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RESEARCH

The Knossian Kamares Style as Transgenerational Memory

Emanuele Prezioso[1,2]

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Abstract

This paper introduces a new perspective on the constitutive role of material culture for memory using the Knossian Kamares pottery style as a case study. It challenges prevalent approaches in mainstream memory studies, which confine memory to individuals' brains or minds, suggesting a deeper relationship between material culture and memory. Presenting a novel methodology rooted in cognitive archaeology to study the long-term making of Knossian Kamares decorations, I suggest that the Knossian Kamares pottery style is a transgenerational memory that enabled generations of artisans to remember, learn, and update technological skills and knowledge. I also claim that, in assuming this distributed, enactive, and non-representational stance on style as memory, it becomes evident that remembering is something we do: an active engagement that emerges *with* and *through* material culture in specific sociomaterial settings.

Keywords Memory · Material culture · Minoan archaeology · Material engagement theory · Style

Introduction

Memory shapes actions, thoughts, and feelings about ourselves and phenomena in the world (Tulving, 2002). It binds together our temporally scattered experiences and supports cognitive functions such as learning, imagination, creativity, and problem-solving.

Disciplines such as philosophy, psychology, and archaeology have produced frameworks and explanations of what memory is and how remembering works. According to those frameworks, remembering is the ability to retrieve previously stored information in memory. A handful of these studies suggest that, beyond studying the brain, considering things, places, or practices can provide valuable insights

✉ Emanuele Prezioso
Emanuele.prezioso@arch.ox.ac.uk

[1] Keble College, University of Oxford, Oxford, UK

[2] School of Archaeology, University of Oxford, Oxford, UK

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into how individuals remember and how knowledge is preserved over time (Connerton, 1989; Pauketat & Alt, 2003; Rowlands, 1993). Some even propose a deeper connection between memory, material culture, and people (Hutto & Peeters, 2018; Jones, 2007; Tribble & Sutton, 2012). Despite numerous frameworks and theories focusing on the effect of things on memory and remembering, the relationship between memory and material culture remains a source of debate.

Material engagement theory (henceforth, MET; Malafouris, 2013, 2019) offers fresh perspectives on these debates. MET contends that cognition, including memory, is situated in a sociomaterial context made of people, things, and practices and emerges whenever we engage *with* and *through* things. Building on this approach, I suggest that material culture *constitutes* memory, highlighting that things are not just triggers for remembering but the very essence of *how* we remember.

To explore these ideas, I examine the Minoan Kamares pottery style from the Cretan site of Knossos (Middle Minoan IB–Middle Minoan IIIA, ca. 1925–1700 BC).[1] Renowned in Aegean archaeology for its remarkable variety of shapes and decorations, this polychrome pottery style showcases the inventiveness of artisans in crafting these vessels and serves as an apt example for investigating the processes through which technical skills and knowledge continued and changed over time. Through a detailed study of the creation processes documented through directly observing the traces of making practices, I demonstrate that the Knossian Kamares style was a *transgenerational memory* that allowed artisans to remember, learn, and update their predecessors' technical skills and knowledge whenever they made novel vessels in this style. Therefore, remembering is *re-enacting: something we do* with *and* through *things*.

Memory and Material Culture

Mainstream theories in psychology have approached memory as a universal phenomenon (*e.g.* the multistore model by Atkinson & Shiffrin, 1968) or have focused on specific memory types (*e.g.* working memory, Baddeley, 2010). Contributions to understanding memory date back to Greek philosophers, including Plato and Aristotle (Bernecker & Michaelian, 2017), and continue with modern philosophers such as Hume (1999) or Bergson (1910). Besides psychology and philosophy, other academic fields contributed ideas and frameworks, including archaeology (see review by Van Dyke, 2019).

Despite their diverse approaches to memory, these disciplines generally share at least one of the perspectives in cognitive neuroscience. They see memory as (1) the neurocognitive capacity to encode, *store*, and retrieve *information*; (2) a hypothetical *store* in which *information* is held; (3) the *information* in that *store*; (4) some property of that *information*; (5) a componential process of retrieval of that *information*;

[1] My use of the term Minoan here follows Betancourt's (1999), who defined it "in terms of its general material culture and in terms of its approach to visual symbolism (…) on seals, pottery, and other objects" (p. 33). For the origins of this term, see Karadimas and Momigliano (2004).

and (6) memory as an individual's phenomenal awareness of remembering something (Tulving, 2000, p. 36). Although they vary slightly, all these perspectives agree on one central idea: memory seems to be a storage for information that can be recalled later on. However, I argue here that, if memory is crucial in our day-to-day lives, it is because it organises how we think and act according to the sociomaterial contexts where we remember. To better understand memory and remembering, it is crucial to account for the different varieties of material culture that populate past and contemporary environments.

Below, I draw attention to how studies in psychology and archaeology have considered the impact of material culture on memory and remembering by highlighting two fundamental assumptions of mainstream memory research: *localisationalism* and *representationalism*.

Localisationalism and Representationalism

As previously discussed, while mainstream theories vary, they commonly designate memory as storing information, an idea conveyed by philosophers and psychologists through various spatial analogies (Roediger, 1980). If for Plato and Aristotle memory comprised a wax block imprinted with sensory impressions (Agócs, 2019), Locke (1689) viewed it as a repository of objects located in an individual's mind. Penfield (1950) referred to the temporal cortex as the "*storehouse* of remembered experience" when demonstrating that stimulation of this area reactivated neural connections that triggered memories (p. 349, emphasis added). These theories typically locate memory somewhere within the mind or brain.

The corollary of this localisationalist perspective is the idea that remembering involves retrieving previously stored information encoded in *mental representations:* an internal code for types of information that represents (states, asserts) that something about the world is in a certain way (Marr, 2010; Newell & Simon, 1961; Ryder, 2009).[2] According to this "representationalist" view (De Brigard, 2014, p. 402), remembering is supported by mental representations which *pre-exist* recalling something from memory; an idea that holds true even for scholars that consider remembering a re-constructive process liable to distortions or failures (Bartlett, 1995; Loftus & Pickrell, 1995). In conforming to this view, the stimuli caused by interacting with a pot would code information about its shape, colour, or an event that happened in the past (*e.g.* when the archaeologist unearthed the vase). These different kinds of information are considered "types of memory" (Nelson, 1989, p. 130), each associated with specific brain areas (*e.g.* temporal cortex, Allen et al., 2020).

These mainstream studies underscore the longstanding philosophical and psychological localisationalist and representationalist views on memory (for a discussion, see Sutton, 2015). While valuable for studying individual memory, this perspective

[2] This informational stance on memory and remembering goes back to the introduction of the digital computer as a metaphor for the mind (Searle, 1990), underlining the Cartesian roots of cognitive neuroscience (for a discussion, Brette, 2022).

aligns with the Cartesian view, which separates the inner mental realm from the external world (Barandiaran et al., 2009; Ingold, 2010). In adhering to this position, material culture is external to the remembering process that happens inside an individual's mind or brain. Even when psychology acknowledges that there exists "some sort of a more complex interaction between stored information and certain features of the retrieval environment" (Tulving & Thomson, 1973, pp. 352–353), these views still contend that things are only cues for remembering information already stored in memory.

Considering memory a store for information in an individual's brain or mind excludes potential environmental contributions from explanations of what memory is and how remembering works (Christensen et al., 2019). If memory is confined within individuals and detached from the broader sociomaterial world, how do we remember how to act and think according to pre-existing social and cultural norms? If memories are located within us, they should cease to exist with the end of our biological life. Perhaps we should consider the possibility that memory involves more than internally stored information. This proposition demands a more contextual approach that considers the social and material dynamics of memory and remembering.

Of all disciplines, archaeology has always placed the sociomaterial context at the forefront when addressing its research questions, and recent research has begun to explore the interplay between the material remains from the past and the preservation of memory. I will explore these perspectives.

