



Beyond the Body: Embodied Markings, Personhood and Gestalt in Palaeolithic Caves

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Abstract. A stalactite emerges from the darkness, its surface encircled by a pattern of perfectly framed, breath-sprayed disks. Each red mark curves with the form, drawing the eye and inviting touch. This article examines such embodied markings in Palaeolithic caves—non-figurative traces created through direct bodily engagement—as biographical expressions of sensory perception. Focusing on case studies from El Castillo and Ardales (Spain) and Pech Merle (France), it explores how these markings extended aspects of identity into the cave surface. Drawing on relational theories of personhood, the article argues that once detached from the body, handprints, stencils, finger dots, sprayed surfaces and other marks could act as durable traces of presence, contributing to caves as sites of memory, interaction, and emplacement. Gestalt principles of visual perception—such as proximity, figure-ground, and continuity—are used to interpret the perceptual logic underlying the placement of markings along concavities, contours, and focal points. These insights suggest that such gestures were not only tactile but also often structured to be noticed and remembered. Though anonymous, these traces represent fragments of lives once enacted underground—gestures carried beyond the body. By foregrounding the interplay of gesture, perception, and material engagement, the article offers a biographical perspective in which identity, memory, and bodily presence are inscribed within the cave itself. It contributes to broader understandings of how non-figurative cave art can record, extend, and transform human presence across deep time.

Keywords: Embodied markings, cave art, Palaeolithic, personhood

Introduction

A stalactite emerges from the darkness, its surface encircled by a pattern of perfectly framed, breath-sprayed red disks. Each red mark curves with the form, drawing the eye and inviting touch. Elsewhere, subtle finger dots trace the edge of a ceiling, a hand stencil grips the wall, and pigment-stained fingers drag down a calcite-covered surface. Such embodied markings (Oosterwijk 2023) are found across Palaeolithic Europe, from the caves of France to those of the Iberian Peninsula. They are inseparably linked to gestures, yet at the same time function as material residues of bodily action, recording the actions of hands, fingers, and mouths.

This article approaches non-figurative embodied markings as biographical gestures. Far from anonymous or merely decorative, they represent bodily encounters with underground spaces. The case study caves—El Castillo, Ardales, and Pech Merle—demonstrate how such markings are distributed, repeated, and framed across particular topographies, and how they relate to the sensory exploration of subterranean environments (Bjerck 2012; Oosterwijk in prep.). Drawing on relational theories of personhood, the argument advanced is that once separated from the body, these markings can be read as acquiring a form of agency, contributing to caves as sites of interaction and emplacement (Mauss 2002 [1925]; Strathern 1988; Malafouris 2008; Brück 2005). Gestalt principles of visual perception—such as proximity, figure-ground,

and continuity—are used as a set of coding terms to describe recurring patterns in where marks are placed and how they cluster in caves, given low light and uneven surfaces (Wertheimer 1938; Koffka 2013 [1935]). This does not assume perception works identically in caves and daylight; it asks whether certain placements recur where relief and moving light make marks more likely to register. Importantly, the paper does not begin by assuming what these marks 'mean'; instead, it asks what can be inferred from their techniques, placements, clustering, and visibility conditions, before advancing interpretive claims. Though anonymous, these traces represent those who once visited the caves and the gestures their bodies left behind. Although hand (and foot) images can invite 'personal' readings, this paper uses 'biographical' in a minimal sense: marks are biographical insofar as they materialise a situated encounter (a body acting here, under these constraints), not because they identify a named individual.

Embodied markings are non-figurative traces created through direct bodily engagement, whether by placing the hand on the wall and spraying pigment over it, pressing palms or fingers onto surfaces, or dragging pigment-covered fingers across concavities and speleothems. Their defining quality is that they emerge directly from bodily action rather than through external imagery. Unlike figurative depictions of animals or abstract motifs, these traces are primarily indexical of bodily action: they are the impressions of

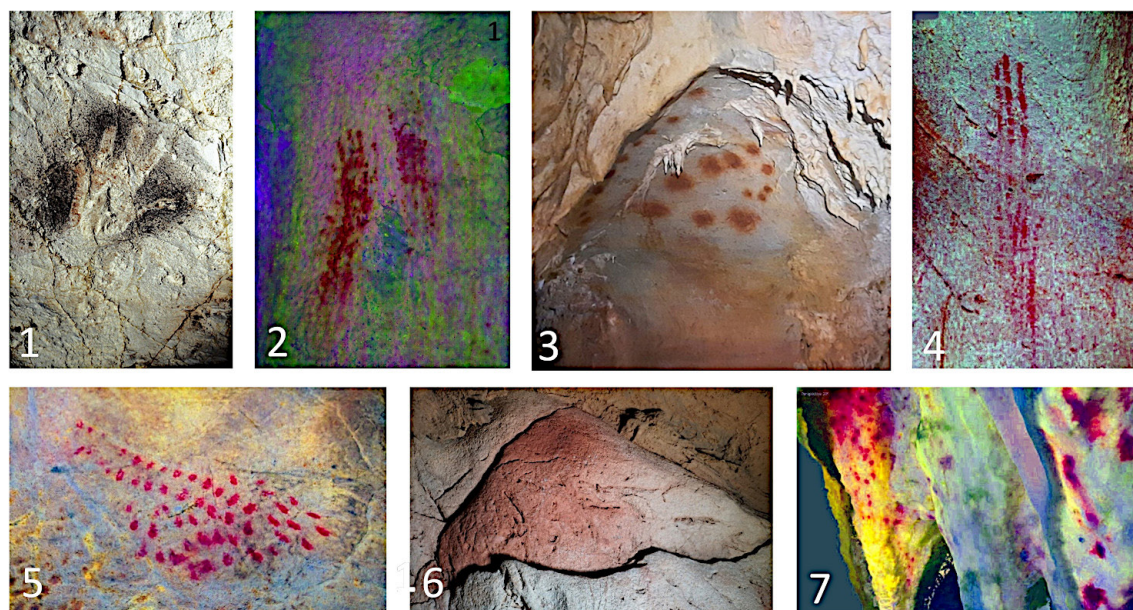


Figure 1. categories of embodied markings: (1) hand stencils (original image under natural light), (2) handprints (Image enhanced with DStretch filter RGB0), (3) sprayed disks (original image under natural light), (4) finger lines (Image enhanced with DStretch filter YRD), (5) finger dots (Image enhanced with DStretch filter LDS), (6) smeared surfaces (original image under natural light), (7) sprayed surfaces (Image enhanced with DStretch filter LDS) (Oosterwijk 2023).

body parts rendered onto surfaces and thus directly register contact, motion, and technique. This does not exclude representational or symbolic readings in some cases; rather, the analytic starting point here is that their first-order evidence is the gesture that produced them. (Oosterwijk 2023).

Seven recurrent categories form the analytical focus: hand stencils, handprints, finger dots, finger lines, sprayed disks, smears, and sprayed surfaces (Figure 1). Each reflects intentional gestures that established physical and perceptual connections with cave walls. Some were produced by projecting pigment with the mouth, leaving faint halos of breath. Others involved dragging fingers or hands across damp surfaces, smearing colour as tactile movement. Across the case studies, patterns of clustering, seriality, and relief-targeting provide the evidential basis for discussing patterned emplacement.

The approach taken here combines visual and spatial analysis with sensory interpretation. Photogrammetry and digital enhancement (e.g., DStretch) clarify techniques such as mouth-spraying and reveal faint traces otherwise invisible to the naked eye. Spatial mapping highlights the repeated positioning of markings along cracks, concavities, and speleothems. Equally important is consideration of the embodied experience of those who made and encountered them: navigating darkness, feeling surfaces with hands, crouching or climbing into restricted spaces (Oosterwijk in prep.; Bjerck 2012). After outlining method and theory, three case studies—El Castillo, Ardales, Pech Merle—are analysed comparatively. A synthesis then identifies recurrent placement regularities (relief targeting, clustering, and visibility) and discusses how

these patterns can support biographical and placemaking interpretations.

Research History

Research on Upper Palaeolithic cave art has often privileged figurative images, while other wall-traces produced through bodily contact—light scratches, shallow incisions, smears, finger marks, and technique-defined residues—were frequently treated as background or analytically negligible. This matters here because the embodied markings examined in this article are among the traces most vulnerable to omission during recording and publication. An early and unusually explicit critique comes from Annette Laming-Emperaire (1962), who argued that dense fields of shallow scratches and lightly incised traces in caves were often excluded from published tracings because they would ‘blur’ the figures, despite recurring across caves and sometimes preserving informative superimposition relationships. She argued these traces should instead be systematically recorded and graphically distinguished so their spatial relations could be evaluated. Her broader writing on Lascaux and her later thesis developed this point further, repeatedly cautioning that ‘minor’ traces are part of the record rather than noise (Laming-Emperaire 1959; 1962). Her critique anticipates later arguments that what counts as ‘Palaeolithic art’ is shaped by recording conventions—selection, tracing, and reproduction—which condition what becomes analytically visible (Conkey 1980). In parallel, her supervisor Leroi-Gourhan’s work (1993 [1964]) on gesture and technical action provides a foundation for treating wall traces as residues of skilled bodily engagement rather than only

images to be decoded.

Several strands of scholarship provide direct context for the approach taken here. General syntheses and disciplinary histories have framed what counts as Palaeolithic cave art and how it has been interpreted (Clottes 1999, 2012; Bahn 2016), while structural and spatial analyses have modelled the organisation of cave assemblages and their patterned placement (Leroi-Gourhan 1993 [1964]; Pastoors and Weniger 2011). Relatedly, Groenen (2013) argues for approaching decorated caves as structured, *experienced* spaces (*espace vécu*), in which circulation routes, sectoring, and light-mediated visibility condition how images and traces are encountered, rather than treating panels as isolated units. Work on cave 'visual systems' has examined how subterranean viewing conditions—low and dynamic illumination, occlusion, and constrained sightlines—shape what is perceived (Hodgson 2008; Rosengren 2012; Medina-Alcaide et al. 2021). Interpretive traditions range from ecological and hunting-oriented accounts (Guthrie 2005) to theories of non-figurative signs and perception, including entoptic and trance-based models (Lewis-Williams and Dowson 1988). Phenomenological and embodiment-oriented approaches treat rock art as situated practice and experience (Tilley 2016a; 2016b), and sensory perspectives challenge vision-centred bias by showing how touch-based traces—such as handprints and rubbed pigment areas—can be analytically central (Lahelma 2010). Sequencing work further demonstrates that superimpositions can register repeated re-engagements in which earlier marks condition subsequent actions on the same surface (Gunn et al. 2022). These literatures motivate the present paper's focus on technique-defined bodily traces and on describing their placement relative to relief, clustering/seriality, and viewing constraints.

