Original Study

Jessica Cooney Williams, Liliana Janik*

Community Art: Communities of Practice, Situated Learning, Adults and Children as Creators of Cave Art in Upper Palaeolithic France and Northern Spain

https://doi.org/10.1515/opar-2018-0014
Received June 30, 2017; accepted March 1, 2018

Abstract: This paper presents acts of fluting as tangible expressions of activities performed by Palaeolithic communities of practice, in which situated learning was part of the social transmission of knowledge and communities of practice include children, men and women. To identify individual members of the communities of practice who were involved in the creation of parietal art in the Franco-Cantabrian region we have analysed the age and the sex of the people who 'decorated' the caves. Secondly, by following the analysis of lines created by flutings by different members of the community of practice, we suggest that children under the age of seven, who had no the cognitive abilities to comprehend the meaning of images, were active and prolific fluters and performed acts of decorating cave walls by themselves or with the support of other community members. This approach allows us to consider parietal art as community art where visual contributions were created by community members of all age and sexes.

Keywords: Palaeolithic art, community of practice, situated learning

1 Introduction

One of the most interesting aspects of looking at prehistoric art is identifying the artists. Who were these people who, when we admire their creations millennia later, still make us marvel? Understanding more about the individuals who spent their time creating this art would afford archaeologists additional tools to interpret prehistoric life and 'populate' places and locations. Somewhat paradoxically, identifying individual artists will help us view the creation of cave art as a community activity as part of the endeavour within the community of practice. We propose that looking at cave art as community art, rather than an individual pursuit, allows an interpretation that goes beyond the existing perception of the symbolic meaning of cave art, and contribute to undertaking its social role.

Identifying individual contributors can be a difficult process, particularly given the various methods used to create art throughout the Palaeolithic. In an attempt to identify the artists, we propose a focus on art created through the method of finger fluting in the Palaeolithic caves of France and Spain (Fig.

Article note: This article is a part of Topical Issue on From Line to Colour: Social Context and Visual Communication of Prehistoric Art edited by Liliana Janik and Simon Kaner.

***Corresponding author: Liliana Janik,** Department of Archaeology, University of Cambridge, Downing Site, CB2 3DZ, UK, E-mail: lj102@cam.ac.uk
Jessica Cooney Williams, Aberdeen Art Gallery and Museums, Marischal College, Broad Street, Aberdeen AB10 1AB, UK, E-mail: jessica.b.cooney@gmail.com

1). Identifying the individuals who created this particular art will allow us to explore various aspects of identity, including age and sex, and discuss whether this knowledge alters our understanding of visual art and communication in the context of Upper Palaeolithic cave art.

Figure 1. Distribution of caves in the Franco-Cantabrian region discussed in this paper.

The contextual approach we present permits us to look at each cave and assess its interpretation as an interplay between the theory and data. Although a variety of artistic styles is present within all of these caves, here we will focus on the imagery created by finger fluting. Finger fluting consists of lines created by people moving their finger/s along malleable surfaces in caves, leaving traces of one, two or more lines. By measuring those lines we can distinguish between different artists who 'decorated' the caves; in other words, the community of artists. Establishing the identity of an artist and/or a group of artists allows us add a new interpretive layer into our analyses of a site by exploring its use by prehistoric communities.

2 Cave Sites and Their Dating

This analysis of finger flutings found in two regions of France and Spain, presented and discussed below, stems from a study exploring Palaeolithic childhood and community by Cooney (2014): the full data set was collected during fieldwork. The two caves are located in France, Rouffignac and Gargas, with a further four sites in the Cantabrian region of northern Spain, El Castillo, Las Chimeneas, El Cudón, and Hornos de la Peña.

The two caves located in France date to around 30,000 BC. The cave of Rouffignac, also referred to as 'The Sanctuary of Mammoths', is an extensive limestone underground system in the Dordogne, France. The cave is currently dated to the Magdalenian period, 13,278–15,200 cal BC, based on stylistic considerations.

However, it has also been postulated that the decorations could date back as far as 29,420–29,269 cal BC as one of the flutings lies underneath a cave bear marking (Sharpe & Van Gelder, 2006a, 2006, 2007; Van Gelder, 2015). The flutings are considered contemporaneous with the engravings, with flutings situated both under and over engraved lines of the figures.

The cave of Gargas is located in the Haute Pyrénées, France. Today there are two different but connected galleries, upper and lower. The two galleries differ from each other archaeologically and geologically. The lower level of Gargas is best known for the vast amount of handprints found throughout, as well as the engravings and flutings. While dating of the cave is so far indirect, Clottes (2009) discovered animal bones which had been inserted in fissures in the 'Great Wall of Hands.' These bones have been dated using radiocarbon AMS to 29,377–29,233 cal BC (Clottes, 2009; Foucher et al., 2007; Valladas et al., 1992; Vercoutère et. al., 2006). This Gravettian period date is stylistically comparable to other directly dated handprints found in Cosquer and Chauvet (Foucher et al., 2007; Van Gelder 2015).

The four Spanish caves are located in Cantabria; El Castillo and Las Chimeneas are two of four decorated caves in Monte Castillo, Puente Viesgo region. El Castillo is one of the largest and best-known caves due to both its cave art and its long archaeological sequence, much of which has been excavated. The artwork within spans between 46,000–43,500 and 12,500 cal BP (Valladas et al., 1992; Pike et al., 2012; Van Gelder, 2015), and there is evidence that this was a cave that was visited multiple times, if not fairly continuously (García Díez & Gutiérrez Rodríquez, 2010). The most recent dates of El Castillo cave, obtained from charcoal figures, suggest that there were two separate phases of decoration during the Magdalenian period: 16,600–16,100 and 15,200–14,900 cal BP (Moure Romanillo et al., 1996; García Díez & Garrido Pimentel, 2010a; Van Gelder, 2015). While no direct dates are yet for the engravings or the flutings, it is proposed that they are roughly contemporaneous.

Hornos de la Peña cave is located in Tarriba, San Felices de Buelna region. The cave art has not been directly dated, but the most recent analyses suggest that the engravings date to approximately 22,000 BP while the interior art was made in the Magdalenian period (Gálvez Lavín & Cacho Toca, 2010; Van Gelder, 2015). The most recent proposed dates for the rock art from the El Cudón cave covers the Gravettian period, broadly c. 31,000–22,000 BP (San Miguel Llamosas & Muñoz Fernández, 2010; Van Gelder, 2015).

The chronology of the sites discussed in this paper indicates that fluting was practiced throughout the Upper Palaeolithic, rather than being concentrated. This suggests that it was wide spread activity carried out in the caves across the Franco Cantabrian region.

3 Methodology

As finger flutings were created with the artist's fingers, biological markers remain imprinted in the material allowing archaeologists to decipher the age range and occasionally sex of the artists. This is the only current methodology, alongside interpretation of positive and negative hand prints (e.g., Bahn, 1998; Groënen, 1997; Guthrie, 2005; Hare, 2008; Lorblanchet, 1991, 1995; Snow, 2006, 2013) that allows the identification of particular individuals by incorporating quantitative as well as qualitative data. An individual's creations can thereby be separated from the array of depictions and specific images allocated to a specific artist.

The methodology to measure finger flutings developed by Sharpe (2004) and Van Gelder (e.g., 2006a, 2006b, 2006c, 2009) and Van Gelder (2015), is based on measuring the impressions of the individual's fingers which remain encapsulated on the walls and ceilings of caves (Fig. 2). While at first glance they appear to simply be a type of engraved line, finger flutings enable us to recognise the identity of the artists by measuring the width of the impression made by the artists' fingers. This approach differs from qualitative interpretations in favour of analyses reliant on measurable data. The methodology has been developed on the basis of contemporary fluted image creation in experimental workshops, assessment of the growth rates and physiological makeup of modern and Palaeolithic individuals, and sizes of the prehistoric marks on the cave walls.

The three-fingered (Fig. 2) width method used to distinguish individuals has been independently verified (Stapert, 2007) and provides the best results when based on flutings created with at least the three

middle fingers, rather than images with only one or two fingers.

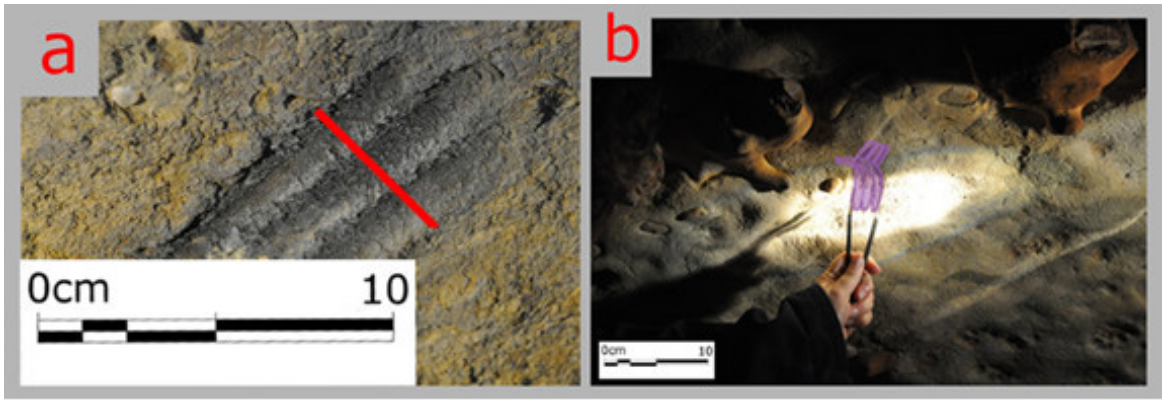


Figure 2. Measurements of finger flutings: (a) the location of accurate measurement on a fluted unit, and (b) measuring of the unit in Rouffignac.

The measurements of the widths of index, middle and ring fingers have been correlated against the ages of the artists during experimentation. It has been established that units with a three finger fluted width of 34mm or less correspond to an artist's age of seven years or younger, while those 35mm or larger are above the age of seven. The use of three fingers also allow us to explore the relationship between the sexes and ages of fluters. A recent study by Snow (2013), examining Palaeolithic handprints, proposes that there is a strong sexual dimorphism between female and male hands; by his estimation, 75% of best preserved hand prints coming from Palaeolithic caves were made by women. Snow also has indicated that the measurements used in this study to analyse finger flutings, based on the technique developed by Sharpe (2004), shows less overlapping between female and male fingers in Palaeolithic populations. This in turn suggests that the use of three figures measurements is a reliable technique, however, Snow (2013) highlights to the need to look at the regional differences between populations that we hope to explore in the future.

