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New data on the sexual dimorphism of the hand stencils in El Castillo Cave (Cantabria, Spain)

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ABSTRACT

The determination of the sex of the individuals who placed their hands on cave walls in order to leave the stenciled paintings of their hands, has been the subject of considerable debate in recent years.

Many research projects have been carried out with varied results. This study has attempted to obtain new data through an experimental approach that is then applied to the prehistoric hand stencils in *El Castillo Cave*.

In the experiment, 77 samples (hand stencils) of western adults from the Iberian Peninsula, 46 women and 31 men, were taken. For each modern individual (22 women and 18 men), both the stencils and the real size of their hands were measured. This data was then compared with the Paleolithic stencils to determine whether there was a range of variation between the negative image and the actual hand. The measurements taken into account were the general hand length, index finger length and ring finger length.

Discriminatory statistical analysis was used for the experimental work and the measurements collected in the field.

In the data obtained in the experimental study, significant differences were observed in the length of male and female fingers, but not in the ring fingers themselves. Discriminant analyses show that it is the absolute finger lengths and not the ring fingers that are able to discriminate between men and women.

By applying this function to 21 stenciled hands in El Castillo Cave, it was found that 11 belong to women and 10 to men, indicating equal gender representation. Three of the 21 hands may be wrongly sexed according to the discriminant function. However, there is a significant difference between the real finger measurements and the measurements of their stencils in the experimental study, as the negative images overestimate the real values.

1. Introduction

Many authors have tried to obtain data from the stencils of the hands of Upper Paleolithic hunter-gatherers. On the one hand, symbolism has been addressed: why did they leave the image of their hands on cave walls? What was their intention? Was it just a show of their existence? An "I am here", "this belongs to me"; or does it go further? The most common answer is that they were individual signatures (Clottes and Lewis-Williams, 2007), on the basis that many of these hand stencils display missing fingers, as in *Cueva de El Trucho* (Utrilla et al., 2013). In some cases, these missing fingers were hidden by bending them towards the interior of the palm, as in Cueva de *Maltravieso* (Giraldo, 2010). In contrast, other researchers have tried to extract data on the sector of society that made these paintings (Gunn, 2007), by determining the age range (Gunn, 2006) and sex (Snow, 2013), and they have even identified marks left by young adults that in some cases might be mistaken for those made by adult females (Van Gelder, 2015). The present study is focused on the latter aspect.

Sexual dimorphism in the Paleolithic hands is currently a much-debated topic because until recently the authorship of rock art has "traditionally" been limited to males. If the opposite could be proved, it would be evidence that the role of women in the Upper Paleolithic was not relegated to the task of gathering.

A paper published by Snow (2013) states that several of the hand stencils in El Castillo Cave belong to women, based on the Manning Index (Manning et al., 1998). Other studies of gender in handprints, such as at Gua Masri II in Borneo, were conducted by Chazine and Noury (2006), who used the software Kalimain to establish the gender of handprints, with the result that 44% were of women. Other authors, like Galeta et al. (2014), made several attempts to determine the sex of handprints through anthropological studies, but concluded that there are no forensic standards to estimate gender through the size of the

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hand.

The aim of this study is to determine the gender of the Paleolithic hand stencils that are preserved in El Castillo Cave (Puente Viesgo, Cantabria, Spain) based on the Manning Index. The reason for choosing this set of hands is to compare our results with those obtained by Snow in his 2013 study.

In order to carry out this research, we first performed an experimental study of healthy subjects in two locations of the Iberian Peninsula. This experimental sample was employed to obtain statistical discriminant functions that might be applied to the Paleolithic stencils in El Castillo Cave.

1.1. El Castillo Cave

1.1.1. Geographical and archaeological context

El Castillo Cave is located in *Monte Castillo* (Puente Viesgo, Cantabria, Spain). The hill stands out in the landscape, and was a point of reference for prehistoric populations because of its strategic and economic value, due to the variety of biotopes and natural resources in the surrounding area. The archaeological importance of *Monte Castillo* is highlighted by the continuous human occupation of the site during at least 150,000 years. It is an exceptional place for understanding the graphic activities and symbolic thought of Paleolithic groups. Five caves with rock art are known: *El Castillo*, *Las Monedas* (Ripoll Perelló, 1972), *Las Chimeneas* (Gonzalez Echegaray, 1974), *La Pasiega* (Breuil et al., 1913; González Sainz and Balbín Behrmann, 2010) and *Cantera I* (García-Diez, 2010).