Against this background, non-figurative marks have long been recognised, but discussion has often remained anchored in iconography, sign typologies, or representational frameworks. The contribution of this paper is to re-centre a subset of non-figurative traces whose primary evidential value lies in gesture, technique, and emplacement: hands, fingers, smearing, and projection acting directly on surfaces. This aligns with 'making'-centred approaches that treat marks as outcomes of skilled engagement with materials (Ingold 2013; 2016) and resonates with work foregrounding bodily tracing in cave contexts, notably finger-fluting studies (Sharpe and van Gelder 2005, 2006).

Materials and Methods

Embodied cave markings are non-figurative traces created through direct bodily contact with cave surfaces. They materialise the actions of hands, fingers, and mouths, reflecting intentional engagement with the cave through touch and movement. Unlike figurative depictions, which represent recognisable forms, or abstract motifs that encode symbolic designs,

embodied markings are defined first by technique and emplacement (pressing, dragging, spraying). These features can be described without assuming a representational meaning; where representational meanings may be present, this paper treats them as an additional interpretive layer rather than the primary evidential basis for defining these traces. For the purposes of this study, seven recurrent categories of embodied markings were analysed: (1) hand stencils, (2) handprints, (3) sprayed disks, (4) finger lines, (5) finger dots, (6) smeared surfaces, (7) sprayed surfaces (Figure 1). Together, these categories encompass a spectrum of bodily techniques and engagements with cave topography, ranging from discrete impressions to repeated, surface-covering gestures. The focus lies in production traces and spatial placement, while still treating touch, movement, and reachability as part of the material conditions of making. Where experiential language is used (e.g., 'demanded crawling' or 'required contorted posture'), it is grounded in spatial constraints and reachability documented for each panel, and is presented as a bounded inference about bodily positioning, not as a reconstruction of subjective states.

The methodological approach combines spatial observation, visual analysis, and contextual comparison across the three case study sites. Markings were documented in relation to their placement within the cave, their association with specific surfaces and formations, and their perceptual framing. This documentation supports both typological comparison and assessment of how marks cluster, recur, and interact with cave relief under constrained viewing conditions. To capture these dynamics, photogrammetry was combined with DStretch colour enhancement (Harman 2005). These visualisations distinguished production techniques—whether impressions made with fingers, hands, or mouth—by making faint markings visible, clarifying pigment halos, and revealing droplets left by mouth-spraying. They also clarified how traces interact with surface topography (cracks, concavities/convexities, flowstone and speleothems). Because embodied markings are often faint, partial, and relief-dependent, their visibility varies with illumination angle, surface moisture, calcite veils, and viewing distance; observations therefore noted colour/saturation, edge definition, droplet/splatter or haloing, mark size/density within clusters, and superimposition or integration with relief (e.g., marks 'wrapping' edges). Because many traces are faint, they often show up as soft patches and spray marks rather than clear lines. Noting features such as halos, droplets, blurred edges, and pigment density helps separate how a mark was made from later surface change and helps explain why some clusters stand out in moving light while others remain hard to see. Where enhancement was used, it served to clarify colour contrasts and faint residues, not to infer motif boundaries beyond what is supported by the unenhanced record, helping to separate

production effects (spray halos, finger-drag striations) from taphonomic effects (calcite veils, abrasion) and to constrain interpretation. Spatial variables were also assessed, including whether markings were placed in hidden or accessible areas, high- or low-visibility contexts, or required particular bodily positions to reach (climbing, crouching, stretching). Their relationship to other markings and their visibility under low light were likewise considered.

Theoretical Framework:

Personhood, Gestalt, and the Embodied Self

This section situates the analysis within theories of embodiment and personhood and uses Gestalt principles as a descriptive vocabulary for recurring salience effects (clustering, framing, continuity) under cave-specific viewing constraints.

The Body as Social and Material Entity

The body cannot be reduced to biology alone—it is socially formed, historically situated and materially entangled (Crossland 2010). In *Techniques of the Body* (1992 [1934]), Mauss showed that actions often assumed to be “natural”-walking, swimming, eating—are learned and culturally embedded. Such techniques are acquired through socialisation and become embodied dispositions (*habitus*), later elaborated in practice theory (Bourdieu 1977). The body is therefore not only a physiological substrate but a medium through which social worlds are reproduced.

Mauss also emphasises the intimacy of bodies and things. In *The Gift* (2002 [1925]), he argued that objects exchanged between people may carry something of the persons who give them, creating enduring bonds that blur boundaries between persons and things. This is relevant here because spraying, smearing, and finger dragging can be approached as culturally situated techniques through which bodily action becomes materially persistent on cave surfaces.

Merleau-Ponty (1962 [1945]) placed the body at the centre of perception and experience: perception is not a detached ‘reading of the world but an embodied engagement in which movement, sensation and affect cohere. (Casey 2001; Carman 2009). For the present argument, the point is modest but specific: embodied markings register learned bodily techniques enacted under subterranean constraints, and they preserve those actions in place. Archaeological engagements with embodiment likewise stress the lived body as integral to social life, identity, and the making of place (Joyce 2005; Brück 2005; Crossland 2010).

Distributed and Partible Personhood

If the body is socially constituted, theories of personhood reveal how selves can be relational, composite, and divisible. Strathern’s (1988) concept of partible/dividual personhood emphasizes that persons are constituted through relations and may be decomposed and recomposed through substances,

names and objects. In such contexts, parts of persons—names, substances, or material possessions—can circulate, detach, or be exchanged, so that objects may carry fragments of selfhood (Strathern 1988: 135). Related accounts foreground the social circulation of persons and things (Fowler 2004), agency mediated through material forms (Gell 1998), and identity constituted through routinised practice (Robb 2007). Archaeological discussions of distributed personhood develop these insights by arguing that identities can be dispersed across objects and places (Brück 2005; Crossland 2010; Crossland and Bauer 2017). This aligns with ‘making’-centred approaches that treat marks as outcomes of skilled engagement (Ingold 2013) and with Malafouris’s (2008; 2013) proposal that selves can be extended through ongoing coupling between bodies and materials.

Applied to embodied markings, these theories suggest that handprints, stencils, and finger traces are materially anchored indices of action and presence. The claim here is not that every mark encodes an individual biography, but that repeated, place-bound bodily traces can make presence persist and become available for later encounter. Accordingly, this paper treats distributed personhood as a framework for interpreting persistence and emplacement (how bodily action becomes durable and place-specific), rather than as a claim about the ‘ontology’ of marks. Yet to understand why these distributed traces endure in memory and perception, we also need to consider how they were structured to be sensed. This is where Gestalt principles of perception help explain how markings were grouped, framed, and made salient.

Gestalt Principles in Palaeolithic Caves

If personhood helps explain why embodied markings mattered, Gestalt theory can help describe how they became perceptually salient. Gestalt psychology (Wertheimer 1938; Koffka 2013 [1935]) examines how perception organises stimuli in patterned wholes, including grouping by proximity, similarity, continuity and figure-ground contrast (Palmer 2002; Koffka 2013 [1935]; Arnheim 1943). This paper does not assume that perception works inside caves in the same way as in daylight. Instead, Gestalt principles are used restrictively as descriptive terms for recurring *salience effects* under cave-specific viewing constraints.

In caves, visibility is shaped by low and uneven illumination, restricted sightlines, occlusion, and moving light sources; what registers can change with distance, angle, and motion (Medina-Alcaide et al. 2021; Intxaurbe et al. 2022; Wisher and Needham 2023). Low light reduces colour discrimination and increases reliance on contrast, edge effects, and shadow; moving light introduces a temporal component (features appear/disappear as a flame or lamp shifts). These conditions make salience situational rather than constant. The approach here, therefore, avoids inferring mental states from Gestalt categories and asks a narrower

Gestalt Principles		Embodied marking examples
1	Figure-ground: Objects stand out in front or recede into the background.	Markings on standout formations (stalactites, stalagmites, draperies, concave/convex surfaces, columns).
2	Similarity: Similar elements are grouped by shape, colour, texture, or orientation.	Clusters of markings with shared form or colour.
3	Common fate: Elements moving together are perceived as grouped.	In low light, grouped markings appear to 'move' together as shadows shift.
4	Proximity: Elements close together are related.	Same-category markings located in close clusters.
5	Common region: Elements within the same bounded area are grouped.	Same-category markings concentrated in one gallery or chamber.
6	Continuity: Aligned elements form perceived lines or curves.	Markings following cracks or curves; disks arranged in arcs (El Castillo, Sala Final).
7	Closure: Missing parts are mentally filled in.	Partial framing of a hollow/speleothem by repeated marks can invite completion of an implied boundary.
8	Focal point: Visually striking elements draw attention.	Markings placed to stand out on prominent formations.
9	Symmetry: Symmetrical arrangements are grouped.	Framed or mirrored markings, e.g. disks on speleothems (El Castillo), concaves (Pech Merle).
10	Convexity: Convex forms are seen as figures more than concaves.	Markings on bulging surfaces; inversely, stencils and disks often in concaves (El Castillo, Pech Merle).
11	Connectedness: Linked elements are grouped.	Combined motifs (disks with hand stencils; stencils with dots/lines).

