutionary psychology is revealed. Observations on how hominins changed physically, especially in terms of brain size, are used to infer a development in cognition. Gaining popularity in 1990s, evolutionary psychology has rooted itself as a significant interest area within psychology.

It is commonly believed that the role of natural selection within evolution has resulted in humans being perfectly adapted for life in the modern world, however this is not true. Buss (2016) points out that due to the rate of evolutionary change, which takes thousands of generations to occur, many of the mechanisms present in modern humans are actually adaptations designed for the world of our hunter-gatherer ancestors. As such, these evolutionary traits are not all best suited for modern life. An example given by Buss (2016) is the preference for the taste of fat and sugar, which would have been useful in a Palaeolithic world with scarce food, but now leads to health problems.

Evolutionary approaches have been used further to explain food preferences as a product of this hunter gatherer way of life. The use of fire for cooking food has been explained as a result of the added nutritional benefits; cooked food provides a higher energy intake whilst also being easier to digest than raw food (Buss, 2016). Similarly, a preference for spices is explained through the antimicrobial properties of some spices which help preserve foods (Buss, 2016). Interestingly, modern alcohol consumption has also been studied on an evolutionary scale. Ripe fruits possess high levels of both sugar and ethanol; this has led to the suggestion that when employing a foraging subsistence strategy, riper fruits would have been favoured by our ancestors therefore creating a preference for this higher level of ethanol (Buss, 2016). Whilst the ethanol level in fruit is far lower than in modern alcoholic drinks, it is still believed that a modern fondness for beer is a malfunctioned by-product of this adapted Palaeolithic perference for ripe fruit (Buss, 2016).

Knowledge of the landscapes occupied by our hunter-gatherer ancestors gained through archaeological excavations has helped evolutionary psychologists understand our modern perception of the natural environment. Orians and Heerwagen (1992) conducted a study into participants' preferences within

landscapes, the findings of which are heavily supported by the notion of evolutionary psychology. They found that regardless of the environment depicted, landscapes with fresh water or animals were chosen over those without them. Another series of test within this study found that cross-culturally, young children always preferred open woodland and savannah landscapes over images of other environments; adults also preferred these landscapes alongside images similar to the environments within which they live (Orians & Heerwagen, 1992). These results indicate a favouritism towards landscapes that would have been beneficial during our evolutionary period, a notion that is furthered by an additional preference for low-branching trees that would have offered both options for foraging and accessibility for defence (Orians & Heerwagen, 1992). Maschner and Marler (2008) believe that these findings represent a subconscious evolved preference, one that is supported by similar choices being made by European colonisers (Fox, Hoobs & Loneragan, 2000).

Differences in the perception of the environment between genders have also been explained in an evolutionary context. Studies have found that there is a divide between men and women in terms of their skill at performing certain tasks relating to an ability to navigate within landscapes. There is a male bias towards map reading, maze learning and mental rotations whereas, there is a female bias towards object location and memory, as well as the spatial relationships between them (Silverman & Eals, 1992; Silverman, Choi & Peters, 2007). This is said to mirror a division of labour present during the Palaeolithic period, in which women gained detailed mapping abilities for gathering in local spaces whilst men gained more generalised mapping skills better applied to long distance hunting (James & Kimura, 1997; Maschner & Marler, 2008; McBurney, Gaulin, Devineni & Adams, 1997)

This evolutionary perspective on psychology has also been used within the realm of social psychology. This branch of psychology aims to explain the social interactions exhibited by humans. As cognitive processes can be explained through the examination of our evolutionary development, social exchanges can also be studied in this manner. Attraction is one study area that has employed evolution within the realm of social psychology. This has been achieved through the investigation of the impacts of dominant and sociable personality traits on male attractiveness in the eyes of women (Graziano, Jenson-Campbell, Todd &

Finch, 1997). It has been found that being highly agreeable can make partners more desirable as it offers increased chances of minimizing conflict with others and can create more positive outcomes for partners (Graziano, Jenson-Campbell, Todd & Finch, 1997). Therefore, this attraction is said to be linked to a desire for a partner that can aid in a person's survival. Evolutionary psychology has also been used to suggest that humans form groups as a natural instinct necessary for reproduction and survival (Caporael & Baron, 1997). This study also proposes that anthropology can be used to aid social psychology as well as archaeology (Caporael & Baron, 1997).

Whilst there are many examples of the positive impact that archaeology has had on psychology, there are still areas which can be explored further. Archaeology shares many common interests with cultural psychology, a sub discipline focused on the interaction between culture and the human mind. These interests include, but are not limited to, the creation and sense of identity (Marshall 1996), conflict (Cuhadar & Dayton, 2011; Mirazón Lahr et al., 2016), and how humans perceive and interact with the environment within which they exist (García-Mira & Real, 2005). González-Ruibal believes that cultural psychology could benefit greatly from archaeology, not from the material remains that are uncovered through excavations; but rather from the approach that archaeologists take of viewing all material culture as a combined entity which can be better understood through the comparison between types of artefact (2012).

3.2. Psychology within Archaeology

The field of archaeology has delved into the pool of psychological methods and theories in the past. Although cognitive archaeology had already begun to explore prehistoric cognition, it is Mithen who can be attributed with bringing the notion of combining archaeology with psychology into the forefront of archaeological research in recent years. In his book, 'The Prehistory of the Mind', Mithen highlights the potential benefit that can be achieved through this form of cross-disciplinary research to an extent that had not yet been suggested (1996). He suggests that psychology's understanding of the developmental stages of the mind and the processes behind the act of learning can help explain the evolutions in material culture exhibited during prehistory (1996).

Mithen has taken this view on the human mind, and applied it to the task of explaining the existence of religion within the archaeological record (1997). He suggests that the formation of ideas regarding the supernatural requires the possession of certain cognitive abilities, abilities which were gained from a development of cognitive fluidity during the Middle Palaeolithic (Mithen, 1997). Religion would not have been the primary output of this cognitive fluidity, but rather this new advancement in cognition would have first benefitted individuals in the designing of improved tools and material culture, with the creation of these abstract belief systems being an added bonus of this evolutionary development (Mithen, 1997).

The theory that material culture is heavily impacted upon by cognitive development is one that has been studied many times by archaeologists seeking to make use of the advantages offered by psychology. The creation of Oldowan stone tools is one aspect of Palaeolithic material culture that has been investigated in this manner. Through the use of brain imaging, the areas of the brain used during the knapping of Oldowan flints have been identified (Stout, Toth & Schick, 2000; Stout & Chaminade, 2007). The knowledge that the creation of these tools is focused around using both sensory and motoric regions of the brain in tandem (Stout Toth & Schick, 2000; Stout & Chaminade, 2007) led Stout to the conclusion that the developments witnessed in Lower Palaeolithic technology are directly linked to advances in cognitive abilities (Stout, 2011). This research is complemented by the findings of Pond (2014), who used eye tracking, a well-established psychological method, to examine how individuals approached making Oldowan tools. The results of this study allowed for inferences into which cognitive abilities the Lower Palaeolithic flint knappers possessed (Pond, 2014).

Further archaeological studies employing eye tracking include Dixson and Dixson's investigation into the attractiveness of Palaeolithic female figurines (2011), which will be discussed later in this work in chapter 5, as well as the work of Gonçalves et al. (2013). Whilst most instances in which psychology is employed by archaeologists relate to the Palaeolithic, Gonçalves et al. focused their eye tracking study on the Roman city of Conimbra in Portugal. They wanted to investigate whether the low intensity lighting of the Roman period would affect the perception of Roman mosaics and frescos when compared to brighter modern lighting (Gonçalves, Moura, Magalhães & Chalmers, 2013). This was achieved

through tracking individuals' eyes when shown a digital reconstruction of a room in a Roman villa whilst mimicking the light intensity that would have been present during the Roman period (Gonçalves, Moura, Magalhães & Chalmers, 2013).

Clearly the cross-disciplinary sharing of thoughts and approaches has been taken on by archaeology as well as psychology. Although this began with Mithen's belief in the benefits of the theoretical understanding of the functions of the mind, it has now developed to the point of using psychological methodologies such as eye tracking to study archaeological materials. Despite the broad range of ways in which psychology has been incorporated into archaeological investigations, there are still plenty of possibilities that have not been explored yet. It has been proposed that cave art derives much of its importance from its location, hidden away in dark caves with poor accessibility; this is furthered by the sensory experience involved in the process of entering and exiting caves (Jansen van Rensburg, 2016). An understanding of the psychology behind what may have drawn these artists to work in such dark environments could shed new light upon this tradition. It seems that both with archaeology and psychology, cross-disciplinary investigations have proved fruitful but there are still many possible research areas that have not been fully explored.

5. Eye tracking

Eye tracking is the process of measuring an individual's viewing pattern when exposed to visual stimuli. The ways in which stimuli are interacted with visually can reveal the cognitive processes that the stimuli prompt. When viewing objects, the human system of attention has been compared to a spotlight in the sense that viewing focus falls on specific points but still allows the areas surrounding these points to remain in focus (Styles, 1997). As such, the perception of objects consists of piecing together multiple features which are focused on separately. Treisman's feature integration theory offers a model for this form of perception in which focal attention brings together the features of an object (Treisman 1998; Treisman & Gelade 1980).

Eye tracking seeks to explore the cognitive mechanisms employed by the brain when presented with specific stimuli. As the eyes are neurally connected to the

brain in such a close manner, the eyes move under the level of conscious awareness. Due to the subconscious nature of these movements, tracking the eyes offers an insight into the processes taking place within the brain. The features that gain focus within an object or a scene reveal the nature of how individuals perceive that stimuli. The eyes fixate on specific areas which are important to the brain. This occurs due to either their visual saliency or their cognitive saliency. The latter can vary between individuals, however in an evolutionary context; most people will find certain areas more important than others. The features which gain the highest proportion of attention within the viewing pattern are deemed to be the most important. Humans make between three and five eye movements every second (Holmqvist et al., 2011). By recording where individuals fixate between these movements an understanding of the relative importance of each feature can be gained. The interest, or lack of, that each feature gains reflect its level of significance in the mind of the viewer. Therefore, areas that receive high levels of attention are seen to be more important than areas with lower attention. Knowledge of the levels of attention that these areas generate creates an understanding of how individuals interpret the visual stimuli.

There are a great number of different eye movements that are studied within psychology. Each type of movement is the subject of a different mechanism within the brain, thus eye tracking can be used to study a broad range of cognitive processes. These movements are too numerous for all of them to be discussed within this work, instead only the eye movements studied within this research will mentioned here (refer to Holmqvist et al. 2011 for a complete guide to eye movements). The first eye movement included in this project is known as dwell time. This is the total time spent focused on each specific Interest Area; it indicates both the volume of information expressed by, and interest in, an object (Holmqvist et al. 2011). The second movement that will be studied is the first fixations. A fixation is when the eye stops moving to focus on an area, first fixations take place at the first moment in which a stimulus is seen. As such it indicates the brain's initial stage of information processing (Holmqvist et al. 2011). Collectively these eye movements reveal information on which areas are deemed to be the most important overall within the stimulus and which area is immediately deemed to be important.

The movements of eyes have been studied for over a century with the earliest eye trackers coming into use in the late 1800s (Holmqvist et al., 2011). As one can imagine, these early approaches to eye tracking were far more invasive than modern techniques, it was not unheard of for the eyes of participants to be anaesthetised with cocaine to alleviate some of the pain (Wade, 2010). Much as within archaeology, the invasive methods of the past have developed into more effective, non-invasive methods. Modern eye trackers use a video-based system in which eye movements are measured using infrared reflection. These eye trackers can take several forms, the most common of which involves mounting the eye tracker in a static position with the participant placed in front of it, viewing the stimuli on a computer monitor. There are two variations of these static eye trackers, a tower-mounted tracker which involves limiting head movements through the use of a head rest, and a remote tracker in which there is nothing to restrict participants' movements (Holmqvist et al., 2011). Eye trackers can also be mounted directly on to the head for experiments in which the stimuli cannot be displayed in a stationary position in front of the participant; such was the case in the work of Pond (2014).

5.1 The uses of eye tracking within psychology

Eye tracking studies have been employed to investigate a broad range of topics within psychology. One of these is how the people around us impact our attention system, this is known as social attention (Gregory et al., 2015). It has been found that during scene viewing, people often gain the most attention, with much of this focus falling on their faces (Freeth, Chapman, Ropar & Mitchell, 2010). The knowledge of how individuals view social scenes has also been used to compare how Autism Spectrum Disorders can impact social attention (Fletcher-Watson, Leekam, Benson, Frank & Findlay, 2009; Freeth, Chapman, Ropar & Mitchell, 2010). The act of following another person's gaze during social scenarios is one way that social attention can be studied using eye tracking (Freeth, Chapman, Ropar & Mitchell, 2010; Smilek, Birmingham, Cameron, Bischof & Kingstone, 2006; Thorup, Nyström, Gredebäck, Bölte & Falck-Ytter, 2016). The stimuli in studies on social scenes usually comprise of static photographs, however it has been suggested that in order to gain the most accurate results videos should be shown instead of photographs (Gregory et al., 2015). Alongside its use in creating

new theories about social attention, eye tracking has been used to test and discredit theories. The suggestion that gaze following is an inherent mechanism present from birth (Baron-Cohen, 1995) was discredited by an eye tracking study which showed that young children are not naturally influenced by such cues; thus indicating that gaze following develops during later childhood (Gregory, Hermens, Facey & Hodgson, 2016).

There have also been many eye tracking studies focussed on the perception of female bodies. This has been done in a number of ways. One study investigated the impact of waist-to-hip ratios on female attractiveness in the eyes of men. It found that men found lower waist-to-hip ratios to be more attractive and spent the majority of the viewing time focussed on the breasts (Dixson, Grimshaw, Linklater & Dixson, 2009). However, another eye tracking study into the impact of waist-to-hip ratios and body fat on attractiveness found that the waist-to-hip ratio had little effect on judging attractiveness (Cornelissen, Hancock, Kiviniemi, George & Tovée, 2009). This eye tracking study also showed a preference for fixating on the breasts when viewing the female form. The difference in results between these two studies may be due to the inclusion of participants of both sexes in the latter study. Further studies have indicated the effects of differing variables such as gender, sexual cues, body dissatisfaction, and eating disorders on the viewing patterns presented whilst observing images of both men and women (Cho & Lee, 2013; Goa et al., 2014; Hewig et al., 2008; Hewig, Trippe, Hecht, Straube & Miltner, 2008; Janelle, Hausenblas, Fallon & Gardner, 2003; Nummenmaa, Hietanen, Santtila & Hyönä, 2012; Pinhas et al., 2014; Rupp & Wallen, 2007). The nature in which women's bodies are objectified has also been investigated using eye tracking; this study allowed for comparison between how different body shapes impact the ways that men and women objectify them (Gervais, Holland & Dodd, 2013). The findings of this study show that when observing women's bodies with a focus on attraction, participants fixated more on the breasts and waist, and less on the face compared to when assessing their personality (Gervais, Holland & Dodd, 2013).

5.2 The application of eye tracking within other disciplines

Eye tracking experiments have also been conducted in order to apply psychological knowledge to aspects of everyday life that touch on elements of other disciplines. For example, a study into the differences in attention orientation between smokers and non-smokers found that the valence of the stimuli impacts the viewing pattern that it receives (Mogg, Bradley, Field & Houwer, 2003). Smokers showed a bias in attention towards smoking cues, which is thought to relate to their addiction to cigarettes (Mogg, Bradley, Field & Houwer, 2003). Although the study of attentional orientating falls squarely within pre-existing areas of psychological research, the knowledge gained from this experiment can be used in a medical context to help improve the process of treatment for this addiction. This understanding of how nicotine addictions impact perception can also be used to infer the effects of addictions to other drugs, though research into other drugs should undertake eye tracking studies of their own as well.

Within the realm of fashion, eye tracking has been used to study how individuals visually interact with images of models and how this relates to their levels of social comparison with the model (Won Ju & Johnson, 2010). The findings on how viewers react to images of models in this context has implications not just for the design of online shopping websites, but also for how to deter young women from socially comparing themselves to fashion models, an issue which can lead to the development of mental health disorders, especially eating disorders (Won Ju & Johnson, 2010).

Website design has been studied further using eye tracking to determine which factors are most advantageous in a website (Goldberg, Stimson, Lewenstein, Scott & Wichansky, 2002). This study focussed on the navigation within websites, finding that individuals usually searched in a horizontal manner and that header bars do not play a large role within navigation (Goldberg, Stimson, Lewenstein, Scott & Wichansky, 2002). These results can be used within design and marketing to aid in the creation of a website model that compliments viewing patterns.

The experiments mentioned in this chapter are indicative of the diverse nature of potential eye tracking investigations. It is easy to see why eye tracking has taken such a central role within modern psychology. The vast nature of neurological processes that can be explored using this technique set it apart from most other

methods of investigation. Outside of purely psychological experiments, the flexibility of eye tracking has allowed for a range of other subjects to approach using this method. The close link between psychology and archaeology created through an interest in cognition has already been shown within this work. It stands to reason that if other topics can call on eye tracking to help formulate a greater understanding of their areas of interest, then archaeology can too.

To summarise this research project thus far, the initial two chapters of this work outlined both the nature of Upper Palaeolithic female representations and their current standing within academic archaeology. It is clear from the previous investigations conducted on these statues, that their combined grouping, as employed by many scholars, restricts the ability for them to be understood fully. Following this observation, it has been suggested that the sub-discipline of Cognitive Archaeology may provide a suitable approach to the reanalysis of this artistic tradition. As all archaeology is heavily rooted in cognition, this research sees fit to adopt a psychological towards the study of this archaeological material. This approach gains further support as these disciplines have been shown to complement each other within previous research. Therefore, this project will seek to unlock a greater understanding of these Upper Palaeolithic female representations through the use of eye tracking methods.

6. Dixson and Dixson's eye tracking experiment

Of all the projects that have been completed in the past, Dixson and Dixson's (2011) study is the most relatable to this project. They also attempted to use psychological approaches to interpret the ways in which individuals interact with Upper Palaeolithic female sculptures. Their research consisted of two parts, asking people to rate the sculptures in terms of their age grouping, reproductive status and attractiveness, as well as conducting an eye tracking study (Dixson & Dixson, 2011). The aim of the eye tracking element of this study was to measure the visual attention given to the various morphological features of these figurines to reveal whether men interacted with the images in the same way that they would with images of modern women, as indicated by previous studies (Dixson & Dixson, 2011; Dixson, Grimshaw, Linklater & Dixson, 2009).

In the first part of this research, individuals were shown 15 images of female sculptures, 14 from the Palaeolithic period and one modern sculpture (Dixson & Dixson, 2011). These were viewed in a random order and were all edited to be the same height. The participants were asked to rate the sculptures on their perceived age, pregnant status, and attractiveness. Those with in the 'young adult' category were collectively deemed to be more attractive than the sculptures within the other age groups, this attractiveness was rated using a 6 point Likert scale, a means of measuring an individual's degree of agreement with a statement (Dixson & Dixson, 2011; Joshi, Kale, Chandel & Pal, 2015). This study found that a low waist to hip ratio correlated to a higher attraction. Further findings indicated that five of the sculptures were thought to be non-pregnant, whilst three of the sculptures were rated as pregnant (Dixson & Dixson, 2011). The remaining stimuli did not gain significant results within the judgement of their pregnant status.

Whilst the sculptures chosen for this study cover a broad geographical range, they were restricted in terms of their stylistic forms. The figurines chosen are not representative of the many forms that are found in Upper Palaeolithic female images, 64% of the figurines used had exaggerated breasts and high waist to hip ratios while the less curvaceous sculptures such as those found at Mal'ta are not included. Dixson and Dixson also included a modern sculpture which has little in common with the prehistoric figures and a fabricated rendition of one of the sculptures found at Brassempouy (2011). The remains of this figurine discovered during Piette's excavation in 1894 consist of nothing more than a head (White, 2006), whereas, Dixson and Dixson (2011) use an image of this head on top of a reconstructed body. No archaeological evidence was found to suggest how the body of this sculpture would have looked, and given that sites such as Kostenki 1 possess figurines of a range of body shapes, it is not possible to state with any certainty what the full form of this statue from Brassempouy would have looked like. A further issue with the use of the Brassempouy figurine is the level of detail assigned to the facial features; all of the other Palaeolithic sculptures used in the questionnaire do not possess any such features with the exception of the figurine from Dolní Věstonice which has two incised lines representing the eyes. Dixson and Dixson included the Brassempouy woman in an attempt to see how the presence of facial features affects the ways in which individuals view the

sculptures. Whist this is a valid point of investigation, one sculpture does not provide enough data to create a strong argument about the ways in which individuals interact with these sculptures.

The choice of stimuli in this study appears to overlook the breadth of potential items available within the archaeological record. It is possible that this limitation arose from an oversight of certain elements within the literature.

The second part of this research employed eye tracking to measure the viewing patterns received by three female sculptures. 35 heterosexual men participated in this study, being shown each of the stimuli for five seconds in a random order whilst being asked to (Dixson & Dixson, 2011). After each presentation, the participants rated the attractiveness of the sculpture using a six point Likert scale. This study found that there was an attentional bias towards the sculptures breasts, midriff and face, this complements previous findings on the eye movements men make when observing images of modern women (Dixson & Dixson, 2011; Dixson, grimshaw, Linklater & Dixson, 2011; Cornelissen, Hancock, Kiviniemi, George & Tovée, 2009).

Similarly to the first part of this research, the main limitation of this eye tracking study is in the stimuli used. Only two Palaeolithic sculptures were viewed and they only showed a frontal view. Not only does this not provide an overview of Palaeolithic female figurines as a whole, but it also means that the conclusions that arise from this small sample have to be extensively stretched in order to be applied to all of the sculptures. By only showing one view of the sculptures, the participants are not able to get a sense of the three dimensional nature of these figurines. These issues with the limited stimuli are amplified by the decision to use the same reconstructed image of the Brassempouy figurine that was used in the first half of this study. Dixson and Dixson admit that artistic license has more of an impact on the creation of this reconstruction than archaeological accuracy (2011), which furthers the question of why they decided to use this sculpture instead of one of the numerous other figurines available to them as indicated by the use of frontal images in their questionnaire.

Dixson and Dixson reached the conclusion that men view these sculptures in the much the same way as they would view modern-day women as shown in previous eye tracking studies with the upper body receiving the most attention (2011;

Dixson, Grimshaw, Linklater & Dixson, 2009). They also suggest that despite the wide geographical spread that the sculptures possess, the sculptures are often rated in the same ways (Dixson & Dixson, 2011). Although the data gained from the eye tracking experiment relating to the Willendorf figurine is still valid, the experiment as a whole is made unreliable due to this being the only authentic Palaeolithic sculpture studied. As such, this study offers very little support to the theories that they have created relating to the function of female sculptures as a whole.

