Making sense of the chronology of Paleolithic cave painting from the perspective of material engagement theory

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Abstract

There exists a venerable tradition of interdisciplinary research into the origins and development of Paleolithic cave painting. In recent years this research has begun to be inflected by rapid advances in measurement techniques that are delivering chronological data with unprecedented accuracy. Patterns are emerging from the accumulating evidence whose precise interpretation demands corresponding advances in theory. It seems that cave painting went through several transitions, beginning with the creation of simple lines, dots and disks, followed by hand stencils, then by outlined figures, and finally by naturalistic figures. So far the most systematic evidence comes from Europe, although there are also indications that this sequence could be a universal pattern. The shamanic hypothesis provides a useful theoretical starting point because of its emphasis on the role of performance and phenomenology in the creative process. However, it still tends to reduce this sequence to mere stylistic and thematic changes that were external products of an already fully formed modern mind. Here I show how key insights from semiotics and material engagement theory can advance this explanatory framework to the extent that we become able to postdict the major transitions in the chronology of Paleolithic cave painting. An intriguing implication is that this is at the same time a chronology of cognitive changes, namely from a performative-phenomenological to a reflective-representational mind.

Keywords: origins of art; enactive cognitive science; embodied cognition; prehistory; cognitive archaeology; archaeology of mind; symbolic cognition

1. Introduction

1.1 Patterns in the origins and developments of European cave painting

One stimulating current debate with regard to Paleolithic cave painting concerns its chronology (Ontañon and Utrilla 2017). New dating methods have begun to confirm the consensus that the practice of creating simple outlined figures preceded that of complex realistic paintings (Pike et al. 2012). For example, in the context of the western Pyrenean and eastern Cantabrian regions, there was a consistent graphic form shared by the earliest samples of portable sculptures (i.e. between 32,500 and 24,500 cal. BP) and the first figurative paintings. They are characterized by:

1 Throughout this article I have avoided the common terminology of cave ‘art’ in order not to give the impression that I am attributing our contemporary notion of art to Paleolithic people (Ingold 2000).
a) anatomically simple representations that were frequently reduced solely to
the outline of the figure;
b) representation of the figure's outline usually just with a single line;
c) an angular or curved intersection between anatomical parts
d) the figure is created by the elongation of the traces that shape the outline;
e) the figure's limbs are usually misplaced anatomically;
f) the different anatomical parts may not be in overall proportion;
g) movement is not represented (figures appear static), the limbs are vertical
and their articulations are represented rigidly (not bent); and
h) the representation lacks naturalistic posture or appears very static.
(Ochoa and García-Diez 2015, p. 277)

Already at this point we should note that these painted figures share some of the
essential properties of their material substrate: a figure is depicted only partially and
without much concern for realism, whereas the rest of its body is allowed to be
completed and filled in by the concrete details of the underlying surface. Moreover,
just like that motionless surface, the figures themselves appear to be flat, rigid, and
very static. In contrast, relatively younger figurative paintings, for example a bison
dated to between 15,901 and 14,545 cal. BP (Valladas et al. 2013), tend to be much
more detailed, scenic, and dynamic. This later phase is characterized by:

- the curved inflexion of the outline, flexed limb joints, unitary form and global
  comprehension of the figures within an overall coherent perspective, limbs
depicted in correct proportion, greater attention to anatomical detail and
  interior quartering, and a concern with volume and massiveness. These
features combine to create naturalistic depictions characterized by a close
control of the configuration of the figures and an analytical conception of the
overall composition of panels. (Ochoa and García-Diez 2015, p. 279)

Accordingly, an important challenge that any theory of the chronology of European
Paleolithic cave painting must address is to account for the transition from outlined to
realistic figurative painting. However, there are older painting traditions, which must
also be taken into account. In particular, new dating methods have confirmed the view
that one of the earliest practices consisted in leaving negative hand stencils, which
were created by placing one’s hand onto the surface and blowing paint over it. What is
surprising is the age of this general technique: one red hand stencil from El Castillo
cave in Spain has a minimum age of 37,290 years, while a red disk without a hand
stencil is even older with a minimum age of 40,800 years (Pike et al. 2012; García-Diez
et al. 2015). These are the oldest examples of painting known in Europe so far.

A similar pattern of development can be observed for French caves. For example,
Pettitt and Bahn (2015) propose the following chronology for Chauvet cave: the first
humans to enter the cave around 30-32k (14C) BP may have left a small amount of
visual displays in the form of some combination of red hand stencils, dots and lines.
Subsequently, around 28k BP, humans also left paintings “in the form of simple,
naturalistic animal outlines in both black and red and a tracé chinois” (p. 550). Finally,
after around 15k BP, humans created complex and dynamic figurative paintings. This chronology is consistent with the Spanish chronology: it puts simple dots and hand stencils before figurative painting and, more specifically, places outlined figurative painting before naturalistic figurative painting.

Another challenge for a theory of the chronology of European cave art is therefore to account for the earlier transition from non-figurative to (outlined) figurative art. In addition, if we assume that the greater age of the red disk compared to the oldest hand stencil is not an isolated example specific to El Castillo cave but part of a systematic pattern, then there is also a need for theory to account for a transition within non-figurative art, namely from simple marks like a red disk to red disks with hand stencils. Currently available dating evidence is not sufficient to establish the overall time span of the practice of making dots and circles in El Castillo cave (d’Errico et al. 2016), and it is unknown whether disks preceded hand stencils in other places like Chauvet cave. Nevertheless, ideally a theory of cave painting should be able to help us predict whether there is a systematic pattern or not.

