METRIC ANALYSIS OF A FEMALE FIGURINE FROM TEPE SARAB

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Abstract

Prehistoric human figurines in general and female figurines in particular have been of long-standing interest to archaeologists, but there has been considerable debate about their function. Although early human figurines are often viewed as a corpus, there is considerable variety in body proportions, forms and artistic styles across the vast geographical areas and temporal periods for which they are attested. Here, a metric analysis using the Root Mean Square Deviation (RMSD) technique is used to compare a figurine from Tepe Sarab with contemporaneous and earlier figurines from a broad geographical area. The results of this analysis indicate that there is a clear division in style and body proportions between the female figurines that are made during the Palaeolithic and Neolithic periods. Moreover, our results indicate that there are clear differences in style and body proportions between figurines found in Central Europe and the Near East.

Keywords

Tepe Sarab; female figurine; metric analysis; Upper Palaeolithic; Neolithic

I. INTRODUCTION

Human figurines are amongst the most evocative artefacts that have been discovered at sites dating to the Palaeolithic and Neolithic across the Old World, though they do not typically appear in great numbers (Beck 2000; Kuijt and Chesson 2005: 123). Female human figurines are often referred to as mother-goddesses or Venus figurines, but these names imply a specific function and there is actually little general agreement about the possible function or functions of such items.

The use of overarching descriptive names suggests that such figurines are parts of a broader tradition and such a view is encapsulated in Leroi-Gourhan's (1968: 96) statement that:

> No matter where found … they are practically interchangeable, apart from their proportions. The most complete figurines have the same treatment of the head, the same small arms folded over the breast or pointing towards the belly, the same low breasts dropping like sacks to far below the waist, and the same legs ending in miniscule or non-existent feet.

The emphasis on some parts of the figurine's body, specifically those responsible for reproduction such as breasts and pelvis, has led some scholars to argue that they were made essentially without head and hands to emphasise the significance of the exaggerated elements (Vess 2006: 8; Whittle 1996: 64).

It is possible that the visual similarities between prehistoric figurines could be related to their function. So far, there have been a range of different explanations proposed for their function, including their usage as cult figurines (Ucko 1968: 443; Daems 2008), as vehicles of magic in rituals (Ucko 1968: 444; Voigt and Meadow 1983: 187; Schmandt-Besserat 1997: 48; Garfinkel 2003: 96; Daems 2008), the worshipping of dead ancestors (Ucko 1968: 444; Schmandt-Besserat 1998: 1; Whittle 1996: 66; Daems 2008), items related to the abundance of food (Voigt 2001: 288), items used to teach proper behaviour (Ucko 1968: 444; Daems 2008) and toys for children (Ucko 1968: 444; Schmandt-Besserat 1997: 48; Voigt and Meadow 1983: 195; Daems 2008). It is often asserted that female figurines might have been made to be used as symbols of fertility (e.g. Voigt and Meadow 1983: 188), and Marckale (1999) has suggested that the belief in "Mother Earth" has been seeded in the unconsciousness of the human beings since the Palaeolithic, and that such beliefs eventually turned to the female dominance during the Neolithic. Kuijt and Chesson (2005: 155) have suggested that the physical

shape of male, female and even of animal figurines embody the social role of males, females and animals in the Neolithic societies. It is possible that the concept of woman as a symbol of fertility and growth developed into the notion of the woman as the goddess of cultivation, domestication, and any activity related to the growth and reproduction of food on earth during the Neolithic period, and mothers might have been seen as the symbols of life (Marckale 1999; Mellaart 1962; Nelson 2004; Beck 2000; Voigt and Meadow 1983: 188). Nonetheless, as Voigt (2001: 288–90) and Daems (2004) have both emphasised, there is unlikely to be one function that will explain all of the possible uses of human figurines across the Old World. Lesure (2011) has argued that it is important to consider the relevance of resemblance between contexts before presuming similarity of use and/or function.