Symbols, Palimpsests, and Practices

Scholars interested in how past communities established their authority and produced social memory have explored how the enduring nature of things connects memory to material culture (*e.g.* Bradley & Williams, 1998).[3] Holtorf (1997) suggested that elites constructed monuments like megaliths with the intention of serving as prospective memories that encoded and stored information about their power and societal roles for the future. Donald (1991) similarly studied how material culture externalises memory,[4] functioning as "symbolic systems" that supported the evolution of human cognition (p. 252; also, d'Errico, 1998; Goonatilake, 1991; contributions in Renfrew & Scarre, 1998). He showed how writing systems such as the cuneiform evolved from simple pictograms to more developed forms that enabled people to record and elaborate increasingly sophisticated information (*e.g.* mathematical theorems).

Another prevalent assumption in the archaeology of memory is that archaeological deposits and their artefacts function as palimpsests, accumulating memory

[3] Social memory is defined here as "a collective notion (not an individual belief) about the way things were in the past" (Van Dyke & Alcock, 2003, p. 2).

[4] Cognitive scientists have also investigated how things, functioning like *aide-mémoires* can extend human memory. The study by Clark and Chalmers (1998) argued that a notebook can work as an external memory device that supports an Alzheimer's disease patient to remember events previously jotted down.

into superimposed layers (Bailey, 2007; Borič, 2010; Huyssen, 2003; Jones, 2007; Lucas, 2012; Olivier, 2011). Through continual processes of overimposition resulting from human and natural phenomena, these views assume that memory is not confined to the brain but inscribed and partially preserved into accumulated traces stored in things or archaeological deposits.

One last strand in archaeological memory research explores how the active use of material culture during communal activities produces memory and preserves traces of past actions (for anthropological antecedents, see Connerton, 1989; Rowlands, 1993). In these studies, sustained communal or individual activities leave traces on material culture that organise present and future generations' interactions among people, things, and practices (Henry, 2017; Joyce & Lopiparo, 2005; Knappett, 2010; Pauketat, 2001; for similar discussions on agency, actions, and structure, see Barrett, 2000). The construction of structures in pre-existing settlements (Pauketat & Alt, 2003) or the continual use of offerings (Williams, 2003) illustrate how activities associated with enduring things adapt the "past according to the needs of the present" (Van Dyke & Alcock, 2003, p. 3).

In exploring how memory was deployed in the past to sustain social groups, archaeology suggests that understanding memory requires observing how our interactions with material culture impact remembering. Memory is, therefore, a process that happens in practice and extends beyond the individuals' timescales conventionally studied. On the other hand, in implicitly accepting the general definition of memory as a process of encoding-storing-retrieving information, these views reiterate some of the localisationalist and representationalist drawbacks. I emphasise two downsides that limit the joint study of material culture and memory.

First, in suggesting that monuments and artefacts are repositories of social memory, this cognitive capacity remains a storage for information. When palimpsests are seen as the accumulation of changing traces imprinted by their histories of uses and depositional processes updated and reinterpreted to respond to present needs (Olivier, 2011), it is the information preserved in these traces that is central in recalling the past.[5] This locationalist view reiterates the separation between inside and outside discussed above. Second, by assuming that memory is stored information, remembering is still the manipulation of information. Even though repeated practices are central to reproducing social memory, the content of what is to be retrieved is defined a priori by the social group, which dictates how and what is to be remembered. This representational stance underscores how practices, techniques, and social skills partake in remembering. Considering material culture in these terms limits explorations of how social and material contexts uniquely constitute memory and remembering.

Contrarily, when discussing the findings on the Knossian Kamares style, I will argue that memory is helpful in organising how we act and think because of its capacity to adapt in the present sociomaterial context past ways of thinking and

[5] It is worth mentioning that Olivier's (2011) emphasis on the role that present actions and surviving materials have in shaping memory aligns closely with this and previous contributions on memory and remembering (Prezioso & Alessandroni, 2023).

of acting. To present this view of *memory as a process unfolding in practice* with *and* through *material culture*, it is essential to view memory not as information preformed in the mind but as *performed* in the world. Understanding memory necessitates accounting for its *situatedness* (James, 1892; Leontiev & Luria, 1972; Malafouris & Koukouti, 2018): the *where* and *how* of memory and remembering. Below, I argue that MET provides solid theoretical foundations for addressing the situatedness of memory and understanding its relationship with material culture.

Thinking *With* and *Through* Things

The MET is a framework committed to a view of thinking "as a process that is profoundly embodied, situated and softly assembled from a variety of non-localisable mental resources (neural and extraneural) and skills spanning the boundaries of the individual brain and body" (Malafouris, 2014a, p. 144). Things and minds are ontologically inseparable entities in a constant state of change (Gosden & Malafouris, 2015). Therefore, for MET cognition is not located somewhere in individuals' insides. Nor is it something that has to do with mental representations. As Malafouris (2004) argues, humans *"think through things, in action, without the need of mental representation"* (p. 58, emphasis in the original). It follows that thinking is *thinging*: "the act of thinking and feeling *with*, *through*, and about things" (Malafouris, 2014b, p. 11, emphasis in the original).

From this angle, cognition is not reducible exclusively to information *about* something in the world. Thinking and acting are constituted *with* and *through* things in specific sociomaterial contexts, tying together people, things, and practices at different temporal scales of interaction (Gosden & Malafouris, 2015; Malafouris, 2015; Overmann & Wynn, 2019). These scales are the transgenerational unfolding of archaeological styles (Gosden, 2005; Kanezaki & Omori, 2022), the life-history of an object or archaeological assemblage (Gosden & Marshall, 1999), the developmental lifespan of a single individual, and the phylogenetic trajectory of our species (Coolidge & Wynn, 2018).

Because of its pragmatic and relational stance on cognition, MET has the potential to reconcile the study of memory with that of its context. Discussions on the *situatedness* of cognition and the process of *enactive signification* are particularly useful to ground my characterisation of memory and remembering.

The *Situatedness* of Cognition

By claiming that human cognition is *constituted by* extracranial bodily processes and material artefacts, MET suggests that to understand cognition, we must consider the *situated environment* where cognitive faculties happen—what I have previously referred to as the *sociomaterial context*. Taking sociomaterial contexts into account involves considering "not only the individual brain and body, but other people and groups, the physical environment, social interaction, cultural norms, artefacts and technologies" (Sutton, 2015, p. 416). However, we should refrain from viewing the

different elements within a sociomaterial context as isolated entities. On the contrary, they should be analysed as active participants in shaping people's thoughts and actions within a situated context.

Casati (2021) offers a practice-based explanation of drawing that exemplifies the situated perspective I am presenting here. Through examples of drawing architectural or landscape features from life, such as pipes on the walls in a conference room, he contends that "when tracing the second line, your action and your perception are coordinated in real-time" (p. 4). If action and perception emerge while drawing, it is because tracing the second line results arises from a combination of environmental factors: Casati's body, neuronal processes, the initial line on the page, the pencil in his hand, his drawing technique learnt over years, and the pipes in the room. These bodily and extrabodily elements, part of the situated sociomaterial context, come together to allow the second and subsequent lines to be traced.[6] These elements do not serve Casati as mere informational resources (*e.g.* pipes do not contain any information on how he should draw them). Instead, the whole sociomaterial context organises the actions and thoughts that he requires to draw the lines that will reproduce the pipes on paper. This example supports the idea that "the unit of analysis for cognition must be extended beyond the individual in order to accommodate broader cognitive events that include facts, space, and time" (Hutchins, 1995, p. 67; Sutton, 2015; Tribble & Sutton, 2012).[7]

Therefore, when it comes to appreciating the relationships between the situated context and memory, MET supports my aim of considering material culture alongside their practices of use or making, which is essential for memory.

Enactive Signification

The second concept that supports my exploration of the relationships between memory and material culture is termed "enactive signification" (Malafouris, 2013, pp. 91–118). This term refers to the capacity of things to bring forth meanings through our direct engagement *with* and *through* them, thereby becoming *material signs* (Malafouris, 2019).