This study is further limited by focusing on the sexual attractiveness of the sculptures. Waist-to-hip ratios have been previously studied as an indicator of attractiveness both in modern-day societies and in historical and prehistoric art (Bovet & Raymond, 2015; Jasieńska, Ziomkiewicz, Ellison, Lipson & Thune, 2004; Hudson & Aoyama, 2007; Singh, 2006; Singh & Singh, 2011). Whilst Dixson and Dixson's work does fit nicely into this strand of research, focusing the study solely on the attractiveness of the sculptures greatly restricts the opportunity for differing interpretations to be made based on their resulting data. Although the belief that the function of these sculptures revolved around their sexual attractiveness is a long established theory, there are many theories that have been applied to these figurines that do not focus on their usage as a form of Palaeolithic erotica (Gamble, 1982; McCoid & McDermott, 1996; Rice, 1981). These theories have not been taken into account during the setting up and running of this experiment. Dixson and Dixson exhibit an understanding of the non-androcentric theories that have been proposed in the past, but have not considered these potential functions when conducting their own research.

7. Methodology

7.1. Aims and objectives

Unusually, there are two aims to this research project, firstly to investigate whether the stylistic differences between Upper Palaeolithic female representations generate different viewing patterns, thereby suggesting the potential for differing functions. Secondly, using eye tracking as an example, to illustrate the positive contribution that psychological methods and theories can have when applied to the interpretation of archaeological materials.

In order for these aims to be met, the following objectives must be completed:

- To curate a collection of images that offer a representative overview of Palaeolithic female figurines as a whole, including multiple views of the sculptures where possible
- To divide the figurines into distinct categories based upon their stylistic variations
- To measure the viewing pattern received by each of these figurine categories and identify any significant differences that may occur
- To assess the impact of these differences on our prior understanding of this artistic tradition, particularly in relation to any differences that are linked to pre-existing theories regarding the function of these artefacts
- To exhibit the benefits of using psychology within archaeology through an effective experiment design which complements the archaeological material.

Due to the nature of results gained through psychological experiments, their presentation is required to follow a strict guideline. In keeping with this, the formatting and referencing employed throughout this work follows the APA approach rather than BU Harvard (see Perrin, 2012).

7.2. Eye Tracking Design

This study used a standard repeated-measures design investigating: 3 x (Category – Exaggerated vs Non-Exaggerated vs Gönnersdorf) 5 (Interest Areas (IAs) – Head; Upper Torso; Lower Torso; Upper Torso; Lower Torso) design. The dependant measures for this study were the percentage dwell time to the Interest Areas in a Dwell-time analysis. The first fixations for the stimuli were also measured.

7.3. Participants

Fifty-three participants took part in the experiment, 27 females and 26 males, between the ages of 18-66 (M = 25.53, SD = 9.85). Participants were students and faculty staff from Bournemouth University and took part on a voluntary basis with no rewards offered. Participants were recruited regardless of their area of study, 36 of the participants came from an archaeological background, and the remaining 17 had little to no pre-existing knowledge of archaeology.

The institutional ethics board approved the study's procedures prior to the start of the study (Appendix 3). Participants with normal, or corrected to normal, vision were allowed to take part, however, individuals with problems with vision that cannot be corrected by wearing contact lenses or glasses could not participate to avoid complications with calibration and within the resulting data. Before taking part in the study, all participants gave full written informed consent.

7.6. Materials and apparatus

7.6.1. Stimuli

The stimuli (the images of the sculptures) were gained from online publications and databases, a full list of which is provided in Appendix 2. A total of 63 stimuli were used, where possible three views of each sculpture were shown: front, side and back. Due to the availability of high quality images of the sculptures, not all of the sculptures were able to be shown from three views. The specific detail of which sculptures were used and which views were shown can be found in Appendix 1. The stimuli were edited to have no background and all be the same height, as close to 700 px as possible, creating a uniform presentation of the

stimuli so as to remove any impacts of size and background effecting the viewing patterns. This is a standard practise within psychological experiments.

7.6.2. Categories

The stimuli used were divided into three stylistic categories by the author: Exaggerated, Non-Exaggerated, and Gönnersdorf. Despite the high variation between the sculptures, these stimuli were divided by the different stylistic approaches to the representation of the female form that they employ. These categories are largely based on the emphasis on, or lack of, sexual characteristics alongside indication of personal identity in the form of facial features and personal adornments, a full break down of these categories can be found in Appendix 10.

7.6.3. Familiarity questionnaire

As well as investigating the potential effects of Category on the dwell time to each IA, the impact on dwell time of the participants' familiarity with the stimuli was also analysed. This was to indicate whether participants who had knowledge of the stimuli and the theories that have been applied to them exhibited a difference in viewing patterns than those who had no prior knowledge of these figurines. Participant's familiarity with the stimuli was measured through the use of a questionnaire with a 10 point Likert scale, in which 1 represented a complete lack of knowledge for the designated sculpture and 10 represented a high degree of knowledge of the stimuli (Appendix 4). Due to the questionnaire containing images of all the sculptures used within the experiment, it was completed after the eye tracking had taken place and participants were asked to rate their levels of familiarity as they were before commencing the study. The results of which divided the participants into quartiles in order to assess the effects of their prior knowledge on their viewing patterns.

7.6.4. Apparatus

Participants' eye movements were recorded using a SMI RED500 (SensoMotoric Instruments, remote eye tracking device; SensoMotoric Instruments, Inc., Teltow, Germany) which has a sampling rate of 500 Hz and a spatial accuracy of 0.5°.

Using SMI ‘Experiment centre’ software, the stimuli were presented on a 22” monitor which was linked to the eye tracker. The operating distance of this eye tracker varied slightly between participants but was usually around 70 cm. The eye tracking data was processed by a connected Dell laptop through the use of SMI ‘BeGaze’ software.

7.7. Procedure

Participants were recruited for the study through advertisements distributed both throughout Talbot Campus, Bournemouth University and on social media, as well as being advertised in a faculty wide email within the Department of Archaeology, Anthropology and Forensic Science.

Participants were tested individually in an eye tracking lab within Bournemouth University (Figure 5). Upon entering the lab, participants were given an information sheet briefly explaining that they were about to participate in a study on eye gaze behaviour in relation to Upper Palaeolithic female representations (Appendix 5). Before beginning the experiment, participants gave full written informed consent to take part in the study (Appendix 6). Participants were then comfortably positioned in front of the eye tracker and their eyes were calibrated. Testing was unable to continue until the participant’s eyes had been calibrated correctly, resulting in the calibration being repeated if necessary.

Participants were then asked to remain still and observe the stimuli, presented on the monitor in front of the participant. Each stimuli was presented for five seconds. The order of the stimuli was randomised for each participant, where multiple views of the same sculpture were presented, these stimuli were grouped together in the order of: front view, back view, side view. Although shown together in the same order for every participant, the groups of stimuli showing the same sculpture were distributed randomly within the overall order of stimuli for each participant. Each trial began with a blank screen with a cross in the centre, participants were asked to focus on this cross, before being presented with the first stimuli. This screen appeared for five seconds between each of the stimuli that were presented. It is worth noting that the first fixation was technically the second fixation, as the first fixation would have been where the participants were

looking before the stimuli appeared on the monitor. This second fixation will henceforth be referred to as the first fixation.

Once all of the stimuli had been viewed, participants were asked to complete the Familiarity questionnaire. Participants were then debriefed regarding the aim and purpose of the study (Appendix 7). Participants were then given the opportunity to raise any queries they had relating to the study, both in terms of the aim of the eye tracking study and the stimuli being investigated. The duration of each session was approximately 20 minutes, but was sometimes exceeded depending on the volume of questions that the participant had as well as the speed with which the eye tracker was calibrated correctly.

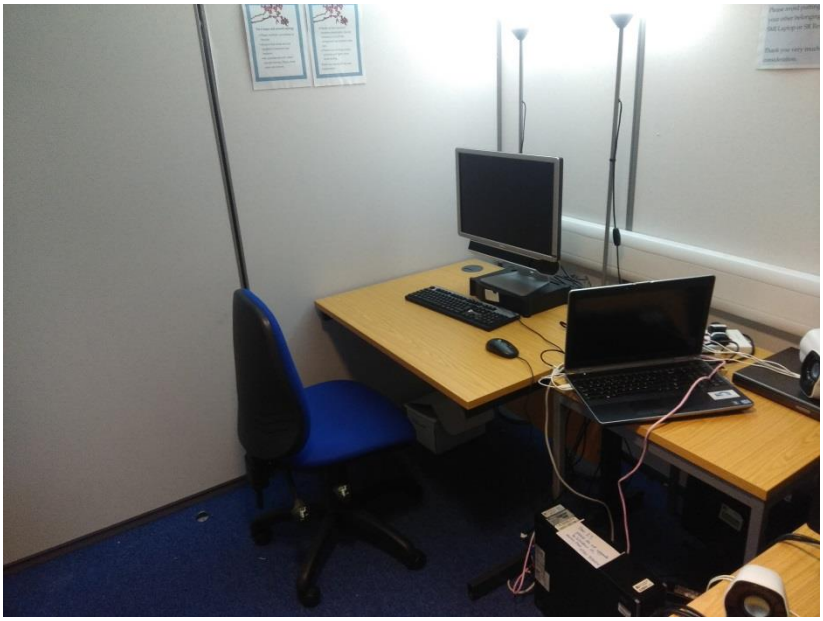


Figure 5: The eye tracking lab used during this study. Participants sat in the chair and view the stimuli on the monitor in front of them. The experiment is controlled using the laptop which is directly connected to the eye tracker, positioned under the monitor

8. Results

8.1. Data handling

The stimuli were each allocated five Interest Areas: Head, Upper Torso, Lower Torso, Upper Legs, and Lower legs (Table 1). These IAs were developed to indicate the main regions of the human body, thus giving a broad view of the characteristics that each stimuli possess (Figure 6). The pubic region is included

within the Upper Legs and not distinguished by a separate interest area due to the small size exhibited by some figurines limiting the accuracy of tracking fixations to these areas. When multiple views of a sculpture were presented, the IAs cover the same area across all views. The Interest Areas (IA) were drawn on to all 63 stimuli using BeGaze software. IA's dwell times were calculated by first grouping the stimuli according to their stylistic category (Exaggerated, Non-Exaggerated and Gönnersdorf) and then finding the average dwell time for each IA within each category across the multiple views. The same process was employed to find the average dwell time for each IA within the familiarity groupings. The familiarity groupings divided the stimuli into quartiles with the top quartile showing stimuli that had the highest mean familiarity scores (High), and the lowest scores being in the bottom quartile (Low), the remaining stimuli were grouped together (Middle).

Table 1
Details of the means of classifying each IA. Where multiple views of a sculpture were present, the IAs covered the same proportionate areas across the views

Interest Area	Description
Head	The area of the head was measured from the top of the sculpture to the base of the neck.
Upper torso	The area of the upper torso was measured from the base of the neck to the lowest point of the breasts.
Lower torso	The area of the lower torso was measured from the lowest point of the breasts to the top of the hips, often in line with the upper-most extreme of the pubic region.
Upper legs	The area of the upper legs was measured from the top of the hips to the bottom of the knees.
Lower legs	The area of the lower legs was measured from the bottom of the knees to the base of the sculpture.

8.2. Outliers

No consistent outliers were detected across participants based on their dwell time data. This was examined using box plots in SPSS which show individuals outside of 1.5 times the interquartile range.

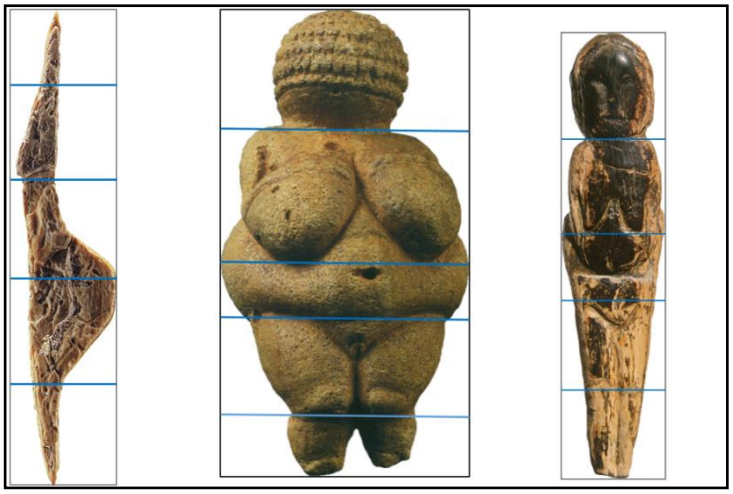


Figure 6: The desginated Interest Areas within each sculpture

8.3. Category Dwell-time analysis

A standard repeated measures ANOVA was conducted to compare the effect of Category on the dwell time for the Interest Areas (IAs – Head, Upper Torso, Lower Torso, Upper Legs, Lower Legs). All of the statistics used an alpha level of 0.5. Pairwise comparisons were corrected using Post Hoc Bonferroni Adjustments.

Mauchly's test of Sphericity indicated that the assumption of sphericity had been met by Category but was violated by both IA, and Category vs IA. These violations have been corrected using Greenhouse-Geisser and Huynh-Feldt estimates of sphericity where appropriate. The details of these outcomes are described further in Appendix 8.

The main effect of Category was significant, F (2, 104) = 9.84, p < .001, n_p^2 = .159, indicating a difference in the viewing pattern for each of the categories. Pairwise comparisons showed that the Exaggerated category received the highest dwell time (M = 14.06, SE = .63), followed by the Non-Exaggerated category (M = 13.70, SE = .64), followed by the Gönnersdorf category (M = 13.51, SE = .63). The main effect of IA was also significant, F (2.28, 118.48) = 135.98, p < .001, n_p^2 = .723, indicating a different proportion of dwell time to each IA. Pairwise comparisons showed that the Lower Torso IA received the highest dwell time (M = 20.82, SE = 1.21), followed by the Upper Torso IA (M = 19.96, SE = .96), followed by the Upper Legs IA (M = 15.00, SE = .76), followed

by the Head IA (M = 10.20, SE = .75), with the Lower Legs IA received the lowest dwell time (M = 2.78, SE = .31) when the stimuli were considered as one group.

Pairwise comparisons revealed that the Interest Areas received different viewing patterns across the categories. All of the interactions that were investigated had significant effects on the dwell time to the IAs, with the exception of the interaction between the Gönnersdorf and Exaggerated categories in relation to their dwell times of the Lower Legs IA which was not statistically significant. The full results of these pairwise comparisons can be found in Table 2.

The interaction between Category and IA on dwell time was significant, F (3.42, 177.70) = 136.23, $p < .001$, $n_p^2 = .724$, indicating a different viewing pattern across the IAs for each of the categories. All of the interactions that were investigated had significant effects on the dwell time to the IAs, with the exception of the interactions between the Head and Upper Legs IAs within the non-Exaggerated Category, and the Lower Torso and Upper Legs IAs within the Gönnersdorf Category. The full outcome of these pairwise comparisons can be found in Tables 3, 4, and 5.

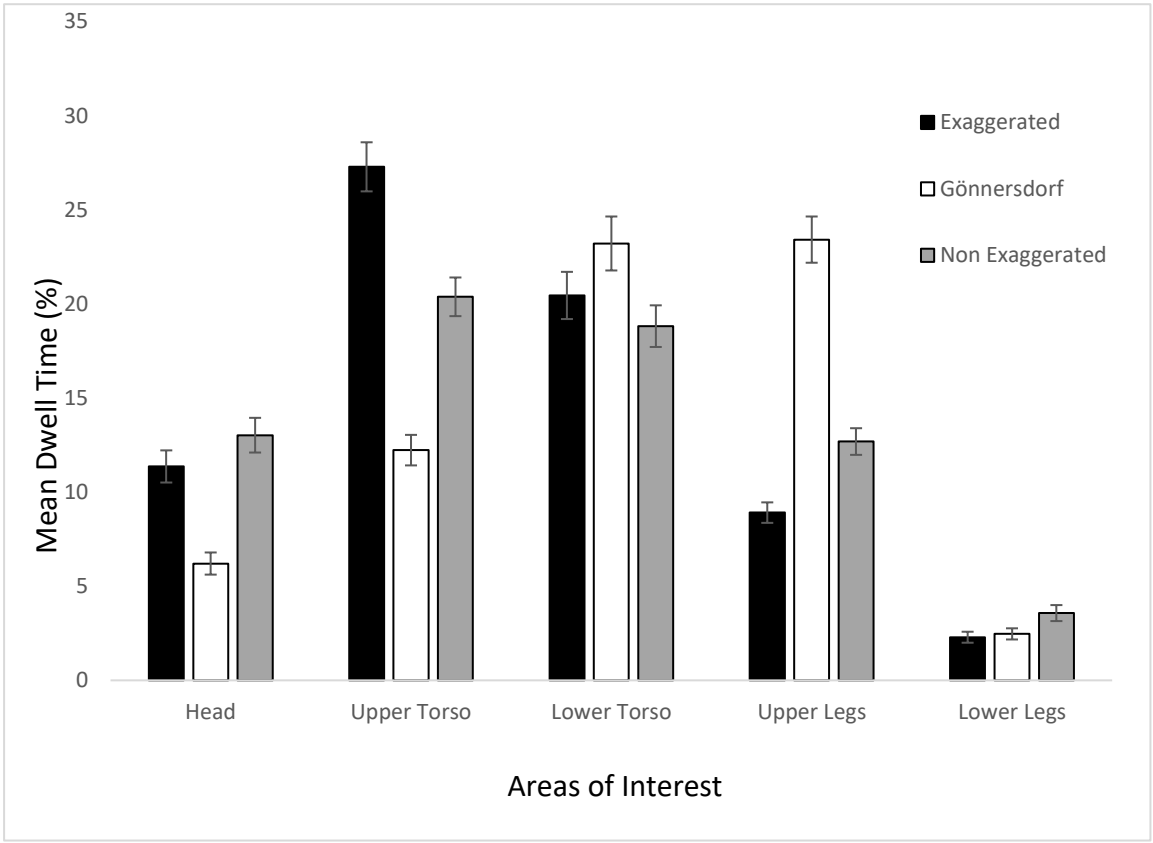


Figure 7: Mean dwell time (%) to the Interest Areas dependant on the category of stimuli. Error bars represent the standard error of the mean. The white space dwell time has been omitted from this and all other graphs presented in this work

Table 2

Pairwise comparisons showing the effects to the dwell time of the Interest Areas across all of the categories. Within each comparison, the Category listed first received the higher proportion of mean dwell time.

Interest Area	Categories being compared	Mean Difference	Std. Error	Significance	95% Confidence Interval for difference	
					Lower Bound	Upper Bound
Head	Exaggerated vs Gönnersdorf	5.158	.507	.000	4.141	6.174
	Non-Exaggerated vs Exaggerated	1.662	.411	.000	.836	2.487
	Non-Exaggerated vs Gönnersdorf	6.819	.585	.000	5.645	7.993
Upper Torso	Exaggerated vs Gönnersdorf	15.050	1.024	.000	12.995	17.106
	Exaggerated vs Non-Exaggerated	6.905	.579	.000	5.743	8.068
	Non-Exaggerated vs Gönnersdorf	8.145	.745	.000	6.650	9.640
Lower Torso	Exaggerated vs Non-Exaggerated	1.631	.542	.004	.543	2.719
	Gönnersdorf vs Exaggerated	2.761	.814	.001	1.128	4.394
	Gönnersdorf vs Non-Exaggerated	4.392	.623	.000	3.142	5.641
Upper Legs	Gönnersdorf vs Exaggerated	14.503	.961	.000	12.575	16.430
	Gönnersdorf vs Non-Exaggerated	10.727	.842	.000	9.038	12.416
	Non-Exaggerated vs Exaggerated	3.776	.383	.000	3.007	4.545
Lower Legs	Gönnersdorf vs Exaggerated	.177	.219	.424	-.263	.616
	Non-Exaggerated vs Exaggerated	1.283	.226	.000	.829	1.736
	Non-Exaggerated vs Gönnersdorf	1.106	.288	.000	.529	1.683

Table 3

Pairwise comparisons of the proportion of dwell time that each Interest Area received within the Exaggerated Category

Interest Areas interacting with each other		Mean Difference	Std. Error	Significance	95% confidence Interval for Difference	
					Lower Bound	Upper Bound
Head	Upper Torso	-15.917	1.253	.000	-18.431	-13.404
	Lower Torso	-9.085	1.401	.000	-11.896	-6.274
	Upper Legs	2.452	.788	.003	.870	4.034
	Lower Legs	9.072	.769	.000	7.528	10.615
Upper Torso	Head	15.917	1.253	.000	13.404	18.431
	Lower Torso	6.833	.994	.000	4.839	8.826
	Upper Legs	18.369	1.231	.000	15.900	20.839
	Lower Legs	24.989	1.337	.000	22.307	27.671
Lower Torso	Head	9.085	1.401	.000	6.274	11.896
	Upper Torso	-6.833	.994	.000	-8.826	-4.839
	Upper Legs	11.537	1.104	.000	9.322	13.752
	Lower Legs	18.157	1.266	.000	15.615	20.698
Upper Legs	Head	-2.452	.788	.003	-4.034	-.870
	Upper Torso	-18.369	1.231	.000	-20.839	-15.900
	Lower Torso	-11.537	1.104	.000	-13.752	-9.322
	Lower Legs	6.620	.455	.000	5.707	7.533
Lower Legs	Head	-9.072	.769	.000	-10.615	-7.528
	Upper Torso	-24.989	1.337	.000	-27.671	-22.307
	Lower Torso	-18.157	1.266	.000	-20.698	-15.615
	Upper Legs	-6.620	.455	.000	-7.533	-5.707

Table 4

Pairwise Comparisons of the proportions of dwell time that each Interest Area received within the Gönnersdorf Category

Interest Areas interacting with each other		Mean Difference	Std. Error	Significance	95% confidence Interval for Difference	
					Lower Bound	Upper Bound
Head	Upper Torso	-6.025	.730	.000	-7.490	-4.560
	Lower Torso	-17.003	1.464	.000	-19.940	-14.066
	Upper Legs	-17.208	1.125	.000	-19.466	-14.951
	Lower Legs	3.738	.523	.000	2.689	4.786
Upper Torso	Head	6.025	.730	.000	4.560	7.490
	Lower Torso	-10.979	1.387	.000	-13.761	-8.196
	Upper Legs	-11.184	1.199	.000	-13.590	-8.777
	Lower Legs	9.762	.836	.000	8.085	11.439
Lower Torso	Head	17.003	1.464	.000	14.066	19.940
	Upper Torso	10.979	1.387	.000	8.196	13.761
	Upper Legs	-.205	1.275	.873	-2.763	2.353
	Lower Legs	20.741	1.471	.000	17.790	23.692
Upper Legs	Head	17.208	1.125	.000	14.951	19.466
	Upper Torso	11.184	1.199	.000	8.777	13.590
	Lower Torso	.205	1.275	.873	-2.353	2.763
	Lower Legs	20.946	1.154	.000	18.629	23.262
Lower Legs	Head	-3.738	.523	.000	-4.786	-2.689
	Upper Torso	-9.762	.836	.000	-11.439	-8.085
	Lower Torso	-20.741	1.471	.000	-23.692	-17.790
	Upper Legs	-20.946	1.154	.000	-23.262	-18.629

Table 5

Comparisons of the proportions of dwell time that each Interest Area received within the Non-Exaggerated Category

Interest Areas interacting with each other		Mean Difference	Std. Error	Significance	95% confidence Interval for Difference	
					Lower Bound	Upper Bound
Head	Upper Torso	-7.350	.840	.000	-9.036	-5.665
	Lower Torso	-5.792	1.147	.000	-8.094	-3.490
	Upper Legs	.338	.876	.701	-1.421	2.096
	Lower Legs	9.451	.866	.000	7.713	11.189
Upper Torso	Head	7.350	.840	.000	5.665	9.036
	Lower Torso	1.558	.643	.019	.269	2.848
	Upper Legs	7.688	.935	.000	5.811	9.565
	Lower Legs	16.801	1.082	.000	14.630	18.972
Lower Torso	Head	5.792	1.147	.000	3.490	8.094
	Upper Torso	-1.558	.643	.019	-2.848	-.269
	Upper Legs	6.130	1.022	.000	4.079	8.181
	Lower Legs	15.243	1.163	.000	12.909	17.576
Upper Legs	Head	-.338	.876	.701	-2.096	1.421
	Upper Torso	-7.688	.935	.000	-9.565	-5.811
	Lower Torso	-6.130	1.022	.000	-8.181	-4.079
	Lower Legs	9.113	.626	.000	7.856	10.370
Lower Legs	Head	-9.451	.866	.000	-11.189	-7.713
	Upper Torso	-16.801	1.082	.000	-18.972	-14.630
	Lower Torso	-15.243	1.163	.000	-17.576	-12.909
	Upper Legs	-9.113	.626	.000	-10.370	-7.856

8.4. Familiarity dwell time analysis

A standard repeated measures ANOVA was conducted to compare the effects of Familiarity on the dwell time for the Interest Areas. All of the statistics used an alpha level of 0.5. Pairwise comparisons were adjusted using Post Hoc Bonferroni Adjustments.