Given favourable conservation conditions, it is also possible to establish the likely biological sex of the fluters. The sex determination is based on research spearheaded by Peters et al. (2002a, 2002b) and Manning (2002, 2009; Manning & Taylor, 2001; Manning et al., 1998, 1999), who encountered a slight sexual dimorphism in human hands. These studies found that there is an identifiable variation between the ratio of the ring finger and the index finger (also Chazine & Noury, 2006) which, given the right conditions, was preserved in flutings.

4 Art as Social Memory of Cultural Transmission

By employing the method of finger fluting with its potential as discussed above we focus on the social dimension of cave art rather than interpretations of what cave art means; a singular form can have varying meanings and understandings (Wiessner, 1983, p. 270). Such an interpretive framework allows us to understand parietal art as an expression of the social practice within the Palaeolithic community, and as a mode of communication and an instrument for defining and transmitting social rules, relationships, and beliefs (Conkey, 1978; Gamble, 1982; Geertz, 1976; Jochim, 1983). Seeing cave art as social memory of cultural transmission highlights the function of the creation and viewing of cave art, which can have both secular and symbolic associations. Parietal art seen as a form of cultural transmission, the process of social reproduction in which the culture's technological knowledge, behaviour patterns and cosmological beliefs, are communicated and acquired (Hewlett & Cavalli-Sforza, 1986).

Art integrated and provided cohesion between social groups and generations (Conkey, 2001). Unlike objects which can break, cave art is durable; Rowlands (1992) argues that as such, this art was imbued with

the biographical and social memories of the group. There was likely no explicit teaching of social memory; rather, individuals imitated the actions of others and observed (Nowell, 2015) and listened to mythologies so that they were gradually absorbed and learned like language (Barth, 1987; Whitehouse, 1992). Through the process of socialisation, the memory engages not just the individual but the entire community via culturally symbolic meanings: a mythogram. Porr (2010) argues that cultural memory relates to the mythological origins, rituals, and materials that constitute a deep-past cultural memory that is beyond the biographical memory of those still living. This type of memory would not have been readily available to everyone in the community, unlike biographical memory, but rather was restricted to being communicated in ceremonial contexts (Porr, 2010). Social memory may have only been permitted to be reproduced and explored in the context of the caves, for example, with a specific audience (Jones, 2007; Porr, 2010), though we suggest it could be open to many if not to all.

Porr notes that, as individual memory does not exist in isolation, its relevance can only be evaluated based on a socially constructed framework (Porr, 2010). The parietal art could, with the right framework, be seen as memory, a collective point of reference that relates to a spatio-temporal specific group. Memory, in this way, is a phenomenon which helps to create a sense of identity which is both communal and individual (Basso, 1996; Bettencourt et al., 2010). Indeed, the communal creations indicate not only a whole group but also features memories of different communities of practice, e.g. those who flute in caves, those who gather, hunt or produce stone tools. The social group and its memories, which could be living or mythical memories, are interrelated with the social space. The meaning of the art, then, is only fully understood in the context in which it was made, which includes both the physical locations but also the social environment. If the cave was used for community events, the art during these times would gain an extra significance that may or may not be apparent in other situations. The meaning would also vary depending on the individual biography of both the artist and the viewer (Mellars, 2009; Mithen, 1991).

Cave art in its role as a conductor and mediator of social memory can become a wider crucial point in the landscape, a regional centre at which people can congregate as a part of 'alliance networks' which facilitated resource and information cooperation among different groups (Gamble, 1982, 1983, 1986, 1999). Some suggest that, within this context, the caves may have been viewed as focal points in the landscape; locations where smaller groups went or larger groups gathered, perhaps to help demarcate or reflect their territory during a time when group boundaries would have been changing (Gamble, 1999, 2010; Mellars, 2009a; Wiessner, 1983, 1984). Parietal art may therefore have been evidence of a social practice in which a shared material culture provided the basis for the larger communities to form and interact, with their common social memory being communicated and implicitly taught to each subsequent generation (Kuechler, 1987; Rowlands, 1992; Verpoorte, 1996).

This interpretation is inherently flexible in the nature for the art being made, where it was made, and who could make it. There are variations among those who propose cultural aspects, but generally art is an activity which is done by and for the community. Such interpretation suggests that knowledge transmission was an important aspect, one which was rooted in the cultural norms and social understanding of the society who made it, where the social memory of the community constituted shared mythological origins, rituals, and the governing principles of the society. In order for this to function, there must be a social construction of memory that engages not just the individual but the entire community via culturally symbolic meanings: a mythogram. A mythogram represents the mythological grammar of the society; it is a visual representation of the deep structure which recorded, preserved and transmitted information about the mythology and social realm of the community (Conkey, 2009, Sheets-Johnstone, 2003).

Production and consumption of cave art/viewing has been of vital importance in constituting and reconstituting social memory and cultural transition in the process of participating in cave art creation and consumption, where artists themselves were the central element in this process. Transmitting the knowledge through millennia and producing the platforms for the creative acts of cave decorating had to span generations of those who knew the meaning of cultural and symbolic norms and ideas, and those who were learning about it. The cultural environment that fostered this knowledge was conveyed between individuals and generations as part of communities of practice within acts of situated learning.

5 Communities of Practice and Situated Learning

The ideas of communities of practice and situated learning emphasise the relationship between community members in relation to creative acts of cave fluting '...individual learning should be thought of as emergent, involving opportunities to *participate* in the *practices* of community as well as the development of an *identity* which provides a sense of belonging and commitment. Knowledge is not primarily abstract and symbolic, but is provisional, mediated and socially-constructed' (Handley et al., 2006, p. 642). The idea of social practices of learning and optimising the results of someone's work is part of the theory of learning and the way corporations foster the individuals who perform 'join enterprise', 'mutual engagement' and 'share repertoire of communal resources' (Wenger, 1998, p. 2) to improve productivity, addressing and solving problems together. By performing tasks and solving problems together as a part of communities of practice, learning and working produced the outcomes that are socially based and reliant on a variety of members who interact with one another in everyday practices (Handley et al., 2006; Lave, 1996; Lave & Wagner, 1991; Wenger, 1998). The idea of a community of practice that fosters situated learning where one learns via practice and participation leads to the inclusion of individuals who are part of an apprenticeship, learning skills and crafts by working under or with the 'master' (Handley et al., 2006; Lave, 1996; Lave & Wagner, 1991; Wenger, 1998). It also suggests that the practice of learning can focus on the notion of learning 'in' the world and 'through' the world rather than about the world (Priest et al., 2016, p. 326). This way of learning and active participation in choice making has been not only used in education as a way to transfer knowledge but also as a focus of transdisciplinary research that goes beyond academia and reaches policy maker, local communities and various state sectors (e.g., Cundill & Parker, 2015), it has been also popular in the knowledge management practices (e.g., Lee et al., 2015).

Such an approach is also postulated in Palaeolithic archaeology by Fritz et al.'s (2016) and Nowell's (2015, p. 891), ideas where they propose that children's participation is related to apprenticeship '... production of ceramics, textiles, lithic and portable and parietal art, including personal ornaments'. Nowell suggests that children integrated into the communities of practice have sufficient physical and cognitive abilities to comprehend and execute the tasks. However, as we will show below some members of the community of practice were so young that their hand had been led by the adult to create the wavy lines (Fig. 11) or they were younger than seven years old, and so unable to make meaningful judgements about why and how to do things, so the community of practice was extended even to those who physically were not able to perform the tasks and/or not able to comprehend implicit its meaning. For the first time in archaeological literature, the idea of a committee of practice is extended to such individuals.

We suggest that integration of the very young members into performing acts of fluting happened in the context of situated learning. By doing things together one learns about the other, self and the world around and does not need to understand the meaning of doing things and/or what the thing means. In such way, we propose to understand the situated learning without the progression to the apprenticeship. Instead learning can be seen from the perspective of the very young members, in the process of developing a sense of belonging through participation in creative acts of fluting and relationships between various members of the community.

The archaeological data indicates who was the artist as well as their relationship with other individuals present in the cave, through analysis of the hand stencils produced by the artists themselves in the Upper Palaeolithic caves of France and Spain. In particular work by Snow (2013) shows who were the artists by looking at hand stencils on the walls of Abri du Poisson, Bernifal, Font-de-Gaume, Pech-Merle and Rocamadour, and three of the six sites we focus on in this paper: Gargas, El Castillo and Las Chimeneas. According to his estimates 75% of the hand images were made by females, 25% by males, 10% produced by adult males and 15% by sub-adult males. Fritz et al. (2016) presents the argument that footprints often categorised as belonging to adolescents could belong to women, which would suggest that the clay sculptures and drawings of Tuc d'Audoubert were created by groups of individuals including one or two women. We know that children were present in the numerous caves across France and Spain: we can recognise them through a number of indicators: footprints, hand-prints, finger-holes in clay and fluting, as

at Aldène, Bedilhac, Chauvet, Cosquer, Font de Gaume, Fontanet, Gargas, Montespan, Niaux, Ojo Guareña, Pech Merle, Réseau Clastres and Tuc d'Adoubert, El Castillo, Gargas, Las Chimeneas (Nowell, 2015; Bahn & Vertut, 1997; Clottes, 2013; Roveland, 2000; Van Gelder, 2015).

The accounting for different individuals in various caves has been part of the ground-breaking research carried out by Sharp and Van Gelder (2004, 2006a, 2006b, 2006c, 2007, 2009; Sharpe et al., 2006; Van Gelder, 2015). What we suggest here is by going beyond acknowledging the sex or age of the person we can identify via analysing flutings, and to look at relationships between individuals to construct a picture of the activities conducted by members of the communities and the relationships between them. We present not only analyses of the data in the context of who created particular lines, but also how the lines created by one individual relate chronologically and sequentially to the lines placed on the cave walls by the other individuals in the proximity of one image, as well as in the space of the cave itself. This we propose can be understood using the interpretative framework of the community of practice and situated learning when children are present.

6 Following the Lines of Fluting: Fluters as a Part of Communities of Practice and Situated Learning

Following the lines of fluting left by prehistoric artists on the walls of six caves our research reveals the community of practice and its members.