Finally, there is also the problem of explaining the origins of the general practice of intentionally marking cave surfaces as such. This was an important challenge for as long as it was believed that the oldest visual displays were found in Europe. However, thanks to a series of remarkable discoveries made in the last couple of decades we now know that the origins of intentional mark-making are much older than previously thought, dating back to at least 60,000 – 100,000 years ago, and that this transition to intentional mark-making did not occur in Europe but in southern Africa (d’Errico et al. 2001; Henshilwood et al. 2002; d’Errico et al. 2005; Texier et al. 2010; Henshilwood et al. 2011). Given that this evidence of practices involving geometric engravings, pigment processing, and bodily decorations does not necessarily entail the existence of cave painting as well, we still do not know for certain where and when cave art originated. Recent dating of cave paintings in Asia has revealed them to be of comparable antiquity (and content) to the oldest European cave paintings. This makes it conceivable that the earliest forms of this practice were already part of the cultural repertoire of the first Homo sapiens to leave Africa tens of thousands of years earlier (Aubert et al. 2014). Be that as it may, we can at least assume that the first groups of H. sapiens arriving in Europe were already capable of creative expression in terms of intentional mark-making, and that they could express this capacity using a variety of material substrates (e.g. egg shells, bones, pieces of ochre, and probably their own bodies). This premise lifts some of the explanatory burden from a theory of the origins and development of cave painting because we do not need to begin by addressing the origins of intentional mark-making as such.

1.2 Patterns in the origins and development of cave painting in other regions

Another challenge faced by a theory of Paleolithic cave painting is how to explain the apparent universality of its developmental pattern. Although this article is focused on Europe because it includes the most extensively studied and dated regions, it is worth
highlighting that there are intriguing indications of similar major transitions in other
continents.

In particular, the world’s oldest hand stencil with a minimum age of 39.9 kyr was
found in a cave on Sulawesi, Indonesia, a region which is also home to one of the
oldest figurative paintings, a babirusa (a ‘pig-deer’) made at least 35.4 kyr ago (Aubert
et al. 2014); the second oldest motif was another hand stencil dating to at least 39.4
kyr ago, while another figurative painting (probably of another babirusa) has a
minimum age of 35.7 kyr. Assuming that this analysis of 14 motifs is representative of
a temporal pattern for this region, then here too there may have been a transition
from hand stencils to figurative painting. Given the global distances involved, this
transition must have occurred independently from the comparable contemporaneous
developments in Europe. It remains to be seen whether Asia also contains evidence
for the more specific transitions within non-figurative and figurative painting.

It is also still unknown to what extent the transitions can be generalized to yet other
continents. For example, Australia is rich in rock painting, including geometric motifs,
hand stencils, as well as figurative painting with varying levels of realism. It seems
reasonable that simple marks and hand stencils preceded figurative painting, and that
there was a transition from outlined to realistic figurative painting. But so far there
are only few direct dates of these displays and there is still insufficient information for
establishing a reliable sequence (David et al. 2013). Unfortunately, a similar situation
applies to other regions. Making simple and geometric motifs, hand stencils, as well as
outlined and completed figurative paintings, were widely distributed practices. This is
suggestive and calls for further dating projects, but as yet there is not enough reliable
evidence to objectively establish developmental patterns in other regions.

1.3 Patterns in the origins and development of cave painting in other Homo species

It may even turn out that a theory of the origins and development of cave painting
cannot be contingent on the specificities of the neurobiology of H. sapiens, i.e.
anatomically modern Homo. Recent evidence demonstrates that the practice of
intentionally engraving abstract patterns was already in the cognitive and
neuromotor capacities of pre-modern Homo². There is one example of a small area of a
cave wall that was engraved by H. neanderthalensis in Europe sometime ~39k cal. BP
(Rodríguez-Vidal et al. 2014). This discovery is surprising but nevertheless consistent
with the ongoing reevaluation of Neanderthal cognitive capacities. Much more
surprising is the discovery that a freshwater clamshell was found to be possibly
engraved by Asian H. erectus before ca. 0.43 million years ago (Joordens et al. 2015).

The general form shared by these two isolated examples, namely consisting of a
number of straight lines that are connected by hard angles, are remarkably similar to

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²I am not committed to taking a side in the contentious debate surrounding the taxonomy of human
evolution. For the purposes of this article I base my classifications on the conservative estimates by
Wood and Boyle (2016), although my arguments do not depend on this choice.
some of the oldest known engraved patterns produced by *H. sapiens* in southern Africa between ca. 60-75k years ago (see, e.g., Henshilwood et al. 2009; Texier et al. 2010). This convergent development of similar graphic forms suggests that this initial stage of intentional mark-making may have been reached independently in different times and places by *H. sapiens*, as well as by pre-modern *Homo*, although apparently only *H. sapiens* then transitioned to cave painting and passed through several kinds of painting traditions (but see Appenzeller (2013) for a discussion of the possibility that *H. neanderthalensis* may have also transitioned at least to painting simple signs). If this tentative interpretation is correct then we are immediately faced by two questions that a theory of Paleolithic visual displays should ideally be able to address, namely why are the first traces of intentional mark-making so similar in appearance despite their wide distribution in space and time, and why did only our species eventually develop this initial shared form into new directions. Although these questions go beyond the scope of this article, we will briefly return to them further below.

1.4 Summary of the explanatory goals

In summary, based on the currently available dating evidence, which admittedly is still limited in many respects, the developmental sequence of Paleolithic cave painting appears to have several features that we would like to understand:

- A general transition from non-figurative to figurative painting
- A specific transition within non-figurative painting, namely from simple marks (e.g. dots, lines, disks, and circles) to hand stencils
- A specific transition within figurative painting, namely from simple outlined figures to complex realistic figures and scenes
- The universality of these general and specific painting transitions across time and place (although apparently limited to *H. sapiens*)

It seems plausible that this tentative chronology could be adapted from painting to other forms of Paleolithic visual displays (e.g. decorated tools and figurines), but unfortunately the archaeological record of such mobile objects is even more poorly understood than cave painting. Moreover, as we will see, there are compelling reasons to think that the type of material and the kinds of interactions it affords makes an important difference to how it is experienced, and so we should not necessarily expect a straightforward generalization from one type of practice to another. Accordingly, here we are only concerned with painting on surfaces in caves and rock shelters.