Mauchly's test of Sphericity indicated that the assumption of sphericity had been violated by all of the variables within the analysis of the effects of Familiarity on

dwell time. These violations have been corrected using Greenhouse-Geisser and Huynh-Feldt estimates of sphericity where appropriate. The details of these outcomes are described further in Appendix 8.

The main effect of Familiarity was significant, F (1.86, 96.44) = 12.47, p < .001, n_p^2 = .193, indicating a different viewing pattern for each category of familiarity. Pairwise comparisons showed that the High category received the greatest dwell time (M = 14.15, SE = .63), followed by the Middle category (M = 13.80, SE = .64), followed by the Low category (M = 13.47, SE = .62). As with the previous analysis, the main effect of IA was also significant, F (4, 208) = 142.07, p < .001, n_p^2 = .732, indicating a difference in the viewing pattern for each IA. Pairwise comparisons showed that the distribution of dwell time to the IAs was the same as in the analysis of the effect of Category on dwell time to the IAs.

Pairwise comparisons revealed that the IAs received different viewing patterns across each of the familiarity groups. All of the interactions that were investigated had significant effects on the dwell times to the IAs, with the exception of the interaction between the Low and Middle group in relation to their dwell times of the Lower Legs IA which was not statistically significant. The full results of these pairwise comparisons can be found in Table 6.

Table 6

Pairwise comparisons showing the effects of the interaction across Familiarity categories on the mean dwell time to each Interest Area. Within each comparison, the Familiarity category listed first received the higher mean dwell time.

Interest Area	Categories of Familiarity being compared	Mean Difference	95% Confidence Interval for difference		Significance
			Lower Bound	Upper Bound	
Head	High vs Low	6.32	4.73	7.92	$p < .001$
	High vs Middle	1.77	0.47	3.06	$p = .004$
	Middle vs Low	4.56	3.37	5.39	$p < .001$
Upper Torso	High vs Low	7.95	14.56	20.88	$p < .001$
	High vs Middle	17.72	6.03	9.87	$p < .001$
	Middle vs Low	9.77	8.34	11.20	$p < .001$
Lower Torso	Middle vs High	2.98	-4.56	-1.40	$p < .001$
	Low vs High	8.01	5.89	10.14	$p < .001$
	Low vs Middle	5.03	3.83	6.24	$p < .001$
Upper Legs	Middle vs High	3.73	2.79	4.70	$p < .001$
	Low vs High	11.41	9.49	13.32	$p < .001$
	Low vs Middle	7.68	5.99	9.37	$p < .001$
Lower Legs	Middle vs High	1.24	0.66	1.83	$p < .001$
	Middle vs Low	0.03	-0.59	0.64	$p = 1.000$
	Low vs High	1.22	0.75	1.68	$p < .001$

The interaction between Familiarity and IA on dwell time was significant, F (2.81, 146.02) = 136.45, p < .001, np^2 = .724, indicating a different viewing pattern of the IAs within each of the familiarity categories. All of the comparisons had significant effects on the dwell time to the IAs, with the exception of the interactions between the Head and Upper Legs IAs as well as the Upper Torso and Upper Legs IAs within the Middle Familiarity group, and the Head and Lower Torso IAs within the High familiarity group. The full outcome of these pairwise comparisons can be found in Tables 7, 8 and 9.

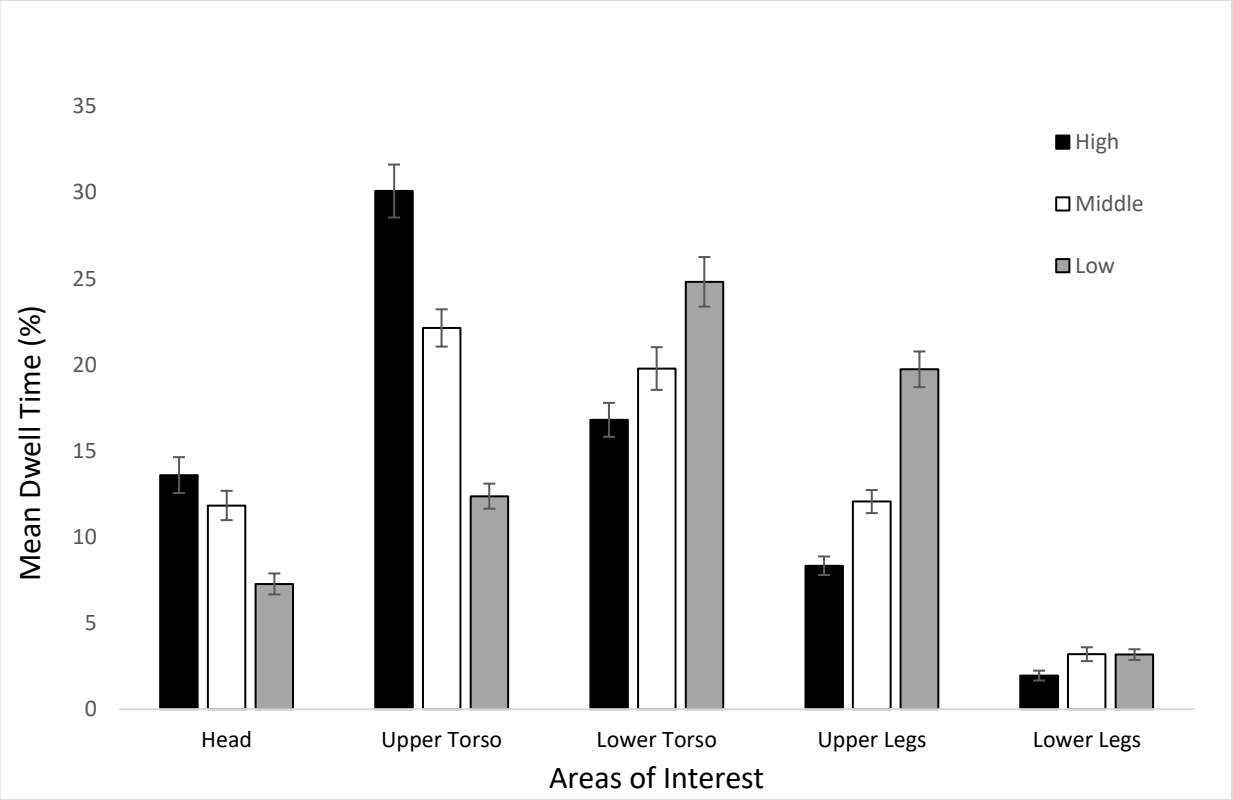


Figure 8: The effect of familiarity on the mean dwell time (%) to the Interest Areas. Error bars represent the standard errors of the means.

Table 7
Pairwise comparisons of the proportion of dwell time that each Interest Area received within the High Familiarity quartile.

Interest Areas interacting with each other		Mean Difference	Std. Error	Significance	95% confidence Interval for Difference	
					Lower Bound	Upper Bound
Head	Upper Torso	-16.50	1.56	.000	-21.08	-11.91
	Lower Torso	-3.21	1.31	.177	-7.05	.63
	Upper Legs	5.26	.99	.000	2.37	8.15
	Lower Legs	11.64	.98	.000	8.77	14.52
Upper Torso	Head	16.50	1.56	.000	11.91	21.08
	Lower Torso	13.29	1.14	.000	9.96	16.62
	Upper Legs	21.76	1.49	.000	17.39	26.132
	Lower Legs	28.14	1.58	.000	23.50	32.78
Lower Torso	Head	3.21	1.31	.177	-.63	7.05
	Upper Torso	-13.29	1.14	.000	-16.62	-9.96
	Upper Legs	8.47	.86	.000	5.95	11.00
	Lower Legs	14.85	.99	.000	11.95	17.75
Upper Legs	Head	-5.26	.99	.000	-8.15	-2.37
	Upper Torso	-21.76	1.49	.000	-26.13	-17.39
	Lower Torso	-8.47	.86	.000	-11.00	-5.95
	Lower Legs	6.38	.50	.000	4.90	7.86
Lower Legs	Head	-11.64	.98	.000	-14.52	-8.77
	Upper Torso	-28.14	1.58	.000	-32.78	-23.50
	Lower Torso	-14.85	.99	.000	-17.75	-11.95
	Upper Legs	-6.38	.50	.000	-7.86	-4.90

Table 8

Pairwise comparisons of the proportion of dwell time that each Interest Area received within the Middle Familiarity quartile.

Interest Areas interacting with each other		Mean Difference	Std. Error	Significance	95% confidence Interval for Difference	
					Lower Bound	Upper Bound
Head	Upper Torso	-10.31	.86	.000	-12.84	-7.78
	Lower Torso	-7.95	1.26	.000	-11.66	-4.25
	Upper Legs	-.23	.81	1.000	-2.61	2.15
	Lower Legs	8.64	.81	.000	6.26	11.01
Upper Torso	Head	10.31	.86	.000	7.78	12.84
	Lower Torso	2.36	.81	.055	-.03	4.74
	Upper Legs	10.08	.95	.000	7.30	12.86
	Lower Legs	18.95	1.12	.000	15.67	22.23
Lower Torso	Head	7.95	1.26	.000	4.25	11.66
	Upper Torso	-2.36	.81	.055	-4.74	.03
	Upper Legs	7.73	1.18	.000	4.26	11.20
	Lower Legs	16.59	1.29	.000	12.80	20.38
Upper Legs	Head	.23	.81	1.000	-2.15	2.61
	Upper Torso	-10.08	.95	.000	-12.86	-7.30
	Lower Torso	-7.73	1.18	.000	-11.20	-4.26
	Lower Legs	8.86	.57	.000	7.20	10.52
Lower Legs	Head	-8.64	.81	.000	-11.01	-6.26
	Upper Torso	-18.95	1.12	.000	-22.23	-15.67
	Lower Torso	-16.59	1.29	.000	-20.38	-12.80
	Upper Legs	-8.86	.57	.000	-10.52	-7.20

Table 9

Pairwise comparisons of the proportion of dwell time that each Interest Area received within the Low Familiarity quartile.

Interest Areas interacting with each other		Mean Difference	Std. Error	Significance	95% confidence Interval for Difference	
					Lower Bound	Upper Bound
Head	Upper Torso	-5.10	.65	.000	-7.00	-3.19
	Lower Torso	-17.54	1.43	.000	-21.74	-13.35
	Upper Legs	-12.47	.96	.000	-15.28	-9.65
	Lower Legs	4.11	.53	.000	2.56	5.65
Upper Torso	Head	5.10	.65	.000	3.19	7.00
	Lower Torso	-12.45	1.31	.000	-16.29	-8.61
	Upper Legs	-7.37	1.03	.000	-10.38	-4.36
	Lower Legs	9.20	.76	.000	6.97	11.43
Lower Torso	Head	17.54	1.43	.000	13.35	21.74
	Upper Torso	12.45	1.31	.000	8.61	16.29
	Upper Legs	5.08	1.02	.000	2.09	8.07
	Lower Legs	21.65	1.46	.000	17.38	25.92
Upper Legs	Head	12.47	.96	.000	9.65	15.28
	Upper Torso	7.37	1.03	.000	4.36	10.38
	Lower Torso	-5.08	1.02	.000	-8.07	-2.09
	Lower Legs	16.57	.93	.000	13.86	19.28
Lower Legs	Head	-4.11	.53	.000	-5.65	-2.56
	Upper Torso	-9.2	.76	.000	-11.43	-6.97
	Lower Torso	-21.65	1.46	.000	-25.92	-17.38
	Upper Legs	-16.57	.93	.000	-19.28	-13.86

8.4. Category First Fixations analysis

A standard repeated measures ANOVA was conducted to compare the effect of Category, on the proportion of first fixations for the Interest Areas. All of the statistics used an alpha level of 0.5. Pairwise comparisons were adjusted using Post Hoc Bonferroni Adjustments.

Mauchly's test of Sphericity indicated that the assumption of sphericity had been violated by all of the variables. The degrees of freedom were corrected using Greenhouse-Geisser and Huynh-Feldt estimates of sphericity where appropriate. The details of these outcomes are described further in Appendix 8.

The main effect of Category was significant, F (1.58, 82.38) = 34.91, p = .007, n_p^2 = .103, indicating a different viewing pattern for each category of sculpture. Pairwise comparisons showed that the Exaggerated category received the greatest proportion of first fixations (M = 19.49, SE = .10), followed by the Non-Exaggerated category (M = 19.21, SE = .16), followed by the Gönnersdorf category (M = 18.83, SE = .22). The main effect of the IA was also significant, F (2.16, 112.54) = 423.87, p < .001, n_p^2 = .891, indicating a difference in the viewing pattern for each of the IAs. Pairwise comparisons showed that the Lower Torso IA received the greatest proportion of first fixations (M = 56.50, SE = 1.55), followed by the Upper Torso IA (M = 26.81, SE = 1.20), followed by the Upper Legs IA (M = 10.09, SE = .97), followed by Head IA (M = 2.19, SE = .63), with the Lower Legs IA receiving the lowest level of first fixations (M = .30, SE = .21).

Pairwise comparisons revealed that the IAs received different viewing patterns across each of the categories. All of the interactions that were investigated had significant effects on the proportion of first fixations received by each IA, with the exception of the interactions relating to the Lower Legs IA as well as the interaction between the Exaggerated and Non-Exaggerated, and Exaggerated vs Gönnersdorf in relation to the Head IA which did not provide statistically different proportions of first fixations,. The details of these pairwise comparisons can be found in Table 10

The interaction between Category and IA was significant, F (2.40, 124.69) = 109.22, p < .001, np^2 = .677, indicating a different viewing pattern of the IAs between the categories. All of the interactions that were investigated had significant effects on the first fixations to the IAs, with the exception of the interactions between the Head and Lower Legs IAs within both the Exaggerated and Gönnersdorf categories, as well as the Head and Upper Legs IAs, and Upper Torso and Lower Torso IAs within the Exaggerated category which were not statistically significant. The full outcome of these pairwise comparisons can be found in Tables 11, 12 and 13.

Table 10

Pairwise comparisons showing the effects of the interaction across Category groups on the first fixations gained by each Interest Area. Within each comparison, the Category listed first received the higher proportion of first fixations.

Interest Area	Categories of stimuli being compared	Mean Difference	95% Confidence Interval for difference		Significance
			Lower Bound	Upper Bound	
Head	Non-Exaggerated vs Gönnersdorf	2.41	0.15	4.66	$p = .033$
	Non-Exaggerated vs Exaggerated	0.80	-0.68	2.28	$p = .562$
	Exaggerated vs Gönnersdorf	1.60	-0.52	3.73	$p = .202$
Upper Torso	Non-Exaggerated vs Gönnersdorf	21.63	18.19	25.07	$p < .001$
	Exaggerated vs Non-Exaggerated	19.14	16.34	21.95	$p < .001$
	Exaggerated vs Gönnersdorf	40.77	36.61	44.93	$p < .001$
Lower Torso	Non-Exaggerated vs Exaggerated	11.81	7.90	15.72	$p < .001$
	Gönnersdorf vs Non-Exaggerated	7.62	1.03	14.21	$p = .018$
	Gönnersdorf vs Exaggerated	19.43	12.28	26.58	$p < .001$
Upper Legs	Non-Exaggerated vs Exaggerated	5.26	3.45	7.06	$p < .001$
	Gönnersdorf vs Non-Exaggerated	14.15	9.67	18.63	$p < .001$
	Gönnersdorf vs Exaggerated	19.40	14.46	24.34	$p < .001$
Lower Legs	Exaggerated vs Non-Exaggerated	0.09	-0.33	0.50	$p = 1.000$
	Gönnersdorf vs Non-Exaggerated	0.37	-0.75	1.48	$p = 1.000$
	Gönnersdorf vs Exaggerated	0.28	-1.07	1.63	$p = 1.000$

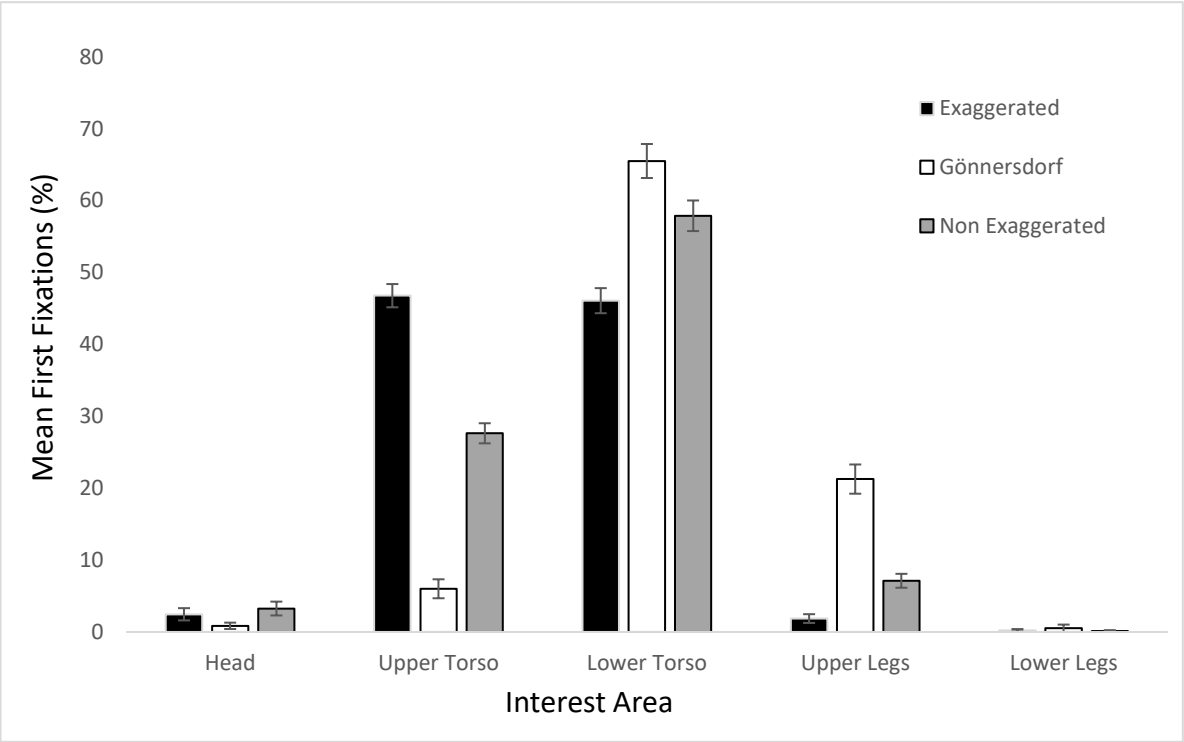


Figure 9: Mean first fixations (%) to IAs dependant on stimuli category. Error bars represent the standard errors of the means.