Aside from the potential function or functions of female figurines in the prehistoric societies, a range of different explanations have been put forward to explain their broad visual similarities. McDermott has suggested (McDermott 1996; McCoid and McDermott 1996) that the particular shape of the female figurines resembles a view of a pregnant female when she was observing her body from above. It has also been suggested that the body proportions and specifically the breasts of some figurines (e.g., Willendorf and Laspugue) are indicative of massive hypertrophy of the breasts (Harding 1976).

Gamble (1982) has proposed that Palaeolithic female figurines can be attributed to three major categories based on their visual features. Group A, which is also known as the classic group, and considered to be the oldest, consists of figurines of different sizes made on different types of raw materials such as limestone (Willendorf), serpentine (Savignano), hematite (Petřkovice), mammoth ivory (Kostenki, Brassempouy, Lespugue, and Gagarino), and baked clay (Dolní Vestoniče). Most of the specimens in this group are fragmentary, and some are believed to be unfinished (Gagarino). Group B female figurines are relatively small in body size, ranging from 3.7 to 9 cm in length, their heads are not very well modelled, and they are made of stone (e.g., Sireuil, Trasimento, Enval, and Farincourt). Group C is comprised of engraved forms made on different materials and in various sizes (e.g., Laussel and Abri Pataud).

The research presented here pursues two main objectives. First, one of the female figurines from Tepe Sarab will be examined and compared metrically with some other contemporaneous and earlier female figurines on the basis of their physical dimensions. Secondly, the possibility that there are any meaningful physical differences between the female figurines made in Palaeolithic and Neolithic periods will be investigated.