In the following sections we will develop a theory of cave painting that enables us to make sense of the patterns we have tentatively identified. We begin with the shamanic hypothesis, which is one of the main contenders for a general theory of prehistoric visual displays, and then enrich its conceptual framework with key insights from semiotics and material engagement theory. The resulting theory will enable us to better understand the kinds of processes that were likely involved in the creation of Paleolithic paintings. Throughout the focus will be on personal-level practices, that is, on people's embodied engagement with the existing material substrates and the
resulting visual displays, rather than on the details of their subpersonal cognitive architecture (cf. Henshilwood and Dubreuil 2011).

Future work could explore the neuroscientific implications of this theory, which in general will be consistent with a growing minority of approaches that question the centrality of brain architecture as determinate of human cognition and its evolution (e.g. Hutto 2008; Malafouris 2008; Barrett 2013; Jeffares 2014; Iliopoulos and Garofoli 2016). These approaches do not deny that activity in the nervous system makes an essential contribution to human cognition, but they situate that contribution in the context of similarly important contributions made by a whole range of extra-neural factors, such as bodily, social, technological, and cultural dynamics that can equally be determinate of human cognition and thereby drive its evolution.

2. A shamanic theory of European cave art

One productive approach to Paleolithic visual displays is known as the shamanic hypothesis, which holds that the key to better understanding can be found in the context of what we know about shamanic religious traditions and the neurobiology of altered states of consciousness (Lewis-Williams and Dowson 1988; Clottes and LewisWilliams 1998; Lewis-Williams 2002; Whitley 2009; Winkelman 2010; Clottes 2016). The shamanic hypothesis provides an inclusive framework that has several virtues, especially the capacity to organize a number of otherwise disparate facts into a meaningful whole. It incorporates key ideas of previous theories, such as the role of hunting magic, totemism, aesthetics, myths, and of a structured worldview (Clottes 2016, pp. 172-174). But it also goes beyond its predecessors in two essential respects, namely by emphasizing the role of the phenomenology of experience and the role of performance in the production of visual displays.

2.1 The role of phenomenology

The shamanic hypothesis assigns an important sociocultural role to the lived experience of the people, especially its potential to be profoundly altered by shamanic practices. In this way it becomes possible to hypothesize about the relationship between certain visual motifs and alterations along a spectrum of possible conscious states (Lewis-Williams 2002, p. 125). For example, it helps to explain the frequent depiction of certain types of geometric motifs because geometric patterns are often seen during altered states of consciousness (Lewis-Williams and Dowson 1988; Siegel 2005; Sacks 2012), and these patterns of disinhibited activity are largely constrained by the topological configuration of the visual neural system (Bressloff et al. 2001).

The shamanic hypothesis also helps to explain images of animal-animal and human-animal hybrids, since the shamanic experience of the universe is characterized by fluidity and the possibility of transformation (Eliade [1951] 2004), whereby a person can take on the form of an animal and vice versa (Stone 2011). Finally, it even has a fitting answer to the relevance of the deep cave environment itself: first, in terms of its function of facilitating the experience of an altered state, and second in terms of the
content of the altered experiences, which in shamanic traditions is often characterized
by a journey into the underground where the shaman makes contact with all kinds of
spirit beings (Lewis-Williams 2002, p. 145). These attempts to take into account the
phenomenology of lived experience when explaining Paleolithic people’s cognitive
and behavioral processes fits well with the growing emphasis on incorporating
phenomenological insights into cognitive science (e.g. Gallagher and Zahavi 2012).

2.2 The role of performance

The shamanic hypothesis questions the standard hypothesis that cave paintings are
nothing but a visual representation of what the Paleolithic artists were perceiving and
imagining. Instead it emphasizes that most cave paintings are likely the result of a
transaction between a person and the perceived supernatural forces residing in the
earth’s surface. This makes the practice of creating paintings continuous with other
practices of interacting with these surfaces, such as doing finger tracings, which may
have also been motivated by a desire to come into contact with sacred powers. Moving
away from a representationalist perspective to one where the “image retains an
affinity – and sometimes is completely identical – with the subject” (Clottes 2016, p.
146) also helps to explain the widespread practice of taking advantage of natural
reliefs, such as contours, fissures, holes, etc., in the creative process. It seems that
Paleolithic people were often less concerned with representing an absent entity than
with interacting with or helping to constitute an entity already present in the material
substrate (Lewis-Williams 2002, pp. 192-196). This possibility fits well with the
increasing recognition of the role cave surfaces played in the positioning and in the
resulting form of the paintings (Robert 2017). This intentional manipulation of the
interaction between painter and surface is already observable in the oldest examples
of non-figurative visual displays (Pettitt et al. 2014; d’Errico et al. 2016), and so must
have played a role from its very origins.

This emphasis on the performative aspects of painting, in contrast to the more typical
focus on analyzing the finished products in terms of its representational qualities, also
fits well with the increasing emphasis that cognitive science places on so-called “4E”
cognition, that is, embodied, embedded, extended, and enactive cognition (Clark 1999;
Beer 2000; Thompson and Varela 2001; Maravita and Iriki 2004; Engel et al. 2013). In
particular, it is becoming evident that this alternative perspective gives rise to more
parsimonious explanations in cognitive archaeology (Iliopoulos and Garofoli 2016). In
line with the shamanic hypothesis, we are led to question to what extent people in
Paleolithic times understood their creations as artistic representations standing for
something else (Malafouris 2007; Hutto 2008; Malafouris 2013; Garofoli 2015). And
even if we accept that they could potentially see their paintings as representations, it
remains plausible that this was a relatively inconsequential aspect when compared to
the performance and experience of the creative act itself, which would help to explain
why cave paintings were often created without much concern for their accessibility by
possible viewers. We can think about this in analogy with speech acts and other
illocutionary acts: we could analyze the exchange of vows in a marriage ceremony in
terms of what the words stand for, but this would miss the important fact that the
The experiential and performative aspects of cave painting are not independent from each other. Instead, there is a recursive interaction between them. For example, Lewis-Williams (2002, p. 158) suggests that after the contents of shamanic visions were made permanent on the surfaces, the resulting images prompted people to see and imagine these contents with greater likelihood, and as a result the presence of the paintings probably exercised a conservative, stabilizing effect on the range of mental imagery experienced and materialized by that community. He argues that this could help to explain why figurative paintings repeatedly depict a specific set of species, rather than being representative of actual ecological diversity.