Table 11

Pairwise comparisons of the proportion of first fixations that each Interest Area received within the Exaggerated category

Interest Areas interacting with each other		Mean Difference	Std. Error	Significance	95% confidence Interval for Difference	
					Lower Bound	Upper Bound
Head	Upper Torso	-44.32	1.90	.000	-49.89	-38.75
	Lower Torso	-43.62	2.35	.000	-50.52	-36.73
	Upper Legs	.60	.86	1.000	-1.92	3.11
	Lower Legs	2.23	.87	.130	-.31	4.77
Upper Torso	Head	44.32	1.90	.000	38.75	49.89
	Lower Torso	.70	2.97	1.000	-8.01	9.40
	Upper Legs	44.92	2.01	.000	39.03	50.81
	Lower Legs	46.55	1.68	.000	41.62	51.48
Lower Torso	Head	43.62	2.35	.000	36.73	50.52
	Upper Torso	-.70	2.97	1.000	-9.40	8.01
	Upper Legs	44.22	1.99	.000	38.38	50.06
	Lower Legs	45.85	1.78	.000	40.64	51.07
Upper Legs	Head	-.60	.86	1.000	-3.11	1.92
	Upper Torso	-44.92	2.01	.000	-50.81	-39.03
	Lower Torso	-44.22	1.99	.000	-50.06	-38.38
	Lower Legs	1.63	.50	.018	.18	3.09
Lower Legs	Head	-2.23	.87	.130	-4.77	.31
	Upper Torso	-46.55	1.68	.000	-51.48	-41.62
	Lower Torso	-45.85	1.78	.000	-51.07	-40.64
	Upper Legs	-1.63	.50	.018	-3.09	-.18

Table 12

Pairwise comparisons of the proportion of first fixations that each Interest Area received within the Gönnersdorf category

Interest Areas interacting with each other		Mean Difference	Std. Error	Significance	95% confidence Interval for Difference	
					Lower Bound	Upper Bound
Head	Upper Torso	-5.15	1.33	.003	-9.06	-1.24
	Lower Torso	-64.66	2.54	.000	-72.11	-57.21
	Upper Legs	-20.41	2.11	.000	-26.58	-14.24
	Lower Legs	.34	.69	1.000	-1.68	2.37
Upper Torso	Head	5.153	1.33	.003	1.24	9.06
	Lower Torso	-59.51	2.97	.000	-68.21	-50.80
	Upper Legs	-15.26	2.80	.000	-23.48	-7.04
	Lower Legs	5.50	1.46	.004	1.22	9.77
Lower Torso	Head	64.66	2.54	.000	57.21	72.11
	Upper Torso	59.51	2.97	.000	50.80	68.21
	Upper Legs	44.25	3.96	.000	32.65	55.85
	Lower Legs	65.00	2.57	.000	57.46	72.55
Upper Legs	Head	20.41	2.11	.000	14.24	26.58
	Upper Torso	15.26	2.80	.000	7.04	23.48
	Lower Torso	-44.25	3.96	.000	-55.85	-32.65
	Lower Legs	20.76	2.07	.000	14.69	26.82
Lower Legs	Head	-.34	.69	1.000	-2.37	1.68
	Upper Torso	-5.50	1.46	.004	-9.77	-1.22
	Lower Torso	-65.00	2.57	.000	-72.55	-57.46
	Upper Legs	-20.76	2.07	.000	-26.82	-14.69

Table 13

Pairwise comparisons of the proportion of first fixations that each Interest Area received within the Non-Exaggerated category.

Interest Areas interacting with each other		Mean Difference	Std. Error	Significance	95% confidence Interval for Difference	
					Lower Bound	Upper Bound
Head	Upper Torso	-24.38	1.54	.000	-28.90	-19.85
	Lower Torso	-54.63	2.95	.000	-63.27	-45.99
	Upper Legs	-3.86	1.16	.016	-7.27	-.45
	Lower Legs	3.12	.95	.018	.35	5.89
Upper Torso	Head	24.38	1.54	.000	19.85	28.90
	Lower Torso	-30.26	2.96	.000	-38.92	-21.59
	Upper Legs	20.52	2.10	.000	14.35	26.68
	Lower Legs	27.49	1.43	.000	23.30	31.68
Lower Torso	Head	54.63	2.95	.000	45.99	63.27
	Upper Torso	30.26	2.96	.000	21.59	38.92
	Upper Legs	50.77	2.65	.000	43.00	58.55
	Lower Legs	57.75	2.17	.000	51.39	64.11
Upper Legs	Head	3.86	1.16	.016	.45	7.27
	Upper Torso	-20.52	2.10	.000	-26.68	-14.35
	Lower Torso	-50.77	2.65	.000	-58.55	-43.00
	Lower Legs	6.97	.92	.000	4.27	9.68
Lower Legs	Head	-3.12	.95	.018	-5.89	-.35
	Upper Torso	-27.49	1.43	.000	-31.68	-23.30
	Lower Torso	-57.75	2.17	.000	-64.11	-51.39
	Upper Legs	-6.97	.92	.000	-9.68	-4.27

8.4. Familiarity First Fixations analysis

A standard repeated measures ANOVA was conducted to compare the effect of Familiarity, on the proportion of first fixations for the Interest Areas. All of the statistics used an alpha level of 0.5. Pairwise comparisons were adjusted using Post Hoc Bonferroni Adjustments.

Mauchly's test of Sphericity indicated that the assumption of sphericity had been violated by all of the variables. The degrees of freedom were corrected using

Greenhouse-Geisser and Huynh-Feldt estimates of sphericity where appropriate. The details of these outcomes are described further in Appendix 8.

The main effect of Familiarity was significant, F (1.76, 91.44) = 5.49, p = .005, n_p^2 = .196, indicating a different viewing pattern for each Familiarity quartile. Pairwise comparisons showed that the High familiarity group received the greatest proportion of first fixations (M = 19.53, SE = .11), followed by the Middle familiarity group (M = 19.23, SE = .13), followed by the Low familiarity group (M = 19.01, SE = .20). The main effect of the IA was also significant, F (2.12, 110.41) = 405.83, p < .001, n_p^2 = .886, indicating a difference in the viewing pattern for each of the IAs. Pairwise comparisons showed that the Lower Torso IA received the greatest proportion of first fixations (M = 53.26, SE = 1.54), followed by the Upper Torso IA (M = 32.07, SE = 1.25), followed by the Upper Legs IA (M = 8.32, SE = .87), followed by Head IA (M = 2.37, SE = .70), with the Lower Legs IA receiving the lowest level of first fixations (M = .26, SE = .16).

Pairwise comparisons revealed that the IAs received different viewing patterns across each of the Familiarity groups. All of the interactions that were investigated had significant effects on the proportion of first fixations received by each IA, with the exception of all the interactions relating to the Head IA as well as all of the interactions in relation to the Lower Legs IA which did not provide statistically different proportions of first fixations,. The details of these pairwise comparisons can be found in Table 14.

The interaction between Familiarity and IA was significant, F (2.40, 124.69) = 109.22, p < .001, np^2 = .677, indicating a different viewing pattern of the IAs between the categories. All of the interactions that were investigated had significant effects on the first fixations to the IAs, with the exception of the interactions between the Head and Lower Legs IAs within both the Low and Middle quartiles, as well as the Head and Upper Legs IAs within the High and Middle quartiles, and Upper Torso and Lower Torso IAs within the High quartile which were not statistically significant. The full outcome of these pairwise comparisons can be found in Tables 15, 16 and 17.

Table 14

Pairwise comparisons showing the effects of the interaction across Familiarity quartiles on the first fixations gained by each Interest Area. Within each comparison, the Familiarity group listed first received the higher proportion of first fixations

Interest Area	Familarity quartiles being compared	Mean Difference	95% Confidence Interval for difference		Significance
			Lower Bound	Upper Bound	
Head	High vs Low	0.93	-0.31	2.17	$p = .209$
	Middle vs Low	1.75	-0.34	3.85	$p = .131$
	Middle vs High	0.8	-0.87	2.52	$p = .710$
Upper Torso	High vs Low	56.01	51.19	60.85	$p < .000$
	High vs Middle	33.42	29.17	37.67	$p < .000$
	Middle vs Low	22.60	18.71	26.48	$p < .000$
Lower Torso	Low vs High	37.78	31.07	44.49	$p < .000$
	Low vs Middle	9.59	3.68	15.49	$p = .001$
	Middle vs High	28.19	24.00	32.43	$p < .000$
Upper Legs	Low vs High	16.48	12.28	20.67	$p < .000$
	Low vs Middle	13.50	9.45	17.56	$p < .000$
	Middle vs High	2.97	1.68	4.27	$p < .000$
Lower Legs	Low vs High	0.11	-0.87	1.09	$p = 1.000$
	Low vs Middle	0.16	-0.60	0.92	$p = 1.000$
	High vs Middle	0.05	-0.20	0.30	$p = 1.000$

Table 15

Pairwise comparisons of the proportion of first fixations that each Interest Area received within the Low Familiarity quartile

Interest Areas interacting with each other		Mean Difference	Std. Error	Significance	95% confidence Interval for Difference	
					Lower Bound	Upper Bound
Head	Upper Torso	-4.39	1.25	.009	-8.07	-.72
	Lower Torso	-67.57	2.79	.000	-75.75	-59.39
	Upper Legs	-16.85	1.92	.000	-22.47	-11.22
	Lower Legs	1.12	.65	.910	-.79	3.02
Upper Torso	Head	4.39	1.25	.009	.72	8.07
	Lower Torso	-63.18	3.11	.000	-72.29	-54.07
	Upper Legs	-12.45	2.62	.000	-20.14	-4.77
	Lower Legs	5.51	1.41	.003	1.38	9.65
Lower Torso	Head	67.57	2.79	.000	59.39	75.75
	Upper Torso	63.18	3.11	.000	54.07	72.29
	Upper Legs	50.73	3.58	.000	40.22	61.23
	Lower Legs	68.69	2.53	.000	61.28	76.10
Upper Legs	Head	16.85	1.92	.000	11.22	22.47
	Upper Torso	12.45	2.62	.000	4.77	20.14
	Lower Torso	-50.73	3.58	.000	-61.23	-40.22
	Lower Legs	17.96	1.78	.000	12.75	23.18
Lower Legs	Head	-1.12	.65	.910	-3.02	.79
	Upper Torso	-5.51	1.41	.003	-9.65	-1.38
	Lower Torso	-68.69	2.52	.000	-76.10	-61.28
	Upper Legs	-17.96	1.78	.000	-23.18	-12.75

Table 16

Pairwise comparisons of the proportion of first fixations that each Interest Area received within the High Familiarity quartile

Interest Areas interacting with each other		Mean Difference	Std. Error	Significance	95% confidence Interval for Difference	
					Lower Bound	Upper Bound
Head	Upper Torso	-59.47	2.21	.000	-65.96	-52.99
	Lower Torso	-28.86	1.82	.000	-34.19	-23.53
	Upper Legs	.56	.70	1.000	-1.48	2.60
	Lower Legs	2.16	.66	.019	.22	4.10
Upper Torso	Head	59.47	2.21	.000	52.99	65.96
	Lower Torso	30.61	3.01	.000	21.79	39.44
	Upper Legs	60.04	2.42	.000	52.96	67.12
	Lower Legs	61.63	1.98	.000	55.82	67.45
Lower Torso	Head	28.86	1.82	.000	23.53	34.19
	Upper Torso	-30.61	3.01	.000	-39.44	-21.79
	Upper Legs	29.43	1.62	.000	24.67	34.18
	Lower Legs	31.02	1.49	.000	26.64	35.40
Upper Legs	Head	-.56	.70	1.000	-2.60	1.48
	Upper Torso	-60.04	2.42	.000	-67.12	-52.96
	Lower Torso	-29.43	1.62	.000	-34.18	-24.67
	Lower Legs	1.60	.55	.051	-.00	3.20
Lower Legs	Head	-2.16	.66	.019	-4.10	-.22
	Upper Torso	-61.63	1.98	.000	-67.45	-55.82
	Lower Torso	-31.02	1.49	.000	-35.40	-26.64
	Upper Legs	-1.60	.55	.051	-3.20	.00

Table 17

Pairwise comparisons of the proportion of first fixations that each Interest Area received within the Middle Familiarity quartile

Interest Areas interacting with each other		Mean Difference	Std. Error	Significance	95% confidence Interval for Difference	
					Lower Bound	Upper Bound
Head	Upper Torso	-25.23	1.84	.000	-30.63	-19.84
	Lower Torso	-56.23	3.02	.000	-65.07	-47.39
	Upper Legs	-1.59	1.13	1.000	-4.91	1.74
	Lower Legs	3.03	1.06	.060	-.07	6.13
Upper Torso	Head	25.23	1.84	.000	19.84	30.63
	Lower Torso	-31.00	3.21	.000	-40.40	-21.60
	Upper Legs	23.65	2.04	.000	17.67	29.62
	Lower Legs	28.26	1.58	.000	23.63	32.90
Lower Torso	Head	56.23	3.02	.000	47.39	65.07
	Upper Torso	31.00	3.21	.000	21.60	40.40
	Upper Legs	54.64	2.55	.000	47.18	62.11
	Lower Legs	59.26	2.19	.000	52.85	65.68
Upper Legs	Head	1.59	1.13	1.000	-1.74	4.91
	Upper Torso	-23.65	2.04	.000	-29.62	-17.67
	Lower Torso	-54.64	2.55	.000	-62.11	-47.18
	Lower Legs	4.62	.73	.000	2.48	6.76
Lower Legs	Head	-3.03	1.06	.060	-6.13	.07
	Upper Torso	-28.26	1.58	.000	-32.90	-23.63
	Lower Torso	-59.26	2.19	.000	-65.68	-52.85
	Upper Legs	-4.62	.73	.000	-6.76	-2.48

9. Discussion

The current study shows that there are differences in the overall observation of the Interest Areas. These results further show that the IAs are interacted with in different ways between the categories of sculptures, supporting the notion of subgrouping these figurines. These findings also indicate that the degree of familiarity with the sculptures possessed by the participant has a significant effect

on the viewing pattern received by the IAs. The nature of the differences in viewing pattern as revealed by the eye tracking study will now be discussed as will their impact upon the archaeological understanding of these female representations.

9.1. The effects of category

9.1.1 Visual attention to the IAs without Category

When Category is not applied as a variable, the dwell time proportions received by each of the IAs revealed significant differences. Visual attention was focused predominantly on the Lower Torso and Upper Torso IAs, with the Upper Legs IA also gaining a high proportion of visual interest. Whilst the lowest dwell times were allocated to the Head and Lower Legs IAs. Although the dwell time to the Upper Legs IA was high, the prominent dwell time to the torso of the figurines suggest that these regions were more important. As the sexual characteristics required to support ideas revolving around sexual attraction to the figurines are contained within the Upper Torso and Upper Legs IAs, a lack of interest in the latter of these areas indicates an inaccuracy within these theories of function, at least when this purpose is applied to all of the sculptures.

It is not unexpected for the Lower Legs IA to have received the lowest dwell time; after all, across all of the sculptures these areas have the least detail. The decision to taper the legs off rather than depict feet and other details already suggests the unimportance of this bodily region. This area of the sculptures does not commonly play a central role within evidencing the potential theories that have been suggested in the past. However, one result which is more surprising is the distinct lack of attention paid to the heads of these sculptures. This collection of figurines evoked far less focus to this region than to the Upper Legs and both Torso IAs. Previous eye tracking investigations into the perception of human bodies indicates that the head, and particularly the face, gain substantial visual attention (Gervais, Holland & Dodd, 2013). The difference in viewing pattern received by these figurines compared to the standard approach to observing female bodies alludes to the importance of the abstraction they employ. These sculptures are designed in a manner that distracts attention away from this normal approach to perceiving the female form, suggesting that their deviations

from realism played a significant role within their function. Immediately this counters Koenigswald's justification for the deified nature of their subject matter (1972). The belief that the stylistic details of the faces were used to symbolize their supernatural nature does not work as the heads are deemed insignificant by those viewing the figurines. If their heads played a pivotal role in both their form and function, this research suggests that this region would acquire the highest level of attention.

The largest proportion of dwell time being received by the Lower Torso IA brings further pre-existing theories into dispute when Category is not considered as an influence. Not only does this IA not contain any of the sexual characteristics that warranted the creation of androcentric theories relating to a sexual or erotic nature within their function (Absolon, 1949; Collins & Onians, 1978). Rice's belief in their role as representing of womanhood is not supported by this finding (1981). If these sculptures are focused on signifying the importance of one gender over another, it would be expected that the physical characteristics unique to that gender would be the most important areas within the sculptures. An emphasis on the Lower Torso IA, which usually does not depict noticeably pregnant stomachs, fails to highlight the femininity of these works of art from an outwards perspective.

However, an interest in the stomachs of these sculptures does align with the view that they acted as symbols of fertility, either in a ritualistic manner or as practical obstetrical aids (McCoid & McDermott, 1996). Despite the Rice's findings that the majority of the sculptures do not appear pregnant (1981), it would appear that the midriff is highly important regardless of its specific morphological properties. Whilst the ability of the stomach to draw individuals' attention could relate to a fertility function, there is no definitive data to support this when all of the sculptures are viewed as one whole. Theories which attribute to these figurines a use which is sexual nature are strongly opposed by this distribution of attention.

As these results do not offer robust support to the major theories relating to the function of these representations that have been suggested in past, they complement the notion put forward earlier in this work that these theories are all inherently flawed due to their inclusion of such a variety of the stylistic forms. The only way to overcome this universal limitation is to acknowledge the significance of the stylistic variations presented within this artistic tradition.

9.1.2. The effect of IA across the categories

When the morphological differences within the overall collection of Upper Palaeolithic female sculptures are taken into account, the evidence for subgrouping these figurines becomes apparent. The analysis of the viewing patterns received by each IA across the categories reveals significant differences within the visual response that they gain. The Head IA received a significantly greater proportion of dwell time within the Non-Exaggerated category than the Exaggerated and Gönnersdorf categories. Whereas, the higher Upper Torso IA dwell time in the Exaggerated category indicated a significant difference when compared to the Non-Exaggerated and Gönnersdorf categories. Conversely, the Gönnersdorf category received the largest proportion of dwell time to both the Lower Torso and Upper Legs IAs. The only overall distributional differences in dwell time to the IAs which did not reveal significant differences across the categories were those of the Lower Legs IA.

These results indicate that each of the categories have been visually interacted with in different ways. As mentioned earlier in this research, variations in viewing patterns reveal differences in the relative importance of each IA towards the function of the stimuli. Therefore, as each of the IAs show different importance relative to the categories of imagery, it is suggested that each category was interacted with differently, thereby having different functions. In order for the potential differing functions of these categories to be understood fully, the relative attention to the IAs must be studied within each group of imagery separately. As the eye tracking data has revealed the categories put forward within this research to be true, these representations can now be reassessed with consideration their varied forms. This allows for the pre-existing theories that have been applied to this material to be reviewed again.

9.1.3. The effect of the Exaggerated Category

Within the Exaggerated category, the viewing pattern reveals that the levels of attention attributed to each of the IAs were of a statistically significant difference. In terms of proportionate dwell time, the Upper Torso IA received the greatest attention by far. Although gaining much less attention than the Upper Torso IA,

the Lower Torso IA received a substantially proportion of dwell time than the other IAs. This reveals that the Upper Torso IA had the highest impact upon the visual interaction with these sculptures, though the Lower Torso IA also played a pivotal role within this interaction. These results suggest that the function of this group of figurines relied heavily upon both of these areas. Dwell time to the Head IA was significantly greater than the attention to the lower body IAs, although the proportion of attention to the Upper Legs IA was much closer to that of the Head IA than it was to the Lower Legs IA, which received substantially less attention than the other IAs.

The distribution of first fixations received by each IA within the Exaggerated category reveals further differences within the viewing pattern. The Upper Torso and Lower Torso IAs both received just under half of the total first fixations, as they received such similar proportions of this attention the difference between their perception was not statistically significant. However, their viewing was significantly higher than that of the other IAs. The Head, Upper Legs and Lower Legs IAs all received very low proportions of first fixations. These proportions were highly similar to each other, although the difference between the Lower and Upper Legs IAs was significant, the Head IA did not have statistically significant differences from either of the Leg IAs. The distribution of first fixations amongst the IAs further emphasises the importance of the Upper Torso and Lower Torso IAs as was indicated by the proportions of dwell time to these regions. It is therefore clear from these results that the function of this category of female representations gained importance from both of these areas.

The viewing patterns received by the Exaggerated category of sculptures have significant impacts upon the interpretation of these works of art. The focus drawn by the Upper Torso IA is likely due to the considerable prominence of the breasts amongst the features of these figurines. The suggestion that these specific sexual characteristics were essential to the function of these artefacts would indicate that androcentric theories regarding attraction hold more weight with these sculptures than they do with the collection of figurines as a whole. Theories revolving around the sexual nature of these representations, such as those suggested by Absolon (1949), Collins and Onians (1978) and Guthrie (2005), are however disputed by the viewing pattern received by the Upper Legs IA. As this IA contains the pubic region, a key sexual characteristic, the relative disinterest

in this area does not support the view that the creation of these figurines was driven largely by the libido of the artists and users of these items. This indicates that the high degree of attention to the breasts is the result of more than just sexual attraction.

The implication that these sculptures are not perceived in a purely sexual manner is complemented by the attention gained by the Lower Torso IA. The combined interest in both the breasts and midriffs of these figurines presents a view of their function outside of the proposition of their attractiveness. Here it is suggested that the perceived importance of these two bodily regions mirrors the idea that the function of these sculptures was linked to the topic of fertility. This suggestion is born from the fact that during pregnancy, it is these areas that are subjected to the greatest morphological changes. This theory is furthered by the essential role that breasts play in feeding babies. As shown by Rice (1981), it is within this Exaggerated category of figurines that the pregnant representations are found, lending further support to this notion. Although Rice's (1981) observation that there are visibly pregnant sculptures within this material collection, she also states that not all of the figurines possess enlarged stomachs that indicate pregnancy. Therefore, it appears that these sculptures depict women in an array of stages within the process of pregnancy, with those which were not deemed clearly to show pregnant women representing women in an early stage of this process where their breasts have grown but their child has not developed to the point of being externally evident.

The suggestion that these figurines aided Palaeolithic societies in the realm of reproduction is well supported by the results of this study, what is not clear is the exact nature of this function. They could have served a practical function as obstetrical aids as suggested by McCoid and McDermott (1996), or their function could have held a more ritualistic significance. The lack of facial features offers some support to the belief that these figurines acted as a form of magical fertility symbol. Whilst visual focus on the heads is not high enough to support fully Koenigswald's view on its symbolism of the supernatural (1972), these sculptures could have used this lack of facial features as a subtle indicator of a spiritual nature to complement an overpowering focus on the pregnant characteristics.

Whilst the notion of a pan-European monotheistic religion as proposed by the Mother Goddess theory is still highly unlikely due to both the extensive network

of interaction it requires and the presence of male imagery within the archaeological record, the visual processing of these images appears to support the notion that these sculptures were used to aid Palaeolithic populations with issues relating to fertility. Whether this function took a practical or spiritual form remains open to debate.

On the other hand, it is possible that the Upper Torso IA received the greatest dwell within the Exaggerated category not because of the sexual connotations attached to the breasts, but rather due solely to their size relative to the features within the other IAs. The saliency of features within has been said to have a direct effect upon the visual attention that they receive (Itti & Koch, 2000). This would suggest that the dwell time received by the Upper Torso IA is the result of the large portion of the stimuli that the breasts occupy. It has been suggested that contrasts act as the biggest factor effecting visual saliency, as such, alongside the size of the breasts, the shadows cast by them further promoted their saliency (Chen & Zhang, 2016; Reynolds & Desimone, 2003).