6.1 Situated Learning

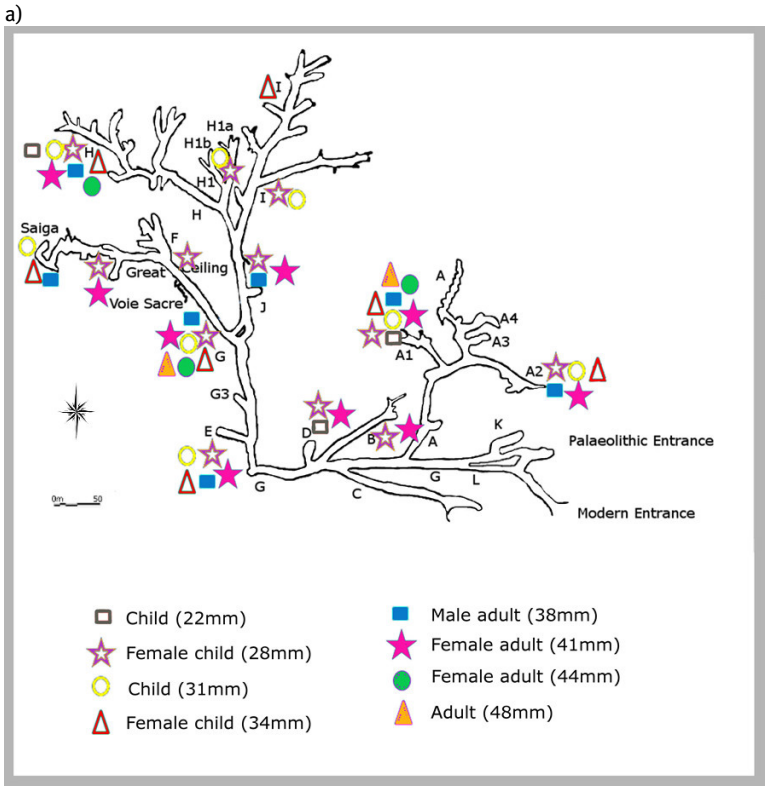
During our investigations multiple people, including children and adults, males and females, were found to have created the flutings in Rouffignac, Gargas, Las Chimeneas, and El Castillo (Fig. 3). Adults and children, some potentially quite young, created flutings in shared spaces as seen on the plans of two caves: Rouffignac and Las Chimeneas (Fig. 3a, b). The flutings discovered in all of these sites were far from the Palaeolithic entrances, including a panel in Rouffignac nearly a kilometre from the entrance. This signifies, we suggest, that the presence of various community members practicing the act of fluting is not only an indication of the existence of a community of practice, but also indicates the productive environment for the situated learning for non-adult members of the community.

In Rouffignac (Fig. 3a), for example, flutings by both children and adults were present in every chamber except one and, at certain times, it is apparent that the children would have been physically assisted in their creative endeavours. Multiple flutings that have been identified as those of children were located on panels/ceilings that would have been inaccessible without assistance, including one which measured over two metres from the presumed Palaeolithic floor level. Similarly, in Gargas (Fig. 3b) there is no area in which adults were found to be present without the children. We can see the physical interaction within the community where age is not a restriction in fluting, where adults enabled children to do it by lifting them to heights otherwise unobtainable by the young individuals.

In Las Chimeneas only one area was without a contribution by a child, a small space high off the floor where two adults appeared to have fluted contemporaneously. At El Castillo, there are two locations where a child's fluting was not identified, but these particular flutings appear on the cave floor; these are the only flutings in this study to have been made on the ground. The geography of both of these 'childless' panels naturally prohibits large groups of individuals viewing the artwork concurrently. However, we suggest that such restricted visibility was probably uncommon as most of the flutings appear to have been purposefully created in locations which could be seen by others. So, there is an involvement of a number of community members in the creation as well as consumption/viewing of the decorated walls.

The flutings' proximity to other images is as enlightening as their location within the landscape of the cave. Flutings are often found near fluted or engraved zoomorphic figurative images. There are many examples from Rouffignac, El Castillo, and Las Chimeneas where measurable flutings made by both children and adults were located inside the animal or crossing its outline.

a)



b)

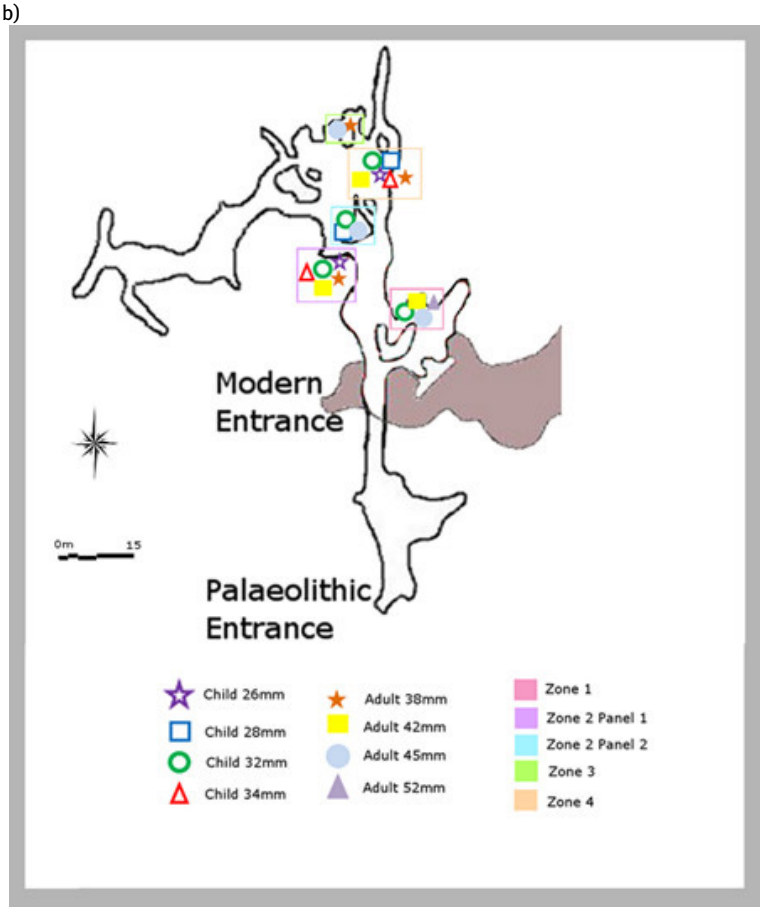


Figure 3. Location of individuals' flutings in a) Rouffignac and b) Las Chimeneas caves.

Many of the mammoths in Rouffignac are marked with flutings which cross over and under the outlines of the animals, as well as flutings which are in the internal body cavity or next to the animals in the empty space around their bodies. These lines have all been interpreted as hunting paraphernalia. While sometimes there was only a single individual fluting near a figurative image, often there were two or more (Fig. 4). Although the material does not always allow for a chronological resolution, there are examples where the fluting was done before the animal figures, which can be viewed in Figure 4 where the adult male fluted prior to the tusks being engraved, and instances where the fluting was created after. These types of flutings in Rouffignac were made by both children and adults pointing to the community of practice where children were learning via participation in the activity of fluting in the context of situated learning.

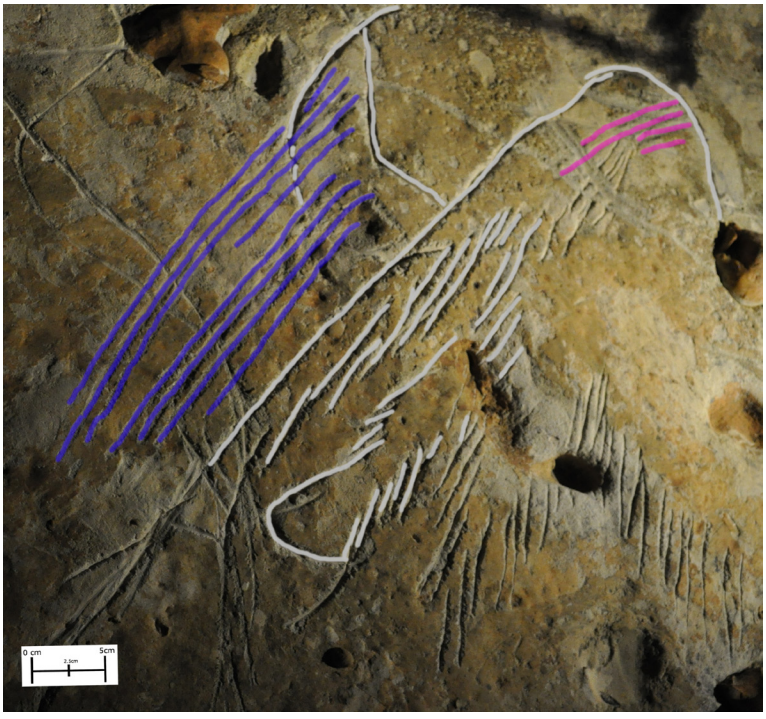


Figure 4. Fluting in Rouffignac made by the male adult (blue) and a female adult (pink) which intersect figurative images (highlighted in grey for clarity).

Flutings found in Las Chimeneas also often intersect with engraved and fluted figurative images, generally those of a deer. The study identified four such flutings: one by a child which crossed over an engraved animal (Fig. 5a), one by an adult that crosses over the back neck of an animal (Fig. 5c), and a third by a different adult whose fluting was underneath the outline of an animal's back (Fig. 5d). One example (Fig. 5b) from this cave is unique as it preserves the sequence of flutings; we can therefore establish the order of line creation. The internal purple line was created first, then the child's fluting, and finally the shape of the nose highlighted in red. This is the clearest example which demonstrates that the individual was creating the fluting contemporaneously with the creation of a figurative image.

In El Castillo there is a paired unit of flutings juxtaposed with an engraved drawing of a horse; only recently discovered, this image is located on the ground underneath an outcrop of rock (Fig. 6). This particular tableau was described as having finger marks which 'cut' the neck of the horse (Groenen, 2012), supposedly an exemplary illustration of how weapons intersect animal's most vulnerable surfaces to facilitate a quick death: neck, head, stomach, and flanks. It is likely that a single individual created these two flutings, one with the left hand and one with the right, indicating that they may have been made simultaneously. The left-handed fluting goes over the outline of the horse figure, but the fluting made with the right hand does intersect the engraving. Indeed, even if these lines were extended the fluting would never come into contact with the horse.