El Castillo Cave was discovered in 1903 and designated a World Heritage site by UNESCO in 2008. The cave is about 759 m long and the entrance to the cave is at 195 m altitude (Groenen et al., 2011).

The archaeological deposit begins with Medieval and Chalcolithic remains that are associated with human burials found inside the first large room (Sector II). Below them, an Azilian layer appeared, with flat oval harpoons. After a speleothem crust, evidence of Upper Magdalenian occupations included important bone artifacts, such as harpoons with one and two rows of barbs, several circular-section assegai points and a baton with the engraving of a deer (Alcalde del Río et al., 1911). Under these, rich Lower Magdalenian occupation levels with numerous portable art objects were documented, such as the scapulae engraved mostly with figures of female deer (Almagro, 1976), whose closest parallels are found on the walls of the cave itself. This was a very intense occupation resulting in a high density of bone and stone materials. Underneath, evidence of human presence during the Solutrean and Gravettian levels has been documented, including a lithic implement with the figure of an animal, one of the earliest evidences of Cantabrian portable art (Alcalde del Río et al., 1911).

Certainly, the most important levels for their scientific implications are the ones corresponding to the Aurignacian. They have been dated between 40,000 and 38,500 BP (Cabrera Valdés and Bernaldo de Quirós, 1999). In these levels, graphic evidence on small bones and stone objects has been documented.

The Mousterian sequence confirms the transition from the Middle Paleolithic to the Upper Paleolithic in the Cantabrian region, with the presence of Neanderthals in the transformations that led to the Aurignacian. Therefore, there is continuity between the Mousterian levels and levels of the Upper Paleolithic (Cabrera Valdés et al., 2000). Finally, under a series of stalagmite layers and silt with remains of cave bears appear Acheulean industries, which are typical of the Lower Paleolithic, reaching the base of the deposit (Alcalde del Río et al., 1911).

1.1.2. Cave art context

El Castillo Cave contains almost all subjects, techniques and artistic styles executed by the first *Homo sapiens* in Europe, an artistic sample of nearly 30,000 years of artistic and symbolic behavior (Alcalde del Río et al., 1911). It was decorated in one or several phases of the Upper Paleolithic (corresponding to the long sequence of human occupation identified in the entrance chamber). Consequently, figures are located in all parts of the cave.

Apart from concentrations of color, which are difficult to interpret, the thematic corpus consists of animal figures (almost three-quarters of the total representations) and references to humans (red stenciled hands). Among the animal motifs, cervids, bovines and caprids are the most numerous, followed by indeterminate figures and an isolated mammoth. Signs include > 50 geometric forms (rectangular, oval, bell-shaped, ramiform, etc.), > 300 disks, groups of points, isolated dots and numerous lines, some of them associated in groups (García-Diez and Gutiérrez, 2017; Groenen et al., 2011; d'Errico et al., 2016; Garrido and García-Diez, 2017).

Various techniques were used to produce the paintings in *El Castillo Cave*. For some paintings, they employed a simple red or yellow line, while in others they used spots of color, but the technique that prevails in this cave and that is associated with the creation of the stenciled hands, involved blowing the red pigment with a kind of airbrush (García-Diez and Gutiérrez, 2017; Garrido and García-Diez, 2017).

The engraved motifs and the exploitation of natural reliefs are also important in El Castillo Cave. This practice is not very common, but there are some examples, like the horse associated with bell-shaped figures (Bea, 2001), the Black Bison (Alcalde del Río et al., 1911) or the stalagmite called "the wizard" (Ripoll Perelló, 1971). Chronologically, as noted above, the art ensemble represents most of the chrono-cultural and artistic phases in the Upper Paleolithic (Alcalde del Río et al., 1911). This cave is witness to at least 40,000 years of Cultural History (Garrido and García-Diez, 2017).