Whilst the effect of saliency has proven to be a fruitful route for visual research to follow, it is less applicable when studying these Palaeolithic female representations. The argument that visual saliency raises is whether attention is the result of a bottom-up approach based upon sensory cues, or a top-down approach in which context plays a large role within visual processing. Whilst there is also evidence that attention is deployed through a combination of both types of processing (Hikosaka, Miyauchi & Shimojo, 1996; Itti & Koch, 2000; Treisman & Gelade, 1980), an argument can be made that the method of processing the Upper Palaeolithic sculptures is not of great impact to the understanding of this archaeological material. As has already been suggested in this work, if a top-down approach is responsible for the proportion of attention gained by the Upper Torso IA then the breasts can be assumed to have played a significant role within the function of these sculptures. However, on the surface a bottom-up visual approach would seem to suggest that the breasts are unimportant within the function of these figurines and only gain attention due to their size.

This view does not take into account the fact that these images were formed by deliberate human action. The time and difficulty involved in the creation of these works of art is indicative of the skill of the artists who made them. This skill, alongside the presence of a whole category of sculptures with these exaggerated

features, shows the intentionality of the large breasts. Their saliency can therefore be seen as a conscious action to attract attention. Thus a bottom-up visual approach to processing these images is reliant on the artists' choosing to direct the viewer's gaze on to the breasts as an active part of the function of these figurines in the same way as can be said for a top-down system of visual processing. This is not to say that the artists' possessed knowledge of the mechanisms that drive visual perception, instead that they knew enlarging the breasts would enhance their prominence within the sculptures. Regardless of which type of visual processing is applied to the high proportion of dwell time gained by the Upper Torso IA, the result is always that the breasts played a pivotal role within the purpose of these figurines.

The distribution of first fixations amongst the IAs could also be the result of the differing levels of visual saliency that these areas have. However, as the high visual saliency of the Upper Torso IA is a direct product of the deliberate design decisions made by the artists', the relative saliency of the IAs can be seen as a premeditated attempt to attract attention to them. As such, the visual saliency of the breasts is indicative of their importance within the function of these figurines.

The relatively high proportion of first fixations to the Lower Torso IA brings further dispute against a bottom-up mechanism driving this effect, as the Lower Torso IA is not as visually salient as the Upper Torso IA. Therefore, due to both the high proportion of fixations to the Lower Torso IA as well as the relationship between the first fixations and dwell time to each IA, a top-down visual process is more likely to have driven the distribution of first fixations.

Overall, the viewing pattern received by the Exaggerated category of sculptures has been shown to have significant ramifications for the interpretations of these figurines. It is clear that regardless of whether a top-down or bottom-up approach towards the visual processing of these items drives there observation, the breasts and midriff of these figures were highly important to their function. Therefore, their role within Upper Palaeolithic society appears to revolve around the notion of fertility and reproduction.

9.1.4. The effect of the Gönnersdorf Category

The pattern for viewing the IAs within the Gönnersdorf category of sculptures also revealed statistically significant differences in attention. In terms of the proportionate dwell time received by each IA, the Upper Legs and Lower Torso IAs received the greatest focus. The distribution of dwell time to these regions was highly similar resulting in no significant difference in the visual attention between them. The Upper Torso IA received the next highest proportion of dwell time, this attention was substantially less than the Lower Torso and Upper Legs IAs, as well as being far greater than the dwell time gained by the Lower Legs and Head IAs. As the Upper Legs and Lower Torso IAs had such a great impact upon the viewing pattern of these sculptures, these results indicate that the function of these figurines was heavily reliant upon both of these areas.

The analysis of the distribution of first fixations amongst the IAs within the Gönnersdorf category further revealed the differences within the viewing pattern received by these sculptures. The Lower Torso IA received two thirds of the overall first fixations, followed by the Upper Legs IA which, despite gaining substantially more first fixations than the other IAs, had a far lower proportion of this attention than the Lower Torso IA. The Upper Torso IA received few first fixations but this was still greater than the Head and Lower Legs IAs. These IAs both gained very low proportions of first fixations and the distribution of attention between these two areas did not reveal a statistically significant difference. The pattern of first fixations complements the conclusion of the dwell time analysis that both the Lower Torso and Upper Legs IAs represent areas of the figurines which were of great importance to their function.

The findings of this analysis into the viewing patterns received by the IAs within the Gönnersdorf category offer an insight into the ways in which these sculptures were interacted with during the Palaeolithic. The attentional similarity between the Upper Legs and Lower Torso IAs suggests that these IAs worked together to significantly impact the function of these sculptures. Thus theories regarding the purpose of these figurines must focus around the role of the Upper Legs and Lower Torso areas of the sculptures.

As theories revolving around the function of Palaeolithic figurines being related to attractiveness focus on the prominence of the breasts, these sculptures clearly do not fit under this explanation. The lack of attention gained by the Upper Torso

IA also disputes the idea of these figurines functioning in relation to fertility and reproduction. The low level of interest for the Head IA contradicts Koenigswald's idea that a lack of facial features could be used to imply a deified nature (1972). A focus on just the Lower Torso and Upper Legs IAs is also unsupportive of the belief that they represent womanhood as a whole as suggested by Rice (1981), if this was the case then surely the entirety of their bodies would be deemed important.

The strict adherence to a set method of abstraction presented by the artists who created these figurines removes the possibility for individuality to be shown, therefore it appears that they were uniform symbols, probably linked to a portrayal of information that required an adherence to a set guide on stylistic form. Within the pre-existing literature, two theories cater for this form of function, the idea of a uniform religion and Gamble's belief in tribal alliances and information exchange (1982). However, whilst the uniform style is in keeping with the idea of the representation of a shared deity, as suggested within the mother goddess theory, the lack of interest in the Upper Torso IA does not suggest that these were used to aid in fertility.

Gamble's theory fits in with the standardized means of abstracting these images, and is supported by the viewing pattern gained by the sculptures but only as his theory does not suggest in what way they were interacted with (1982). As Lindfors has shown (1996), images do not have to portray their subject matter with a complete sense of realism in order to convey information. This could account for the subtle changes in form exhibited by the Gönnersdorf figurines. The exact nature of the information that these sculptures could have been used to convey is not apparent from this study. These results indicate that this message is unlikely to relate to topics of attraction, fertility or womanhood, but have no guidance towards what this information may have been.

Due to the highly stylized nature of these figurines it is not surprising that the Lower Torso and Upper Legs IAs gained the greatest attention. In most of the stimuli used to represent this category of figurines, the Upper Legs and Lower Torso feature the only protrusion from an otherwise rod-like form. This is in keeping with a bottom-up form of visual processing, however, this approach to perceiving the Gönnersdorf style figurines suffers from the same limitations as the Exaggerated category. Though the visual saliency of the Upper Legs and

Lower Torso IAs is likely to have been responsible for the proportion of dwell time and first fixations they each received, the deliberate crafting of this saliency suggests an intention for these areas to be focused upon. Therefore, the attention to these IAs appears to be the result of both a bottom-up attraction to the saliency of these features, as well as an expression by the artist of a top-down interest in the connotations held by these regions.

Overall, the viewing pattern received by the Gönnersdorf category of figurines has allowed for the pre-existing theories regarding their function to be reassessed. It is clear that these sculptures derived much of their purpose form the region extending over the Lower Torso and Upper Legs IAs. This suggests that of the interpretations of their use proposed in the past, those relating to the communication and information exchange between Palaeolithic populations carry the most strength.

9.1.5. The effect of the Non-Exaggerated Category

Within the Non-Exaggerated category, the pattern of viewing received by the IAs reveals that the interaction with these sculptures had statistically significant differences. In regards to the distribution of dwell time amongst the IAs, the Upper Torso IA received the most attention, followed closely by the Lower Torso IA. Unlike within the other categories, the proportion of dwell time to these IAs is not far greater than that of the Head and Upper Legs IAs. The Head IA received a highly similar proportion of dwell time to the Upper Legs IA, resulting in there being no statistically significant difference between the two. This dwell time received by the Head IA was proportionately greater than was found in either of the other categories. As has been the case for all of the categories, the Lower Legs IA received very little dwell time. What is most striking about this category is that, with the exception of the Lower Legs IA, the proportions of dwell time received by each IA is much more evenly distributed compared to the Exaggerated and Gönnersdorf categories.

In contrast to this distribution of dwell time, the relative proportion of first fixations received by each IA does not indicate the same pattern of viewing. The Lower Torso IA received over half of the total first fixations, whilst the second highest proportion of first fixations belonged to the Upper Torso IA which received less than half of that amount. The Upper Legs and Head IAs both received low

proportions of first fixations, with the Lower Legs IA gaining very few first fixations. These results indicate that the Lower Torso IA had a greater impact upon the way that these figurines are interacted with than the other IAs. This suggests that this region was more important to the function of these sculptures than the other IAs.

The results of this study reveal that the Non-Exaggerated figurines are interacted with in a very different way to the other two categories. Not only did this category receive the most even distribution of dwell time across the IAs, unlike the other categories the first fixations did not mirror the proportions of dwell time. This suggests that whilst the function of the sculptures within this category relies on a much broader use of the IAs, the Lower Torso IA played a significant role within their use.

The importance of the Lower Torso IA is not readily explained within the literature. As this research project is unique in its approach towards the study of these figurines, there are no pre-existing theories which hold the midriff as such a focal point within Upper Palaeolithic female representations. An interest in this region could lend support to theories regarding fertility, reproduction and attraction such as those suggested by Absolon (1949), Collins and Onians (1978) and Guthrie (2005). However, as the breasts do not gain substantial importance within the interaction with these sculptures, these theories are brought into dispute when applied to these figurines.

Further theories are challenged by the broad viewing pattern of the IAs within this category. Ideas relating to monotheistic practises, as suggested by Baring and Cashford (1991), Carmody (1981), and Markale (1999), are also disputed as this pattern of attention does not align with the notion of a ‘mother goddess’. Despite having a higher proportionate dwell time to the Head IA than the other two categories, Koenigswald’s theory of deification is not supported due to the presence of facial features amongst many of the sculptures (1972).

Considering that these sculptures are designed to be interacted with in a manner that takes all of their features into account, it is most likely that they are either symbols of womanhood as suggested by Rice (1981), or signifiers of individuality. The distribution of attention prompted by these sculptures suggests that, out of all three categories, they aim to portray the most accurate image of the female form as a whole. The attentional overview of the sculptures may echo a

Palaeolithic interest in portraying not just an accurate image of a woman, but also a sense of her individuality; a thought that is furthered by the presence of clothing on many of these figurines.

This realism could relate to Gamble's (1982) theory of interaction across exchange networks. Perhaps the message that they conveyed between societies required a greater realism than is exhibited by the other sculptures. It is not clear what this message may have been from this eye tracking study, Gamble suggests that the networks of alliance put forward in his research were likely to have been upheld through inter-marriage ties. These sculptures could convey information relating to this; however the expression of identity within these figurines makes the Gönnersdorf figurines more likely to have fulfilled this function. It is unlikely that both categories of sculptures held the same function as the differences in the visual processing of them inhibits this. Though they both could have functioned as exchangers of information, with their differences resulting from their expression of different information, this requires a more complex nature of communication than is suggested by both Gamble (1982) and the archaeological record.

Due to the lack of exaggerated and highly contrasting features, visual saliency is unlikely to have had an effect upon the dwell time received by each IA within this category of female representation. The relatively low salience level of the Lower Torso IA renders bottom-up processing an improbable explanation for the prominence of this IA amongst the first fixations. Therefore, the interest in this area must follow a top-down process of perception which sees the midriff of these sculptures as highly significant.

Overall, the pattern of attention received by the Non-Exaggerated sculptures has had a substantial impact on the reassessment of the theories applied to these sculptures in the past. The distribution of dwell time and first fixations within these figurines, alongside the low level of saliency exhibited with their stylistic forms, distinguishes them from the other categories of Upper Palaeolithic female representations. Although these results could indicate their function as either representations of womanhood and identity, or symbols of information exchange, there are no theories that have been suggested in the past which accurately coincide with the methods of interaction these figurines receive. From this it is clear that the limitations in the interpretation of these Palaeolithic female imagery

as a whole caused by their collective grouping has had the greatest impact in relation to the Non-Exaggerated sculptures.

9.2. The effects of Familiarity

The impact of the differing levels of familiarity with the sculptures and the theories that surround them has had interesting effects on the perception of the IAs. The analysis of the viewing patterns received by each IA across the familiarity quartiles reveals significant differences within the visual response that they gain.

The Head IA received a significantly greater proportion of dwell time within the High familiarity group than the Middle and Low groups. The higher Upper Torso IA dwell time in the High group indicated a further significant difference when compared to the Middle and Low groups. Conversely, the Low group received the largest proportion of dwell time to both the Lower Torso and Upper Legs IAs. Whilst the distribution in dwell time to the Lower Legs IAs was greater to the Middle group, this comparison did not reveal a statistically significant difference between the Middle and Low groups. These results indicate that the level of familiarity with the sculptures that the participants possess has impacted upon the ways in which they visually interacted with the stimuli.

9.2.1. The effect of High Familarity

Within the High familiarity quartile, the viewing pattern received by the each of the IAs was of statistical significance. In terms of the proportionate dwell time, the Upper Torso IA received the greatest dwell time by far. This was followed by the Lower Torso and Head IAs which despite gaining a substantially lower proportion of dwell time were also viewing much more than the Upper Legs IA. The Lower Torso and Head IAs were viewed in similar ways, resulting in no statistically significant difference. These results suggest that individuals who are highly familiar with the sculptures found the Upper Torso IA to be the most important.

This finding is supported by the distribution of first fixations amongst the IAs. The Upper Torso IA received just under two thirds of the total first fixations, followed by the Lower Torso IA which received half of this proportion of first fixations. Individuals who were highly familiar with the figurines before participating in this

study allocated very few first fixations to the Head, Upper Legs and Lower Legs IAs, these areas all received proportions of attention which were not statistically significant from one another.

It is clear from this data that a familiarity with the sculptures and the theories that have been presented in the past to explain their function impacts the ways that individuals interact with these figurines. The focus of attention on the Upper Torso IA within the High familiarity group indicates that when individuals have prior knowledge of these figurines, they deem the breasts to hold an important role within the function of these artefacts. As the breasts are prominent within the creation of many popular theories relating to these sculptures (Absolon, 1949; Collins & Onians, 1978), individuals could fixate more on these features due to the sense of their importance derived from scholarly writings. The same can be said for the distribution of attention to the Lower Torso IA, a region that holds weight within many theories such as those relating to pregnancy and fertility.

Whilst these results do indicate that a higher familiarity with the figurines leads to a greater interest in the breasts and midriff, it is important to consider which specific sculptures fall within the highest level of familiarity. As shown in Appendix 8, all of these figurines belong to the Exaggerated category, as such these results mirror the dwell time gained by this category to an extent. What is interesting about the viewing of the highly familiar sculptures, is that the relative proportions of dwell time between the Head and Lower Torso IA are much closer than they were during the analysis of the viewing patterns received by the Exaggerated category. This greater interest in the head presented within this quartile suggests that a prior knowledge of the exaggerated sexual features, allowed individuals to explore the figurines further than those who had no prior knowledge of these artefacts.

Overall, it seems that having a higher familiarity with the sculptures does have a substantial effect upon the viewing patterns it receives. Though the large interest in the breasts could be a reflection of the visual processing inspired by the Exaggerated sculptures which formed this Familiarity quartile in its entirety, the increased proportion of attention to the Head IA is the direct result of this level of prior knowledge.

9.2.2. The effect of Low Familiarity

The pattern of viewing the IAs within the Low familiarity quartile shows differences of statistical significance. In terms of the proportionate dwell time, the Lower Torso IA received the greatest dwell time, followed by the Upper Legs IA. The next highest proportions of dwell time were gained by the Upper Torso and Head IAs respectively. As was also the case for the High familiarity group, the Lower Legs IA received the lowest proportion of dwell time by far.

The distribution of first fixations within this low level of familiarity mirrored the dwell time received by each IA. The Lower Torso IA received over two thirds of the total first fixations whilst the Upper Legs receiving substantially less first fixations but still far more than the other IAs. The Upper Torso, Head and Lower Legs IA all received very few first fixations. As was found with the distribution of dwell times, the Lower Legs IA received the least attention; however within this familiarity group there was no statistically significant difference between this attention and the attention given to the Head IA.

This data suggests that a lack of familiarity with these sculptures has a significant impact upon the ways in which they are visually processed. The high focus on the Lower Torso and Upper Legs IAs would suggest that individuals without prior knowledge of the figurines regard these areas as highly important within the function of these artefacts. Due to these regions housing the stomach and the pubic region, an interest in these areas could be seen to offer support to notions regarding fertility and reproduction. However, this quartile is predominantly formed from Gönnersdorf category sculptures, thus explaining the visual preference for the Lower Torso and Upper Legs IAs.

It is the dwell time received by the Upper Torso IA that raises questions about the effect of low familiarity upon the visual processing of these images. As the low quartile consists of such a high ratio of Gönnersdorf sculptures, it is logical that the viewing pattern would follow the same route as was the case for this category. As such, the low proportion of dwell time on the Upper Torso IA is not surprising, however, the presence of Non-Exaggerated and Exaggerated sculptures within this category would be expected to increase the mean interest in this area. This was not the case; instead the Lower Torso IA received a higher proportionate dwell time than within the Gönnersdorf category whilst attention to the Upper Torso IA remained the same. Another difference can be seen between the dwell

times to the Upper Legs IA within the Low familiarity quartile and the Gönnersdorf category. This IA receives a lower proportion of dwell time relative to that of the Lower Torso IA within the Low group. This is unlikely to be caused by the inclusion of Non-Exaggerated and Exaggerated sculptures within this quartile as they did not produce a substantial effect in relation to the viewing of the Upper Torso IA.

Overall, it is clear that having a Low familiarity has had a significant impact upon the viewing pattern received by the figurines. It appears that when one lacks knowledge of the sculptures, they place added importance upon the midriff of the figures. Although the stimuli within this quartile had a substantial impact upon its perception, the lack of familiarity also appears to have affected these results.

9.3. Overview

In summary, the discussion of these results has shown this study to have a great impact upon the understanding of this Upper Palaeolithic artistic tradition. Firstly, this chapter has shown that not only are each of the differing categories that these sculptures were divided into interacted with in different ways, therefore supporting the notion of the subcategorization of this form of material culture. But the ways in which this interaction takes shape has revealed new information on the potential ways in which they were interacted with in the Palaeolithic period. This has allowed for past theories to be reassessed and either supported or disputed.

Secondly, this chapter has revealed that familiarity with the sculptures has had an impact on how they are observed. Whilst these results appear to be largely impacted by the limited range of categories within each group, there are still some significant differences created by the participants' familiarity with the imagery. The results suggest that having a High familiarity has the greater impact upon the perception of these figurines, although a Low familiarity does also have an effect.

10. Conclusion

This project has successfully met both of the aims as set out in the Methodology chapter. The completion of the objectives has allowed not only for the figurines to be divided into separate categories based upon their morphological differences, but also for the execution of an eye tracking study which provides a strong overview of the Upper Palaeolithic female representations as a whole. This

enabled this study to achieve the first aim as the results of this study have revealed that each of the categories received a different viewing pattern.

Overall, the separation of the sculptures into three distinct categories has proved very beneficial towards the study of these figurines. It is clear that the examination of these works of art as separate types aids in overcoming the inherent short comings of the popular theories that have been applied to them in the past. Only through this acknowledgement of their differences can their true purpose can be identified. It is not within the scope of this research to uncover new ideas regarding the function of these items, in fact, several of the pre-existing notions of their purpose are greatly supported by the results of this investigation. The pattern of visual attention received within the Exaggerated category promotes theories relating the figurines to ideas of fertility, particularly McCoid and McDermott's belief in their role as obstetrical aids (1996). Gamble's (1982) belief in their role as symbols through which information was exchanged is in keeping with the attentional biases found within the Gönnersdorf category. Whilst the Non-Exaggerated sculptures exhibit a viewing pattern which places a broad spread of importance over the areas of the figurines, suggesting that identity was a key factor within their function alongside an emphasis on depicting women with realism, linking to Rice's (1981) views on this artistic tradition. However, as these theories have not been designed with the knowledge of these categories within the figurines, it is essential that these sculptures are re-examined under this new light in order to advance our understanding of their varied functions. As the variance in the perception of each of the categories of these figurines suggests that they each a different role within Upper Palaeolithic society, the question remains of how these separate categories interacted with each other within their usage.

This study has also successfully achieved the second aim in that the benefits towards the interpretation of archaeological materials that can be gained through the use of eye tracking have been confirmed. As the analysis of the viewing patterns received by the figurines has revealed the validity of this means of categorising the sculptures, thus allowing for the pre-existing theories regarding their potential functions to be reassessed. The insight into this artistic tradition gained through this application of eye tracking suggests a new route for the interpretation of these materials to follow. This understanding of the ways in which

individuals interact with these figurines has provided a completely new perspective on both the sculptures themselves and how to approach their investigation. As this knowledge could not have been uncovered by any other scientific methods, it is the finding of this research that cross-disciplinary approaches towards the study of archaeological materials provide an invaluable insight into the human past. Alongside shining a new light upon the potential ways in which these figurines functioned within Upper Palaeolithic society, eye tracking also provides research into this field with a valuable means of testing theories. Due to the nature of the archaeological record, many theoretical interpretations that arise from academic research are not readily testable. The use of eye tracking data to support these studies offers not only a greater understanding of the material in question, but also provides the resulting conclusions with a more robust argument.

Overall, the outcome of this project strongly suggests that the application of psychological methods and theories should be further employed within the study of archaeology. Particularly within studies focused on prehistoric time periods where distinct gaps in our knowledge hinder interpretations of the past.

10.1. Further work

The most immediate potential work suggested by this project revolves around the interpretation of these female figurines. With the knowledge that these sculptures fall into distinct categories, there are now new opportunities for the development of theories suggesting their function.

Due to the diverse nature of the discipline of psychology, the potential for further cross-disciplinary investigations are limitless. First, following directly on from this work, there are many potential avenues for eye tracking research into these sculptures to take. Investigations into the effects of differing variables within the participants taking part in the study pose several interesting points of inquiry. Attentional differences relative to age could coincide with theories that suggest who may have used these items. A comparison of the viewing patterns gained when adults and children are exposed to these sculptures could give an insight into theories regarding the role of the sculptures as aids for teaching. Children

would also offer a unique perspective on the sculptures, void of beliefs in the sexual connotations of some of the IAs.

Additionally, participants of different ethnic backgrounds could be used to provide a cross-cultural understanding of how these figurines were interacted with. Gender and sexuality could also offer interesting points of comparison. Whilst participants in this study came from a variety of academic backgrounds, it would also be interesting to investigate the potential differences in the perception of these figurines between individuals with an artistic background and those without. Perhaps individuals with artistic skill may interact with the sculptures in a distinct manner.