Table 1. Gestalt principles and embodied markings. The table summarises key Gestalt principles of perceptual organisation and illustrates how each applies to the placement and grouping of embodied markings in Palaeolithic caves.

question: given cave lighting and relief, do marks recur where contrast and micro-topography would make them more likely to register during movement? On this basis, several principles are especially relevant to embodied markings. Figure-ground contrasts may be intensified by raking light and shadow, so marks on convexities, concavities, or framed surfaces may 'pop' against the rock ground. Proximity and similarity link repeated gestures (dots, short lines, disks, stencils) into perceptual clusters. Good continuation aligns attention along cracks, curves, and drapery folds; closure and symmetry can emerge where repeated marks partially frame a speleothem or bracket a hollow. Connectedness is relevant where techniques are combined (e.g., disks with stencils; dots with lines) (Palmer 2002). These principles do not prove intention in every case; they help describe non-random regularities in placement (e.g., clustering at edges, hollows, cracks, and visually responsive relief). Merleau-Ponty (1962 [1945]) also recognised both the potential and limits of Gestalt accounts: Gestalt describes structural regularities of perceptual organisation, while phenomenology stresses perception as lived and embodied. This matters in caves because 'seeing' is typically inseparable from moving, pausing, orienting a light source, and sometimes touching surfaces—so salience is produced through embodied viewing conditions rather than

static observation (Medina-Alcaide et al. 2021; Wisher and Needham 2023). In the analyses that follow, these principles are used only as coding criteria—to specify how marks relate to relief (edges/concavities), to one another (clustering/seriality), and to likely viewing conditions (distance/angle under low light)—so that claims about 'salience' are described consistently and compared across caves (Table 1).

Case Studies

Building on the theoretical framework, this section explores how embodied gestures operated within specific cave contexts. The case studies of Ardales, El Castillo, and Pech Merle demonstrate that markings were not only bodily traces but also shaped by the spatial and sensory qualities of the caves themselves.

El Castillo

El Castillo, perched on Monte Castillo, is one of the most significant caves of Palaeolithic Europe. The conical hill contains 43 caves, five of which preserve Palaeolithic art, and the site itself has an exceptionally long occupation history of more than 150,000 years, spanning Neanderthals and modern humans (Cabrera Valdés et al. 2001, 2006; Almagro Basch 1976; Zilhão and d'Errico 1999). Although no human remains have been securely linked to particular phases, the

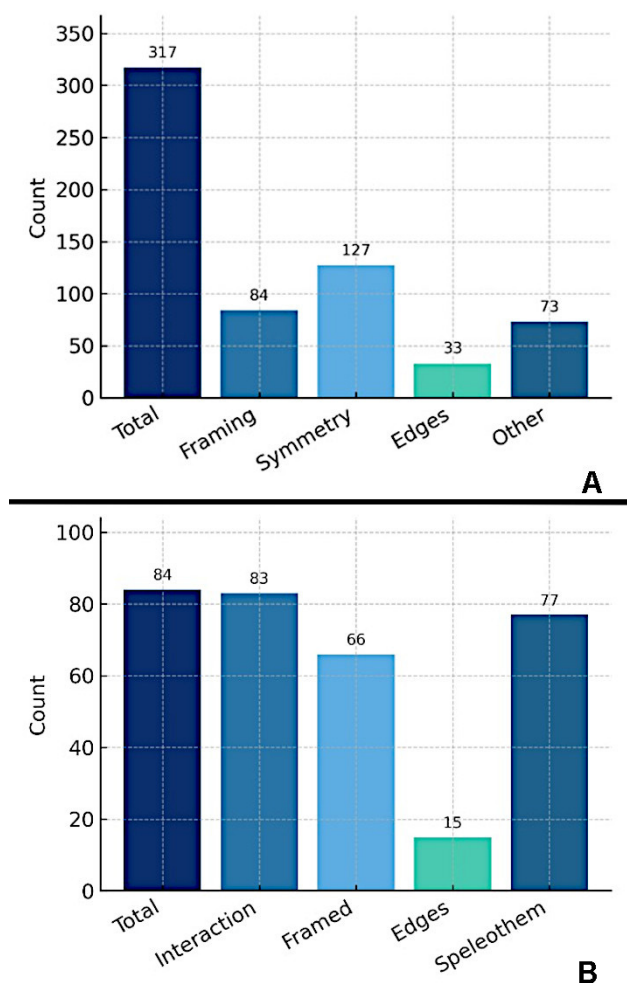


Figure 2. A) Repetition and grouping of sprayed disks at El Castillo. B): Repetition and grouping of sprayed disks at Sala Final.

sequence covers Mousterian, Aurignacian, Gravettian, Solutrean, and Magdalenian occupations. Some of the paintings are among the earliest known in Europe.

A set of hand stencils on the 'Ceiling of the Hands' has a minimum age of 37,500 years, while one of the disks has a minimum age of 31,000 years and another a maximum of 35,700 (Pike et al. 2012). Six of the seven categories of embodied markings occur here, with the exception of handprints.

Sprayed disks form the most iconic corpus. At least 317 sprayed examples are known, heavily concentrated in the Galería de los Discos and Sala Final. Pigment analyses (d'Errico et al. 2016) reveal variation in mineral recipes, including pigment mixing, suggesting repeated preparation and perhaps multiple phases of marking. Several surfaces in these chambers were also directly sprayed, coating speleothems and walls. Their placement is highly selective: disks occur almost exclusively on speleothems and concavities and are virtually absent from the left-hand side of the cave. Out of 317 disks, 268 (84%) were placed in interaction with natural features (Figure 2A). In Sala Final, 83 of 84 disks were placed on speleothems; of these, 77 occur directly on columns, draperies, or stalactites, with 66 carefully aligned to frame their contours (Figure 2B, 3A-D). Fifteen further disks were deliberately applied along edges. Rather than appearing randomly distributed, these placements are highly patterned, with repeated framing and alignment that suggest deliberate emplacement.

Hand stencils (N=80) reveal contrasts between public and private contexts. At the Polícromos and Techo de las Manos panels, hand stencils are spread across large, visible surfaces with a collective, performative character, often placed beneath bison figures or framed by disks. Techo de las Manos, finds the largest concentration of hand stencils with 44 examples. By contrast, smaller groups occur in secluded or shared spaces such as Bas Cote, Carrefour, and the Galería de las Manos, tucked into hollows or awkward niches (Figure 4). A striking subset—nine stencils—depict hands

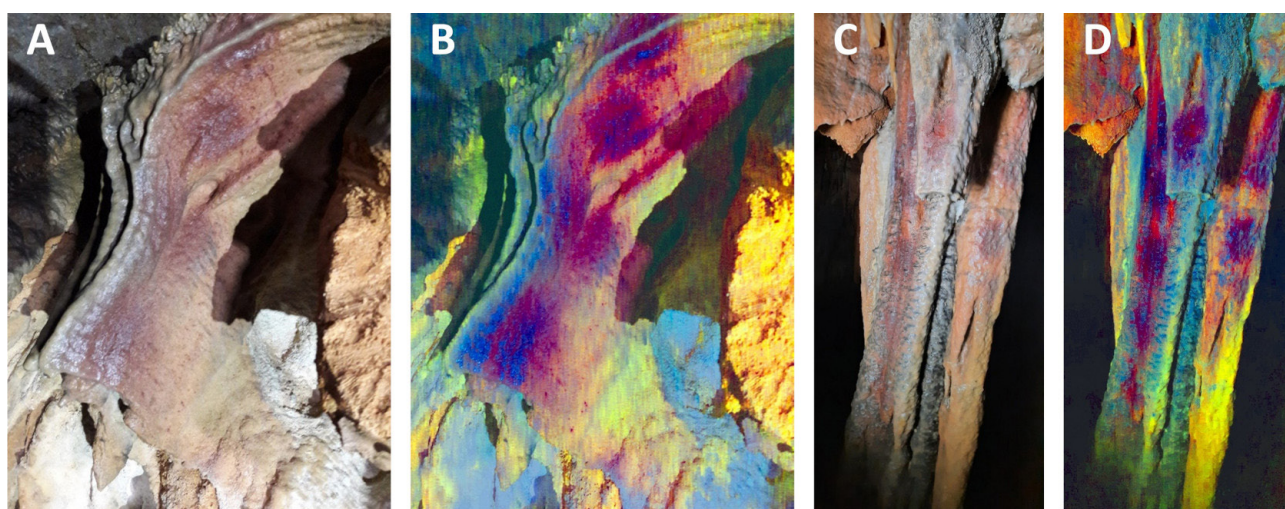


Figure 3. A) Sprayed disks on speleothem (original image under natural light). B) Image enhanced with DStretch filter LDS. C) Sprayed disks framing speleothem (original image under natural light). D) Image enhanced with DStretch filter LDS.

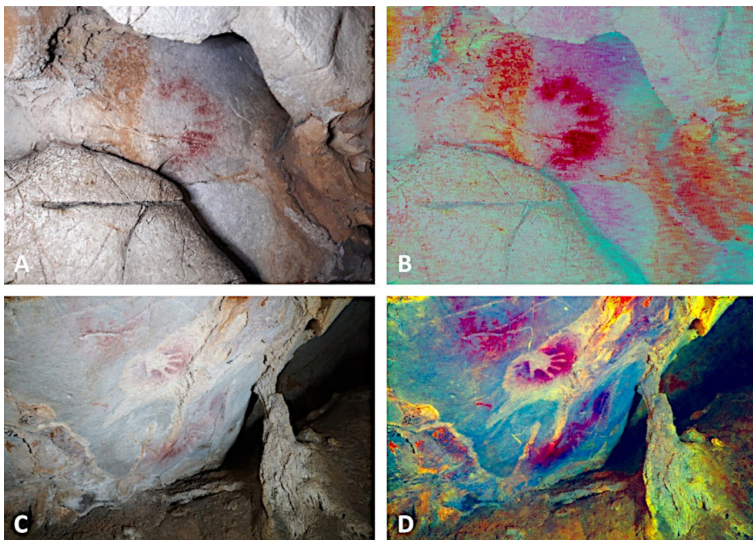


Figure 4. A) Hand stencil near Bas Cote in hidden nook (original image under natural light). B) Image enhanced with DStretch filter LRE. C) Several hand stencils on the ceiling of the hands placed in uncomfortable positions (original image under natural light). D) Image enhanced with DStretch filter LDS (Oosterwijk 2023).