1.1.3. Hand stencils and authors

The hand stencils in El Castillo Cave are generally well preserved, although some of the hands have been naturally washed by cave dripwater and some were rubbed when 20th century graffiti was eliminated. These manifestations are direct evidence of the presence of our ancestors in a given geographical area. The stencils are grouped in panels in the first rooms but become more scarce and isolated further inside. In the deepest part of the cave, these motifs are absent.

Ante quem numerical dates are associated with two hands in El Castillo; a hand located in *Panel de las Manos* (*Panel IV*), is the oldest pictorial representation known to date; (37.63 ± 0.34 ky BP), while the others are between 20.81 ± 0.12 ky BP and 25.02 ± 0.29 ky BP, within the Solutrean/Gravettian period (Pike et al., 2012; García-Diez et al., 2015). The earliest of these *termini* falls at the boundary between the Aurignacian I and the Aurignacian II in Europe (Banks et al., 2013), while the later one falls at the boundary between the Terminal Gravettian and the Proto-Solutrean in Iberia and southwestern France (Zilhão and d'Errico, 1999).

The hands stencils in *El Castillo* Cave display several states of preservation. Some of them show the full range of anatomical parts, including palm, wrist and forearm, whereas others preserve only isolated fingers.

Most hand stencils are located in the mid-section of the cave from the *Panel de Policromos* to the *Panel de las Manos* and its side-passage. In addition, there are a few more hands in deeper parts of the cave, the last one being located in the *Galería de los Discos*. In total, 85 hand stencils have been identified in El Castillo Cave (Groenen et al., 2011); while about 60 can be clearly distinguished. All these stencils were painted in red using the technique of spraying the pigment (no analyses of the pigment used in these figures have been performed) over the hand by blowing it directly from the mouth or by means of a hollow instrument (Groenen, 1988). In the case of El Castillo Cave, it is likely that they were all painted with a kind of implement that acted like an airbrush.

Generally, specialists who have studied the Paleolithic art over the years have claimed that men, specifically hunters-gatherers, were responsible for the hands (Gifford-Gonzalez, 1993). Other authors like Solometo and Moss (2013) argue that men did not exclusively produce them.

In contrast, Dean R. Snow argues that a high percentage of the hand stencils in El Castillo Cave belongs to women (Snow, 2013). In this research, he employed a method known as the Manning Index (2D: 4D digital ratio) (Manning et al., 1998; Manning et al., 2000). This method argues that the existing sexual dimorphism in *Homo sapiens* between the proportions of the ring finger and the index finger is inherited from the concentrations of testosterone or estrogen in these anatomical parts while the fetus is developing in the uterus.

2. Material and method

In order to determine the sex of the Paleolithic hand stencils in El Castillo Cave, an experimental approach was first employed with a modern human sample. The information obtained from this sample was used to perform statistical analyses that were subsequently employed with the hand stencils in El Castillo Cave.

2.1. Taking hand measurements in the modern Spanish population

A database was developed with the hands of volunteers aged between 18 and 50 years old. These volunteers belong to two regions in the Iberian Peninsula. Specifically, they were researchers at the IPHES (Tarragona, Spain), students at the Universitat Rovira i Virgili (URV-IPHES, Catalonia, Spain) and students at the University of Granada (UGR, Andalusia, Spain).

Our protocol to obtain the negatives of the hands consisted of recording the right hand of each individual on paper and spraying around the hand with conventional paint at a distance of 15 cm approximately. Paper was selected because of its porosity and absorption capacity. Hand stencils were taken of 24 individuals at the URV in April 2012 and of 56 students from the UGR in February 2014. Thus 77 hand stencils were collected, 46 of which belong to women and 31 to men (Table 1).

The sample of modern humans for the analysis includes 77 individuals of known sex, namely 46 women and 31 men, who provided data on the three variables mentioned above. The actual measurements of these variables were taken for 40 of the 77 volunteers in order to observe whether there are statistically significant differences when compared with their stenciled counterparts.