For MET, enactive signification is the process of embodied "conceptual integration responsible for the co-substantial symbiosis and simultaneous emergence of the signifier and the signified that brings forth the material sign" (p. 99). According to this view, material signs do not "embody a 'communicative' or representational

[6] It is important to note that this example extends beyond procedural or body memory (*i.e.* memory that does not require the recollection of facts or events). As Casati (2021) elaborates in his paper, while drawing the pipes, he also recalls certain facts and feelings associated with them, such as their location in a conference room in Rio and the experience of being seated in that room, observing them.

[7] Recent ecological-enactive approaches in the cognitive sciences similarly emphasise the significance of considering the situated nature of cognition (Bruineberg & Rietveld, 2014; Di Paolo et al., 2017; Gallagher, 2017; Hutto & Myin, 2013, 2017; Hutto & Peeters, 2018; Michaelian, & Sant'Anna, A., 2021). For these studies, "the possibilities for action provided to an animal by the environment—by the substances, surfaces, objects, and other living creatures that surround the animal" are what structure thoughts and actions (Rietveld & Kiverstein, 2014, p. 327).

logic but an *enactive* one" (Malafouris, 2013, p. 90, emphasis in the original). Bartending students learn to associate the names of cocktails and the actions required to make them to the shape of glasses (*e.g.* collins, cocktail, rock, champagne) in the context of mixing drinks behind bars (Beach, 1993).[8] For them, a Collins glass does not simply stand for a Mojito. It is in engaging over time with shapes of cocktail glasses through the mixology practices learnt through individual readings and during hands-on sessions with their instructors that a Collins glass becomes a material sign for a Mojito and the mixing skills required to make one. In future engagements with this type of glass, and assuming that bartenders will continue to practice mixing drinks, they would associate the names of cocktails and practices required to make a Mojito.

As this example shows, meaning is not simply offloaded and stored in a glass, as Holtorf suggested for monuments or Donald for writing scripts. It is according to the process of enactive material signification that occurs over all mentioned scales of interactions (*i.e.* things' life-histories, transgenerational, developmental, and phylogenetic) that things assume specific values for people (Hutchins, 1995, p. 322; Malafouris, 2015). As argued elsewhere in discussing the theoretical implications of grounding memory and remembering in recent enactive, ecological, extended, embodied, and embedded cognitive studies, this perspective allows us to explore how things accumulate histories of interactions capable of bringing forth memories (Prezioso & Alessandroni, 2023, p. 11).

In what follows, I will explore my hypothesis regarding the constitutional role of material culture in memory, grounding it in the long-term making of the Kamares pottery style.

Memory and Remembering in Middle Bronze Age Knossos

With the beginning of the Middle Bronze Age in Crete, known as the Protopalatial period (MM IB–MM IIB, ca. 1900–1700 BC), a new pottery tradition characterised by lustrous black paint embellished with polychrome geometric and naturalistic decorations in white, yellow, orange, red, or purple emerges in several sites across the island (*e.g.* Malia and Myrtos Pyrgos: Poursat & Knappett, 2005; Kommos: Betancourt, 1990; Knossos: Macdonald & Knappett, 2007; MacGillivray, 1998; Palaikastro: Bosanquet & Dawkins, 1923; Petras: Haggis, 2012; Relaki, 2016; Phaistos: Baldacci, 2017; Levi & Carinci, 1988).

Commonly known as Kamares ware or style,[9] the surface of these vases exhibits its distinctive combinations of lines, dots, spirals, and diamonds intersecting or

[8] While Beach (1993) still works within the context of *action theory*, he acknowledged that environmental features are important in how they "guide the acquisition and flexible use of a number of potential mnemonic strategies during the process of becoming experienced" (p. 192).

[9] Originating from the cave where the first examples of this pottery were found (Taramelli, 1901), the term *Kamares* (Chambers in English) is still ambiguous today (Levi & Carinci, 1988; MacGillivray, 1986). Scholars have recently adopted the term *polychrome* (Macdonald & Knappett, 2007; MacGillivray, 1998). My usage of *Kamares style* in this article refers to a ceramic tradition found in Crete and the Mediterranean defined by the combination of white, yellow, red, orange, or purple geometric figures traced over a lustrous black or brown-reddish slip.

enclosing stamped spirals or clay appliqués. The Kamares style stands out for its use of polychromy and the remarkable diversity in how artisans combined shapes and decorations to produce always distinct pots. As noted by Knappett (2008), scholars have long recognised that "Kamares ware is so variable that no two vases are ever quite the same in shape and decoration" (p. 122; see also, Betancourt, 1985; Levi & Carinci, 1988; Walberg, 1978).

These distinctive visual qualities have attracted scholarly attention since the early twentieth century (Hogarth & Welch, 1901; Mariani, 1895; Myres, 1903; Pernier, 1935; Taramelli, 1901), when Mackenzie (1903, 1906) and Evans (1921, 1928, 1930, 1935) used ceramic findings from Knossos to establish a chronological framework for the Minoan civilisation. Later studies rooted in art historical approaches examined the stylistic aspects of Kamares pottery (*e.g.* Andreou, 1978; Mackenzie, 1903; Matz, 1928; Zois, 1968).[10] Influential works by Walberg (1976, 1978), Levi and Carinci (1988), and MacGillivray (1998) have contributed to understanding and classifying this unique pottery tradition.

Grounded on Matz's (1928) and Furumark's (1941) structural studies on the relationship between the shapes of vessels and their decorations (Washburn, 2022 for a discussion on structural studies), Walberg (1976) adopted a stylistic approach to categorise the Kamares pottery into four relative periods: Pre-Kamares, Early Kamares, Classic Kamares, and Late Kamares (pp. 14–82). However, archaeologists found Walberg's categories too abstract to describe the diversity and creativity of the archaeological data (Levi & Carinci, 1988; MacGillivray, 1986; Momigliano, 2007). Levi and Carinci (1988) and MacGillivray (1998, 2007), while more attentive to the diversity of the Kamares, similarly produced typologies arranged across time according to their similarities in forms. MacGillivray also classified similar decorative patterns into styles and dated them to the same period, as exemplified by the *Woven Style* (Fig. 1) decoration traced on vases dated MM IB or IIA. Other recent works, such as those by Baldacci (2017), Caloi (2009), Carinci and La Rosa (2007), Girella (2010), and La Rosa and Carinci (2009), have followed a similar approach.

These studies have examined Kamares from a stylistic perspective, creating standardised typologies like the *Woven Style* and linking them to specific chronological periods from simpler to more complex forms. While offering an outline of the progressive stages and a reliable chronological framework for comparisons across Cretan sites, this taxonomic approach falls short of capturing the diversity exhibited by the excavated material (for a discussion, see Sørensen, 1997, 2015).[11] This approach leaves questions unanswered regarding the role that sociomaterial contexts

[10] The roots of this stylistic approach are grounded in art historical studies on attribution and connoisseurship (Morelli, 1892; Neer, 2005; Wollheim, 1973). For these views, shared visual attributes of artworks are useful to produce referent categories about individual styles, such as Rembrandt's *œuvre*, or general artistic movements like Cubism (Walton, 1970). Archaeologists, less interested in individual attributions (but see Hill & Gunn, 1977; Morris, 1993), adopted style to identify or create archaeological cultures (*e.g.* Graves, 1998; Plog, 1980) or produce relative and absolute chronologies spanning individual sites or whole regions.

[11] Recent critiques of typologies and style have challenged the taxonomic approach of style from a relational perspective that observes how types emerge from their spatial association rather than according to their aesthetic qualities (Boozer, 2015; Fowler, 2017; Jones, 2007; Van Oyen, 2015; Zedeño, 2009).

Fig. 1 Example a cup in MacGillivray's (1998) *Woven Style* from the "NW Kamares Area" (KWM115). Courtesy of the British School at Athens, photo by the author

have in driving the tension between stability and change in the Kamares pottery over time. By tension, I refer to the fact that, while each vessel stands out due to how artisans traced decorations on different shapes, they also share certain visual attributes. This tension is not exclusive to the Kamares style but is intrinsic to the notion of style used in archaeology, as shown by discussions on styles from other periods and geographical contexts (*e.g.* Garrow & Gosden, 2012; March, 2021).