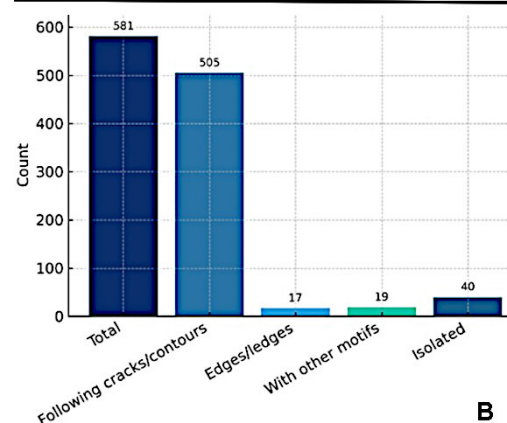
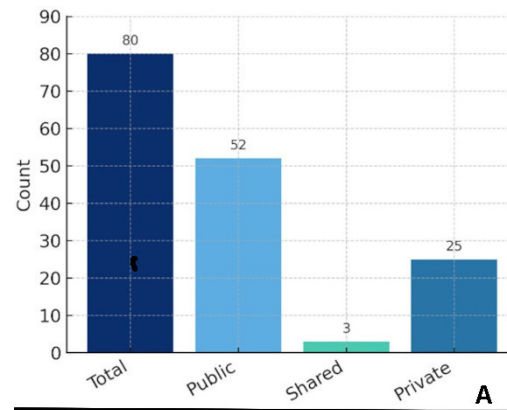


Figure 5. A) Accessibility of hand stencils at El Castillo, showing their distribution across public, shared, and private contexts. B) Interaction of finger dots at El Castillo with cracks, concavities, edges, and other motifs.

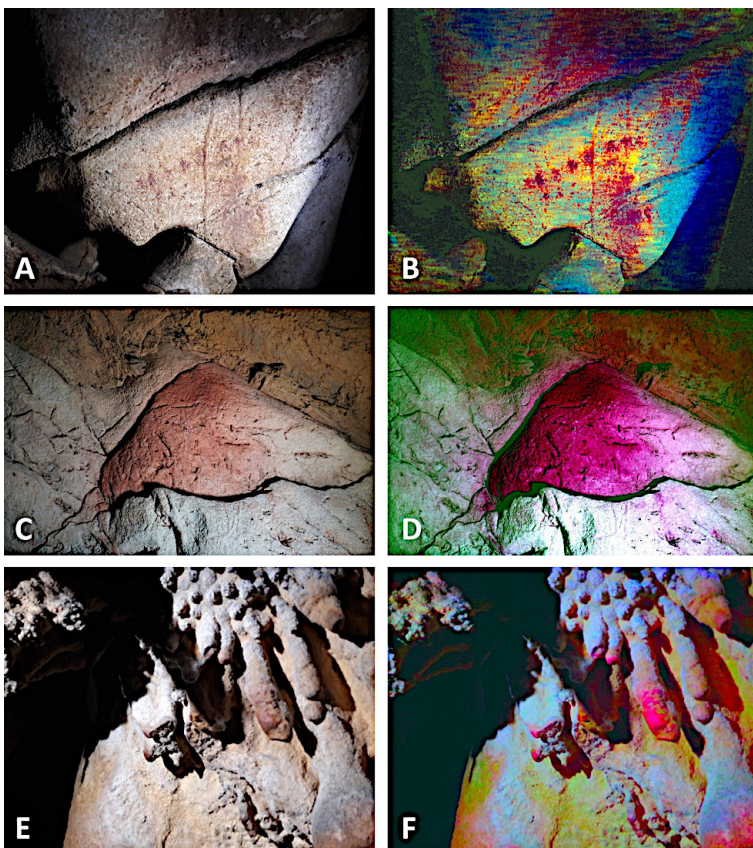


Figure 6. A) Finger dots frame surface (original image under natural light). B) Image enhanced with DStretch filter LDS. C) Triangular shaped rock smeared with pigment (original image under natural light). D) Image enhanced with DStretch filter LDS. E) Edges of formation hanging from the ceiling smeared with pigment (original image under natural light). F) Image enhanced with DStretch filter LRE (Oosterwijk 2023).

in gripping positions, oriented rightwards or upwards as though clasping cracks or ledges (Pettitt et al. 2015). Overall, 75 of the 80 stencils (92%) engage directly with the cave's topography, placed on convex bosses, in concave hollows, or around depressions. Their distribution often coincides with thresholds and transitions, consistent with a role in marking routes into deeper chambers. El Castillo also displays a hand outline in which the contour of the hand is traced in red with the fingers.

Finger dots are the most numerous category (N=582). They are widely distributed, but 433 concentrate on the Rincón de los Tectiformes, forming dense clusters across the panel. Elsewhere, they appear in liminal points—along edges, at dead ends, or near crossings such as Sala de la Oveja. Rows of dots follow cracks (Figure 6A-B) or are arranged around triangular forms, framing features, and accentuating boundaries. Finger lines (N=48) follow the same logic, dragging across surfaces to outline concavities or trace cracks. Smeared surfaces

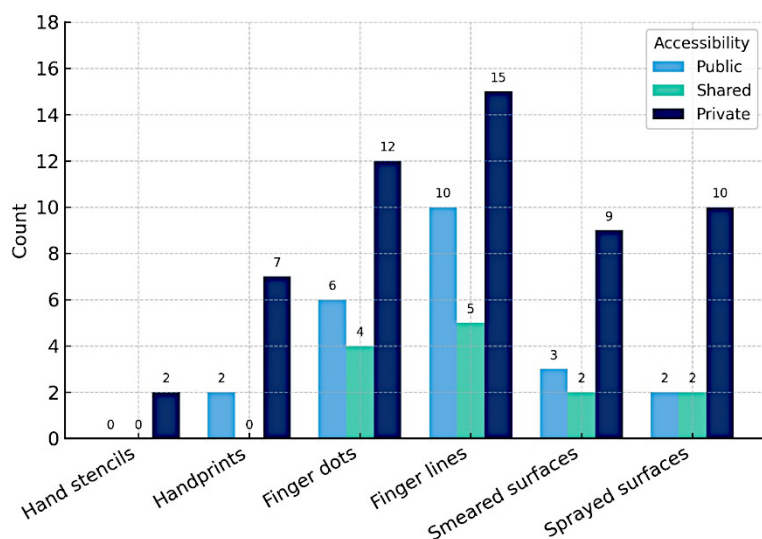


Figure 7. Distribution of selected subset of embodied marking categories at Ardales by accessibility zone (public, shared, private).

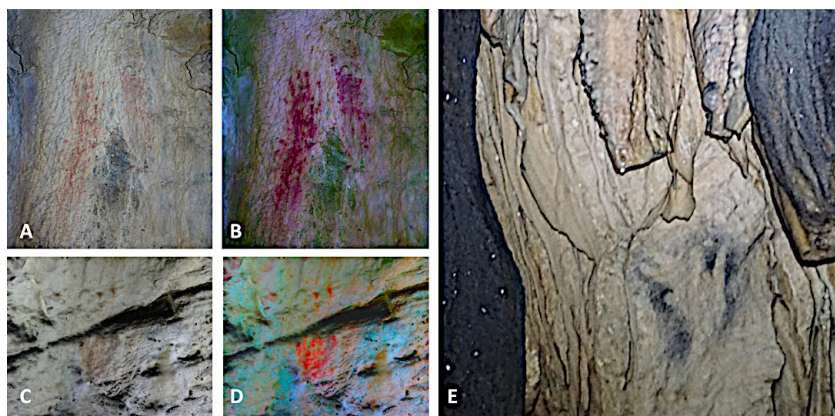


Figure 8. A) Dragging handprints at Camarin (original image under natural light). B) Enhanced with DStretch filter RGB0. C) Handprint covering crack in wall (original image under natural light). D) Enhanced with DStretch filter LDS. E) Black hand stencil in central drapery (original image under natural light) (Oosterwijk 2023).

(N=71) occur mainly in hollows, triangular ceiling shapes (Figure 6C-D), and along edges (Figure 6E-F), reinforcing tactile engagement with rock. Sprayed surfaces (N=15, of which 14 are directly related to topography) are restricted to the deepest, most inaccessible parts of the cave, adding colour to stalactites, columns, and draperies.

Patterns of repetition and framing unify these categories. Disks cluster symmetrically around stalactites and columns. Finger dots are grouped in rows or lines that follow cracks and edges, while stencils are aligned to concavities or placed across thresholds. Across categories, symmetry, framing, and repetition recur, binding gestures into a shared visual and tactile grammar. Markings also punctuate movement: they appear at thresholds, junctions, and crossings, structuring how people navigated the cave. Finally, many were placed in awkward or difficult positions—high on speleothems, along steep inclines, or deep in folds—place-

ments that required effort and negotiation of space. The repeated placement strongly suggests intentionality, though alternative explanations (accident, chance accumulation) must also be considered.

Ardales

Ardales is a vast cave system in southern Spain, about 60 km from Málaga, extending more than 1.5 km through a pyramid-shaped limestone hill. Its archaeological record spans from the Middle Palaeolithic to the Neolithic (Cantalejo et al. 2003; Cantalejo et al. 2006; Pitarch Martí 2021). Neanderthal presence is indicated by Levallois flakes dated to c. 58 ka and ochre fragments, while later visits are documented in the Aurignacian, Gravettian, and Solutrean (Pitarch Martí 2021). U-Th dating of speleothems coated with sprayed pigment

has revealed repeated painting episodes spanning at least 25,000 years: 63.7–32 ka (panel II C), 48.7–45.3 ka (panel II A), and 45.5–38.6 ka (panel III C), with minimum ages of 65.5 and 45.9 ka also obtained (Hoffmann et al. 2018). These results support repeated marking episodes spanning at least 25,000 years and are consistent with participation by both Neanderthals and *Homo sapiens* (see White et al. 2020; Hoffmann et al. 2020; Standish et al. 2025).

Non-figurative imagery dominates Ardales, accounting for nearly 90% of all motifs (Cantalejo et al. 2006). All seven categories of embodied markings are present: hand stencils, handprints, finger dots, finger lines, smeared surfaces, sprayed disks, and sprayed surfaces. Their placement consistently engages the cave's topography—concavities, draperies, niches, and dangerous ledges—often emphasising thresholds or liminal zones.