2.2. Taking measurements of the hand stencils in El Castillo Cave

Due to the limitation imposed by the state of preservation, only 21 out of the 85 hand stencils documented in El Castillo Cave (Groenen et al., 2011) were measured directly in the cave for this study. We selected only the ones whose airbrushed boundaries were well defined and retained all the necessary measurements to estimate sex (Table 2). Consequently, the stencils studied here were associated with smooth and mostly flat or nearly flat walls (Fig. 1).

2.3. Way of measuring the hand variables

The methodology carried out in this study consisted of taking measurements of each anatomical part of the hand stencil. Although a large number of variables could be measured, we have only considered the length of the index and ring fingers, and the overall length of the hand (Fig. 2).

Table 1
Summary of the samples collected from the current population.

	Females	Males	Age range
Granada University (Andalusia, Spain)	34	19	18–30 years old
Universitat Rovira i Virgili (Catalonia, Spain)	13	12	20–50 years old
Total	46	31	

Table 2
Distribution of hand stencils in different parts of El Castillo Cave.

I. Panel of the polychromes	2 hands
II. Panel on the descent	1 hand
IV. Panel of the hands	10 hands
V. Lower panel of the hands	1 hand
VI. Panel in *Carrefour* gallery	1 hand
VII. Panel in the gallery of the hands	2 hands
IX. Panel in the gallery of the disks	1 hand
X. Panel in the passage to chamber B.	1 hand

In the hand stencils, the measurements of the index and ring fingers were taken from the end of the fingertip to the mid-part of an imaginary line that is traced between the two deepest points in the interdigital spaces (Fig. 3).

In the modern human experimental sample, we also measured the real distances of the variables described above in 40 out of 77 volunteers in order to compare them with their stenciled counterparts (Fig. 4).

2.4. Statistical analysis

The statistical analysis included *t*-test and discriminant analysis. *t*-Tests were used to compare measurements of the real length of the hand and the index and ring fingers, with their stencils. *t*-Tests were also performed in order to seek differences between men and women.

Data from modern humans were used to perform discriminant analysis, with the aim of finding mathematical functions that differentiate men from women. These discriminant functions were applied to the 21 hand stencils in El Castillo Cave.

All statistical analyses were performed using the R software through its R Commander graphic user interface.

3. Results

In order to estimate the sex of the 21 hand stencils in El Castillo Cave, two statistical analyses were conducted with our modern human experimental sample. We tested for differences between the measurements of the stencils and the real values and then compared these measurements between men and women. The resulting data was used to create a discriminant function that was applied to the Paleolithic stencils.

3.1. Comparison of the real and negative measurements in the modern human experimental sample

The statistical comparison of the real measurements taken directly from the hand and the negatives on the paper are shown in Table 3. This corresponds to the modern sample of 18 men and 22 women.

The results indicate that there are statistically significant differences between the real measurements and their negative counterparts in the three variables measured in both men and women, as well as in the combination of both. The only comparison that does not show statistically significant differences is the length of the index finger in women ($p > 0.05$).

Our results indicate that the measurements of the hand in the stencils are larger than the real values, while the measurements of the fingers in the stencils (except for the aforementioned case) are smaller than the real ones.

3.2. Comparison of the measurements of men and women in the modern sample

The statistical comparison between sexes of the lengths of index finger, ring finger and the hand are shown in Table 4. There are statistically significant differences between men and women for all the