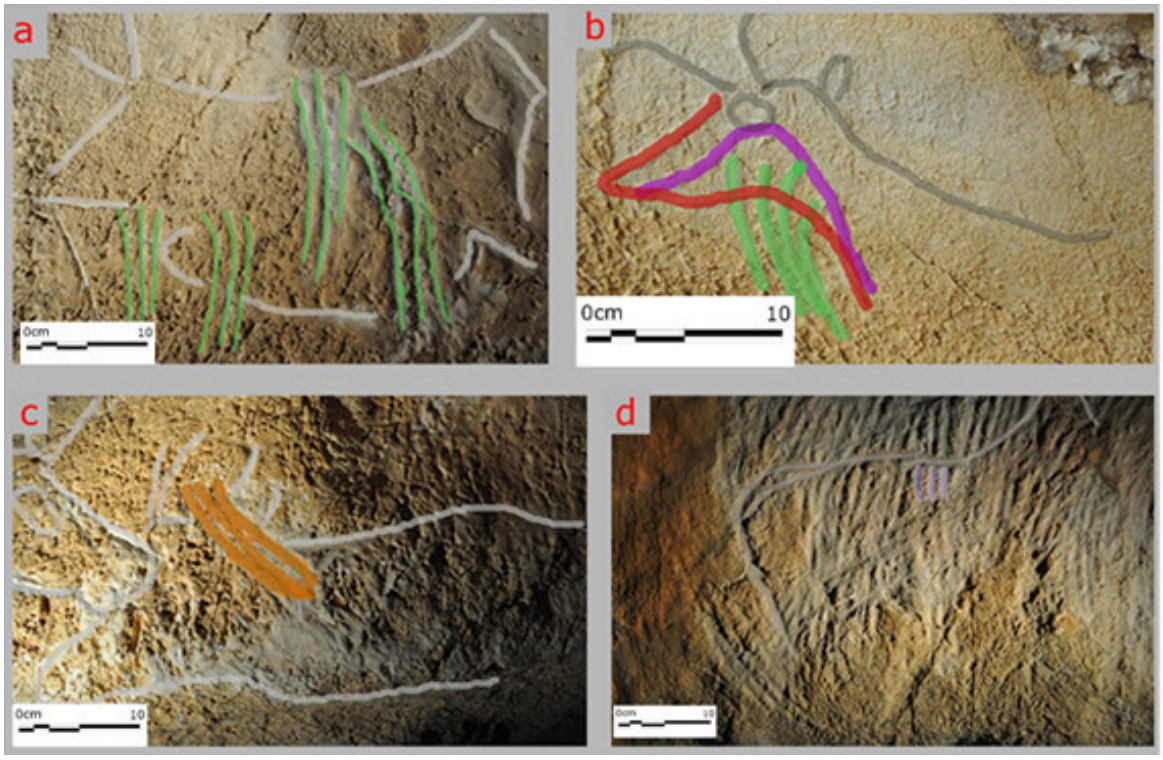


Figure 5. Simultaneous flutings in Las Chimeneas made by (a-b) a child (32mm, green), (c) the adult 38mm (orange), and (d) the adult 52mm (grey) that intersect a figurative image.

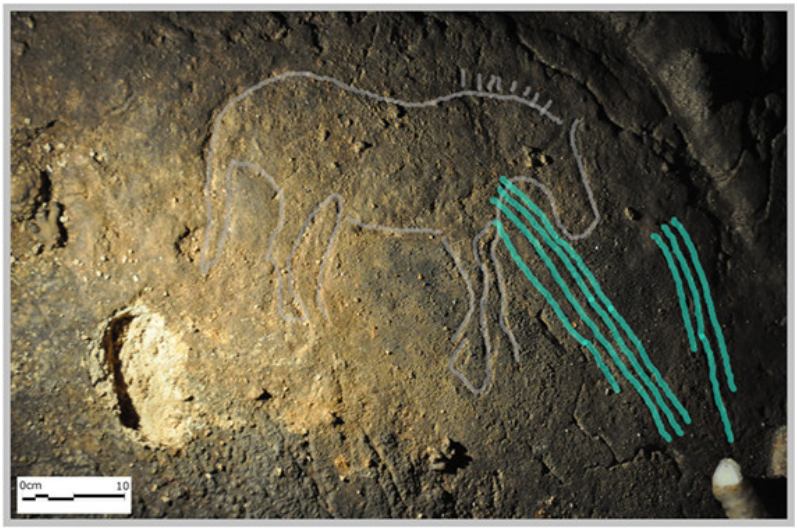


Figure 6. Fluting by an adult intersecting a horse in El Castillo.

The position and style of these flutings from different locations in relation to the outlined animals is telling. With the exception of the child's fluting in Las Chimeneas (Fig. 5b), no evidence was found that suggests the figures and flutings were created simultaneously. The evidence suggests that flutings were made before, during, and after the creation of the figurative art, by either individuals or multiple people. In some cases, the lines intersect to show the stratigraphy but there are also examples where flutings lie internally within the animal and therefore the chronology of creation cannot be determined. Flutings that came before the

figurative art, and those which are clearly not intersecting the animal or only crossing an area which would not slay the animal, like the tusks of a mammoth, suggest the practice of fluting carried out by different members of the community with the flexibility of adding to the already existing images. This in turn indicates that community of practice and the situated learning were not only restricted to one chronological episode but were a process where the act of fluting was carried out by generations of community members.

One of the most intriguing examples is a composite image located nearly a kilometre from the entrance of Rouffignac where three people have added their contribution to create a panel which many modern researchers have interpreted as a single image (Fig. 7). Once the panel is reached, requiring careful navigation across bear pits and small spaces, the fluting of at least three individuals can be seen creating what has been identified as a saiga antelope: two children under the age of seven and a male adult.

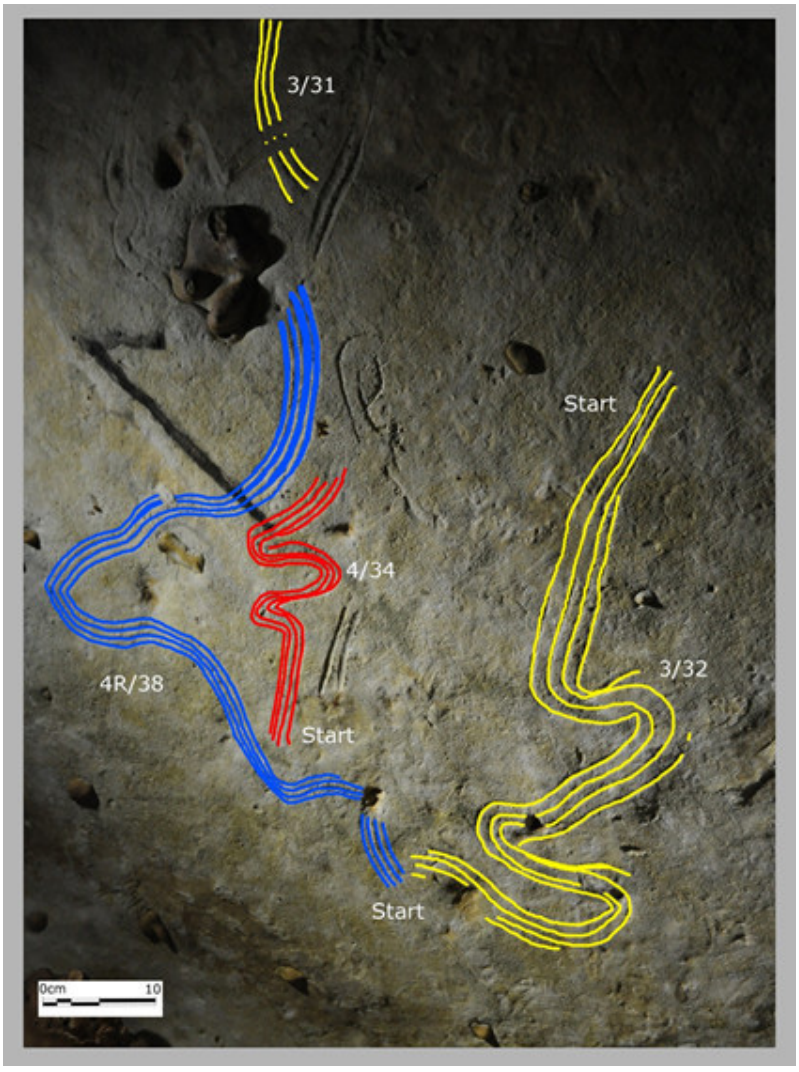


Figure 7. Flutings by three individuals at a terminal end of Rouffignac: the flutings of the smallest child (31mm) are highlighted in yellow, a female child (34mm) in red, and the male adult (38mm) in blue.

Multiple individuals fluting in close proximity appears common. The stratigraphy of flutings by at least two individuals each from Rouffignac, Las Chimeneas, and Gargas suggests that the individuals fluted simultaneously. Figure 8 presents evidence indicating that two of the Rouffignac children were likely fluting simultaneously; likewise in Las Chimeneas there is evidence that two children were fluting contemporaneously, as well as two adults in a separate location. This data seems to contradict the image

of a solitary individual, possibly a shaman in a trance as part of an individual journey, as proposed by Lewis-Williams (2002, 2009). Indeed these flutings would have certainly been seen by more than one adult and the spirits they were communing with in each of these instances in the process of situated learning as a part of community of practice activity. While the flutings in El Cudón and Hornos de la Peña show two artists utilizing the same space their contemporaneity cannot be ascertained; therefore it is possible that each created the flutings alone but used the same location. Yet whether the artists were creating flutings concurrently or consecutively, we suggest it was part of the activity shared with the community of practice over time.

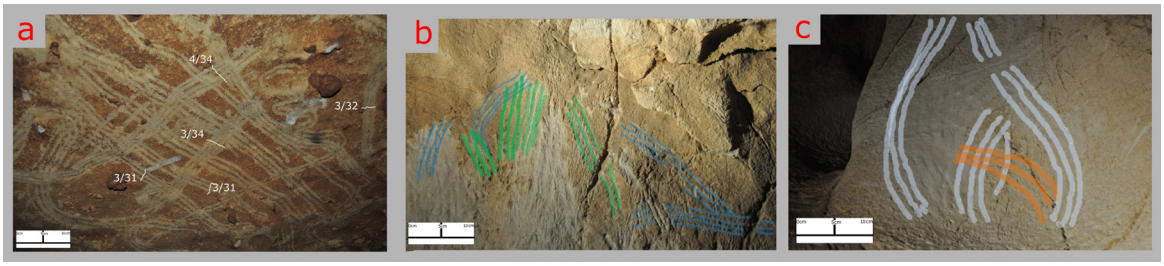


Figure 8. Flutings by (a) two children under the age of seven (31mm and 34mm) in Rouffignac, (b) two children in Chimeneas, and (c) two adults in Las Chimeneas, demonstrating the contemporaneous nature of the fluting.