Handprints and hand stencils are striking for their tactile intensity. Nine handprints are known from Ardales, often in difficult or dangerous locations. At Camarín, the highest and most inaccessible chamber, two dragging handprints were smeared down a near-vertical wall (Figure 8A-B), embodying bodily strain. Elsewhere, hands seem to grip fissures or ledges: one clutches a crack near the entrance (Figure 8C-D), another the edge of a stalactite, while a very small print—possibly a child's—rests delicately on calcite. Two manganese-black stencils, unique in colour within the cave, are located in niches high within a central drapery (Figure 8E). Both display bent index and little fingers, as if grasping the rock, and could only have been produced through climbing. Their

hidden, strenuous emplacement emphasises the intimate link between gesture and surface.

Finger dots and finger lines are the most abundant categories. Panel I.A.11 alone preserves 196 dots and 64 lines, executed in two pigment shades—bright red and violet red. Many are arranged in vertical rows or grouped in clusters; long finger drags, sometimes over 20 cm, accentuate the wall's contours (Figure 10A-B). Sets of three lines or three dots recur in at least 18 documented instances across the cave, most often placed in cracks or on ledges. The prevalence of these triplets distinguishes Ardales from El Castillo and Pech Merle, underscoring a localised gestural tradition.

Other finger lines convey motion and effort: some are long, straight drags down vertical walls (Figure 11A-B); others consist of parallel marks drawn by pigment-covered fingers, evenly spaced as if placed one at a time. One example near the entrance displays a set of three finger lines gripping into a ledge. The finger lines do not simply follow the rock; they curve over its edge, as though the person was physically gripping the surface (Figure 11C-D). Across finger lines, handprints, and hand stencils, at least 14 instances show gestures of gripping, and seven depict dragging motions. These repeated actions highlight not only the gestural repertoire but also the bodily exertion of emplacement.

Sprayed surfaces add another layer of engagement. At least ten examples occur on prominent speleothems and draperies, often located high above the ground, or recessed into folds of the cave. One large drapery, at three-meter height, now accessed with scaffolding, was entirely coated in pigment

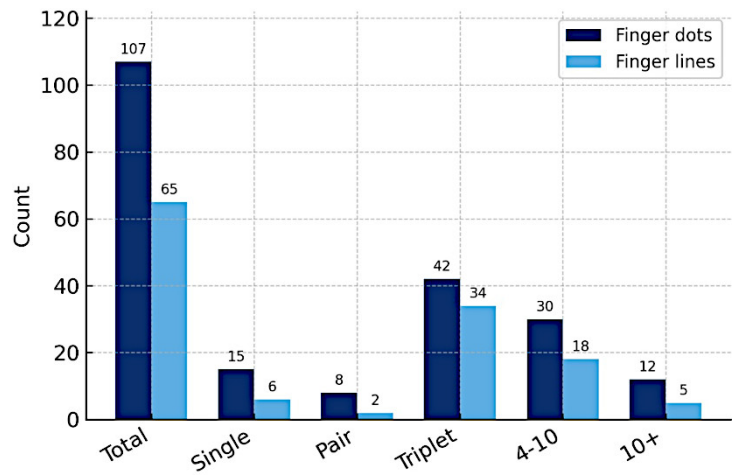


Figure 9. Repetition of finger dots and lines at Ardales.

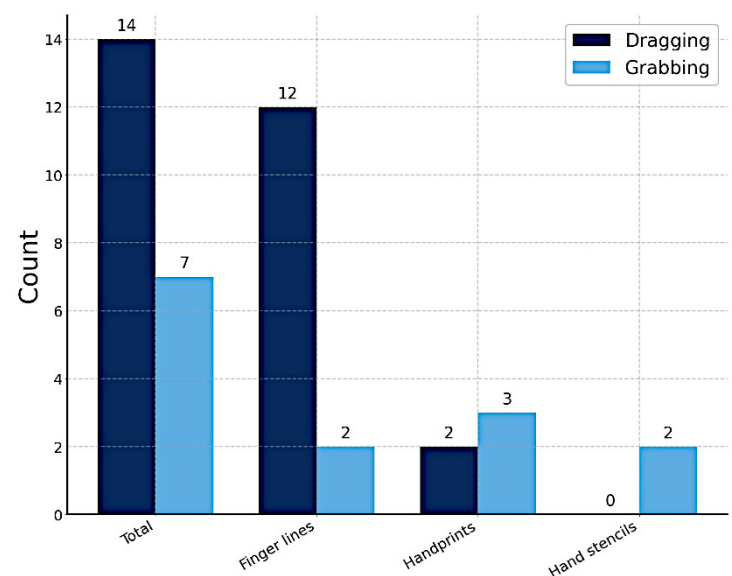


Figure 10. Frequency of dragging vs. grabbing gestures at Ardales, by category.

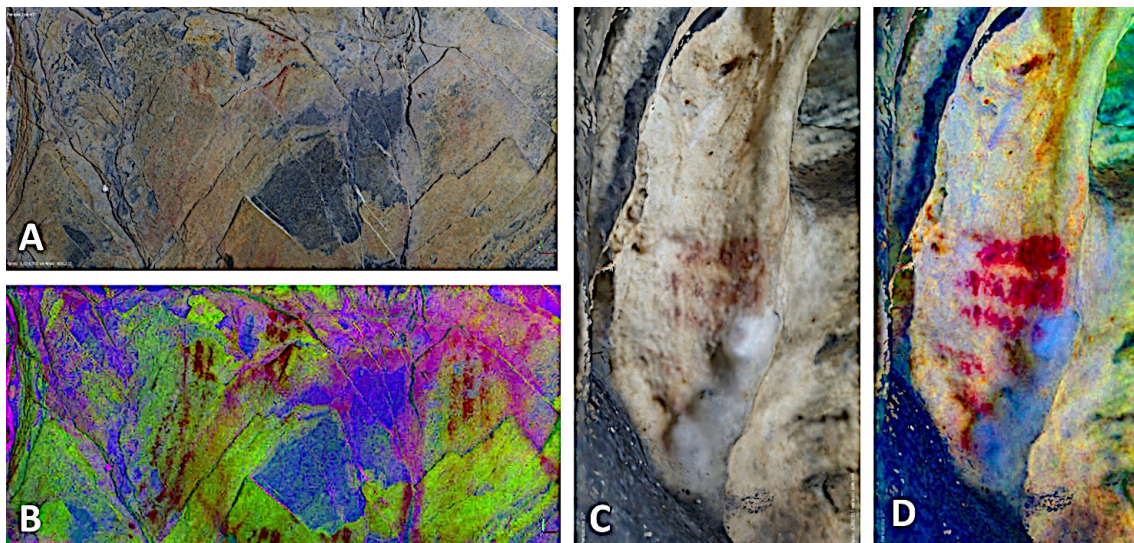


Figure 11. A) Dragging finger lines (original image under natural light). B) Image enhanced with DStretch filter CRGB. C) Grabbing finger lines (original image under natural light). D) Image enhanced with DStretch filter LDS (Oosterwijk 2023).



Figure 12. A) author producing 3D models of sprayed drapery hanging from ceiling (original image under natural light). B- detail sprayed drapery (original image under natural light) (Oosterwijk 2023).

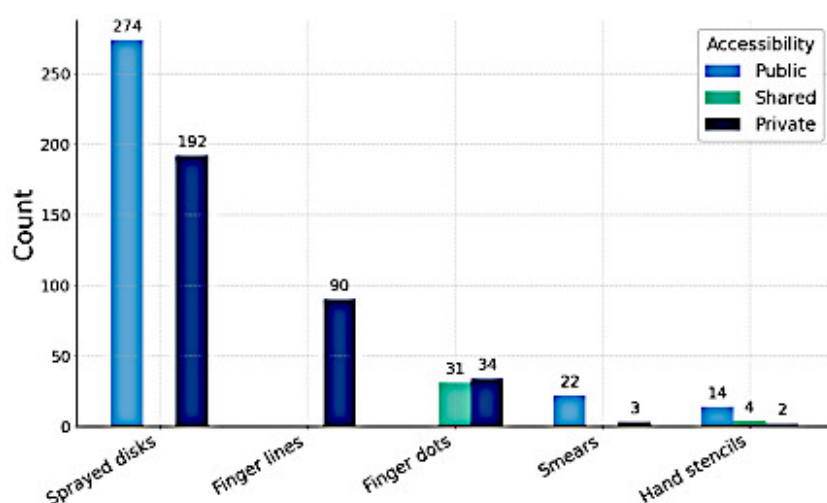


Figure 13. Accessibility of embodied markings at Pech Merle by category (public, shared, private).

through mouth-spraying or projection with bone tubes (Figure 12A-B). The splatter patterns attest to close bodily proximity, while the difficulty of access suggests that visibility was not the main goal. Instead, these markings emphasise sensory intimacy and the deliberate act of coating surfaces. The repeated episodes of spraying, confirmed by U-Th dating, underscore the long-term biographical presence of these acts.

The Ardales corpus highlights two interrelated themes: repetition and spatial intimacy. Markings cohere in patterned clusters. They are grouped by type, recur in similar contexts, and remain tied to the cave's formations. Many focus on thresholds, narrow passages, or dangerous ledges—spaces charged with liminality. Others emphasise gestures of gripping, dragging, and coating surfaces. Such actions could be read as biographical traces: gestures that extend the self into

place. Their repetition suggests not only an aesthetic rhythm but also the reinforcement of presence and memory. These groupings reflect proximity and similarity effects, as clustered marks guide perception and organise engagement with surfaces.

Pech Merle

Pech Merle, located in the Lot region of southern France, extends nearly two kilometres through a karstic hill overlooking the Célé valley. Its figurative repertoire—spotted horses, mammoths,

and bison—was executed primarily in black pigment, while embodied markings were overwhelmingly rendered in red (Lorblanchet 1996; Lorblanchet 2010; Guineau et al. 2001). Five categories of embodied markings are present here: hand stencils, sprayed disks, finger lines, finger dots, and smears.