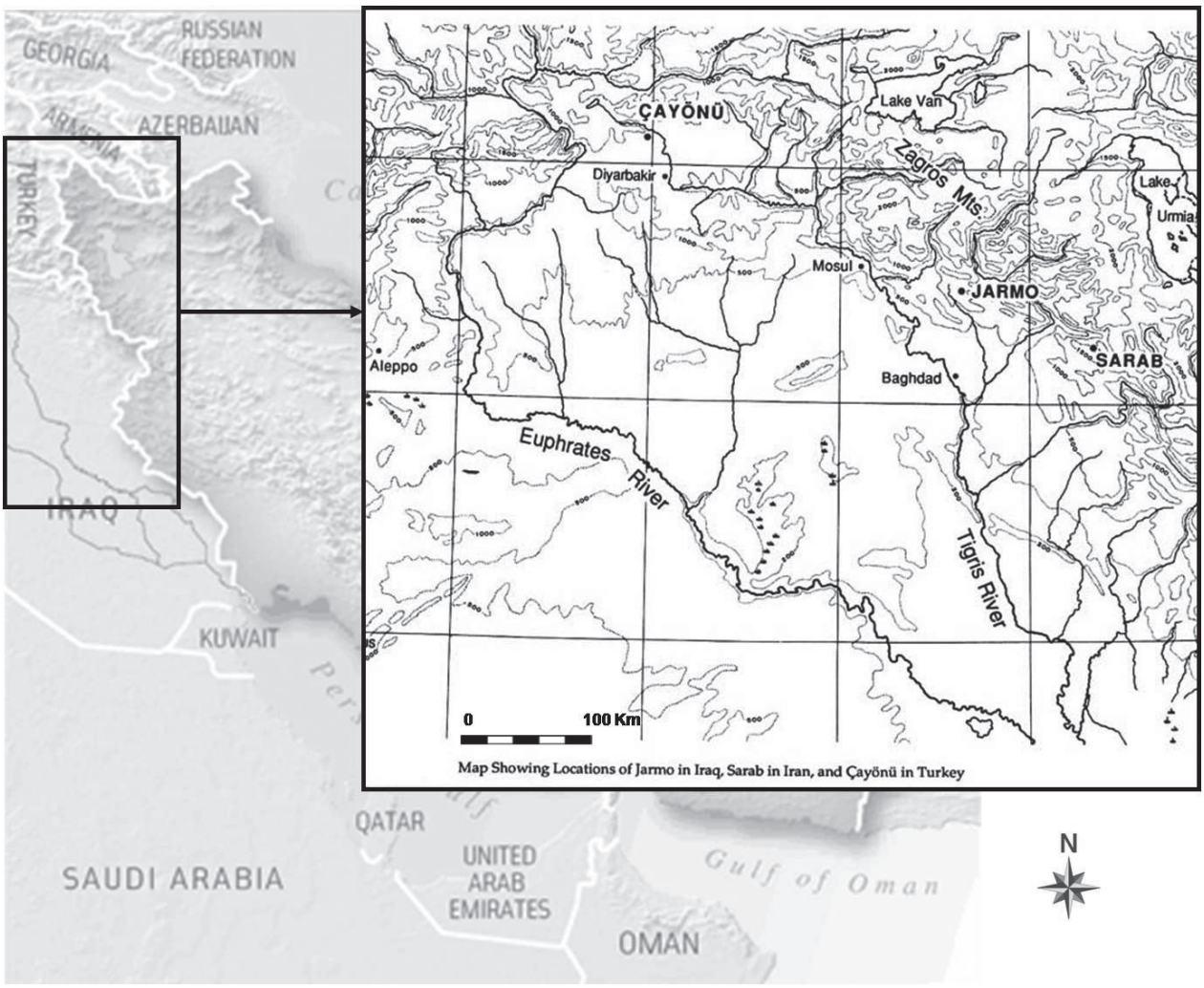
II. GEOGRAPHICAL LOCATION AND ARCHAEOLOGICAL HISTORY OF TEPE SARAB

The mound known as Tepe Sarab is located to the east of the modern city of Kermanshah, in north-west Iran, in the central part of the Zagros Mountains (Fig. 1). Tepe Sarab was first recognised by nearby villagers who conducted illicit excavations, but during the 1960s, as a part of the Oriental Institute's Prehistoric project, Robert Braidwood and his colleagues tested some of the undisturbed portions of the mound (Braidwood *et al.* 1960; Braidwood 1961). It was subsequently inspected by researchers from the University of Toronto. The University of Toronto excavations concluded that the site was occupied around 6000 BC (Levine 1976; Levine and McDonald 1977).

The University of Toronto excavations lead to the discovery of approximately 2400 clay objects (Broman Morales 1990). Although Tepe Sarab is not the only site where early human figurines have been discovered in Iran (e.g., Ganj Dareh, Ali Kosh, Tepe Guran, Yanik Tepe, Haji Firuz, Zaghe, etc.), it has the largest quantity of human figurines among all excavated Iranian Neolithic sites. McDonald (1979) proposed that Tepe Sarab was probably not occupied by family groups, but Broman Morales (1990) has argued that due to the large variety within the clay figurines corpus, Tepe Sarab was inhabited seasonally by groups of families for some hundreds of years (Broman Morales 1990).

III. SARAB FEMALE FIGURINE

Of the 2400 clay figurines discovered at Tepe Sarab, human clay figurines are the most abundant form. These clay figurines were often well-made, reflecting a great degree of manual dexterity. Seven different categories of human figurines and five types of female figurines (see also Daems 2004, figs. 5 to 11) are recognisable among the Tepe Sarab human figurine



Map Showing Locations of Jarmo in Iraq, Sarab in Iran, and Çayönü in Turkey

Fig. 1. Geographical location of Tepe Sarab, after Broman Morales 1990.

corpus (Broman Morales 1990). However, because of good preservation and the issue of accessibility only one specimen from the site is used in this study (Fig. 2). This is probably the best known figurine from the site and in this paper is will henceforth be referred to as the Sarab figurine.