Eye tracking could also be used to compare the attentional biases within these sculptures to the other forms of Upper Palaeolithic art that surrounded the artists in their prehistoric landscapes. An investigation into the visual attention gained by female images that have been found in parietal forms, such as at Laussel and La Linde, could provide an understanding of why Palaeolithic artists' chose to use such different forms of depiction and whether the differences in portability are mirrored by a difference in interaction. Parietal art could also make further use of eye tracking in cases where multiple images are clustered together. Knowledge of the ways in which individuals interact with collections of images could offer insight into the decision making process behind the placement of these images.

The suggestion by Hodgson and Pettitt (2018) that the low level of lighting present within caves is another avenue that can more explored through the application of eye tracking. It is their view that the lighting added to the intensity of the atmosphere within the caves, especially in relation to the movement of shadows caused by firelight (Hodgson & Pettitt, 2018). Following a similar route to Gonçalves, Moura, Magalhães, and Chalmers (2013), a combination of digital reconstruction and virtual reality would present the opportunity for the effects of lightings conditions on the perception of Palaeolithic cave art to be examined.

Whilst it has been said that eye tracking can offer the most to studies in prehistory, this need not be limited to the Palaeolithic. The abstract art of the Neolithic and Iron Age art could also benefit greatly from the application of this methodology, especially in the case of the highly decorative Celtic artefacts that have been found across Britain. Often these objects are regarded as symbols of status,

perhaps an investigation into the perception of these items could reveal the effects of this symbolism on the viewer, as well as to shed light on why these communities chose this particular means of displaying wealth. The changes seen in British art that are witnessed by the onset of the Roman occupation may also gain further clarity from an adoption of psychological knowledge.

As this project has illustrated that a cross-disciplinary approach towards the study of archaeological materials can only further our limited understanding of the human past, it is suggested that a wider range of psychological methods and theories can also be applied to archaeological investigations.

11. References

Absolon, K. (1949). The diluvial anthropomorphic statuettes and drawings, especially the so-called Venus Statuettes, discovered in Moravia: A comparative study. *Artibus Asiae, 12*(3), 201-220. doi:10.2307/3248385

Bailey, D. W. (1994). Reading prehistoric figurines as individuals. *World Archaeology, 25*(3), 321-331. Retrieved from https://www.jstor.org/stable/pdf/124884.pdf?refreqid=excelsior%3Ac533a428181ac3b26e6a15399d8c5021

Bahn, P. G. (1996). Comments. In L., McDermott (Ed.). Self-representation in Upper Palaeolithic female figurines. *Current Anthropology, 37*(2), 248-249. Retrieved from https://www.jstor.org/stable/pdf/2744349.pdf?refreqid=excelsior%3A9c2e859a2a18a45e4b4f32cf85fdd9e3

Baring, A. & Cashford, J. (1991). *The myth of the goddess: evolution of an image*. New York: Viking.

Baron-Cohen, S (1995). *Mindblindness: an essay on autism and theory of mind*. Massachusetts: MIT Press.

Barton, C. M., Clark, G. A. & Cohen, A. E. (1994). Art as information: explaining Upper Palaeolithic art in Western Europe. *World Archaeology, 26*(2), 185-207. Retrieved from https://www.jstor.org/stable/pdf/124852.pdf?refreqid=excelsior%3Aa80a8c36965eeb865b013e2e68baa54f

Bisson, M. S. (1996). Comments. In L., McDermott (Ed.). Self-representation in Upper Palaeolithic female figurines. *Current Anthropology, 37*(2), 249-250. Retrieved from https://www.jstor.org/stable/pdf/2744349.pdf?refreqid=excelsior%3A9c2e859a2a18a45e4b4f32cf85fdd9e3

Belfer-Cohen, A. & Goren-Inbar, N. (1994). Cognition and communication in the Levantine Lower Palaeolithic. *World Archaeology, 26*(2), 144-157. Retrieved from https://www.jstor.org/stable/pdf/124849.pdf?refreqid=excelsior%3A0ee37812ba9ce01a35d0fcf738107036

Bradley, R. (1994). Symbols and signposts – understanding the prehistoric petroglyphs of the British Isles. In: C. Renfrew & E. B. W. Zubrow (Eds). *The ancient mind: elements of cognitive archaeology* (pp. 95-106). Cambridge: Cambridge University Press.

Bovet, J. & Raymond, M. (2015). Preferred women's waist-to-hip ratio variation over the last 2,500 years. *PLoS ONE, 10* (4), 1-13. doi:10.1371/journal.pone.0123284

Buss, D. M. (2016). *Evolutionary psychology: the new science of the mind* (5th ed.). London: Routledge.

Caporael, L. R. & Baron, R. H. (1997). Groups as the mind's natural environment. In: J. A. Simpson & D. T. Kenrick (Eds). *Evolutionary social psychology* (pp. 317-343). Mahwah: Lawrence Erlbaum Associates, Inc.

Carmody, D. L. (1981). *The oldest god.* Nashville: Abingdon.

Chen, J. & Zhang, L. (2016). Joint multi-image saliency analysis for region of interest detection in optical multispectral remote sensing images. *Remote Sensing, 8*(6), 461. doi:10.3390/rs8060461

Cho, A. & Lee, J. (2013). Body dissatisfaction levels and gender differences in attentional biases toward idealized bodies*. Body Image, 10*(1), 95-102. doi:10.1016/j.bodyim.2012.09.005

Collins, D. & Onians, J. (1978). The origins of art. *Art History, 1*(1), 1-25. doi:10.1111/j.1467-8365.1978.tb00002.x

Conard, J. (2009). A female figurine from the basal Aurignacian of Hohle Fels Cave in southwestern Germany. *Nature, 459*(7244), 248-252. doi:10.1038/nature07995

Conkey, M W. (2003). Has feminism changed archaeology?. *Gender and Science: New Issues, 28*(3), 867-880. Retrieved from

https://www.jstor.org/stable/pdf/10.1086/345322.pdf?refreqid=excelsior%3Afd822f093eec69dac534a6070a2b8c99

Conkey, M. W. (1997). Mobilizing ideologies: Palaeolithic art, gender trouble and thinking about alternatives. In: M. W. Conkey, O. Soffer, D. Stratman & N. G. Jablonski (Eds). *Beyond art: Pleistocene image and symbol* (pp. 172-207). San Francisco: California Academy of Sciences and University of California Press.

Conkey, M. W. & Gero, J. M. (1997). Programme to practise: gender and feminism in archaeology. *Annual Review of Anthropology, 26*(1), 411-437. Retrieved from https://www.jstor.org/stable/pdf/2952529.pdf?refreqid=excelsior%3A90953ed4fdc2a14a2313734081230906

Cook, J. (1996). Comment. In L., McDermott (Ed.) Self-representation in Upper Palaeolithic female figurines. *Current Anthropology, 37*(2), 250-251. Retrieved from https://www.jstor.org/stable/pdf/2744349.pdf?refreqid=excelsior%3A9c2e859a2a18a45e4b4f32cf85fdd9e3

Cook, J. (2013). *Ice Age art: arrival of the modern mind*. London: The British Museum Press.

Cornelissen, P. L., Hancock, P. J. B., Kiviniemi, V., George, H. R. & Tovée, M. J. (2009). Patterns of eye movements when male and female observers judge female attractiveness, body fat and waist-to-hip ratio. *Evolution and Human Behaviour, 30*(6), 417-428. doi:10.1016/j.evolhumbehav.2009.04.003

Cudahar, E. & Dayton, B. (2011). The social psychology of identity and inter-group conflict: from theory to practice. *International studies perspectives, 12*(3), 273-293. doi:10.1111/j.1528-3585.2011.00433.x

Delporte, H. (1993). Gravettian female figurines: a regional survey. In H. Knecht, A. Pike-Tay and R. White (eds). *Before Lascaux: the complete record of the Early Upper Palaeolithic* (pp. 243-275). Boca Raton and London: CRC Press.

Dixson, A. F. & Dixson, B. J. (2011). Venus figurines of the European Palaeolithic: symbols of fertility or attractiveness?. *Journal of Anthropology, 2011*, 10-20. doi:10.1155/2011/569120

Dixson, B. J., Grimshaw, G. M., Linklater, W. L. & Dixson, A. (2009). Eye-tracking of men's preferences for waist-to-hip ratio and breast size of women. *Archives of Sexual Behaviour, 40*(1), 43-50. doi:10.1007/s10508-009-9523-5

Ehrenberg, M. R. (1989). *Women in prehistory*. London: British Museum Publications.

Flannery, K. V. & Marcus, J. (1998). Cognitive archaeology. In: D. S. Whitley (Ed). *Reader in archaeological theory: Post-Processual and cognitive approaches* (pp. 35-48). London: Routledge.

Fletcher-Watson, S., Leekam, S. R., Benson, V., Frank, M. C. & Findlay, J. M. (2009). Eye-movements reveal attention to social information in autism spectrum disorder. *Neuropsychologia, 47*(1), 248-257. doi:10.1016/j.neuropsychologia.2008.07.016

Fox, P., Hoobs, R. J. & Loneragan, W. A. (2000). The lie of the land: the role of perception in our relationship to the environment. *Ecological management and restoration,1*(2), 105-110. doi:10.1046/j.1442-8903.2000.00025.x

Freeth, M., Chapman, P., Ropar, D. & Mitchell, P. (2010). Do gaze cues in complex scenes capture and direct the attention of high functioning adolescents with ASDS? Evidence from eye-tracking. *Journal of Autism and Developmental Disorders, 40*(5), 534-547. doi:10.1007/s10803-009-0893-2

Gamble, C. (1982). Interaction and alliance in Palaeolithic society. *Man, 17*(1), 92-107. doi:10.2307/2802103

García-Mira, R. & Real, J. E. (2005). Environmental perception and cognitive maps. *International journal of psychology, 40*(1), 1-2. doi:10.1080/00207590444000069

Gaudzinski-Windheuser, S. & Jöris, O. (2015). Contextualizing the female image – symbols for common ideas and communal indentity in Upper Palaeolithic female imagery. In: F. Coward, B. Hosfield, M. Pope & F. Wenban-Smith (Eds). *Settlement, society and cognition in human evolution: landscapes in mind* (pp. 288-314). New York: Cambridge University Press.

Gervais, S. J., Holland, A. M. & Dodd, M. D. (2013). My eyes are up here: the nature of the objectifying gaze toward women. *Sex Roles, 69*(11-12), 557-570. doi:10.1007/s11199-013-0316-x

Gilman, S. L. (1985). Black bodies, white bodies: toward an iconography of female sexuality in late nineteenth-century art, medicine, and literature. *Critical Inquiry, 12*(1), 204-242. Retrieved from

https://www.jstor.org/stable/pdf/1343468.pdf?refreqid=excelsior%3A6dd055fc286e0975cb1ab8301f09ec4b

Gimbutas, M. (1974). *Gods and Goddesses of old Europe*. London: Thames and Hudson.

Gimbutas, M. (1989). Women and culture in Goddess-orientated old Europe. In: J. Plaskow & C. C. Christ (Eds). *Weaving the visions* (pp. 63-71). San Francisco: Harpers.

Goa, X., Deng, X., Yang, J., Liang, S., Liu, J. & Chen, H. (2014). Eyes on the bodies: an eye tracking study on deployment of visual attention among females with body dissatisfaction. *Eating Behaviours, 15*(4), 540-549. doi:10.1016/j.eatbeh.2014.08.001

Goldberg, J. H., Stimson, M. J., Lewenstein, M., Scott, N. & Wichansky, A. M. (2002, March). Eye tracking in web search tasks: design implications. Paper presented at the ETRA '02 Proceedings of the 2002 symposium on Eye tracking research & applications. doi:10.1145/507072.507082

Gonçalves, A., Moura, J. P., Magalhães, L. and Chalmers, A. (2013). Perceptual images of Conimbriga using High Dynamic Range. *Journal of Archaeological Science, 40*(1), 116-128. doi:10.1016/j.jas.2012.06.024

González-Ruibal, A. (2012). Archaeology and the study of material culture: synergies with cultural psychology. In: Valsiner, J. (Ed). *The oxford handbook of culture and psychology* (pp. 132-164). Oxford: Oxford University Press. Retrieved from http://digital.csic.es/bitstream/10261/60140/1/Archaeology%20and%20cultural%20psychology.pdf

Gould, S. J. (1985). *The flamingo's smile: reflections in natural history*. New York: W. W. Norton & Company. Retrieved from https://www.docdroid.net/w1ebYlN/flamingos-smile-stephen-jay-gould.pdf#page=379

Graziano, W. G., Jenson-Campbell, L. A., Todd, M. & Finch, J. F. (1997). Interpersonal attraction from an evolutionary perspective: women's reactions to dominant and prosocial men. In: J. A. Simpson & D. T. Kenrick (Eds). *Evolutionary social psychology* (pp. 141-167). Mahwah: Lawrence Erlbaum Associates, Inc.

Gregory, N. J., Hermens, F., Facey, R. & Hodgson, T. L. (2016). The developmental trajectory of attentional orienting to socio-biological cues. *Experimental Brain Research, 234*(6), 1351-1362. doi:10.1007/s00221-016-4627-3

Gregory, N. J., López, B., Graham, G., Marshman, P., Bate, S. & Kargas, N. (2015). Reduced gaze following and attention to heads when viewing a "live" social scene. *PLoS One, 10*(4), e0121792. doi:10.1371/journal.pone.0121792

Guthrie, R. D. (2005). *The nature of Palaeolithic art*. Chicago: University of Chicago Press.

Halverson, J. (1987). Art for art's sake in the Palaeolithic. *Current Anthropology, 28*(1), 63-89. Retrieved from https://www.jstor.org/stable/pdf/2743113.pdf?refreqid=excelsior%3A9eb3e9cdccff0af5c614c7509acd3e83

Hewig, J., Cooper, S., Trippe, R. H., Hecht, H., Straube, T. & Miltner, W. H. R. (2008). Drive for thinness and attention toward specific body parts in a

nonclinical sample. *Psychosomatic Medicine, 70*(6), 729-736. doi:10.1097/PSY.0b013e31817e41d3

Hewig, J., Trippe, R. H., Hecht, H., Straube, T. & Miltner, W. H. R. (2008). Gender differences for specific body regions when looking at men and women. *Journal of Nonverbal Behaviour, 32*(2), 67-78. doi:10.1007/s10919-007-0043-5

Hikosaka, O., Miyauchi, S. & Shimojo, S. (1996). Orienting a spatial attention – its reflexive, compensatory, and voluntary mechanisms. *Brain Research and Cognitive Brain Research, 5*(1-2), 1-9. doi:10.1016/S0926-6410(96)00036-5

Hodgson, D. & Pettitt, P. (2018). The origins of iconic depictions: a falsifiable model derived from the visual science of Palaeolithic cave art and world rock art. *Cambridge Archaeological Journal*, 1–22. Cambridge University Press. doi:10.1017/S0959774318000227

Holmqvist, K., Nyström, M., Andersson, R., Dewhurst, R., Jarodzka, H. & Van De Weijer, J. (2011). *Eye tracking: a comprehensive guide to methods and measures*. Oxford: Oxford University Press.

Hudson, M. J. & Aoyama, M. (2007). Waist-to-hip ratios of Jomon figurines. *Antiquity, 81*(314), 961-971. doi:10.1017/S0003598X00096046

Huffman, T. N. (1986). Cognitive studies of the Iron Age in Southern Africa. *World Archaeology, 18*(1), 84-95. doi:10.1080/00438243.1986.9979990

Itti, L. & Koch, C. (2000). A saliency-based mechanism for overt and covert shifts of visual attention. *Visual Research, 40*(10-12), 1489-1506. doi:10.1016/S0042-6989(99)00163-7

James, T. W. & Kimura, D. (1997). Sex differences in remembering the locations of objects in an array: location-shifts versus location-exchanges. *Evolution and human behaviour, 18*(3), 155-163. doi:10.1016/S1090-5138(97)00004-4

Janelle, C. M., Hausenblas, H. A., Fallon, E. A. & Gardner, R. E. (2003). A visual search examination of attentional biases among individuals with high and low drive for thinness. *Eating and Weight Disorders – Studies on Anorexia, Bulimia and Obesity, 8*(2), 138-144. doi:10.1007/BF03325003

Jansen van Rensburg, J. (2016, Decmeber). The body in the cave: a sensory exploration of caves. Unpublished conference talk at TAG 2016.

Jasieńska, G., Ziomkiewicz, A., Ellison, P. T., Lipson, S. F. & Thune, I. (2004). Large breasts and narrow waists indicate high reproductive potential in women. *Proceedings of the Royal Society B: biological Sciences, 271*(1545), 1213-1217. doi:10.1098/rspb.2004.2712

Joshi, A., Kale, S., Chandel, S. & Pal, D. K. (2015). Likert scale: explored and explained. *British Journal of Applied Science & Technology*, 7(4), 396-403. doi:10.9734/BJAST/2015/14975

Karlin, C. & Julien, M. (1994). Prehistoric technology: a cognitive science? In: C. Renfrew & E. B. W. Zubrow (Eds). *The ancient mind: elements of cognitive archaeology* (pp. 152-165). Cambridge: Cambridge University Press.

Kitahara-Frisch, J. (1980). Stone tools as indicators of linguistic abilities in early man. *Annals of the Japan Association for Philosophy of Science, 5*(3), 101-109. doi:10.4288/jafpos1956.5.101

Koenigswald, G. H. R. von. (1972). Early Homo sapiens as an artist: the meaning of Palaeolithic art. In F. Bordes (Ed.). *The origin of Homo sapiens* (pp. 133-139). Paris: UNESCO. Retrieved from http://unesdoc.unesco.org/images/0000/000023/002377mo.pdf#nameddest=2276

Králík, M., Novotny, V. & Oliva, M. (2002). Anthropologie, 40(2), 107-113. Retrieved from https://pdfs.semanticscholar.org/b99c/e0f9f692b6bb9bdaf359b08b87d793b802b3.pdf

Lander, L. M. (2005). *From artefact to icon: an analysis of the Venus figurines in archaeological literature and contemporary culture* (Doctoral dissertation). Retrieved from http://etheses.dur.ac.uk/3027/

Leroi-Gourhan, A. (1968). *The art of prehistoric man in Western Europe*. London: Thames and Hudson.

Lindfors, B. (1996). Hottentot, Bushman, Kaffir: taxonomic tendencies in Nineteenth-Century racial iconography. *Nordic Journal of African Studies, 5*(2), 1-28. Retrieved from http://www.njas.helsinki.fi/

Markale, J. (1999). *The great goddess: reverence of the divine feminine from the Palaeolithic to the present*. Vermont: Inner Traditions International.

Marshall, S. K. (1996). A developmental social psychology of identity: understanding the person-in-context. *Journal of adolescence, 19*(5), 429-442. doi:10.1006/jado.1996.0041

Maschner, H. D. G. & Marler, B. C. (2008). Evolutionary psychology and archaeological landscapes. In: David, B. & Thomas, J., (Eds). *Handbook of landscape archaeology*. Abingdon: Routledge.

McBurney, D. H., Gaulin, S. J. C., Devineni, T. & Adams, C. (1997). Superior special memory of women: stronger evidence for the gathering hypothesis. *Evolution and human behaviour, 18*(3), 165-174. doi:10.1016/S1090-5138(97)00001-9

McCoid, C. H. & McDermott, L. D. (1996). Toward decolonizing gender: Female vision in the Upper Palaeolithic. *American Anthropologist, 98*(2), 319-326. Retrieved from https://www.jstor.org/stable/pdf/682890.pdf?refreqid=excelsior%3A561a630303ed84d8788063e9c11cfd7e

McDermott, L. D. (1996). Self-representation in Upper Palaeolithic female figurines. *Current Anthropology, 37*(2), 227-275. Retrieved from https://www.jstor.org/stable/pdf/2744349.pdf?refreqid=excelsior%3A9c2e859a2a18a45e4b4f32cf85fdd9e3

Mirazón Lahr, M., Rivera, F., Power, R. K., Mounier, A., Copsey, B., Crivellaro, F., Edung, J. E., Maillo Fernandez, J. M., Kiarie, C., Lawrence, J., Leakey, A., Mbua, E., Miller, H., Muigai, A., Mukhongo, D. M., Van Baelen, A., Wood, R., Schwenninger, J. L., Grün, R., Achyuthan, H., Wilshaw, A. & Foley, R. A., 2016. Inter-group violence among early Holocene hunter-gatherers of West Turkana, Kenya. *Nature, 529*(7586), 394-398. doi:10.1038/nature16477

Mithen, S. (1994). From domain specific to generalized intelligence: a cognitive interpretation of the Middle/Upper Palaeolithic transition. In: C. Renfrew & E. B. W. Zubrow (Eds). *The ancient mind: elements of cognitive archaeology* (pp.29-40). Cambridge: Cambridge University Press.

Mithen, S. (1996). *The prehistory of the mind: The cognitive origins of art and science*. London: Thames and Hudson Ltd.

Mithen, S. (1997). Cognitive archaeology, evolutionary psychology and cultural transmission, with particular reference to religious ideas. In C. M. Barton and G. A. Clark (Eds). *Rediscovering Darwin: Evolutionary Theory and Archaeological Explanation. Archaeological Papers of the American Anthropological Association, 7*(1), 67–74. Retrieved from https://www.researchgate.net/publication/249008809_Rediscovering_Darwin_Evolutionary_Theory_in_Archaeological_Explanation

Mithen, S. (2003). *After the ice: a global human history, 20,000-5,000 BC*. London: Weidenfeld & Nicolson.

Mogg, K., Bradley, B. P., Field, M. & Houwer, J. D. (2003). Eye movements to smoking-related pictures in smokers: relationship between attentional biases and implicit and explicit measures of stimulus valence. *Addiction, 98*(6), 825-836. doi:10.1046/j.1360-0443.2003.00392.x

Museum Ulm. (n.d.). Löwenmensch 2.0. Retrieved from http://www.loewenmensch.de/figur_5.html

Mussi, M. (1991). L'utilisation de la steatite dans les grottes du Balzi Rossi (ou Grottes du Grimaldi). *Gallia Préhistorie, 33*(1), 1-16.

Mussi, M., Sinq-Mars, J. & Bolduc, P. (2000). Echoes from the mammoth steppe: the case of Balzi Rossi. In: W. Roebroeks, M. Mussi, J. Svoboda & K. Fennema (eds). *Hunters of the Golden Age: the Mid Upper Palaeolithic of Eurasia 30,000-20,000 BP* (105-123). Leiden: University of Leiden.