The distribution of these categories highlights a duality between highly visible public panels and secluded, physically demanding contexts (Figure 13). In the Salle Préhistorique, hand stencils and disks are integrated into figurative compositions, framing the famous dotted horses and accentuating natural contours. By contrast, in the

deeper Combel galleries, disks, finger lines, and dots occur in cramped spaces that demanded crawling, crouching, or lying prone. This juxtaposition between expansive chambers and narrow passages situates Pech Merle within the same perceptual and bodily logics evident at Ardales and El Castillo, though here postural effort is especially pronounced.

Hand stencils at Pech Merle (N=20, plus two possible examples) occur exclusively in upward-facing orientation, often in association with cracks or surface irregularities. They are strikingly absent from the most inaccessible areas and instead cluster at crossroads, entrances, and central spaces. The Panel of the Spotted Horses includes six black hand stencils (Figure 14D) framing the animals, while additional red examples occur at the Ossuaire and near the cave entrance. Distinct from these is a unique charcoal-drawn hand

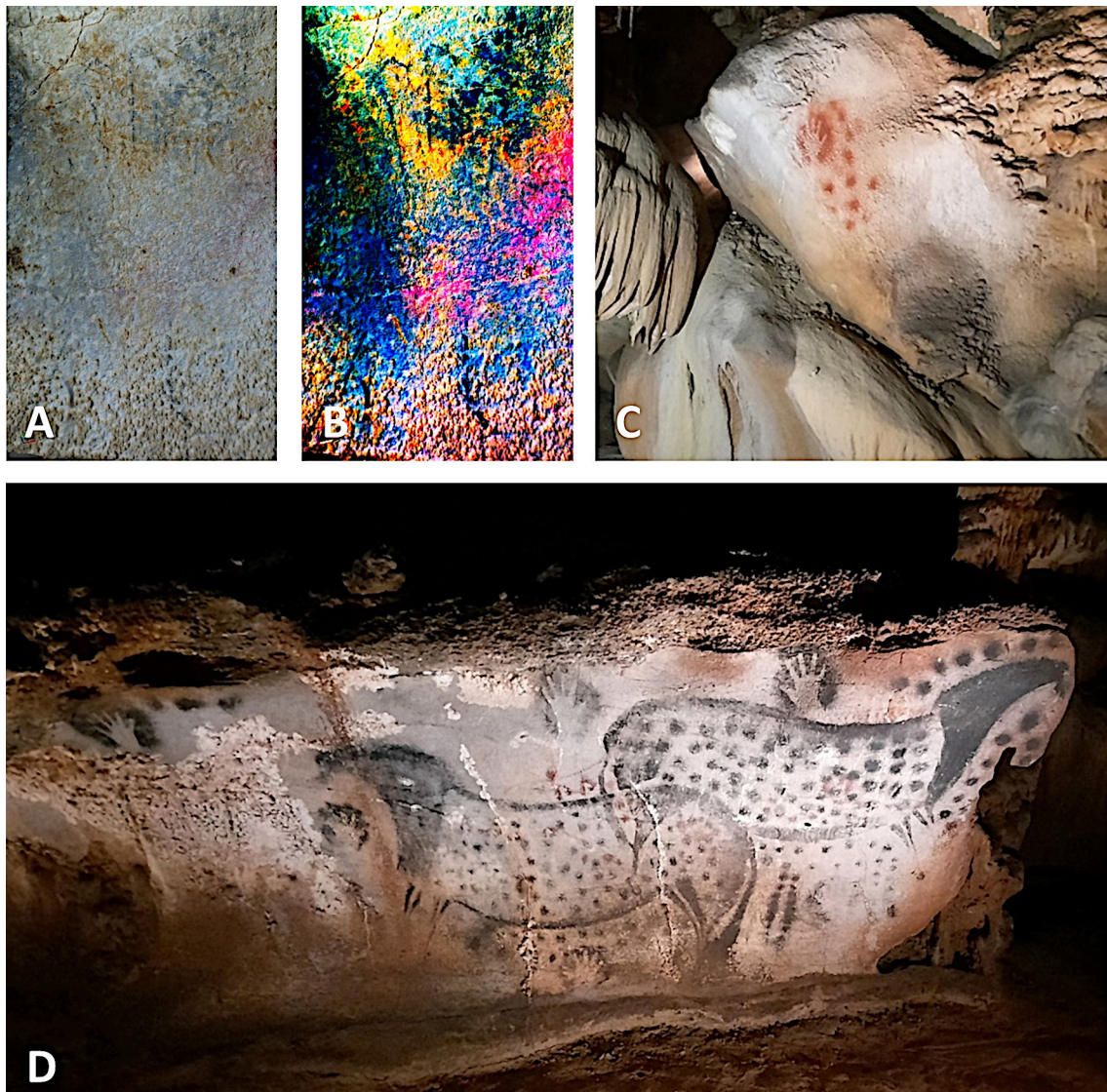


Figure 14. A) Hand outline in black (original image under natural light). B) Image enhanced with DStretch filter LBK. C) Panneau Main et Disques (original image under natural light). D) Panel of the horses and black hand stencils (original image under natural light) (Oosterwijk 2023).

outline, traced with a crayon which emphasises experimentation and creative intent (Figure 14A–B). The only other example of a hand outline is known from El Castillo, where a red example was observed. At Panneau Main et Disque, a red stencil is surrounded by red sprayed disks (Figure 14C). These placements suggest a performative, public quality: stencils marked passageways and thresholds, guiding movement as much as they signalled presence.

Sprayed disks, the largest category (N=459), are distributed throughout the cave. Their character varies: clustered black disks inside the horse figures of the Salle Préhistorique; orange-red disks at Femmes-Bisons; snake-like rows of disks on the ceilings of Combrel. In Combrel especially, production required extreme bodily effort: to see or paint the disks one had to crawl, squeeze, or lie flat. In Combrel and elsewhere, disks frame surfaces, accentuate edges, or cluster in hollows (Figure 15A–B), producing perceptual salience through

repetition and figure–ground contrast.

Finger lines (N=86) occur both in the Salle Préhistorique—such as at the Wounded Man panel—and deep in Combrel. At Wounded Man, sets of short red lines cluster in hollows or along contours. In Combrel, at least 46 finger lines are visually and spatially comparable to cave bear scratchings, raising the testable hypothesis that some human gestures were made in dialogue with animal traces (Lorblanchet 2009; Dowson 2009). Most are vertical and placed in proximity to one another, reinforcing their collective and tactile character. Finger dots (N=85) follow similar logics. At Ossuaire, a cluster of dots frames the ceilings and cracks (Figure 17C–D), while in Combrel, they occur in small, paired groups (Figure 17E–F), often near disks or animal figures. Smears are rare (N=25) but significant. They occur at the Black Frieze, underlying mammoth figures, as thick, powdery clusters of red pigment (Figure 17A–B); as rectangular orange traces above the

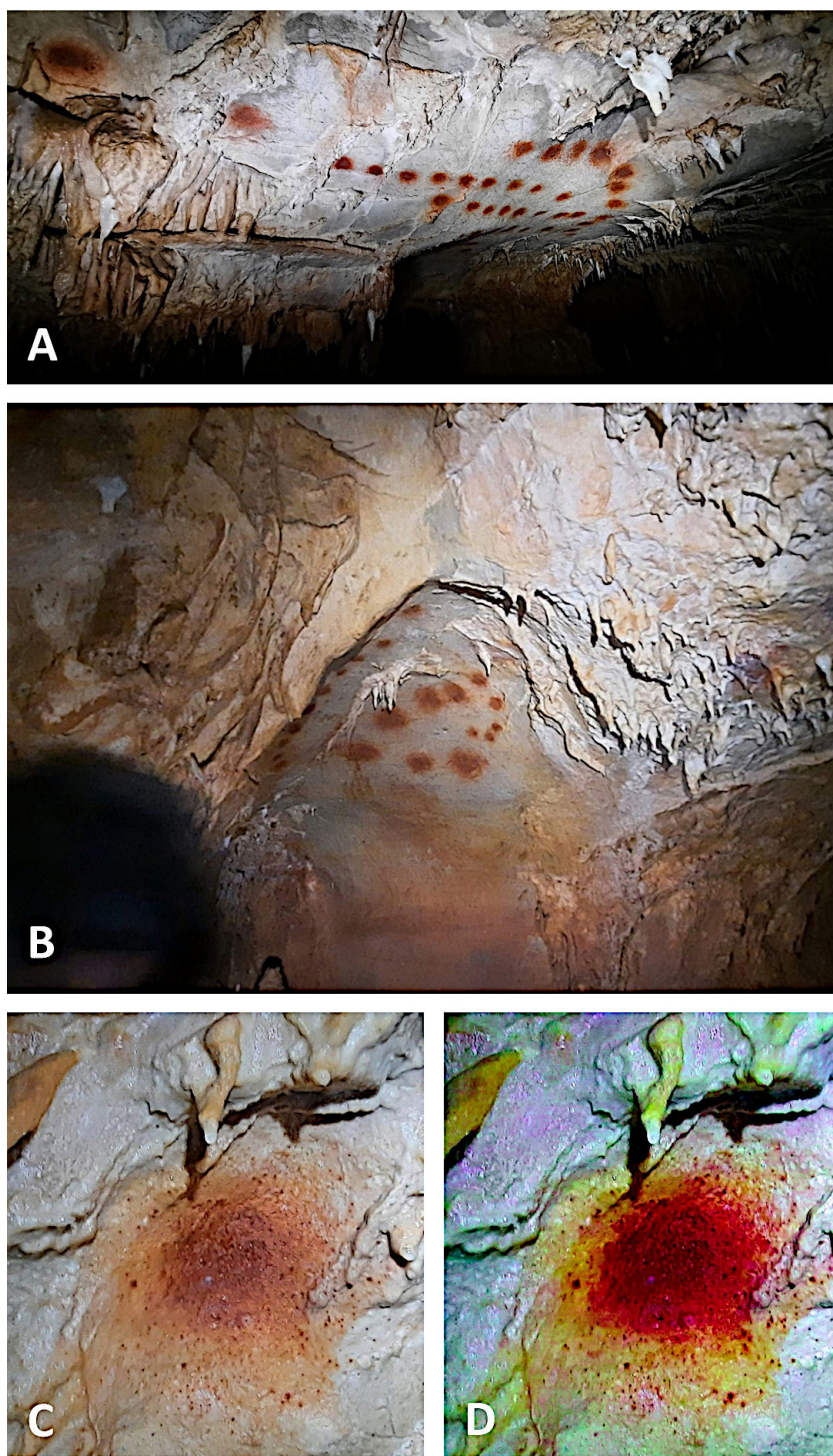


Figure 15. A-B) Framed sprayed disks at Combel (original image under natural light). C) Details of sprayed disks showing splattering (original image under natural light). D) Image enhanced with DStretch filter LDS (Oosterwijk 2023).