FIG 2

The Sarab figurine was discovered alongside many other clay figurines, deep in level Sic - 2a, close to the west end of the central trench in Operation I (Broman Morales 1990). The Sarab figurine (currently exhibited at the Tehran National Museum) is in a seated position and naked. It shows no head and no arms. However, because of the specific form of the neck, it is possible that the original figurine was manufactured with a separate piece as a head, which is missing. The legs are fat and the lower part of the body is dominated by the stomach and the large breasts (Fig. 2). It has no signs of being pregnant. In general, the Sarab figurine's body has a more realistic form and less exaggeration when compared to other contemporaneous examples (Broman Morales 1990).

IV. MATERIALS AND METHODS

Most previous studies of prehistoric female figurines have been non-quantitative in nature, and solely based

Fig. 2. Tepe Sarab figurine (Photograph is taken by the permission of Tehran National Museum).

on the visual aspects of the body features (e.g., large belly, breasts and legs, and the absence or presence of organs). Although such visual comparative analysis provides a great deal of information about the style and form of figurines, the incorporation of more in-depth quantitative approaches is an obvious avenue for future research. Computerised measurements have the potential to facilitate the use of appropriate statistical techniques to assess non-quantitative features. For example, while there have been claims concerning the similarities and dissimilarities of some of the figurines in their shape and style, it is not exactly clear how strong the resemblance between certain figurines actually is. Some female figurines are visually similar in form (e.g., Avdeevo and Serpantine), but the question remains open about how close those similarities are.

There are various methods that might be used to examine similarities, including consideration of manufacturing steps, and reconstruction of elements of the life cycle of the figurines, including patterns of breakage, and also methods focused on morphological characteristics. In order to generate quantitative data for early figurines, a method using body indices and computerised measurements has been adopted here.

To ensure that the analysis of the Sarab figurine could be situated in a broad geographical and chronological context, a range of female figurines were selected for analysis from Upper Palaeolithic and Neolithic sites in both Western Asia and Europe. In the original data collecting process, information from 33 female figurines were gathered, but several of those figurines lacked the body parts needed for this study, so a final data set of 22 figurines were selected for this investigation. The figurines that have been analysed are listed in Table 1 and include samples from Western and Eastern Europe, the Mediterranean and Western Asia. In addition, some of the samples were deliberately selected in the hope that they would act as outliers in the analysis (e.g. the figurines from Upper Palaeolithic Laspugue in France and Neolithic Jomon in Japan).

The analysis carried out for this research involved two steps; the first of which was the measurement of different body parts. Figure 3 indicates the specific body parts that were used for making indices. In this study, the height of the body is equal to the full length of the statue, from the neck to the most distal part of the body. Width and height of each breast were

TABLE 1. List of Female figurines analysed in this study.

Name	**Location**	**Period**	**Reference**
Laspugue	France	Upper Palaeolithic	Berghaus 2004: 183; Davidson 1998: 91
Avdeevo	Russia	Upper Palaeolithic	Guthrie 2005: 361
Laussel	France	Upper Palaeolithic	Kleiner *et al*. 2004: 18; Vess 2006: 7
Monpazier	France	Upper Palaeolithic	Marckale 1999: 51
Serpantine **Serpentine??**	Italy	Upper Palaeolithic	*Peabody Museum of Archaeology and Ethnology* 1953: 37
Willendorf	Austria	Upper Palaeolithic	Nead 1992: 38; Kleiner *et al*. 2004: 18; Waller 2001: 37
Kostenki	Russia	Upper Palaeolithic	Morwood and Hobbs 2002: 183
Vestonika **Vestonicka??**	Czech	Upper Palaeolithic	Robert 2005: 178
Durankulak	Bulgaria	Neolithic	Bailey 2005: 13
Lerna	Greece	Neolithic	Caskey and Blackburn 1997: 6
Pharsala	Greece	Neolithic	Preziosi and Hitchcock 1999: 38
Bilche Zolotoe	Ukraine	Neolithic	Milisauskas 2002: 187
Horvat Minha	Levant	Neolithic	Landay 1971: 40
Střelice	Czech	Neolithic	Pallottino 1968: 208
Jomon	Japan	Neolithic	Habu 2004: 145; Furse 2002: 19
Vidra	Romania	Neolithic	*Encyclopedia Britannica* 1974: 708
Sarab	Iran	Neolithic	Prithvi 1984: 11
Badarain	Egypt	Neolithic	Arkell 1975: 31–32; Wengrow 2006: 55
Tell Kashkuk	Syria	Neolithic	Akkermans and Schwartz 200: 143
Malta	Malta	Neolithic	Bain and Wilson 2004
Moldavia	Romania	Neolithic	Emerson 1996: 83
Hacılar 5	Turkey	Neolithic	Muscarella 2000: 438