2.3 Problems of a lingering internalism

The shamanic hypothesis demonstrates that taking into account phenomenology and embodied action helps us to better understand the Paleolithic human mind. But from the perspective of the cognitive science of 4E cognition it still does not go far enough. While it illustrates how these factors may have played an essential role in the creation of cave paintings, it does not sufficiently address the other side of this process, namely how the normal and altered perceptual experiences, the active engagement with the material substrates, and the resulting marks and paintings, may have played an essential role in the constitution of their cognitive processes. To be clear, proponents of enactive cognition certainly agree that humans already had an enhanced capacity for recreative imagination long before migrating to Europe, although they question whether this capacity must be conceived in representational terms (Malafouris 2007; Hutto 2008). And it is reasonable to assume, following Lewis-Williams’ proposal, that once a tradition of cave painting was in place the perception of its motifs conditioned the subsequent selection of motifs.

However, so far the shamanic hypothesis has not systematically considered the more radical possibility suggested by the enactive approach, namely that the recursivity between the creative engagement with material and the experiences of the resulting cultural products may have played an essential role in shaping the mental structures of ancient people (Malafouris 2013). The shamanic hypothesis has implicitly retained a commitment to internalism, typical of orthodox cognitive science, which effectively shields mental processes from incorporating such external and interactional factors. Despite its nonrepresentational approach to the paintings, it is actually not that far removed from the traditional assumption that an explanation of the origins of cave painting will basically consist in the externalization of a preexisting mental capacity to manipulate internal visual representations.

We can see the resulting ambiguity in Lewis-Williams’ (2002, p. 185) account: “In short, people did not invent two-dimensional images of things in their material environment. On the contrary, a notion of images and the vocabulary of motifs were part of their experience before they made parietal or portable images.” He motivates...
this phenomenological claim by arguing that people will have already known what such images are because of the universal human capacity to enter into altered states of consciousness (hallucinations, visions, dreams, etc.). In other words, he seems to buy into the assumption of orthodox cognitive science that an experience of visual imagery consists in the experience of seeing mental pictures. On this internalist view, cultural practices only play a secondary role of externalizing, fixing, and filtering the experienced imagery according its perceived value, but the capacity for perceiving 2D pictures as such is assumed to be constituted by the specific architecture of the human brain alone, which may have originated because of some fortuitous mutations.

In sum, internalism prevents the shamanic hypothesis of assigning a genuine role to the “cave in the mind” (Lewis-Williams and Clottes 1998) and instead unwittingly undermines the explanatory roles of phenomenology and performance. Nevertheless, nothing hangs on this lingering commitment to internalism. As I argued elsewhere, its framework can be usefully extended to explain the origins of our enhanced capacity for imagination, rather than taking that capacity for granted (Froese 2013; Froese et al. 2013; Froese 2015). Ideally, such a non-internalist shamanic hypothesis will allow us to conceive of the origins and development of our specifically human mental capacities as resulting from a mutually reinforcing synergy of biological, cognitive, and sociocultural factors. Here I will demonstrate this for the case of cave painting.

2.4 The shamanic hypothesis meets material engagement theory

The first step is to become clear about the nature of mental imagery and how it is experienced. We need to be careful not to equate a capacity for dreaming and visual imagination with the capacity to see contentful 2D pictures in our minds. This representationalist assumption does not stand up to philosophical scrutiny (Hutto 2015). Nothing stands in the way of assuming that basic forms of imagining consist in sensorimotor reenactments that only become contentful when they are hybridized with contentful cognitive attitudes, which arguably originate via enculturation into certain kinds of social practices (Hutto 2008). This proposal is supported by careful phenomenological analyses that reveal the experience of visual imagery of an object or scene to consist in bringing forth an experience of a possible perception of that object or scene (Thompson 2007).

Accordingly, it cannot be taken for granted that Paleolithic people experienced their mental imagery as 2D images. Indeed, they may not have perceived a significant difference between perceived and imagined entities. Instead of experiencing pictorial representations of entities, they may have instead experienced being faced directly by ephemeral manifestations of those very entities. This non-representational approach to mental imagery is more consistent with how the shamanic hypothesis conceives of Paleolithic people’s experience of figurative paintings. Lewis-Williams (2002, p. 193) explicitly questions the appeal to representational reference: “In all probability the makers did not suppose that they ‘stood for’ real animals”. However, if it is no longer necessary to assume that a figurative painting contains representational content, it is also no longer necessary to conceive of the painted image itself as a representational
vehicle. As long as there is not yet any vehicle-content distinction, such that the image
is completely identical with the subject (Clottes 2016, p. 146), there is also not yet a
distinct notion of a 2D image. There is a visual display or presentation of something,
but not a contentful image that represents or stands for something else.

Nevertheless, once a tradition of figurative painting is in existence it opens up the
possibility of directly engaging with the concrete visual displays as such, e.g. to
duplicate and embellish them (Lewis-Williams 2002, p. 196). It seems reasonable to
assume that this kind of repeated interaction with the material displays on the
surfaces eventually permitted people to also relate differently to their experience of
mental imagery, for example to reify them into experiences of seeing a 2D picture on a
surface. In other words, by allowing for the possibility that material engagement has a
transformative effect on people’s minds, it becomes possible to conceive of the origins
of a representational notion of the image as enacted in the practice of painting rather
than as independently preceding it (Malafouris 2007, 2013).

For our current purposes there is another advantage of framing the origins of the
notion of an image in terms of material engagement, rather than as exclusively inside
the mind or brain, because it suggests that its emergence should be reflected in
changes in the material record. To give just a brief example, possessing the explicit
notion of a 2D image will open up new practical possibilities, such as experimenting
with the depiction of perceptual perspectives, filling in details, aiming for realism, and
designing compositions. If so, then we may even speculate that this transformative
event may have coincided with the observable transition from a tradition of creating
outlined figures to a tradition of naturalistic paintings. Other transitions may similarly
reflect cognitive transformations, as we will see. To pave the way for this assessment
we will take a closer look at what kinds of painting traditions can be identified based
on their semiotic properties.