Generally, in all of the sites from this study, there was no location where only a single individual fluted. The one exception is in Rouffignac, where the flutings of a female child (28mm), who was likely aged between four and seven years, was the only person to have fluted in the immediate vicinity of the Great Ceiling. However, the Great Ceiling contains many painted images of animals, and at least one other individual would have spent a great deal of time working to create that. The child's age likely precludes her from being the artist responsible for the animals; studies indicate that normally developing children do not have the cognitive or physical capacity to make complex and technically accurate images such as these (Scherf et al., 2009). What we see here again is the community of practice where the female child was in the company of the other individuals, both children and adults, whose flutings were found in the same locations as hers in other areas of the cave (Fig. 3a).

In fact, the same individuals are rarely found in only one area of these caves. Most are encountered fluting in multiple locations, travelling through the chambers a great deal. The children's flutings indicate that the visits were limited in time. The established contemporaneity of some of these individuals with other children and adults suggests that they were there together rather than returning year after year, as with growing children we would not expect to encounter the same individuals constantly but rather a more diverse group.

It also would have been necessary to touch the wall multiple times given the vast number of flutings individuals made. Indeed, in Rouffignac there are two individuals, a female child and a male adult, who each made over one hundred identifiable flutings. While touching the wall may have been important for the individual to commune with the spirits, an analysis of the evidence suggests that there were multiple individuals repeatedly touching the cave walls in the same locations as other people and it was potentially not an extremely restricted activity.

The location of the flutings on the surface of the cave we suggest further supports the community of practice as part of Upper Palaeolithic societies where situated learning was widely practiced. Flutings are often situated between 1.25–1.75m from the accepted Palaeolithic floor level, which may have been a comfortable height even for children younger than seven years (Fig. 9). Some children's flutings are at heights which would not have been reachable without climbing or being held up by another person. The flutings are almost never found on or near the floor, with the exception of flutings by adults in Las Chimeneas as previously discussed. The lowest flutings from other caves are at least half a meter above the approximate Palaeolithic floor levels in Rouffignac and Hornos de la Peña.

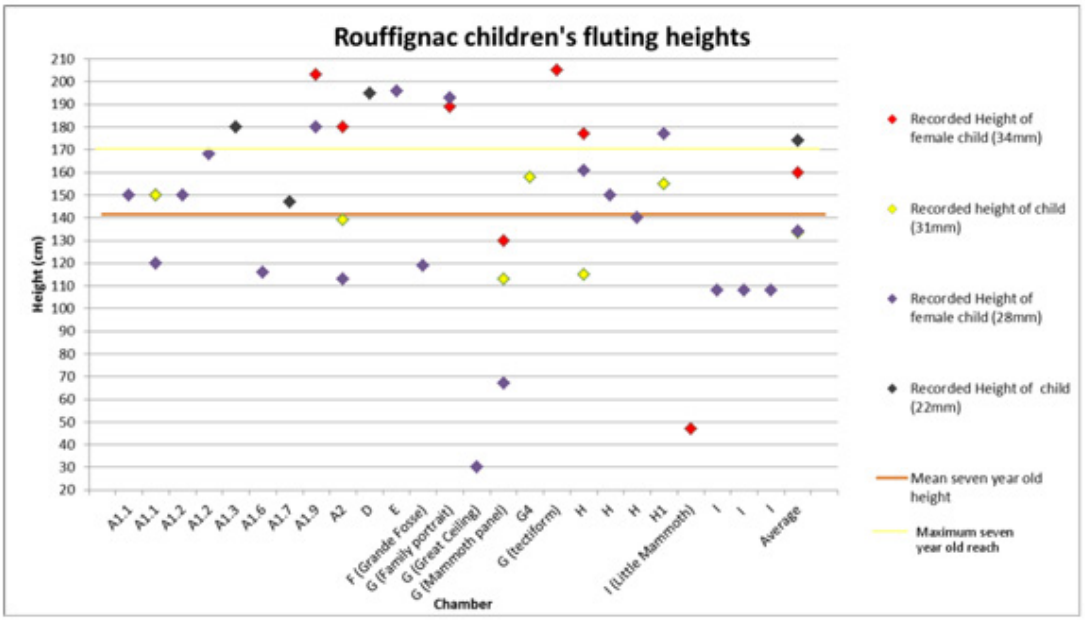


Figure 9. Rouffignac: childrens' fluting heights.

That people would have been standing as well as moving throughout the cave is also evidenced by the data (e.g., Fig. 3a, b), where acts of fluting were a part of dynamic acts of walls decorating. Some of the flutings would have been impossible for an individual child to make without the physical assistance of another.

Furthermore, looking at the cave walls we can see that many people, of various ages and both sexes, touched the walls to create flutings. If wall was a membrane between the world of humans and spirits as proposed by Lewis-Williams (2002, 2009) and Clottes (2009, 2010), the evidence presented here contradicts the theory that it was only touched by adult males. The same can be said about the creation of the female-male mythogram (Laming-Emperaire, 1959, 1962; Leroi-Gourhan, 1964, 1965, 1967, 1976, 1982). Although children were found to make finger flutings, concepts like mythograms are not understandable for those who have not developed higher order cognition. Laming-Emperaire's and Leroi-Gourhan's ideas about mythograms and the importance of the cave structure are an illustration of the higher-order function of relational reasoning, a cognitive ability which does not seem to fully develop until approximately seven years old (Ferrer et al., 2009; Gogtay et al., 2004; Toga et al., 2006; Wright et al., 2008). Child artists would therefore not have been aware of the significance of their creations. This would support the argument of situated learning as acts of participation without implicit understanding of meaning or mythogram, where the learning of meaning comes later, since such young children's comprehension would not allow them to meaningfully engage with the signification of cave art.

Acts of situated learning via participation put a new perspective on some images, specifically the tectiforms found in Rouffignac, identified as vulvas by Guthrie (2005), who infers these images were made by males for other males. Yet the data informs us that women were highly involved in the creation of these images as well. Indeed, the young ages of the three children making the tectiforms, thought to be between four and seven years, renders the idea that this is an image related to a desire for sex for procreation purposes improbable (Fig. 10). This example indicates just how much previous interpretations suffered a male bias (Fritz et al., 2016) and how through engagement with the data and proposal of different not symbolic/meaning-based interpretation give us access to the structure of learning as well as communal practices in Upper Palaeolithic communities.

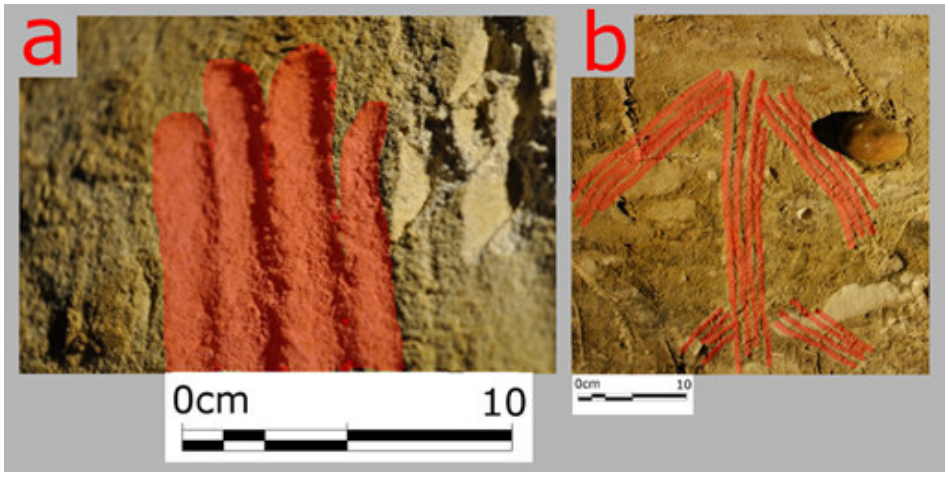


Figure 10. In Rouffignac the (a) left hand finger profile of the child (34mm) which indicates that she was female, in Chamber A2, and (b) her tectiform in Chamber G.

We see through an analysis of finger fluting that making cave art was a part of the 'creating acts' potentially involving the whole community, without identifiable restrictions of sex or age at certain sites. Access to different areas of the caves was open to all, and eve the deep parts of caves were frequented by children whose acts of marking the wall are visible to us.

6.2 Communities of Practice

Bahn (2003, 2010, 2011) and Bender (1995) have argued that Palaeolithic public art could be made by any member of the community, and is located in easy-to-reach locations that are typically close to the entrance or visible. Although they propose no strict guidelines as to who can create private art, they argue that some was likely to have been made by people who were communicating with spirits. This art would have been made in deep cave locations that were difficult to access as well as view. Yet the analysis of the flutings as presented above suggests that the same individuals who were fluting in open areas of the caves were also the individuals making flutings in the difficult-to-access rear areas of the cave without restrictions on gender or age.

We suggest that there is, however, a case for public versus private art: based on type of caves themselves rather than the areas within the caves. There are two caves in which only two people's fluting are found, El Cudón and Hornos de la Peña, and these may have been generally more difficult to access. El Cudón is very muddy, with an uneven floor. There is one chamber at the back which requires crawling, or sliding, but no flutings have been discovered there. Hornos de la Peña would have required crawling in order to enter the cave; even today, with a trench dug out for ease of access, it is still necessary to crouch. It would have been a long crawl to enter. The community of practice in those two locations must have been restricted to only very few people.

Therefore, it may not have been the areas in a particular cave which were off limits to certain people, but rather using Bahn's terms, there were private and public caves. The public caves would have been open, communal spaces where individual biographic memory became part of the social memory, where situated learning took place. Some caves which required a greater physical effort to reach may have been reserved for those who were only there to transmit their own biographic memory without the space for situated learning and restriction on who was a part of the community of practice. Regardless of any spiritual significance of the biographical memories being transmitted, though, it is impossible for these to exist in a vacuum without being integrated into the social memories of the community. Likewise, social memory cannot occur without the individual memories of the individuals who constitute the community; they are complimentary, for one form of memory cannot exist without the other.

Bahn's argument that the flutings were categorized by their visibility is not supported by the data, as there is no noticeable difference in shapes between the caves which have traces of many people versus the caves which had fewer. Even within each cave, the shapes of the flutings appear much the same regardless of how accessible the space is. In addition, there were no flutings discovered which would have been completely visually inaccessible to anyone, including the artist.

While no evidence was found during this investigation to evaluate Bender's interpretation regarding public and private meanings of the same art, the age of the children found suggests that there would have been varying levels of symbolic comprehension by different viewers, hence the situated learning took place without necessary comprehension of the meaning. The smallest children in Rouffignac and Gargas, whose fingers measure just 22mm across, were likely extremely young, perhaps even between the ages of one and three; they certainly would not have yet developed higher order processing skills. The bigger fingers belonged to children who were older, perhaps of an age when higher order cognitive processes were developing.