Recent technological studies partially challenged stylistic approaches (Day et al., 2006; Day & Wilson, 1998, 2002; Faber et al., 2002). These works, focusing on technical choices and practices, suggest that the Kamares style was embedded in a broader tradition involving "the raw material sources and the past recipes used by some potters in Central Crete from the Prepalatial, through the First Palace periods and into the Late Bronze Age" (Day & Wilson, 1998, p. 355).[12] They also illustrate that this tradition extended to consumption practices, requiring artisans to produce fine pottery, such as the Kamares, as evidenced by the remains of communal events in the Knossian deposits (Day et al., 2006, p. 59). These findings imply that both practices and sociomaterial contexts contribute to the tension between change and stability observed in the Kamares. They prompt a reconsideration of the role that the continuation of practices had for artisans' memory of skills and knowledge. To do so, I developed a methodology that accounted for material qualities and

[12] The Prepalatial conventionally refers to the Early Minoan I–Middle Minoan IA period (ca. 3500–2100 BC).

associated practices, which I present below before outlining my perspective on style as transgenerational memory and remembering as re-enacting.

Outline of the Methodology

Excavated by Evans, Mackenzie, and Pendlebury from 1901 to 1930, the pottery was partially published in MacGillivray (1998), Macdonald and Knappett (2007), and Mathioudaki (2018). For this study, I examined 788 fragmentary and reconstructed examples chosen according to a representative sampling approach. I selected only pieces with a black lustrous or semi-lustrous slip adorned with decorations outlined in white and, crucially, at least one additional colour, such as yellow, orange, red, or purple; my definition of the Kamares style. Fragments from the same vessel were counted only once and recorded together in a database developed for this study.

My examination consisted of direct macroscopic analyses of throwing and decoration-making techniques discernible from the direct observation of the material. I traced connections among the pots in the assemblage to understand how previous creations contributed to the making of later ones to unveil the underlying dynamics behind the tension between stability and change. Though I do not suggest studying decoration and shapes separately, for the purpose of this paper, I will concentrate on the long-term making of decorations as it offers faster rates of change and insights into what happens when we explore memory beyond individual timescales.

To study the long-term making of decorations, I adopted a bottom-up approach involving the observation and comparison of surface decorations. I gathered information on various aspects of the making process, including the techniques employed (*e.g.* stamping), the tools utilised (*e.g.* paintbrushes), the gestures executed (*e.g.* circular or linear), the direction of these gestures, and the interactions between different decorative elements, what I termed *geometric units*, *motifs*, and *compositions*. The terminology used, although derived from structural approaches in ceramics, is stripped of any theoretical or methodological association with linguistic metaphors (as in Van Berg, 1994; Gardin, 1978; Plog, 1980; Shepard, 1956). Rather than viewing ceramic decorations as a grammar-like system to explain the degree of interaction between groups or the information they signal, my terminology aims to understand the relationships among decorations, gestures, techniques, tools, and raw materials. This perspective, based on the theoretical discussions in cognitive sciences mentioned above, gives insights into memory by acknowledging the contribution of material culture in remembering over time.

Geometric units refer to the elementary polychrome geometric shapes traced by Minoan artisans. This includes considerations of the pigments chosen, the techniques applied, and the tools adopted in the making. These shapes encompass a range of colours, such as white, yellow, orange, red, and purple, and take various forms: horizontal, oblique, arrow-shaped, S-shaped, or U-shaped lines, circles, spirals, diamonds, triangles, and petals. Artisans employed diverse tools like paintbrushes, sponges, blades, and clay stamps, adopting painting, stamping, impressing, incising, excising, and spraying techniques. Two examples among the 143 geometric

Fig. 2 Restored rounded spouted-jar (KWM342) from the "Area South of the Area of the Spiral Fresco 137A". Courtesy of the British School of Athens, photograph by the author

units identified in my analysis are the *Dot - Medium White* and the *Two Line – Horizontal Medium Red*, as evidenced in the rounded spouted-jar in Fig. 2.

Coherent sequences of geometric units come together to form *motifs*, such as the *Foliate band - Stamped W(hite) with lines R(ed) R(red)*, which results from combining several *Line - Arrow-shaped stamped Medium W(hite)* and *Line – Horizontal Medium R(ed)* units. This motif is one of the 328 documented within the assemblage. In this case, geometric units are integral components of a chronostratigraphy of skilled actions: a sequence in which one unit, with its specific skills, choice of raw materials, technique, and tools, follows another to create something in line with the existing Knossian Kamares motif repertoire. I documented this chronostratigraphy

of geometric units as it could be observed from their superimposition. This methodology enabled me to reconstruct the choices made by Minoan artisans in terms of tools, raw materials, skills, and techniques to adopt when tracing a motif. Motifs also provide insights into whether these movements were executed discontinuously or continuously, including considerations about vessel rotation (as discussed by Roux, 2019, p. 104). For instance, in the bridge spouted-jar depicted in Fig. 2, we observe a continuous motif in the making of the *Foliate band - Stamped W(hite) with Lines R(ed) R(red)*.

Finally, *compositions* denote the spatial arrangements of motifs on a single pot. I observed and documented 350 compositions, aiming to understand the making processes that potters employed. I recorded the motifs' locations in specific areas of the vessel, such as the rim, neck, body, base, or bottom, or, when covering more areas, combinations of these (*e.g.* body-base). Motifs were then linked to one another based on their spatial placement. For example, in Fig. 2, a composition comprises of six motifs: on the rim, the *Dots running – W(hite) within lines W(hite)W(white)*, on the neck *Spiral running – Dot R(ed) and S-shaped lines W(hite)*, on the body the *Foliate band - Stamped W(hite) with lines R(ed) R(red)* enclosed within two *Dots running – W(hite) within lines W(hite)W(hite)*, and on the base *Two lines – Horizontal Medium W(hite)W(hite)*. These associations provide insights into "the range of motifs and design variation possible at a specific point in time" (Morris, 2006, p. 103), disclosing artisans' technical skills and practices in each period, their spatial perception, and the choices made during the making.

The application of this methodology has provided new insights into the long-term making of Knossian Kamares decorations and its related mnemonic dynamics. It is on these that I focus below.

Style as Transgenerational Memory

The re-examination of Knossian Kamares pottery suggests that style is more than the succession of stylistic attributes changing over time. It reveals a strong continuity in decorative forms, techniques, and skills that emerge in the decoration-making context.

Figures 3 and 4 illustrate the temporal distribution of all motifs through the Middle Minoan. Figure 3 shows the percentages of motifs not documented in earlier periods alongside overall motifs, while Fig. 4 provides the numbers of new and overall motifs. It is worth noting that in the graphs in Figs. 3, 4, 5, 8, and 9, the periods span from MM IA to MM IIIA (ca. 2100–1700 BC). My re-examination suggests that pottery conforming to the mentioned Kamares definition was found in MM IA or MM IIIA contexts, which might appear unconventional as the Kamares style is usually considered the hallmark of the Protopalatial period (Knappett, 2008; Walberg, 1976).