3. A semiotic theory of European cave art

Semiotics enables us to analyze the properties of signs that imbue them with meaning
and thereby to determine their relative complexity to other signs. Importantly, these
semiotic properties are independent of the sign’s time and place, and therefore a
sequence of sign-making traditions ordered in terms of their increasing complexity
should be generalizable across contexts. This allows us to go beyond the shamanic
hypothesis by treating the transitions of Paleolithic cave painting in more than just
stylistic or thematic terms. It turns out that they can be described as transitions in
qualitatively distinct semiotic practices.

3.1 Different kinds of signs

We can identify at least three semiotic properties listed in terms of their increasing
complexity: indexicality, iconicity, and symbolism. Importantly, it is not necessary to
treat indexicality and iconicity in representational terms because their meaning can
be directly perceived, which makes them more parsimonious than true symbols for explaining the first examples of art (Barrett 2013; Garofoli 2015; Iliopoulos 2016).

Indexicality is the least cognitively demanding semiotic property because an indexical sign is intrinsically related to what it signifies. Any effect can become a sign of its causal origin based on simple associative learning. The paradigmatic example is that the presence of smoke is an index because it can signify the presence of fire. This example also shows that this form of sign does not require intentionality to be created. Unintentional cutting traces left on a bone while removing its flesh with a stone tool can still signify the presence of humans in the area. Similarly, occupation of a cave may leave accidental traces on its surfaces that will signify to later visitors that there had been other occupants. One of the first monumental transitions occurs when such marks begin to be intentionally made rather than just as accidental byproducts of other activities. Spraying a disk on a cave wall could have been done to actively create a sign of the maker in their role as an occupant of the shelter. Similarly, making marks on a tool or container could signify being possessed by someone. The oldest examples of engravings may fall into the category of signifying ownership (Henshilwood et al. 2002; Texier et al. 2010; Rodríguez-Vidal et al. 2014; Joordens et al. 2015).

Iconicity is cognitively more demanding than indexicality because it requires that an external resemblance between the sign and that which is signified is perceived. For example, in some respects a hand stencil resembles the hand that made it. And a painting of a bison resembles in its outline the body of a flesh and blood bison. This resemblance between a 2D image and a real body, which enables us to perceive the former as standing for the latter, may seem obvious to us modern observers, but it is actually a remarkable achievement that is beyond the cognitive capacities of human infants and non-human animals (as long as they are not enculturated). Indeed, for some philosophers the invention of iconicity, i.e. of practices making use of such artificial likenesses to serve as the basis for a sign relationship, is therefore precisely the external criterion that demonstrates their makers to be humans like us (Jonas [1966] 2001, p. 174). This of course raises the question of how this significant cognitive gap between indexical signs and iconic signs can be bridged, a problem to which will return later.

Even more cognitively demanding than iconicity is symbolism because it constitutes the class of arbitrary signs, which are related to their object neither intrinsically nor by external resemblance but rather by sociocultural convention. It follows that while the meanings of the previous two semiotic properties of indexicality and iconicity can be at least partially understood by an interpretant based on basic principles of causal reasoning and on perceptual resemblance, respectively, this is not the case for signs in the class of arbitrary symbols. The meanings expressed by an arbitrary symbol will remain opaque as long as the interpretant (including ourselves) is not enculturated into the relevant sociocultural practices. There is no consensus about what are the first true symbols. Language is of course the paradigmatic example of such a symbol system, although its origins remain controversial (Hauser et al. 2014).
The semiotic properties of these three kinds of sign relationships are summarized in Table 1. This is not meant to be an exhaustive assessment of semiotic theory, which can involve much more subtle distinctions that have been demonstrated to be useful in some archaeological contexts (Sonesson 1994; Iliopoulos 2016). Nevertheless, the basic properties of being an index, icon, and symbol are sufficient for our purposes.

Table 1. Signs and their grounds. An indexical sign is easiest to understand because of its intrinsic ground relationships such as causality and contiguity, like a hand stencil signifying there was a hand that made it. An iconic sign is harder to understand because there are no intrinsic ground relationships linking the icon with what it signifies, which therefore requires training the mind to perceive an external relationship of resemblance, for example in terms of a similar outline. A symbol is even harder to understand because there are no intrinsic ground relationships and no perceivable resemblances with what is signified. The key insight from material engagement theory is that practice with the easier signs can pave the cognitive way for the harder signs.

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Another important consideration is that semiotic properties can co-occur and this can facilitate appreciation of their meaning. A hand stencil, for example, is both indexically and iconically related to its maker since it leaves a 2D image of the 3D hand that made it. Understanding of the stencil’s iconic signification of that specific artist is therefore aided by the co-presence of an indexical link. Such an additional meaningful link is absent in figurative painting that is iconic (i.e. an outline of a bison resembles the body of a bison) but not indexical (i.e. no actual bison body was used to make it).

3.2 A sequence of kinds of signs

This semiotic assessment fits well with the finding that intentional mark-making of simple signs (e.g. disks and lines), which may have just indexically signified their...

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3 Table adapted from Sonesson (1994). The illustrations of the hand and hand stencil were taken from Pettitt et al. (2014). The illustration of the outlined bison was taken from Pike et al. (2012). The illustration of the abstract rectangular shape was taken from García-Diez et al. (2013). The photo of the bison is by Tim Pearce and was taken from Wikimedia Commons.
maker, preceded figurative paintings, which derived their meaning from iconicity. The possibility of co-occurrence also suggests an intermediate step in which the signs were both indexical and iconic (Figure 1), and indeed there is an important category of Paleolithic visual displays that fits this description: hand stencils. This suggests that hand stencils should tend to appear after the intentional creation of simple signs but before iconic figures, which again fits well with the current evidence.