It is also thus far impossible to positively say whether or not the non-figurative fluted lines had an intrinsic meaning to the community. The flutings all had similar shapes, and there seems to be little difference between the images that adults and children created, however there may have been personal preferences for the style of line made. The female child (34mm) in Rouffignac made many curved flutings, for example, while others seemed to prefer creating straight lines. This may simply be a matter of choice and personal preference rather than a predetermined form. There is little that archaeologists have recognized as signs, except the tectiforms and claviforms. With further study, however, it may become apparent that there are meaningful patterns in the other flutings that have yet to be recognized.

It is possible that flutings made by the adults, or simply the act of fluting, had a special meaning of which all or some of the children were not yet aware in the context of the community of practice. Yet through the encouragement of adults they participated in the creation and transmission of social memory from one generation to the next in the process of situated learning. The flutings made by children appear similar to adult flutings, again with some slight differences that may have been personal preferences; the children may have been imitating the movements and artwork of adults in a learning method which is not explicit. Yet while the adults would have understood any private or sacred meaning, children of the age thought to be responsible for many of the flutings discovered in the caves would not.

Larger caves therefore appear to have been both physically and socially accessible to children and adults of both sexes; this may or may not have been for a ritualistic purpose. Within these sites there is evidence that some of the art was being created collaboratively, with the physical and perhaps even artistic assistance of others as a part of community of practice activity. There may have been a private meaning to the art, but the physical marks were visible to others. The caves without children, however, were much more difficult to access and smaller. We therefore suggest that the concept of private and public spaces should not be applied to areas within the caves, as there is no corroboration between the data and this theory, rather the sites themselves may have been public or private, in the latter case the community of practice is restricted to very few people.

The evidence points to the caves themselves, rather than the locations within them, as perhaps having more personal focus versus social meanings imbued in the art. Of course, it is difficult to separate the two aspects of meaning as each inform the other. The evidence indicates, however, that in the case of the art in El Cudón and Hornos de la Peña, there was possibly a restriction on who could create art there based on the low number of individuals encountered as compared to other sites.

7 Community of Practice and Community Art

The transmission of culture, through which information regarding the lifeways of a community are acquired, communicated, taught, and learned, is a foundation of the social interpretation of cave art. There can be differences in the nature and content of the information, but the general learning structure remains the same and the identity of the artists appears to be flexible; the community of practice comprised anyone. The data

from the four caves in which children were identified supports this interpretation where 'artistic creativity … is based in the community setting, characterised by the interaction or dialog within the community' (Tate–Art Term, 2017), which would indicate that the custom of fluting within the Palaeolithic caves can be interpreted as community art, created by the members of communities of practice that encompassed individuals of different age and sex, and in which situated learning was encouraged and appreciated.

The location of flutings near figurative art as seen in Rouffignac and Las Chimeneas also suggests that figurative art may have played a role in the choices of the group, for example helping to determine the placement or shape of the fluting. The only evidence encountered that a child fluted contemporaneously with the creation of figurative art is the Las Chimeneas child (Fig. 5b); the sequencing resolution suggests that the timing of the fluting and the figure were simultaneous, creating a visual dialogue between contributions possibly created by different community members.

However, there is much evidence to suggest that figurative images were made prior to the flutings, and there are also examples of figurative art being fluted with a single finger. In some respects, it perhaps does not matter if the figurative images were made in front of the children, or if they came before. Indeed, the figure may have existed long before the fluting artists entered the cave. Regardless, children were included in the group of people who could see and share culturally-based images or ideas, even if they did not yet fully understand their significance. Although the children may not yet have been aware of why they were making the art and of the social meanings which were apparent to adults, they nevertheless took an active part in creating the art and through this process began to learn the underlying importance of the art, its meaning and its communicative aspects.

The fact that the children were actively encouraged to make the marks, evidenced by the physical help they would have needed in Rouffignac, El Castillo, and Gargas to reach certain areas, is further evidence that this was an activity supported by the group. The flutings may have been a method of teaching children about the cave and socially important artistic forms, allowing them to participate in the creation of social memory from young ages in a way which then became firmly ingrained in their own personal memories and worldview as a part of situated learning.

This may have been accomplished by encouraging children to explore and interact with the environment in culturally sanctioned ways or imitate the actions of older individuals. Over imitation is a significant form of learning, occurring when a child imitates the actions of an older individual, even without necessarily understanding its meaning (Lyons et al., 2007; Nielsen, 2006; Nielsen & Tomaselli, 2009; Tomasello et al., 2004). Children also learn through the active guidance of others. In Rouffignac the smallest individual, likely between one and four years old, almost certainly had his or her hand held and guided while creating the flutings, based on the length and precision of the flutings (Fig. 11). In this manner, through imitation and guidance, the children were learning to create art, and knowledge was being transmitted between generations as an active part of the community of practice.

Again, it is important to remember that recreating an image, imitating or copying the art of another person does not mean that the individual comprehends the social significance of the image. The flutings do not clarify whether this constituted a biographical memory or a social memory, but it does indicate that there was a method of communication and transmission that included art from one generation to the next. As discussed previously, there were no spaces within a cave where it appeared that children could not flute while adults could, but any restriction appears to apply to entire caves. It was acceptable, appropriate, or desirable for children to be fluting in El Castillo, Las Chimeneas, Rouffignac, and Gargas, but not in El Cudón or Hornos de la Peña, although children may have been physically present in the caves without fluting as a part of community of practice.

It must also be pointed out that, while this does not appear to be a solitary activity, neither is there evidence of vast numbers of people. The lowest number of fluters identified is two, in El Cudón and Hornos de la Peña, with four people in El Castillo and eight in Rouffignac, Gargas, and Las Chimeneas. If this was a truly communal activity that everyone would have been included in there would likely have been more individuals found in most, if not all, of the caves. We have to remember that community of practice as discussed in this paper is based on our examination of fluting only, and the number of individuals identified represent a minimum number. If it were also possible to analyse the paintings and drawings the number of individuals may increase.

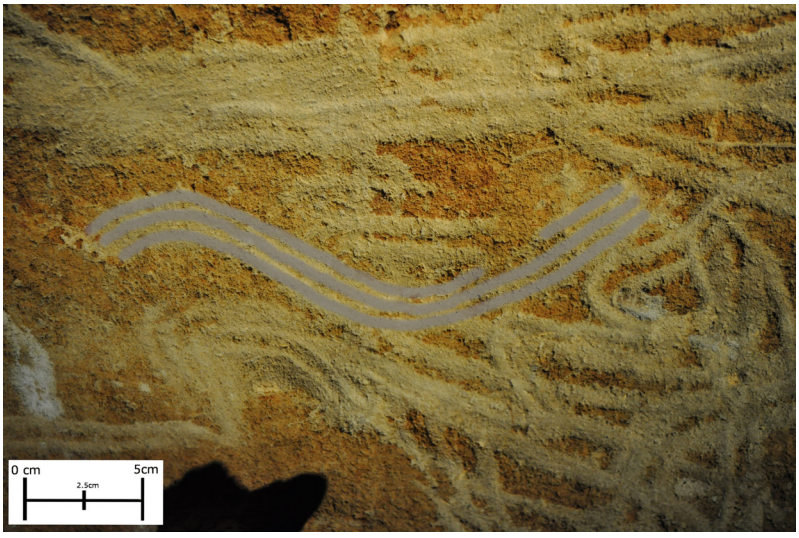


Figure 11. Fluting by young child (22mm) in Rouffignac, likely with the guidance of an adult.

The resolution of the dating of flutings is also not clear, and to fully support or disprove this interpretation clear dates are needed. Evidence from Rouffignac, Gargas, and Las Chimeneas suggests that some of the fluters were part of the same community of practice based on the stratigraphy of the flutings. However it is unclear if all the fluters in all the caves were present contemporaneously or separately. Indeed, if fluting is an activity that took place during much of the Palaeolithic, it must be questioned why there were relatively few individuals in total. It might be argued that fluting was an activity that was still reserved for certain individuals who met certain criteria, but one which precluded age and sex. Alternatively, there may have been other methods of children interacting with the material culture of the society, imitating their elders and learning how to participate in the community through the creation of other forms of social memory.

Gamble's suggestion of regional centres may be supported by this research, especially the Cantabrian sites (Gamble, 1982, 1983, 1986, 1999). It has been argued that the caves of Monte Castillo were part of a ritual centre based on the presence of five decorated caves on the same mountain, itself a prominent feature in the landscape, and the long history of human presence at the sites. Children were found in El Castillo and Las Chimeneas, both within the Monte Castillo system; El Cudón and Hornos de la Peña are not located on this mountain and have no evidence of children. Indeed, the relative abundance of decorated caves at the same geographical site may indicate that this was a boundary or a gathering place of different groups, all who recognized the importance of this site but had their own cultural space, a cave, at the site. Alternatively, there may have been different uses between all of the caves. The fact that children were found in two out of five caves might indicate that there were different purposes and social identities for each. Regardless, a site was a location where the impetus appears to have been building social memories.

If the presence of children is indicative of caves which were congregation areas for larger communities and were important to a shared history, then the long-held assumptions about the importance of a cave being linked to the subjectively modern judgment of the aesthetic quality of the art within needs to be reassessed. There is no reason to infer that the two French caves, Rouffignac and Gargas, were not regionally important centres where children were being introduced and were contributing to the social memory as part of the community of practice through exposure to the mythograms portrayed in the caves. It may have also been that there were both regional and local centres of cultural importance.

8 Conclusion

By following the lines of fluting in the context of the community of practice, the understanding of Palaeolithic art proposed here gives us better recognition of the individuals and the relationships between them. The

artists were not only individuals who could be distinguished and qualified, whether by training or their powers, for example as a shaman or spiritual leader, they were also children. Children and adults created art together, with adults encouraging children through their physical assistance, even those children whose cognitive capacities due to their age did not allow them to comprehend the meanings of their actions. Socially situated learning within these communities of practice was a foundation for the transmission of knowledge, symbolism, myths, and artistic techniques.

The caves in which children are found, at or near a focal point of parietal art, suggest that these activities occurred in locations which had a specific context within the social memory of the culture. These may have been important places for local and regional communities. Creative activity was exercised by the community of practice compose by individuals of different age and sex, thereby producing community art.