Moving on to the analysis of the long-term making of motifs, there is a key observation to be made: later motifs did not replace earlier ones as commonly assumed in typological studies of style. As indicated by the percentages in Fig. 3 and the number of motifs in Fig. 4, there is a strong continuity in motifs from one period

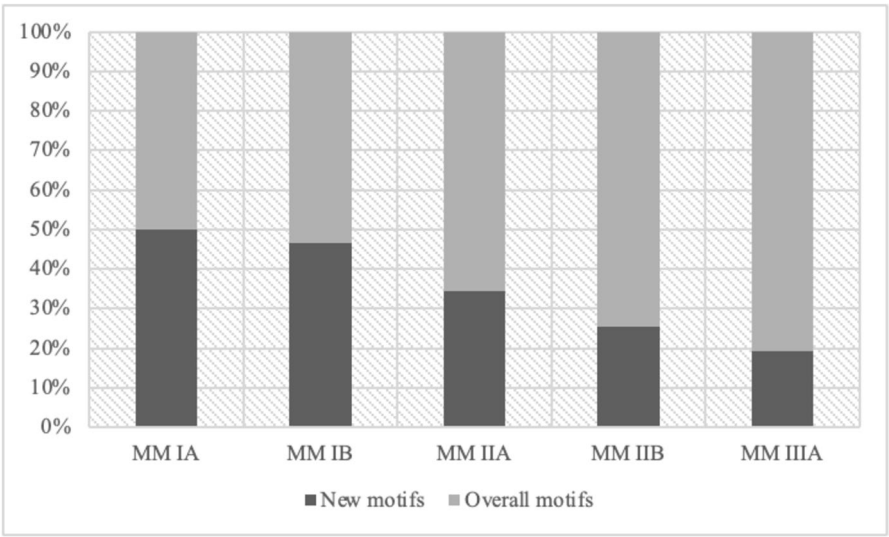

Fig. 3 Stacked bar chart presenting the temporal distribution with the percentage of overall motifs and new motifs introduced in each period from MM IA to MM IIIA

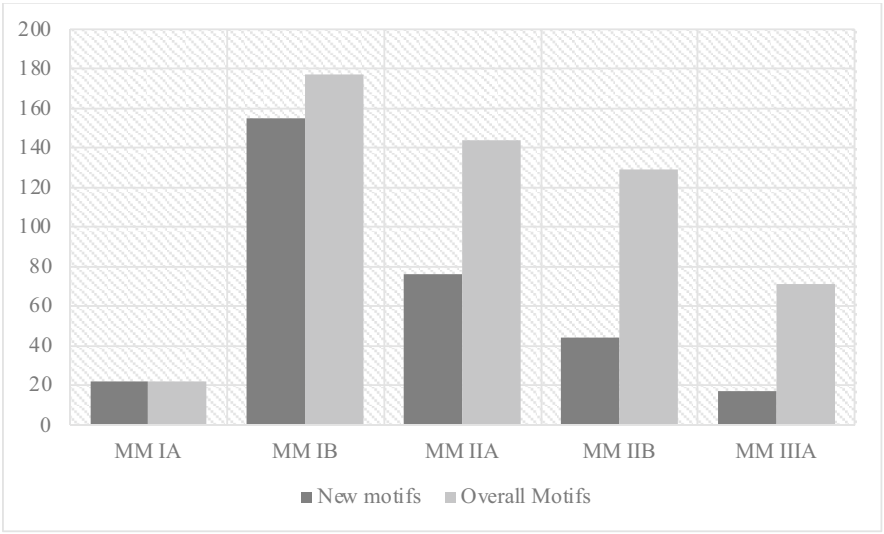

Fig. 4 Bar chart confronting the new motifs counted only once with the numbers of all geometric units from MM IA to MM IIIA

to another. I observed that all motifs that emerged in previous phases of the Middle Minoan continued to be traced but one, the *Petals – Oval R(ed) R(ed) inner W(hite)*. This permanence of past motifs into later periods is further emphasised by the continuity of geometric units, as illustrated in Fig. 5. These observations imply that once

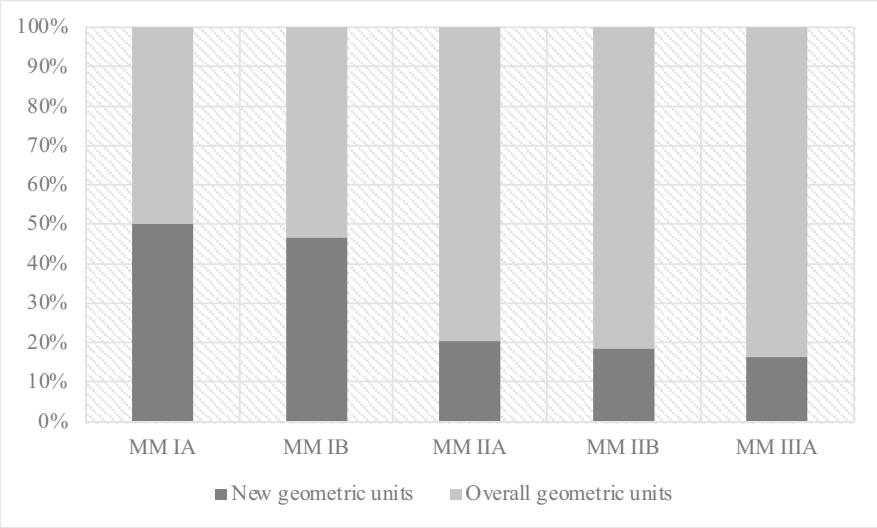

Fig. 5 Stacked bar chart with percentages of all geometric units and novel geometric units from MM IA to MM IIIA

Fig. 6 **a** Rounded bowl from "NW Kamares Ware Area" (KWM531). **b** Fragment of an angular cup with tall rims from the "SE Kamares Area" (KWM066). **c** Angular cup with tall rims from the "SE Kamares Area" (KWM063). Courtesy of the British School at Athens, photos by the author

a Kamares motif was traced, it became part of the Knossian Kamares style and persisted in later periods.

To illustrate this point, let us consider the examples in Fig. 6. The *S-shaped lines chained - Medium W(hite)* motif involves a discontinuous movement: a sequence of several concatenated *S-shaped line - Medium W(hite)* traced with a paintbrush and a white-chalk pigment. This motif is typically found within compositions alongside the *Two lines - Horizontal Medium W(hite) R(ed)* or one or more *Line – Horizontal Medium R(ed)* motifs and has been documented on ten pottery fragments from MM IB to MM IIIA (Fig. 6a–c). While most of these fragments are MM IB in date, as noted by MacGillivray (1998), it is worth mentioning that the *S-shaped lines chained - Medium W(hite)* motif continued to be traced during MM IIA and MM IIIA (Fig. 6b, c).

The continuity in the Kamares decorative forms suggests that the skills and knowledge required to trace the geometric units that give rise to motifs also endured over time. These findings align with the theoretical perspective discussed earlier, emphasising the inseparability of material forms and correlated practices in constituting memory.

Even when artisans were exposed to more recent motifs, they did not forget how to trace previous ones, as evident in the continuity illustrated in Figs. 3 and 4. The choice of which motifs to trace, and thus the memory of skills and knowledge required to trace them, was constituted by engaging with the existing corpus of Kamares decorative forms and the Minoan sociocultural context, which is only partially documented. This memory of skills and knowledge is distributed into varieties of motifs and embodied in the artisans, constituting how skills, knowledge, attitudes, and beliefs were remembered throughout generations.

This suggestion is reinforced by observing how artisans *aggregated* earlier motifs and geometric units to trace new ones, emphasising the continuity of decorative forms and correlated skills and knowledge. By *aggregation*, I refer to a process where Minoan artisans merged past motifs and geometric units to trace new ones. For example, the motif *Floral – Flower Petal O(range) Spiral W(hite)* (Fig. 7a–d), dating to MM IIIA, emerged as an artisan used a paintbrush to combine two or three *Spiral – Medium W(hite)* and a *Line – Petal O(range)*, both motifs documented in the assemblage since MM IIB. Alternatively, a variation of the same motif (Fig. 7b, d) could combine the *Spiral – Medium W(hite)* with several *Line – Oblique Medium O(range)*. In both examples, MM IIIA artisans aggregated previous motifs and geometric units to create something visually new: a motif incorporating past Kamares decorative forms and the associated skills and knowledge. As mentioned earlier, old motifs are not forgotten but recalled and adapted over time to create something new yet in line with the preceding tradition of Kamares decorative forms.