![Diagram](image)

**Figure 1. Semiotic analysis of the first stages of cave art.** (a) Indexicality: the simplest form of mark-making involves leaving traces that are meaningful due to an intrinsic connection with their cause. This can even happen without intention, e.g. smoke stains signifying previous occupation of a cave. The first monumental transition therefore consists in using this relation intentionally, e.g. spraying paint on a wall to mark a cave as occupied. (b) Iconicity. The next crucial transition is to additionally employ an external resemblance between signifier and signified, e.g. putting one’s hand on the surface before blowing paint such that it leaves a negative hand stencil.

Accordingly, semiotic theory predicts the following developmental sequence in cave art: from indexes (simple signs) to iconic indexes (hand stencils) to icons (figurative painting). Note that each transition involves the addition or removal of just one semiotic property while another property remains constant. That should make these transitions more likely than transitions involving several changes at the same time.

This first pass at a semiotic sequence of cave painting is already a good start because it is broadly consistent with the major transitions identified by current dating evidence and with the potential universality of this pattern. However, it still leaves several key challenges unaddressed, namely to explain the transition from hand stencils to figurative painting, the role of signs’ interactions with their substrate, and the transition from outlined figurative painting to realistic figurative painting. It also does not yet address the origins of complex abstract marks (arbitrary symbols). To make progress with regard to these outstanding challenges it is helpful to supplement semiotic theory with material engagement theory.

4. **A material engagement theory of European cave art**

Material engagement theory enables us to expand the scope of semiotic theory in two essential respects (Malafouris 2013): (1) it emphasizes that what is signified by a sign is not limited to an object but can also be an action or process, and (2) it insists that the material substrate also plays a constitutive role in the creation of a sign. The first
instances of Paleolithic visual displays in the European caves already demonstrate both of these features at work. For example, finger tracings are found on many soft cave walls; their form resembles the trajectories of the hands that made them, and these trajectories was also partially shaped by the contours of the surface. In general, a Paleolithic visual display can therefore be conceived of as signifying a process of material engagement, which was co-constituted by the maker’s movements and the surface’s contours and, to the extent that they mutually influenced the resulting form of the sign, the sign’s form also resembles them. This embodied and extended view of the indexical-iconic sign is illustrated in Figure 2.

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\text{Figure 2. Material engagement theory of the first stages of cave painting. Conceiving of simple signs and hand stencils as resulting from a process of material engagement (M.E.), in which the person and the surface both play a constitutive role, leads to several refinements of the semiotic analysis. Most importantly, the sign is no longer just indexically and/or iconically related to the person alone, but also to the substrate: the form of the substrate plays a role in shaping the form of the sign, and therefore the latter is indexically related to and resembles the former.}
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I will now show how the emphasis material engagement theory places on interaction dynamics and on actor-material co-constitution allows us to refine the chronological sequence that was created on the basis of a semiotic theory of signs.

4.1 From simple signs to hand stencils to figurative painting

We start with the assumption that initially all marks were indexical in that they were directly perceived in relation to their process of production. They could signify human presence in general, and their maker in particular, and even more specifically, the concrete details of their act of creation. This is true even of marks that were made unintentionally, and so archaeologists must invest considerable effort in determining whether the earliest examples of marks were not just accidental byproducts of other activities (e.g. scraping meat from a bone, grinding pieces of ochre into a powder). The precise reasons for the switch from unintentional to intentional mark-making remain unclear, but hominins had already engaged in tool-using practices that resulted in marks for millions of years, and so intentional mark-making did not have to develop from nothing. Moreover, the form of these first intentional marks was largely shaped by the interaction between bodily and material properties: it is much easier to scratch a line into a hard surface than it is to create a circle. Material engagement theory therefore enables us to account for the fact that the results of the initial stages of
intentional mark-making tend to be similar in form, be they made by spatiotemporally
separated H. sapiens subpopulations or by species of pre-modern Homo.

And we can already identify the start of a resemblance relationship in these early
stages: the form of these indexical marks resembles the form of the bodily actions and
their interaction with the surface contours that were employed to create them. We
may refer to this as “process iconicity” in order to distinguish this iconicity from its
more common application to resemblance with an object or entity. Such “object
iconicity” requires an additional cognitive effort to establish an external resemblance
between the sign and what is being signified. Presumably, this additional effort is
more easily accomplished when object iconicity is still accompanied by indexicality as
well, and so we expect indexical object iconicity to appear before non-indexical object
iconicity. Hand stencils fulfill exactly this intermediate position. As we noted
previously, a hand stencil is a 2D image that serves as an iconic sign if it is recognized
that its form resembles the contour of a hand, and this recognition of resemblance is
aided by the fact that indeed a hand had caused the sign’s form. We can speculate that
this important transition from purely indexical mark-making of simple signs to hand
stencils involved a desire to enhance the signs’ capacity to signify their maker by
adding a resemblance relationship. For example, while a simple sign like a red disk
could signify human presence in general, a hand stencil could signify a specific person,
or at least also signify the person’s height, age, and gender.

How do we go from this specific object iconicity with respect to the mark-maker’s
body to a general object iconicity with respect to other possible entities, namely to a
tradition of figurative painting? First of all, it would not be surprising to discover that
some kind of indexicality is still at work in the creative process of the first examples of
figurative painting, similar to the hand stencils. The most direct way to take advantage
of the more direct meaning provided by indexicality would be to actually cover the
signified entity with paint and use it to leave a figurative print on the substrate. But
this is impractical to do with large animals, say a stag, and there is an easier option to
retain the contiguity needed to take advantage of the cognitive facility afforded by an
indexical sign: using parts of the animal in the very process of creating its painting, for
example by using its tail to make a brush, its antlers to stir paint, or by mixing its
blood, fat, bones, or antlers into the pigment. This idea is at least consistent with the
fact that the preparation and application of pigments can involve such organic
materials (d’Errico et al. 2016), but so far the evidence is not strong.