Children, as analysis of the data suggests, were participatory members of the Palaeolithic community of practice, encouraged to become involved in the social and possibly symbolic aspects of society before they cognitively understood the full implications and meanings of their actions. We suggest the aim was not only to develop artistic motor skills but also to participate in the social memory regardless of comprehension level. In this way, children were participating in the creation of the mythogram of their community; what they create stays on the rocks and in the cave, building and influencing the memories. The biographical memory of the artist, regardless of age, contributed to the social memories, mythograms, and structure. Through the participation in art and memory creation the child was introduced into the system of social norms via community art.

In this light, the meaning of art goes beyond being a by-product of sacred and symbolic ritual, a method of communicating with spirits, or a reflection of the sacred worldview of the Palaeolithic people. It was neither place of an exclusive activity, with the community at large only involved in a ritually prescribed manner, nor were all caves places with restricted access.

Summarising our understanding of prehistoric cave art based on the contextual analyses of fluting, we propose that these fluted lines are moved from a context of public or private art into community art created by the communities of practice. Here old and young interacted, and created a visual contribution left for us to discover on the cave walls. In the case of the El Cudón and Hornos de la Peña caves a community contribution is not explicitly visible, but the social and/or symbolic interactions which allow the individual, outside of the participation of the others, to express themselves in small caves, gives us a window on to diversity in the creation, constitution and reconstitution of individual and communal biographies 'locked' into the cave walls.

By joining the activity in these spaces, either as an artist or a participant in a ritual, an individual is contributing to communal, social and creative acts. Some caves may embody individual memories due to the limited numbers of individuals, members of community of practice who created the art. In such cases we would argue that they are also part of the community art since these individuals were a part of a community of practice. The forms of presence they perform in the caves reflected social acts which may have been undertaken for the sake of the entire community. The individual acts may therefore still be social, but are manifested in more individual ways. Cave art, we suggest, is therefore reflective of the biographical and social memory of the whole community, where the community of practice and situated learning are an integral part of this process.

Acknowledgments: This paper would not have been possible without the help and support of many people.

Fieldwork was overseen by Dr L. Van Gelder, whose work with her late husband Dr K. Sharpe provided the methodology to identify children in the cave art record. The authors would like to thank her for her support, particularly for allowing access to early data from Gargas. We are grateful to Prof P. Pettit and Dr W. Davis for their constructive comments on the part of the work presented here. We would like also to thank anonymous reviewers for their encouraging and valuable comments that made us to improve the paper and to communicate our ideas.

The authors would like to thank the Plassard Family kindly granting access to Rouffignac Cave, and Frédéric Goursolle for his guiding skills, and knowledge of the cave. We would also like to thank the Cantabrian Government for granting access to the Spanish sites. Roberto Ontañon Peredo, Director of the

Prehistoric Caves of Cantabria, and his colleagues Gustavo Sanz Palomera and Raúl Gutiérrez, as well as the other guides at Monte Castillo for their help facilitating fieldwork. Eduardo Palacio Perez, from the University of Cantabria, also provided great support and was the official Spanish Collaborator of the Cantabrian fieldwork. This research would not have been possible without their support and interest in the project.

Funding for this work was provided by the Gates Cambridge Trust, St John's College, and the Department of Archaeology, University of Cambridge.

References

Bahn, P. G. (1998). *The Cambridge illustrated history of prehistoric art*. Cambridge: Cambridge University Press.

Bahn, P. G. (2003). Location, location: What can the positioning of cave and rock art reveal about Ice Age motivations? In A. Pastoors & G. C. Weniger (Eds.), *Höhlenkunst und Raum: Archäologische und architektonische Perspektiven* (pp. 11–20). Düsseldorf: Jan van der Most.

Bahn, P. G. (2011). Religion and ritual in the Upper Palaeolithic. In T. Insoll (Ed.), *The Oxford handbook of the archaeology of ritual and religion* (pp. 344–357). Oxford: Oxford University Press.

Bahn, P. G. & Vertut, J. (1997). *Journey Through the Ice Age*. Berkeley , CA: University of California Press.

Barth, F. (1987). *Cosmologies in the making*. Cambridge: Cambridge University Press.

Basso, K. H. (1996). *Wisdom sits in places: Landscape and language among the Western Apache*. Albuquerque: University of New Mexico Press.

Bender, B. (1995). The roots of inequality. In M. Dodson & J. Palmer (Eds.), *Design and Aesthetics: A reader* (pp. 190–195). London: Routledge.

Bettencourt, A., Sanches, M. J., Alves, L. B., & Fábregas Valcarce, R. (2010). Conceptualising space and place on the role of agency, memory and identity in the construction of space from the Upper Palaeolithic to the Iron Age in Europe: an introduction. In Bettencourt, A. M. S., Jesus Sanches, M., Alves, L. B, & Fábregas Valcarce, R. (Eds.), *Conceptualising Space and Place*. Proceedings of the XV World Congress (Lisbon, 4-9 September 2006) (pp. 1–3). Oxford: BAR International Series 2058.

Chazine, J.-M., & Noury, A. (2006). Sexual determination of hand stencils on the main panel of the GuaMasri II Cave (East-Kalimantan/Borneo – Indonesia). *International Newsletter on Rock Art*, 44, 21–6.

Clottes, J. (2009). Sticking bones into cracks in the Upper Palaeolithic. In C. Renfrew & I. Morley (Eds.), *Becoming human: Innovation in prehistoric material and spiritual culture* (pp. 195–211). Cambridge: Cambridge University Press.

Clottes, J. (2010). *Cave art*. London: Phaidon.

Clottes, J. (2013). Consequences of the discovery and study of the Chauvet Cave. In K. Sachs-Hombach & J. R. J. Schirra (Eds.), *Origins of pictures* (pp. 46–71). Cologne: Herbert von Halem Verlag.

Cooney, J. (2014). *The Child in the cave: the contribution of non-adults to the creation of cave art and community in the Upper Palaeolithic*. (Unpublished doctoral dissertation). University of Cambridge, Cambridge.

Conkey, M. (1978). Style and information in cultural evolution: towards a predictive model for the Palaeolithic. In C. Redman, M. J. Berman, E. V. Curtin, W. T. Langhorne Jr., N. M. Versaggi & J. C. Wanser (Eds.), *Social archaeology: Beyond sustenance and dating* (pp. 61–85). New York: Academic Press.

Conkey, M. (2001). Hunting for images, gathering up meanings: art for life in hunting-gathering societies. In C. Panter-Brick, R. H. Layton, P. Rowley-Conwy (Eds.), *Hunter-gatherers: An interdisciplinary perspective* (pp. 267–291). The Biological Social Society Series, 13. Cambridge: Cambridge University Press.

Conkey, M. (2009). Materiality and meaning-making in the Palaeolithic 'arts'. In C. Renfrew & I. Morley (Eds.), *Becoming Human: Innovation in Prehistoric Material and Spiritual Culture* (pp. 179–194). Cambridge: Cambridge University Press.

Cundill, G., Roux, D. J., & Parker. J. N. (2015). Nurturing communities of practice for transdisciplinary research. *Ecology and Society* 20(2): art22 http://dx.doi.org/10.5751/ES-07580-200222

Ferrer, E., O'Hare, E. D., & Bunge, S. A. (2009). Fluid reasoning and the developing brain. *Frontiers in Neuroscience*, 3(1), 46–51.

Foucher, P., San Juan-Foucher, C., & Rumeauy, Y. (2007). *La grotte de Gargas. Un siècle de découvertes*. Saint-Laurent-de-Neste: Communauté de communes du canton de Saint-Laurent-de-Neste.

Fritz, C., Tosello, G., & Conkey, M. W. (2016). Reflections on the identities and roles of the artists in European Paleolithic societies. *Journal of Archaeological Method and Theory*, 23, 1307–1332. https://doi.org/10.1007/s10816-015-9265-8

Gálvez Lavín, N. & Cacho Toca, M. W. (2010). Hornos de la Peña, In F. O. Goyarrola (Ed.), *Las Cuevas con arte Paleolítico en Cantabria* (pp. 145–150). Santander: Gobierno de Cantabria.

Gamble, C. (1982). Interaction and alliance in Palaeolithic society. *Man, New Series* 17, 92–107.

Gamble, C. (1983). Culture and society in the Upper Palaeolithic in Europe. In G.N. Bailey (Ed.), *Hunter-Gatherer economy in prehistory* (pp. 201–211). Cambridge: Cambridge University Press.