measured using maximum height and width. Height of chest refers to the distance between the distal part of the neck to the distal portion of the breasts, the stomach height indicates the distance between the distal portion of the breasts and the proximal part of the legs. In order to measure the pelvic width, the maximum width was recorded.

The second step involved determining body indices. To make comparable indices and to avoid the effect of differences in sizes, each body part's measurement was divided by the height of the sample (h in Fig. 3) (e.g., height of the left breast/height of the body, width of the left leg/height of the body, and etc.).

After making all the indices for the 11 different body parts for each specimen, the matrix of morphological distances of each female figurine from the rest

Fig. 3. Body parts used for making indices. (h: full length of the statute from the neck to the most distal part of the body, a: maximum breast width, b: maximum breast height, c: height of the chest, d: maximum pelvic width, e: stomach height, f: maximum width of leg, and g: maximum height of leg).

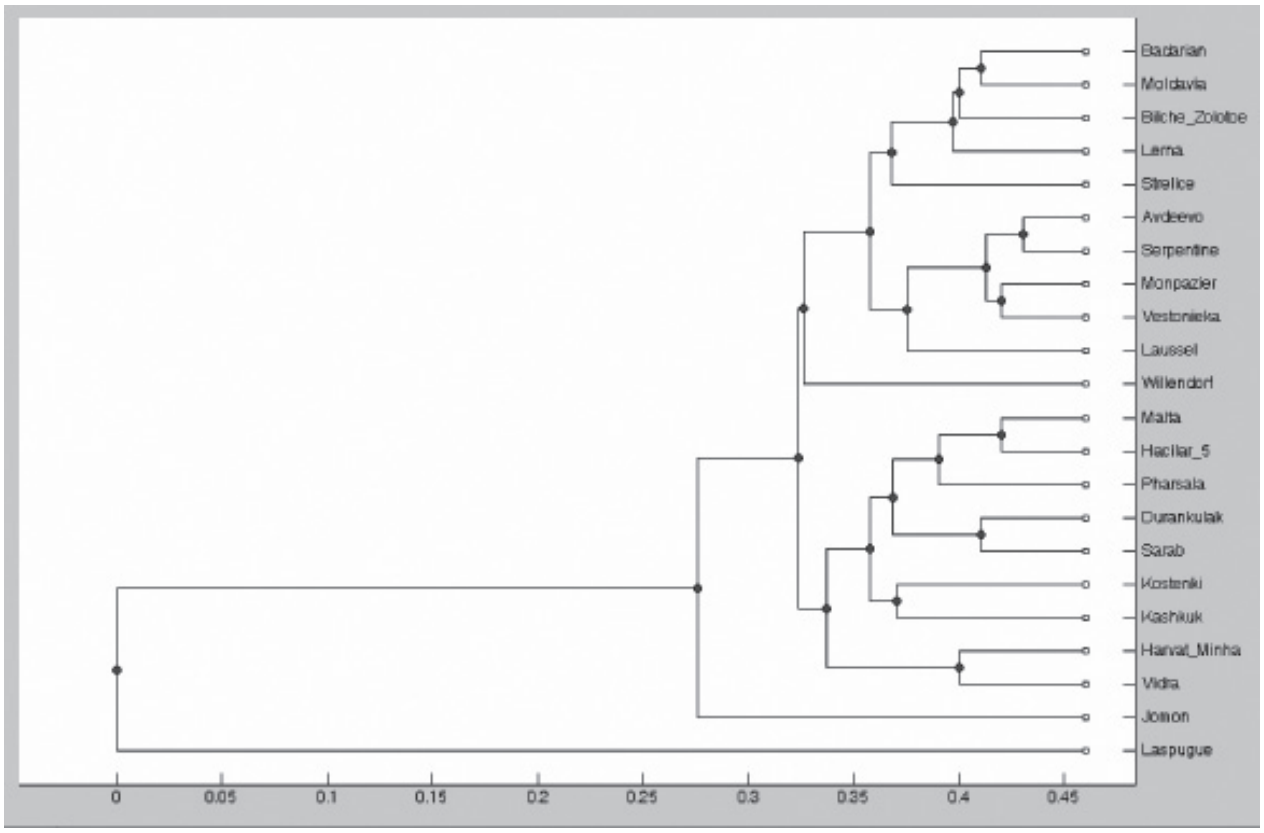


Fig. 4. Phylogenic tree of the female figurines.

of the figurines was calculated using the Root Mean Square Deviation or RMSD technique. Root Mean Square Deviation computes the mean of each specific attribute value, the deviation of each sample from that mean, the square of that deviation, and ultimately calculates the mean of all of the squared deviations for each sample figurine. The RMSD technique makes it possible to compare