Fortunately, material engagement theory allows us to evaluate Paleolithic paintings’
semitic properties from another perspective. So far we have approached them as
signs in terms of their relationship with the person and actions that gave rise to them,
but we have not yet systematically considered the role of the substrate itself. This
extension of our theory is suggested by the paintings themselves: from the beginnings
of cave painting to its later stages people evidently took advantage of the material
affordances of the substrate (Lewis-Williams 2002; Pettitt et al. 2014; Clottes 2016;
Robert 2017). From the perspective of material engagement theory this suggests that
the signs resulting from this process of co-creation also bore corresponding relations
of indexicality and iconicity with respect to their substrate. For example, the target of engagement could be a specific aspect of the substrate, namely contours that already seemed to signify the presence of an entity, such as a bison, in the wall. The artist could then enhance that entity’s presence by complementing the natural contours with a few strokes of paint: what we call an outlined figure has been created. Let us unpack this interactive process in more detail.

4.2 From signs that signify the self to signs that signify the other

Any mark can indexically signify a maker and a specific activity to someone familiar with the processes that result in those marks. And marks can also be meaningful by being process iconic with respect to how they were created. A line painted on the wall resembles the movement of the arm along the surface; a red disk on the wall resembles the conical dispersal of the blown paint. It is precisely these semiotic properties that enable archaeologists to reconstruct the processes by which cave paintings were made (e.g. d’Errico et al. 2016). As we have noted, hand stencils play an intermediate role between simple signs and figurative paintings in that they are both process and object iconic: the 2D hand stencil resembles a part of the creative process, namely of using a hand to block the sprayed paint, but it also thereby resembles the hand itself and can serve as an iconic sign of that object.

And once this transition to understanding the possibility of object iconicity based on a resemblance relationship has been accomplished new creative possibilities based on forms, contours, and outlines are unleashed. Here we connect with a key proposal of the shamanic hypothesis, namely that Paleolithic people perceived animal entities in the contours of the substrate with whom they interacted and turned into fixed signs with their paint. Today we perceive the results of this sensorimotor engagement as outlined figurative paintings. We can make sense of this transition to figurative painting by imagining the cave wall as a kind of interface (Lewis-Williams 2002): a hand stencil signifies the presence of a person on this side of the wall, whereas an outlined figure signifies the presence of that entity on the other side of the wall. Indeed, according to material engagement theory there is no semiotic difference between emphasizing a sign’s object iconic relation with an aspect of the person (by leaving their own bodily imprint, e.g. of a hand) or with an aspect of the substrate (e.g. by outlining its perceived bodily contours, e.g. of a bison). Both the artist and the substrate co-constitute the sign and both can take on more active or more passive roles in this mutual person-substrate engagement.

An advantage of this proposal is that we can explain the origins of figurative painting as resulting from sociocultural practices without yet having to explain the origins of a notion of representational content (Hutto 2015). We do not need to assume from the start that Paleolithic people had an understanding of their cave paintings as visual representations, even if nowadays it is hard for us to see these paintings otherwise. Another advantage of this proposal is that it explains why outlined figures and hand stencils are chronologically closely related: the semiotic properties involved in outlined figures are not distinct from those involved in hand stencils and thus involve
a similar level of cognitive complexity to be appreciated. The main difference is a shift in emphasis from self to other: in the case of figures their substrate (or more precisely the entity perceived to be enclosed in it) is the primary index of the sign, while their human maker takes on a more passive role. The result is that whereas hand stencils are object iconic with respect to the person’s hands, the outlined figures are object iconic with respect to the substrate-bound entity’s body parts.

A further advantage of this proposal is that we are able to account for the transition from non-figurative to figurative painting without leaving the class of indexical signs, which would have been an additional necessary step if we had assumed that these outlines were created with the intention to abstractly represent an entity rather than to concretely present an entity. In other words, material engagement theory has reduced the explanatory burden with respect to the cognitive capacities required for painting outlined figures in two essential respects: first, it shows how perception of iconic signs can be facilitated by grounding their external resemblance relation in the intrinsic causal relation between sign and signified; second, it shows how iconic signs can be meaningful while avoiding the difficulty of having to ground a representational relation on the resemblance relation. Material engagement theory therefore allows us think of the development of cave painting as a series of transformations that build upon one another (Figure 3).

![Figure 3. Material engagement theory of the first transitions of cave painting. Conceiving of the creation of cave painting as resulting from an interactive process of material engagement, in which both person and surface play a constitutive role in the formation of signs, suggests a specific developmental pathway culminating in outlined figures. All paintings are indexical signs of their creators, even the simplest dots and lines. Some indexical signs derive an additional part of their meaning by resembling (being iconic) of aspects of the process by which they were created, a possibility that is already open for simple signs but is best exemplified by a hand stencil resembling the hand used in creating it. Hand stencils, but not simple signs, can derive an additional part of their meaning from being iconic of an objective aspect of the self that created them. In all of these signs both person and surface played a co-constructive role, but with an emphasis on the sign’s relationships with the self. The last transition involves a shift in perspective whereby emphasis is placed on the sign’s relationships with the surface.](image-url)

The possibility that the transition to figurative painting took place within the class of indexical signs, whereby Paleolithic people perceived the entities they outlined to be emanating from within the surfaces, promises a new way of looking at the placement of such paintings in the caves. For instance, consider Clottes’ (2016, p. 116) surprise when he discovered that a “highly suitable” smooth and white wall in Chauvet cave
had been left completely untouched, whereas other, deeper parts of the same cave had been decorated. Moreover, he noticed that in many caves painted figures could often only be seen to be figures from certain angles because of the shape of contours and/or lighting conditions. Some of these therefore took a long time to be discovered. For Clottes these combined facts mean that Paleolithic people must have specifically sought after these contours, “rather than searching for a surface where it would be technically easy to produce an image” (p. 117). Technically easy for us, that is, based on our cultural familiarity with the practice of painting figures on a flat white canvas. But we have to be careful not to project our artistic experience into the Paleolithic past. Another explanation that is suggested by the theory developed here is that, quite to the contrary, the people who made Chauvet’s figurative paintings could not easily perceive a flat white wall as affording a painting. That is, they were not accustomed to making visual representations per se. Instead their perception of an affordance for an outlined figure depended on perceiving an entity in the surface, which therefore had to be sufficiently complex in terms of its existing forms and contours.