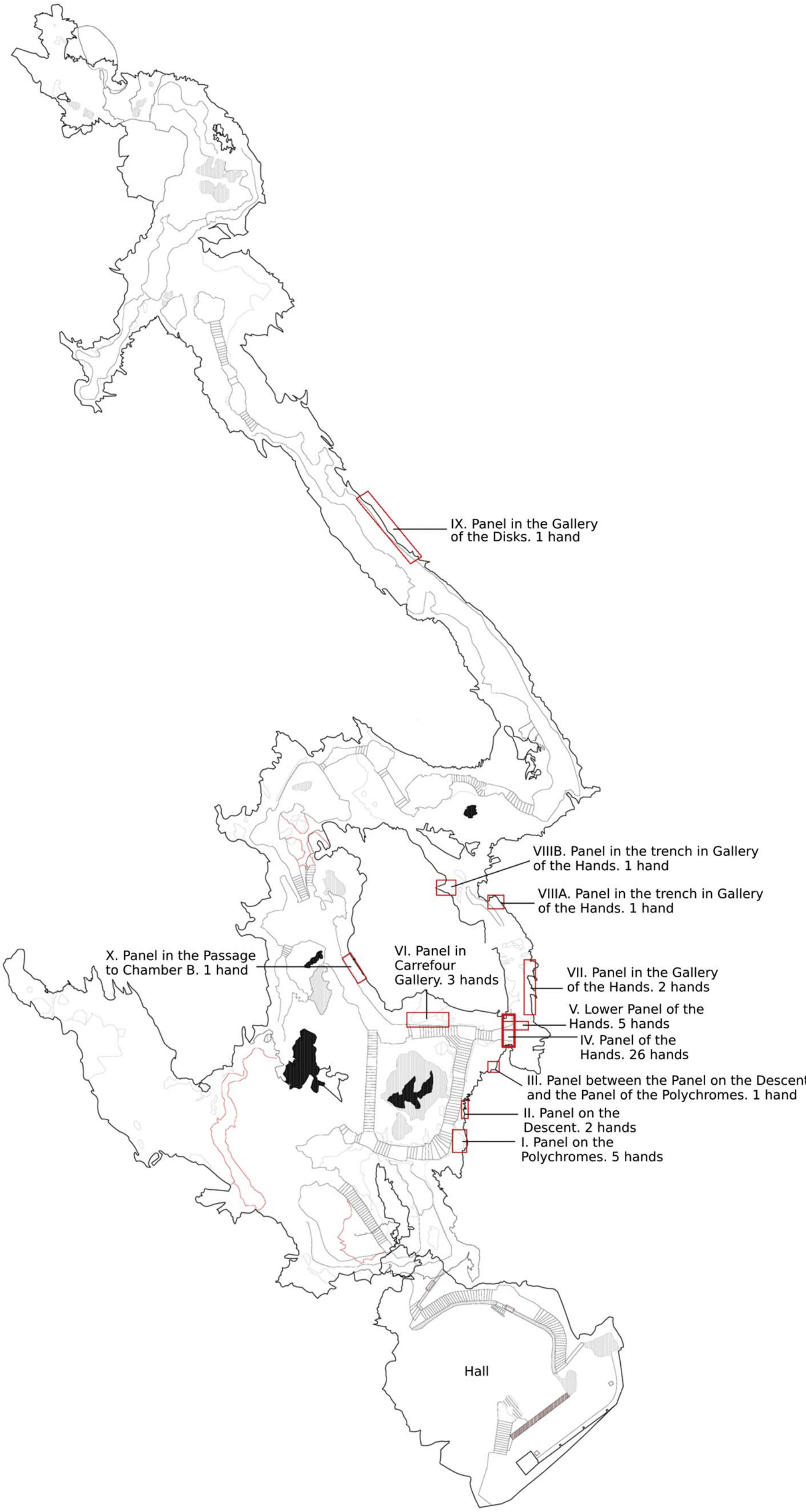

Fig. 1. Plan of El Castillo Cave, adapted from Groenen et al. (2011) showing the position of the hand stencils in the present study.

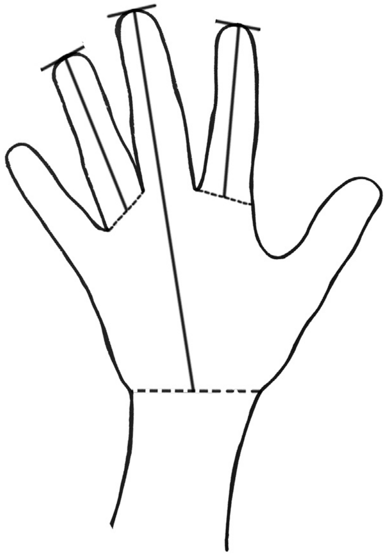

Fig. 2. Methodology used to take measurements.