individual figurines with each of the other figurines in the sample set, and enables the calculation of the degree of similarity between the specimens based on morphology. Table 2 summarises the results of the RMSD analysis in the form of a matrix that compares each of the selected figurines. Based on the results produced by RMSD, a phylogenic tree of the female figurines was created (Fig. 4).

V. RESULTS AND DISCUSSION

The phylogenic tree shown in Figure 4 displays the relationships between the 22 figurines as implied by the RMSD analysis, where the figurines are grouped on the basis of the degree of their morphological resemblance. The samples from Laspugue (Upper Palaeolithic) in France and Jomon (Neolithic) in Japan are clear outliers as was predicted. Leaving these aside, three major clusters are observable. Cluster one consists of five figurines, Badarian (Egypt), Moldavia (Romania), Bilche Zolotoe (Ukraine), Lena (Greece) and Strelice (Czech Republic). All of these samples date to the Neolithic period, and, except for Badarian which comes from Egypt, are from Eastern Europe.

Cluster two is represented by six figurines: Avdeevo (Russia), **Serpetine???** (Italy), Monpazier (France), Vestonieka **Vestonicka???** (Czech Republic), Laussel (France), and Willendorf (Austria). All of these samples belong to the Upper Palaeolithic, and except for Avdeevo, which is geographically distant from the rest of the samples, all are from Central and Western Europe.

Cluster three consists of nine figurines: Malta (Malta), Hacılar 5 (Turkey), Pharsala (Greece),

TABLE 2. Matrix of RMSD.