Mussi, M., Roebroeks, W. & Svoboda, J. (2000). Hunters of the Golden Age: an introduction. In: W. Roebroeks, M. Mussi, J. Svoboda & K. Fennema (eds). *Hunters of the Golden Age: the Mid Upper Palaeolithic of Eurasia 30,000-20,000 BP* (1-11). Leiden: University of Leiden.

Nesbitt, S. (2001). Venus figurines of the Upper Palaeolithic. *Totem: The University of Western Ontario Journal of Anthropology, 9*(1), 53-64. Retrieved from https://ir.lib.uwo.ca/totem/vol9/iss1/6

Nummenmaa, L., Hietanen, J. K., Santtila, P. & Hyönä, J. (2012). Gender and visibility of sexual cues influence eye movements while viewing faces and bodies. *Archives of Sexual Behaviour, 41*(6), 1439-1451. doi:10.1007/s10508-012-9911-0

Orians, G. H. & Heerwagen, J. H. (1992). Evolved responses to landscapes. In J. Barkow, L. Coosmides & J. Tooby (Eds). *The adapted mind: evolutionary psychology and the generation of culture* (pp. 555-580). New York: Oxford University Press.

Perrin, R. (2012). *A pocket guide to APA style* (4th ed.). Wadsworth: Cengage Learning.

Pinhas, L., Fok, K., Chen, A., Lam, E., Schachter, R., Eizenman, O., Grupp, L. & Eizenman, M. (2014). Attentional biases to body shape images in adolescents with anorexia nervosa: An exploratory eye-tracking study. *Psychiatry Research, 220*(1-2), 519-526. doi:10.1016/j.psychres.2014.08.006

Pond, R. S. (2014). *Visual information processing and the evolution of flake making skill* (Masters' thesis). Retrieved from https://digitalcollections.trentu.ca/islandora/object/etd%3A280/.../PDF/.../citation.pdf

Postgate, J. N. (1994). Text and figure in ancient Mesopotamia: match and mismatch. In C. Renfrew & E. B. W. Zubrow (Eds). *The ancient mind: elements of cognitive archaeology* (pp. 176-185). Cambridge: Cambridge University Press.

Qureshi, S. (2004). Displaying Sara Baartman, the 'Hottentot Venus'. *History of Science, 42*(2), 233-257. doi:10.1177/007327530404200204

Reynolds, J. H. & Desimone, R. (2003). Interacting roles of attention and visual salience in V4. Neuron, 37(5), 853-863. doi:10.1016/S0896-6273(03)00097-7

Rice, P. C. (1981). Prehistoric Venuses: symbols of motherhood or womanhood?. *Journal of Anthropological Research, 37*(4), 402-414. doi:10.1086/jar.37.4.3629836

Rupp, H. A. & Wallen, K. (2007). Sex differences in viewing sexual stimuli: An eye tracking study in men and women. *Hormones and Behaviour, 51*(4), 524-533. doi:10.1016/j.yhbeh.2007.01.008

Russell, P. (1998). The Palaeolithic mother goddess: fact or fiction?. In K., Hays-Gilpin & D. S., Whitley (Eds.). *Reader in gender archaeology* (pp. 261-26). London: Routledge.

Scarre, C. (1994). The meaning of death: funerary beliefs and the prehistorian. In C. Renfrew & E. B. W. Zubrow (Eds). *The ancient mind: elements of cognitive archaeology* (pp. 73-83). Cambridge: Cambridge University Press.

Schnapp, A. (1994). Are images animated? The psychology of statues in Ancient Greece. In C. Renfrew & E. B. W. Zubrow (Eds). *The ancient mind: elements of cognitive archaeology* (pp. 40-44). Cambridge: Cambridge University Press.

Segal, E. M. (1994). Archaeology and cognitive science. In C. Renfrew & E. B. W. Zubrow (Eds). *The ancient mind: elements of cognitive archaeology* (pp. 22-27). Cambridge: Cambridge University Press.

Silverman, I. & Eals, M. (1992). Sex differences in spatial abilities: Evolutionary theory and data. In J. H. Barkow, L. Cosmides, & J. Tooby (Eds*.). The adapted mind: Evolutionary psychology and the generation of culture* (pp. 531–549). New York: Oxford University Press

Silverman, I., Choi, J. & Peters, M. (2007). The Hunter-Gatherer Theory of Sex Differences in Spatial Abilities: Data from 40 Countries. *Archives of Sexual Behavior, 36(*2), 261-268. doi:10.1007/s10508-006-9168-6

Singh, D. (2006). Universal allure of the hourglass figure: an evolutionary theory of female physical attractiveness. *Clinics in Plastic Surgery, 33*(3), 359-370. doi:10.1016/j.cps.2006.05.007

Singh, D & Singh, D. (2011). Shape and significance of feminine beauty: an evolutionary perspective. *Sex Roles, 64*(9-10), 732-731. doi:10.1007/s11199-011-9938-z

Smilek, D., Birmingham, E., Cameron, D., Bischof, W. & Kingstone, A. (2006). Cognitive Ethology and exploring attention in real-world scenes. *Brain Research, 1080*(1), 101-119. doi:10.1016/j.brainres.2005.12.090

Steele, J., Quinlan, A. and Wenban-Smith, F. (1995). Stone tools and the linguistic capabilities of earlier hominids. *Cambridge Archaeological Journal, 5*(2), 245-256. doi:10.1017/S0959774300015043

Stout, D. (2011). Stone tool making and the evolution of human culture and cognition. *Philosophical transcripts of the Royal Society Biology, 366*(1567), 1050-1059. doi:10.1098/rstb.2010.0369

Stout, D., Toth, N. and Schick, K. (2000). Stone tool making and brain activation: position emission tomography (PET) studies. *Journal of Archaeological Science, 27*(12), 1215-1223. doi: 10.1006/jasc.2000.0595

Stout, D. & Chaminade, T. (2007). The evolutionary neuroscience of tool making. *Neuropsychologia, 45*(5), 1091-1100. doi:10.1016/j.neuropsychologia.2006.09.014

Styles, E. A. (1997). *The psychology of attention*. Hove: Psychology Press Ltd.

TAG (2017). A look forward at the study of the mind in the past [online]. Cardiff: TAG 2017. Retrieved from: http://tag2017cardiff.org/2017/06/01/a-look-forward-at-the-study-of-the-mind-in-the-past/

Thorup, E., Nyström, P., Gredebäck, G., Bölte, S. & Falck-Ytter, T. (2016). Altered gaze following during live interaction in infants at risk for autism: An eye tracking study. *Molecular Autism, 7*(12). doi:10.1186/s13229-016-0069-9

Tripp, A. J. & Schmidt, N. E. (2013). Analyzing Fertility and Attraction in the Palaeolithic: The Venus Figurines. *Archaeology, Ethnology and Anthropology of Eurasia, 41*(2), 54-60. doi:10.1016/j.aeae.2013.11.005

Treisman, A. M. (1998). Feature binding, attention and object perception. *Philosophical transactions of the royal society B: biological sciences, 353*(1373), 1295-1306. doi:10.1098/rstb.1998.0284

Treisman, A. M. & Gelade, G. (1980). A feature-integration theory of attention. *Cognitive psychology, 12*(1), 97-136. doi:10.1016/0010-0285(80)90005-5

Voss, B. L. (2000). Feminisms, queer theories, and the archaeological study of past sexualities. *World Archaeology, 32*(2), 180-192. Retrieved from http://users.clas.ufl.edu/davidson/Historical%20archaeology%20fall%202015/Week%209%20ethnicity%20gender/Voss%202000%20archaeology%20and%20sexuality.pdf

Wade, N. J. (2010). Pioneers of eye movement research. *I-Perception, 1*(2), 33-68. doi:10.1068/i0389

Wallis, B. (1995). Black bodies, white science: Louis Agassiz's slave daguerreotypes. *American Art, 9*(2), 38-61. Retrieved from https://www.jstor.org/stable/pdf/3109184.pdf?refreqid=excelsior%3A78880f1515cdc81864b9dee4cdad50bc

White, R. (1982). Rethinking the Middle/Upper Palaeolithic transition. *Current Anthropology*, *23*(2), 169-192. doi:10.1086/202802

White, R. (2006). The women of Brassempouy: a century of research and interpretation. *Journal of Archaeological Method and Theory, 13*(4). 251-304. Retrieved from https://link.springer.com/article/10.1007/s10816-006-9023-z

Won Ju, H. & Johnson, K. K. P. (2010). Fashion advertisements and young women: determining visual attention using eye tracking. Clothing and Textiles Research Journal, 28(3), 159-173. doi:10.1177/0887302X09359935

Wynn, T. (1991). Tools, grammar and the archaeology of cognition. *Cambridge Archaeological Journal, 1*(2), 191-206. doi:10.1017/S0959774300000354

12. Appendices

Appendix 1

Table I
List of sculptures used within this study.

Name	Geographical Location	Age	Media	Approximate height	Views of Sculpture Used
Andernach	Germany	15,000 BP	Ivory	20cm	Side
Andernach 2	Germany	15,000 BP	Ivory	4.7cm	Side
Avdeevo	Near the city of Kursk, Russia	20,000 BP	Ivory	15cm	Front and Side
Avdeevo 2	Near the city of Kursk, Russia	20,000 BP	Ivory	15cm	Front
Dolní Věstonice	Czech Republic	30-27,000 BP	Burnt clay	11cm	Front, Side and Back
Eliseevichi	Russia	c.16,000 BP	Ivory	15cm	Front and Side
Gagarino	Russia	c.20,000 BP	Ivory	12.7cm	Front, Side and Back
Gönnersdorf 1	Germany	c.15,000 BP	Ivory	7cm	Side
Gönnersdorf 2	Germany	c.15,000 BP	Ivory	8.5cm	Side
Gönnersdorf 3	Germany	c.15,000 BP	Ivory	8cm	Side
Gönnersdorf 4	Germany	c.15,000 BP	Ivory	6.5cm	Side
Grotte du Prince					Front
Hohle Fels	Germany	c.35,000 BP	Ivory	6cm	Front, Side and Back
Kostenki 1a	Russia				Front and Side
Kostenki 1b	Russia	23-21,000 BP	Limestone	10cm	Front and Side
Kostenki 1c	Russia	22,000 BP	Mammoth Ivory	11cm	Front
Lespugue	France	26-24,000 BP	Ivory	15cm	Front and Side
Mal'ta 1	Siberia	22-21,000 BP	Ivory	13.4cm	Front
Mal'ta 2	Siberia	c.22,000 BP	Ivory	4.2cm	Front
Mal'ta 3	Siberia	c.22-21,000 BP	Ivory	12.5cm	Front
Mal'ta 4	Siberia	22-20,000 BP	Ivory	9.4cm	Front

Mal'ta 5	Siberia	23-19,000 BP	Mammoth tusk	8.7cm	Front
Menton	Italy	24-19,000 BP	Yellow Steatite	4.7cm	Front, Side and Back

Table I continued

Name	Geographical Location	Age	Media	Approximate height	Views of Sculpture Used
Monpazier	France	c.30-20,000 BP	Limonite	5.6cm	Front, Side and Back
Nebra 1	Germany	14-13,000 BP	Mammoth Ivory	6.5cm	Side
Nebra 2	Germany	14-13,000 BP	Bone	6.3cm	Side
Nebra 3	Germany	14-13,000 BP	Mammoth Ivory	5.2cm	Side
Neuchatel	Switzerland	c.15,000 BP	Jet	1.6cm	Side
Pekarna	Czech Republic	14,500 BP	Mammoth Ivory	4.5cm	Side
Petrkovice	Czech Republic	28-25,000 BP	Haematite	4.5cm	Front and Side
Polichinelle	Italy	27,000 BP	Green Steatite	6.1cm	Front, Side and Back
Renancourt	France	23,000 BP	Limestone	12cm	Front and Side
Savignano	Italy	25-20,000 BP	Serpentine	22cn	Front and Side
The Undescribed Venus	Italy	24-19,000 BP	Green steatite	3.7cm	Front
Trasimeno	Italy	30-20,000 BP	Steatite	3.7cm	Side
Tursac	France	25,000 BP	Calcite	8cm	Front and Side
Willendorf	Austria	30-27,000 BP	Limestone	11cm	Front, Side and Back
Zaraysk	Russia	22-16,000 BP	Mammoth Ivory	16.6cm	Front, Side and Back

Appendix 2

Table II
Stimuli used during study

Name	Images used	Source
Andernach		Hitchcock, D. (n.d.). Andernach Venus [online image]. Retreived 15 October 2017 from https://donsmaps.com/gonnersdorf.html Adapted with permission.
Andernach 2		Hitchcock, D. (n.d.). Andernach Venus [online image]. Retreived 15 October 2017 from https://donsmaps.com/gonnersdorf.htm Adapted with permission.
Avdeevo		Cook, J. (2013). *Ice Age art: arrival of the modern mind* (p. 83). London: The British Museum Press. Copyright 2013 by Jill Cook.
Avdeevo 2		Hitchcock, D. (n.d.). Avdeevo Venus [online image]. Retreived 15 October 2017 from https://donsmaps.com/avdeevo.htm Adapted with permission.
Dolní Věstonice		Cook, J. (2013). *Ice Age art: arrival of the modern mind* (p. 46). London: The British Museum Press. Copyright 2013 by Jill Cook.
Eliseevichi		Cook, J. (2013). *Ice Age art: arrival of the modern mind* (p. 85). London: The British Museum Press. Copyright 2013 by Jill Cook.
Gagarino		Hitchcock, D. (n.d.). Gagarino Venus [online image]. Retreived 15 October 2017 from https://donsmaps.com/gagarino.htm Adapted with permission.

Gönnersdorf 1		Hitchcock, D. (n.d.). Gönnersdorf Venus [online image]. Retreived 15 October 2017 from https://donsmaps.com/gonnersdorf.html Adapted with permission.
Gönnersdorf 2		Hitchcock, D. (n.d.). Gönnersdorf Venus [online image]. Retreived 15 October 2017 from https://donsmaps.com/gonnersdorf.html Adapted with permission.
Gönnersdorf 3		Hitchcock, D. (n.d.). Gönnersdorf Venus [online image]. Retreived 15 October 2017 from https://donsmaps.com/gonnersdorf.html Adapted with permission.
Gönnersdorf 4		Hitchcock, D. (n.d.). Gönnersdorf Venus [online image]. Retreived 15 October 2017 from https://donsmaps.com/gonnersdorf.html Adapted with permission.
Grotte du Prince		Cook, J. (2013). *Ice Age art: arrival of the modern mind* (p. 94). London: The British Museum Press. Copyright 2013 by Jill Cook.
Hohle Fels		Cook, J. (2013). *Ice Age art: arrival of the modern mind* (p. 39). London: The British Museum Press. Copyright 2013 by Jill Cook. Jensen, H. (n.d.). The Venus of Hohle Fels [online image]. Retreived 15 October 2017 from https://donsmaps.com/hohlefelsvenus.html. Copyright by University of Tübingen
Kostenki 1a		Cook, J. (2013). *Ice Age art: arrival of the modern mind* (p. 85). London: The British Museum Press. Copyright 2013 by Jill Cook.
Kostenki 1b		Cook, J. (2013). *Ice Age art: arrival of the modern mind* (p. 82). London: The British Museum Press. Copyright 2013 by Jill Cook.
Kostenki 1c		Cohen, C. (2003). Venus figure from Kostenki [online published photograph]. Retreived 16 october 2017 from https://donsmaps.com/kostenkivenus.html. Copyright 2003 by Cohen.
Lespugue		Cook, J. (2013). *Ice Age art: arrival of the modern mind* (p. 97). London: The British Museum Press. Copyright 2013 by Jill Cook.

Mal'ta 1		Cook, J. (2013). *Ice Age art: arrival of the modern mind* (p. 88). London: The British Museum Press. Copyright 2013 by Jill Cook.
Mal'ta 2		Cook, J. (2013). *Ice Age art: arrival of the modern mind* (p. 88). London: The British Museum Press. Copyright 2013 by Jill Cook.
Mal'ta 3		Cook, J. (2013). *Ice Age art: arrival of the modern mind* (p. 89). London: The British Museum Press. Copyright 2013 by Jill Cook.
Mal'ta 4		Cook, J. (2013). *Ice Age art: arrival of the modern mind* (p. 89). London: The British Museum Press. Copyright 2013 by Jill Cook.
Mal'ta 5		Cook, J. (2013). *Ice Age art: arrival of the modern mind* (p. 89). London: The British Museum Press. Copyright 2013 by Jill Cook.
Menton		Hitchcock, D. (n.d.). Venus of Menton [online image]. Retreived 13 October 2017 from https://donsmaps.com/menton.html Adapted with permission.
Monpazier		Hitchcock, D. (n.d.). Venus of Monpazier [online image]. Retreived 13 October 2017 from https://donsmaps.com/monpazier.html Adapted with permission.
Nebra 1		Hitchcock, D. (n.d.). The Nebra Venus [online image]. Retreived 13 October 2017 from https://donsmaps.com/nebravenus.html Adapted with permission.
Nebra 2		Hitchcock, D. (n.d.). The Nebra Venus [online image]. Retreived 13 October 2017 from https://donsmaps.com/nebravenus.html Adapted with permission.

Nebra 3		Hitchcock, D. (n.d.). The Nebra Venus [online image]. Retreived 13 October 2017 from https://donsmaps.com/nebra venus.html. Adapted with permission.
Neuchatel		André, L. (n.d.). The Nebra Venus [online image]. Retreived 13 October 2017 from https://donsmaps.com/venusmonruz.html. Adapted with permission.
Pekarna		Hitchcock, D. (n.d.). The Nebra Venus [online image]. Retreived 13 October 2017 from https://donsmaps.com/venuspekarna.html. Adapted with permission.
Petrkovice		Svoboda, J. (2008). *Petrkovice: on shouldered points and female figurines* (p. 194). Czech Republic: Institute of Archaeology, Academy of Sciences of the Czech Republic, Brno. Copyright 2008 by Svoboda.
Polichinelle		Hitchcock, D. (n.d.). The Venus of Polichinelle [online image]. Retreived 13 October 2017 from https://www.donsmaps.com/polichinelle.html. Adapted with permission.
Renancourt		Hitchcock, D. (n.d.). Venus of Renancourt [online image]. Retreived 13 October 2017 from https://www.donsmaps.com/venusrenancourt .html. Adapted with permission.
Savignano		Hitchcock, D. (n.d.). The Savignano Venus [online image]. Retreived 13 October 2017 from https://donsmaps.com/savignanovenus.html. Adapted with permission.
The Undescribed Venus		Hitchcock, D. (n.d.). The Undescribed Venus from Balzi Rossi [online image]. Retreived 13 October 2017 from https://donsmaps.com/undescribedvenus.html. Adapted with permission.
Trasimeno		Hitchcock, D. (n.d.). The Nebra Venus [online image]. Retreived 13 October 2017 from https://www.donsmaps.com/trasimenovenus. html. Adapted with permission.

Tursac		Hitchcock, D. (n.d.). The Nebra Venus [online image]. Retreived 13 October 2017 from https://donsmaps.com/tursacvenus.html. Adapted with permission.
Willendorf		Cook, J. (2013). Ice Age art: arrival of the modern mind (pp. 60-61). London: The British Museum Press. Copyright 2013 by Jill Cook.
Zaraysk		Cook, J. (2013). *Ice Age art: arrival of the modern mind* (p. 86). London: The British Museum Press. Copyright 2013 by Jill Cook.

Appendix 3- Copy of ethics approval

Bournemouth University

Dear Samuel Hirst,

Your checklist (Upper Palaeolithic female representations: an eye tracking study) has now been reviewed and APPROVED in line with BU's Research Ethics Code of Practice.

You can now save and/or print off a hard copy of the checklist at https://ethics.bournemouth.ac.uk.

This approval relates to the ethical context of the work. Specific aspects of the implementation of the research project remain your professional responsibility.

It is your responsibility to ensure that where the scope of the research project changes, such changes are evaluated to ensure that the ethical approval you have been granted remains appropriate. You must re-submit for ethical approval if changes to the research project mean that your current ethical approval is no longer valid.

Students – if the scope of your research changes, please discuss with your Tutors/Supervisors before submitting a new checklist.

Many thanks

For UG/PGT enquiries – please contact your Supervisor in the first instance

For general enquiries – please email *researchethics@bournemouth.ac.uk*

Risk Assessments

Please ensure that an appropriate risk assessment has been completed before the commencement of your research. Access to the BU On-line Risk Assessment Tools & Information can be found at:

Staff: https://staffintranet.bournemouth.ac.uk/workingatbu/healthsafetywellbeing/

Students: https://www1.bournemouth.ac.uk/students/log-services

Appendix 4- Familiarity questionnaire

<u>Familiarity Questionnaire</u>

Participant number: ....

Thank you for taking part in this eye tracking study, please now rate your levels of familiarity with the sculptures you have been shown. Using the scales below, please mark how well you knew each of the sculptures before participating in this study. On the scales, 1 represents being completely unfamiliar with the sculpture, whilst 10 represents being completely familiar with the sculpture.