Examining the accumulation and aggregation of motifs reveals that the Knossian Kamares style did not follow a linear progression from simpler to more complex forms. Instead, this style accumulated decorative elements and the associated skills and knowledge, which were continually remembered, adapted, and updated. Let us consider two vessels, one from MM IB and another from MM IIIA, both featuring the same *S-shaped lines chained - Medium W(hite)* (Fig. 6a–c). As argued above, the continuity of this motif suggests that the practice of using a paintbrush with white

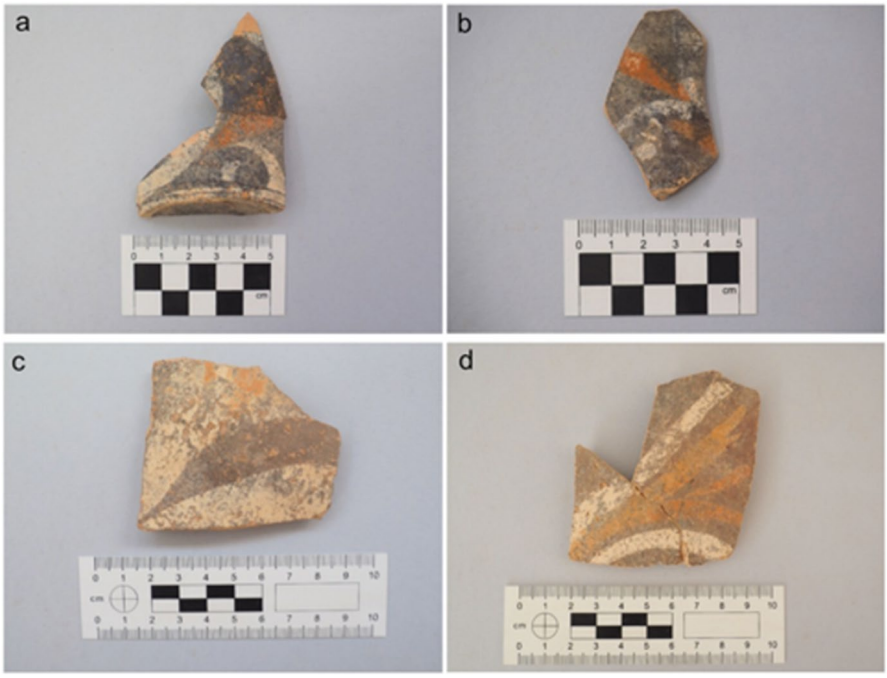

Fig. 7 Several examples and variations of the motif *Floral – Flower Petal O(range) Spiral W(hite)*, all dated to the MM IIIA. **a** Broad straight-sided cup from the "West facade T.P. I" (KWM552); **b** Straight-sided cup from the "House of Sacrifice East" (KWM433); **c** Fragmented jug from the "House of Sacrifice" (KWM550); **d** Possibly a jug from the "Test Pit 11 - West Square Kamares" (KWM768). Courtesy of the British School at Athens, photos by the author

pigment was not simply forgotten or discarded. The same argument holds for the *Floral – Flower Petal O(range) Spiral W(hite)* and the *Spiral – Medium W(hite) and Line – Petal O(range)* in MM IIIA (Fig. 7a–d). These examples illustrate that motifs and geometric units, with their technical skills and knowledge, continued to be part of the Knossian artisans' repertoire for generations, as supported by the continuity in decorative forms highlighted in Figs. 3, 4, and 5.

Considering the temporal accumulation and aggregation of motifs and correlated practices, I maintain that the Knossian Kamares style describes an enactive and non-representational type of *transgenerational memory*. This memory encompasses knowledge of tools and raw materials, technical skills, and beliefs, all of which are distributed in each Knossian Kamares vase. From this perspective, it becomes challenging to confine memory solely to the brain. Instead, we can conceptualise style as a memory continually (re)emerging in practice. For instance, if artisans could trace a *Floral – Flower Petal O(range) Spiral W(hite)*, it was because they had access to examples of Kamares vessels decorated with *Spiral – Medium White* and *Petal – Orange Oblique* motifs up to their periods (MM IIIA). Within this framework, memory practices, such as decoration-making, unfold in response to the demands of specific sociomaterial contexts (similarly,

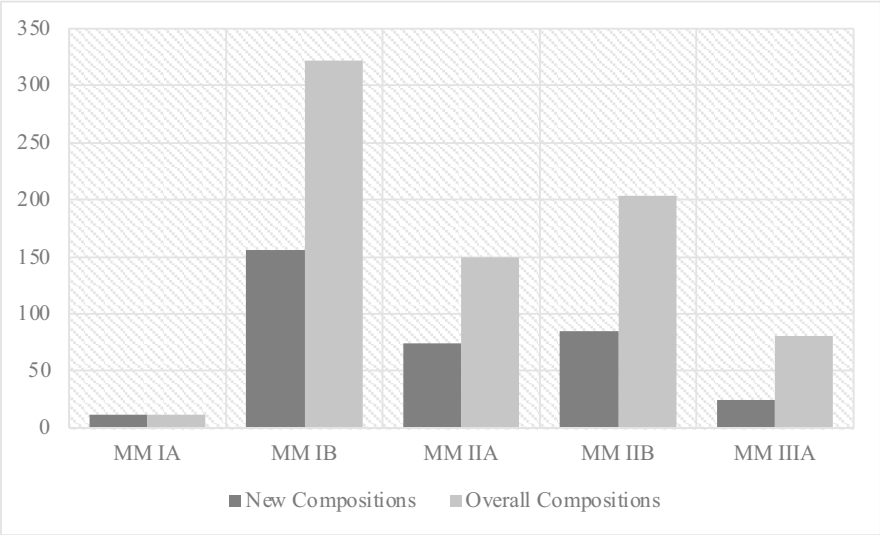

Fig. 8 Bar chart confronting the overall number of compositions with the numbers of compositions counted only once from MM IA to MM IIIA

Moyal-Sharrock, 2009; Sutton, 2015). Hence, the memory of skills and knowledge accumulated in the Kamares style was constituted *through* using, observing, making, and physically interacting *with* past vessels in the context of tracing the geometric units to draw a *Floral – Flower Petal O(range) Spiral W(hite)* or *S-shaped lines chained - Medium W(hite)*. Consequently, technical skills and knowledge developed across generations through a continuous engagement *with* and *through* the Kamares vases. It is the coming together of pots, practices, techniques, and skills made possible by the continual engagements with and through previous vessels by artisans that constituted the transgenerational memory of the Knossian Kamares style.

This proposition for style that emerged from the data analysis suggests that the impact of things on memory is more substantial than assumed in studies on material culture and memory. It confirms a theoretical proposal moved in a previous contribution (Prezioso & Alessandroni, 2023): the idea that the things that surround us and our ongoing interaction *with* and *through* them *constitute memory*. In assuming this stance on style and memory, my suggestion bears implications for how material culture partakes in remembering.

Remembering as Re-enacting

If we view style as a transgenerational memory distributed in things and people, remembering technological skills and knowledge goes beyond the activity of a brain. While remembering certainly involves the brain, it is inseparable from the body and the situated sociomaterial context. Hence, I argue that without the brain,

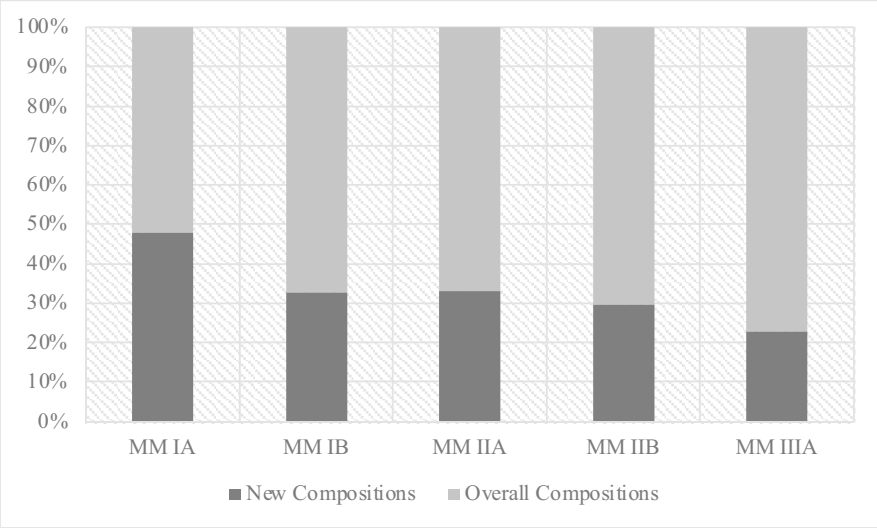

Fig. 9 Stacked bar chart of the temporal distribution with percentages of all compositions and new compositions from MM IA to MM IIIA