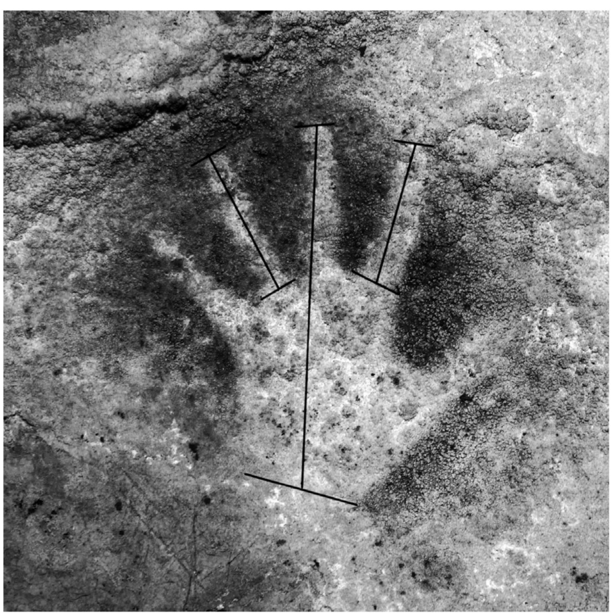

Fig. 3. Methodology used to take measurements of hand stencils.

measurements. In both real and negative stenciled measurements, men's values are larger than women's.

3.3. Obtainment of discriminant functions from the modern human experimental sample

A discriminant function was obtained from the modern human experimental sample categorized by sex. The function includes the measurement variables of the length of the index and ring fingers, and the hand length.

Table 5 shows the percentage of correct classifications in the attribution of sex when applying the discriminant functions to the modern human experimental sample.

As shown in Table 5, the discriminant function that presents the highest percentage of correct sex attributions is the one based on the absolute lengths of the variables. The error rate with such function is 16.88%, which, expressed in terms of individuals, means that the function misclassified 13 individuals from a total of 77. In contrast, the function based on index fingers gave the highest percentage error

Fig. 4. Methodology used to take measurements of real sizes in modern humans.

(36.36%), representing a total of 28 individuals wrongly sexed out of 77.

The percentages of successes and failures of the function indicates that the most dimorphic variable in relation to *Homo sapiens* hand morphology is in absolute length of the fingers, while rates between these lengths do not appear to be dimorphic variables.

3.4. Sexual dimorphism of the hand stencils in El Castillo Cave

Of all the Paleolithic hand stencils in El Castillo Cave, length measurements of the index finger, ring finger and length of the hand were obtained for 21 of them. By applying the discriminant function obtained from the absolute length of the index finger, ring finger and the length of the hand, which is the variable with the highest percentage of correct estimations, it has been possible to estimate the sex of those 21 stencils in the cave. The results are shown in Table 6.

With the discriminant function of the absolute lengths of the fingers, the results indicate that 11 hands are of women and 10 of men, leaving a ratio of 57:43 respectively. However, considering that the discriminant function has a 16.88% failure rate, that would indicate that 3 or 4 hands may be wrong sexed.

4. Discussion

The population sample in Liverpool taken by Manning for his study gave results of 1.00 for women with longer index finger (4D > 2D) and 0.98 for men with the longer ring finger (2D > 4D) (Manning et al., 1998; Manning et al., 2000).

Several attempts have been made to develop a system to determine the gender of prehistoric artists with the handprints found in many caves with rock art of this chronology. One of the most prominent attempts, as we mentioned above, was by Dean R. Snow. In 2006, Snow studied the hands in *Les Combarelles, Font-de-Gaume and the Abri du Poisson* with the result that four out of six hands belonged to women. In 2010, Snow along with other authors such as Wang used a computer image method to determine the gender of hand stencils.