Gamble, C. (1986). *The Palaeolithic settlement of Europe.* Cambridge: Cambridge University Press.
Gamble, C. (1999). *The Palaeolithic societies of Europe.* Cambridge: Cambridge University Press.
Gamble, C. (2010). Palaeolithic society and the release from proximity: A network approach to intimate relations. *World Archaeology* 29(3), 426–449.
Garcia Diez, M., & Garrido Pimentel, D. (2010). Las Chimeneas. In F.O Goyarrola (Ed.), *Las Cuevas con arte Paleolítico en Cantabria* (pp. 205–210). Santander: Gobierno de Cantabria.
Garcia Diez, M. & R. Gutierrez Rodriquez. (2010a). El Castillo. In F.O Goyarrola (Ed.), *Las Cuevas con arte Paleolítico en Cantabria* (pp. 179–190). Santander: Gobierno de Cantabria.
Geertz, C. (1976). Art as a cultural system. *Modern Language Notes*, 91, 1473–1499.
Gogtay, N., Giedd, Lusk, L., Hayashi, K. M., Greenstein, D., Vaituzis, A.C. , Nugent, T.F., Herman, D. H. , Clasen, L. S. , Toga, A.W. , Rapoport, J.L., & Thompson, P.M. (2004). Dynamic mapping of human cortical development during childhood through early adulthood. *Proceedings of the National Academy of Sciences of the United States of America*, 101(21), 8174–8179.
Groënen, M. (1997). *Ombre et lumières dans l'art des grottes*. Cahiers d'études VI. Bruxelles: Université Libre de Bruxelle.
Groënen, M. (2012). Recorridos decorada por la Cueva de El Castillo. 373–394. Arte artistas sin: una mirada al Paleolithic [exposición celebrada en el] Arqueológico Museo Regional, Alcalá de Henares, Madrid, de diciembre de 2012 abril de 2013. https://dipot.ulb.ac.be/dspace/bitstream/2013/142099/1/Groenen-Recorridos.pdf. (11.10.2014)
Guthrie, R. D. (2005). *The nature of Paleolithic art*. Chicago: University of Chicago Press.
Handley, K., Sturdy, A., Fincha, R. & Clark, T. (2006). Within and beyond communities of practice: making sense of learning through participation, identity and practice. *Journal of Management Studies*, 43(3), 641–653.
Hare, A. M. (2008). *Handprints in French Upper Paleolithic parietal art: A comparative analysis of age and sex using current subadult data.* (Unpublished doctoral dissertation). Northern Illinois University, DeKalb.
Hewlett, B. S., & Cavalli-Sforza, L. L. (1986). Cultural transmission among Aka pygmies. *American Anthropologist*, 88(4), 922–934.
Jochim, M. (1982). Palaeolithic cave art in ecological perspective. In G. Bailey (Ed.), *Hunter- Gatherer economy in prehistory* (pp. 212–219). Cambridge: Cambridge University Press.
Jones, A. (2007). *Memory and material culture.* Cambridge: Cambridge University Press.
Kuechler, S. (1987). Malangan: art and memory in a Melanesian society. *Man, New Series*, 22(2), 238–55.
Laming-Emperaire, A. (1959). *Lascaux: Paintings and engravings*. Harmondsworth: Pelican.
Laming-Emperaire, A. (1962). *La Signification de l'Art Rupestre Paléolithique*. Paris: Picard.
Lave, J. (1996). Teaching, as learning, in practice. *Mind, Culture, and Activit*, 3(3), 149–164
Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. New York: Cambridge University Press.
Lee, L., Reinicke, B., Sarkar, R., & Anderson, R. (2015). Learning through interactions: Improving project management through communities of practice. *Project Management Journal* 46(1): 40–52.
Leroi-Gourhan, A. (1964). *Les religions de la préhistoire*. Paris: Presses Universitaires de France.
Leroi-Gourhan, A. (1965). *Préhistoire de l'art occidental.* Paris: Lucien Mazenod.
Leroi-Gourhan, A. (1967). *The art of prehistoric man in western Europe*. London: Thames & Hudson.
Leroi-Gourhan, A. (1976). Interpretation esthétique et religieuse des figures et symbols dans la préhistoire. *Archives de Sciences Sociales des Religions*, 42, 5–15.
Lewis-Williams, J. D. (2002). *The mind in the cave: consciousness and the origins of art.* London: Thames and Hudson.
Lewis-Williams, J. D. (2009). Of people and pictures. In C. Renfrew & I. Morley (Eds.), *Becoming Human: Innovation in prehistoric material and spiritual culture* (pp. 135–158). Cambridge: Cambridge University Press.
Lorblanchet, M. (1991). Spitting images: Replicating the spotted horses of Pech Merle. *Archaeology*, 44(6), 24–31.
Lorblanchet, M. (1995). *Les grottes ornées de la préhistoire: nouveaux regards*. Paris: Errance.
Lyons, D. E., Young, A. G., & Keil, F. C. (2007). The hidden structure of overimitation. *Proceedings of the National Academy of Sciences*, 104(50), 19751–19756.
Manning, J. T. (2002). *Digit ratio: A pointer to fertility, behaviour, and health.* New Jersey: Rutgers University Press.
Manning, J. T. (2009). *The finger ratio: sex, behaviour and disease revealed in the fingers*. London: Faber.
Manning, J. T., & Taylor, R. P. (2001). Second to fourth digit ratio and male ability in sport: Implications for sexual selection in humans. *Evolution and Human Behaviour*, 22(1), 61–9.
Mellars, P. (2009). Cognition and climate: why is Upper Palaeolithic cave art almost confined to the Franco-Cantabrian region? In C. Renfrew & I. Morley (Eds.), *Becoming human: Innovation in prehistoric material and spiritual culture* (pp. 212–231). Cambridge: Cambridge University Press.
Mithen, S. (1991). Ecological interpretations of Palaeolithic art. *Proceedings of the Prehistoric Society*, 57(1), 103–14.
Moure Romanillo, A., Gonzales Sainz, C., Bernaldo de Quiros, F., & Cabrera Valdes, V. (1996). Dataciones absolutas de pigmentos en cuevas cantabricas: Altamira, El Castillo, Chimeneas y Las Monedas. In A. Moure Romanillo (Ed.), *El Hombre Fosil 80 Años Despues* (pp. 295–324). Santander: Servicio de Publicaciones, Universidad de Cantabria.
Nowell, A. (2015). Learning to see and seeing to learn: children, communities of practice and Pleistocene visual cultures. *Cambridge Archaeological Journal*, 25(4), 889–899.

Nielsen, M. (2006). Copying actions and copying outcomes: Social learning through the second year. *Developmental Psychology*, 4, 555–565.
Nielsen, M., & Tomaselli, K. (2010). Overimitation in Kalahari Bushman children and the origins of human cultural cognition. *Psychological Science*, 21(5), 729–736.
Peters, M., Mackenzie, K., & Bryden, P. (2002a). Finger Length and Distal Finger Extent Patterns in Humans. *American Journal of Physical Anthropology* 117(3), 209–17.
Peters, M., Tan, Ü., Kang, Y., Teixeira, L., & Mandal, M. (2002b). Sex-Specific Finger- Length Patterns Linked to Behavioural Variables: Consistency across Various Human Populations. *Perceptual and Motor Skills*, 94(1), 171–81.
Pike, A. W., Hoffmann, D. L., García-Diez, M, Pettitt, P. B., Alcolea, J., De Balbin, R., Gonzàlez-Sainz, C., de las Heras, C., Lasheras, J. A., Montes, R., & Zilhão, J. (2012). U-series dating of Paleolithic art in 11 caves in Spain. *Science*, 336(6087), 1409–1413.
Porr, M. (2010). Palaeolithic Art as Cultural Memory: a Case Study of the Aurignacian Art of Southwest Germany. *Cambridge Archaeological Journal*, 20(1), 87–108.
Roveland, B. (2000). Footprints in the clay: Upper Palaeolithic children in ritual and secular contexts. In J. Sofaer (Ed.), *Children and material culture* (pp. 29–38). London: Routledge.
Rowlands, M. (1992). The Role of Memory in the Transmission of Culture. World Archaeology, 25(2), *Conceptions of Time and Ancient Society*, 141–151.
Priest, K. L., Saucier, D. A. & Eiselein, G. (2016). Exploring students' experiences in first-year learning communities from a situated learning perspective. *International Journal of Teaching and Learning in Higher Education*, 28(3), 361–371.
San Miguel Llamosas, C. & Muñoz Fernández, E. (2010). Cudón. In F.O Goyarrola (Ed.), *Las Cuevas con arte Paleolítico en Cantabria* (pp. 157–165). Santander: Gobierno de Cantabria.
Scherf, K. S., Behrmann, M., Kimchi, R., & Luna, B. (2009). Emergence of Global Shape Processing Continues through Adolescence. *Child Development*, 80(1), 162–177.
Sharpe, K. (2004). Incised linear markings: animal or human origin? *Rock Art Research*, 21, 57–84.
Sharpe, K. & Van Gelder, L. (2004). Children and Paleolithic 'art': indications from Rouffignac cave, France. *International Newsletter on Rock Art*, 38, 9–17.
Sharpe, K. & Van Gelder, L. (2006a). Evidence for cave marking by Palaeolithic children. *Antiquity*, 80(310), 937–947.
Sharpe, K. & Van Gelder, L. (2006b). Finger flutings in Chamber A1 of Rouffignac Cave, France. *Rock Art Research*, 23(2), 179–198.
Sharpe, K. & Van Gelder, L. (2006c). The study of finger flutings. *Cambridge Archaeological Journal*, 16(03), 281–295.
Sharpe, K. & Van Gelder, L. (2007). More about 'More about finger flutings'. *Rock Art Research*, 24(1), 133–135.
Sharpe, K. & Van Gelder, L. (2009). Paleolithic finger flutings as efficient communication: Applying Zipf's Law to two panels in Rouffignac Cave, France. *Semiotica*, 177, 157–175.
Sharpe, K., Van Gelder, L., & Bednarik, R. G. (2006). Finger flutings in chamber A1 of Rouffignac Cave, France. *Rock Art Research*, 23(2), 179.
Sheets-Johnstone, M. (2003). *The Roots of Power: Animate Form and Gendered Bodies*.
Peru, I.L.: Open Court Publishing.
Snow, D. R. (2006). Sexual Dimorphism in Upper Palaeolithic Hand Stencils. *Antiquity*, 80, 390–404.
Snow, D. R. (2013), Sexual dimorphism in European Upper Palaeolithic cave art. *American Antiquity*, 78(4), 746–761.
Stapert, D. (2007). Finger flutings by Palaeolithic children in Rouffignac Cave: comments on a paper by Sharpe & Van Gelder. *Antiquity* 81(312): https://www.antiquity.ac.uk/projgall/stapert312/
Tate–Art Term. Community art, http://www.tate.org.uk/art/art-terms/c/community-art (28.06.2017)
Toga, A. W., Thompson, P. M., & Sowell, E. R. (2006). Mapping brain maturation. *Trends in Neurosciences*, 29(3), 148–159.
Tomasello, M., Carpenter, M., Call, J., Behne, T., & Moll, H. (2005). Understanding and sharing intentions: The origins of cultural cognition. *Behavioral and Brain Sciences*, 28, 675–691.
Valladas, H., Cachier, H., Maurice, P., de Quiros, F. B., Clottes, J., Valdes, V. C. , Uzquiano, P., & Arnold, M. (1992). Direct radiocarbon dates for prehistoric paintings at the Altamira, El Castillo and Niaux caves. *Nature* 357, 68–70.
Van Gelder, L., (2015). Counting the children: The role of children in the production of finger flutings in four upper palaeolithic caves. *Oxford Journal of Archaeology*, 34(2), 119–138.
Vercoutère, C., San Juan-Foucher, C., & Foucher, P. (2006). Human modifications on cave
bear bones from the Gargas cave (Hautes-Pyrénées, France). Scientific Annals, School of Geology Aristotle University of Thessaloniki, 98, 257–261.
Verpoorte, A. (1996). Networks in ancient times. *Archaeological Dialogues* 3, 71–76
Wenger, E. (1998). *Communities of Practice: Learning as a social system*. (Published in the "Systems Thinker," June 1998). PDF, eduhk.hk (10.11.2017).
Whitehouse, H. (1992). Memorable religions: transmission, codification and change in divergent Melanesian contexts. *Man, New Series*, 27(4), 777–799.
Wiessner, P. (1983). Style and information in Kalahari San projectile points. *American Antiquity*, 48, 253–76.
Wiessner, P. (1984). Reconsidering the behavioural basis for style: A case study among the Kalahari San. *Journal of Anthropological Archaeology*, 3, 190–234.

Wright, S. B., Matlen, B. J., Baym, C. L., Ferrer, E., & Bunge, S. A. (2008). Neural correlates of fluid reasoning in children and adults. *Frontiers in Human Neuroscience*, 1(8), 1–8.