Table 1 A list of all the compositions that attested on more than eight vases in the assemblage

Compositions	Total
Three registers – Running Dots W(hite) R(ed), foliate bands, Running Dots W(hite) R(ed)	34
Lines oblique - O(range) W(hite) frieze with W(hite) O(range) O(range)	18
Wavy lines - Fishes R(ed) and little dots W(hite)	17
Lines oblique - W(hite) W(hite) O(range) O(range) W(hite) W(hite)	17
Curvilinear lines W(hite)W(hite)R(ed)R(ed)	16
Three registers – Semicircular line W(hite), Line O(range), Semicircular line W(hite)	15
Line horizontal O(range) over rounded neck	13
Spirals – W(hite) O(range) and two lines vertical thick-O(range) O(range)	11
Five oblique lines - W(hite) W(hite) O(range) W(hite) W(hite) O(range) O(range) + line oblique W(hite)	11
Vertical O(range) O(range) O(range) lines within W(hite) W(hite)	9
Three registers - Spirals running R(ed) and lines W(hite), Foliate band stamped with lines R(ed), Spirals running R(ed) and lines W(hite)	9

body, material culture, and the practices connecting them there would be nothing to remember. The example of Knossian Kamares compositions illustrates this proposal.

Figures 8 and 9 reveal that the data on compositions differ from the trends observed in the analysis of geometric units and motifs. Distinctive compositions emerge in each period, with only a handful continuing from one phase to the next. This observation gains further strength when we consider that, out of a total of 350 compositions, 214 have only one attestation, 57 two attestations, and

Fig. 10 Rounded cup from "West of West court - Middle Kouloura (2)" (KWM104). Courtesy of the British School of Athens, photo by the author

28 three attestations, which make up most of the compositions in the assemblage. Only eleven compositions are found on more than eight vases (Table 1), which is a representative number when it comes to observing patterns of continuity in making compositions.

Notably, the compositions listed in Table 1 are not exclusive to any phase; for instance, the *Three registers – Running Dots W(hite) R(ed), foliate bands, Running Dots W(hite) R(ed)* appears both in MM IIB and IIIA. Examples with the composition *Lines oblique - O(range) W(hite) frieze with W(hite) O(range) O(range)* are dated MM IB. These trends underscore the degree of creativity involved in making Kamares pottery, defined here in terms of variability in motif selection and their spatial arrangement on the surface of vessels. These observations support scholars' arguments regarding the idiosyncrasy of Kamares decorative forms (Betancourt, 1985; Knappett, 2008; Walberg, 1978).

Furthermore, the data indicate that this creativity in decoration-making did not arise from frequent changes in techniques, the introduction of novel geometric units, or different motifs. Figures 3, 4, and 5 show that motifs and geometric units persisted over time, even as compositions underwent constant change. When artisans traced Knossian Kamares motifs, they were not merely replicating past compositions and techniques (unless they intended to do so). Artisans adapted and modified

Fig. 11 Fragmented MM IIB bridge spouted jar from the "West square - East Kouloura (1)" (KWM117). Courtesy of the British School of Athens, photo by the author

their own and their predecessors' skills and knowledge to make pots reminiscent of others previously encountered, as visible in the decorative forms of the vases in Figs. 10 and 11.

The vases in Figs. 10 and 11 present respectively the *Running Dots W(hite) R(ed) with Stamped circles* and the *Three registers – Running Dots W(hite) R(ed)*, *foliate bands*, *Running Dots W(hite) R(ed)*. Both compositions feature the *Running Dots W(hite) R(ed)* motif but differ in the inclusion of two other elements: the *Stamped circles* and *foliate bands*. This example highlights that, when decorating a vessel, the rules governing interactions among motifs were not preformed but *performed* in action. Information regarding which motifs to select, techniques to employ, or actions to take to achieve a specific task was not recalled from an individual's memory. Every time artisans traced the lines required to draw a *Running Dots W(hite) R(ed)* motif, a foliate band, or stamped circles, *they were re-enacting the skills and knowledge distributed and accumulated through generations of previously made Kamares vessels, producing unique compositions*. My use of *re-enacted* here does not refer to internal thought processes manifested as mental representations subsequently imposed onto matter. Re-enacting a memory necessitates individuals to adapt

their thoughts and actions in accordance with the demands of the sociomaterial context at hand.[13]

These mnemonic dynamics can be observed in the variations of motifs, such as the *Floral – Flower Petal O(range) Spiral W(hite)* in Fig. 7a–d. As for the compositions themselves, their variations resulted from Minoan artisans re-enacting the transgenerational memory of the Knossian Kamares style when engaging in decoration-making. It was in the moments when the paintbrush touched the clay surface to draw geometric units, where the pressure of the artisan's hand encountered the smoothness of the black slip and clay, that the skills and knowledge accumulated in the Knossian Kamares style were instantiated and adapted to trace motifs and new compositions. Adaptations may have been influenced by an artisan's skills, prior experience with Kamares vases, inspiration from other styles of pottery or material culture, the availability of raw materials, or shifts in consumption patterns (Day et al., 2006; Day & Wilson, 1998). A similar observation has been recently suggested in the context of Palaeolithic cave paintings, where the execution of lines and choices in pigments and subject to trace were not random but the result of consistencies in gestures derived from histories of making parietal decorations (Fritz & Tosello, 2007; Malafouris, 2021). In these contexts, what allowed an artisan's thoughts and actions to be re-enacted within a specific sociomaterial context involved the coordinated efforts of both brain and body engaged in ongoing interactions *with* and *through* material culture.

Considering the above, re-enacting is the fundamental mnemonic process through which past modes of material engagement are instantiated and adapted to meet the demands of the present sociomaterial context (Malafouris & Koukouti, 2018; Prezioso & Alessandroni, 2023). Therefore, remembering is re-enacting: *something we do* with *and* through *material culture and people in a sociocultural context.*

This proposal for re-enacting raises a question about forgetting: what happens to transgenerational memory when styles disappear? As the Protopalatial ends, the Kamares style leaves room for new styles. The decorative techniques of the Neopalatial (Middle Minoan IIIB–Late Minoan IB, ca. 1700–1450 BC) appear less precise than those of the past (Betancourt, 1998, p. 109). Naturalistic figures, such as reeds and floral motifs, emerge in friezes alongside past decorative forms, such as spirals, lines, and stamped decorations.[14] While polychromy became scarcer than in the Protopalatial period, not all Kamares decorative forms and techniques disappeared. Vases from the "Gypsades Well (Upper Deposit)" in Knossos (Hatzaki, 2007, pp. 180–181; also, Kommos, Watrous, 1992) still exhibit brown-reddish dots alongside

[13] This idea resonates with Bartlett's (1995) (re)constructive memory theory, for which memory is all about schemata: a series of past reactions reconstructed every time an organism perceives a stimulus like one previously experienced (pp. 201-202; also, Wagoner, 2017). Such a view is also supported by recent ecological-enactive studies on memory (Hutto & Myin, 2017; Hutto & Peeters, 2018; Michaelian, & Sant'Anna, A., 2021; Myin & van Dijk, 2022).

[14] Antecedents of these figurative decorations can be found in earlier works, with the Alternating Floral Style possibly serving as the most direct precursor (Floyd, 1997). Some of the Kamares style from Phaistos, in central-southern Crete, also display some of the later developments of the Neopalatial period (MM IIIB – LM IB).

dark-red horizontal bands reminiscent of Kamares examples. Hence, Minoan artisans did not forget the techniques and knowledge required to replicate Knossian Kamares decorations. Past technological skills and techniques were adapted according to the novel social and material coordinates of the Neopalatial.

I do not mean to imply that sociocultural changes did not affect stylistic variation. Significant social and cultural changes appear to have occurred during this period, as the emergence of monumental villas inspired by palatial architecture suggests (McEnroe, 2010). However, these changes took place within a sociomaterial context where some artisans and vessels bearing previous styles continued to circulate. The transgenerational memory of skills and knowledge of the Knossian Kamares was never completely forgotten but re-enacted according to the novel sociomaterial coordinates. This enabled Neopalatial artisans to produce visually different styles with their unique mnemonic dynamics.