	Laspugue	Avdeevo	Laussel	Monpazier	Serpentine	Willendorf	Kostenki	Vestonieka	Durankulak	Lerna	Pharsala	Bilche Zolotoe	Harvat Minha	Střelice	Jomon	Vidra	Sarab	Badarian	Kashkuk	Malta	Moldavia	Hacılar 5
Laspugue	-																					
Avdeevo	0.45	-																				
Laussel	0.45	0.07	-																			
Monpazier	0.46	0.04	0.09	-																		
Serpentine	0.45	0.03	0.09	0.04	-																	
Willendorf	0.37	0.1	0.12	0.11	0.1	-																
Kostenki	0.42	0.11	0.12	0.14	0.11	0.13	-															
Vestonieka **Ves-tonicka?**	0.45	0.05	0.09	0.04	0.06	0.09	0.14	-														
Durankulak	0.42	0.15	0.14	0.18	0.16	0.17	0.1	0.19	-													
Lerna	0.48	0.09	0.11	0.09	0.1	0.16	0.15	0.12	0.16	-												
Pharsala	0.44	0.12	0.11	0.14	0.13	0.14	0.12	0.15	0.09	0.11	-											
Bilche Zolotoe	0.5	0.11	0.12	0.09	0.11	0.17	0.19	0.13	0.2	0.06	0.15	-										
Harvat Minha	0.49	0.15	0.11	0.17	0.16	0.19	0.15	0.17	0.14	0.14	0.09	0.16	-									
Střelice	0.5	0.11	0.09	0.11	0.12	0.17	0.18	0.13	0.19	0.1	0.14	0.08	0.11	-								
Jomon	0.53	0.2	0.2	0.22	0.2	0.25	0.15	0.24	0.16	0.18	0.16	0.22	0.17	0.22	-							
Vidra	0.5	0.13	0.09	0.14	0.15	0.19	0.15	0.16	0.14	0.11	0.1	0.13	0.06	0.09	0.17	-						
Sarab	0.44	0.14	0.12	0.16	0.15	0.16	0.09	0.17	0.05	0.13	0.07	0.18	0.1	0.16	0.14	0.1	-					
Badarian	0.49	0.07	0.11	0.05	0.06	0.14	0.15	0.09	0.19	0.07	0.14	0.06	0.16	0.09	0.2	0.14	0.17	-				
Kashkuk	0.45	0.13	0.15	0.15	0.12	0.17	0.09	0.17	0.12	0.11	0.11	0.16	0.17	0.18	0.11	0.16	0.11	0.13	-			
Malta	0.44	0.06	0.07	0.08	0.07	0.11	0.1	0.1	0.12	0.07	0.07	0.1	0.11	0.1	0.17	0.1	0.09	0.08	0.1	-		
Moldavia	0.51	0.1	0.13	0.09	0.1	0.18	0.16	0.13	0.19	0.06	0.15	0.06	0.16	0.1	0.17	0.14	0.17	0.05	0.12	0.1	-	
Hacılar 5	0.43	0.08	0.08	0.11	0.09	0.12	0.09	0.12	0.1	0.08	0.07	0.12	0.12	0.12	0.16	0.1	0.08	0.11	0.09	0.04	0.11	-

Durankulak (Bulgaria), Sarab (Iran), Kostenki (Russia), Kashkuk (Syria), Harvat Minha (Levant), and Vidra (Romania). With the exception of Kostenki, which dates to the Upper Palaeolithic, the remainder of these examples date to the Neolithic, and they appear to come from several geographically distinct regions, including the Mediterranean, Eastern Europe and Western Asia. It is notable that there appear to be degrees of similarity between the three samples from the Mediterranean (Malta, Hacılar 5 and Pharsala), but the remaining samples most resemble others that are not geographically proximate (e.g. Sarab and Durankulak, Kostenki and Kashkuk, and Harvat Minha and Vidra).

Female figurines have undoubtedly been a topic of debate for which there has been no consensus. Explanations have fluctuated from the universalist to the variable and back (e.g. Voigt 2001; Daems 2004; Lesure 2011), and it seems unlikely that a decisive explanation will be achieved in the near future, which is undoubtedly complicated by the relative similarity of many early figurines across vast time periods and geographical regions. While some human technological innovations and cultural adaptations might be seen as being the simplest responses to factors such as environmental pressures (e.g. modifications to flint-knapping strategies in response to the shortage of raw materials, invention of the wheel), the manufacture of female figurines is unlikely to be a simple response to environmental demands. Although objects classified as female figurines might look similar to each other, there are often significant variations in shape, form, style, and materials. In spite of the range of variation, these figurines do display similar body features.

By using a RMSD analysis, a selection of female figurines clustered into three groups:

- Eastern Europe Neolithic (EEN) (Badarian, Moldavia, Bilche Zolotoe, Lena, Strelice)
- European Upper Palaeolithic (EUP) (Avdeevo, **Serpetine???**, Monpazier, Vestonieka **Vestonicka???**, Laussel, Willendorf)
- Near Eastern, Mediterranean and Eastern European Neolithic (NEMEN) (Malta, Hacılar 5, Pharsala, Durankulak, Sarab, Kostenki, Kashkuk, Harvat Minha, Vidra).