1	2	3	4	5	6	7	8	9	10

1	2	3	4	5	6	7	8	9	10

1	2	3	4	5	6	7	8	9	10

1	2	3	4	5	6	7	8	9	10

1	2	3	4	5	6	7	8	9	10

1	2	3	4	5	6	7	8	9	10

1	2	3	4	5	6	7	8	9	10

1	2	3	4	5	6	7	8	9	10

1	2	3	4	5	6	7	8	9	10

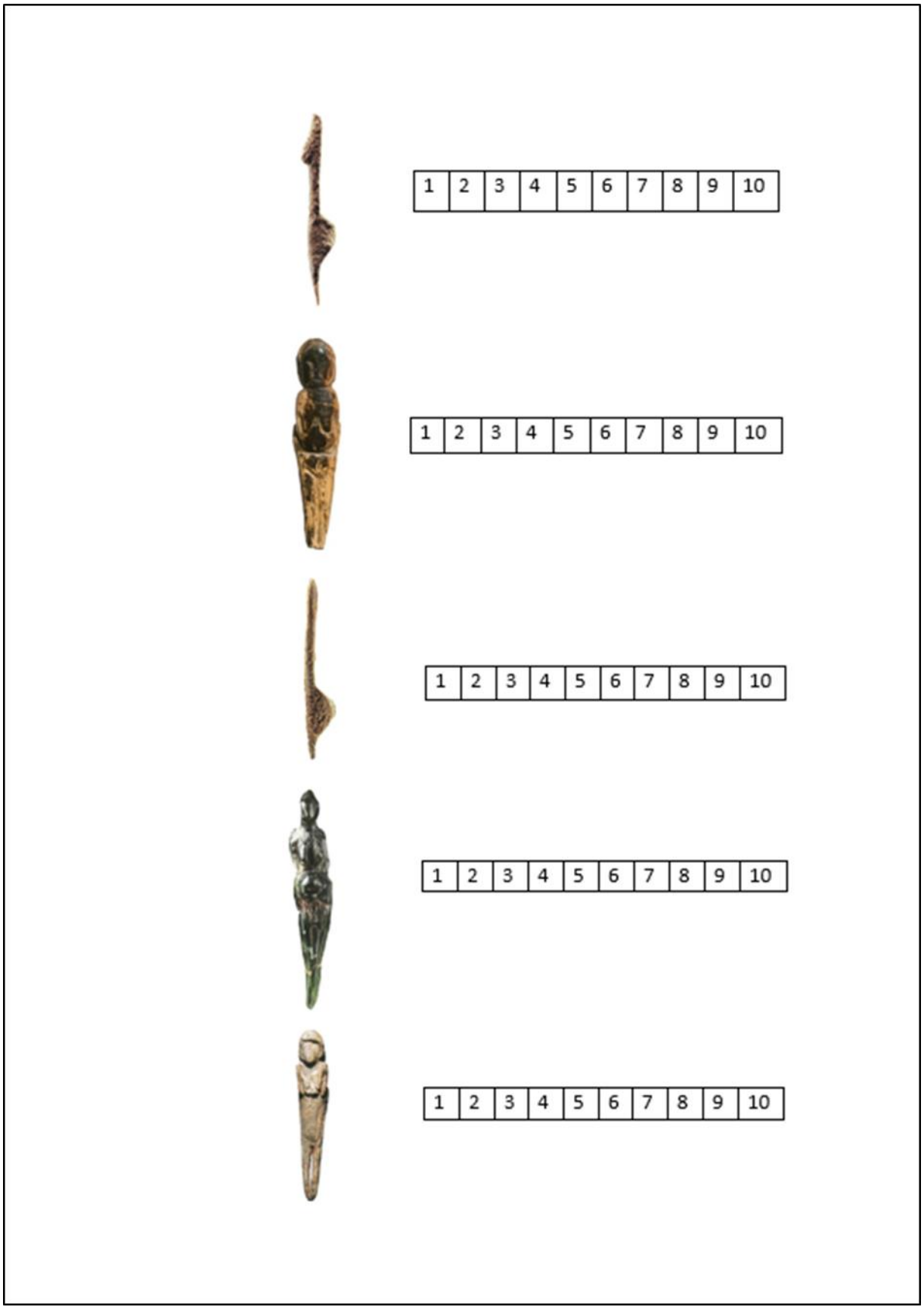
1	2	3	4	5	6	7	8	9	10

1	2	3	4	5	6	7	8	9	10

1	2	3	4	5	6	7	8	9	10

1	2	3	4	5	6	7	8	9	10

1	2	3	4	5	6	7	8	9	10


1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10

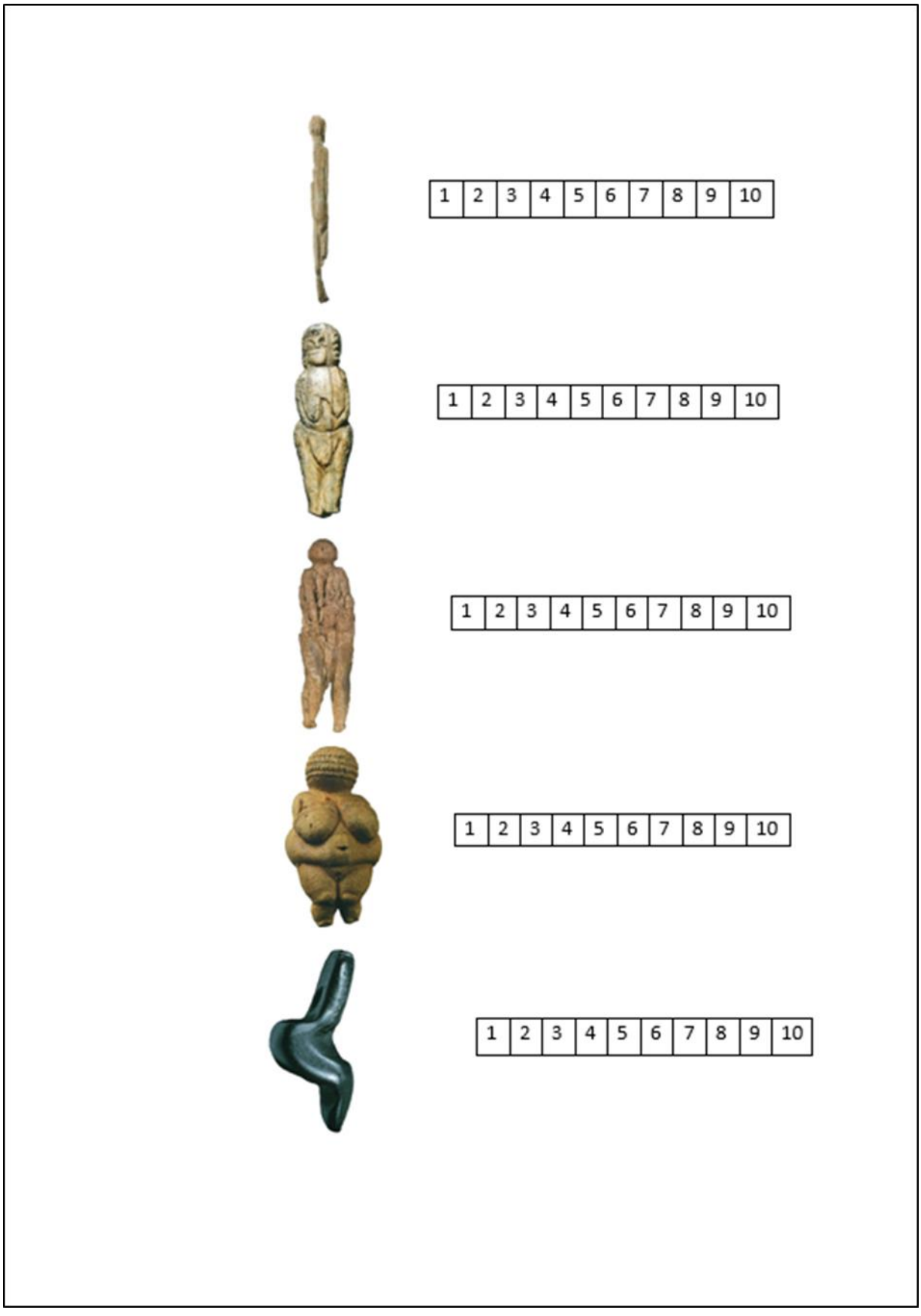
1	2	3	4	5	6	7	8	9	10

1	2	3	4	5	6	7	8	9	10

1	2	3	4	5	6	7	8	9	10

1	2	3	4	5	6	7	8	9	10

1	2	3	4	5	6	7	8	9	10


1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10

1	2	3	4	5	6	7	8	9	10

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1	2	3	4	5	6	7	8	9	10

1	2	3	4	5	6	7	8	9	10

1	2	3	4	5	6	7	8	9	10

Appendix 5- Information sheet

All personal data relating to this study will be held for 5 years from the date of publication of the research. BU will hold the information we collect about you in hard copy in a secure location and on a BU password protected secure network where held electronically.

Except where it has been anonymised, we will restrict access to your personal data to those individuals who have a legitimate reason to access it for the purpose or purposes for which it is held by us.

The information collected about you may be used in an anonymous form to support other research projects in the future and access to it in this form will not be restricted. It will not be possible for you to be identified from this data.

What will happen to the results of the research project?
The experimenters will not calculate your scores on the questionnaire whilst you are at the University and will not provide the calculated scores to you. Your data will never be associated with your name at any point as it will be anonymized at the point of collection.

Who is organizing/funding the research? (If applicable)
This session is organised and funded by Samuel Hirst in partnership with Bournemouth University.

Will I be recorded, and how will the recorded media be used?
Although the eye tracker records the movements of your eyes, it does not record your whole face and you cannot be identified from the recording.

Contact for further information

For further information please contact:

Samuel Hirst, shirst@bournemouth.ac.uk

In case of complaints, please contact Professor Tiantian Zhang, Deputy Dean for Research & Professional Practice, Deputy Dean for Research & Professional Practice by email to: researchgovernance@bournemouth.ac.uk

You can keep this form and a copy of the signed participant agreement form to take home.
Thank you for taking the time to read this form.

Appendix 6- Consent form

Bournemouth University

PARTICIPANT AGREEMENT FORM

Title of the project: **Upper Palaeolithic female representations: an eye tracking study.**

Name, position and contact details of the researcher: *Samuel Hirst, Post Graduate Researcher, Bournemouth University.*

Contact email: shirst@bournemouth.ac.uk

I confirm that I have read and understood the participant information sheet.	
I confirm that I have had the opportunity to ask questions.	
I understand that my participation is voluntary	
I understand that I am free to withdraw up to the point of anonymisation, without giving reason and without there being any negative consequences.	
During the task or experiment, I am free to withdraw without giving a reason and without there being any negative consequences.	
Should I not wish to answer any particular question(s), complete a test, I am free to decline	
I give permission for members of the research team to have access to my anonymised responses. I understand that my name will not linked with the research materials, and I will not be identified or identifiable in the outputs that result from the research.	
I agree to take part in the study	

Name of Participant	Date	Signature
Name of Researcher	Date	Signature

Once this has been signed by all parties the participant should receive a copy of the signed and dated participant consent form, the participant information sheet and any other written information provided to the participants. A copy of the signed and dated consent form should be kept with the project's main documents which must be kept in a secure location. Any concerns about the study should be directed to Samuel Hirst (shirst@bournemouth.ac.uk). If your concerns are not answered by Samuel Hirst, you should contact Professor Tiantian Zhang, Deputy Dean for Research and Professional Practice, Faculty of Science and Technology, Bournemouth University by email to: researchgovernance@bournemouth.ac.uk

Appendix 7- Debrief sheet

Bournemouth University

Upper Palaeolithic female representations: an eye tracking study

Thank you for taking part in this study!

What was the aim of the study?

This study is investigating the ways in which people interact with Upper Palaeolithic female sculptures.

As you have seen during this experiment, these sculptures have been found to possess a large range of forms, and are also found at sites all the way across Europe. Despite radical differences in both style and geographical location, all of these sculptures are viewed as being the same when it comes to their interpretation. This study hopes to provide an insight, through a cognitive archaeological approach, into how these items were interacted with during the Upper Palaeolithic period. Depending on the results of this project, it can be used to either support the notion that these sculptures were the same or to suggest a new way of categorizing the sculptures.

What happens with the information?

All the information that you have given will be treated in accordance with UK Data Protection Regulations and only used for research purposes. Results are identified by participant number only so you will remain completely anonymous. If you decide that you no longer want the results to be included in this study, please tell the experimenter now. Once you leave it will not be possible to trace your results to your name.

I would like to receive a summary of the results of the study. Who should I contact?

Once the results are analysed a summary will be made available for those that are interested. Please do not hesitate to contact me if you would like a summary or if you would like more information at: shirst@bournemouth.ac.uk

I have concerns about this study or the way in which it was conducted. Who should I contact?

In the first instance you should contact Samuel Hirst by the email listed above. If your concerns are not dealt with by him, then please contact Professor Tiantian Zhang, Deputy Dean for Research and Professional Practice, Faculty of Science and Technology, Bournemouth University (researchgovernance@bournemouth.ac.uk)

Appendix 8- Mauchly's test of sphericity

Mauchly's test of Sphericity indicated that during the analysis of the effects of Category on dwell time to the IAs the assumption of sphericity had been met by Category, but was violated by both IA (X^2 (9) = 74.43, $p < .001$), and Category vs IA (X^2 (35) = 234.93, $p < .001$). The degrees of freedom in these variables were corrected using Greenhouse-Geisser estimates of sphericity (E = .57, E = .43).

During the ANOVA to compare the effect of Familiarity on IA dwell times, all of the variables violated the assumption of sphericity; Familiarity (X^2 (2) = 6.20, $p = .045$), IA (X^2 (9) = 83.51, $p < .001$), Familiarity vs IA (X^2 (35) = 282.32, $p < .001$), IA remained the same as during the Category dwell time analysis. Familiarity was corrected using Huynh-Feldt estimates of sphericity (E = .93), whilst IA and Familiarity vs IA were corrected using Greenhouse-Geisser estimates (E = .56, E = .35).

During the ANOVA to compare the effect of Category on the first fixations to the IAs the assumption of sphericity was violated by all of the variables: Category (X^2 (2) = 15.53, $p < .001$), IA (X^2 (9) = 180.13, $p < .001$), and Category vs IA (X^2 (35) = 476.21, $p < .001$). The degrees of freedom for Category were corrected Huynh-Feldt estimates of sphericity (E = .79), whilst IA and Category vs IA were both corrected using Greenhouse-Geisser estimates (E = .54, E = .30).

During the ANOVA to compare the effect of Familiarity on the first fixations to the IAs the assumption of sphericty was violated by all of the variables: Familiarity (X^2 (2) = 9.63, $p = .008$), IA (X^2 (9) = 203.76, $p < .001$), (Familiarity vs IA (X^2 (35) = 562.30, $p < .001$). the degrees of freedom for Familiarity were corrected using Huynh Feldt estimates of sphericty (E = .88), whilst IA and Familiarity vs IA were both corrected using Greenhouse-Geisser estimates (E = .53, E = .34).

Appendix 9

Table III
Familiarity quartiles

Quartile	Stimuli	Category
High Familiarity	Willendorf, front view	Exaggerated
	Willendorf, back view	Exaggerated
	Willendorf, side view	Exaggerated
	Kostenki 1b, front view	Exaggerated
	Kostenki 1b, side view	Exaggerated
	Dolní Věstonice , front view	Exaggerated
	Dolní Věstonice , back view	Exaggerated
	Dolní Věstonice , side view	Exaggerated
	Kostenki 1c, front view	Exaggerated
	Menton, front view	Exaggerated
	Menton, back view	Exaggerated
	Menton, side view	Exaggerated
	Monpazier, front view	Exaggerated
	Monpazier, back view	Exaggerated
	Monpazier, side view	Exaggerated
	Lespugue, front view	Exaggerated
	Lespugue, side view	Exaggerated
Low Familiarity	Mal'ta (2), front view	Non-Exaggerated
	Gönnersdorf (1), side view	Gönnersdorf
	Kostenki 1a, front view	Non-Exaggerated
	Kostenki 1a, side view	Non-Exaggerated
	Nebra (1), side view	Gönnersdorf
	Nebra (3), side view	Gönnersdorf
	Tursac, front view	Exaggerated
	Tursac, side view	Exaggerated
	Gönnersdorf (2), side view	Gönnersdorf
	Pekarna, side view	Gönnersdorf
	Trasimeno, side view	Exaggerated
	Neuchatel, side view	Gönnersdorf
	Andernachc, side view	Gönnersdorf
	Gönnersdorf (3), side view	Gönnersdorf
	Andernachc (2), side view	Gönnersdorf
	Gönnersdorf (4), side view	Gönnersdorf

Appendix 10

Table IV
Category definitions

Category	Gönnersdorf	Exaggerated	Non-Exaggerated
Style	A distinct lack of features on the front and back of these sculptures indicates that they were meant to be viewed in profile.	The emphasis on details covering all sides of this imagery shows that their three dimensional form played an important role within their usage.	The features presented by these sculptures reveal that they were also designed to be viewed from all angles.
Method of Abstraction	These sculptures reduce the female body down to a completely non-representational form. Depicting women in a rod-like fashion in which protrusions represent the buttocks and in some cases also the breasts. There are no attempts to denote the head or signifiers of personal identity.	These sculptures emphasize the female form through the enlargement of the sexual characteristics. They also, with the exception of some examples, exhibit a distinct lack of facial features; either depicting hair or a headdress instead or simply lacking detail on the head all together. They are usually depicted as naked, can be wearing personal adornments usually in the form of necklaces and bracelets. These sculptures are still clearly recognisable as women, and in some cases are pregnant.	They take perhaps the most realistic approach towards female representation out of all of the categories. The sexual characteristics are not emphasized, and in some cases are even understated. Faces are often present amongst this imagery, and clothing can also be depicted. Generally these figurines do not appear pregnant and it is clear they show women.
Media	The majority of these sculptures are formed from bone, ivory and antler. There have also been finds made	These sculptures are formed from a large range of materials, ranging from limestone and ivory to baked clay.	Similarly to the Exaggerated sculptures, these figurines have been constructed from a diverse range of media. Ivory and bone are popular materials for this style of art, though the artists were

	from slate and local stone.		creative with the materials as indicated by the presence of figurines carved from red haematite.
Distribution	These statues are mostly found in Central Europe, but discoveries further east in Ukraine suggest a broader distribution.	These statues have been found widely distributed throughout most of Europe, with a focus on Central and Western Europe.	They are also spread throughout Europe, with finds from sites such as Mal'ta evidencing a distribution that extends out east into Siberia.
Relation to Immobile Art	The Gönnersdorf style sculptures are paired with an artistic tradition towards parietal art. Taking the form of engravings, this art depicts women in the same way as presented by the figurines.	There are some examples of this style of female imagery having been translated into parietal art, most notably is the bas-relief from Laussel. However, this does not come close to matching the volume of Gönnersdorf engravings that have been found.	This style of female imagery is not easily comparable to parietal art, implying that whatever their function; it could not be translated into a stationary format.

Appendix 11

Table V
List of sculptures within each category

Category	Female figurine	Views of Figurine Shown
Exaggerated	Dolní Věstonice	Front, Side and Back
	Gagarino	Front, Side and Back
	Hohle Fels	Front, Side and Back
	Kostenki 1b	Front and Side
	Kostenki 1c	Front
	Lespugue	Front and Side
	Menton	Front, Side and Back
	Monpazier	Front, Side and Back
	TheUndescribed Venus	Front
	Trasimeno	Side
	Tursac	Front and Side
	Willendorf	Front, Side and Back
Gönnersdorf	Andernach	Side
	Andernach 2	Side
	Gönnersdorf 1	Side
	Gönnersdorf 2	Side
	Gönnersdorf 3	Side
	Gönnersdorf 4	Side
	Nebra 1	Side
	Nebra 2	Side
	Nebra 3	Side
	Neuchatel	Side
	Pekarna	Side
Non-Exaggerated	Avdeevo	Front and Side
	Avdeevo 2	Front
	Eliseevitchi	Front and Side
	Grotte du Prince	Front
	Kostenki 1a	Front and Side
	Mal'ta 1	Front
	Mal'ta 2	Front
	Mal'ta 3	Front
	Mal'ta 4	Front
	Mal'ta 5	Front
	Petrkovice	Front and Side
	Polichinelle	Front, Side and Back
	Renancourt	Front and Side
	Savignano	Front and Side
	Zaraysk	Front, Side and Back

Appendix 12- Map of distribution

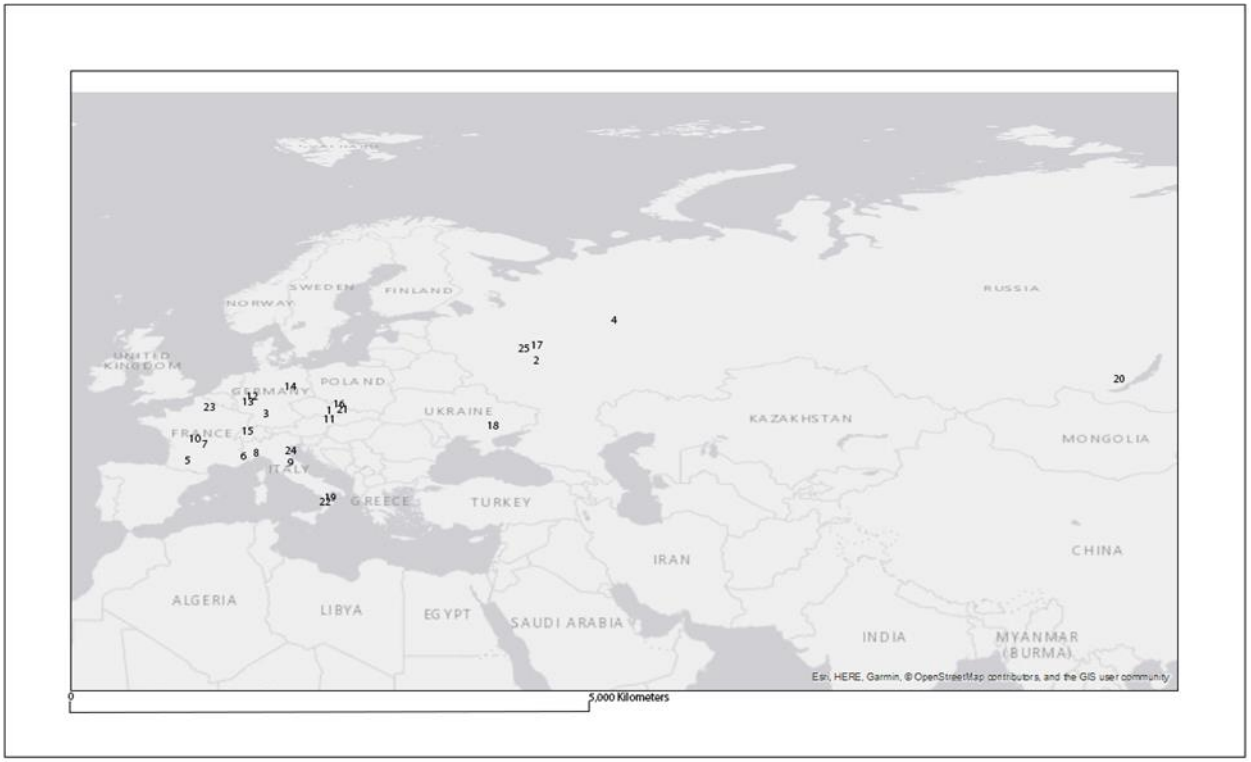

Figure 10: Distribution of female figurines. The sites shown are as follows: 1: Dolní Věstonice, 2: Gagarino, 3: Hohle Fels, 4: Kostenki, 5: Lespugue, 6: Menton, 7: Monpazier, 8: The Undescribed Venus, 9: Trasimeno, 10: Tursac, 11: Willendorf, 12: Andernach, 13: Gonnersdorf, 14: Nebra, 15: Neuchatel, 16: Pekarna, 17: Avdeevo, 18: Eliseevitchi, 19: Grotte du Prince, 20: Mal'ta, 21: Petřkovice, 22: Pilichinelle, 23: Renancourt, 24: Savignano, 25: Zaraysk.