Final Discussion

In this paper, I have drawn attention to some aspects of the long-term making of the Knossian Kamares style, shedding light on the relationship between memory and material culture.

Firstly, by situating the Knossian Kamares style in relation to other aspects of pottery production and discussing its long-term making processes, I suggested that *style is a transgenerational memory of technological skills and knowledge*. The continuity and aggregation of Knossian Kamares geometric units and motifs from MM IA to MM IIIA indicate that the persistence of decorative forms and associated technical skills and knowledge can be attributed to the ongoing interactions that artisans had with Kamares pots over generations. Style is a memory distributed in time and space through things and people, enabling the continuity of knowledge for future generations. Without previously made and decorated Kamares vessels, there would be nothing to remember.

Secondly, I argued that if styles are transgenerational memories, it becomes challenging to view remembering as simply retrieving information stored in the brain—or, as some archaeological memory studies propose, material culture. The variations in Knossian Kamares motifs and compositions suggest that the memory of technical choices, skills, and knowledge necessary for drawing decorations was not performed in the mind but *performed* in the act of decoration-making. The Knossian Kamares transgenerational memory was continually re-enacted whenever artisans produced new Kamares pottery. Therefore, I proposed that *remembering is re-enacting*, a way of doing something *through* and *with* things adapted to the sociomaterial context and the task to be completed.

This proposed perspective on memory and remembering has several implications for general research and our understanding of the relationship between material culture and memory. I outline here five main points.

First, understanding how memory emerges in diverse sociocultural contexts *with* and *through* material culture accumulating histories of interactions becomes central to a deeper understanding of memory. This viewpoint highlights the situated nature

of memory and emphasises the active role that material culture has in shaping people's thoughts and actions at different periods. It supports and opens novel avenues for those studies of memory and the cognitive sciences interested in exploring the mind as extended, enacted, embedded, embodied, and distributed in past and present sociomaterial contexts (Heersmink, 2021; Michaelian & Sutton, 2013; Sutton, 2015; Tribble & Sutton, 2012).

Second, contrary to mainstream approaches in psychology and archaeology, I propose that an approach grounded in MET can better use the available archaeological evidence and offer valuable insights for further archaeological studies on memory. The stylistic approach outlined in the "Memory and Remembering in Middle Bronze Age Knossos" section, involving the meticulous examination of material culture and the chronostratigraphy of actions within its sociocultural contexts, provides a means to document and analyse changes in forms and techniques, not only pottery-making. More importantly, this approach renders the study of cognitive phenomena testable and quantifiable. It could also provide more data on the continuation of knowledge in Minoan Crete if this methodology is applied to previous and following styles and used to explore if similar or different mnemonic dynamics were at play in other geographical and (pre)historical contexts. Moreover, my suggestion underlines the constitutional role of material culture in memory and underscores the significance of studying skills and practices in conjunction with the materials involved in memory.[15]

Third, the theoretical foundations and the stylistic methodology applied to the Knossian Kamares style demonstrated that the continuity in technological skills and knowledge was shaped by transgenerational processes of accumulation and aggregation, as evidenced by geometric units and motifs. This suggests that material culture is not simply anecdotal but, due to its permanence over time and continuity in practices, is now *constitutive of memory*. Artisans never started from scratch but had the whole transgenerational memory of skills and techniques distributed in each previously made Kamares pot. This enabled them to remember and adapt their technical skills and knowledge from the past according to their current sociomaterial contexts. The Knossian Kamares style was continually updated every time, thereby enabling a potential for future generations of artisans to re-enact skills and knowledge. However, rather than being seen as a passive transmission of information, this potential for future re-enactments is configured in terms of possibilities for action and throughs, determined by the tasks at hand and situated context. When it comes to explaining the disappearance of this style, I proposed that owing to the gradual accumulation and aggregation of decorative forms across generations and shifts in the sociocultural context, artisans slowly enabled a potential for future styles. Skills

[15] Considering the non-representational position I adopt with transgenerational memory, traditional classifications of memory based on information no longer apply (Squire & Dede, 2015). Given my emphasis on the relationality and situatedness of memory, it is more useful to classify types of memories in terms of different practices (*e.g.* pottery-making). Examining these practices allows us to observe how memory operates within a specific sociomaterial context without delineating distinct categories such as episodic memory, working memory, semantic memory, and motor habits.

and knowledge are not forgotten but adapted, giving rise to new styles with their own internal mnemonic dynamics.

Fourth, the stylistic methodology and the theoretical suggestions for memory and material culture might contribute to recent anthropological and archaeological studies on technology. While I argue that all styles are transgenerational memories, accumulating over time materials and associated practices manifested in things, I am not proposing that they share the same temporal and mnemonic dynamics of the Knossian Kamares. Quite the opposite. Every style, when re-enacted within its sociomaterial context, possesses distinct internal mnemonic dynamics. These dynamics enable artisans to instantiate and adapt prior modes of action and thought to the current action. This type of memory does not adhere to a fixed rule but rather emerges uniquely in each case when artisans engage *with* and *through* things. Therefore, to make sense of how the internal dynamics of a style influence how artisans think and act, it is essential to trace the relationship among materials, techniques, practices, and sociomaterial contexts as they unfold over time. In particular, the observations moved in the "Memory and Remembering in Middle Bronze Age Knossos" section align with studies of technological transmission for which the "cognitive activity" of artisans is defined in terms of the choices and skills used in selecting, preparing, and using raw materials based on the possibilities offered by their environment (Roux, 2010, p. 223).[16] I am referring here to the works by Roux (2007, 2019), Gosselain (2008), Bril (2019), and Ingold (2001) among others (for reviews, see Costin, 2000; Hegmon, 2000), which explore technological change in terms of continuity and discontinuities and the dynamics of craft production and stability of traditions as part of individuals' learning processes. The argument on the constitutive role of material culture for re-enacting memory that I suggested in this paper can support these studies and develop insights on stylistic variation by providing a framework to explore the cognitive activity of individual artisans involved in learning skills *alongside* the transgenerational processes by which styles of material culture change over time. Examining how memory is reinterpreted *with* and *through* material culture over generations can provide insights into how techniques and finished products changed over time, supporting the ecological approach that underpins technological studies.

Ultimately, while my primary objective in this paper was to present a new argument for the constitutive role of material culture on memory using the Knossian Kamares as a case study, the analyses provide valuable implications for future contributions in Minoan archaeology. The results discussed support scholars' assumptions regarding the creativity of Kamares (*e.g.* Betancourt, 1985). However, I have demonstrated that this openness is not reflected in technological expertise or the making of new motifs; inventiveness rested in the freedom artisans had to combine motifs and create ever-changing compositions. One possible explanation might lie

[16] From these perspectives, style involves preserving the cognitive and motor skills learned during the apprenticeship process, with stylistic variation found in the transmission of these skills from one artisan to another. Social groups sharing technical traditions are called *communities of practice* (Roddick & Stahl, 2016). The term describes how identity is created through shared practices among individuals who practice together (Lave & Wenger, 1991).

in the sociocultural context: individual artisans could freely reinterpret the Kamares tradition whenever they created a new vase in this style. This would also suggest greater connectivity among Cretan artisanal communities. The decorative skills and knowledge used in creating Kamares pottery could have been applied to other artisanal practices, such as painting frescoes and textile production. The *Woven Style* identified by MacGillivray (1998) might be a hint at this fluidity in artisanal traditions, possibly reflected in the organisation of Protopalatial workshops, exemplified by Quartier Mu at Mallia (Poursat, 1996). However, these are only some suggestions that demonstrate the potential of this approach to transgenerational memory and material culture in addressing questions related to both new and existing research questions and archaeological materials.

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Author Contributions E.P. wrote the manuscript text and took and prepared Figures 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11. The author also reviewed and edited the manuscript.

Declarations

Competing Interests The authors declare no competing interests.

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