Although some of the samples in the clusters are not strictly related geographically, (e.g., Kostenki from Russia in Group 3), the majority of the samples comply with such clustering.

In each cluster, there are some interesting patterns concerning the within group variations. Group 1 (EEN) displays a significant degree of similarity in the RMSD distances between samples (between 0.40 and 0.42), with the exception of Střelice. Such close resemblance might be due to the close proximity of the figurines in both geography and time. Such close affinities might also be responsible for the separation of this group from other Neolithic specimens (Group 3). Close resemblance in terms of RMSD distances are also seen in Group 2 (EUP) (between 0.42 and 0.43), although there are two specimens (Laussel and Willendorf) that deviate from the rest of the EUP group while still clustering with the rest of the EUP specimens. The Willendorf figurine may actually be an outlier of Group 2. The widest dispersal of RMSD distances is in Group 3. While all of the samples except the one from Kostenki belong to the Neolithic period, their distances are variable (between 0.34 and 0.42). Such a large range might be indicative of the vast geographical dispersal of the samples in this group.

In terms of between cluster relationships, Group 1 (EEN) and 2 (EUP) have lower RMSD distances compared to Group 3. It is notable that all of the samples in these two groups come from a broadly similar geographical zone, despite being significantly separated by time. With one exception, the clustering shows a clear separation between the figurines of the Palaeolithic and Neolithic, and also provides some evidence for geographical separation as well.

VI. CONCLUSIONS

As noted above, this research was designed to address two main objectives: first, to investigate whether the Sarab female figurine demonstrates any similarity in form and physical dimensions to other figurines from neighbouring regions; and secondly, to examine whether there is any meaningful similarities or differences between female figurines made in Palaeolithic and Neolithic periods.

In terms of the first question, it appears that the Sarab figurine is completely separate from the Upper Palaeolithic group (Group 2) and clusters with Group 3, which dates to the Neolithic. As demonstrated in the phylogenic tree (Fig. 4), this group is the only one that features figurines from Western Asia, and some neighbouring regions to Iran such as Turkey, Levant and Syria, and also examples from the Mediterranean. The rest of the figurines in this group all come from Eastern Europe (e.g. Greece, Bulgaria, and Russia).

On the basis of the observed data, there is some possibility that geographical proximities could have been responsible for some similarities in form and physical appearance, and this may hold for the samples in Group 3, i.e. those from Western Asia, the Mediterranean and Eastern Europe, including the Sarab figurine. There is a considerable amount of literature dealing with the dispersal of Neolithic practices and populations from Western Asia into Europe (e.g. Sokal *et al*. 1991; Chikhi *et al*. 2002), so there is certainly some possibility that there was a degree of cultural interaction and connectivity between populations in Western Asia and Eastern Europe in the Neolithic period. Whether resemblances in figurines are the result of interaction through factors like trading networks or migrations between Neolithic societies remains open for further investigation.

Regarding the second question of this research, the results show much less ambiguity. There is a clear separation between the Upper Palaeolithic and Neolithic specimens, and only one instance of overlap (Kostenki). It is perhaps significant that although all the Upper Palaeolithic figurines form a separate cluster (Group 2), they also show a closer proximity to Group 1 (Neolithic figurines from Europe) than they do with Group 3, which has some Western Asian samples. This could indicate that, aside from the appearance of a distinctly new style, form and body dimensions in the Neolithic, there might be a degree of continuity between the Upper Palaeolithic and Neolithic periods caused by geographical proximities. More comprehensive conclusions related to the two questions posed here will only be possible when larger data sets are analysed.

What seems inescapable in all of this is that female figurines dominate the early figurine corpus in most contexts. Furthermore, most of these early figurines have exaggerated body parts that appear to be related to fertility. At the least, this seems to indicate the importance of the female and fertility, but the significance and social role of that importance still remains enigmatic.

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