What remains to be explained is what brought about this shift of perspective from self to other within the class of object icons. One possibility is that changes in sociocultural practices and beliefs could have facilitated this decentering along the axis of co-constitution. For instance, in accordance with the shamanic hypothesis, we could speculate that the ritualization of altered states of consciousness, and especially the frequently reported experiences of traveling underground to meet entities in the netherworld (Eliade [1951] 2004), could have increased the likelihood of seeing entities in cave walls. Material engagement theory suggests another possibility: familiarization with the tradition of hand stencils eventually led to the understanding that a hand stencil signifies a person not only by being caused by them but also by resembling a part of their body, and this made it possible to see other forms present in the walls as signifying entities based on their external resemblances.

4.3 From outlined figures to realistic figures and abstract symbolism

The introduction of a distinction between process iconicity and object iconicity, as well as the proposal that the transition from non-figurative to figurative painting is based on a self-other perspectival shift, helps to fill in some of the steps leading to the emergence of figurative painting understood representationally. Essentially, in order to fulfill the proper function of a representation the sign has to become independent of the signified, which means that the meaning of the paintings can no longer be grounded on their direct physical-causal connection with the signified (e.g. aspects of the process, person, and/or substrate). In other words, for the very first time there would be object icons that are meaningful but without being indexically so. This may essentially characterize the final transition toward realistic figurative painting.

However, as we have seen, this monumental transition does not appear from nothing: by this time many surfaces are no longer empty substrates but have already been significantly modified in their appearance and meaning by various kinds of pictorial practices across generations. They were beginning to be humanized caves (De Balbín-
Accordingly, the cognitive niche of these later Paleolithic people is no longer comparable with that of the pioneers: with time it becomes harder not to somehow engage with the artificial marks and contours instead of interacting with the properties of the raw substrate directly (Malafouris 2013). This changed and charged environment offers new affordances to engage with paintings: visitors of the caves can restore faded paintings and embellish them, but they can also go beyond what was already there by making additions, repetitions, compositions, etc. (Lewis-Williams 2002, p. 196). Eventually engagement with the 2D images as such may have become an important motivation for further painting, which in turn entails a receding role for the material substrate as an indexical (or iconic) source of their meaning. A decrease in substrate dependency paves the way for important developments in both non-figurative and figurative painting (Figure 4).

![Diagram](image)

**Figure 4. Hypothesis of an inverse relationship between the complexity of a sign and its dependence on the substrate.** If the intention is to engage with the surface (e.g. to obtain or curtail its powers, or to help bring forth an entity already present in it, like a spirit bison), then no complex sign is necessary. On the other hand, when the intention of the painting is largely independent of its medium, then the sign takes center stage. Two contrasting possibilities offer themselves: 1) aspects of figurative painting that would have been constituted by the substrate can be creatively filled in, sometimes in exquisite detail (realism), and 2) elements of non-figurative painting can be integrated into complex compositions. Both possibilities can become imbued with abstract referents (symbolism).

The increased attention directed at the marks themselves, in combination with a decrease in the substrate’s role in determining their meaning, can be expected to lead to a notion of the sign as distinct from the signified, and thereby to pave the way for visual representational practices that depend on a vehicle/content distinction. The painter can compensate for the substrate’s decreasing importance in constituting the form and meaning of the image by creating a more detailed painting with a more complex referent. In the case of figurative painting, this involves a transition from outlined figures to realistic figures, which precisely because of their realism have less to do with highlighting or presenting something already there but with representing something that is otherwise absent. A related transition can be expected for non-figurative painting: it is likely that simple and isolated marks will be replaced by...
geometric compositions and arbitrary abstract designs that increasingly take on symbolic functions.

A key insight of this analysis is that both of these transitions were probably enabled by the monumental transition from the extended class of indexical signs (Figure 3) to that of non-indexical signs. When the meaning of a painting is no longer intrinsically grounded by being an indexical sign, its meaning has to be indirectly attributed via external resemblance (icons) and/or convention (symbols). And as the scope of the signified became less constrained by the form of its visual sign, new possibilities of signifying became available until the expressed meaning was entirely arbitrary. It seems that the perspectival shift from self to other may have set the stage for another round of decentering: from here to there to anywhere and nowhere.

5. Conclusions

The shamanic hypothesis serves a suitable theoretical starting point to understand cave painting. But to develop its full potential it must drop its commitment to an internalist neurocentric concept of the mind, which has led to a bias of seeing human prehistory in terms of similarity and continuity rather than difference and becoming. For example, Clottes (2016, p. 165) confidently concludes his impressive analysis of European cave painting by emphasizing the lack of cognitive transformation: “One of the major certainties, underlying all others, is the identity of thought structures throughout the entire Upper Paleolithic on a pan-European scale.” Of course he recognizes that there are important transitions in painting practices, but they are relegated to a secondary status of external aspects, such as changes of themes and techniques. In other words, taking internalism as a starting point naturally leads to an insistence on the permanence of mental structures in the Paleolithic, which in turn has the unfortunate consequence that the major transitions in painting are explained away as contingent historical events without significance for understanding the development of the modern human mind.

However, this conclusion is not inevitable. As Clottes himself recognizes, the shamanic hypothesis is “a large enough framework to accommodate a reality with inescapable complexity, within which all proposed explanations have their place” (p. 172). In this article we have demonstrated that this framework gains additional explanatory power by accommodating a semiotic theory of signification as well as material engagement’s theory of the inherent fluidity of the mind-world relation. This deeper reciprocity between mind and world, one in which a painting tradition is not only a product but also a part of the cognitive processes, helps us to explain the major transitions in the chronology of Paleolithic cave painting.

Acknowledgements

4 Interestingly, this would make the shamanic hypothesis more consistent with a shamanic worldview, given that “the fundamental characteristic of many traditional societies, and in particular of those that practice shamanism, is fluidity” (Clottes 2016, p. 157).
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References