Spotted Horses; and as isolated rubbings in Combel.

Pech Merle's markings articulate two themes: tactile narrative and postural work in confined space. In public spaces, stencils and disks framed animal imagery and marked thresholds, structuring movement and sight. In confined passages, rows of disks, finger lines, and smears required contorted posture and physical

effort, inscribing difficulty into stone. These gestures were choreographed through proximity, framing, and repetition, and were inseparable from the postures that produced them.

Synthesis: Gestures, Perception, and the Embodied Self

When viewed together, the three case studies show both variation and convergence in the production and placement of embodied markings. At Ardales, downward-dragged handprints and recurrent triplets of dots or lines emphasise tactile intimacy and repetition. At El Castillo, the emphasis is on visual framing: disks and finger dots accentuate speleothems, creating symmetry and focality in deep chambers. At Pech Merle, markings articulate a duality between public panels and private recesses, where postural effort was integral to emplacement. Each site, therefore, highlights different aspects of engagement—intimate repetition, visual framing, and postural work—yet all are united by a shared concern with gesture, placement, and the transformation of subterranean space.

These patterns align closely with theoretical perspectives introduced earlier. Body theory suggests that markings were not only technical but embodied actions, carried out with learned bodily techniques (Mauss 1992 [1935]; Merleau-Ponty 1962). At Ardales, the repeated triplets of dots or lines reveal routinised gestures, learned and reproduced as part of a shared repertoire. At El Castillo, the precision of disk framing reflects a mastery of projection and placement, while at Pech Merle, the contorted bodily postures required to produce markings in Combel highlight the corporeal strain of gesture in confined space. In each case, the body was both the medium and the message: techniques of spraying, pressing, and dragging inscribed

socialised forms of bodily action into stone.

From a comparative perspective, the case studies also underline the chronological depth of these practices. Absolute dating shows that projected disks and sprayed surfaces could belong among the earliest phases of cave marking (Pike et al. 2012; Hoffmann et al. 2018), and at both El Castillo and Pech Merle

red embodied markings sometimes underlie later figurative images. Elsewhere, the non-figurative repertoire often stands apart from animals, forming a self-contained practice rather than a subsidiary one. This separation underscores their deliberate, choreographed character.

Gestalt principles (summarised in Table 1) help explain the perceptual structuring of these gestures. At El Castillo, figure-ground contrasts and symmetry made disks and stencils visually salient. At Ardales, similarity and proximity grouped finger marks into coherent sets, while at Pech Merle, continuity and focality guided gestures along cracks and into concavities. The convexity principle appears inverted, as stencils at El Castillo and disks at Pech Merle were often placed in hollows. Connectedness is also evident in combined motifs, such as disks paired with stencils or lines.

The comparative data further emphasise this structuring. Across all three sites, markings recur at transitional points—thresholds, junctions, concavities, and edges—positions that are consistent with liminal emphasis and route-structuring practices. Their repeated placement in sets (pairs, triplets, rows) and their clustering around salient features exemplify Gestalt logics of proximity, similarity, and focality.

Gestalt salience also links perception to movement. In darkness, the hand followed the ridge of a drapery or the edge of a concavity, and the eye later followed the same curve, guided by the placement of marks. Touch and sight converged in shared rhythms of perception. Even if makers were not consciously applying ‘rules’ of perception, they engaged bodily with features that naturally lent themselves to visual and tactile organisation. This reinforces the argument that embodied markings were choreographed—not incidental but intentionally structured to stand out, be grouped, and endure in memory.

Across the three caves, three recurrent pattern-families emerge from the coded comparisons. (1) Relief targeting: embodied markings disproportionately occur at edges, hollows/concavities, cracks, and speleothem contours, rather than on planar wall fields (El Castillo disks and stencils; Ardales dots/lines; Pech Merle disks/lines). (2) Seriality and clustering: repeated gestures are rarely isolated; they recur as clusters, rows, and small sets (pairs/triplets) that create local concentrations and rhythm (notably Ardales triplets; Pech Merle ceiling rows; El Castillo disk groupings). (3) Visibility as episodic: placement repeatedly privileges surfaces that become salient under raking, moving light (relief + contrast), implying that ‘what is seen’ is contingent on distance, viewing angle, and movement in the cave. These findings do not require assuming fixed ‘Gestalt rules’ for Palaeolithic minds; they are comparative regularities in placement and grouping that can be described consistently across sites and evaluated against alternative explanations (chance accumulation, taphonomic loss, or recording

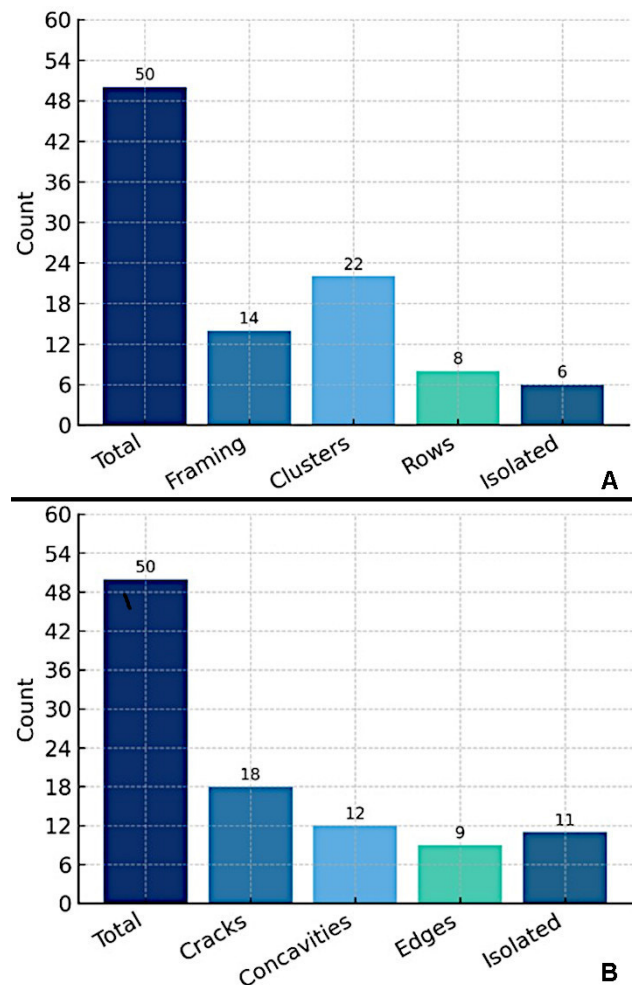


Figure 16. A) Interaction of sprayed disks at Combel, showing the frequency of framing, clusters, rows, and isolated examples. B) Interaction of finger dots and lines at Pech Merle with cracks, concavities, edges, and isolated surfaces.

bias).

The case studies demonstrate that embodied markings operated at the intersection of body and perception. They were bodily gestures made with learned techniques, yet also perceptual configurations choreographed to engage both hand and eye. Across sites, the homogeneity of certain practices—marking edges, framing concavities, repeating triplets—suggests a shared visual grammar, while local emphases (repetition at Ardales, framing at El Castillo, tactile strain at Pech Merle) reveal distinctive rhythms of practice. All demonstrate the same underlying logic: that embodied markings extended parts of the self into the cave, where they remained visible, tactile, and memorable. These patterns set the stage for a broader discussion of embodied placemaking and the cave as a biographical space.