Snow (2013) studied 16 stencils in the *Panel of the hands* in El Castillo Cave. The present study has considered 21 of the 85 stencils in

Table 3
Statistical tests to compare the means between the real measurements and negative of the index finger, ring finger and hand length. Normality (Shapiro-Wilk) and homoscedasticity (F Fisher) tests were performed. Depending on whether there is normality and homoscedasticity, we have compared their measures using T-Student, Welch assuming different variances or Wilcoxon-Mann-Whitney (Wilcoxon). Tests have also determined which of the two measurements, real or negative, is higher or lower. The sample size (n) is the same for real and negative values.

		n	Shapiro-Wilk real/negative	F Fisher	T-Student	Welch (diff. var.)	Wilcoxon	T-Student/Wilcoxon H1: (negative − real > 0)	
Men	Index finger	18	0.8268/0.1202	0.6191	**0.0145**	–	–	0.9927	Real > negative
	Ring finger	18	0.6321/0.3000	**0.0171**	–	**0.0007**	**0.0004**	0.9998	Real > negative
	Hand length	18	0.1265/0.1007	**0.0010**	–	**0.0000**	**0.0000**	**0.0000**	Negative > real
Women	Index finger	22	0.6785/0.5830	0.3299	0.1132	–	–	–	–
	Ring finger	22	0.6101/0.524	0.0869	**0.0026**	–	–	0.9987	Real > negative
	Hand length	22	**0.0199**/0.8449	0.5991	–	**0.0000**	**0.0001**	**0.0001**	Negative > real
Mixed	Index finger	40	0.3656/0.2189	0.452	**0.0170**	–	–	0.9915	Real > negative
	Ring finger	40	0.8969/0.6473	**0.0252**	–	**0.0002**	**0.0003**	0.9998	Real > negative
	Hand length	40	**0.0215/0.0105**	0.8889	–	**0.0000**	**0.0000**	**0.0000**	Negative > real

Bold p-values represent significant statical differences

the cave (Groenen et al., 2011). They were selected because they are best-preserved images, with the pigment around complete fingers. Preliminary results obtained by Snow show that most of the hands were of women (75%). However, in our results, they belong equally to men and women. The difference may be the consequence of the larger number of hands in our study and not only those located in the *Panel of the hands*. Of the 21 negatives that we used, only 11 were in this panel (1 (I.1), 6 (II.1), 9 (IV.1), 10 (IV.3), 12 (IV.7), 13 (IV.9), 15 (IV.11), 21 (IV.18), 22 (IV.19), 23 (IV.22), 25 (IV.24), 26 (IV.25), 27 (IV.26), 28 (V.5), 29 (VI.2), 30 (VII.1), 31 (VII.2), 32 (VIII.1a)).

The statistical method used by Snow (2013) to determine the gender of the hands was based on a discriminant analysis involving the treatment of algorithms of various measurements taken, in direct relation with the length of the fingers and hand. The study concluded that the most reliable measurements are the lengths of all the fingers except the thumb and especially the overall length of the hand. The present investigation also used discriminant analysis of the real measurements of volunteers' hands and the stencils in El Castillo Cave in the same way as Snow. However, unlike the latter, only the length of the index finger and ring finger and the overall length of the hand were used to verify whether there are significant differences between men and women in the ring and the index fingers. In the recorded data, significant differences were found between the lengths of the fingers of men and women, but not between the index and the ring finger. These analyses in our experimental work indicate that the variables capable of differentiating men and women are the absolute lengths.

Snow created a database from samples with a different population source (2013) in accordance with studies conducted by Manning et al. (2000) who showed that the development in African, Asian and European populations is not the same and this is reflected in the sexual dimorphism of the extremities. Thus, in the present study both the North and South of the Iberian Peninsula were sampled to create our own database. Samples from the Iberian Peninsula were chosen because that is the location of the site under study: El Castillo Cave. Even so, special caution must be taken in interpreting this, as notable differences have been proven in different population centers, and we cannot be sure that the current population in the Peninsula has the same hormonal growth as the group that did the paintings in El Castillo Cave. Snow (2013) collected a total sample of 111 individuals, taking measurements of both right and left hand. 57 were women and 54 men of European descent.

It has been shown that each subset of human populations must be studied separately as sexual dimorphism can be different (Manning et al., 2000; Napier and Tuttle, 1993; Ramesh and Murty, 1999; Semino et al., 2000).