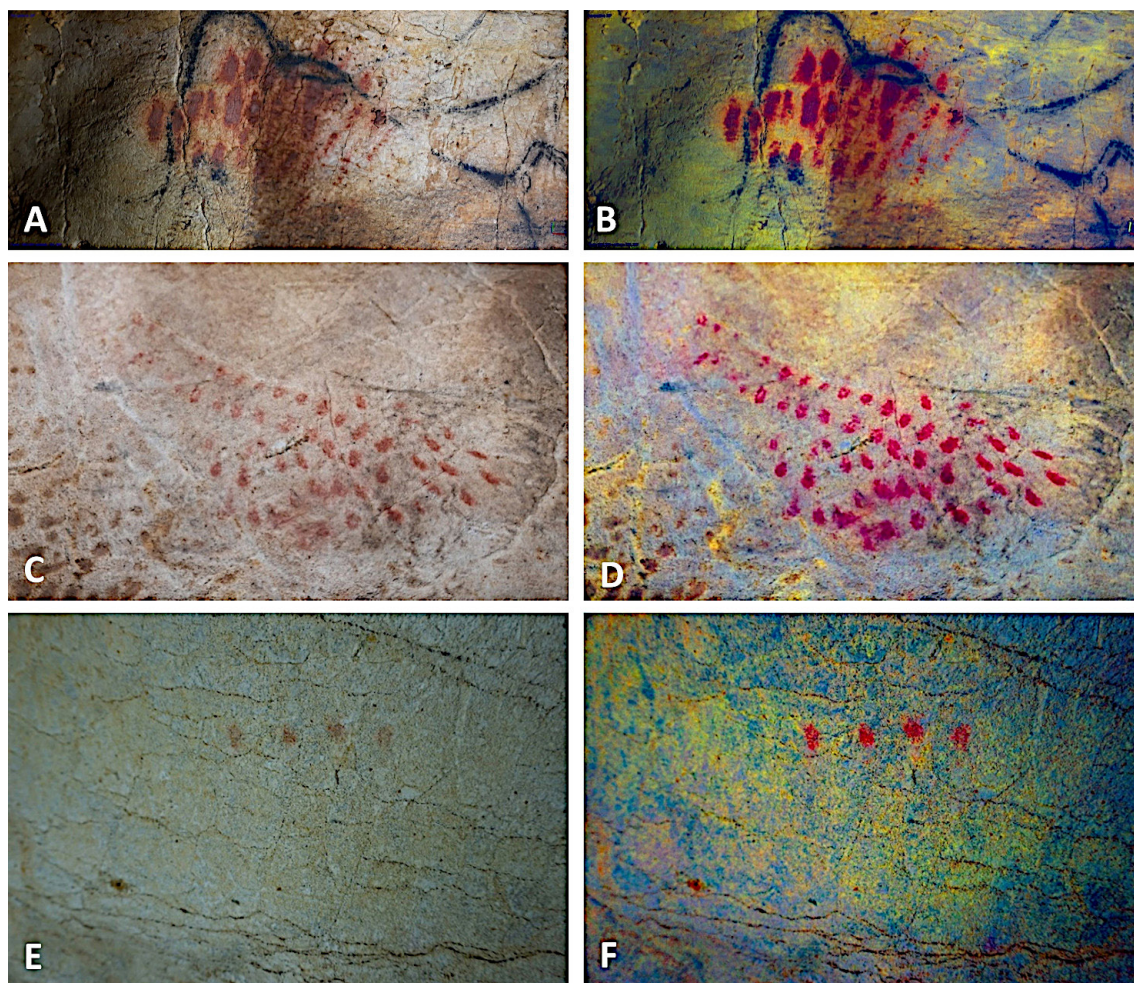


Figure 17: A) Combination between smears, finger dots and finger lines at Black Frieze (original image under natural light). B) Image enhanced with DStretch filter LDS. C) Grouped finger dots at Ossuaire (original image under natural light). D) Image enhanced with DStretch filter LDS. E) Finger dots at Combel (original image under natural light). F) Image enhanced with DStretch filter LDS (Oosterwijk 2023).

Discussion: Embodied Placemaking and the Cave as Biographical Space

Operationalising body theory

The embodied nature of non-figurative markings underscores that Palaeolithic people were acutely aware of themselves as actors of their own bodies. When a hand was pressed against stone and pigment sprayed over it, the maker produced a clear bodily outline that could be recognised as a hand, and when fingers traced cracks or dragged across calcite, tactile feedback would have been immediate. These acts suggest a reflexive awareness of the self as both agent and template. The body was not merely a biological tool but a cultural medium: its techniques were learned, shared, and practised within social contexts. Some gestures—such as mouth-spraying to produce disks or stencils—would have required training and repetition, while others, like pressing palms or dragging fingers, involved deliberate choices about which parts of the body to mobilise. The consistent use of palms without fingers for prints, or repeated series of three dots and three lines, highlights conventions transmitted

through shared practice.

Yet the body is not only individual but social. As Mauss (1992 [1935]) and Bourdieu (1977) argued, body techniques are acquired through socialisation and habitus. Through such learned practices, hand stencils, dots, and smears were more than marks: they materialised shared bodily repertoires. The use of the body as a template also raises questions about selfhood and identity. Hand stencils and prints are literal extensions of the body, but once deposited on cave walls, they became detached and autonomous. In this sense, they resonate with theories of partible and extended personhood (Strathern 1988; Mauss 2002 [1925]; Malafouris 2008; 2013). Just as gifts in Melanesian exchange systems embodied parts of persons and circulated fragments of identity, so too did hand imprints and sprayed pigment detach aspects of the self into subterranean surfaces. Some even carried bodily substance—saliva from mouth-spraying—although whether people recognised this transfer remains uncertain. What matters is that these traces endured beyond the moment of their making, imbued with

their own agency as materialised fragments of persons.

Caves as liminal spaces, markings as liminal agents

The settings of these gestures amplify their significance. Caves are inherently liminal: thresholds between light and dark, surface and depth, known and unknown (van Gennepe 1960 [1909]; Turner 1969; Bjerck 2012). Within them, this liminality was heightened by transitions between chambers, constrictions, and hidden recesses. The placement of embodied markings consistently highlights such thresholds. At Ardales, dragging handprints appear in the Camarín, the most inaccessible space; at El Castillo, disks concentrate in deep chambers, framing speleothems; at Pech Merle, stencils and disks occur both on central panels and in cramped galleries that required crawling.

By marking transitional surfaces—columns, draperies, concaves—these gestures can be read as marking and mediating thresholds (Westerdahl 2005; 2009; Horn 2018). They carried the human body, symbol of the living world, into subterranean thresholds. Once detached, the marks themselves took on the role of boundary-crossers, mediating between worlds. This aligns with Malafouris's (2008) notion of the extended self: static images of the body can exceed corporeal limits and act in the world. In this sense, handprints and finger traces became enduring mediators between peripersonal and extrapersonal space, between visible and invisible domains (Groenen 1988).

Embodied placemaking

The cumulative effect of these gestures was to transform caves into storied places. Placemaking, refers to the process by which natural locales acquire meaning through memory, narrative, and human experience (Basso 1996; Casey 2001). In much of this literature, placemaking is framed in terms of symbolic appropriation or the gathering of histories, turning landscapes into cultural places (Tilley 2016b; Ingold 2000). Fleming (2007) describes placemaking as the process by which people attach meaning to locales; here, however, the body itself was the medium of inscription. This is where embodied placemaking diverges from earlier formulations: rather than meaning being conferred symbolically or retrospectively, caves were transformed directly through bodily traces impressed into surfaces. By leaving bodily traces—palms, fingers, sprayed pigment—people bound identity and memory into the cave. These acts were not only performative but durable: once made, they persisted, visible and tactile, long after the makers were gone.

Embodied placemaking also highlights the sensory dimension of caves. Movement in darkness demanded touch: fingers following cracks, hands gripping ledges, bodies crouching or crawling. The markings materialise this sensory exploration. They often occur at visibility's edge, where the passable and impassable meet, and where surfaces had to be felt rather than seen. Marks emerging from shadow or lining concavi-

ties materialised this boundary, turning darkness itself into an active element of the art. In this way, embodied placemaking extends placemaking theory into a tactile and corporeal register: the human body was both template and medium, leaving behind not abstract symbols but extensions of the self. Embodied markings did not simply decorate caves; they choreographed the sensory experience of moving through them.

Linking Gestalt with Personhood

Gestalt theory and theories of personhood may seem distinct—one grounded in perception, the other in social ontology—but they converge in embodied markings. Gestalt principles clarify how traces were grouped and made salient: clustered dots (similarity and proximity), framed disks (figure-ground and symmetry), combined motifs (connectedness), or striking placements (focal point and convexity). Personhood theories explain why they mattered: because they were fragments of selves extended into stone. The two perspectives meet in the recognition that perception is not separate from identity. To be seen, touched, or remembered is to exist. The perceptual salience of markings reinforced their biographical character: grouped dots, framed disks, and tactile smears were not only visible configurations but also durable presences of persons.

Embodied markings as biographical records

The case studies and theoretical frameworks allow us to view embodied markings as biographical records. Biography here does not mean narrative or name, but the durable trace of lived presence. Here, 'biography' is used operationally: repeated visits and bodily techniques leave durable traces that accumulate as a record of encounters with particular cave places (whoever the makers were), without requiring individual identification. Each imprint is a fragment of a life once enacted underground: a hand pressed against rock, a breath exhaled in pigment, a finger dragged down a calcite fold. Such gestures extend the self into stone, leaving perceptually salient, relationally charged residues that persist long after their makers.

In this sense, embodied markings merge the sensory and the social. They are structured to be seen and felt through Gestalt logics; they extend the self through distributed and partible personhood; and they transform subterranean thresholds into storied, biographical spaces. Through embodied placemaking, caves became archives of gestures—biographies preserved beyond the body.

Conclusion

This article has argued that non-figurative cave art—hand stencils, dots, disks, lines, smears, and sprayed surfaces—should be understood not as marginal but as central to Palaeolithic visual culture. By comparing Ardales, El Castillo, and Pech Merle, the analysis has shown how such traces were systemati-

cally placed, repeated, and framed, binding body and surface into durable configurations of presence. This reframes discussions of 'art origins': the first graphic expressions were not primarily figurative depictions but bodily acts of emplacement, revealing that the impulse to mark was as much about being present as about representing.

The integration of personhood theory with cave-specific perceptual description provides an interpretive lens anchored in comparative patterning rather than assumed meanings. Rather than treating Gestalt as a universal cognitive claim, this study uses a limited set of grouping principles as a descriptive vocabulary for recurrent salience effects under constrained illumination. The comparative analysis shows that embodied markings (i) cluster at relief-responsive affordances (edges, concavities, speleothem contours), (ii) recur through seriality (rows, clusters, and small sets), and (iii) are positioned so that visibility is often episodic—dependent on raking light, viewing distance, and movement. These patterns are the paper's results; they specify what requires explanation. Personhood perspectives help interpret how such traces can function as fragments of selves—divisible, relational, and extended into stone—while Gestalt-informed coding clarifies how these traces were structured to stand out, be grouped, and persist as perceptual cues. Together, these frameworks suggest that embodied markings were not random accretions, but practices organised around gesture, relief, and viewing conditions. This shifts debates about symbolism: meaning need not reside only in abstract representation, but can also emerge through the distributed, bodily, and perceptual dynamics of making.

In concrete terms, 'archives' and 'storied landscapes' here refer to cumulative, revisitable patterning. Hand stencils at thresholds, disks framing speleothems, and repeated sets of dots and lines create stable points of reference—returnable surfaces that cue movement (where to pause, turn, crawl, or look), attention (what stands out under moving light), and relation (encountering prior traces and placing new ones alongside them). Through embodied placemaking, these traces helped structure cave space as a landscape of remembered routes and focal points, where later visitors could recognise prior traces and situate their own actions in relation to them. This perspective matters not only for understanding *Homo sapiens* but also for ongoing debates on Neanderthal creativity: if even the most minimal traces carry biographical and perceptual weight, then the boundary between symbolic 'art' and embodied action becomes more porous, inviting us to reassess what constitutes symbolic behaviour across species.

Future research combining pigment analysis, direct dating, and experimental replication will further clarify how these gestures were performed and experienced. For now, the evidence supports a narrower conclusion: across three caves, embodied markings

recur in patterned ways—targeting relief, appearing in series, and becoming visible in flashes as light and bodies move—suggesting practices that made presence durable and re-encounterable underground.

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