Another factor to consider is that the experimental stencils were taken on paper, on a flat surface and with a conventional spray in order to give the least possible error. The limestone base (often irregular), means that the blower does not follow strict patterns allowing sufficient precision in the measurements of the index and ring finger to determine the gender of the hands. This is extrapolated to both the present study and Snow (2013). In turn, this will also influence the position that the artist would take and the place where the hand was laid. Thus, we observe hands with peculiar differences in the lengths of the ring and index finger (e.g. Hand I.1) (Annex 1).

However, the results suggest that the hand stencils in El Castillo Cave correspond equally to men (10) and women (11). This means that both genders participated in artistic activities or rituals of their population group.

5. Conclusions

The comparison between the patterns of the real measurements of the volunteers' hands and those of their stencils showed significant differences, as the negatives overestimate the real values. In addition to the anomalies of several hand stencils in the cave due to the position taken by the artist to make the hand stencil or highlight the surface, this can lead to confusion when applying statistical methods.

However, the statistical methods used in the this paper are quite reliable if we assume that the measurements collected in the cave are correct and have not been influenced by any factor discussed above. Discriminant analysis developed from our database and applied to these stencils gives similar results which complement each other.

Applying our statistical analysis on the data obtained for 21 hands

Table 4
Statistical tests to compare the measurements of index finger, ring finger and hand length between sexes. Normality (Shapiro-Wilk) and homoscedasticity (F Fisher) tests were performed. They have also tested which of the two sexes, male or female, is larger or smaller.

		N women/men	Shapiro-Wilk women/men	F Fisher	T-Student (two-sided)	T-Student H1: (men – women > 0)	
Real	Index finger	22/18	0.6785/0.8268	0.1073	**0.0004**	**0.0002**	Men > women
	Ring finger	22/18	0.6101/0.6321	0.8153	**0.0001**	**0.0000**	Men > women
	Hand length	22/18	0.0199/0.1265	0.6986	**0.0006**	**0.0003**	Men > women
Neg	Index finger	46/31	0.6767/0.1284	0.6985	**0.0000**	**0.0000**	Men > women
	Ring finger	46/31	0.1829/0.4538	0.2920	**0.0000**	**0.0000**	Men > women

Bold p-values represent significant statical differences

Table 5
Sexual discriminant functions obtained from the current sample. They have been made on the length of the index finger, ring finger and hand length on their indexes (index/ring, index/length, ring/length).

Variable	Discriminant function	%♂	%♀	%♂♀
Lengths	f(x) = − 0.0447 ∗ Index − 0.1513 ∗ Ring − 0.0551 ∗ Length	74.19	89.13	83.12

Table 6
Sexing of 21 hand stencils in El Castillo Cave using the discriminant function obtained from the absolute lengths of the index finger, ring finger and hand length of the modern sample.

Hand	Sex
1 (I.1)	Male
6 (II.1)	Female
9 (IV.1)	Male
10 (IV.3)	Female
12 (IV.7)	Female
13 (IV.9)	Female
15 (IV.11)	Male
21 (IV.18)	Female
22 (IV.19)	Male
23 (IV.22)	Male
25 (IV.24)	Female
26 (IV.25)	Female
27 (IV.26)	Male
28 (V.5)	Female
29 (VI.2)	Female
30 (VII.1)	Female
31 (VII.2)	Male
32 (VIII.1a)	Male
33 (VIII.1b)	Male
34 (IX.1)	Female
35 (X.1)	Female

in El Castillo Cave shows that 11 belong to women and 10 to men, giving a balanced gender representation, although 3 of those 21 hands may be wrongly sexed following the discriminant function.

Even with this data, and assuming that the anatomical parts of the hands of *Homo sapiens* in Cantabria (Spain) in the Upper Paleolithic were very similar in size to those of modern humans, we conclude that studies on morphometric measurements of modern hands for gender determination should be treated with caution because of the many factors that can influence the making of a hand stencil. These can lead to confusion in the final results, as observed in the results obtained by different researchers.

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